Expansion of Hong Kong International Airport into a Three-Runway System

Environmental Impact Assessment Report – Executive Summary

June 2014

Airport Authority Hong Kong

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Abbreviations

2RS	Two-Runway System
3RS	Three-Runway System
AAHK	Airport Authority Hong Kong
ACABAS	The Advisory Committee on the Appearance of Bridges and Associated Structures
ADWF	Average Dry Weather Flow
AERMOD	AERMIC (American Meteorological Society / Environmental Protection Agency Regulatory Model Improvement Committee) Model
AFCD	Agriculture, Fisheries and Conservation Department
AFTF	Aviation Fuel Tank Farm
ALARP	As Low As Reasonably Practicable
AMO	Antiquities and Monuments Office
AMSL	Airport Management Services Limited
ANA	Aircraft Noise Assessment
APM	Automated People Mover
APU	Auxiliary Power Unit
AQO	Air Quality Objectives
ASR	Air Sensitive Receiver
ATCT	Air Traffic Control Tower
ATM	Air Traffic Movement
BHS	Baggage Handling System
BMP	Brothers Marine Park
C&D	Construction and Demolition
CAD	Civil Aviation Department
CALINE4	CAlifornia LINE Source Dispersion Model, version 4
CAP	Contamination Assessment Plan
CAR	Contamination Assessment Report
CCC	Criterion Continuous Concentration
CDA	Comprehensive Development Area
CEDD	Civil Engineering and Development Department
CLG	Community Liaison Group
CMC	Criteria Maximum Concentration
CMP	Contaminated Mud Pit
CO	Carbon Monoxide
CWD	Chinese White Dolphin

DCM	Deep Cement Mixing
DEVB	Development Bureau
DG	Dangerous Goods
DSD	Drainage Services Department
E&M	Electrical and Mechanical
EEA	European Environment Agency
EIA	Environmental Impact Assessment
EIAO	Environmental Impact Assessment Ordinance
EIAO-TM	Technical Memorandum on Environmental Impact Assessment Process Issued Under the Environmental Impact Assessment Ordinance
EM&A	Environmental Monitoring and Audit
EP	Environmental Permit
EPD	Environmental Protection Department
ERUF	Engine Run-Up Facility
ETWB	Environment, Transport and Works Bureau
EV	Electric Vehicles
FAA	Federal Aviation Administration
FCZ	Fish Culture Zone
FES	Fisheries Enhancement Strategy
FSD	Fire Services Department
FSP	Fine Suspended Particulates
GDP	Gross Domestic Product
GEO	Geotechnical Engineering Office
GESF	Guidelines for Estimating Sewage Flows for Sewage Infrastructure Planning Version 1.0
GFS	Government Flying Service
GSE	Ground Service Equipment
H_2S	Hydrogen sulphide
HDD	Horizontal Directional Drilling
HIA	Health Impact Assessment
HKSAR	Hong Kong Special Administrative Region
HKIA	Hong Kong International Airport
HKIAAA	Hong Kong International Airport Approach Area
HKO	Hong Kong Observatory
HKU	The University of Hong Kong
HSF	High Speed Ferry
IARC	International Agency for Research on Cancer
IATA	International Air Transport Association

IAQ	Indoor Air Quality
ICAO	International Civil Aviation Organization
INM	Integrated Noise Model
IRIS	Integrated Risk Information System
LAOI	Land Administration Office Instruction
LCA	Landscape Character Area
LDPN	Land Department Practice Note
LLP	Lantau Logistics Park
LPG	Liquefied Petroleum Gas
LR	Landscape Resources
LTO	Landing and Take-off
MAI	Marine Archaeological Investigation
MCC3	Marginally Compliant Chapter 3
MLP	Master Layout Plan
MP2030	Hong Kong International Airport Master Plan 2030
MTR	Mass Transit Railway
NAMP	New Airport Master Plan
NATS	National Air Traffic Services
NEF	Noise Exposure Forecast
NH_3	Unionised Ammonia
NO_2	Nitrogen Dioxide
NSR	Noise Sensitive Receiver
OEHHA	Office of Environmental Health Hazard Assessment
OZP	Outline Zoning Plan
PAM	Passive Acoustic Monitoring
PATH	Pollutants in the Atmosphere and their Transport over Hong Kong
PDZ	Planning Data Zone
PFRF	Public Fill Reception Facilities
PM10	Particulate Matter 10
PM2.5	Particulate Matter 2.5
PME	Powered Mechanical Equipment
PNAP	Practice Note for Authorized Persons
PRCWDNR	Pearl River Chinese White Dolphin Nature Reserve
PRD	Pearl River Delta
PRE	Pearl River Estuary
QRA	Quantitative Risk Assessment
RAP	Remediation Action Plan

RNP	Required Navigation Performance
RR	Remediation Report
RSP	Respirable Suspended Particulates
SCLKCMP	Sha Chau and Lung Kwu Chau Marine Park
SEA	Strategic Environmental Assessment
SHWSTW	Siu Ho Wan Sewage Treatment Works
SI	Site Investigation
SM1	Sewerage Manual – Part 1
SO_2	Sulphur Dioxide
SS	Suspended Solids
SSRC	Social Sciences Research Centre
SSSI	Site of Special Scientific Interest
SWL	Sound Power Level
SWLMP	Southwest Lantau Marine Park
T2	Terminal 2
TAAM	Total Airspace and Airport Modeler
TAP	Toxic Air Pollutants
TBG	Technical Briefing Group
TCNTE	Tung Chung New Town Extension
TCSPS	Tung Chung Sewage Pumping Station
TIN	Total Inorganic Nitrogen
TRC	Third Runway Concourse
TSP	Total Suspended Particulates
USEPA	US Environmental Protection Agency
VSR	Visually Sensitive Receiver
WCZ	Water Control Zone
WHM	Western Harbour Model
WHO	World Health Organization
WPCO	Water Pollution Control Ordinance
WQO	Water Quality Objectives
WSD	Water Supplies Department
WSR	Water Sensitive Receiver

1. Introduction

1.1.1.1 This Executive Summary summarises the results of the Environmental Impact Assessment (EIA) for the expansion of Hong Kong International Airport (HKIA) into a three-runway system (3RS). The EIA accompanies an application for an Environmental Permit (EP) and has been prepared in accordance with the requirements of the Environmental Impact Assessment Ordinance (EIAO).

1.1.1.2 Since the opening of the existing HKIA in 1998, airport facilities and operations have been progressively expanding throughout the years to meet increasing demand. At the same time, the development needs of the airport have been reviewed by Airport Authority Hong Kong (AAHK) every five years through the preparation of a 20-year Master Plan, as part of a continuous master planning process, which also considers the need for airport expansion. The HKIA Master Plan 2030 (MP2030) is the latest master plan prepared by AAHK.

1.1.1.3 As part of MP2030, a three-month extensive public consultation, including a questionnaire survey, was conducted in 2011. Members of the public were invited to comment on the possible options as the strategic direction of the future development of HKIA. Option 1 was to "maintain the existing two-runway system", and Option 2 was to "expand into a 3RS". The survey results, compiled by Social Sciences Research Centre (SSRC) of the University of Hong Kong (HKU), an independent research centre, showed that 73 % of more than 24,000 respondents preferred the 3RS. In light of this finding, the Government of the Hong Kong Special Administrative Region (HKSAR) approved in principle the adoption of the 3RS as the future development option for HKIA for planning purposes on 20 March 2012, and also approved the recommendation of AAHK to proceed with the statutory EIA.

1.1.1.4 The 3RS project (henceforth referred to as the 'project') is proposed to be located on a new land formation immediately north of HKIA in North Lantau, covering a permanent footprint of approximately 650 ha. The project primarily comprises:

- New third runway with associated taxiways, aprons and aircraft stands;
- New passenger concourse building;
- Expansion of the existing Terminal 2 (T2) building; and
- Related airside and landside works, and associated ancillary and supporting facilities.

1.1.1.5 An EIA study brief (ESB-250/2012) for the project was issued by the Environmental Protection Department (EPD) on 10 August 2012. The EIA report has been prepared according to the study brief requirements, which identified 12 key environmental assessment aspects to be addressed as part of the EIA study. The findings of these assessments are described in **Chapter 5** of this Executive Summary.

1.1.1.6 From late 2008 to early 2014, AAHK organised and took part in 970 stakeholder engagement activities with a variety of stakeholder groups to explain the airport's long-term development plan. Key channels for which some of the stakeholder engagement activities were conducted include:

- Four Technical Briefing Groups (TBGs) comprising experts and academia with technical expertise in specific environmental aspects to discuss issues of noise, air quality, marine ecology and fisheries, and Chinese White Dolphins (CWD); the first round of meetings were held in September and October 2012, the second round in April and June 2013, and the last round in November and December 2013;

- Five Community Liaison Groups (CLGs) comprising District Councillors and Community Leaders from HKIA's neighbouring districts (Islands, Kwai Tsing, Shatin, Tsuen Wan and Tuen Mun); meetings were held in October 2012 and June, July and December 2013;
- Focused consultations held with green groups in September 2012 and June, August, November and December 2013; and
- A Public Exhibition, held from 1 to 4 August 2013, and two sessions of public forums, which took place on 3 and 4 August 2013; both were held to update the public on the progress of the EIA and the direction for avoiding / mitigating the potential impacts of the project.

1.1.1.7 The other stakeholder engagement activities included meetings, briefings, seminars, discussion forums, exhibitions and airport visits. They covered a broad spectrum of stakeholders, including professional bodies, community representatives, industry representatives, businesses, political parties, academia, non-government organisations, green groups, youth and media.

1.1.1.8 The feedback and advice obtained from the various stakeholder engagement activities have been considered and incorporated, where applicable, as part of the technical assessments under the EIA study.

2. Need of the Project

2.1 Development of Hong Kong International Airport

2.1.1.1 HKIA has long been recognised as an important infrastructure asset supporting the economic development of Hong Kong. When the original airport at Kai Tak began to experience constrained operation, increasing adverse impacts on both the economy and the environment (particularly in terms of noise) were apparent. A strategic study was carried out including a Strategic Environmental Assessment (SEA) to consider alternative sites for the airport. The site that was ultimately selected was Chek Lap Kok. The relocation of the airport to Chek Lap Kok was a strategic decision to meet the growth demand for aviation service, prevent long-term economic loss and improve the environmental quality of the urban Kowloon area. This decision was pivotal to enabling the success that Hong Kong continues to enjoy, namely as one of the key players in the international arena for the city's economic pillars, which include finance, trade and logistics, tourism and professional services. From an environmental perspective, the Chek Lap Kok location was chosen primarily because it involved much less impact when compared to other viable options. Therefore, the Chek Lap Kok location was seen as the best way forward at the time for both economic and environmental considerations.

2.1.1.2 As an international aviation hub at the heart of the Asia Pacific region, HKIA serves traffic originating or terminating in Hong Kong (origin-destination traffic) as well as transfer traffic of passengers and trans-shipment of cargo around the world, facilitated by its capacity and 24-hour operations. With its advantageous geographical location and highly efficient operation, air traffic demand at HKIA has been steadily growing each year. HKIA is ranked as the world's busiest international cargo airport since 1996, and third busiest airport for international air passengers in 2013. To meet increasing demand, HKIA has grown within the physical limits of the airport island footprint, providing new facilities and services over the years that include terminal expansion, cross-boundary ferry service, a new satellite concourse, and the more recent expansion of the apron and midfield areas for additional aircraft parking stands. HKIA is now reaching its maximum handling capacity within the existing airport island footprint.

2.2 Demand Projection

2.2.1.1 The maximum handling capacity of HKIA was originally designed to meet the air traffic demand projected under the 1992 New Airport Master Plan (NAMP), which estimated 376,000 air traffic movements (ATMs)[1] per year by 2040[2]. However, air traffic demand has increased much faster than originally predicted. It was estimated in MP2030 as published in 2011 that the existing two-runway system at HKIA would reach its practical maximum capacity sometime between 2019 and 2022. Nevertheless, the latest review by the International Air Transport Association (IATA) on MP2030 suggests that this practical maximum capacity may be reached one to three years earlier than what was previously projected and presented in MP2030.

2.2.1.2 The increase in demand is mainly attributed to the connectivity advantages of HKIA, coupled with the rapid development of Hong Kong as a business and financial centre. These factors have converted HKIA from the originally envisaged origin-destination airport (primarily serving air traffic

[1] Also known as flight movements and comprises both passenger and cargo flights.

[2] 1992 NAMP forecast capacity by 2040 is at 87 million passengers and 8.9 million tonnes of cargo.

to/from Hong Kong) into an international hub airport (serving air traffic to/from Hong Kong as well as traffic routing via Hong Kong). The international hub airport status of HKIA brings additional air traffic demand as well as a change in aircraft mix. The latest traffic demand at HKIA is forecast to reach approximately 607,000[3] ATMs per year by 2030.

2.2.1.3 Given that future air traffic demand is also dependent on a number of external factors, a review of other key factors that may influence future air traffic demand in Hong Kong has been carried out, including aircraft mix, high-speed rail service and the effect of optimisation of Pearl River Delta (PRD) airspace on PRD airports and so forth. However, the analysis suggests that these external factors will not significantly affect or reduce the projected air traffic demand in Hong Kong.

2.3 Alternatives to Expanding HKIA into a Three-Runway System

2.3.1.1 Alternatives to meet the projected air traffic demand apart from expanding HKIA into a 3RS were considered. These include optimising the remaining two-runway capacity and cooperating with neighbouring airports. After careful consideration, these two alternatives were found to be unfeasible for the following reasons:

- Optimising the remaining two-runway capacity would be a short-term measure, as the two-runway system will soon reach its practical maximum capacity. Runway saturation will occur sometime between 2019 and 2022 according to MP2030, or one to three years earlier than the MP2030 projection based on the latest review by IATA. Beyond this point, further expansion would still be required. The delay in expanding HKIA into a 3RS would mean that the maximum runway capacity of HKIA would be reached before further expansion is completed. Optimising the two-runway capacity before developing into a 3RS would also lead to resource wastage, as the added infrastructure for upgrading the two-runway capacity would be for only a few years before redevelopment under a 3RS.
- Cooperation with neighbouring airports in PRD region would be difficult due to the differences in air jurisdictions and air services agreements. Furthermore, the need to transit between cities would bring inconvenience to passengers and cargo operators, and incur additional time and resource depletion affecting both the scheduling and affordability of the journey. Relying on other airports to meet Hong Kong’s air traffic demand also reduces the benefits that HKIA brings to Hong Kong’s economy and would ultimately diminish the overall competitiveness of HKIA and, by extension, Hong Kong.

2.4 Benefits of the Project

2.4.1.1 Expansion into a 3RS has been identified as the best way forward to secure the continual growth of HKIA operation. With a 3RS, additional benefits can be realised, including:

- Airport services and facilities would be further improved with the provision of new and modified passenger and airfreight facilities as well as increased operational flexibility, which would permit runway operations to better take into account the needs and concerns of nearby residents.

[3] Latest forecasts from IATA by 2030 is 102.3 million passengers, 8.9 million tonnes of cargo and 607,000 ATMs.

- Air connectivity would increase with the larger number of destinations served and frequency of flights to destinations, providing more choices for airport users and contributing to increased business and trade to/from Hong Kong.
- New jobs and direct employment at HKIA would be increased, as would indirect employment resulting from the supply of goods and services to the aviation sector and non-aviation activities at HKIA, as well as jobs that are induced from the spending of income by direct and indirect employees associated with HKIA.
- The contribution of HKIA to economic growth would increase by boosting gross domestic product (GDP) as a result of increased imports, exports and re-exports passing through HKIA. Hong Kong's share of the international business and trade markets would also increase as a result of the increased international connections enabled by the expansion of HKIA.

2.4.1.2 While some environmental impacts associated with airport expansion would be unavoidable, there are also opportunities, at the project's design, construction and operation stages, for incorporating positive environmental elements into the project. These include minimisation of night-time operations at the South Runway wherever practical; increased flexibility on preferential use of flight tracks to minimise aircraft noise impact to populated areas; decreased aircraft taxiing and holding times to reduce aircraft emissions; beneficial use of fill materials generated by other projects; and incorporation of best practice for environmental and efficiency improvements, such as energy efficiency, water conservation and waste recycling at airport buildings and facilities.

2.5 Consequences of Not Proceeding with the Project

2.5.1.1 Under the current two-runway system, the MP2030 study identified that the maximum practical runway capacity was expected to be reached between 2019 and 2022. The latest forecast suggests that this maximum capacity may be reached one to three years earlier than previously projected. In the absence of the project, HKIA will have to operate under a constrained mode[4]. When this happens, the following consequences will arise:

- For airport operations, service quality will deteriorate due to increased congestion and reduced flexibility to cope with, and recover from, service disruptions.
- For airline operations, the limited availability of landing / take-off slots would result in a reduction in available routes / destinations, which would instigate a need to seek alternative airports for expanding their flight network.
- For the aviation industry, growth would effectively be capped as no new routes nor increased frequency of existing routes can be made without the substitution of existing flights.

2.5.1.2 These changes would then impact passengers, cargo businesses and environmental performance as follows:

- Passengers would face reduced choice of destinations and flights, longer waiting / connecting times, increased travelling costs as a result of shortage in supply, and increased risk of delays.
- Cargo business would experience similar impacts due to loss of business associated with the reduction in destinations, increased risk of delays to delivery of goods, increased costs,

[4] Constrained mode refers to a mode of operation where demand (for aircraft landing and take-off (LTO) slots) exceeds supply (availability of LTO slots)

reduced scheduling flexibility and the need to seek alternative airports for expanding their service.

- The environmental performance of the airport would worsen due to increased air traffic congestion (and associated emissions) and increased aircraft noise impacts to nearby populated areas.

2.5.1.3 Inevitably, the impacts would be far-reaching and would lead to a reduction in the city's status as an international aviation hub and the overall competitiveness of Hong Kong. To avoid these consequences, expansion of HKIA into a 3RS is considered to be the best option.

3. Consideration of Alternatives

3.1 Background

3.1.1.1 The expansion of the airport requires the consideration of a multitude of external and intrinsic factors that are inherently complex. These factors were carefully considered as part of a number of feasibility studies undertaken during the master planning process[5].

3.1.1.2 For MP2030, AAHK commissioned relevant consultants to conduct feasibility studies covering airspace and runway capacity analysis, initial land formation engineering evaluation, preliminary engineering feasibility and environmental assessment, preliminary aircraft noise impact analysis, preliminary air quality impact analysis, economic impact analysis and financial feasibility assessment. These evaluations and assessments provided essential input into the master planning process, enabling identification of the various constraints and issues as well as identifying the opportunities for optimising different components of the airport, such as the configuration of the third runway, passenger processing terminal and passenger concourse areas. One of the purposes of the feasibility studies was to assess the environmental acceptability of different expansion / construction options, which led to a number of improvements in the environmental performance of the project, including reduced extent of land formation, use of non-dredge methods during land formation to minimise impacts on water quality, waste and marine ecology, and use of the deep cement mixing (DCM) approach for ground improvement at the contaminated mud pit (CMP) area to prevent leakage of contaminants.

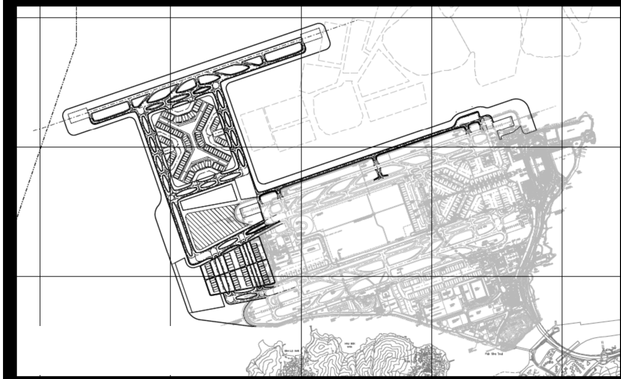
3.2 Airport Layout

3.2.1.1 Considerations for the runway alignment formed the first major foundation to the airport layout options assessment. Sixteen initial alignment options (comprising 15 original options plus one additional option) were identified and evaluated against a set of mandatory criteria that are crucial to the safe and effective operation of the third runway. This screening process narrowed the list of viable options to four alignments. Further evaluation against operational requirements resulted in a shortlist of three viable alignment options for further analysis. These three alignment options were combined with airport layout options to create a total of 18 airport layout options, covering possible permutations of passenger terminal, concourse and aircraft apron locations. These 18 options were then evaluated against a number of operational criteria, which resulted in a final shortlist of four airport layout options. These final shortlisted options were subsequently taken forward for detailed engineering and environmental evaluation.

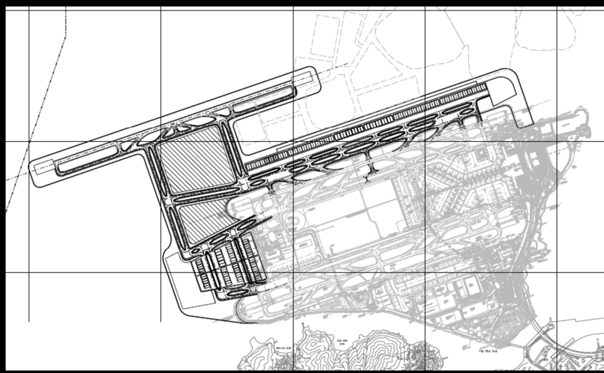
3.2.1.2 The four shortlisted airport layout options are shown below:

[5] These feasibility studies are published as part of the MP2030 consultation and are available via the website http://www.threerunwaysystem.com/en/Information/Consultancy_reports.aspx

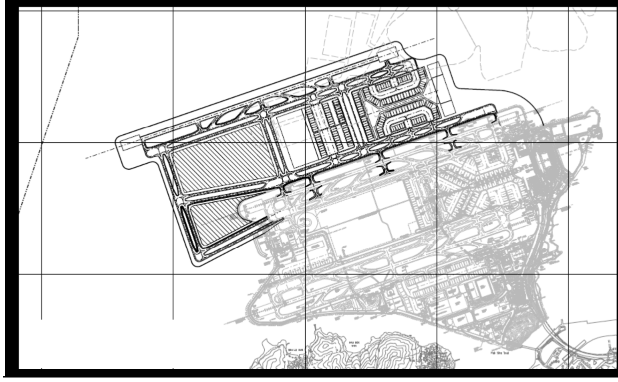
Option 1 Northward expansion with remote satellite concourse to the north



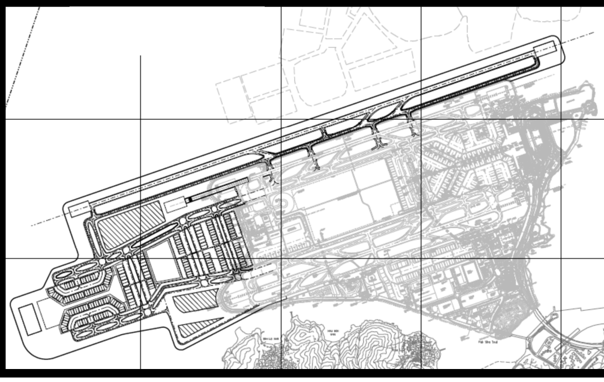
Option 2 Northward expansion with remote satellite concourse to the west



Option 3 Northward expansion with remote satellite concourse to the east of the expansion area



Option 4 Westward expansion with operational infrastructures located to the west



3.2.1.3 The four shortlisted options were assessed against both the non-environmental criteria and environmental criteria. The non-environmental evaluation comprised the following criteria:

- Airfield efficiency
- Passenger convenience
- Surface access
- Cargo operations efficiency
- Constructability / cost

3.2.1.4 In general, the non-environmental criteria evaluation found that northward expansion (Options 1, 2 and 3) would provide better performance than the westward expansion option (Option 4).

3.2.1.5 Similarly, evaluations were undertaken against the environmental criteria. The evaluation was based on a number of key criteria, with different rankings assigned according to the degree of potential environmental impact associated with each airport layout option. The findings are summarised in **Table 3.1**.

Table 3.1: Summary of Environmental Evaluation of Shortlisted Airport Layout Options

Criteria	Preferred Option	Reason
Air Quality	All options would result in similar level of impact.	All options would result in similar level of impact.
CWD	Option 3	Generally affects a smaller area of CWD feeding habitat and has less impact on other CWD-important areas compared to the other options.
Fisheries	Option 3	Generally considered to have less impact on fishery activities compared to other options.
Marine Ecology	Option 3	Impacts to marine ecological areas are generally less compared to other options.
Noise	Option 3	Generally associated with less potential aircraft noise impact compared to other options.
Visual	Option 3	Generally associated with less potential visual impact compared to other options.
Water Quality and Hydrodynamics	Option 3	Generally associated with less potential water quality and hydrodynamic impacts compared to other options.

Note:
1. Cultural heritage – not a key environmental differentiator as all options would have similar potential marine archaeological impact, and no direct impacts on terrestrial cultural heritage.
2. Hazard to Human Life – not a key environmental differentiator as all options would have similar potential hazard to human life impacts associated with diversion of submarine aviation fuel pipeline, extension of fuel hydrant system, and dangerous goods (DG) storage (diesel, gasoline and liquid petroleum gas)
3. Terrestrial ecology – not a key environmental differentiator as all options would have similar impacts (mainly indirect impacts) to terrestrial ecology.
4. Waste – the waste differentiator was based on previous assumptions of using dredged land formation. As the project is now confirmed to use non-dredge methods, this differentiator is no longer applicable.
5. Land Contamination – not a key environmental differentiator as all options would have similar potential impacts associated with works required at the existing airport island.

3.2.1.6 Based on the comparison between the different airport layout options in terms of potential environmental impacts, it was concluded that Option 3 is associated with less overall environmental impacts. Thus Option 3 was identified as the best-performing option. While taking forward this preferred option for further evaluation, additional environmental enhancements were identified and subsequently made to the preferred option. These included a substantial reduction of the land formation area (from approximately 827 ha to approximately 650 ha). Other major components of the airport, including T2 expansion and the new third runway concourse (TRC) layout, were also evaluated against various criteria to determine the best-performing option. The outcome of these evaluations was the preferred airport layout (shown in **Drawing No. MCL/P132/ES/3-001**), which has been adopted in this EIA study.

3.3 Construction Methods

3.3.1 Land Formation

3.3.1.1 From an early stage, it was identified that only the non-dredge method, which involves ‘filled’ land formation, would meet the long-term operational requirements of the project while minimising the environmental impact associated with land formation. As the project will be partly formed over the historical capped CMPs, the evaluation of ground improvement options was one of the key requirements to ensure minimal disturbance to the capped CMPs. A total of 11 ground improvement options were initially compared and evaluated on technical feasibility and environmental acceptability. The results of the evaluation produced a shortlist of six options (cylindrical steel cells, DCM, prefabricated vertical drains, sand compaction piles, stone columns and vertical sand drains) that were considered to be technically and environmentally acceptable. However, only one option, namely, DCM, was found to be environmentally acceptable for application within the CMP area. This non-dredge method differs from the other methods in that it provides in-situ treatment and stabilisation of the marine sediment, which reduces the potential for release of contaminated pore water. Based on research findings on overseas application of this method, the results of a previous trial[6] in Hong Kong and consultation with EPD, it was concluded that only the DCM method would be applied within the CMP area for land formation works. Recognising the benefits of this approach, DCM is also proposed for other marine infrastructure works within the CMP area, such as the piles for the new runway approach lights.

3.3.1.2 Consideration was also given to various seawall design options, taking into account engineering requirements, environmental benefits and other considerations. The findings of the evaluation identified rockfill sloping seawalls as presenting an environmental advantage from the perspectives of waste minimisation and marine ecological habitat. Taking into account all other applicable factors, rockfill sloping seawalls, comprising either mound core or circular steel cell cofferdam, were identified as the preferred options to be implemented as the dominant seawall types for the project. However, the adoption of vertical seawall design would be required at local areas with specific operational requirements, such as sea rescue berths.

3.3.1.3 After completion of land formation, various facilities would be constructed on the existing and expanded airport area, including (but not limited to) the third runway, taxiways, aprons, TRC, T2 expansion, tunnels, road networks, drainage, sewerage, utilities, fuel hydrant system and various ancillary buildings of the project. These will generally comprise standard construction methodologies that, with the implementation of recommended mitigation measures, are not anticipated to result in significant variations to the environmental performance of the project.

3.3.2 Marine Infrastructure Diversion

3.3.2.1 Key existing marine infrastructure elements will require diversion as part of the project, including the existing submarine aviation fuel pipelines and the submarine 11 kV cables.

3.3.2.2 The existing airport island is currently supplied with aviation fuel via submarine aviation fuel pipelines that originate from the permanent aviation fuel facility at Tuen Mun. These pipelines route via the aviation fuel receiving facility at Sha Chau before connecting to the existing aviation fuel tank farm on the airport island. As the land formation for the airport expansion will cover part of the existing alignment of the submarine pipelines, these pipelines will need to be diverted prior to commencement of land formation. Three alignment / construction options were evaluated as part of the scheme design for this project for diverting the submarine aviation fuel pipelines. Two of these options involve open trench excavation from the airport island to Sha Chau, while the

[6] A DCM trial was carried out at the CMP area in February 2012, during which extensive water quality and underwater noise monitoring was performed to check for any potential environmental impacts. The monitoring results indicated that the DCM work would not cause any appreciable deterioration of water quality, and no leakage of contaminants or cement slurry was detected throughout the trial process. It was also found that the DCM work was relatively quiet compared to other marine construction techniques, and the underwater noise generated was typically below 200 Hz, which is a frequency of low sensitivity for CWD. Therefore, the field trial has demonstrated that DCM is an environmentally acceptable ground improvement method at the CMP area.

remaining option involves drilling through bedrock using the horizontal directional drilling (HDD) method. All three options were evaluated from the perspectives of design, construction, environment and inspection and maintenance. The results of the evaluation identified the HDD method to be the option with the least potential for environmental impacts. This method was subsequently adopted as the preferred option for diverting the submarine aviation fuel pipelines.

3.3.2.3 Similarly, an evaluation was undertaken for the existing submarine 11 kV power cables. These cables provide power supply from the northwest of the airport island to various facilities located on Sha Chau and Lung Kwu Chau islands. As the land formation for the airport expansion will cover part of the existing alignment of the submarine cables, these cables will need to be diverted prior to commencement of land formation. A total of five alignment / construction options were evaluated from both technical and environmental perspectives. Three of the options involve direct bury methods from the airport island to Sha Chau. One involves direct bury method from the airport island to a ‘mid-point’ outside the Sha Chau and Lung Kwu Chau Marine Park (SCLKCMP), whereby the diverted cable would subsequently be connected to the existing cable via a field joint. The remaining option involves drilling through bedrock using the HDD method. Of the five options, the HDD method was identified to be technically infeasible due to the high risk of damage to the power cables; thus this option was not considered further. Of the remaining four options, the option with the least environmental impact was identified to be the direct bury method with field joint, as this method avoids encroachment into the ecologically sensitive Marine Park. This method was subsequently adopted as the preferred option for diversion of the submarine 11 kV power cables.

4. Project Description

4.1 Key Project Components

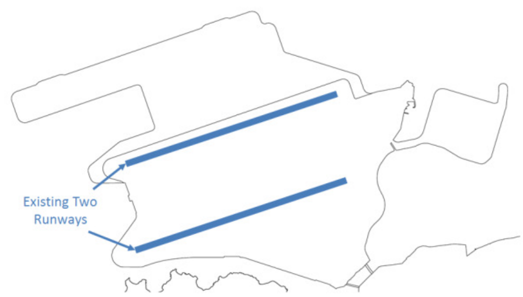
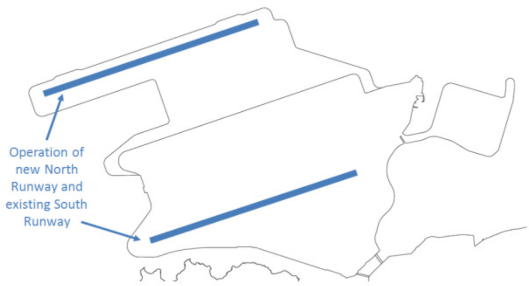
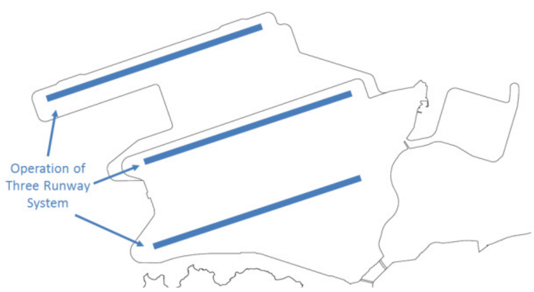
4.1.1.1 Based on the preferred airport layout (shown in **Drawing No. MCL/P132/ES/3-001**), the key project components include:

- Land formation comprising ground improvement, seawall construction and modification (including sea rescue boat points), filling and surcharge activities;
- Construction of new airfield facilities including the third runway, taxiways, aprons, aviation fuel supply network and other airfield infrastructure, aircraft navigational aids, approach lighting system and new Hong Kong International Airport Approach Area (HKIAAA) marker beacons;
- Modification of existing airfield facilities, including the existing North Runway, taxiways and aprons in the Midfield area;
- Construction of new passenger facilities including the TRC and expansion of T2, the automated people mover (APM) system and associated depot and maintenance / stabling areas, and the baggage handling system (BHS);
- Construction of new ancillary facilities to support the operational needs of the expanded airport, including utility buildings, airport support developments, air cargo staging, catering, aircraft maintenance, aircraft engine run-up (engine testing) facilities, ground service equipment (GSE) area, early bag storage facility, fire station, fire training facility, petrol fuelling station, new air traffic control towers (ATCT), Hong Kong Observatory (HKO) facility, mobile phone system antenna towers, stores, security gate houses, etc.;
- Construction of new and expanded infrastructure and utilities, including road networks, seawater cooling and flushing system, stormwater drainage system, greywater system, sewerage network and potable water supply, Towngas supply, 132 kV / 11 kV and other power supply networks, communication networks, etc.;
- Diversion of existing submarine infrastructure, including the submarine aviation fuel pipelines and submarine 11 kV cables.

4.2 Construction Programme

4.2.1.1 The tentative programme for the project is for the 3RS to be operational in 2023. Given the scale and complexity of the project, the construction and concurrent runway operational configuration will be implemented in phases as shown in **Table 4.1** below. Some components, such as the TRC, may be constructed in phases based on the level of demand. Due to such phasing arrangement, the three-runway airfield system will be in operation before the full completion of all infrastructure associated with the project.

Table 4.1: Summary of Construction and Runway Operational Configuration Phasing

<table>
<tr><th>Phase</th><th>Description</th><th>Runway Operational Configuration</th><th>Timeframe</th></tr>
<tr><td>Advanced Works</td><td>Diversion of the submarine pipelines and power cables</td><td rowspan="2">
</td><td>2015 to 2016</td></tr>
<tr><td>Phase 1</td><td>Land formation works will commence before subsequent construction of third runway, new taxiways and the new TRC. Expansion of T2 will also commence. The existing two-runway system remains operational throughout the construction phase.</td><td>2016 to 2021</td></tr>
<tr><td>Phase 2</td><td>Upon completion of the third runway and associated taxiways, the existing North Runway will be closed for modification works, while construction activities for the TRC and aprons, vehicle tunnels and reconfiguration of T2 are on-going. During this interim period, the South Runway and the new third runway will be operational.</td><td>
</td><td>2021 to 2023</td></tr>
<tr><td>Phase 3</td><td>Upon completion of all essential infrastructure and facilities, including part of the TRC and aprons and expanded T2, the airport will operate under the 3RS. Construction of the remaining facilities will continue until completion.</td><td>
</td><td>2023 and after</td></tr>
</table>

4.3 Summary of Designated Projects

4.3.1.1 The project components that constitute a Designated Project under the EIAO are listed as follows:

- Reclamation works (including associated dredging works) more than 5 ha in size (Item C.1, Part I, Schedule 2).
- An airport (including its runway and the development and activities related to aircraft maintenance, repair, fueling and fuel storage, engine testing or air cargo handling) (Item B.1, Part I, Schedule 2).
- A railway and its associated stations (Item A.2, Part I, Schedule 2).
- A road or railway tunnel more than 800 m in length between portals (Item A.7, Part I, Schedule 2).
- An activity for the reuse of treated sewage effluent from a treatment plant (Item F.4, Part I, Schedule 2).

- A submarine gas pipeline or submarine oil pipeline (Item H.2, Part I, Schedule 2).
- All projects including new access roads, railways, sewers, sewage treatment facilities, earthworks, dredging works and other building works partly or wholly in an existing or gazetted proposed country park or special area, a conservation area, an existing or gazetted proposed marine park or marine reserve, a site of cultural heritage, and a site of special scientific interest (Item Q.1, Part I, Schedule 2).
- A road which is an expressway, trunk road, primary distributor road or district distributor road including new roads, and major extensions or improvements to existing road (Item A.1, Part I, Schedule 2).
- A railway siding, depot, maintenance workshop, marshalling yard or goods yard (Item A.4, Part I, Schedule 2).
- A road or railway bridge more than 100 m in length between abutments (Item A.8, Part I, Schedule 2).
- Reclamation works (including associated dredging works) more than 1 ha in size and a boundary of which is less than 100 m from a seawater intake point (Item C.2(b), Part I, Schedule 2).
- A cement works or concrete batching plant with a total silo capacity of more than 10,000 tonnes in which cement is handled and manufactured (Item K.5, Part I, Schedule 2).
- A sand depot with a site area of more than 1 ha in size (Item K.11, Part I, Schedule 2).

4.4 Concurrent Projects

4.4.1.1 A review of available information during preparation of the EIA identified a number of other planned / committed projects that may be implemented around the same time as this project, and which may contribute to cumulative environmental impacts. Where applicable, these concurrent projects have been considered and incorporated into relevant technical assessments as part of this EIA report.

5. Summary of Environmental Impact Assessment

5.1 Approach to Environmental Impact Assessment

5.1.1.1 The EIA process provides a means of identifying, assessing and reporting the environmental impacts and benefits of the project. It is an iterative process that has been followed in parallel with the design process to identify the potential environmental effects of various design options, and develop alternatives as well as mitigation measures to be incorporated into the design, construction and operation of the airport expansion. AAHK has considered and incorporated the feedback and advice obtained from the various stakeholder engagement activities into the EIA process where appropriate. AAHK has also come up with measures that can avoid some potential environmental impacts, while others are minimised or mitigated to acceptable levels.

5.2 Overview of Impact Avoidance, Minimisation and Mitigation Measures

5.2.1.1 On the basis of the preliminary engineering and environmental assessments undertaken during the preparation of MP2030, and the subsequent EIA study, a number of environmental considerations have been identified and integrated into the project. AAHK is committed to implementing the following key design and planning initiatives to improve environmental performance:

Minimising Land Formation Footprint

5.2.1.2 After detailed evaluation of a range of airport layout options, a preferred option has been selected to achieve the best balance among various key environmental factors, operational efficiency and engineering constraints. Nevertheless, further enhancements have been made to the preferred option, which include, among others, substantial reduction of the land formation area from approximately 827 ha to approximately 650 ha. A key driver for the reduction was to minimise associated impacts on marine habitat and its marine life, including CWD.

Avoiding / Minimising Construction Phase Impacts

5.2.1.3 Non-dredge ground improvement methods (e.g., DCM) will be used for land formation in order to avoid bulk removal and disposal of any dredged materials, as well as to minimise suspended solids (SS) and contaminants release. The use of this method will substantially reduce the potential impacts to surrounding marine water quality and marine ecology, including CWD.

5.2.1.4 The HDD method will be deployed through the deep rock stratum below the seabed for diversion of the submarine aviation fuel pipelines from the airport island to Sha Chau to avoid dredging of any seabed, thereby eliminating any impacts on marine water quality and marine ecology, including impacts on the SCLKCMP. In addition, the daylighting location of the fuel pipelines (i.e., the point where the pipelines surface at ground level) on Sheung Sha Chau Island has been carefully selected to minimise disturbance to the egretry on the island.

5.2.1.5 The water jetting method will be adopted to lay new submarine 11 kV cables for connection to the existing cables at over 500 m from the boundary of the SCLKCMP. The use of this method will minimise the generation and disposal of marine sediment and avoid disturbance to the seabed inside the Marine Park.

5.2.1.6 During the design and construction planning process, priority was given to maximise, as far as practicable, the reuse of inert construction and demolition (C&D) materials generated by the project, including rock armour from the removal of the existing northern seawall for the land formation works. This will minimise off-site delivery of the surplus inert C&D materials and the associated environmental impacts. Optimising the use of C&D materials on site will be balanced with maximising, as far as practicable, the use of public fill materials from the Government's public fill reception facilities (PFRF), i.e., unwanted fill materials from other projects in Hong Kong, for the project's land formation works.

5.2.1.7 All marine sediment that will be excavated as a result of the various construction works on the expanded airport island will be treated and reused on-site as backfilling materials for the project, in accordance with the relevant requirements. This approach avoids the need for off-site disposal which could result in impacts on the marine environment.

Minimising Aircraft and Related Emissions and its Potential Health Impact

5.2.1.8 AAHK is committed to reducing, where practicable, the potential air quality and health impacts associated with airport and its associated operations. As such, a number of initiatives have already been put in place to minimise emissions of air pollutants. These initiatives include enforcing the use of fuel-efficient airside vehicles through mandatory requirement in the licensing process; promoting increased use of electric vehicles and electric GSE at HKIA by providing charging infrastructure and progressively replacing the entire vehicle fleet with electric or fuel-efficient / hybrid vehicles, with the aim of replacing all saloon vehicles on the airside by electric vehicles by 2017; banning all idling vehicle engines on the airside since June 2008, with the exemption of certain vehicles and equipment due to safety and operational considerations; provision of the cleanest diesel and gasoline at the airfield; requiring all of AAHK's diesel vehicles to use biodiesel (B5); and providing liquefied petroleum gas (LPG) fuelling points for airside vehicles and GSE.

5.2.1.9 Furthermore, AAHK is increasing the use of fixed ground power and pre-conditioned air systems, which currently has an approximately 80% usage rate for aircraft parking at frontal stands. AAHK will also ban aircraft from using auxiliary power units (APU) at frontal aircraft parking stands by end of 2014.

Minimising Aircraft Noise and Potential Health Impact

5.2.1.10 In order to minimise aircraft noise and the associated health impact, a number of planned operational procedures will be incorporated into the future operation of the proposed 3RS, which include:

(i) Putting the South Runway on standby where possible at night between 2300 and 0659;

(ii) Requiring departures to take the southbound route via West Lamma Channel during east flow at night from 2300 to 0659, subject to acceptable operational and safety consideration. This is an arrangement that is consistent with the existing requirement in the operation of the two-runway system at night;

(iii) A new arrival Required Navigation Performance (RNP[7]) Track 6 has been designed for preferential use in the west flow direction (i.e., runway 25 direction) between 2300 and 0659 and it is assumed that up to 95% of flights may preferentially use this new Track 6 instead of the existing straight-in tracks by year 2030; and

(iv) Implementing a preferential runway use programme when wind conditions allow such that west flow is used when departures dominate while east flow is used when arrivals dominate during night-time.

Mitigation of Unavoidable Impacts

5.2.1.11 While environmental impacts associated with the construction and operation of the project will be avoided/ minimised by implementing the aforementioned key design and planning strategies, the project will inevitably give rise to some impacts on the environment. Therefore, detailed and comprehensive assessment of the environmental impacts has been carried out and, where necessary, appropriate mitigation measures have been established to further alleviate the potential impacts. A summary of the major assessment findings is presented in the following sections. Details of specific mitigation measures are included in the relevant sections of the main EIA report.

[7] RNP is a method of navigation which permits aircraft operations on any desired flight path within the coverage of station-referenced navigation aids or within the limits of the capability of self-contained aids, or a combination of these, with the addition of an on-board performance monitoring and alerting capability.

5.3 Air Quality

5.3.1 Introduction

5.3.1.1 Potential air quality impacts associated with the construction and operation phases of the project have been assessed in accordance with the criteria and guidelines as stated in the requirements given in Section 3.4.3 and Section I of Appendix A of the EIA study brief, as well as Section 1 of Annex 4 and Annex 12 of the Technical Memorandum on EIA Process issued under the EIAO (EIAO-TM).

5.3.1.2 Quantitative assessment using the relevant air models approved by EPD was performed for both the construction and operation phase impact assessments.

5.3.2 Construction Phase

5.3.2.1 The key activities that could potentially result in dust emissions during construction phase of the project have been identified. These activities include land formation works; construction of the third runway, a passenger concourse, the apron and relevant airfield infrastructure facilities; expansion of the existing T2 and part of the midfield freighter apron; extension of the APM and BHS; improvement of relevant road networks; rock crushing plants; diversion of the submarine aviation fuel pipelines and submarine 11 kV cables; modification of existing outfalls; and the concrete batching plants, asphalt batching plants and barging points. In addition, construction dust emissions from concurrent projects within the 500 m assessment area have also been identified and included in the cumulative air quality impact assessment where appropriate.

5.3.2.2 According to Clause 3 (ii) under Section I of Appendix A of the EIA Study Brief, representative air sensitive receivers (ASRs) within 500 m from the project boundary were identified for air quality impact assessment during the construction phase. The air pollutants of interest in the assessment include Total Suspended Particulates (TSP), Respirable Suspended Particulates (RSP or PM_{10}) and Fine Suspended Particulates (FSP or $PM_{2.5}$).

5.3.2.3 With the implementation of the recommended mitigation measures and relevant control requirements[8] as part of the construction works, it has been assessed by the use of quantitative modelling that the hourly TSP criterion would be complied with at all ASRs, and compliance with the corresponding Air Quality Objectives (AQO) for RSP and FSP would be achieved at all ASRs throughout the whole construction period. Therefore, no adverse residual TSP, RSP or FSP impacts are anticipated at any ASRs during the construction phase of the project.

5.3.2.4 During the proposed DCM process that would be carried out as part of the ground improvement works for land formation, cement powder will be transferred from supporting vessels to DCM barges through piping in closed loop, or in a totally enclosed manner. There will be no open storage of cement on the DCM barges or supporting vessels. Therefore, no adverse residual dust impacts due to cement transfer or storage are anticipated.

[8] Air Pollution Control (Construction Dust) Regulation, EPD's *Guidance Note on the Best Practicable Means for Cement Works (Concrete Batching Plant) BPM 3/2(93), Guidance Note on the Best Practicable Means for Tar and Bitumen Works (Asphaltic Concrete Plant) BPM 15 (94)* and *Guidance Note on the Best Practicable Means for Mineral Works (Stone Crushing Plants) BPM 11/1 (95)*

5.3.2.5 There is potential for emissions associated with bitumen fumes from the proposed asphalt batching plants at the airport expansion area. However, given their large separation distances from ASRs (at least 3.1 km from the nearest ASR) and with the implementation of various emission control measures as given in the EPD's Guidance Note on the Best Practicable Means for Tar and Bitumen Works (Asphaltic Concrete Plant) BPM 15 (94), adverse residual air quality impacts due to bitumen fume emissions are not anticipated.

5.3.2.6 In view of the above assessment findings, construction of the project will not result in adverse residual air quality impacts.

5.3.3 Operation Phase

5.3.3.1 There are various key air emission sources due to airport operation, which include emissions from the aircraft landing and take-off (LTO) cycle; use of APUs during aircraft ground operation; the aircraft maintenance centre; engine testing facilities; operation of Government flying service (GFS), including fixed wing aircraft and helicopters; ferry operation at SkyPier; operation of airside vehicles, including GSE and non-GSE; aviation fuel tank farm operation; operation of the Hong Kong Business Aviation Centre; car park operation; catering facilities; fire training activities; and use of motor vehicles on the airport island.

5.3.3.2 Based on the trends of future aircraft emissions forecast by the International Civil Aviation Organization (ICAO), as well as the air traffic forecast prepared by IATA for the 3RS project, the highest aircraft emissions scenario would occur in Year 2031, which is therefore selected as the year of assessment.

5.3.3.3 Existing and planned air emission sources within 5 km of the project boundary (i.e., the boundary of the expanded airport island) have been identified and included in the operation phase air quality assessment. Other far-field air emission sources (i.e., those outside the 5 km assessment area from the airport boundary) are collectively considered as background emissions that contribute to the ambient air pollutant concentrations in the study area. The background contributions comprise various sources covering the Guangdong Province, Pearl River Delta Economic Zone and HKSAR.

5.3.3.4 In determining the emission inventories for airport operation, nearby infrastructure and ambient emissions, both committed policies and practical technology advancement have been considered. AAHK has been implementing a number of measures and initiatives aimed at further reducing air emissions from airport activities and operations, and air quality will remain a key focus of AAHK's environmental plan, including:

- Banned all idling vehicle engines on the airside since 2008, except for certain vehicles that are exempted ;
- Banning the use of APU for all aircraft at frontal stands by end-2014;
- Requiring all airside saloon vehicles to be electric by end-2017;
- Increasing charging stations for electrical vehicles (EVs) and electric GSE to a total of 290 by end-2018;
- Conducting a review on existing GSE emissions performance and exploring measures to further control air emissions;

- Exploring with franchisees the feasibility of expediting replacement of old airside vehicles and GSE with cleaner ones during tender or renewal of contracts;
- Requiring all new airside vehicles to be fuel-efficient, and making it a prerequisite for the licensing process;
- Providing the cleanest diesel and gasoline at the airfield;
- Requiring all of the AAHK's diesel vehicles to use biodiesel (B5); and
- Providing an LPG fuelling point for airside vehicles and GSE.

5.3.3.5 It is anticipated that with implementation of the above measures, air emissions associated with operation of the 3RS will be further reduced.

5.3.3.6 According to Clause 4 (i) under Section I of Appendix A of the EIA Study Brief, the operational air quality impact within 5 km of the project boundary shall be quantified. As such, the 5 km boundary from the project site was taken as the study area, which generally covers the entire area of Tung Chung, San Tau, Sha Lo Wan, San Shek Wan, Siu Ho Wan and Sham Wat Wan in North Lantau, and Tap Shek Kok in Tuen Mun.

5.3.3.7 Representative ASRs within 5 km of the project boundary have been identified. Existing ASRs, which mainly include residential buildings, educational institutions and hotels, have been identified by reviewing topographic maps, aerial photos and land status plans, supplemented by site inspections. Planned / committed ASRs have been identified by making reference to the relevant Outline Zoning Plans (OZP), Outline Development Plans, Layout Plans and other published plans in the study area. They include:

- Chek Lap Kok OZP (No. S/I-CLK/12);
- Tung Chung Town Centre Area Layout Plan – Lantau Island (L/I-TCTC/1F);
- North Lantau New Town Phase IIB Area (Part) Layout Plan (L/I-TCIIB/1C);
- Sha Lo Wan Village Layout Plan (L/I-SLW/1);
- Tung Chung Town Centre Area OZP (S/I-TCTC/18);
- Siu Ho Wan Layout Plan (No. L/I-SHW/1); and
- Tuen Mun OZP (No. S/TM/31).

5.3.3.8 A Planning and Engineering Study on the remaining development in Tung Chung is being undertaken by the Civil Engineering and Development Department (CEDD). The objective of the study is to assess the feasibility of the remaining development located in the east and west of Tung Chung. Representative ASRs have been selected at the site boundary of the proposed Tung Chung New Town Development Extension in the air quality study of this EIA.

5.3.3.9 Near-field models accepted by EPD (i.e., AERMOD, CALINE4) and the regional model developed by EPD (i.e., PATH) were adopted to predict the pollutant concentrations at the ASRs. Both the two-runway system (2RS) scenario (i.e., "without project" scenario) and 3RS scenario (i.e., "with project" scenario) have been modelled.

5.3.3.10 The model results for the Year 2031 3RS scenario indicate that cumulative nitrogen dioxide (NO_2), RSP, FSP, sulphur dioxide (SO_2) and carbon monoxide (CO) levels comply with the relevant AQOs at all ASRs. The annual average NO_2 and FSP concentration contours at 1.5 m above ground are shown in **Drawing No. MCL/P132/ES/5-3-001** and **MCL/P132/ES/5-3-002**, respectively, which show compliance of the relevant AQOs in the air sensitive areas outside the airport. For the airport island, in addition to continuous outdoor air quality monitoring, AAHK also monitors indoor air quality to maintain a quality environment for passengers and staff. Terminal 1, Terminal 2, SkyPier and the North Satellite Concourse have achieved and maintained a "Good Class" indoor air quality under EPD's "IAQ Certification Scheme for Offices and Public Places".

5.3.3.11 On comparing the annual pollutant levels of the 3RS scenario with those of the 2RS scenario (i.e., "without project" case), the increase in annual NO_2, RSP and FSP are less than 1$\mu g/m^3$, 0.2 $\mu g/m^3$ and 0.1 $\mu g/m^3$ respectively, indicating relatively insignificant changes.

5.3.3.12 With respect to the incremental changes in the annual concentration of NO_2 in Sha Lo Wan (i.e., 3RS – 2RS), which is downwind of the airport (the prevailing wind at the airport is easterly), a decrease in concentration is predicted. This suggests that the 3RS will bring environmental benefit to the receivers at Sha Lo Wan and the contributing factors include:

- Shifting of dominant aircraft departure from the South Runway (2RS scenario) to the centre runway (3RS scenario); and
- Assigning the South Runway as standby mode wherever practicable during the night-time period between 2300 and 0659.

5.3.3.13 NO_2 is the key air pollutant associated with airport operations. The source contribution breakdown for the cumulative annual average NO_2 impact at the key sensitive areas under the 3RS scenario is shown in **Table 5.1**. The dominant emission sources are from ambient emissions, which contribute in most cases more than 60% of the total NO_2 concentrations. Except for Sha Lo Wan, this is followed by proximity infrastructure emissions (10 – 30%) and airport-related emissions (< 10%).

Table 5.1: Annual Average NO_2 Source Contribution Breakdown for 2031 (3RS) Scenario

Area	Cumulative Impact ($\mu g/m^3$)	Ambient Emissions ($\mu g/m^3$)	Proximity Infrastructure Emissions ($\mu g/m^3$)	Airport Related Emissions ($\mu g/m^3$)
Tung Chung	33	22	9	2
Tung Chung West	30	22	6	2
Tung Chung East	28	22	4	2
Sha Lo Wan	36	20	4	12
Tuen Mun[1]	38	27	9	2 [1]

Note:

[1] Airport-related emissions are included in ambient emissions in PATH model for Tuen Mun area.

5.3.3.14 In view of the above assessment findings, it can be concluded that operation of the project will not result in adverse residual air quality impacts.

5.4 Hazard to Human Life

5.4.1 Introduction

5.4.1.1 Development of the 3RS will require the existing aviation fuel hydrant system to be extended and extra hydrant pumps to be installed at the existing aviation fuel tank farm (AFTF). Due to the land formation for the 3RS, the existing submarine aviation fuel pipeline lying underneath the proposed land formation will also need to be diverted.

5.4.1.2 In accordance with the EIA study brief, a hazard assessment has been conducted to evaluate the risk due to:

- Construction works near the existing aviation fuel pipelines and storage facilities;
- Operation of new aviation fuel pipelines (submarine and underground) and new fuel hydrant systems for aircraft refuelling operations at the new aircraft stands in the airport expansion area; and
- New facilities for the storage of dangerous goods (DG), i.e., fuel for airside vehicles / GSE.

5.4.1.3 In the assessment, the hazardous scenarios associated with these activities were identified and a quantitative risk assessment (QRA) was conducted to determine both the individual and societal risk levels based on a set of identified hazardous scenarios. The major tasks involved in the QRA included hazard identification, frequency assessment, consequence modelling, risk summation and identification of mitigation measures. The evaluated risk levels were compared with the criteria for evaluating hazard to human life as stipulated in Annex 4 of the EIAO-TM.

5.4.1.4 Hazard identification involved conducting a review of the historical incidents that have occurred at HKIA and airports worldwide, as well as conducting a hazard identification workshop using ‘Structured What If’ technique. The identified hazardous scenario(s) were then further assessed as part of the frequency assessment, using fault tree analysis and event tree analysis techniques to analyse the hazard frequencies. The updated hazard rates have been inputted into the RiskTool model to evaluate the overall individual and societal risk.

5.4.1.5 Consequence analysis was undertaken to determine the amount of leakage of jet fuel and airside vehicle fuel (gasoline and diesel) under each of the identified scenarios, and the corresponding safety risk to working staff and travellers was assessed. The software PHAST was used for the consequence modelling for vehicle fuel, while the software PoolFire6 thermal radiation model was used for the consequence modelling for jet fuel pool fire.

5.4.1.6 The risk summation was carried out using the RiskTool program to generate both the individual and societal risk levels. Safety measures were identified during the hazard identification workshop, and cost benefit analysis was undertaken for risk levels falling into the As Low As Reasonably Practicable (ALARP) region.

5.4.2 Potential Hazard and Risk

5.4.2.1 Offsite individual risk during both the construction phase and operation phase was below the criterion of 1×10^{-5} per year (i.e., less than 1 in 100,000 chance of death per year); therefore, they comply with the Hong Kong Risk Guidelines as stipulated in Annex 4 of the EIAO-TM.

5.4.2.2 For societal risk, construction phase risk is dominated by potential impact due to the construction of the new submarine pipeline adjacent to the existing submarine pipelines, and construction of the airside tunnels adjacent to the existing underground pipeline serving Terminal 1 and the Midfield. Total societal risk was assessed to be within the acceptable region.

5.4.2.3 Total societal risk during the operation phase is dominated by the risk associated with operating the aviation fuel hydrant pit valves, and this was assessed to be within ALARP region. Uncertainty analysis was conducted, which concluded that the uncertainty had been minimised by adopting conservative assumptions / parameters. This provides confidence that the risk level assessed during the operation phase would not exceed the Hong Kong Risk Guidelines.

5.4.2.4 A range of further mitigation measures has been recommended to be implemented for the 3RS project in order to further reduce risk level. Construction phase mitigation measures to reduce the risk level identified in the study include, for example, implementing precautionary measures for marine traffic management, clear instructions to construction workers on avoidance of existing hydrant networks / pipeline locations, and conducting tests and inspecting pipeline integrity prior to commissioning. Operation phase mitigation measure includes improvement audits to reinforce existing refuelling practices and achieve better compliance.

5.4.2.5 With the implementation of the mitigation measures, the risk is considered to be within the ALARP region and complies with the Hong Kong Risk Guidelines.

5.5 Noise Impact

5.5.1 Introduction

5.5.1.1 Potential noise impacts associated with the construction and operation phases of the project have been assessed in accordance with the technical requirements stipulated in Section 3.4.5 and Section I of Appendix C of the EIA study brief, as well as Annexes 5 and 13 of the EIAO-TM.

5.5.2 Aircraft Noise

5.5.2.1 An aircraft noise assessment (ANA) was prepared in accordance with the requirements stipulated in the EIA study brief. Noise criteria, in terms of noise exposure forecast (NEF) 25 and 30 as stipulated in the EIAO-TM, were adopted in the ANA. The assessment covers the entire Hong Kong with particular emphasis on those areas under and near the flight tracks, and in the vicinity of HKIA.

5.5.2.2 The ANA was carried out in accordance with the guidelines set out by the ICAO and Federal Aviation Administration (FAA). The FAA's integrated noise model (INM) Version 7.0dsu1 (released in late May 2013, with a service update released in September 2013) was adopted for quantitative assessment, and the results were presented in the form of aircraft noise contours in NEF metrics. Data derived from the air traffic forecast developed by IATA[9], and Total Airspace and Airport Modeler (TAAM) simulations undertaken by National Air Traffic Services (NATS) based on the IATA's air traffic forecast, were employed as key data inputs for noise modelling. The assumptions, input data, operational modes, noise sources inventory and mitigation measures adopted for assessments have been confirmed with the Civil Aviation Department (CAD).

5.5.2.3 In addition, a NEF contour map based on the aviation operation data for HKIA in 2011[10], utilising operational records and radar data provided by CAD, was prepared as part of the study to describe the prevailing aircraft noise environment.

5.5.2.4 In addition to the existing measures, CAD has been exploring other measures and new initiatives that could be implemented in the near term with a view to further reducing the aircraft noise impact arising from the existing operation of HKIA. Since February 2012, CAD has implemented a set of flight procedures whereby aircraft which are capable to use satellite-based navigation technology, when departing to the northeast of HKIA, can adhere closely to the nominal flight track when making the turn to the West Lamma Channel, thereby keeping the aircraft at a distance away from the areas in the vicinity of the flight paths and reducing the noise impact on these areas.

5.5.2.5 Furthermore, all subsonic jet aircraft landing or taking off in Hong Kong have already been required to meet the noise standards stipulated in Chapter 3 of Annex 16 Volume I, Part II to the

[9] Includes number of aircraft arriving and departing from HKIA, origin and destination of each flight, type of aircraft, and cargo or passenger aircraft, projected up to 2038.

[10] Year 2011 is employed to represent the prevailing noise environment because the full-year data set in 2011 is the latest information available at the commencement of the assessment and is considered representative of the prevailing aircraft noise environment.

Convention on International Civil Aviation ("Chapter 3 standards") since July 2002. To further improve the local noise environment and alleviate the impact of aircraft noise on local communities, with effect from end of March 2014, CAD would not allow airlines to schedule the noisier marginally compliant Chapter 3 (MCC3) aircraft, which are defined as per CAD's Aeronautical Information Circular 32/13 dated 26 November 2013, to operate between 2300 and 0659 (MCC3-Prohibited Period). Besides, upon review of this measure, CAD would consider extending the MCC3-Prohibited Period to cover the whole day for the existing two-runway operation.

5.5.2.6 Moreover, AAHK is conducting a detailed study to develop an environmental charges / incentives scheme as a means of encouraging airlines to use quieter aircraft types, and the introduction of any such scheme must follow thorough consultation with the aviation community. Demand for night flights will also be managed at HKIA to ensure that the noise contour in the remaining years of two-runway operations will not expand to any new noise sensitive receivers (NSR).

5.5.2.7 When the airport is operating under the existing 2RS, certain villages along North Lantau shoreline would be impacted by the aircraft noise. Therefore AAHK will offer the provision of window insulation and air-conditioning for all houses situated within the newly affected villages before the operation of the third runway in order to alleviate the potential aircraft noise impact on the residents.

5.5.2.8 According to the EIA study brief, the operational assessment scenarios for the 3RS project include (1) worst operation mode, representing the maximum aircraft noise emission scenario (which was identified as year 2030 for the EIA); (2) the interim phase operation mode, representing the phase during which the existing North Runway is closed and the proposed third runway is operational with the South Runway (identified as year 2021 for the EIA); and (3) full operation of the 3RS at design capacity (defined as Year 2032 for the EIA).

5.5.2.9 A number of aircraft noise mitigation measures have been identified, and these will be implemented as standard HKIA operating procedures in the operation of the 3RS under the primary operating mode. These measures include the following and are illustrated in **Drawing No. MCL/P132/ES/5-5-001**:

- Putting the South Runway on standby where possible at night between 2300 and 0659;
- Requiring departures to take the southbound route via the West Lamma Channel during east flow at night from 2300 to 0659, subject to acceptable operational and safety consideration. This is an arrangement that is consistent with the existing requirement in the operation of the two-runway system at night;
- A new arrival RNP Track 6 has been designed for preferential use in the west flow direction (i.e., runway 25 direction) between 2300 and 0659 and it is assumed that up to 95% of flights may preferentially use this new Track 6 instead of the existing straight-in tracks by year 2030; and
- Implementing a preferential runway use programme when wind conditions allow, such that west flow is used when departures dominate while east flow is used when arrivals dominate during night-time.

5.5.2.10 The INM modelling has taken into account the above mitigation measures in predicting the potential aircraft noise impact under 3RS operation.

5.5.2.11 During the interim phase period in 2021, the NEF25 contour will still be causing impact to Sha Lo Wan and certain village houses along North Lantau shoreline due to the close proximity of these areas to the airport. The affected village houses/ licensed structures will be offered the provision of indirect noise mitigation measures in the form of window insulation and air-conditioning before the operation of the third runway, as described in **Section 5.5.2.7** above. As there are only two operating runways, it would be impossible to introduce some of the above measures such as putting the South Runway on standby mode. However, the 2021 NEF25 contour would not encroach onto any existing or planned NSRs in the Tung Chung area.

5.5.2.12 For the 2030 and 2032 scenarios, a slight encroachment of the NEF25 contour remains at Sha Lo Wan and certain villages along North Lantau shoreline, in view of their close proximity to the airport island. However, the impact will be largely reduced with the full commissioning of the 3RS and placing the South Runway on standby mode during night-time. The NEF contours of 2030 are presented in **Drawing No. MCL/P132/ES/5-5-002**.

5.5.2.13 Apart from the measures as stated in **Section 5.5.2.9**, as an additional direct mitigation measure, it is recommended that in developing the Master Layout Plan (MLP) for the Comprehensive Development Area (CDA) site at Lok On Pai, the alignment of the NEF25 contour line should be taken into account to ensure that no noise sensitive uses are situated within the NEF25 contour in the planned development. On the other hand, as mentioned above, some village houses in Sha Lo Wan and other villages along North Lantau shoreline will still be situated within the NEF25 contours after the operation of the third runway (including the 2021, 2030 and 2032 scenarios), however these village houses would have been offered the provision of window insulation and air-conditioning as stated in **Section 5.5.2.7** above. Hence, no adverse residual aircraft noise impact is identified to be associated with the operation of the project. For future village houses, they should be planned in accordance with the prevailing government policy and guidelines.

5.5.3 Fixed Noise Sources

5.5.3.1 The potential fixed noise sources during the operation phase include the operation of aircraft on ground level (i.e., taxiing, operation and maintenance testing of APUs and engines); APM; BHS; and ventilation systems / shafts. Fixed noise sources have been assessed individually and cumulatively. Concurrent projects have also been identified and incorporated into the assessment for cumulative impact where appropriate. Representative NSRs have also been identified for the fixed noise impact assessment.

5.5.3.2 The proposed APM has a horizontal separation distance of at least 200 m from the nearest NSRs. Other underground facilities such as the BHS and the proposed greywater recycling plant are fully enclosed. Therefore, no significant adverse ground-borne noise impacts are anticipated from the proposed APM or other underground facilities.

5.5.3.3 In accordance with the EIA study brief, the airport operation modes assessed include the worst operation mode, with maximum aircraft noise emission from the operation of the project; the interim phase; and full operation mode at design capacity.

5.5.3.4 The predicted noise levels associated with aircraft taxiing under the worst operation mode, interim phase operation mode and full operation mode scenarios indicated compliance with the relevant daytime/evening and night-time noise criteria at all representative NSRs. The operation of APUs was also predicted to comply with the relevant daytime/evening and night-time noise criteria at all representative NSRs under all three scenarios.

5.5.3.5 Noise mitigation measure in the form of a noise enclosure has been proposed to alleviate the noise impacts from aircraft engine run-up facilities. With this proposed mitigation measure, the overall noise levels at all NSRs are expected to comply with relevant noise criteria for the daytime/evening and night-time periods. Therefore, adverse residual noise impacts from fixed noise sources on the existing and planned NSRs are not anticipated.

5.5.4 Construction Noise

5.5.4.1 Quantitative assessment of the potential construction noise impact has been carried out in accordance with the EIA study brief requirements. The potential key sources of noise impact during the construction phase include land formation works; construction works on the newly formed land and existing airport island; concrete batching plants, asphalt batching plants, haul roads, barging points and crushing plants and diversion of the submarine aviation fuel pipelines and submarine 11 kV cables. Concurrent projects have also been identified and incorporated into the assessment for cumulative impact.

5.5.4.2 The assessments were based on standard acoustic principles and the guidelines in the EPD Technical Memorandum on Noise from Construction Work other than Percussive Piling. Based on the tentative construction programme and powered mechanical equipment (PMEs) anticipated to be used, the potential construction noise impact on representative NSRs was assessed.

5.5.4.3 The construction of the APM, BHS and submarine aviation fuel pipelines may potentially generate ground-borne noise impacts. The APM and BHS will be constructed by cut and cover method (instead of drill and blast or bored tunnelling method), and no rock breaking or tunnel mining works will be involved in the underground construction. Therefore, no ground-borne noise impact is anticipated. The works involved in the diversion of the submarine aviation fuel pipelines are expected to be at least 1.8 km from the nearest NSR, where the vibration from HDD will be screened out. Therefore, no ground-borne noise impact is anticipated during the construction phase.

5.5.4.4 With the implementation of mitigation in the form of quiet plant and the use of movable noise barriers and enclosures, the construction noise levels at all NSRs are predicted to comply with the noise standards stipulated in the EIAO-TM. Adverse residual construction noise impacts are therefore not anticipated in this project.

5.5.5 Road Traffic Noise

5.5.5.1 As stipulated in the EIA study brief, the assessment area for impact from road traffic noise includes areas within 300 m from the boundary of the project. The nearest identified NSRs are located beyond the 300 m assessment area for the proposed road alignments of 3RS project; therefore, adverse road traffic noise impact on the NSRs is not anticipated.

5.5.6 Marine Traffic Noise

5.5.6.1 Based on the guideline in *British Standard 4142:1997 Method for Rating Industrial Noise Affecting Mixed Residential and Industrial Areas* and information from the *Engineering Feasibility and Environmental Study for Airport Master Plan 2030 – Marine Traffic Impact Assessment*, the marine traffic impact assessment area was determined to be 1,350 m from the manoeuvring of vessels. No NSRs were identified within the 1,350 m assessment area; representative NSRs were found to be over 1,700 m from the manoeuvring route of marine vessels associated with airport activities. Therefore, adverse marine traffic noise impacts from vessels associated with airport activities during operation are not anticipated.

5.6 Water Quality

5.6.1 Introduction

5.6.1.1 In accordance with the EIA study brief, the study area for the water quality impact assessment covers the North Western, North Western Supplementary, Deep Bay and Western Buffer Water Control Zones (WCZ). Water sensitive receivers (WSRs) such as cooling seawater intakes, Water Supplies Department (WSD) flushing water intakes, typhoon shelters, bathing beaches, coral communities, fishery sensitive areas, and ecologically sensitive areas that might be affected by the project were identified.

5.6.1.2 The criteria used for evaluating water quality impacts follow the EIAO-TM and Water Quality Objectives (WQO) for the North Western, North Western Supplementary, Deep Bay and Western Buffer WCZs. Other local and international criteria were also adopted where applicable[11].

5.6.1.3 Quantitative analysis using the validated 3-dimensional hydrodynamic model – Western Harbour Model (WHM), derived from the Update Model by Deltares in 2000-2001, was performed for the construction and operation phases. This model covers the study area for the project and includes the Pearl River Estuary (PRE) and the Dangan (Lema) Channel with some project-specific refinements. Concurrent projects for the construction and operation phases were identified and incorporated into the assessment for cumulative impact where appropriate.

5.6.2 Construction Phase

5.6.2.1 Potential key sources of water quality impact during the construction phase include land formation works; modification of existing northern seawall; diversion of submarine aviation fuel pipelines and 11 kV submarine cable; construction of new stormwater outfalls and modifications of existing outfalls; piling activities for construction of the new runway approach lights and the HKIAAA marker beacons; construction site runoff and drainage; sewage effluent from construction workforce and general construction activities. It should be noted that potential construction phase water quality impacts associated with the proposed works have already been substantially reduced by the adoption of non-dredge methods for land formation and the HDD method for submarine aviation fuel pipeline construction, which avoids disturbance to the seabed. The adoption of the DCM method for ground improvement at the CMPs also avoids the removal of contaminated sediment during land formation and provides an environmentally friendly way of ground improvements at the CMP area.

5.6.2.2 A quantitative assessment of potential water quality impacts associated with marine construction works was conducted, taking into account the period of planned highest productivities and worst case periods of SS release. Other activities that could affect water quality during construction are primarily land-based and were assessed qualitatively.

[11] Other criteria adopted includes WSD's Water Quality Criteria (for flushing water); sediment deposition and SS criteria for corals; No Observable Effect Concentration from an EPD's ecotoxicology study; UK Shellfish Waters Directive; EU's Environmental Quality Standards Directive; as well as the USEPA National Recommended Water Quality Criteria: Criteria Maximum Concentration (CMC) and Criteria Continuous Concentration (CCC).

5.6.2.3 The assessment has shown that with the application of a construction design approach that ensures a minimum 200 m leading edge of partially completed seawall prior to marine filling activities and the implementation of mitigation measures (in the form of double silt curtains and silt screens where applicable), there will be no exceedance of the depth-averaged SS criteria at any WSR due to project activities. However, when combined with the assumptions of SS release from concurrent projects, cumulative exceedance is predicted at a few WSRs. Nevertheless, the findings show that the cumulative exceedances are primarily due to the conservative assumptions for the concurrent project rather than due to the contributions from the 3RS project. Those conservative assumptions are based on the maximum allowable SS release rates of the relevant concurrent project. However, based on the available information, the actual SS release rates are much lower than the maximum allowable release rates. Therefore, adverse residual water quality impacts due to the project are not anticipated.

5.6.2.4 In addition, based on the findings of the quantitative assessments, no unacceptable water quality impacts associated with the submarine 11 kV cable diversion, ground improvement via DCM and surcharge activities of the land formation are anticipated.

5.6.2.5 Other construction activities include diversion of the submarine aviation fuel pipelines, construction of stormwater outfalls, and piling for the new runway approach lights and the HKIAAA marker beacons. With the implementation of good site practices and the recommended mitigation measures to minimise potential water quality impacts, these construction activities, as well as general construction site drainage and sewage effluent from the construction workforce, are not anticipated to result in significant water quality impacts.

5.6.2.6 In view of the above assessment findings, it is concluded that no adverse residual water quality impacts are anticipated during the construction phase of the project.

5.6.3 Operation Phase

5.6.3.1 The potential key sources of water quality impact during the operation phase include changes in hydrodynamics as a result of the permanent new landform; embayment of water at the western end of HKIA; sewage discharge; reuse of treated greywater; spent cooling water discharge; stormwater discharge; accidental fuel spillage; and potential maintenance dredging of the navigable waters north of HKIA. It should be noted that as part of the earlier studies on the airport layout, the potential hydrodynamic impacts associated with the physical landmass of the project were considered. These early studies led to the current land formation footprint, which minimises changes to hydrodynamics and water quality associated with the project.

5.6.3.2 Quantitative assessments of potential impacts for 'with project' and 'without project' scenarios were undertaken. Year 2026 was adopted as the assessment year to represent the worst case pollution loading, taking into account other planned and committed concurrent projects in the study area.

5.6.3.3 The findings show that despite minor exceedances in SS, total inorganic nitrogen (TIN) and unionised ammonia (NH_3) were predicted at some WSRs, these were all identified as not attributed to the project. Therefore, implementation of the project would not result in adverse hydrodynamic and water quality changes in the study area.

5.6.3.4 For other operation phase activities, appropriate design / precautionary measures have been proposed to ensure that sewage discharge, the reuse of treated greywater and accidental fuel spillage would not result in adverse water quality impacts. The findings from the assessment also show that the project would not result in significant sedimentation of the navigable waters north of HKIA; therefore, maintenance dredging is not required due to the implementation of the project.

5.7 Sewerage and Sewage Treatment

5.7.1 Introduction

5.7.1.1 Impacts on the public sewerage system, sewage treatment and disposal facilities associated with the project have been assessed according to the requirements as specified in Section 3.4.7 and Appendix D2 of the EIA study brief.

5.7.1.2 Based on the forecast of ATM, passengers and cargo throughput in 15 years after commencement of operation of 3RS (i.e., 2038), the project would generate a total sewage flow of 43,500 m^3/day. On this basis, the impacts arising from the project on the existing / planned sewerage system in North Lantau, including the sewerage catchments of Tung Chung Sewage Pumping Station (TCSPS) and Siu Ho Wan Sewage Treatment Works (SHWSTW), have been assessed.

5.7.2 Potential Impact

5.7.2.1 The sewerage system for 3RS will be designed, operated and maintained by AAHK in accordance with all the relevant standards and guidelines published by Drainage Services Department (DSD). In addition to continuing the odour control arrangements, AAHK will monitor the hydrogen sulphide (H_2S) level and adopt active septicity management measures that can effectively contain any future septicity problems in the design for the 3RS sewerage system. With the implementation of the said measures, no adverse impacts in respect of septicity and odour from the new sewerage system are anticipated.

5.7.2.2 According to the hydraulic assessment results, the existing gravity sewers from the airport discharge manhole to TCSPS will reach full capacity by 2027. AAHK has therefore proposed to construct a new gravity sewer with a diameter of 1,200 mm adjacent to the existing gravity sewer (1,050 mm in diameter), and then divert the sewage flow generated from the airport and other sub-catchments in Tung Chung to the new gravity sewer. AAHK will consider to study the feasibility to keep the proposed abandoned sewer (i.e., the existing gravity sewer of 1,050 mm in diameter) in place as a spare sewer with an overflow system for the emergency discharge subject to future design of the new gravity sewer. This sewer upgrading work will be able to provide sufficient design capacity in the sewer in order to deliver the sewage arising from the project to the TCSPS. The sewer upgrading work shall be completed by 2026 (allowing a buffer period of about one year before full capacity is reached), with planning work to commence in 2022 (assuming one year for planning plus three years for design and construction).

5.7.2.3 While AAHK undertakes to implement and complete the mitigation works for the affected gravity sewers by 2026, the discharge of additional sewage will start upon commissioning of the project, and the sewage build-up may occur at a more rapid rate than that predicted. Therefore, it is recommended that AAHK should monitor the sewage flow build-up as part of the environmental monitoring and audit (EM&A) for the project, and start planning construction of the upgrading works in 2022 or when the sewage flow in the affected gravity sewer exceeds 80% of the design capacity of the sewer, whichever is earlier. This will ensure timely completion of the mitigation works before flow exceeds the design capacity of the sewer.

5.7.2.4 Based on the assessment findings, the total peak sewage flow from the airport and the relevant Planning Data Zones (PDZ) will exceed the existing design peak flow of TCSPS in 2023, subject to future development of the Tung Chung New Town Extension (TCNTE). A Government project under Agreement No.CE6/2012 is currently underway to investigate, design and construct an additional sewage rising main between TCSPS and SHWSTW to enhance the operational reliability of the sewerage system. That project is planned to commence construction in 2015 and complete the works by end 2022. According to the latest sewerage impact assessment report from the DSD under Agreement No.CE6/2012, twin 1,200 mm diameter sewage rising main will be adopted for conveying the planned sewage flow from Tung Chung and the airport to SHWSTW, which is sufficient for the estimated ultimate design sewage flow of 3,648 L/s[12].

5.7.2.5 In view of the assessment findings, it is considered that the design capacity of the existing SHWSTW is sufficient to handle the estimated total Average Dry Weather Flow (ADWF) from the project and the relevant PDZ during year of 2038. However, it is estimated that the design peak flow of SHWSTW will be exceeded after 2026. It is understood that SHWSTW will be upgraded by the relevant Government departments to cater for the sewage treatment demand arising from future developments within the relevant sewerage catchment areas, including the expanded airport and TCNTE. It is understood that the EPD will monitor the sewage flow build-up and coordinate the necessary upgrading works for the SHWSTW when needed in due course.

5.7.2.6 With implementation of upgrading works for the gravity sewer, TCSPS and SHWSTW, there is no need to establish any central pre-treatment facilities or separate sewage treatment plant for the project. Provided that the upgrading of the gravity sewer, TCSPS and SHWSTW will be completed by 2026, end 2022 and 2026 respectively, no interim sewage treatment facilities will be required for the project.

[12] EPD has agreed to reserve 43,500 m^3/day (ADWF) at the TCSPS for the total sewage discharge from the expanded airport, and AAHK will closely liaise with EPD and DSD to ascertain a smooth interface with the upgrading works for TCSPS.

5.8 Waste Management

5.8.1 Introduction

5.8.1.1 The types of waste that would be generated during the construction and operation phases of the project have been identified. The potential environmental impacts that may result from these waste materials have been assessed in accordance with Section 3.4.8 of the EIA study brief as well as the criteria and guidelines outlined in Annex 7 and Annex 15 respectively of the EIAO-TM.

5.8.2 Construction Phase

5.8.2.1 The approach for development of the project is to avoid or to reduce the volume of waste generated through the application of alternative design options and / or construction methods. Non-dredge methods are proposed for ground improvement to completely avoid bulk removal and disposal of any dredged materials. The proposed sloping seawall option would allow for the reuse of rock armour from the existing northern seawall. The HDD method proposed for the diversion of submarine aviation fuel pipelines would avoid dredging of the seabed, thereby eliminating the need for removal and disposal of any dredged materials and the associated impacts on marine environment. Similarly, the water jetting method proposed for the diversion of submarine 11 kV cables would avoid the generation and disposal of marine sediment.

5.8.2.2 The major waste types that would be generated by construction activities would include inert C&D materials from excavation works, demolition works, seawall modification, piling works and superstructure construction works on the existing airport island / proposed land formation area, as well as from HDD during diversion of the existing submarine pipelines; non-inert C&D materials from site clearance at the golf course area, works for the T2 expansion and various superstructure construction works; marine sediments dredged from the cable field joint area; CMP and marine sediments excavated from the foundation / piling / basement / excavation works for constructing the various tunnels, facilities and buildings; chemical waste from the maintenance and servicing of construction plant and equipment; general refuse from the workforce; and floating refuse trapped / accumulated on the newly constructed seawall.

5.8.2.3 In order to minimise the extent of excavation and maximise on-site reuse of the inert C&D materials generated, the excavation works for various facilities, buildings and tunnel works as well as the construction programme have been carefully planned and developed. Based on the scheme design estimates, it is anticipated that a total of approximately 9,543,500 m^3 of inert C&D materials will be generated from 2015 to 2022, the majority of which will be generated from excavation works for the APM and BHS tunnels, the new APM depot and airside tunnels, and the piling works for the TRC and other facilities. Of this total amount of inert C&D materials, it is estimated that approximately 3,639,230 m^3 (or about 38%) could be reused on-site as fill materials for the proposed land formation works. The remaining 5,904,270 m^3 (or about 62%) of inert C&D materials would be generated after completion of majority of the filling activities. Therefore, these materials will need to be transferred off-site to any identified projects that require fill materials and/or the government's PFRF for beneficial use by any other projects in Hong Kong. Despite maximising the on-site reuse of inert C&D materials, it is estimated that the project would require importing approximately 10,911,770 m^3 of public fill material for land filling activities during the period from 2016 to 2018.

5.8.2.4 Based on scheme design information, it is estimated that approximately 96,200 m^3 of non-inert C&D materials would be generated during the period from 2016 to 2021. The contractor would separate the non-inert C&D materials from the inert C&D materials on site. Any recyclable materials (e.g. metal) will be segregated from the non-inert C&D materials for collection by reputable licensed recyclers. The remaining non-recyclable waste materials will be disposed of at designated landfill sites by a reputable licensed waste collector.

5.8.2.5 It is estimated that in total, approximately 777,860 m^3 of marine sediments will be generated by the various construction activities from 2015 to 2022. The majority of this total amount of marine sediments, i.e., about 767,660 m^3 (or about 98.7%), would be generated from the foundation / piling works for the tunnels, buildings, approach lights and new HKIAAA marker beacons as well as excavation works for the new APM depot. These marine sediments will be treated and reused on-site as backfilling materials, thus avoiding the need for disposal of the sediments off-site. The remaining minority, i.e. about 10,200 m^3 (or about 1.3%), is estimated to be generated from excavation of the cable field joint area during the advance works in 2015/16. This material would require open sea disposal (for Category L sediments) or open sea disposal at dedicated sites (for Category M_p sediments), as such sediments cannot be treated and reused as backfilling materials on-site due to a mismatch with the overall construction programme (i.e., the estimated time to generate such sediments would be over one year before the majority of the filling works for the proposed land formation work is scheduled to begin).

5.8.2.6 The maximum daily arising of general refuse from the construction workforce is estimated to be approximately 9,100 kg. A Construction Waste Management Plan will be developed, which will prioritise the provision and arrangement of recycling facilities to maximise the diversion of construction waste from being sent to landfill. Non-recyclable waste will be disposed of at designated landfill sites. With the appropriate design of the artificial seawall to avoid or minimise any trapped or accumulated refuse, it is estimated that about 65 m^3 of floating refuse will be collected during each year of construction from the newly constructed seawall. The floating refuse will be sorted and recycled or disposed of at designated landfill sites, as appropriate. It is expected that small quantity of chemical waste will be generated during construction, which would be properly handled, stored, labelled and disposed of in accordance with the Waste Disposal (Chemical Waste) (General) Regulation.

5.8.2.7 Provided that all the identified waste materials are handled, transported and reused / disposed of in strict accordance with the relevant legislative and recommended requirements, and that the recommended good site practices and mitigation measures are properly implemented, no unacceptable environmental impacts are expected during the construction phase.

Table 5.2: Summary of Waste Arising during Construction Phase

Waste Type	Estimated Total Quantity of Waste Generation
Inert C&D Material	About 3,639,230 m^3 would be reused on-site as fill materials About 5,904,270 m^3 would be delivered off-site
Non-inert C&D Material	About 96,200 m^3 would be disposal of at landfills after on-site sorting and segregation of recyclable materials
Excavated Marine Sediments	About 10,200 m^3 would require open sea disposal (for Category L sediments) or open sea disposal at dedicated sites (for Category Mp sediments) About 767,660 m^3 would be treated and reused on-site as backfilling materials
Chemical Waste	Anticipated as small quantity
General Refuse	Maximum daily arising of approximately 9,100 kg

Waste Type	Estimated Total Quantity of Waste Generation
Floating Refuse	About 65 m^3/year to be collected from the newly constructed seawall

5.8.3 Operation Phase

5.8.3.1 During the operation phase, the key waste types generated would include general refuse from the operation of passenger concourses, aircraft cabin, terminal buildings, offices, commercial establishments (e.g. restaurants, retail outlets) and various airport infrastructure facilities as well as chemical waste from the maintenance, servicing and repairing of various electrical and mechanical (E&M) equipment. As mentioned previously, it is expected that there will also be accumulation of floating refuse on the artificial seawall. With the proposed installation of a new greywater treatment plant, sludge from the proposed treatment plant will also be generated and disposed of in accordance with the relevant guidance and regulations.

5.8.3.2 Based on the forecast of passengers in 2038 (commencement of operation of 3RS in 2023 plus 15 years), it is estimated that approximately 46,190 tons of general refuse will be generated by the project. The initiatives currently implemented at HKIA in segregating recyclable waste materials (such as cardboard, paper, metals, plastics, glass bottles, food waste, etc.) from general refuse for recycling will be extended to cover the expanded airport. The non-recyclable waste will be disposed of at designated landfill sites.

5.8.3.3 The new artificial seawall has been properly designed to achieve a shoreline that does not have any sharp turns or abrupt indentation in order to avoid or minimise any trapped or accumulated refuse. With appropriate seawall design, it is estimated that about 65 m^3 of floating refuse would be collected from the new artificial seawall every year. The floating refuse will be sorted and recycled or disposed of at designated landfill sites, as appropriate.

5.8.3.4 It is difficult to quantify the amount of chemical waste that could arise during the operation phase of the project at this stage, as it would be dependent on the equipment maintenance requirements and the amount of equipment utilised. As per current requirements at the airport, all chemical waste would be properly handled, stored, labelled and disposed of in accordance with the Waste Disposal (Chemical Waste) (General) Regulation.

5.8.3.5 Based on the operation records of the existing greywater treatment facility, it is estimated that the quantity of dewatered sludge from the proposed new greywater treatment plant would be approximately 0.23 tons/day. The dewatered sludge will be stored in tight containers or skips and delivered to the designated landfill sites for final disposal by a reputable licensed waste collector. The sludge generated will be handled and managed to minimise the adverse impact of odour and potential health risks to the operators by attracting pests and other disease vectors.

5.8.3.6 Provided that all the identified waste materials are handled, transported and disposed of in strict accordance with the relevant legislative requirements, and the recommended mitigation measures are properly implemented, no unacceptable environmental impacts are expected during the operation phase.

5.9 Land Contamination

5.9.1 Introduction

5.9.1.1 The potential land contamination issues associated with the project have been assessed by following the guidelines in Sections 3.1 and 3.2 of Annex 19 of the EIAO-TM as specified in Section 3.4.9 of the EIA study brief. In accordance with the requirement set out in Appendix E2 of the EIA study brief, a Contamination Assessment Plan (CAP) was prepared for the project and endorsed by EPD in February 2014.

5.9.1.2 Desktop study and site reconnaissance surveys were conducted to determine the past and present land uses, including potentially contaminative uses, within or in the vicinity of the project area. Other relevant information was also collected from various Government departments.

5.9.2 Potential Impact

5.9.2.1 Based on the findings of the site appraisal on the present and past land uses in the land contamination assessment areas, none of the assessment areas are identified as potential contaminative land use types listed in Table 2.3 of the EPD Practice Guide for Investigation and Remediation of Contaminated Land (2011), except the golf course area, the underground and above-ground fuel storage tank areas, emergency power generation units, fuel tank rooms and airside petrol filling station.

5.9.2.2 There was no record of chemical waste spillage or leakage in any of the assessment areas, according to information obtained from the EPD. Based on information provided by the Fire Services Department (FSD), no DG spillage or leakage incidents were recorded within the assessment areas. The reconnaissance site surveys also did not identify any potential source or sign of land contamination within the assessment areas, except the golf course area, the underground and above-ground fuel storage tank areas, emergency power generation units, fuel tank rooms and airside petrol filling station.

5.9.2.3 According to the EP of the golf course, artificial chemical fertilisers and pesticides are not allowed to be used on the golf course and turf area. While no sign of land contamination was observed at the golf course maintenance facility, maintenance activities are still on-going, which may potentially cause land contamination when the site is returned to AAHK. The EP requires that Airport Management Services Limited (AMSL) should carry out post-operation soil sampling and testing works in order to identify any land contamination issues and, if necessary, to decontaminate the site. AMSL will then undertake all the necessary testing and remediation works, if required, after the expiry of operation of the golf course. Therefore, it is anticipated that upon the return of the golf course area to AAHK, there would be no land contamination issues, or any land contamination would have been satisfactorily cleaned up. Therefore, no unacceptable impact due to land contamination is anticipated.

5.9.2.4 For the T2 building expansion area, two underground fuel storage tanks, two above-ground fuel storage tanks and two emergency power generation units to the north and south of T2 were identified. Besides, two more above-ground fuel storage tanks within the T2 building will be demolished as part of the expansion works. For the existing airside facilities, a petrol filling station and a fuel tank room will also require relocation. The preparation and implementation of a sampling and testing plan, including the number of sampling locations and sampling depths, is recommended prior to the commencement of any construction works at these areas.

5.9.2.5 Since some of the assessment areas were currently not accessible for site reconnaissance, future site investigation (SI) locations are proposed for the potential contaminated areas based on the relevant drawings. Further site reconnaissance will be conducted once these areas are accessible in order to identify any land contamination concern. Subject to the further site reconnaissance findings, a supplementary CAP for additional SI (if necessary) may be prepared and submitted to the EPD for endorsement prior to the commencement of SI and any construction works at these areas. Nevertheless, it is anticipated that any potential land contamination concern related to possible leakage / spillage of fuel from such areas will not cause any insurmountable impact.

5.9.2.6 After completion of the SI, a Contamination Assessment Report (CAR) will be prepared and submitted to the EPD for approval prior to the start of the proposed construction works at the golf course, the underground and above-ground fuel storage tank areas, emergency power generation units, airside petrol filling station and fuel tank room. Should remediation be required, a Remediation Action Plan (RAP) and Remediation Report (RR) will be prepared for the EPD's approval prior to the commencement of the proposed remediation and any construction works, respectively. As a result, no unacceptable impact due to land contamination is anticipated.

5.9.2.7 Mitigation measures for handling, transporting and disposing contaminated materials (if any) and regular site audits are recommended in the EIA to minimise the potential adverse impacts on workers' health and safety.

5.10 Terrestrial Ecology

5.10.1 Introduction

5.10.1.1 Potential impacts on terrestrial ecology that may arise from construction and operation of the project have been assessed in accordance with the relevant requirements as specified in Section 3.4.10 and Appendix F of the EIA study brief, as well as the relevant criteria and guidelines identified in Annexes 8 and 16 of the EIAO-TM. The study area for terrestrial ecology covers the area between the airport island, north of Lantau and Sha Chau.

5.10.1.2 Literature reviews were conducted to identify ecologically sensitive terrestrial habitats in the study area. The literature review was then updated following terrestrial field surveys to fill any data gaps and provide updated information. Key terrestrial ecological sensitive receivers within the study area, or the areas that may potentially be affected by the project, include Tai Ho Stream SSSI, San Tau Beach SSSI, and Lung Kwu Chau, Tree Island and Sha Chau SSSI.

5.10.1.3 The terrestrial field surveys carried out for this EIA study between September 2012 and September 2013 include habitat mapping, flora surveys, and other relevant terrestrial and aquatic fauna surveys (i.e., macroinvertebrate, herpetofauna and aquatic fauna surveys) at off-site habitats located within the study area. In relation to the lack of available information on the flight activities of birds in the land formation area and adjacent sea, tailored avifauna field surveys, including boat transect and land-based surveys, were conducted for a total of 12 months to study the birds' activities. The boat transect survey was conducted at North Lantau waters to investigate the birds' utilisation of that area. Land-based surveys were conducted at three survey stations on the airport island and one station at Sha Chau. Furthermore, an additional egretry survey was conducted for the Sha Chau egretry.

5.10.2 Field Survey Findings

5.10.2.1 The field survey results, supplemented with the literature review, suggest that ardeid is the major bird group recorded in the open waters of North Lantau. The ardeid community includes the Little Egret, Great Egret, Pacific Reef Heron and Black-crowned Night Heron. These species are widely recorded in the study area and associated mostly with coastal habitats in North Lantau, SCLKCMP and along Urmston Road. An egretry (breeding ground for ardeid) was identified at Sha Chau. The artificial coastline of North Lantau, including the HKIA site and marine construction sites, are also commonly used by the species. Although widespread sightings were recorded, the area proposed for land formation was not found to be particularly important because of the relatively low abundance that was recorded compared to the context of the whole of North Lantau waters for this bird group.

5.10.2.2 Seabirds are mainly recorded in open areas and are seldom found in coastal areas. The abundance of seabirds in Hong Kong is highly seasonal. The analysis for seabirds in four seasons showed a relatively high abundance in the winter season, which is attributed to wintering gulls such as Black-headed Gull and Heuglin's Gull, with lower abundance in other seasons. The aggregation of wintering gulls is found mostly along Urmston Road and SCLKCMP. These species are seldom recorded in coastal water areas and are generally not present in the proposed land formation area. The results of the surveys indicate that the proposed land formation area is not an important habitat for waterbirds and landbirds. The marine-associated

Black Kite was widely recorded in the waters of North Lantau owing to its ubiquitous habit, although the proposed land formation area does not appear to be particularly important to this species.

5.10.2.3 Based on the information collected, it was found that the flight movement adjacent to the airport island is not prominent for all identified bird species. The major flight activities in the study area were found to be associated with the ardeid species, as they move between foraging places.

5.10.3 Potential Impact

5.10.3.1 The assessment of potential terrestrial ecological impacts has been made based on literature reviews and field survey findings. Based on the assessment findings, it can be concluded that the loss of 650 ha of open sea area to the north of existing airport island due to the proposed land formation works will not cause any direct loss of terrestrial habitat. The loss of 5.9 km of artificial seawall along north coast of the existing airport due to land formation works will be reinstated after the construction of the new 13-km artificial seawall.

5.10.3.2 The proposed land formation area displayed low abundance and frequency in terms of bird feeding grounds. Therefore, the impact of loss of the area as a foraging ground is considered to be low, during both the construction and operation phases. Potential interruption to bird flight movements is anticipated to be negligible, owing to the absence of important avifauna habitats or migration passages near the proposed land formation area. Given the large separation distances between ecologically sensitive areas in North Lantau and the project area, the construction and operation of the proposed project is not predicted to significantly affect the ecological resources of North Lantau.

5.10.3.3 It is concluded that the identified impacts to the terrestrial habitats, flora and fauna species in North Lantau, including the airport island, would be low or negligible in general during both the construction and operation phases of the project, except for potential construction phase impacts to the Sha Chau egretry. As part of the submarine aviation fuel pipelines diversion work, the pipeline daylighting location / works area on Sheung Sha Chau Island would potentially affect the Sha Chau egretry with moderate degree of impact. Therefore, mitigation measures for protection of the egretry are required.

5.10.3.4 The recommended mitigation measures include locating the HDD daylighting and flat top barge (if required) away from the Sha Chau egretry, preserving the nesting vegetation used by breeding ardeids; and avoiding construction activities of Sheung Sha Chau Island during night-time and the ardeids' breeding season (i.e., April to July).

5.10.3.5 A pre-construction survey prior to the commencement of HDD works at HKIA is recommended to update the latest boundaries of the egretry, as these features may change over time. With the recommended mitigation measures in place, the potential impact on terrestrial ecology would be minimised to low. As a result, no adverse residual impacts are anticipated during both the construction and operation phases.

5.11 Marine Ecology

5.11.1 Introduction

5.11.1.1 Potential impacts on marine ecology that may arise from the construction and operation of the project have been assessed in accordance with the relevant requirements as specified in Section 3.4.10 and Appendix F of the EIA study brief, as well as the relevant criteria and guidelines identified in Annexes 8 and 16 of the EIAO-TM. The study area for marine ecological impact assessment is the same as that for the water quality impact assessment, which includes the North Western WCZ, North Western Supplementary WCZ, Deep Bay WCZ and Western Buffer WCZ, which includes the key habitats for CWDs.

5.11.1.2 The CWD is resident in Hong Kong's western waters and has been shown to be declining in abundance in Hong Kong in recent years. The available survey data are largely based upon more than 20 years of data collected by the Agriculture, Fisheries and Conservation Department's (AFCD) long-term small cetacean monitoring programme, which does not cover the existing HKIAAA (i.e., Marine Exclusion Zone). In order to supplement project specific baseline details, focused CWD surveys were undertaken over a 12-14 month period, covering the proposed land formation footprint and particularly within the existing HKIAAA. The CWD surveys include vessel based line transect surveys, land-based theodolite tracking surveys and underwater noise assessment in the form of passive acoustic monitoring (PAM) surveys.

5.11.1.3 In addition to CWD surveys, a comprehensive baseline ecological literature review has also been conducted for the identification of information gaps. Marine ecological surveys specific to the proposed land formation footprint, especially within the existing HKIAAA, were conducted, covering intertidal habitats, sub-tidal soft bottom and hard bottom habitats, and marine waters. Updated verification surveys were also conducted along the North Lantau coast (from Yan O to the east and Tai O to the west), SCLKCMP and The Brothers. Where appropriate, reference sites with similar ecological attributes to the habitats within the land formation footprint were also surveyed to facilitate ecological evaluation.

5.11.2 Field Survey Findings

5.11.2.1 The field surveys yielded important data on which a full evaluation of the importance of the proposed works area to the CWDs was conducted, based on a synthesis of information from previous studies and the results of the current field work directed at assessing impacts within the land formation area and specifically within the current HKIAAA. While the abundance of CWDs within the two surveyed areas (airport north and airport west) is considered to be at the low end of moderate, the densities of dolphins in those areas, based on 12-14 months of data collected, appear similar to those in the known historically important CWD habitats, such as The Brothers area and Southwest Lantau. These densities are much lower than those in the most critical habitat areas of Northwest Lantau and West Lantau, however the Northeast Lantau (covering the proposed land formation footprint) and Southwest Lantau areas are still considered important habitats particularly in the light of the declining abundance of CWDs in Hong Kong waters. The PAM survey data collected between December 2012 and December 2013 suggests that CWDs may use the areas directly north of the airport more at night than during the day, although the significance of this compared with CWD use in other CWD habitat areas during night-time is not known.

5.11.2.2 Some CWDs use the airport north and airport west survey areas as part of their general habitat and as a portion of a much larger home range. A variety of activities occur in these areas, although they do not seem to represent prime feeding areas for the CWDs. The data collected appears to point to these areas being used as important travelling areas between feeding habitats to the east at The Brothers and Sham Shui Kok, and to the west at the SCLKCMP and West Lantau area. Although the value of these focused survey areas was not readily apparent from historical studies of CWDs in Hong Kong, recent changes in habitats (such as the opening of SkyPier and its attendant new vessel traffic just north of the airport, on-going intensive construction of the Hong Kong Boundary Crossing Facility directly northeast of the existing airport island and the construction of the Hong Kong Link Road to the west and south of the airport) have potentially resulted in variations in how the CWDs are using the available space. It is possible that these focused study areas may have been used more by CWDs during the study period than in the past because of these habitat changes.

5.11.2.3 Data from literature review and field surveys were obtained to evaluate the ecological value for the intertidal, sub-tidal soft bottom and hard bottom, and marine water habitats within the proposed land formation footprint. Along the surveyed artificial seawall of the existing airport island, species diversity and evenness were found to be moderate-low, and no intertidal species of conservation importance were recorded. Polychaetes represented the highest species richness and abundance recorded at sub-tidal soft bottom habitats within the land formation footprint. For sub-tidal hard bottom habitats, isolated colonies of Gorgonian *Guaiagorgia* sp., which is common in western Hong Kong waters, were recorded with a low coverage along the existing artificial seawall at the north of Chek Lap Kok within the proposed land formation footprint. A cup coral species of conservation importance, *Balanophyllia* sp., was recorded with low coverage at the northeast seawall along the existing airport island outside the land formation footprint. Within the open waters of the land formation footprint, six marine fish species of conservation importance were recorded, all of which were also found outside the footprint, except for the Longheaded eagle ray (recorded within the footprint only by trawl survey at a relatively low density). The ecological values of artificial seawall along the existing airport island, the sub-tidal soft bottom and hard bottom habitats, as well as marine waters within the land formation footprint were thus considered in a range from low to moderate-high.

5.11.2.4 Data from literature reviews and field surveys were also obtained to evaluate the ecological value for the intertidal, sub-tidal soft bottom and hard bottom, and marine water habitats along the North Lantau coast, and four recognised sites of marine conservation importance within the North Western WCZ and Southern WCZ. These sites included the San Tau Beach SSSI, SCLKCMP, planned Brothers Marine Park (BMP) and potential Southwest Lantau Marine Park (SWLMP), which are all outside the land formation footprint but within the study area. Such habitats may be subject to indirect impact by the project but anticipated to be insignificant.

5.11.2.5 Mangrove and intertidal mudflat habitats along the North Lantau coast at Tai Ho Wan, Tung Chung Bay, San Tau and Sham Wat Wan were identified as important intertidal habitats. The presence of seagrass beds at San Tau and Tai Ho Wan was verified with three seagrass species recorded, and a new locality of *Halophila beccarii* was found at Sham Wat Wan. A significant number of horseshoe crab juveniles and sub-adults were recorded at Sham Wat Wan, San Tau, Tung Chung Bay and Tai Ho Wan, suggesting that these areas may be part of the nursery grounds of horseshoe crabs in Hong Kong. Eight fish species and one crab species of conservation importance were recorded for intertidal streams along the North Lantau coast, including the spotted seahorse *Hippocampus kuda* and the pipefishes *Syngnathoides biaculeatus* and *Syngnathus schlegeli*. For the sub-tidal soft bottom habitat, one individual of amphioxus, *Branchiostoma belcheri*, was found at North Lantau outside the land formation footprint, and low coverage of cup coral *Balanophyllia* sp. and ahermatypic coral *Paracyathus rotundatus* were observed within SCLKCMP. For the sub-tidal hard bottom habitat, a low abundance of benthic fauna and low coverage of cup coral *Balanophyllia* sp. were commonly recorded throughout the study area outside of the land formation footprint. For the open marine water habitats, a moderate abundance of marine fauna was recorded at North of airport island outside the land formation footprint, SCLKCMP and The Brothers, and a total of 20 species of conservation importance (including 17 fish species, one sea snail and two horseshoe crabs) were identified. In summary, the four sites of marine conservation importance within the North Western WCZ were considered overall to be of high ecological value, while the intertidal, sub-tidal and marine water habitats were evaluated to range from low to high ecological values. Nevertheless, the identified recognised sites of conservation importance are all outside the land formation footprint and would only be subject to insignificant indirect impact by the project.

5.11.3 Potential Impact

5.11.3.1 The proposed 3RS project layout and construction methods have been chosen to avoid and minimise potential ecological impacts by design. The land requirement estimates have been reduced by about 20% through systematic option assessment and refinement. In terms of construction methods, percussive piling and underwater blasting, which can present high risks of nuisance and injury to the CWDs, have been avoided and the measures such as the adoption of the method of Deep Cement Mixing (DCM) have been adopted to minimise disturbance to the marine environment. Bored piling for the new runway landing lights and beacons would also avoid the peak CWD calving season of March to June as a precautionary measure.

5.11.3.2 Nevertheless, the proposed land formation will result in the permanent loss of 672 ha[13] of seabed (about 40% of which is part of the capped CMP). Beyond the seawall toe at the seabed, varying widths of scour aprons of approximate 10 ha will be constructed (the actual width required for scour protection is subject to detailed design). The scour aprons will be in the form of stone or gravels. These habitats will provide hard substrates for the re-colonisation of benthic fauna. In addition, 650 ha of open waters for marine fishes, CWDs and associated marine benthos, as well as 5.9 km of artificial seawall with low coverage of soft corals will be lost.

5.11.3.3 With regard to CWDs, the construction and operation phase impacts associated with habitat loss, influence on travelling areas and overall disturbance to CWD behaviour have been assessed. Many impacts have been concluded to be insignificant or minor as a result of the above measures. However, the project will result in some impacts on the CWD population in Hong Kong waters, mostly related to the loss of CWD habitat, the reduction of the size of CWD travelling areas between the east and west of the airport and the associated impacts on habitat fragmentation and carrying capacity, largely as a result of the new land formation, as well as impacts from the SkyPier high-speed ferries (HSF) traffic.

[13] Proposed land formation footprint: 650 ha. The net seawall toe construction is 12 ha (22 ha proposed seawall toe minus 10 ha of the existing seawall toe). Approximate 10 ha scour apron of varying widths (subject to detailed design) will be constructed beyond the seawall toe for scour protection. Therefore, the total open water to be lost is 650 ha, but seabed habitat to be lost would be 672 ha.

5.11.3.4 The proposed land formation footprint area is a very small proportion of the overall PRE CWD population's habitat area and only 2.5 % of the Hong Kong habitat area but represents part of the home range for some of the Hong Kong sub-population. Also, the SkyPier HSF traffic will need to move through regions of moderate or even high CWD density and controls are, therefore, required to minimise nuisance and risk of collisions.

5.11.3.5 The potential disturbance to the function and quality of marine parks within the study area during the construction and operation phases has been assessed. Indirect disturbance to the SCLKCMP may include the corresponding effects of gradual habitat loss due to land formation, marine traffic and vessel noise, loss of CWD prey resources, and disturbance from HSF. It is, however, possible that the building of the 3RS project could result in increased CWD use of the SCLKCMP as they may be displaced from the area north of the airport. Potential impacts due to the change in habitat quality of the SCLKCMP, including the potential loss of prey resources of CWDs and hydrodynamic changes to the water quality regime, are considered to be of low-moderate significance. With the implementation of mitigation measures including construction vessel speed restrictions and other protection measures for CWDs (see **Section 5.11.3.10**), residual impacts are predicted to be acceptable.

5.11.3.6 Potential indirect disturbance to the planned BMP including the impact on travel areas (north of the airport island), marine traffic movements, vessel noise and the potential disturbance as a result of changing in hydrodynamic and water quality during the construction and operation of the 3RS project have been evaluated. If the new travel area (north of the expanded airport island) is not used as extensively as the existing travel area (north of the existing airport island), then CWDs may travel less to the Brothers area, and this will likely result in a negative impact on CWD abundance in that specific area. For the marine traffic movements, the increase in SkyPier HSF traffic is not expected to be significant that may affect the function and quality of the planned BMP. The potential disturbance to the planned BMP as a result of change in hydrodynamic and water quality regime from the land formation and the associated potential impact on prey resources available for CWDs has been reviewed. It has been concluded that there would not be any significant impact on the sustainability of the fisheries resources at the planned BMP, and specifically the CWD prey species, due to the high mobility of the fish and availability of prey for the CWD in northern Lantau waters. However, taking a precautionary approach, the potential impact on CWD use of the planned BMP during the construction phase is considered to be of moderate significance, and appropriate mitigation has therefore been proposed, in particular the establishment of a much larger marine park by linking the planned BMP.

5.11.3.7 The potential SWLMP is far from the 3RS construction works, hence significant impact on the quality or function of this potential marine park due to the 3RS development is not expected.

5.11.3.8 The potential impacts on marine fauna other than CWDs are considered to be insignificant to moderate. Moderate impacts on the sub-tidal soft bottom habitat and open waters are predicted in view of the permanent loss associated with land formation works and seawall construction.

5.11.3.9 A range of measures has been proposed to minimise, mitigate and compensate for the potential impacts on CWDs and marine ecology during the construction and operation phases of the project. As noted above, the proposed land formation area has been reduced to 650 ha to minimise loss of marine resource habitat, including CWD habitat and alternative construction methods have been proposed to reduce direct and indirect disturbance to seabed and marine habitats to a minimum, including the non-dredge DCM methods; the use of HDD at bedrock level for submarine aviation fuel pipeline diversion and the use of water jetting for submarine cable diversion. To minimise water quality impacts and therefore, associated impacts to CWDs, construction of a minimum 200 m leading edge of seawall prior to marine filling works will be adopted, together with the deployment of silt curtains.

5.11.3.10 Specific mitigation measures for the protection of CWDs and marine ecology have been recommended, which include:

- Conducting a pre-construction phase coral dive survey to review the feasibility of coral translocation as a precautionary measure;
- Avoiding peak calving season for CWDs when undertaking bored piling activities as a precautionary measure;
- Establishing dolphin exclusion zones during ground improvement works (e.g. DCM), water jetting works for submarine cables diversion, excavation at the field joint locations, seawall construction and bored piling works;
- Acoustic decoupling of construction equipment mounted on barges;
- Establishing a spill response plan as precautionary measure;
- Setting speed restrictions for construction vessels at a maximum of 10 knots within areas where CWDs are likely to occur; and
- Diverting SkyPier HSFs travelling to/from Zhuhai and Macau to the north of SCLKCMP and restricting their speed to 15 knots across areas with high CWD abundance.

5.11.3.11 In addition, the establishment of a new marine park of approximate 2,400 ha by linking the planned BMP and the existing SCLKCMP (**Drawing No. MCL/P132/ES/5-11-001**) is recommended. The total area of this proposed new marine park is much greater than the seabed habitat loss of 672 ha and is expected to significantly improve the conservation prospects for the Hong Kong sub-population of CWDs by mitigating the impacts of habitat loss, habitat fragmentation, changes in patterns of habitat use, as well as minimising the noise and disturbance from marine traffic, specifically HSFs. It should also be noted that the new marine park will be contiguous with the PRE CWD national nature reserve established by the Mainland side, thereby linking the protected habitat between Hong Kong and the mainland. The Administration has made a firm commitment to seek to designate the proposed marine park of approximately 2,400 ha in the waters north of the 3RS project in accordance with the statutory process stipulated in the Marine Parks Ordinance, as a mitigation measure for the permanent habitat loss arising from the 3RS project. AAHK will seek to assist in completing the designation tentatively around 2023 to tie in with the full operation of the 3RS. In addition, environmental enhancement measures have also been recommended to contribute to strengthening marine ecology and fisheries resources in northern Lantau waters. These includes eco-enhancement designs of part of the seawall to facilitate colonisation by intertidal and sub-tidal fauna within the future extended HKIAAA, exploring the feasibility of deployment of artificial reefs, setting up a marine research programme to support conservation of marine ecology, setting up an education programme to provide a platform for local school groups and the general public to learn more about local marine ecology and CWDs, and the promotion of environmental education and eco-tourism. An Environmental Enhancement Fund will be established to support these activities.

5.11.3.12 Through the implementation of the proposed mitigation measures, the potential residual impacts due to the construction and operation of the project would be reduced to levels that are not predicted to cause significant population-level impacts on the PRE CWD population or the Hong Kong sub-population. Similarly, the potential construction and operation phase impacts on marine fauna other than CWDs would also be mitigated to acceptable levels.

5.12 Fisheries

5.12.1 Introduction

5.12.1.1 Potential impacts on fisheries associated with the construction and operation of the project have been assessed in accordance with Section 3.4.11 and Appendix G of the EIA study brief as well as Annex 9 and Annex 17 of the EIAO-TM. The study area for the fisheries impact assessment is the same as that for the water quality impact assessment, which includes the North Western WCZ, North Western Supplementary WCZ, Deep Bay WCZ and Western Buffer WCZ.

5.12.1.2 The fisheries impact assessment was conducted based on information gathered from literature review and fisheries surveys to fill identified information gaps, especially within the HKIAAA, where vessels are restricted entry for security purposes. Fisheries surveys on marine habitats that would potentially be affected by the 3RS project were carried out. Various surveys including fish trawl, purse seine, gill net, hand line, artificial reefs, ichthyoplankton and fish post-larvae surveys, as well as fisheries interview survey were carried out to update and supplement the status of fisheries resources and fishing activities within the study area for a robust fisheries impact assessment.

5.12.2 Field Survey Findings

5.12.2.1 Based on the literature review and latest fisheries survey findings, the sites of fisheries importance that were identified within the study area include spawning grounds of commercial fisheries resources in northern Lantau waters; SCLKCMP; artificial reefs at SCLKCMP and proposed artificial reefs deployment at the planned BMP; Ma Wan Marine Fish Culture Zone (FCZ); the area of high production of capture fisheries at Tai O; the area around the Brothers which has been proposed to be designated as Marine Park arising from the Hong Kong-Zhuhai-Macao Bridge – Hong Kong Boundary Crossing Facilities project; and the oyster production area at the Deep Bay mudflat.

5.12.2.2 There were no aquaculture activities or artificial reefs within the land formation footprint. The level of overall fishing operations was moderate. The fisheries productions in terms of abundance and yield were low and moderate respectively, and most dominant species were of low or no commercial value. The ichthyoplankton and fish post-larvae densities and family richness were low.

5.12.2.3 Apart from the land formation footprint, four areas adjacent to the footprint that may be affected by the project were examined. These included The Brothers, western and northern Chek Lap Kok waters, and SCLKCMP.

5.12.3 Potential Impact

5.12.3.1 Fisheries impacts are likely arising from the 3RS project due to the proposed land formation works, diversion of submarine 11kV cables, SI within the SCLKCMP and construction of a floating temporary platform for the submarine aviation fuel pipeline diversion works, the provision of approach lights at two ends of the third runway, and provision of marker beacons along the boundaries of the future HKIAAA, which will lead to both permanent and temporary loss of fishing grounds, direct loss of fisheries habitats (and resources), direct loss of spawning grounds at the northern Chek Lap Kok waters. There will also be indirect disturbance of fisheries habitats due to the potential deterioration of water quality, indirect impact on aquaculture sites, indirect impact on artificial reefs, disturbance of fishing activities, disturbance to fisheries resources associated with underwater sound, change in hydrodynamics and tidal influence, impingement and entrainment due to seawater intakes, indirect disturbance of marine fishes due to aircraft noise and potential impact due to the extension of HKIAAA as fisheries "no-take-zone".

5.12.3.2 The waters within the proposed land formation footprint would be moderately used by fishermen for capture fisheries. The land formation works will result in a total (permanent plus temporary) fishing ground loss of approximately 1,392 ha, including a permanent loss of 410 ha[14] during the construction phase, which is considered to be of low impact significance from the commencement of construction to moderate impact significance upon completion of land formation works. During the operation phase, permanent loss of fishing ground will be 768 ha[15], which is also considered to be of moderate impact significance.

5.12.3.3 There would be a permanent loss of 672 ha[16] of fisheries habitats (and resources), which is considered to be of low impact significance from the commencement of construction to moderate impact significance upon completion of land formation works. The proposal to establish a large marine park of approximately 2,400 ha (**Drawing No. MCL/P132/ES/5-11-001**) would compensate for the loss of fisheries habitats (and resources) / fishing ground by improving the ecological connectivity between the existing SCLKCMP, the planned BMP, the Pearl River Chinese White Dolphin Nature Reserve (PRCWDNR) and the existing / future HKIAAA. In addition, a suite of controls and restrictions according to the Marine Parks Ordinance and the Marine Parks and Marine Reserves Regulation, including the control of fishing activities, speed restriction to 10 knots or below and control of other anthropogenic disturbance, would further promote the recovery of fisheries resources in the northern Lantau waters and adjacent areas. With the implementation of the proposed new marine park, conservation of fisheries resources within the proposed new marine park and adjacent waters would be promoted, and there would be a positive synergistic effect on fisheries resources conservation. Therefore, no adverse residual impact on loss of fisheries habitats (and resources) is anticipated after the establishment of the proposed new marine park.

5.12.3.4 The recovery of potential fisheries resources due to the relevant protection measures to be applied for the proposed marine park, together with the synergic effect of the connected marine protected areas, will benefit the adjacent fishing grounds. Based on successful cases of establishing marine protected area to enhance fishing efficiency, it is considered that the proposed establishment of the new marine park as a compensation measure for loss of fishing grounds will mitigate the potential impact to no adverse residual impact.

5.12.3.5 Nevertheless, a number of fisheries enhancement measures, including eco-enhancement design of part of the seawalls within the future extended HKIAAA, potential deployment of artificial reefs at appropriate locations to promote juvenile fish recruitment, and implementation of a Fisheries Enhancement Strategy (FES), are proposed in addition to the recommended mitigation

[14] 410 ha = 650 ha of proposed land formation area – 240 ha of existing HKIAAA

[15] 768 ha = 650 ha of proposed land formation area – 240 ha of existing HKIAAA + 358 ha of proposed new HKIAAA

[16] 672 ha = 650 ha of proposed land formation area + 22 ha of proposed seawall toe construction + 10 ha of scour apron – 10 ha of existing seawall toe

measures, with a view to further improving the fisheries resources in the western Hong Kong waters and supporting sustainable fisheries operation. A Fisheries Enhancement Fund will be established to support these activities.

5.13 Landscape and Visual

5.13.1 Introduction

5.13.1.1 A landscape and visual impact assessment has been carried out in accordance with Section 3.4.12 and Appendix H of the EIA study brief, and Annexes 10 and 18 of the EIAO-TM. The current relevant planning and development control framework was reviewed, it is concluded that the proposed 3RS is generally consistent with the current land uses, and there is no conflict with the relevant planning and development control framework.

5.13.1.2 The main sources of impacts on existing landscape and visually sensitive receivers were identified. These include construction and operation of the proposed land formation, T2 expansion and associated infrastructure, new passenger concourses and other airport buildings, laying of the 11 kV submarine cables and field joint connection, and the daylighting point for submarine aviation fuel pipelines. It should be noted that impacts have already been avoided or minimised as part of the project design. For example, the land formation footprint has been located to the north of the existing HKIA, which is furthest away from most of the visual sensitive receivers (VSRs), and the adoption of HDD method for construction of the submarine aviation fuel pipelines has minimised the area of landscape resources (LR) affected.

5.13.1.3 Within the landscape and visual impact assessment study area, a total of 19 LR, 11 landscape character areas (LCAs) and 79 representative VSRs were identified that may be affected by the 3RS. In addition, a broad-brush tree survey was also carried out to determine, in broad terms, the potential impacts on existing trees.

5.13.2 Construction Phase

5.13.2.1 Based on the impact assessment findings, mitigation measures covering all relevant landscape and visual aspects are proposed to be implemented during construction. These include minimising construction works areas, construction periods, construction-related marine and road traffics and construction plants; phasing construction; providing screen hoarding; controlling night-time lighting; hydroseeding exposed surfaces; protecting existing trees; transplanting affected trees.

5.13.2.2 After implementing the recommended mitigation measures, all LRs and LCAs are either anticipated to experience residual impacts of slight or insubstantial significance, or they are not anticipated to be affected by the construction of the 3RS, with the exception of the following:

Landscape Resources

- The coastal waters of North Lantau adjacent to Chek Lap Kok are anticipated to experience impacts of substantial significance due to a loss of 650 ha of coastal waters as a result of the new land formation.
- Roadside amenity planting within the assessment area is anticipated to experience impacts of moderate significance after the implementation of mitigation measures.

Landscape Character Areas

- Inshore water landscape is anticipated to experience a residual impact of substantial significance due to highly visible marine construction activity and the loss of 650 ha of this LCA.

5.13.2.3 With implementation of the mitigation measures, all VSRs are either anticipated to experience residual impacts of slight or insubstantial significance, or are not anticipated to be affected by the 3RS during construction phase, except the following VSRs:

- Passengers / drivers of recreational marine craft in North Lantau waters and Urmston Road and recreational users of Sha Chau islands are anticipated to experience a large magnitude of visual change, and this, combined with their high sensitivity, results in an impact considered to be of substantial significance.
- Residents of Tung Chung, including Tung Chung Crescent, Seaview Crescent, Caribbean Coast, Area 53 to Area 56, as well as residents along south coast of Tuen Mun, Hong Kong Gold Coast and Siu Lam; Hong Kong SkyCity Marriott Hotel, Hong Kong Airport Passenger Terminal and Regal Airport Hotel; passengers of Cable Cars of Ngong Ping 360; hikers of Nei Lak Shan, Fung Wong Shan (Lantau Peak), Tai Tung Shan (Sunset Peak), Lantau North Country Park, Lantau South Country Park and Scenic Hill are anticipated to experience an intermediate magnitude of visual change, and this, combined with their high sensitivity, results in an impact considered to be of moderate significance.
- Passengers / drivers of vehicles and Mass Transit Railway (MTR) along Cheong Wing Road; visitors to AsiaWorld-Expo; passengers of commercial aircraft; passengers / drivers of the proposed Hong Kong Link Road; and passengers of ferries in North Lantau waters and Urmston Road are anticipated to experience an intermediate magnitude of visual change, and this, combined with their medium sensitivity, results in an impact considered to be of moderate significance.

5.13.3 Operation Phase

5.13.3.1 Based on the impact assessment findings, mitigation measures covering all relevant landscape and visual aspects are proposed to be implemented during operation. These include sensitive landscape design at the land formation edges; sensitive and aesthetic design of building / structure facades to ensure good integration and compatibility; sensitive lighting / streetscape design; reinstatement of disturbed areas; implementation of greening measures; compensatory tree planting use of appropriate building materials and colours; sensitive design of footbridges; greening of noise barriers and enclosures; sensitive design of streetscapes and lighting and aesthetic improvement planting.

5.13.3.2 The residual landscape impacts on LRs and LCAs after the implementation of mitigation measures during the operation phase were assessed. All LRs and LCAs are anticipated to experience residual impacts of slight or insubstantial significance or are not anticipated to be affected by the 3RS, except that the residual impacts on coastal waters of North Lantau and inshore water landscape would remain substantial during operation phase due to the permanent loss of approx. 650 ha of coastal waters. However, this permanent loss is the absolute minimum necessary for the creation of the 3RS, and there remains a much larger area of coastal waters of North Lantau and inshore water landscape that will be unaffected by 3RS and that will be available in the operation phase as an on-going landscape resource.

5.13.3.3 With implementation of the recommended mitigation measures, all VSRs are either anticipated to experience residual impacts of slight or insubstantial significance, or are not anticipated to be affected by the 3RS, except that passengers / drivers of recreational marine craft in North Lantau waters and Urmston Road and recreational users of Sha Chau islands are anticipated to experience residual impacts of moderate significance.

5.13.3.4 In accordance with the criteria and guidelines for evaluating and assessing impacts as stated in Annex 10 and 18 of the EIAO-TM, it is considered that the overall residual landscape and visual impacts of the proposed 3RS are marginally acceptable with mitigation during the construction and operation phases.

5.14 Cultural Heritage

5.14.1 Introduction

5.14.1.1 As required under Section 3.4.13 of the EIA study brief, a cultural heritage impact assessment has been conducted. This includes a marine archaeological investigation (MAI), along with a review of terrestrial archaeology and built heritage, to evaluate the impacts on known or potential cultural heritage in the study area. The cultural heritage impact assessment follows the requirements of Annexes 10 and 19 of the EIAO-TM, while the requirements for the MAI are also set out in Appendix I of the EIA study brief.

5.14.2 Marine Archaeology

5.14.2.1 The scope of the MAI covers all marine-based activities that have the potential to impact marine archaeological resources. These include:

- Land formation of approximately 650 ha to the north of the existing airport island;
- Construction of new runway approach lights; and
- Diversion of the 11 kV submarine cables.

5.14.2.2 Activities for diversion of the submarine aviation fuel pipelines (including the associated marine SI and drilling works) have not been included in the MAI study area as the marine SI works affect a very small area of seabed only, while the pipelines would be constructed through sub-sea bedrock. With this construction method, direct impact on marine archaeological resources would be avoided and the risk of indirect impacts due to vibration would be insignificant.

5.14.2.3 The methodology for conducting the MAI was based on the Guidelines for MAI issued by the Antiquities and Monuments Office (AMO), which specifies the following tasks:

- Baseline Review;
- Geophysical Survey;
- Establishing Archaeological Potential; and
- Visual Diver Survey.

5.14.2.4 The findings of the baseline review established that the area is generally considered to have high archaeological potential based on records of historical events in the area, and due to a previous discovery (and the subsequent recovery) of a 19^{th} century cannon in 1993 as part of the original airport construction works. However, it was also recognised that approximately 28% of the MAI study area has already been impacted due to construction and operation of the CMPs, therefore, the CMP area is considered to have zero archaeological potential.

5.14.2.5 Based on the findings of the baseline review, further investigation was warranted. In December 2012, a geophysical survey comprising side scan sonar, seismic profiler, dual frequency and multi beam echo sounder was completed. Analysis of the data showed a total of 41 sonar contacts within the MAI study area, of which 22 were deemed to have archaeological potential. Further investigation in the form of magnetometer survey for the 22 sonar contacts was completed in March 2013. The magnetometer survey located a total of 180 magnetic contacts within 25 m radius of the 22 sonar contacts. After more detailed review of the findings, and taking into account relevant factors, a final list of 57 magnetic contacts and 11 sonar contacts were deemed to have archaeological potential, and thus required visual inspection.

5.14.2.6 An application for Licence to Excavate and Search for Antiquities under the Antiquities and Monuments Ordinance was made for conducting the visual diver survey, and the licence was issued on 28 June 2013. The diver survey was conducted in July and August 2013. All 11 sonar and 57 magnetic contacts were located during the diver survey and identified as modern debris. No marine archaeological remains were positively identified during the seabed survey.

5.14.2.7 Based on these findings, it was concluded that there are no resources of marine archaeological value located with the MAI study area. Therefore, no adverse marine archaeological impacts are expected, and no mitigation measures are required.

5.14.3 Terrestrial Cultural Heritage

5.14.3.1 For the terrestrial cultural heritage impact assessment, a study area covering a radius of 500 m from the land-based project boundary was adopted. This includes the daylighting point of the submarine aviation fuel pipelines on Sheung Sha Chau Island, where the aviation fuel receiving facility is located, and the existing airport island. A literature review and desktop study was undertaken to identify any baseline terrestrial cultural heritage resources within the study area. The literature review identified six sites of archaeological interest and two built heritage features, which wholly or partially lie within the 500 m study area boundary. Of these, the Ha Law Wan site of archaeological interest and the Sha Chau site of archaeological interest are located within the project boundary, but not within the construction works boundary. No other sites of archaeological potential or built heritage features were identified as part of the literature review. A site walkover survey at Sheung Sha Chau Island also did not identify any additional built heritage features.

5.14.3.2 Potential impacts on the sites of archaeological interest located within the project boundary were assessed, taking into account the nature and proximity of the nearest construction activities. The construction activities adjacent to the Ha Law Wan site of archaeological interest involve the construction of new elevated roads and re-alignment of existing roads. However, there will be no encroachment into the boundary of the Ha Law Wan site during the construction or operation phase; therefore, direct impacts have been avoided. Potential indirect impacts due to bored piling activities were assessed to be insignificant given the small scale of the works and a buffer distance of approximately 25 m.

5.14.3.3 For the Sha Chau site of archaeological interest, the adoption of the HDD method avoids direct impacts due to the construction of the submarine aviation fuel pipelines. Potential indirect impacts due to the drilling activities were assessed to be insignificant, given that each drillhole would be less than 1 m in diameter and the drilling depth will be largely about 50 m below the seabed. Temporary power supply to Sha Chau (during the submarine 11 kV cable diversion) will be provided via a temporary generator unit and cables located on existing paved areas; therefore, no direct impacts will arise. The terrestrial archaeological assessment concluded that there will be no impact on the identified sites of archaeological interest during the construction or operation phase, and no mitigation measures are required.

5.14.3.4 For the two built heritage features within the study area (Tung Chung Battery at Tung Chung and Tin Hau Temple at Sha Chau), no direct impacts were identified as no built heritage resources are located within the project boundary. Indirect impacts due to vibration, noise or visual disturbance were assessed to be unlikely given the large buffer distance (approximately 400 m or more) between the construction works areas and the built heritage features. The built heritage assessment concluded that there will be no impact to the built heritage resources during the construction or operation phase, and therefore no mitigation measures are required.

5.15 Health Impact

5.15.1 Introduction

5.15.1.1 Potential health impacts in relation to air emissions and aircraft noise arising from the operation of the project, have been assessed in accordance with the requirements given in Section 3.4.14 together with Section II of Appendix A and Section II of Appendix C of the EIA study brief. This is the first transport infrastructure project in Hong Kong for which a Health Impact Assessment (HIA) has been carried out.

5.15.2 Air Pollutants

5.15.2.1 The HIA focused on toxic air pollutants (TAP) and criteria pollutants. A literature search was conducted for determining the best approach and methodology for the HIA. Inhalation was identified as the major exposure pathway.

5.15.2.2 Health risk determination based on acute, chronic non-cancer risk and cancer risk forms the basis of many of the reviewed literatures. This was adopted as the approach for the HIA of the project and consisted of the following steps: (i) hazard identification, (ii) exposure assessment, (iii) dose-response assessment, and (iv) risk characterisation.

5.15.2.3 A three-tiered approach has been adopted to short-list the key TAP. Tier 1 involves a quantitative screening that considers the emission quantities and toxicity levels of the TAP. Tiers 2 and 3 are to identify other relevant and concerned chemicals:

- Tier 1: Screening based on calculation of emission-toxicity values
- Tier 2: Reference to IARC Group 1 (Carcinogenic to humans) Chemicals
- Tier 3: Reference to TAP identified in other airport-related studies

5.15.2.4 The assessment findings revealed that the short-term (i.e., 1-hour / 24-hour) and long-term (i.e., annual) TAP concentrations due to the operation of the 3RS modelled at all potential human receptors would comply with the respective acute and chronic non-carcinogenic risk criteria. Therefore, the acute and chronic non-carcinogenic risk due to 3RS are considered acceptable. Compared with the “without project” scenario, the maximum increase in carcinogenic health risk due to TAP is predicted to be 1.14×10^{-5} which is considered acceptable.

5.15.2.5 For short-term exposure to criteria pollutants, the short-term concentrations of CO (1-hour), NO_2 (1-hour) and SO_2 (10-minute) comply with the AQO in the assessment areas. Moreover, the estimated largest yearly increases in risks of hospital admission and premature death (short-term mortality risk) associated with short-term exposure to NO_2, RSP and SO_2 due to the operation of the 3RS compared with 2RS are relatively small (i.e., maximum incremental unit risk of premature deaths per annum is predicted to be around 1.27×10^{-5}). Therefore, the short-term health risk associated with short-term exposure of the concerned criteria pollutants is considered acceptable.

5.15.2.6 The incremental change arising from the operation of 3RS against 2RS for annual concentrations of NO_2, RSP, FSP and SO_2 are less than 3% in the assessment areas. In addition, the estimated largest yearly increase in premature death (long-term mortality risk) associated with long-term exposure to FSP due to the operation of the 3RS compared with 2RS is relatively small.

Therefore, the long-term health impact associated with long-term exposure of the concerned criteria pollutants is considered acceptable.

5.15.3 Aircraft Noise

5.15.3.1 The HIA due to aircraft noise was undertaken by taking into account the requirements stipulated in the EIA study brief. Since there are no guidelines or criteria for HIA associated with aircraft noise in the EIAO-TM, the best approach and methodology for HIA were developed after a review of relevant practices in Hong Kong and overseas.

5.15.3.2 Published literature on potential health effects associated with exposure to environmental noise was reviewed. The literature review has revealed positive associations with environmental noise exposure (including aircraft noise) for both annoyance and self-reported sleep disturbance. Besides, there are some studies that focused on primary schoolchildren which indicated effects of aircraft noise on cognitive performance of children in school environment.

5.15.3.3 The HIA analysis focused on comparing the changes of health impacts between the operation of 3RS and 2RS in 2030, i.e., the year of “worst operation mode”, which represented the maximum total aircraft noise emission. The locations of interest include those populated areas adjacent to the NEF25 contour line, namely Sha Lo Wan, Tung Chung, North Lantau, Ma Wan and Siu Lam, which are collectively identified as the assessment area for this HIA. The assessment involved a quantitative analysis for both annoyance and self-reported sleep disturbance as the two main aspects, but also covered cognitive effects on children for other potential health effects from aircraft noise exposure.

5.15.3.4 The HIA findings identified that under the operation of 3RS, there would be a reduction in future population that would be subject to potential annoyance and self-reported sleep disturbance (with about 10% and 50% reduction of population affected respectively) in the assessment area.

5.15.3.5 Regarding cognitive effect on children by aircraft noise, it is noted that one kindergarten is within the noise band of 55 to 60 dB in Siu Lam under the three-runway scenario. However, it is considered that cognitive effects on students in this institute would unlikely be significant, as the aircraft noise levels would be masked by the background noise levels of 60 dB measured onsite.

5.15.3.6 As compared with the “without project” scenario, implementation of the 3RS will reduce the population that would be subject to potential annoyance and self-reported sleep disturbance in the assessment area, while cognitive effect on children arising from the operation of the project is not apparent. Therefore, it is concluded that the overall health impact associated with aircraft noise from the project in the assessment area is minimal.

5.16 Impact Summary

5.16.1.1 A summary of the environmental impacts for individual aspects in the EIA report is presented in **Table 5.3**.

Table 5.3: Summary of Environmental Impacts

Assessment Points	Results of Impact Predictions	Relevant Standards / Criteria	Extent of Exceedances Predicted	Impact Avoidance Measures Considered	Mitigation Measures Proposed	Residual Impacts
Air Quality Impact – Construction Phase						
Air Sensitive Receivers within 500 m Assessment area	▪ Compliance with the hourly TSP criterion as well as the AQOs for daily RSP and daily FSP at all ASRs under the mitigated scenario ▪ Compliance with the AQO for annual RSP and annual FSP at all ASRs under the mitigated scenario	▪ Annexes 4 and 12 of EIAO-TM ▪ Air Pollution Control Ordinance ▪ AQO	With the mitigation measures in place, the predicted cumulative TSP, RSP and FSP levels at all ASRs would comply with the relevant TSP criterion as well as the relevant AQO for RSP and FSP.	N/A	▪ Relevant measures stipulated in Air Pollution Control (Construction Dust) Regulation ▪ Water spraying for heavy construction activities at all active works areas, at a frequency of 12 times a day or once every two hours for a 24-hour working period ▪ 80% of the stockpiling area covered by impervious sheets and all dusty materials sprayed with water immediately prior to any loading transfer operation ▪ Good practices for dust control ▪ Relevant measures stipulated in EPD's Guidance Note on the Best Practicable Means for Cement Works (Concrete Batching Plant) BPM 3/2(93) ▪ Relevant measures stipulated in EPD's Guidance Note on the Best Practicable Means for Tar and Bitumen Works (Asphaltic Concrete Plant) BPM 15 (94) ▪ Relevant measures stipulated in EPD's Guidance Note on the Best Practicable Means for Mineral Works (Stone Crushing Plants) BPM 11/1 (95)	Adverse residual impact is not anticipated.
Air Quality Impact – Operation Phase						
Air sensitive receivers within 5km assessment area	NO_2, RSP, FSP SO_2, and CO levels would comply with the AQO at all ASRs	▪ Annexes 4 and 12 of EIAO-TM ▪ Air Pollution Control Ordinance ▪ AQO	No non-compliance of AQO was predicted on identified ASRs	AAHK has already been implementing a number of initiatives aimed at reducing air emissions from airport activities and operations, including: ▪ Banned all idling vehicle engines on the airside since 2008, except for certain vehicles that are exempted ; ▪ Banning the use of APU for all aircraft at frontal stands by end-2014; ▪ Requiring all airside saloon vehicles to be electric by end-2017; ▪ Increasing charging stations for EVs and electric GSE to a total of 290 by end-2018; ▪ Conducting a review on existing GSE emissions performance and exploring measures to further control air emissions; ▪ Exploring with franchisees the feasibility of expediting replacement of old airside vehicles and GSE with cleaner ones during tender or renewal of contracts; ▪ Requiring all new airside vehicles to be fuel-efficient, and making it a prerequisite for the licensing process; ▪ Providing the cleanest diesel and gasoline at the airfield;	N/A	Adverse residual impact is not anticipated.

Assessment Points	Results of Impact Predictions	Relevant Standards / Criteria	Extent of Exceedances Predicted	Impact Avoidance Measures Considered	Mitigation Measures Proposed	Residual Impacts
				▪ Requiring all of the AAHK's diesel vehicles to use biodiesel (B5); and ▪ Providing an LPG fuelling point for airside vehicles and GSE.		
Hazard to Human Life – Construction Phase						
Risk due to construction works near: ▪ Existing aviation fuel pipeline; and ▪ Storage facilities	▪ The individual risk level is below 1 x 10^{-5} per year; and ▪ Societal risk level is in the acceptable region	Annex 4 of EIAO-TM	N/A	Mitigation measure is not necessary due to the fact that the societal risk level is in the acceptable region	Although mitigation measure is not required due to the fact that the societal risk level is in the acceptable region, the following measures have been recommended for general best practice: ▪ Precaution measures should be established to request barges to move away during typhoons; ▪ An appropriate marine traffic management system should be established to minimise risk of collision, which could lead to sinking or dropped objects; and ▪ Location of all existing hydrant networks should be clearly identified prior to any construction works.	Adverse residual impact is not predicted.
Hazard to Human Life – Operation Phase						
Risk due to the operation of: ▪ New aviation fuel pipelines (submarine and underground); ▪ New fuel hydrant systems for aircraft refuelling operation at the new aircraft stands in the airport expansion area; and ▪ Airside petrol filling station	▪ The individual risk level is below 1 x 10^{-5} per year; and ▪ Societal risk level is in ALARP region	Annex 4 of EIAO-TM	N/A	▪ A similar coating standard shall be applied to the new submarine pipelines as for the existing pipelines ▪ Checks on the integrity of the new submarine pipeline should be conducted during testing and commission ▪ Before the commencement of any construction works, as-built drawings showing the alignment and level of the underground aviation fuel pipelines for the work area will be provided to the third party construction contractors ▪ Third party construction contractors are required to undertake underground pipeline detection works to ascertain the exact alignment of the underground pipeline before the commencement of works ▪ Monitoring of underground pipelines by the Leak Detection System should be provided ▪ Study should be conducted to ensure the new pipeline can withstand the planned future loading ▪ New pressure surge calculations are required for the hydrant network ▪ Appropriate pressure drop calculations should be undertaken for the new system	▪ Improvement audit to reinforce existing refuelling practices and to achieve better compliance ▪ During refuelling process, four cones are to be put in place to indicate the refuelling zone from aircraft fuelling point for the new fuel hydrant system where practicable. AAHK will communicate this recommendation to airlines and their refuelling operators as appropriate. Proper implementation of this recommendation will be checked in AAHK's future safety audits.	▪ The individual risk level is below 1 x 10^{-5} per year; and ▪ Societal risk level is in ALARP region.
Noise Impact – Aircraft Noise						
Aircraft Noise						
Whole Hong Kong territory	NEF 25 and NEF 30 contours	NEF25 for all domestic premises, hotels, educational institutions,	A portion of land use in Lok On Pai under planning	The following noise abatement practices currently adopted for the existing airport	▪ Putting the South Runway on standby where possible at night between 2300	N/A

Assessment Points	Results of Impact Predictions	Relevant Standards / Criteria	Extent of Exceedances Predicted	Impact Avoidance Measures Considered	Mitigation Measures Proposed	Residual Impacts
		places of worship, courts of law and hospitals; and NEF 30 for offices (Ref. Table 1A, Annex 5 of EIAO-TM)		operation will be continued and maintained for the future airport operation: ▪ aircraft departing to the northeast are required to adopt the noise abatement take-off procedures stipulated by ICAO so long as safe flight operations permit; and ▪ all aircraft on approach to the HKIA from the northeast between 11:00 pm to 07:00 am are encouraged to adopt the Continuous Descent Approach.	and 0659; ▪ Requiring departures to take the southbound route via the West Lamma Channel during east flow at night from 2300 to 0659, subject to acceptable operational and safety consideration. This is an arrangement that is consistent with the existing requirement in the operation of the two-runway system at night; ▪ A new arrival RNP Track 6 has been designed for preferential use in the west flow direction (i.e., runway 25 direction) between 2300 and 0659 and it is assumed that up to 95% of flights may preferentially use this new Track 6 instead of the existing straight-in tracks by year 2030; ▪ Implementing a preferential runway use programme when wind conditions allow, such that west flow is used when departures dominate while east flow is used when arrivals dominate during night-time; and ▪ Direct measures – when developing the MLP for the CDA site at Lok On Pai, the alignment of the NEF25 contour line should be taken into account to ensure that no noise sensitive uses are situated within the NEF25 contour in the planned development[17].	
Noise Impact – Fixed Noise Sources						
Assessment area boundary has been established against the criteria of 70 dB(A) (for daytime/evening periods) or 60 dB(A) (for night-time period) under several worst assumptions.	With the recommended avoidance and mitigation measures in place, the cumulative mitigated noise levels due to fixed noise sources, including ground noise sources associated with the aircraft taxiing as well as the operations of aircraft engine run-up facilities and APUs, would comply with the relevant daytime/evening and night-time criteria at all representative NSRs.	▪ Noise Control Ordinance; ▪ EIAO-TM; relevant Guidance Notes under EIAO; and ▪ Technical Memorandum for the Assessment of Noise from Places other than Domestic Premises, Public Places or Construction Sites.	With the avoidance and mitigation measures in place, no exceedance of the relevant noise criteria at any representative NSRs was predicted.	Specification of the maximum permissible SWLs of the project's fixed plants during daytime/evening and night-time should be followed.	Noise enclosure with noise reduction of at least 15 dB(A) at the ERUFs is required to comply with the relevant day & evening and night-time fixed noise criteria.	Adverse residual impact is not anticipated.
Noise Impact – Construction Noise						
The first layer of NSRs (nearest to the noise sources in various directions) has been selected as the assessment points.	With the recommended avoidance and mitigation measures in place, the cumulative mitigated noise levels would comply with the daytime construction noise criterion at all representative NSRs.	▪ Noise Control Ordinance; ▪ EIAO-TM; relevant Guidance Notes under EIAO; and ▪ Technical Memorandum on Noise from Construction Work other than Percussive Piling.	With the avoidance and mitigation measures in place, no exceedance of the daytime construction noise criterion at any representative NSRs was predicted.	Good site practice to limit noise emissions at source as follows: ▪ Only well-maintained plant to be operated on-site, and plant should be serviced regularly during the construction works ▪ Machines and plant that may be in intermittent use to be shut down between work periods, or throttled down to a minimum ▪ Plant known to emit noise strongly in one direction should, where possible, be orientated to direct	▪ Selection of quieter plant ▪ Use of movable noise barrier ▪ Use of noise enclosure / acoustic shed	Adverse residual impact is not anticipated.

[17] AAHK will offer the provision of window insulation and air-conditioning for all houses situated within the newly affected villages before the operation of the third runway in order to alleviate the potential aircraft noise impact on the residents.

Assessment Points	Results of Impact Predictions	Relevant Standards / Criteria	Extent of Exceedances Predicted	Impact Avoidance Measures Considered	Mitigation Measures Proposed	Residual Impacts
				noise away from the NSRs ▪ Mobile plant should be sited as far away from NSRs as possible ▪ Material stockpiles and other structures to be effectively utilised, where practicable, to screen noise from on-site construction activities		
Noise Impact – Traffic Noise						
For road traffic noise, assessment shall generally include areas within 300 m from the boundary of the project and the works of the project. For marine traffic noise, the assessment area has been established against the standard where the predicted marine traffic noise at the boundary of area is 10 dB(A) below the prevailing background noise level at the nearest NSR.	For road traffic noise, adverse noise impact from the proposed road alignments is not anticipated as the nearby NSRs are all found to be located beyond the 300m assessment area for the proposed road alignments of 3RS project For marine traffic noise, adverse noise impact is not anticipated as the nearby NSRs are all found to be located outside the assessment area.	▪ Noise Control Ordinance; and ▪ EIAO-TM; relevant Guidance Notes under EIAO	N/A	N/A	N/A	Adverse road traffic noise impact is not anticipated. Adverse marine traffic noise impact is not anticipated.
Water Quality Impact – Construction Phase						
WSRs within: ▪ North Western WCZ; ▪ North Western Supplementary WCZ; ▪ Deep Bay WCZ; and ▪ Western Buffer WCZ	▪ No exceedance of sedimentation criteria ▪ No adverse water quality impact due to depletion of dissolved oxygen at WSRs from submarine cable diversion ▪ No adverse water quality impact due to release of contaminants from submarine cable diversion ▪ No adverse water quality impact due to release of contaminated pore water from DCM activities ▪ No adverse water quality impact due to release of contaminated pore water from surcharge ▪ No exceedance of depth-averaged SS criteria due to the project under the mitigated scenario; however, exceedance of depth-averaged SS criteria at some WSRs under the mitigated cumulative scenario (primarily due to conservative assumptions of marine construction activities by other concurrent projects) ▪ For all other construction activities (e.g. drilling for submarine aviation fuel pipelines, construction / modification of stormwater outfalls, piling for new runway approach lights and HKIAAA marker beacons, construction site runoff and drainage, sewage effluent from construction	▪ EIAO-TM Annex 6 & 14 ▪ Water Pollution Control Ordinance (WPCO) ▪ North Western WCZ WQO ▪ North Western Supplementary WCZ WQO ▪ Deep Bay WCZ WQO ▪ Western Buffer WCZ WQO ▪ WSD's water quality criteria for flushing water intake ▪ Sediment Deposition and SS Criteria for Corals, *"Standards and Criteria for Pollution Control in Coral Reef Areas"* ▪ UK Council Directive on the quality required of shellfish waters (Shellfish Waters Directive) ▪ Directive 2008/105/EC of the European Parliament and of the Council of 16 December 2008 on environmental quality standards in the field of water policy ▪ The US Environmental Protection Agency (USEPA) Criteria Maximum Concentration (CMC) ▪ The USEPA Criteria Continuous Concentration (CCC)	For mitigated SS due to the project only: ▪ No exceedances of the depth-averaged SS criteria at all WSRs. For mitigated cumulative SS, no exceedance of the depth-averaged SS criteria at all WSRs except the following: ▪ C20 – WSD seawater intake at Tsing Yi – up to 2.5 mg/l above criteria (mainly due to concurrent projects) ▪ CR3 – Hard corals at The Brothers islands – up to 1.26 mg/l above criteria (primarily due to conservative assumptions for concurrent projects[18]) ▪ C7a – cooling water intake at HKIA (North) – up to 16.91 mg/l above criteria (no exceedance after further mitigation) ▪ C8 – future cooling water intake at HKBCF – up to 1.23 mg/l above criteria (no exceedance after further mitigation) ▪ E12 – Sham Shui Kok – up to 4.4 mg/l above criteria (primarily due to conservative assumptions for the concurrent Lantau Logistics Park (LLP) project. However, there is currently no implementation programme for this concurrent project, and the future project at this site will require an EIA	▪ Use of non-dredge ground improvement methods for land formation for avoidance of SS and contaminants release; ▪ Use of horizontal directional drill (HDD) method for submarine aviation fuel pipelines diversion; ▪ Only welding works will be carried out on the floating platform, and bulk storage of chemicals is not required at the daylighting point at Sha Chau; ▪ No dewatering of pipe at Sha Chau; ▪ Provision of a small concrete bund wall around the high side of the pit, and a cover to prevent rain entry at the daylighting point at Sha Chau to prevent muddy runoff; ▪ Drilling is conducted via a closed-loop system at the launching point at airport island, and drilling fluid is reconditioned and reused; ▪ Use of water jetting method and closed grabs for field joint excavation for diversion of submarine 11kV cables to minimise SS and contaminant release; and ▪ Connection works for outfalls to be undertaken during dry season.	▪ Capping of daily maximum production rates of relevant land formation works to those assumed in the water quality assessment; ▪ Restricting the fines content for sand blanket and marine filling activities; ▪ 200m advanced / partially completed seawall prior to marine filling operations; ▪ Double layer silt curtain system around selected active works areas; ▪ Double layer silt curtain and/or silt screen system around selected WSRs; ▪ Use of closed grabs and silt curtains for field joint excavation activities; ▪ Use of closed grabs, steel casing and silt curtains for piling activities; ▪ Implementation of guidelines set in Practice Note for Professional Persons on Construction Site Drainage (ProPECC Note PN 1/94) ; ▪ Provision of chemical toilets for construction workforce; ▪ Treatment of wastewater per WPCO requirements prior to discharge; ▪ Treatment of chemical wastes in accordance to Waste Disposal (Chemical Waste) (General) Regulation and Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes; and ▪ 'Zero discharge' policy for activities at Sha Chau.	Adverse residual impact is not predicted.

[18] Conservative assumptions are based on the maximum allowable SS release rates of the relevant concurrent project. However based on the available information, the actual SS release rates are much lower than the maximum allowable release rates.

Assessment Points	Results of Impact Predictions	Relevant Standards / Criteria	Extent of Exceedances Predicted	Impact Avoidance Measures Considered	Mitigation Measures Proposed	Residual Impacts
	workforce and general construction activities), no adverse water quality impacts are anticipated with the implementation of the proposed design / construction methods and the recommended mitigation measures where applicable.		which will minimise the potential water quality impacts associated with this concurrent project)			
Water Quality Impact – Operation Phase						
WSRs within: ▪ North Western WCZ; ▪ North Western Supplementary WCZ; ▪ Deep Bay WCZ; and ▪ Western Buffer WCZ	▪ No adverse water quality impacts anticipated due to changes in hydrodynamics , but minor exceedances in water quality criteria at some WSRs; ▪ No adverse water quality impacts anticipated due to embayment of water at western end of HKIA; ▪ No adverse water quality impacts anticipated due to sewage discharge; ▪ No adverse water quality impacts anticipated due to spent cooling water discharge; ▪ No adverse water quality impacts anticipated due to stormwater discharge; ▪ No adverse water quality impacts anticipated due to greywater reuse with the proposed design measures in place; ▪ No adverse water quality impacts anticipated due to accidental fuel spillage with the proposed design and contingency measures in place; and ▪ No need for maintenance dredging of the navigable waters north of HKIA.	▪ EIAO-TM Annex 6 & 14 ▪ WPCO ▪ North Western WCZ WQO ▪ North Western Supplementary WCZ WQO ▪ Deep Bay WCZ WQO ▪ Western Buffer WCZ WQO ▪ WSD's water quality criteria for flushing water intake ▪ Criteria for cooling water discharge (e.g. USEPA CCC and ecotoxicology study by Ma *et al.* (1998))	Minor exceedances were predicted for the below parameters and stations: *SS* (*monthly depth-averaged value)* C3 – up to 12.0 mg/l C5 – up to 13.2 mg/l C6 – up to 14.9 mg/l *TIN (annual depth-averaged value)* C1 – up to 0.62 mg/l C9 – up to 1.05 mg/l E1 – up to 3.61 mg/l *NH_3 (annual depth-averaged value)* C9 – up to 0.026 mg/l E1 – up to 0.134 mg/l Although exceedances were predicted, they were assessed as not attributable to the implementation of the project, but due to the high background levels.	▪ Connection of sewage of network for treatment of sewage at SHWSTW; ▪ Reuse of treated greywater to reduce sewage effluent and fresh water usage; ▪ Placement of submarine aviation fuel pipelines under seabed rocks to avoid possible damage from marine vessels and fuel leakage; ▪ Appropriate design of the land formation to avoid major changes in local and regional hydrodynamics; and ▪ Restrict operation of the fuel supply and refuelling systems to qualified and trained personnel.	▪ Treatment of wastewater per WPCO requirements prior to discharge; ▪ Treatment of chemical wastes in accordance with Waste Disposal (Chemical Waste) (General) Regulation and Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes; ▪ Install and maintain roadside gullies to trap and remove silt and grit from stormwater; ▪ Install and maintain oil/grease and oil/grease interceptors at storm drains; ▪ Intercept and discharge runoff from aircraft and vehicle washing activities to foul sewer or divert to temporary storage for treatment off-site; ▪ Fuel pipelines and hydrant systems should be designed with adequate protection and pressure / leakage detection systems; ▪ Provision of a 'spill trap containment system' at aircraft apron and stand areas; and ▪ Implement an emergency spill response plan for spillage events.	Adverse residual impact is not predicted
Sewerage and Sewage Treatment Implication – Construction Phase						
Refer to the relevant parts of the Water Quality Impact – Construction Phase						
Sewerage and Sewage Treatment Implication – Operation Phase						
▪ Gravity sewer from airport discharge manhole to Tung TCSPS ▪ TCSPS ▪ Sewage rising main from TCSPS to SHWSTW ▪ SHWSTW	▪ The existing gravity sewers from the airport discharge manhole to TCSPS would reach its full capacity by 2027 ▪ Pump capacity of TCSPS would be exceeded in 2023 ▪ No adverse impact to the sewage rising main from TCSPS to SHWSTW ▪ No adverse impact to the daily treatment capacity of SHWSTW ▪ Peak flow capacity of SHWSTW would be exceeded from year 2026	▪ Guidelines for Estimating Sewage Flows for Sewage Infrastructure Planning Version 1.0 published by EPD (GESF) ▪ Sewerage Manual – Part 1 published by DSD (SM1)	N/A	N/A	▪ The sewerage system for 3RS will be designed, operated and maintained by AAHK in accordance with all the relevant standards and guidelines published by DSD. In addition to continuing the odour control arrangements, AAHK will monitor the H_2S level and adopt active septicity management measures that can effectively contain any future septicity problems in the design for the 3RS sewerage system. ▪ AAHK undertakes to implement and complete the upgrading works for the affected gravity sewer by 2026 (allowing a buffer period of about one year before the full capacity is	No adverse residual impacts would be anticipated.

Assessment Points	Results of Impact Predictions	Relevant Standards / Criteria	Extent of Exceedances Predicted	Impact Avoidance Measures Considered	Mitigation Measures Proposed	Residual Impacts
					reached), with the planning work to commence in 2022 (assuming one year for planning plus three years for design and construction). AAHK should also monitor the sewage flow build-up as a part of the EM&A for the project and start planning construction of the upgrading works in 2022, or when the sewage flow in the affected gravity sewer exceeds 80% of the design capacity of the sewer, whichever is earlier, so as to ensure timely completion of the mitigation works before the flow would exceed the design capacity of the sewer. ▪ A government project under Agreement No.CE6/2012 is currently underway by DSD to investigate, design and construct an additional sewage rising main between TCSPS and SHWSTW, which would enhance the operational reliability of the sewerage system. Construction is planned to commence in 2015 and complete the works by end 2022. The TCSPS is sufficient to cater for the ultimate design sewage flow arising from the project after the completion of construction under Agreement No. CE6/2012[19]. ▪ EPD will monitor the sewage flow build-up and coordinate the necessary upgrading works for the SHWSTW when needed in due course.	
Waste Management Implication – Construction Phase						
Project area	▪ Inert C&D materials of about 9,543,500m^3 (in-situ volume) generated from excavation works, piling works, demolition works on the existing airport island / proposed land formation area as well as from HDD during diversion of the existing submarine pipelines; ▪ Non-inert C&D materials of about 96,200m^3 (in-situ volume) generated from site clearance of the golf course area, demolition works for the T2 expansion, and various superstructure construction works; ▪ Marine sediment of about 10,200m^3 (in-situ volume) generated from excavation at the cable field joint area; ▪ Marine sediment of about 767,660m^3 (in-situ volume) generated from the foundation / piling / excavation works for	▪ Annex 7 and 15 of EIAO-TM; ▪ Waste Disposal Ordinance (Cap. 354); ▪ Waste Disposal (Chemical Waste) (General) Regulation (Cap. 354C); ▪ Waste Disposal (Charges for Disposal of Construction Waste) Regulation (Cap. 354N); ▪ Building Ordinance (Cap.123); ▪ Land (Miscellaneous Provisions) Ordinance (Cap. 28); ▪ Dumping at Sea Ordinance (Cap. 466); and ▪ Public Cleansing and Prevention of Nuisances Regulation (Cap. 132BK).	N/A	▪ The use of non-dredge methods for ground improvement will completely avoid bulk removal and disposal of any dredged materials; ▪ Most sloping seawall options can allow for the reuse of rock armour from the existing northern seawall to minimise waste generation; ▪ Priority will be given to maximise the use of suitable fill materials available from other concurrent projects and the Government's PFRF; ▪ Minimise the extent of excavation and maximise on-site reuse of the inert C&D materials generated as far as practicable. The relevant construction activities (particularly for the tunnel works) and construction programme have been carefully planned and developed; ▪ All marine sediments to be generated from the foundation / piling / excavation works for constructing various tunnels, facilities, buildings	▪ Good site practices and waste reduction measures for C&D materials ▪ Marine disposal of marine sediments from the cable field joint excavation ▪ Handling of chemical wastes in accordance with the Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes, and disposal of chemical wastes at licensed chemical waste recycling/ treatment facilities ▪ Employ a reputable licensed waste collector for disposal of general refuse and floating refuse at designated landfill sites	No adverse residual impacts would be anticipated.

[19] EPD has agreed to reserve 43,500 m^3/day (ADWF) at the TCSPS for the total sewage discharge from the expanded airport, and AAHK will closely liaise with EPD and DSD to ascertain a smooth interface with the upgrading works for TCSPS.

Assessment Points	Results of Impact Predictions	Relevant Standards / Criteria	Extent of Exceedances Predicted	Impact Avoidance Measures Considered	Mitigation Measures Proposed	Residual Impacts
	constructing various tunnels, facilities, buildings and APM depot; ▪ Small quantity of chemical waste from maintenance and servicing of construction plant and equipment; ▪ General refuse of maximum daily arising of up to 9,100kg from construction workforce; and ▪ Floating refuse of about 65m^3 to be collected from the newly constructed seawall per year.			and APM depot will be treated and reused on-site as backfilling materials, thus avoiding the need for disposal of the sediments; ▪ Using HDD method to construct the new pipeline will avoid dredging of seabed; and ▪ Use of water jetting method to lay the new cable will avoid generation and disposal of any marine sediment.		
Waste Management Implication – Operation Phase						
Project area	▪ About 46,190 tons/year of general refuse from the operation of the passenger concourse, aircraft cabins, terminal buildings, offices, commercial establishments and various airport infrastructure facilities; ▪ Chemical waste from maintenance, servicing and repairing of various E&M equipment; ▪ Floating refuse of about 65m^3 to be collected from the new artificial seawall per year; and ▪ About 0.23 ton/day of dewatered sludge from the proposed greywater treatment plant	▪ Waste Disposal Ordinance (Cap. 354); and ▪ Waste Disposal (Chemical Waste) (General) Regulation (Cap. 354C).	N/A	▪ The initiatives currently implemented at HKIA in segregating recyclable waste materials (such as cardboard, paper, metals, plastics, glass bottles, food waste, etc.) from general refuse for recycling should be extended to cover the expanded airport; and ▪ The artificial seawall of the expanded airport island has been properly designed to achieve a shoreline without any sharp turns or abrupt indentation where floating refuse would easily be trapped or accumulated.	▪ Employ a reputable licensed waste collector to collect general refuse on a daily basis and dispose of the general refuse at designated landfill sites ▪ Handling of chemical wastes in accordance with the Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes, and disposal of chemical wastes at licensed chemical waste recycling/ treatment facilities ▪ Regular cleaning of floating refuse trapped or accumulated on the artificial seawall, and disposal of the floating refuse together with general refuse at designated landfill sites ▪ Employ a reputable licensed waste collector to dispose of the dewatered sludge (stored in tight containers or skips) at designated landfill sites	No adverse residual impacts would be anticipated.
Land Contamination – Construction Phase						
Potential land contaminative areas within the project	Land contamination impacts were identified by carrying out land contamination assessment of the past / present land uses of potential contaminative areas. The potential land contaminative areas include: ▪ Golf course area ▪ T2 expansion area (underground and above-ground fuel tank areas, and emergency power generation units) ▪ Existing airside facilities (petrol filling station and fuel tank room)	▪ Section 3 of Annex 19 of EIAO-TM; ▪ Guidance Note for Contaminated Land Assessment and Remediation; ▪ Guidance Manual for Use of Risk-based Remediation Goals for Contaminated Land Management; and ▪ Practice Guide for Investigation and Remediation of Contaminated Land.	N/A (As all potential land contaminative areas are still under operation, all sampling and testing works will be conducted prior to commencement of any construction works at these areas.)	N/A	▪ The contaminated soil identified (if any) should be excavated and treated on-site; and ▪ The recommended environmental mitigation and safety measures, progress monitoring and / or confirmation sampling / testing recommended should be implemented.	No adverse residual impacts would be anticipated.
Land Contamination – Operation Phase						
N/A	N/A	N/A	N/A	N/A	N/A	N/A
Terrestrial Ecological Impact – Construction and Operation Phases						
Tai Ho Stream SSSI, San Tau Beach SSSI, Lung Kwu Chau, Tree Island and Sha Chau SSSI; Open sea to the north of the existing airport island in relation to the investigation of birds' activities	Low or negligible impacts to the terrestrial habitats, flora and fauna species in the study area during construction and operation phases	▪ Annexes 8 and 16 of EIAO-TM.	N/A	N/A	N/A	None

Assessment Points	Results of Impact Predictions	Relevant Standards / Criteria	Extent of Exceedances Predicted	Impact Avoidance Measures Considered	Mitigation Measures Proposed	Residual Impacts
over the land formation area and the adjacent waters; All land areas within 500 m from the coastline of North Lantau from Sham Wat Wan to Tai Ho Wan; and All land areas within the boundary of SCLKCMP.						
Sha Chau Egretry	Sha Chau egretry: moderate impact due to the fuel pipeline installation works; but no impact during operation phase	▪ EIAO-TM, particularly Annexes 8 and 16.	N/A	▪ Avoidance of direct impact to egretry – the daylighting location should be outside egretry boundary ▪ Construction activities at Sheung Sha Chau Island should avoid night-time and the ardeid's breeding season (April – July).	▪ Preservation of Nesting Vegetation – the vegetation used by ardeids for nesting should be preserved.	None
Marine Ecological Impact – Construction and Operation Phase						
San Tau Beach SSSI, SCLKCMP , planned BMP and potential SWLMP, intertidal, sub-tidal hard bottom, sub-tidal soft bottom and open marine waters habitats	Temporary/ permanent loss of habitats due to land formation and associated works: ▪ Low-moderate for intertidal and sub-tidal hard bottom habitats; ▪ Moderate for open marine waters; ▪ Low for rocky shore at SCLKCMP; ▪ Insignificant to moderate for sub-tidal soft bottom habitats; ▪ Insignificant for open marine waters around Sha Chau, and two ends and northwestern waters of the 3RS Loss of carrying capacity and habitat fragmentation, changes in species distribution, abundance and patterns of habitat use: ▪ Low impacts Release of SS and associated changes in water quality: ▪ Low-moderate for corals ▪ Insignificant to low for other habitats Release of contaminants from pore water, oil/chemical spillage, change in hydrodynamics, changes in water quality associated with change in hydrodynamics, indirect disturbance of habitats due to deterioration of water quality: ▪ Insignificant to low impacts Importation and transportation of marine fill and filling activities, piling activities and associated underwater noise: ▪ Low impacts Impingement and entrainment due	▪ Annexes 8 and 16 of EIAO-TM ▪ WPCO ▪ North Western WCZ WQO ▪ North Western Supplementary WCZ WQO ▪ Deep Bay WCZ WQO ▪ Western Buffer WCZ WQO ▪ Sediment Deposition and SS Criteria for Corals, *"Standards and Criteria for Pollution Control in Coral Reef Areas"*	No exceedances are predicted	Relevant avoidance measures as detailed above for the water quality aspect	▪ Minimisation of land formation area ▪ Use of construction methods with minimal risk / disturbance ▪ Consideration of alternative alignment for pipeline diversion with minimal risk / disturbance ▪ Consideration of alternative treatment to existing pipelines after diversion ▪ Strict enforcement of no-dumping policy ▪ Good construction site practices ▪ Relevant water quality mitigation measures during construction and operation phases as detailed above ▪ Pre-construction phase coral dive survey to review the feasibility of translocating coral species ▪ Spill response plan ▪ Proposed establishment of new marine park of approximately 2,400 ha linking the planned BMP and the existing SCLKCMP [20]	No adverse residual impact is anticipated.

[20] In addition to the proposed mitigation measures, environmental enhancement measures have also been recommended, including deployment of artificial reefs; provision of eco-enhancement designs for part of the seawall; establishment of a marine research programme to support conservation of marine ecology; promotion of environmental education and eco-tourism; and setting up of environmental enhancement fund.

Assessment Points	Results of Impact Predictions	Relevant Standards / Criteria	Extent of Exceedances Predicted	Impact Avoidance Measures Considered	Mitigation Measures Proposed	Residual Impacts
	to seawater intakes, indirect disturbance of marine fauna due to aircraft noise: ▪ Insignificant to low impacts					
CWD habitats at north of airport island, around Sha Chau, marine waters between airport and Sha Chau	Temporary and permanent loss of dolphin habitats due to land formation and associated construction: ▪ Low to high for marine waters north of airport island ▪ Insignificant at other locations Loss of carrying capacity: ▪ Moderate for marine waters and CWD habitat Habitat fragmentation: ▪ Moderate for marine waters and CWD habitat Loss of CWD travelling area and connectivity between core CWD habitat areas: ▪ Moderate for travel areas north of airport island Loss of prey resources for CWD as a result of temporary loss of benthic habitat: ▪ Low for marine waters Disturbance to the CWD use of travelling area and connectivity between core CWD habitat areas: ▪ Moderate for travel area north of existing airport island Changes to species distribution, abundance and habitat use: ▪ Moderate Changes in water quality: ▪ Insignificant to low Impacts to marine life from the importation and transportation of marine fill and filling activities: ▪ Low Increased acoustic disturbance from construction works: ▪ Insignificant for 11kV cable and fuel pipeline diversion; low for bored piling for approach lights and marker beacons; low-moderate for general construction works. Increased disturbance from night-time construction works: ▪ Moderate Increased acoustic disturbance from changes to marine vessels and ferry traffic: ▪ Low to moderate during construction phase, Moderate-high during operation phase Increased risk of injury/mortality to	• Annexes 8 and 16 of EIAO-TM • WPCO • North Western WCZ WQO • North Western Supplementary WCZ WQO • Deep Bay WCZ WQO • Western Buffer WCZ WQO • Sediment Deposition and SS Criteria for Corals, *"Standards and Criteria for Pollution Control in Coral Reef Areas"*	N/A	Relevant avoidance measures as detailed above for the water quality aspect	▪ Relevant water quality mitigation measures during construction and operation phases as detailed above ▪ Acoustic decoupling of construction equipment mounted on barges ▪ Dolphin Exclusion Zones ▪ Avoid peak calving seasons of CWD for bored piling works ▪ Spill response plan ▪ Construction vessel speed limits and skipper training ▪ Establishment of new marine park of approximately 2,400 ha linking the planned BMP and the existing SCLKCMP ▪ SkyPier HSFs' speed restrictions and route diversions	No adverse residual impact is anticipated.

Assessment Points	Results of Impact Predictions	Relevant Standards / Criteria	Extent of Exceedances Predicted	Impact Avoidance Measures Considered	Mitigation Measures Proposed	Residual Impacts
	CWDs from marine traffic ▪ Low for construction vessels; High for HSFs. Changes to CWD movement patterns as a result of marine traffic: ▪ Low to moderate during construction phase, Moderate-high during operation phase Disturbance to the function and quality of Marine Parks: ▪ Low-moderate for SCLKCMP; low for potential SWLMP; moderate for planned BMP Changes to the hydrodynamic regime and water quality as a result of the new land formation: ▪ Low Secondary impacts of the proposed new marine park and extension of HKIAAA on CWDs: ▪ Positive secondary impacts					
Fisheries Impact – Construction Phase						
North Western WCZ; North Western Supplementary WCZ; Deep Bay WCZ; and Western Buffer WCZ	▪ Direct loss of fishing ground from construction works are of low significance from commencement to moderate. ▪ Direct loss of fisheries habitats (and resources) from construction works are of low significance from commencement to moderate. ▪ Direct loss of fisheries habitats (and resources) from diversion of submarine 11 kV cables and submarine fuel pipelines is insignificant. ▪ Low impact significance for the direct loss of spawning and nursery ground. ▪ Insignificant to low impact for indirect disturbance due to deterioration of water quality. ▪ Insignificant for indirect impact on aquaculture sites. ▪ Low for the indirect impact on artificial reef. ▪ Low for the impact of fishing activities. ▪ Low impact significance for the disturbance to fisheries resources associated with underwater sound.	▪ Annexes 9 and 17 of EIAO-TM ▪ Fisheries Protection Ordinance ▪ Marine Fish Culture Ordinance ▪ Marine Parks Ordinance	N/A	Relevant avoidance measures as detailed above for the water quality aspect	▪ Relevant water quality mitigation measures during construction phase as detailed above ▪ Minimisation of land formation area ▪ Use of construction methods with minimal risk / disturbance ▪ Consideration of alternative alignment for pipeline diversion with minimal risk / disturbance ▪ Consideration of alternative treatment to existing pipelines after diversion ▪ Strict enforcement of no-dumping policy ▪ Good construction site practices	No adverse residual impact is anticipated.
Fisheries Impact – Operation Phase						
North Western WCZ; North Western Supplementary WCZ; Deep Bay WCZ; and Western Buffer WCZ	▪ Moderate impact significance for the direct loss of fishing ground. ▪ Low impact significance for the disturbance of fishing activities.	▪ Annexes 9 and 17 of EIAO-TM ▪ Fisheries Protection Ordinance ▪ Marine Fish Culture Ordinance	N/A	Relevant avoidance measures as detailed above for the water quality aspect	▪ Relevant water quality mitigation measures during operation phase as detailed above ▪ Proposed establishment of new	No adverse residual impact is anticipated.

Assessment Points	Results of Impact Predictions	Relevant Standards / Criteria	Extent of Exceedances Predicted	Impact Avoidance Measures Considered	Mitigation Measures Proposed	Residual Impacts
	▪ Moderate impact significance for the direct loss of fisheries habitats (and resources). ▪ Low for the direct loss of spawning and nursery grounds. ▪ Low impact significance for the change in hydrodynamics and tidal influence. ▪ Insignificant for the indirect disturbance of fisheries habitats due to deterioration of water quality. ▪ Low impact significance for the impingement and entrainment due to seawater intakes. ▪ Insignificant for the indirect disturbance due to aircraft noise. ▪ Positive impact on fisheries resources conservation, low impact significance on fishing activities with the implementation of the proposed new marine park together with extension of HKIAAA for the project.	▪ Marine Parks Ordinance			marine park of approximately 2,400 ha linking the existing/planned marine parks and the extended HKIAAA[21]	
Landscape and Visual Impact – Construction Phase						
Identified LRs, LCAs and VSRs that may be affected by the project	After the implementation of mitigation measures during the construction phase, all LRs and LCAs are anticipated to experience residual impacts of slight or insubstantial significance or are not anticipated to be affected by the 3RS, except the following: ▪ Coastal waters of North Lantau and inshore water landscape are anticipated to experience residual impacts of substantial significance ▪ Roadside amenity planting within the assessment area is anticipated to experience impacts of moderate significance After the implementation of mitigation measures during the construction phase, all VSRs are anticipated to experience residual impacts of slight or insubstantial significance or are not anticipated to be affected by the 3RS, except the followings: ▪ Passengers / drivers of recreational marine craft in North Lantau waters and Urmston Road and recreational users of Sha Chau Islands are anticipated to experience residual impacts of substantial	▪ Annexes 3, 10, 11, 18, 20 and 21 of EIAO-TM; ▪ Hong Kong Planning Standards and Guidelines; ▪ Hong Kong 2030 Planning Vision and Strategy Final Report; ▪ Landscape Value Mapping of Hong Kong; ▪ EIAO Guidance Note No. 8/2010; ▪ Town Planning Ordinance; ▪ Forests and Countryside Ordinance; ▪ Country Parks Ordinance; ▪ Foreshore and Sea-bed (reclamations) Ordinance; ▪ Marine Parks Ordinance; ▪ Protection of Endangered Species of Animals And Plants Ordinance; ▪ Approved Chek Lap Kok OZP No. S/I-CLK/12; ▪ Approved Tung Chung Town Centre Area OZP No. S/I-TCTC/18; ▪ SILTech Publication (1991) – Tree Planting and Maintenance in Hong Kong (Standing	N/A	▪ The construction area and contractor's temporary works areas should be minimised to avoid impacts on adjacent landscape; ▪ Reduction of construction period to practical minimum; ▪ Control of night-time lighting by hooding all lights and through minimising night working periods; and ▪ All existing trees shall be carefully protected during construction.	▪ Phasing of the construction stage to reduce visual impacts during the construction phase; ▪ Construction traffic (land and sea) including construction plants, construction vessels and barges should be kept to a practical minimum; ▪ Erection of decorative mesh screens or construction hoardings around works areas in visually unobtrusive colours; ▪ Trees unavoidably affected by the works shall be transplanted where practical; ▪ Avoidance of excessive height and bulk of site buildings and structures; and ▪ Land formation works shall be followed with advanced hydroseeding around taxiways and runways as soon as practical.	In accordance with the relevant criteria and guidelines for evaluating and assessing impacts, it is considered that the overall residual landscape and visual impacts of the project are marginally acceptable with mitigation.

[21] In addition to the proposed mitigation measures, a number of fisheries enhancement measures are proposed to further improve the fisheries resources in the western Hong Kong waters and support sustainable fisheries operation, including eco-enhancement design of part of the seawalls within the future extended HKIAAA which restricts vessel entry including fishing vessels; potential deployment of artificial reefs at appropriate locations to promote juvenile fish recruitment; implementation of a FES; and setting up of a Fisheries Enhancement Fund.

Assessment Points	Results of Impact Predictions	Relevant Standards / Criteria	Extent of Exceedances Predicted	Impact Avoidance Measures Considered	Mitigation Measures Proposed	Residual Impacts
	significance ▪ Residents of Tung Chung, including Tung Chung Crescent, Seaview Crescent, Caribbean Coast, Area 53 to Area 56, residents along south coast of Tuen Mun, Hong Kong Gold Coast and Siu Lam; visitors to AsiaWorld Expo, Hong Kong SkyCity Marriott Hotel, Hong Kong Airport Passenger Terminal and to Regal Airport Hotel; passengers of Cable Cars of Ngong Ping 360; hikers of Nei Lak Shan, Fung Wong Shan (Lantau Peak), Tai Tung Shan (Sunset Peak), Lantau North Country Park, Lantau South Country Park and Scenic Hill are anticipated to experience residual impacts of moderate significance. ▪ Passengers / drivers of vehicles and MTR along Cheong Wing Road; passengers of commercial aircraft, passengers / drivers of the proposed Hong Kong Link Road; and passengers of ferries in North Lantau waters and Urmston Road are anticipated to experience residual impacts of moderate significance.	Interdepartmental Landscape Technical Group) [11-23]; ▪ GEO publication (1/2009) – Prescriptive Measures for Man-made Slopes and Retaining Walls; ▪ GEO 1/2011 – Technical Guidelines on Landscape Treatment for Slopes ▪ Land Administration Office Instruction (LAOI) Section D-12 – Tree Preservation; ▪ LDPN 7/2007 - Tree Preservation and Tree Removal Application for Building Development in Private Projects; ▪ DEVB TC (W) No.2/2012 Allocation of Space for Quality Greening on Roads; ▪ DEVB TC (W) No.3/2012 Site Coverage of Greenery for Government Building Projects; ▪ DEVB TC (W) No.2/2013 Greening on Footbridges and Flyovers; ▪ ETWB TCW No. 2/2004 – Maintenance of Vegetation and Hard Landscape Features; ▪ ETWB TCW No. 29/2004 – Registration of Old and Valuable Trees, and Guidelines for their Preservation; ▪ ETWB TCW No. 36/2004 The Advisory Committee on the Appearance of Bridges and Associated Structures (ACABAS); ▪ ETWB TCW No. 5/2005 – Protection of Natural Streams/Rivers from Adverse Impacts Arising from Construction Works; ▪ ETWB TCW No. 10/2013 - Tree Preservation; ▪ WBTC No. 25/93 – Control of Visual Impact of Slopes; ▪ WBTC No. 17/2000 – Improvement to the Appearance of slopes in connection with WBTC 25/93; ▪ WBTC No. 7/2002 – Tree Planting in Public Works; ▪ Latest Proper Planting Practices and other relevant guidelines issued by Development Bureau (Greening, Landscape and Tree Management Section); and ▪ Latest Hong Kong International Airport Approved Plant Species List.				
Landscape and Visual Impact – Operation Phase						

Assessment Points	Results of Impact Predictions	Relevant Standards / Criteria	Extent of Exceedances Predicted	Impact Avoidance Measures Considered	Mitigation Measures Proposed	Residual Impacts
Identified LRs, LCAs and VSRs that may be affected by the project	After the implementation of mitigation measures during the operation phase, all LRs and LCAs are anticipated to experience residual impacts of slight or insubstantial significance or are not anticipated to be affected by the 3RS, except the following: ▪ Impacts on coastal waters of North Lantau and inshore water landscape are anticipated to remain substantial in the operation phase. After the implementation of mitigation measures during the operation phase, all VSRs are anticipated to experience residual impacts of slight or insubstantial significance, or are not anticipated to be affected by the 3RS, except the following: ▪ Passengers / drivers of recreational marine craft in north Lantau waters and Urmston Road and recreational users of Sha Chau Islands are anticipated to experience residual impacts of moderate significance.	Same as for the Construction Phase.	N/A	Lighting units to be directional and minimise unnecessary light spill and glare.	▪ Sensitive landscape design of land formation edge; ▪ All above ground structures, including Vent Shafts, Emergency and Firemen's Accesses etc. shall sensitively designed; ▪ Sensitive design of buildings and structures in terms of scale, height and bulk (visual weight); ▪ Use appropriate building materials and colours in built structures to create cohesive visual mass; ▪ Greening measures, including vertical greening, green roofs, road verge planting and peripheral screen planting, shall be implemented; ▪ Compensatory Tree Planting for all felled trees shall be provided to the satisfaction of relevant Government departments; ▪ Streetscape (e.g. paving, signage, street furniture, lighting, etc.) shall be sensitively designed; ▪ All streetscape areas and hard and soft landscape areas disturbed during construction shall be reinstated to equal or better quality (with implementation of screen planting, road verge planting etc.); ▪ Aesthetic improvement planting of viaduct structure; and ▪ Sensitive design of footbridges, noise barriers and enclosures with greening (screen planting / climbers / planters) and chromatic measures.	In accordance with the relevant criteria and guidelines for evaluating and assessing impacts, it is considered that the overall residual landscape and visual impacts of the project are marginally acceptable with mitigation.
Cultural Heritage Impact – Construction Phase						
Cultural heritage within the marine archaeological assessment area and within the 500 m assessment area for terrestrial cultural heritage	No impacts predicted	Guidelines for Cultural Heritage Impact Assessment MAI Guidelines for MAI	None	N/A	None required	N/A
Cultural Heritage Impact – Operation Phase						
Cultural heritage within the marine archaeological assessment area and within the 500 m assessment area for terrestrial cultural heritage	No impacts predicted	Guidelines for Cultural Heritage Impact Assessment MAI Guidelines for MAI	None	N/A	None required	N/A
Health Impact – Aerial Emissions						
Human receptors within 5km Assessment area	Levels of acute and chronic exposure due to TAP comply with the respective international guideline values. Maximum increase of carcinogenic risk due to TAP is around 1.14×10^{-5} which is considered acceptable. For criteria pollutants, the estimated risks of hospital admission and premature death for short-term exposure are relatively small. The estimated risk of premature death for long-term exposure is also relatively small.	▪ International guidelines values (such as WHO, IRIS, OEHHA, etc.) ▪ Health risk / impact assessment guidelines (such as WHO)	N/A	Those adopted for alleviating potential air quality impacts during operation phase	Those adopted for mitigating potential air quality impacts during operation phase	N/A
Health Impact – Aircraft Noise						
Populated areas located adjacent	Changes in populations affected	Health risk / impact assessment	N/A	Those adopted for alleviating potential	Those adopted for mitigating potential	N/A

Assessment Points	Results of Impact Predictions	Relevant Standards / Criteria	Extent of Exceedances Predicted	Impact Avoidance Measures Considered	Mitigation Measures Proposed	Residual Impacts
to the NEF 25 contour line	relative to "without project" scenario: ▪ Annoyance: approximately 10% less ▪ Sleep disturbance: approximately 50% less	guidelines (such as WHO and EEA)		aircraft noise impacts	aircraft noise impacts	

6. Environmental Monitoring and Audit

6.1.1.1 An EM&A programme to check the effectiveness of the recommended mitigation measures and compliance with relevant statutory requirements will be implemented. Details of the EM&A works are given in the separately prepared EM&A Manual for the project, with the specific EM&A requirements highlighted as follows:

6.1.1.2 Air

- Monitoring of TSP during the construction phase.
- No additional air quality monitoring is required during the operation phase, as AAHK has been carrying out routine outdoor and indoor air quality monitoring on the airport island.

6.1.1.3 Hazard to Human Life

- Regular inspections to ensure that measures to reduce the risk associated with aircraft refueling operations are carried out properly.

6.1.1.4 Noise

- Regular review of aircraft noise related operation data for aircraft noise management and continuous community engagement.
- Noise commissioning tests for major fixed plant within HKIA and noise enclosure of aircraft engine run-up facilities prior to operation of the project.
- Noise level monitoring during construction works.

6.1.1.5 Water Quality

- Water quality monitoring during marine construction works (including DCM-specific monitoring).
- Post-construction monitoring upon completion of all marine construction works.
- Water quality monitoring for the greywater treatment facility during commissioning and operation.

6.1.1.6 Sewage

- Regular monitoring of the sewage flow build-up for the project to ensure timely completion of the mitigation works for the affected gravity sewer before the flow exceeds the sewer design capacity.
- H_2S monitoring for the sewerage system of the 3RS to ensure no adverse impacts in respect of septicity and odour issues.

6.1.1.7 Waste

- Regular site inspections to ensure the proper implementation of the Waste Management Plan.
- Regular inspection along the artificial seawall to check for any accumulation of floating refuse.

6.1.1.8 Land Contamination

- Regular audit of all related procedures and facilities for the handling or storage of chemicals and chemical wastes.

6.1.1.9 Terrestrial Ecology

- Pre-construction survey for the Sha Chau egretry during ardeid breeding season.

6.1.1.10 Marine Ecology

- Baseline, construction, post-construction and operation phase monitoring, including dolphin monitoring (vessel line transect, land-based theodolite tracking and PAM).
- Pre-construction coral dive survey at the artificial seawall at the north and northeast of the airport island, and the proposed daylighting location at Sha Chau.

6.1.1.11 Fisheries

- No specific fisheries monitoring is required because the proposed water quality monitoring programme will cover the sites of fisheries importance and will provide an indication of the effectiveness of the water quality mitigation measures that would in turn reduce fisheries impact.

6.1.1.12 Landscape and Visual

- Checking implementation of the landscape and visual mitigation measures during construction and operation phases.

7. Conclusion

7.1.1.1 The development needs of the airport are reviewed every five years as part of a continuous master planning process. During MP2030 study process, a number of feasibility studies were undertaken, where it was identified that there would be a need to expand the existing airport in order to cope with the projected air traffic demand up to 2030. Since then, a series of engineering studies, environmental assessments and public engagements have been undertaken to assess the various options and derive the preferred airport layout option. The outcomes from these studies and views collected from stakeholder engagements have been incorporated into the EIA study where appropriate.

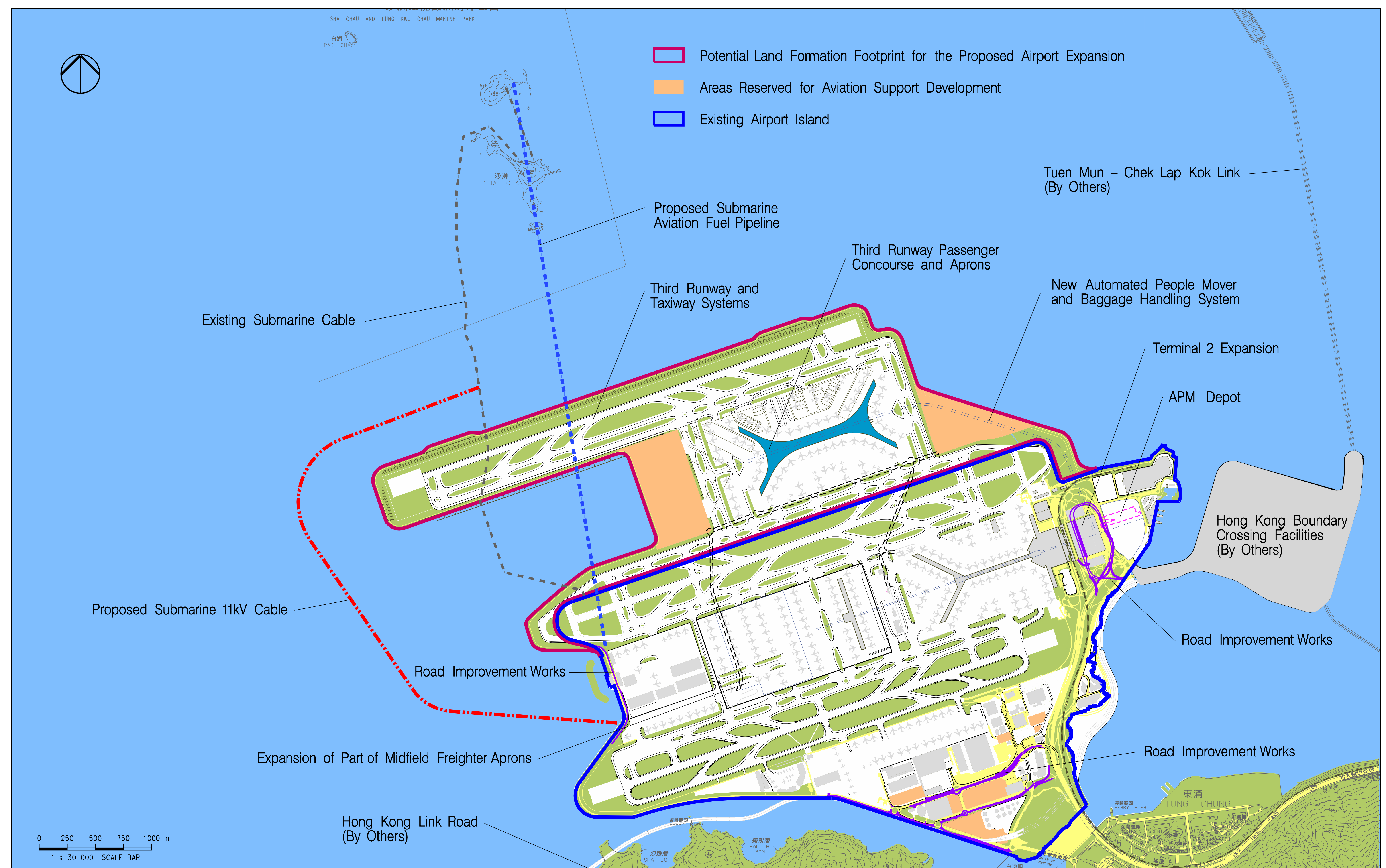
7.1.1.2 On the basis of the engineering and environmental assessments undertaken during the MP2030 study stage and the subsequent EIA study, AAHK has committed to implementing a number of key design, construction and operation initiatives that aim to eliminate or substantially reduce some of the environmental impacts of the project, including the impacts on marine ecology, water quality, air quality, noise and health issues. Nevertheless, even with the implementation of the design and planning strategies, environmental impacts due to the project are still expected. These potential impacts have been assessed in a comprehensive and scientifically robust manner under this EIA with effective and practicable mitigation measures recommended to further minimise the potential impacts.

7.1.1.3 The EIA study has identified and assessed the potential environmental impacts that may arise from the construction and operation of the project, in accordance with the EIA study brief and the relevant requirements of the EIAO-TM. A summary of the outcome of the technical assessments is shown in **Table 7.1**.

Table 7.1: Summary of Outcome from the EIA Study

Environmental Aspect	Construction Phase		Operation Phase	
	Without mitigation	With mitigation	Without mitigation	With mitigation
Air Quality	Some impacts	Acceptable	Acceptable	N/A
Hazard to Human Life	Acceptable	N/A	Some impacts	As low as reasonably practicable
Noise	Some impacts	Acceptable	Some impacts	Acceptable
Water Quality	Some impacts	Acceptable	Acceptable	N/A
Sewerage and Sewage Treatment	N/A	N/A	Some impacts	Acceptable
Waste	Some impacts	Acceptable	Some impacts	Acceptable
Land Contamination	Potential impacts	Acceptable	N/A	N/A
Terrestrial Ecology	Some impacts	Acceptable	Acceptable	N/A
Marine Ecology	Some impacts	Acceptable	Some impacts	Acceptable
Fisheries	Some impacts	Acceptable	Some impacts	Acceptable
Landscape & Visual	Some impacts	Acceptable	Some impacts	Acceptable
Cultural Heritage	Acceptable	N/A	Acceptable	N/A
Health	N/A	N/A	Some impacts	Acceptable

7.1.1.4 Based on the results of the assessments, the EIA study concludes that the project would be environmentally acceptable and in compliance with the relevant environmental legislation and standards. With implementation of the recommended environmental mitigation measures, no unacceptable adverse residual impacts from the project are anticipated. A comprehensive EM&A programme will be implemented to check the implementation of mitigation measures and environmental compliance.



Rev.	Date	Description	Checked
A	13NOV13	FIRST ISSUE	EC
B	14APR14	GENERAL REVISION	EC

香港國際機場 HONG KONG INTERNATIONAL AIRPORT

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Deltares
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SDA Marine Limited
Urbis Limited
URS Limited

Title
PREFERRED AIRPORT LAYOUT OPTION

Consultant's Signatures for Approval		Date
Design	EY	13NOV13
Checkers	EY	13NOV13
Design Supervisor	EC	21MAR14
Authorised Representative	AFK	21MAR14

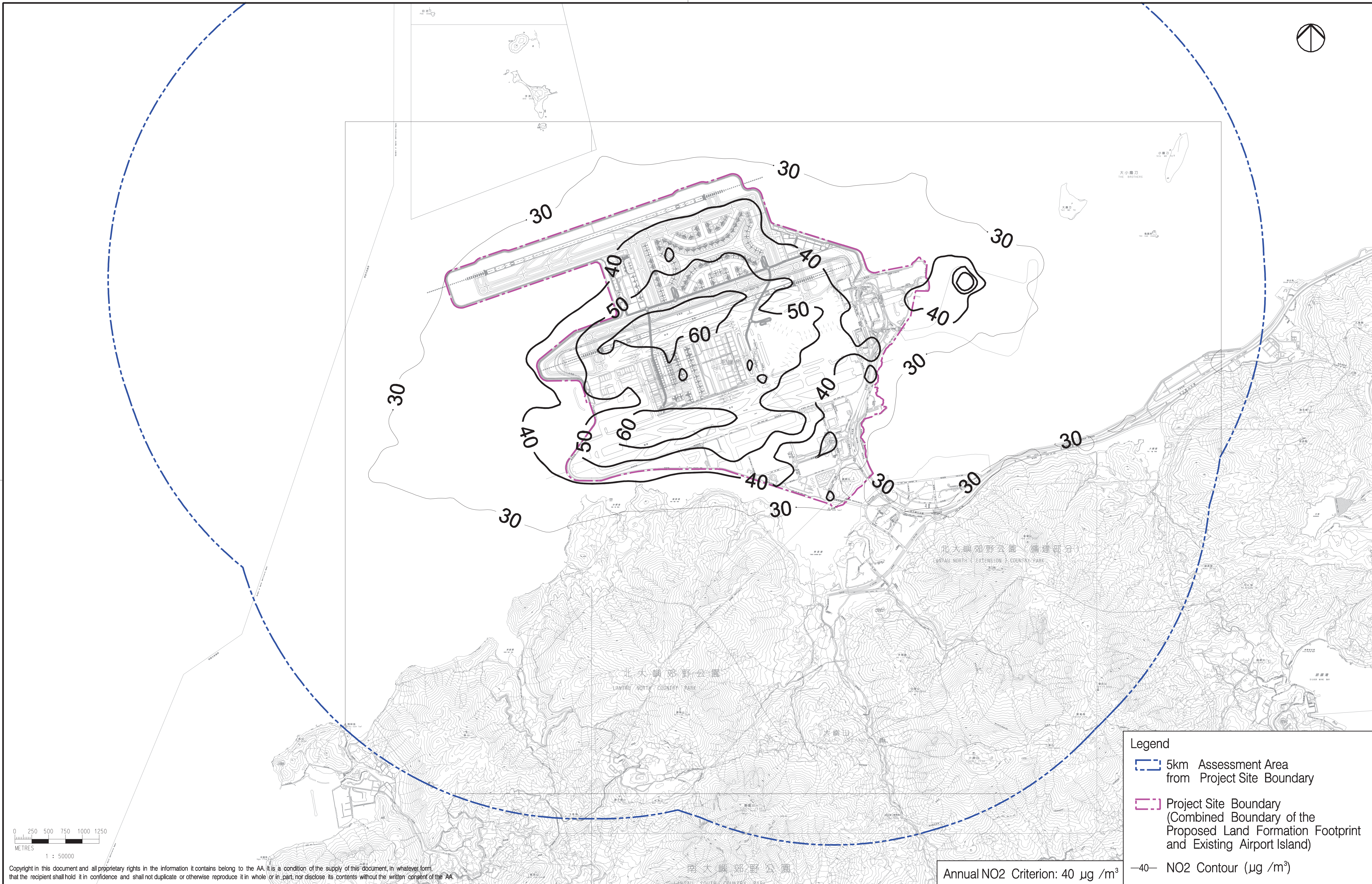
EXPANSION OF HONG KONG INTERNATIONAL AIRPORT INTO A THREE-RUNWAY SYSTEM

Drawing No. MCL / P132 / ES / 3-001

Scale at A3 1 : 30000

Rev. B

Filename: J:\308875\REPORT\ENV\ES\140414\MCL-P132-ES-3-001.dgn



Legend

5km Assessment Area from Project Site Boundary

Project Site Boundary (Combined Boundary of the Proposed Land Formation Footprint and Existing Airport Island)

—40— NO2 Contour (µg /m³)

Rev.	Date	Description	Checked
A	23OCT13	FIRST ISSUE	GK
B	10FEB14	SECOND ISSUE	GK
C	28FEB14	THIRD ISSUE	GK
D	06MAR14	FOURTH ISSUE	GK
E	24MAR14	FIFTH ISSUE	GK

香港國際機場 HONG KONG INTERNATIONAL AIRPORT

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Title
CONTOURS OF CUMULATIVE ANNUAL AVERAGE NO_2 CONCENTRATIONS AT 1.5M ABOVE GROUND FOR YEAR 2031 (AIRPORT ISLAND AND TUNG CHUNG AREA)

Consultant's Signatures for Approval		Date
Design	GL	24MAR14
Checkers	GK	24MAR14
Design Supervisor	EC	24MAR14
Authorised Representative	AFK	24MAR14

EXPANSION OF HONG KONG INTERNATIONAL AIRPORT INTO A THREE-RUNWAY SYSTEM

Drawing No. MCL /P132 /ES/5-3-001.1

Scale at A3 50000

Rev. A

Filename: G:\env\project\226428\13 Drawing Deliverables\13 EIA Chapter\Revised Final Draft EIA\MCL_P132_EIA_5-3-010 - Contours of Cumulative Annual NO2 Concentrations at 1.5m above Ground during Operational Phase(Lantau Area).dgn

0 500 1000 m

1 : 20 000 SCALE BAR

Legend

5km Assessment Area from Project Site Boundary

— 40 — NO2 Contour (µg/m³)

Annual NO2 Criterion: 40 µg /m³

Rev.	Date	Description	Checked
A	23OCT13	FIRST ISSUE	GK
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CONTOURS OF CUMULATIVE ANNUAL AVERAGE NO_2 CONCENTRATIONS AT 1.5M ABOVE GROUND FOR YEAR 2031 (TUEN MUN AREA)

Consultant's Signatures for Approval		Date
Design	GL	24MAR14
Checkers	GK	24MAR14
Design Supervisor	EC	24MAR14
Authorised Representative	AFK	24MAR14

EXPANSION OF HONG KONG INTERNATIONAL AIRPORT INTO A THREE-RUNWAY SYSTEM

Drawing No. MCL/P132/ES/5-3-001.2

Scale at A3 1:20000

Rev. A

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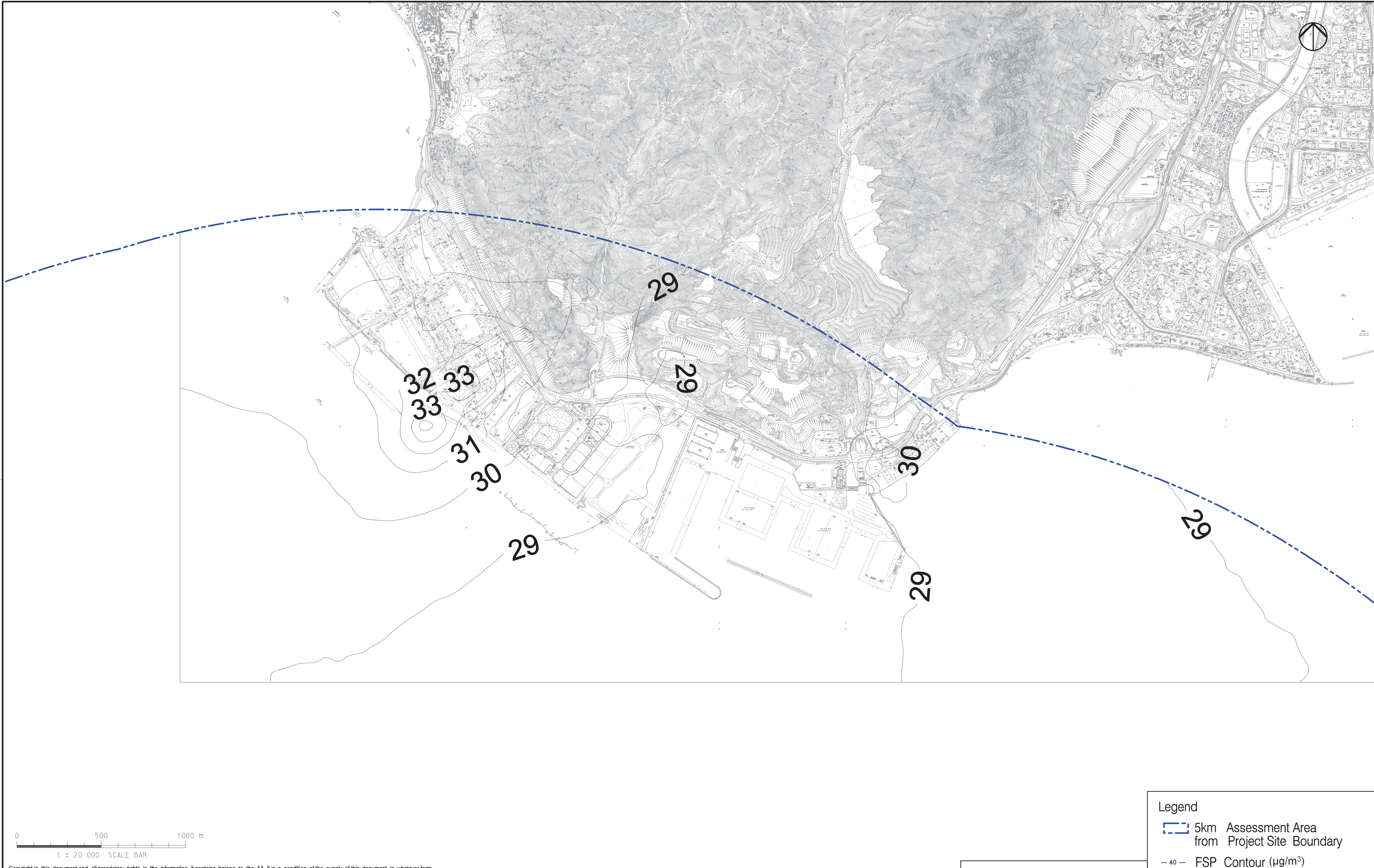

Legend

5km Assessment Area from Project Site Boundary

— 40 — FSP Contour (µg/m³)

Annual FSP Criterion: 35 µg /m³

Rev.	Date	Description	Checked
A	23OCT13	FIRST ISSUE	GK
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CONTOURS OF CUMULATIVE ANNUAL AVERAGE FSP CONCENTRATIONS AT 1.5M ABOVE GROUND FOR YEAR 2031 (TUEN MUN AREA)

Consultant's Signatures for Approval		Date
Design	GL	24MAR14
Checkers	GK	24MAR14
Design Supervisor	EC	24MAR14
Authorised Representative	AFK	24MAR14

EXPANSION OF HONG KONG INTERNATIONAL AIRPORT INTO A THREE-RUNWAY SYSTEM

Drawing No. MCL/P132/ES/5-3-002.2

Scale at A3 1:20000

Rev. A

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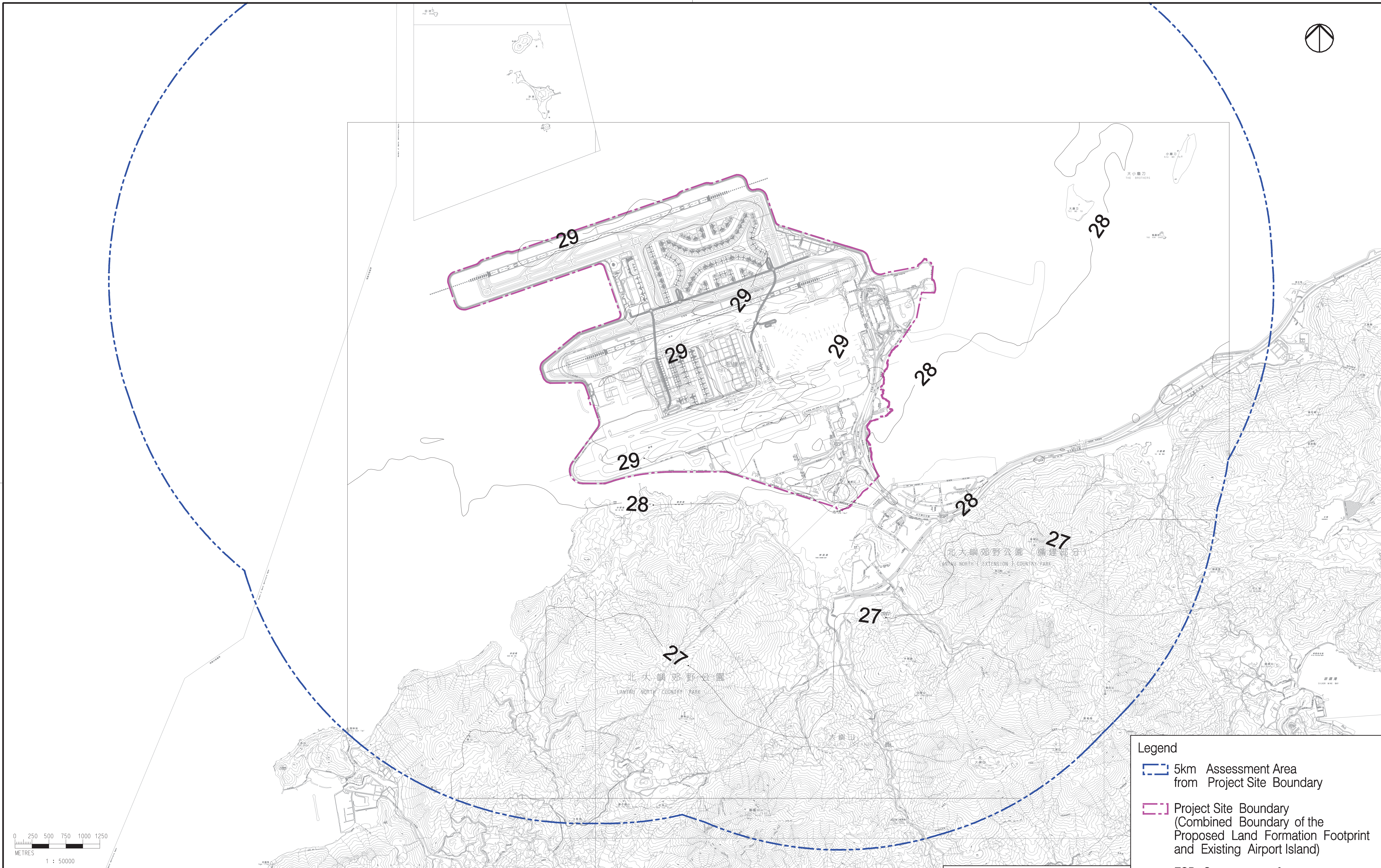

Rev.	Date	Description	Checked
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B	10FEB14	SECOND ISSUE	GK
C	06MAR14	THIRD ISSUE	GK
D	24MAR14	FOURTH ISSUE	GK

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Title

CONTOURS OF CUMULATIVE ANNUAL AVERAGE FSP CONCENTRATIONS AT 1.5M ABOVE GROUND FOR YEAR 2031 (AIRPORT ISLAND AND TUNG CHUNG AREA)

Consultant's Signatures for Approval		Date
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EXPANSION OF HONG KONG INTERNATIONAL AIRPORT INTO A THREE-RUNWAY SYSTEM

Drawing No. MCL/P132/ES/5-3-002.1

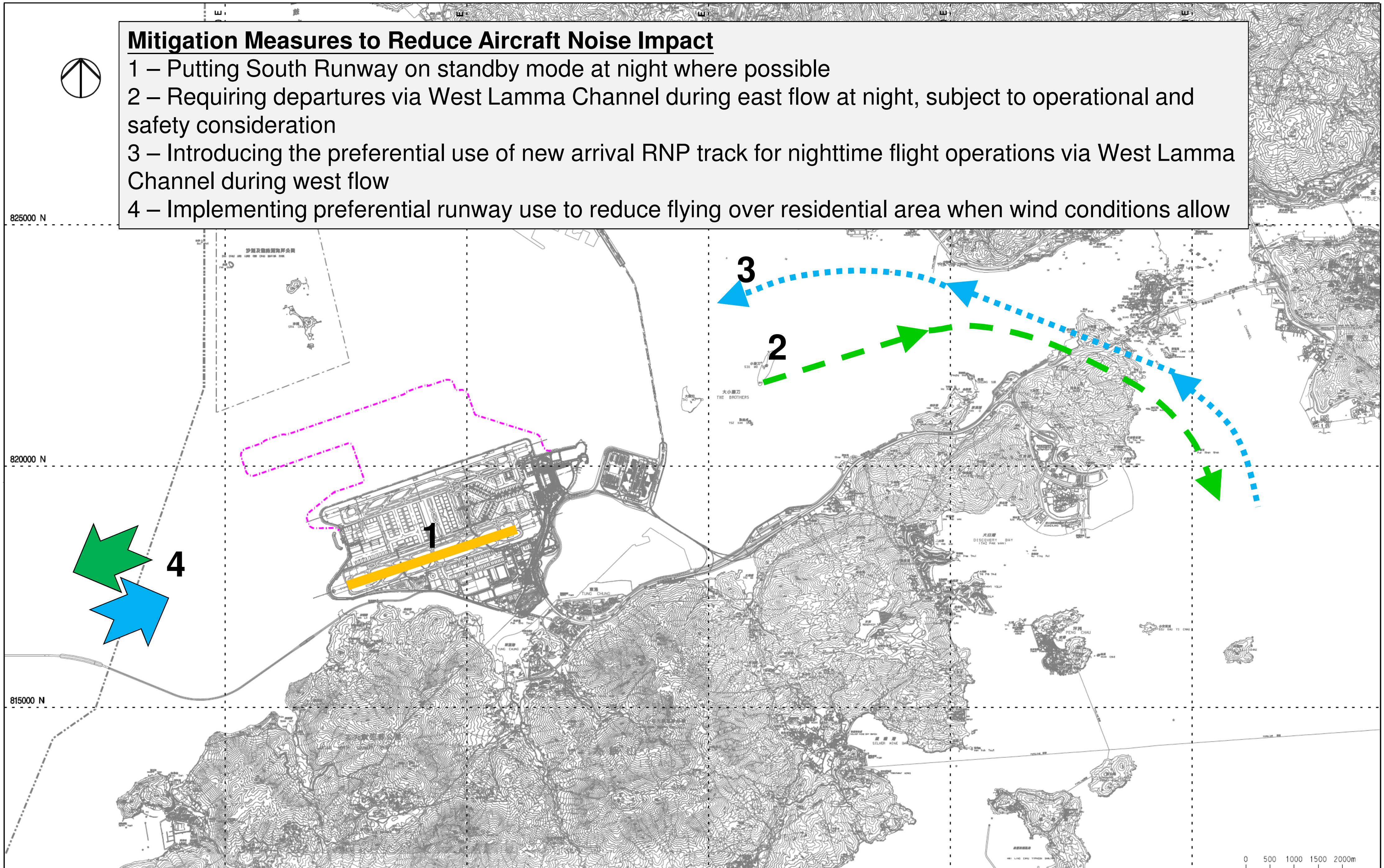
Scale at A3: 50000

Rev. A

Filename: G:\env\project\226428\13 Drawing Deliverables\13 EIA Chapter\Revised Final Draft EIA\MCL_P132_EIA_5-3-022 - Contours of Cumulative Annual FSP Concentrations at 1.5m above Ground during Operational Phase (Lantau Area).dgn

Mitigation Measures to Reduce Aircraft Noise Impact

1 – Putting South Runway on standby mode at night where possible
2 – Requiring departures via West Lamma Channel during east flow at night, subject to operational and safety consideration
3 – Introducing the preferential use of new arrival RNP track for nighttime flight operations via West Lamma Channel during west flow
4 – Implementing preferential runway use to reduce flying over residential area when wind conditions allow



Rev.	Date	Description	Checked
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香港國際機場 HONG KONG INTERNATIONAL AIRPORT

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Title
Mitigation Measures to Reduce Aircraft Noise Impact

Consultant's Signatures for Approval		Date
Design		
Checkers		
Design Supervisor	EC	25MAR14
Authorised Representative	AFK	25MAR14

EXPANSION OF HONG KONG INTERNATIONAL AIRPORT INTO A THREE–RUNWAY SYSTEM

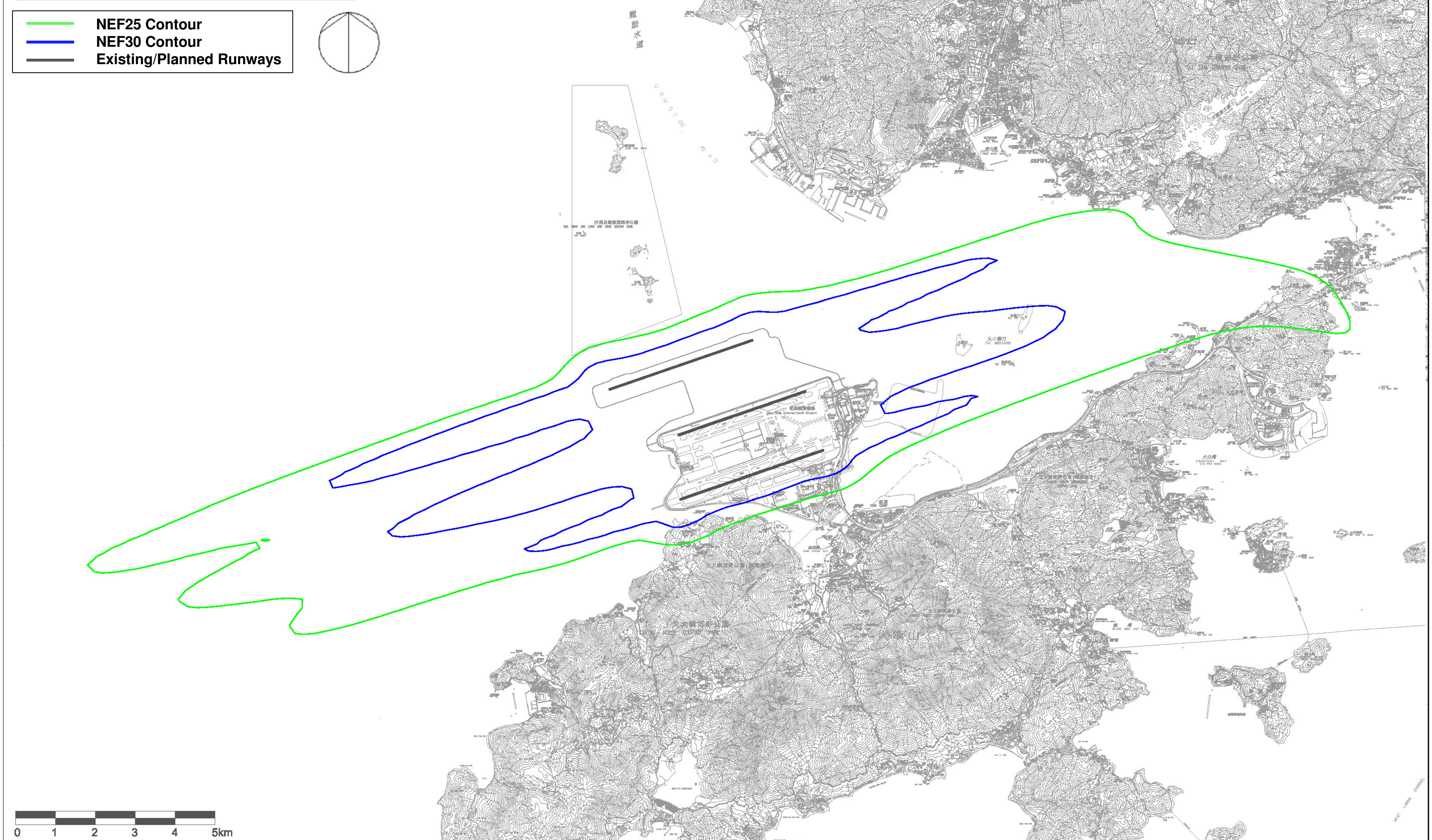
Drawing No. MCL/P132/ES/5-5-001

Scale at A3 1 : 70000

Rev. A

Filename: J:\308875\SKETCH\SK0054\SK0054.dgn

2030 NEF Contours



Rev.	Date	Description	Checked
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Title: NEF Contour of Year 2030

Consultant's Signatures for Approval		Date
Design	TW	25MAR14
Checkers	TW	25MAR14
Design Supervisor	EC	25MAR14
Authorised Representative	AFK	25MAR14

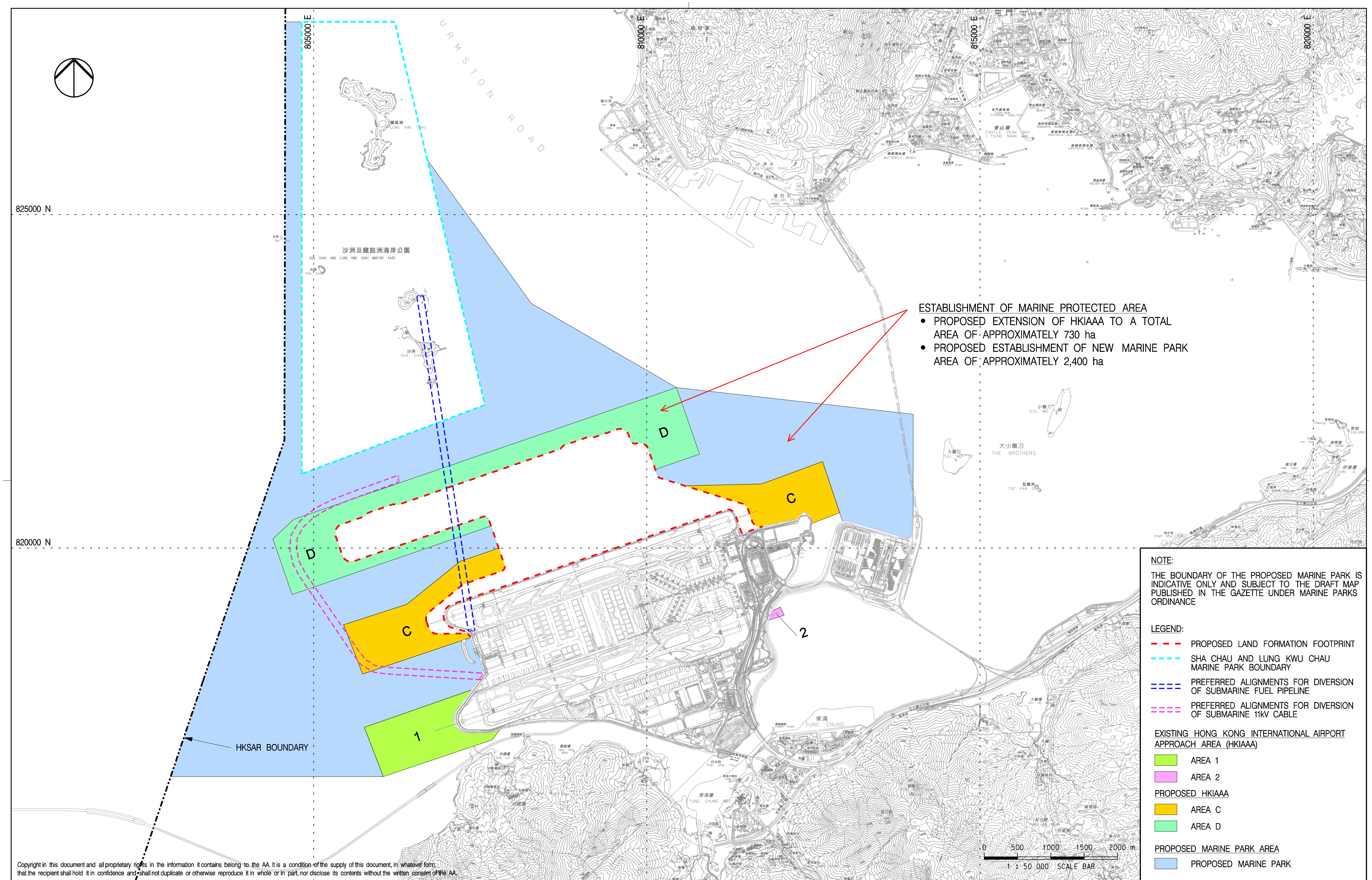
EXPANSION OF HONG KONG INTERNATIONAL AIRPORT INTO A THREE-RUNWAY SYSTEM

Drawing No. MCL/P132/ES/5-5-002

Scale at A3 1 : 70000

Rev. A

Filename: J:\308875\SKETCH\SK0054\SK0054.dgn



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Title
PROPOSED MARINE PARK AND HKIAAA EXTENSION

Consultant's Signatures for Approval		Date
Design	JC	19NOV13
Checkers	JC	19NOV13
Design Supervisor	EC	21MAR14
Authorised Representative	AFK	21MAR14

EXPANSION OF HONG KONG INTERNATIONAL AIRPORT INTO A THREE-RUNWAY SYSTEM

Drawing No. MCL / P132 / ES / 5-11-001
Scale at A3 1 : 50000
Rev. C

Filename: J:\308875\REPORT\ENV\ES\140414\MCL-P132-ES-5-11-001.dgn

擴建香港國際機場成為三跑道系統

環境影響評估報告－行政摘要

2014 年 6 月

香港機場管理局

擴建香港國際機場成為三跑道系統

環境影響評估報告－行政摘要

2014 年 6 月

香港機場管理局

此乃中文譯本。如中文本與英文原文有任何歧異，概以英文版本為準。

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Mott MacDonald

目錄

表格

圖則

1. 簡介

1.1.1.1 本行政摘要概述擴建香港國際機場（機場）成為三跑道系統的環境影響評估（環評）結果。環評附帶一項環境許可證的申請，並按照《環境影響評估條例》（環評條例）的規定編製。

1.1.1.2 現有機場自 1998 年啟用以來，多年來一直逐步擴展機場設施及運作，以應付日益增長的需求。與此同時，香港機場管理局（機管局）在持續總體規劃過程中，會制定 20 年的規劃大綱，並每五年檢討一次，同時考慮擴建機場的需要。《香港國際機場 2030 規劃大綱》（《2030 規劃大綱》）是機管局最近期編製的規劃大綱。

1.1.1.3 作為《2030 規劃大綱》的一部分，機管局於 2011 年進行了為期三個月的大型公眾諮詢（包括一項問卷調查），就作為機場未來發展策略性方向的可能方案，邀請公眾提供意見。方案一是「維持現有雙跑道系統」，方案二則是「擴建成為三跑道系統」。調查結果由獨立研究中心香港大學社會科學研究中心編撰，結果顯示超過 24,000 名回應者中，73%認為三跑道系統方案較可取。基於這項調查結果，香港特別行政區政府於 2012 年 3 月 20 日，原則上批准機管局的建議，採納三跑道系統作為機場未來發展規劃方案，並進行法定環評。

1.1.1.4 三跑道系統工程項目（下稱「工程項目」）建議選址於北大嶼山機場以北的新開拓土地，涵蓋約 650 公頃的永久佔用面積。工程項目主要包括：

- 新建第三條跑道及相關滑行道、停機坪及停機位；
- 新建客運廊；
- 擴建現有二號客運大樓；及
- 相關機場禁區及非禁區工程與相關附屬及配套設施。

1.1.1.5 環境保護署（環保署）於 2012 年 8 月 10 日就工程項目發出環評研究概要（ESB-250/2012）。環評報告乃根據研究概要要求編製，研究概要列明環評研究須要處理的 12 個主要環境評估範疇。這些評估結果載於本行政摘要**第 5 節**。

1.1.1.6 由 2008 年後期起至 2014 年年初，機管局舉辦和參加了 970 項持份者參與活動，向各界持份者解釋機場的長期發展計劃，這些持份者參與活動主要經以下渠道進行：

- 在特定環境範疇擁有豐富專業技術知識的專家及學者組成了四個技術研討小組，探討噪音、空氣質素、海洋生態及漁業，以及中華白海豚的事宜。第一輪研討會已於 2012 年 9 月及 10 月舉行；第二輪於 2013 年 4 月及 6 月舉行；最後一輪則於 2013 年 11 月及 12 月舉行；
- 與機場鄰近地區（離島、葵青、沙田、荃灣及屯門）的區議員及社區領袖組成的五個社區聯絡小組，在 2012 年 10 月及 2013 年 6 月、7 月及 12 月舉行會議；
- 於 2012 年 9 月及 2013 年 6 月、8 月、11 月及 12 月與環保團體進行研討會議；及
- 在 2013 年 8 月 1 日至 4 日期間舉辦公眾展覽，並於 2013 年 8 月 3 日及 4 日進行兩場公眾論壇，向公眾介紹環評的最新進展，以及避免／緩解工程項目潛在影響的最新方向。

1.1.1.7 其他持份者參與活動則包括會議、簡報會、研討會、研討論壇、展覽及機場參觀。這些活動涵蓋多個層面的持份者，包括專業團體、社區代表、業界代表、商界、政治團體、學界、非政府機構、環保組織、青年及媒體。

1.1.1.8 從各項持份者參與活動收集到的意見及建議，均予以考慮，並已按情況適當地納入環評研究的技術評估中。

2. 工程項目的需要

2.1 香港國際機場的發展

2.1.1.1 香港國際機場一直被視作支持香港經濟發展的重要基建資產。當舊啟德機場的運作開始受限，對經濟及環境（尤其是噪音方面）造成的負面影響不斷增加，亦愈見明顯。策略性研究亦隨之展開，以為機場另覓地點，當中包括進行策略性環境評估。最終選定赤鱲角為機場新址。遷移機場至赤鱲角是應付航空服務需求增長、避免長遠經濟損失，以及改善九龍市區的環境質素的策略決定。這關鍵決定令香港的金融、貿易、物流、旅遊及專業服務等經濟支柱，能夠繼續在國際舞台上扮演重要角色。從環境角度而言，選址赤鱲角主要因為其牽涉的影響遠低於其他可行方案，因此基於當時的經濟與環境考慮因素，赤鱲角的位置被視作最佳方案。

2.1.1.2 作為亞太地區中心的國際航空樞紐，香港國際機場憑藉機場容量及 24 小時營運，提供以香港為起點或終點的交通連繫（點對點直航交通）、轉機旅客的交通接駁，以及全球貨物轉運服務。藉着香港國際機場優越的地理位置及高效運作，機場的航空交通需求量逐年穩步攀升。香港國際機場自 1996 年來是全球最繁忙的國際貨運機場，以及在 2013 年成為全球第三繁忙的國際客運機場。為滿足不斷上升的需求量，香港國際機場一直在機場島範圍內發展，多年來提供多項新設施及服務，包括擴建客運大樓、增設跨境渡輪服務、興建新衛星客運廊，以及最近進行停機坪及中場範圍擴建，以便容納更多停機位。香港國際機場正逐步達至現有機場島範圍內的最高處理能力。

2.2 需求量預測

2.2.1.1 根據 1992 年《新機場總綱計劃》，香港國際機場最高處理量原為應付所預測的航空交通需求量而設計，《新機場總綱計劃》估計飛機起降量[1]至 2040 年[2]每年為 376,000 架次。然而，航空交通需求量的增長速度遠較原先預計迅速。根據在 2011 年發表的《2030 規劃大綱》的估計，香港國際機場現有雙跑道系統將在 2019 年至 2022 年之間達到實際最高容量。然而，國際航空運輸協會對《2030 規劃大綱》進行的最新檢討認為，機場的實際最高容量可能較《2030 規劃大綱》呈列的預測提前一至三年達到。

2.2.1.2 需求量增長的主要原因，是機場航空網絡完善的優勢，加上香港作為商業及金融中心的急速發展所致。這些因素使香港國際機場由原先規劃的點對點直航機場（主要提供往來香港的航空交通服務），轉變成國際樞紐機場（提供往來香港的航空交通服務及途經香港的交通接駁服務）。香港國際機場作為國際樞紐機場的地位，除了帶來額外的航空交通需求量，也改變了飛機機種組合。根據最新的航空交通需求量預測，至 2030 年的飛機起降量每年將達約 607,000[3]架次。

2.2.1.3 由於未來航空交通需求會受若干外在因素影響，就可能影響香港未來航空交通需求的其他主要因素，包括飛機機種組合、高速鐵路服務，以及珠江三角洲（珠三角）空域優化對珠三角機場的影響等方面進行了檢討。然而，分析顯示這些外在因素，將不會對香港航空交通需求預測造成顯著影響或令需求量降低。

[1]亦可稱為飛機升降量，並包括客運及貨運航班。

[2] 1992 年《新機場總綱計劃》預測至 2040 年的最高需求量為 8,700 萬旅客人次及 890 萬公噸貨運量。

[3]根據國際航空運輸協會的最新預測，至 2030 年客運量將達 1.023 億人次、貨運量為 890 萬公噸以及飛機起降量為 607,000 架次。

2.3 擴建機場成為三跑道系統的替代方案

2.3.1.1 除了擴建機場成為三跑道系統的方案外，其他可應付預測航空交通需求的方案，包括盡量提升雙跑道餘下容量及與鄰近機場合作，亦曾作考慮。經過仔細考慮後，這兩個方案被認為不可行，理由如下：

- 由於雙跑道系統快將達至其實際最高容量，盡量提升雙跑道餘下容量只會是短期措施。根據《2030 規劃大綱》，跑道容量將於 2019 年至 2022 年之間達到飽和，而按照國際航空運輸協會最新的檢討，跑道容量將較《2030 規劃大綱》的預測提前一至三年達到飽和。在此之後，機場仍須進一步擴建。延遲擴建機場成為三跑道系統，意味着在完成進一步擴建前機場將會達到最高跑道容量。先盡量提升雙跑道容量再擴展成為三跑道系統亦只會浪費資源，原因是為提升雙跑道容量所增設的基礎設施只可維持數年，此後便要再發展成為三跑道系統。
- 由於航空司法管轄區及民用航空運輸協定的不同，與珠三角地區的鄰近機場合作有困難。此外，若須在不同城市轉機，會為旅客及貨運營運商帶來不便，並會增加額外時間及耗費資源，影響行程的編排及負擔能力。倚賴其他機場來應付香港的航空交通需求，亦會減低香港國際機場為香港經濟帶來的優勢，最終會削弱機場以及香港的整體競爭力。

2.4 工程項目帶來的益處

2.4.1.1 擴建機場成為三跑道系統被視為最佳發展方向，以確保香港國際機場的運作能持續增長。機場以三跑道系統運作，更可帶來其他優勢，包括：

- 增加及提升客運及空運設施，將會進一步完善機場服務及設施，並提高運作靈活性，令跑道運作更能顧及鄰近居民的需要及關注事宜。
- 增加航點數目及前往航點的飛機班次，將會加強航空連繫緊密度，為機場使用者提供更多選擇，並促進香港商貿活動往來的增長。
- 機場提供的新職位及直接職位、間接職位（在機場為航空業及非航空活動提供商品及服務）及連帶職位（源自機場直接及間接僱員的消費）的數目將會增加。
- 由於經機場的出入口及轉口活動增加，將會帶動本地生產總值增長，機場對經濟增長的貢獻亦隨之而上升。機場進行擴建亦會加強國際聯繫，有助香港在國際商貿市場提高市場份額。

2.4.1.2 雖然擴建機場將無可避免造成一些環境影響，但亦可在工程項目的設計、施工及營運階段中，採取一些有利環境的元素。這些元素包括，在可行情況下將南跑道在夜間運作減至最少；提高優先採用航道的彈性，以將飛機噪音對人口稠密地區的影響減至最少；減少飛機滑行及停留時間，從而減少飛機污染物排放；善用其他項目產生的填料；以及在機場建築物及設施實行提高環保效能及效率的最佳措施，例如符合能源效益、節約用水及廢物循環再造等。

2.5 不進行工程項目的後果

2.5.1.1 在《2030 規劃大綱》的研究中指出，在現行的雙跑道系統下，預期跑道將會在 2019 年至 2022 年之間達到最高實際容量；而最新的預測顯示，可能會較早前所預測的提前一至三年達到有關最高容量。若不進行工程項目，機場將須在容量不足[4]的模式下運作。如出現這情況會導致以下的後果：

- 對機場運作方面，由於機場日益擠迫，應付服務中斷及恢復服務的彈性減弱，服務水平將會因而下降。
- 對航空公司營運方面，由於可供飛機起／降的時段有限，可提供的航線／航點將會因而減少，繼而令航空公司須轉用其他機場，以擴展他們的航空服務網絡。
- 對航空業方面，除非透過取代現有航班，否則不能開設新航線或增加現有航線班次，行業將因而不能進一步發展。

2.5.1.2 這些變化繼而對旅客、貨運業及環境方面的表現造成以下影響：

- 旅客將面對航點及航班選擇減少、等待／轉機時間延長、因航班供應不足而使旅遊成本上升，以及延誤機會增加等情況。
- 由於航點減少導致業務損失、延期交貨的風險上升、成本增加、運貨編排缺乏彈性，以及須轉用其他機場擴展服務等，貨運業預計會受到類似的影響。
- 因航空交通日漸擠迫（及相關污染物排放量增多），以及飛機噪音對鄰近人口稠密地區的影響增加，機場在環保方面的表現將會下滑。

2.5.1.3 上述因素將無可避免地造成深遠影響，並會削弱本港作為國際航空樞紐及香港整體的競爭力。為免造成這些後果，擴建機場成為三跑道系統被視為是最佳方案。

[4] 「容量不足」是指供不應求（即飛機起降時段的需求多於可供飛機起降的時段）的運作狀況。

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3. 其他方案的考慮

3.1 背景

3.1.1.1 機場擴建須考慮許多本質複雜的外在及內在因素。在進行總體規劃過程的各項可行性研究[5]時，已經審慎考慮這些因素。

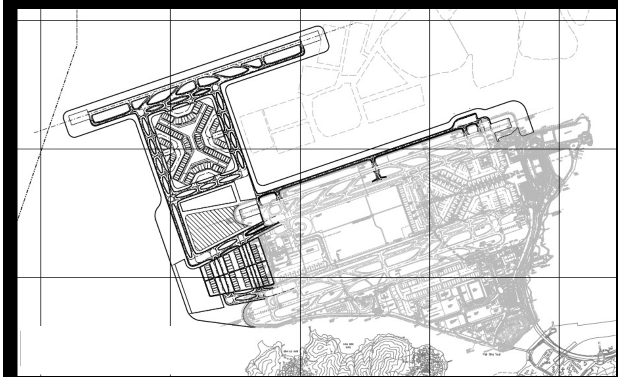
3.1.1.2 機管局就《2030 規劃大綱》委託相關顧問公司進行的可行性研究，涵蓋空域及跑道容量分析、初步拓地工程評估、初步工程可行性及環境評估、初步飛機噪音影響分析、初步空氣質素影響分析、經濟影響分析以及財務可行性評估。這些評估為總體規劃過程提供重要資料，以助識別各種限制因素及事宜，同時找出可提升機場運作及營運的地方，例如三跑道的布局、客運大樓以及客運廊。可行性研究其中一個目的，是評估環境對各項擴建／施工方案的可接受程度，從而在多方面提升工程項目的環境表現，包括縮小拓地範圍；在進行拓地工程時，使用免挖方法將對水質、廢物及海洋生態的影響減至最少；以及利用深層水泥拌合法在污染泥料卸置坑（污泥坑）範圍進行地質改良，以防釋出污染物。

3.2 機場布局

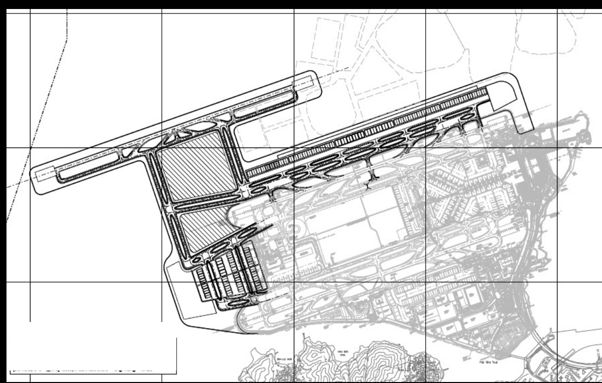
3.2.1.1 考慮跑道的排列方法構成評估機場布局方案的首要基礎。評估根據對第三條跑道安全及高效運作非常重要的準則進行，識別了 16 個初步跑道排列方案（包括 15 個原有方案，以及一個額外方案）。這個篩選過程挑選出四個可行的跑道排列方案。就運作要求作進一步評估後，揀選出三個可行的跑道排列方案再作分析。這三個排列方案與機場布局方案結合，產生了共 18 個機場布局方案，當中包括客運大樓、客運廊及停機坪位置的可能排列方式。這 18 個方案按照多項運作準則進行評估，最後選出四個機場布局方案。最後選出的方案其後再進一步作詳細的工程及環境評估。

3.2.1.2 下圖列出四個選出的機場布局方案：

方案 1：機場向北擴建並在北面興建衛星客運廊

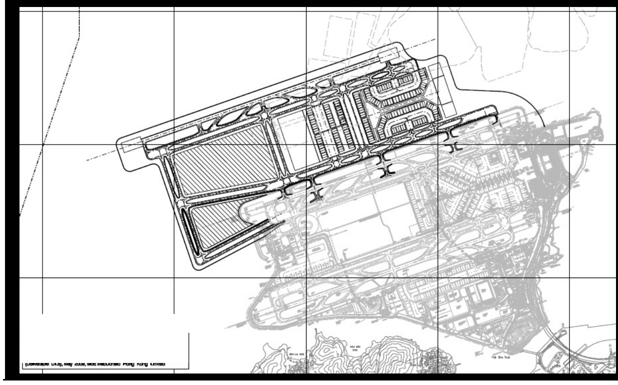


方案 2：機場向北擴建並在西面興建衛星客運廊

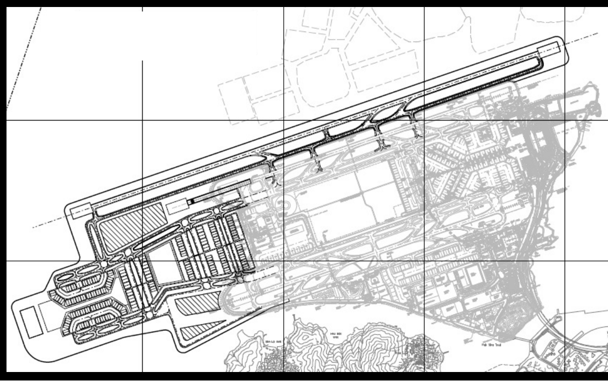


[5] 這些可行性研究為《 2030 規劃大綱》諮詢工作一部分而刊發，並上載至網站 http://www.threerunwaysystem.com/tc/Information/Consultancy_reports.aspx，以供閱覽。

方案 3：機場向北擴建並在擴建部分的東面興建衛星客運廊



方案 4：機場向西擴建並在西面興建營運基礎設施



3.2.1.3 四個選出的方案根據非環境準則及環境準則進行評估。非環境評估包括下列準則：

- 飛行區效率
- 旅客方便程度
- 地面交通系統
- 貨運效率
- 可建造性／成本

3.2.1.4 總體而言，非環境準則評估結果顯示，機場向北擴建方案（方案 1、2 及 3）比向西擴建方案（方案 4）較為可取。

3.2.1.5 同樣地，這些方案亦根據環境準則進行評估。評估以多項主要準則為基礎，而這些準則會根據每個機場布局方案的潛在環境影響程度排序。評估的結果概列於**表 3.1**。

表 3.1：　選出的機場布局方案的環境評估概要

標準	優選方案	理由
空氣質素	所有方案的影響程度相若。	所有方案的影響程度相若。
中華白海豚	方案 3	與其他方案相比，這方案整體對中華白海豚覓食棲息地的影響範圍較小及對其他中華白海豚重要區域的影響較低。
漁業	方案 3	與其他方案相比，這方案整體對漁業活動的影響較低。
海洋生態	方案 3	與其他方案相比，這方案整體對海洋生態的影響較低。
噪音	方案 3	與其他方案相比，這方案整體帶來較少潛在飛機噪音影響。
視覺	方案 3	與其他方案相比，這方案整體帶來較少潛在視覺影響。
水質及水動力	方案 3	與其他方案相比，這方案整體帶來較少潛在水質及水動力影響。

註：
1. 文化遺產－並非主要環境差異因素，原因是所有方案都會造成相若的潛在海洋考古影響，並且對陸地文化遺產並無直接影響。
2. 生命危害－並非主要的環境差異因素，原因是所有方案都涉及海底航油管道改道、延長加油栓系統及危險品貯存（柴油、汽油及液化石油氣），潛在影響程度相若。

3. 陸地生態－並非主要的環境差異因素，原因是所有方案的影響程度相若（主要為間接影響）。
4. 廢物－廢物差異因素是以先前假設以挖泥方式拓地為基礎。由於工程項目目前已確定採用免挖方法，此差異因素不再適用。
5. 土地污染－並非主要的環境差異因素，原因是在所有方案中，均須在現有機場島進行工程，潛在影響程度相若。

3.2.1.6 經比較不同機場布局方案可能造成的環境影響後，結果顯示方案 3 的整體環境影響較低。因此方案 3 被視為最佳執行方案。在進一步評估此最可取方案時，若干其他環境改善措施亦已確定並隨後被納入此最可取方案中。其中包括大量減少拓地面積（從約 827 公頃減至約 650 公頃），而機場其他主要組成部分，包括二號客運大樓擴建及新建第三條跑道客運廊布局，亦根據多項標準予以評估，以決定最佳執行方案。通過該等評估結果，得出最可取的機場布局（見**圖則 MCL/P132/ES/3-001**），並在本環評研究進行評估。

3.3 施工方法

3.3.1 拓地

3.3.1.1 自早期階段起，已確定只有免挖式的「填土」拓地方法，才能應付工程項目的長期運作需求，同時亦可將拓地帶來的環境影響減至最低。由於工程項目所需的部分土地位於先前已覆蓋的污泥坑之上，故對不同地質改良方法進行評估是其中一項重要要求，以確保對已覆蓋的污泥坑造成最小干擾。就技術可行性及環境可接受程度，初步合共比較及評估了 11 種地質改良方法。評估結果顯示其中六種方法（圓筒形鋼結構、深層水泥拌合、預製的疏水豎管、擠密砂樁、碎石樁及垂直排水砂井）在技術及環境考慮方面屬可接受。但就應用在污泥坑範圍而言，只有一種方法，即深層水泥拌合法在環境考慮方面屬可接受。這種免挖方法與其他方法不同之處，在於其可原地處置及穩固海泥，減少釋出污染孔隙水的可能性。根據海外應用這種方法的研究結果、先前在香港進行測試[6]的結果，以及徵詢環保署後，結論是污泥坑範圍將只可採用深層水泥拌合法進行拓地工程。基於這方法的好處，污泥坑範圍內的其他海洋基礎設施工程，例如新跑道進場燈的燈樁，亦建議採用這個方法。

3.3.1.2 就海堤設計亦曾考慮不同方案，考慮範圍包括工程要求、環境效益及其他因素。評估結果確定從減少廢物及海洋生態生境角度而言，堆石坡海堤對環境較有利。綜合所有其他適用的考慮因素，由土石芯或圓形鋼結構圍堰組成的堆石坡海堤屬較可取的方案，並成為工程項目的主要海堤類型。然而，在有特定運作要求的局部範圍（如海上救援），則會採用直立式的海堤設計。

3.3.1.3 拓地完成後，在機場現有及擴建範圍將興建各項設施，包括（但不限於）第三條跑道、滑行道、停機坪、第三條跑道客運廊、二號客運大樓擴建、隧道、道路網、排水設施、污水收集系統、公用設施、燃料加油栓系統，以及工程項目的各種附屬建築物。以上建設將大體上採用標準施工方法，透過實施建議的緩解措施，預計工程項目的環境表現將不會有顯著變化。

3.3.2 海洋基礎設施改道

3.3.2.1 在工程項目中，主要現有海洋基礎設施將須改道，包括現有海底航油管道及 11 千伏海底電纜。

3.3.2.2 現有機場島目前由位於屯門的永久航空燃油儲存庫經海底航油管道供應航油。這些管道經沙洲的飛機燃料接收設施，然後連接至機場島上現有航空燃油儲存庫。由於機場擴建的拓地工程將覆蓋部分現有海底航油管道的位置，這些管道將須在拓地工程展開前改道。就海底航油管道改道，工程項目

[6] 於 2012 年 2 月在污泥坑範圍進行了深層水泥拌合測試，期間進行廣泛的水質及水底聲音監測工作，以檢測有否造成潛在環境影響。監測結果顯示，在整個測試過程期間，深層水泥拌合工程不會導致水質出現任何明顯惡化，亦沒有監察到任何污染物或水泥漿溢出。測試亦發現，與其他海上工程技術比較，深層水泥拌合工程相對較寧靜，所產生的水底聲音一般低於 200 赫，而中華白海豚對有關頻率敏感度較低。因此，實地測試證明，在污泥坑範圍以深層水泥拌合法進行地質改良在環境考慮方面屬可接受。

擬定了三個走線／施工方案作為方案設計的一部分進行評估。其中兩個方案涉及從機場島開挖管坑至沙洲，而另一方案涉及採用定向鑽挖法鑽穿基岩。三個方案均從設計、施工、環境，以及檢查及維修方面進行評估。評估結果顯示，定向鑽挖法是對環境造成最少潛在影響的方案。這方法隨後獲採納為海底航油管道改道的最可取方案。

3.3.2.3 同樣地，就現有的 11 千伏海底電纜進行了評估。這些電纜從機場島西北面供電給位於沙洲及龍鼓洲島的各類設施。由於機場擴建的拓地工程將覆蓋部分現有海底電纜的位置，這些電纜將須在拓地工程展開前改道。從技術及環境方面評估了合共五個走線／施工方案，其中三個方案涉及從機場島至沙洲採用直埋法，另一個方案涉及從機場島至沙洲及龍鼓洲海岸公園外的「中間點」採用直埋法，然後改道後的電纜會經安裝接口與現有電纜連接。餘下的一個方案則涉及以定向鑽挖法進行基岩鑽探。在以上五個方案中，由於定向鑽挖法令電纜受損的風險較高，故技術上被視為不可行，因此不再作考慮。其餘四個方案之中，採用直埋法及安裝接口的方案被確定為對環境造成最少影響的方案，原因是這方法會避免工程伸延至生態易受影響的海岸公園。這方法隨後獲採納為 11 千伏海底電纜改道的最可取方案。

4. 項目描述

4.1 工程項目的主要組成部分

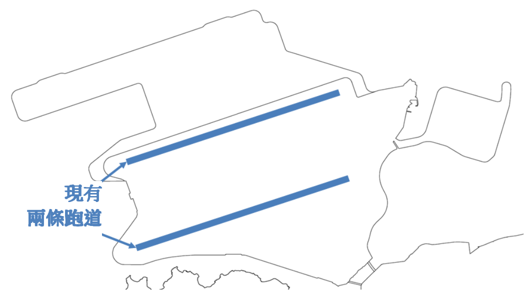
4.1.1.1 根據最可取機場布局（見**圖則 MCL/P132/ES/3-001**），工程項目的主要組成部分包括：

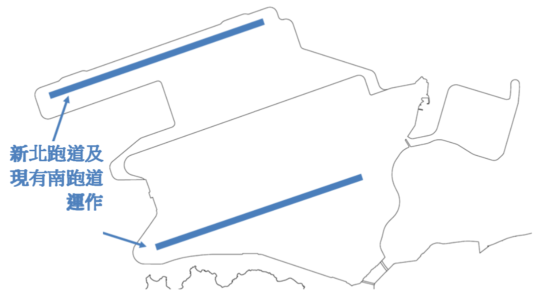
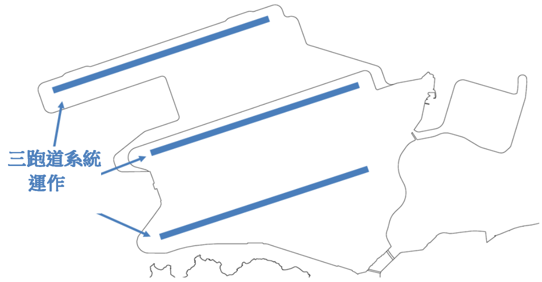
- 拓地，包括地質改良、海堤建設及改建（包括海上救援艇分布點）、填土及加載工程；
- 興建新飛行區設施，包括第三條跑道、滑行道、停機坪、航油供應網絡及其他飛行區基礎設施、飛機導航設備、進場燈系統及新香港國際機場進口航道區的指點標；
- 改建現有飛行區設施，包括現有北跑道、滑行道及中場範圍的停機坪；
- 興建新客運設施，包括第三條跑道客運廊及擴建二號客運大樓、旅客捷運系統及相關車廠和維修／列車停放處，以及行李處理系統；
- 興建新附屬設施以支援擴建後的機場運作需要，包括公用設施大樓、機場輔助發展項目、空運停候區、食肆、飛機維修、飛機引擎起動（引擎測試）設施、地勤設備區、暫存行李系統設施、消防局、消防培訓設施、加油站、新航空交通指揮塔、香港天文台設施、流動電話系統天線塔、店舖、保安檢查閘等；
- 興建及擴建基礎設施及公用設施，包括道路網絡、海水冷卻及沖廁系統、雨水排放系統、廢水處理系統、污水收集網絡及食水供應、煤氣供應、132 千伏／11 千伏及其他供電網絡、通訊網絡等；
- 現有海底基礎設施改道，包括海底航油管道及 11 千伏海底電纜。

4.2 施工計劃

4.2.1.1 根據工程項目的暫定計劃，三跑道系統將在 2023 年開始運作。基於工程項目的規模及複雜程度，施工期間與跑道同時運作的布局將按下文**表 4.1** 所示分階段實施。工程項目若干組成部分（如第三條跑道客運廊）可能根據需求量分階段施工。根據這分階段的安排，三跑道飛行區系統將會在工程項目全部相關基礎設施竣工前開始運作。

表 4.1： 施工期間與跑道運作布局的階段摘要

階段	說明	跑道運作布局	時間表
前期建築	海底管道及電纜改道		2015 至 2016 年
第一期	先進行拓地工程，隨後興建第三條跑道、新滑行道及新第三條跑道客運廊。同時亦開始二號客運大樓擴建工程。整個施工階段期間，將維持現有雙跑道系統運作模式。		2016 至 2021 年

階段	說明	跑道運作布局	時間表
第二期	第三條跑道及相關滑行道完工後，現有北跑道將關閉以作改建，同時會進行第三條跑道客運廊與停機坪、行車隧道的建造工程及重新配置二號客運大樓工程。在這過渡階段，現有南跑道與新建的第三條跑道將同時運作。		2021 至 2023 年
第三期	當所有主要基礎及設施，包括部分第三條跑道客運廊、停機坪及擴建後的二號客運大樓完工後，機場將以三跑道系統運作。其餘設施施工將繼續進行直至完工為止。		2023 及以後

4.3 指定工程項目摘要

4.3.1.1 根據《環評條例》構成指定工程項目的項目組成部分摘要如下：

- 面積超過 5 公頃的填海工程（包括相聯挖泥工程）（附表 2 第 I 部的 C.1 項）。
- 機場（包括其跑道及與飛機維修、修理、加油及燃料貯存、引擎測試或空運貨物處理有關的發展及活動）（附表 2 第 I 部的 B.1 項）。
- 鐵路及其相聯車站（附表 2 第 I 部的 A.2 項）。
- 入口之間的長度超過 800 米的行車隧道或鐵路隧道（附表 2 第 I 部的 A.7 項）。
- 對從處理廠流出並經處理的污水進行再使用的活動（附表 2 第 I 部的 F.4 項）。
- 海底氣體管道或海底油管（附表 2 第 I 部的 H.2 項）。
- 包括下述項目在內的全部工程項目：新通路、鐵路、下水道、污水處理設施、土木工事、挖泥工程及其他建築工程，而該等項目部分或全部位於現有的郊野公園或特別地區或經憲報刊登的建議中的郊野公園或特別地區、自然保育區、現有的海岸公園或海岸保護區或經憲報刊登的建議中的海岸公園或海岸保護區、文化遺產地點和具有特別科學價值的地點（附表 2 第 I 部的 Q.1 項）。
- 屬快速公路、幹道、主要幹路或地區幹路的道路，包括新路及對現有道路作重大擴建或改善的部分（附表 2 第 I 部的 A.1 項）。
- 鐵路側線、車廠、維修工場、調車場或貨物場（附表 2 第 I 部的 A.4 項）。
- 橋台之間的長度超過 100 米的行車橋樑或鐵路橋樑（附表 2 第 I 部的 A.8 項）。
- 面積超過 1 公頃而其一條界線距離一個海水進水口少於 100 米的填海工程（包括相聯挖泥工程）（附表 2 第 I 部的 C.2(b)）。

- 處理和製造水泥的總筒倉量超過 10,000 公噸的水泥廠或混凝土拌合廠（附表 2 第 I 部的 K.5 項）。
- 場地面積的規模超過 1 公頃的沙倉（附表 2 第 I 部的 K.11 項）。

4.4 同期進行的項目

4.4.1.1 在準備環評時檢閱現有資料，識別了若干可能與工程項目在相若時間進行的其他已計劃／既定項目，並可能產生累積環境影響。在適當情況下已考慮這些同期進行的項目，並納入環評報告的相關技術評估部分。

5. 環境影響評估摘要

5.1 環境影響評估方法

5.1.1.1 環評程序是識別、評估及滙報工程項目對環境帶來的影響及效益的方法。這是與設計流程同時進行的過程，以識別各項設計方案的潛在環境影響，以及制訂將予納入機場擴建設計、施工及營運的不同方案及緩解措施。機管局已考慮在持份者參與活動取得的意見及建議，並在可行情況下將其納入環評過程中，同時已提出可避免部分潛在環境影響的措施，而其他影響則減少或緩解至可接受水平。

5.2 避免影響、將影響減至最少及緩解影響措施的概覽

5.2.1.1 根據在擬備《2030 規劃大綱》時進行的初步工程及環境評估，以及其後的環評研究，已識別多項環境考慮因素，並納入工程項目中。機管局承諾實行以下主要設計及規劃措施，以提升環保表現：

<u>將拓地範圍減至最小</u>

5.2.1.2 在詳細評估多個機場布局方案後，就各項主要環境、營運效率及工程限制等因素，作出最佳平衡並選出可取方案。然而，有關方案亦作出進一步改良，其中包括將拓地面積由約 827 公頃大幅減少至約 650 公頃，當中主要考慮是將對海洋生境及其海洋生物（包括中華白海豚）的相關影響減至最少。

<u>避免施工階段影響 / 將施工階段影響減至最少</u>

5.2.1.3 拓地工程將採用免挖式地質改良方法（例如深層水泥拌合法），以避免大量挖走及處置任何疏浚物料，並將釋出的懸浮固體及其他污染物減至最少。採用此方法將會大幅減少對周圍海水水質及海洋生態（包括中華白海豚）的潛在影響。

5.2.1.4 從機場島至沙洲的海底航油管道改道工程將採用定向鑽挖法，於海床以下石層內進行，以避免浚挖任何海床，從而消除對海水水質及海洋生態的任何影響，包括對沙洲及龍鼓洲海岸公園的影響。此外，亦已仔細選取上沙洲的燃油管道鑽孔出土位置（即管道穿出地面的地點），以將對島上鷺鳥林造成的干擾減至最低。

5.2.1.5 新的 11 千伏海底電纜將採用水力噴注法鋪設，連接沙洲及龍鼓洲海岸公園界線外距離超過 500 米的現有電纜。採用此方法會將產生及處置海泥減至最少，避免對海岸公園內的海床造成干擾。

5.2.1.6 在設計及施工規劃過程中，在可行情況下，優先就拓地工程重用工程項目所產生的惰性拆建物料，包括來自拆卸現有北面海堤的護面岩石，這樣可將運離工地的過剩惰性拆建物料及相關環境影響減至最少。在工程項目的拓地工程方面，將會善用工地現場產生的拆建物料之餘，亦會在可行情況下，採用來自政府公眾填料接收設施的公眾填料，即香港其他工程項目產生的廢棄填料。

5.2.1.7 根據相關規定，因擴建機場島的各項建築工程而挖掘的所有海泥將予處理，並會在工地再用作工程項目的回填物料。此方法可避免在工地範圍外處置海泥的需要，免卻可能會對海洋環境造成影響。

<u>將飛機與相關排放及其潛在健康影響減至最少</u>

5.2.1.8 機管局承諾在可行情況下，減少機場及其相關運作的潛在空氣質素及健康影響。因此，機管局已採取多項措施，以減少空氣污染物排放至最低程度。這些措施包括透過發牌制度，規定使用節約燃料型號的機場禁區車輛；提供充電基礎設施，鼓勵在機場多用電動車及電動地勤設備，並逐步全面更

換車隊，引入電動車或節約燃料型號／混合動力車輛，目標是在 2017 年年底前，將機場禁區內所有房車更換為電動車；自 2008 年 6 月起，除因安全或運作理由而獲豁免的車輛及設備外，機場禁區內所有車輛及設備不得空轉引擎；在飛行區提供最潔淨的柴油及汽油；規定機管局所有柴油車輛必須使用 B5 生物柴油；以及為機場禁區的車輛及地勤設備提供液化石油氣加氣站。

5.2.1.9 此外，機管局正增加使用固定地面供電系統及預調空氣系統。現時飛機在廊前停機位使用這些系統的比率約為 80%。機管局亦將於 2014 年年底前，禁止飛機在廊前停機位使用輔助動力裝置。

<u>將飛機噪音及其潛在健康影響減至最少</u>

5.2.1.10 為將飛機噪音及相關健康影響減至最少，多項計劃運作程序將會納入擬建三跑道系統的未來運作，其中包括：

(i) 在可行情況下，安排現有南跑道於夜間 2300 至 0659 時段處於備用狀態；

(ii) 規定飛機於夜間 2300 至 0659 時段，在可接受的操作及安全情況下，向東方起飛的航機採用經西博寮海峽的南行航線，有關安排符合現有的雙跑道系統夜間運作規定；

(iii) 已設計一條新的進場航道 6，讓設有「所需導航性能[7]」的飛機於夜間 2300 至 0659 時段優先採用西面方向（即跑道 25 方向）進場；於 2030 年，估計有高達 95%飛機可優先採用此新航道 6 抵港，取代目前直線進場航道；及

(iv) 在風速及風力許可的情況下，實行優先跑道使用計劃。於夜間時段，在飛機起飛架次較多時採用西行航道，在飛機降落架次較多時則採用東行航道。

<u>緩解不可避免的影響</u>

5.2.1.11 實行上述主要設計及規劃措施，在工程項目施工及營運期間，將會避免相關的環境影響或將有關影響減至最少，但工程項目仍會無可避免地對環境造成若干影響，因此已就有關環境影響進行詳盡及全面的評估，並按需要制訂適當的緩解措施，以進一步減低潛在影響。主要評估結果概要載於下文，具體緩解措施的詳情載列於主要環評報告的相關章節。

[7] 所需導航性能是一種導航模式，讓在機上配備性能監察，及預警功能的飛機，在參考站的導航覆蓋範圍內或其本身的導航性能範圍內或結合兩者的導航範圍內的任何航道運作。

5.3 空氣質素

5.3.1 簡介

5.3.1.1 與工程項目施工及營運階段相關的潛在空氣質素影響，已按照環評研究概要第 3.4.3 節及附錄 A 第 I 節，以及根據《環境影響評估條例》發出的《環境影響評估程序的技術備忘錄》附件 4 第 1 段及附件 12 規定所訂明準則及指引進行評估。

5.3.1.2 在施工及營運階段的影響評估中，採用由環保署批准的相關空氣模型進行定量評估。

5.3.2 施工階段

5.3.2.1 有關評估已識別在工程項目施工階段可能會排放塵埃的主要活動，這些活動包括拓地工程、興建第三條跑道、客運廊、停機坪及相關飛行區基建設施、擴建現有二號客運大樓及部分中場範圍貨運停機坪、擴建旅客捷運系統及行李處理系統、改善相關道路網、石料加工廠、海底航油管道及 11 千伏海底電纜改道、改建現有排水口，以及水泥廠、瀝青廠及躉船碇泊處。此外亦已識別在 500 米評估範圍以內同期進行的其他項目所產生的建築塵埃排放，亦已按情況納入累積空氣質素影響評估。

5.3.2.2 根據環評研究概要附錄 A 第 I 節第 3(ii)條，就施工階段的空氣質素影響評估，識別了位於工程項目界線起計 500 米範圍內的具代表性易受空氣污染影響地方。評估的相關空氣污染物包括總懸浮粒子、可吸入懸浮粒子（PM_{10}）及微細懸浮粒子（$PM_{2.5}$）。

5.3.2.3 在建築工程實行建議的緩解措施及相關的法規要求[8]後，採用定量模擬分析進行的評估顯示，在整個施工期間，所有易受空氣污染影響地方將符合每小時總懸浮粒子準則，以及可吸入懸浮粒子及微細懸浮粒子的相關空氣質素指標。因此，預計在工程項目施工期間，所有易受空氣污染影響地方將不會受到與總懸浮粒子、可吸入懸浮粒子或微細懸浮粒子相關的負面剩餘影響。

5.3.2.4 在拓地的地質改良工程進行建議的深層水泥拌合過程中，水泥粉將會以封閉式管道或完全密封方式由支援船隻運送至深層水泥拌合作業躉船。在深層水泥拌合作業躉船或支援船隻上不會露天貯存水泥，因此預計不會因水泥運送或貯存而造成負面的剩餘塵埃影響。

5.3.2.5 在機場擴建範圍的擬建瀝青廠可能會產生與瀝青煙霧相關的排放。然而，由於瀝青廠與易受空氣污染影響地方相距較遠（距離最近的易受空氣污染影響地方最少 3.1 公里），加上實行環保署就瀝青廠指明工序相關指引所載的各項排放管制措施後，預計瀝青煙霧排放不會造成負面的剩餘空氣質素影響。

5.3.2.6 基於上述評估結果，工程項目的施工將不會造成負面的剩餘空氣質素影響。

5.3.3 營運階段

5.3.3.1 機場運作帶來多個主要空氣污染物排放源，包括飛機降落及起飛周期、飛機在地面運作時使用輔助動力裝置、飛機維修中心、引擎測試設施、政府飛行服務隊（包括定翼飛機及直升機）運作、海天客運碼頭的快船營運、機場禁區車輛（包括地勤設備及非地勤設備）運作、航空燃油儲存庫營運、香港商用航空中心營運、停車場營運、餐飲設施、消防訓練活動，以及在機場島行駛的汽車。

[8] 《空氣污染管制(建造工程塵埃)規例》；環保署就水泥廠、瀝青廠及石料加工廠等指明工序制定的相關指引。

5.3.3.2 根據國際民航組織對未來飛機排放趨勢的預測，加上由國際航空運輸協會就三跑道系統編製的航空交通量預測數據，預計出最高飛機空氣污染物排放量將於 2031 年出現，因此選取這年份作為評估年度。

5.3.3.3 有關評估已識別在工程項目界線（即擴建後的機場島界線）起計五公里範圍內的現有及已規劃空氣污染物排放源，並計入營運階段的空氣質素評估。其他更遠的空氣污染物排放源（即位於機場界線起計五公里評估範圍外的排放源）在整體上視作背景排放，有關排放會對研究範圍內周圍環境的空氣污染物濃度造成影響。背景排放包括多個源頭，當中涵蓋廣東省、珠江三角洲經濟區及香港特區。

5.3.3.4 在確定機場運作、鄰近基建及周圍環境的排放物清單時，均已考慮既定政策及實際技術提升。機管局一直推行多項方法及措施，以進一步減少機場所產生的空氣污染物排放，而機管局會繼續以空氣質素為環境計劃的其中一個重點。有關方法及措施包括：

- 自 2008 年起，禁止所有機場禁區內的車輛引擎空轉，惟已受豁免的特定車輛除外；
- 在 2014 年年底前禁止所有飛機在廊前停機位使用輔助動力裝置；
- 在 2017 年年底前，機場禁區內行駛的所有房車必須為電動車；
- 在 2018 年年底前，增設電動車及電動地勤設備充電站數目至 290 個；
- 就現有地勤設備排放表現進行檢討，探討有助進一步控制空氣污染物排放的措施；
- 在招標或更新合約時，與專營服務商探討加快以較潔淨型號取代舊款機場禁區車輛及地勤設備的可行性；
- 所有新增的機場禁區車輛必須為節約燃料型號，並以此為發牌的先決條件；
- 在飛行區提供最潔淨的柴油及汽油；
- 規定機管局所有柴油車輛必須使用 B5 生物柴油；及
- 為機場禁區的車輛及地勤設備設置液化石油氣加氣站。

5.3.3.5 預計在實行上述措施後，與三跑道系統運作相關的空氣污染物排放將會進一步減少。

5.3.3.6 根據環評研究概要附錄 A 第 I 節第 4(i)條，必須為工程項目界線起計五公里範圍內以量化方式進行運作空氣質素影響評估。因此，自工程項目界線起計的五公里劃作研究範圍，整體涵蓋北大嶼山的東涌、磡頭、沙螺灣、磡石灣、小蠔灣及深屈灣，以及屯門的踏石角。

5.3.3.7 在工程項目界線起計五公里範圍以內，已識別具代表性的易受空氣污染影響地方。透過檢視地形圖、航攝照片及土地類別圖，加上實地勘察，已識別現有的易受空氣污染影響地方，當中包括住宅樓宇、教育機構及酒店等。藉着參考相關的分區計劃大綱圖、發展大綱圖、發展藍圖及研究範圍內的其他已發布藍圖，識別了已規劃／既定的易受空氣污染影響地方，有關參考資料包括：

- 赤鱲角分區計劃大綱圖（編號 S/I-CLK/12）；
- 東涌市中心地區發展藍圖－大嶼山（編號 L/I-TCTC/1F）；
- 北大嶼山新市鎮第二期乙地區（部分）發展藍圖（編號 L/I-TCIIB/1C）；
- 沙螺灣村發展藍圖（編號 L/I-SLW/1）；
- 東涌市中心地區分區計劃大綱圖（編號 S/I-TCTC/18）；
- 小蠔灣發展藍圖（編號 L/I-SHW/1）；及

- 屯門分區計劃大綱圖（編號 S/TM/31）。

5.3.3.8 土木工程拓展署正進行東涌餘下發展計劃的規劃及工程研究，這項研究旨在評估東涌東及東涌西餘下發展計劃的可行性。在本環評的空氣質素研究中，已於東涌新市鎮擴展建議發展範圍的界線選取具代表性的易受空氣污染影響地方。

5.3.3.9 為預測易受空氣污染影響地方的污染物濃度，採用了環保署接納的近場模型（即 AERMOD、CALINE4）及由環保署研發的地區模型（即 PATH）。就雙跑道系統（即沒有三跑道系統運作）情況及三跑道系統（即有三跑道系統運作）情況均已進行模擬分析。

5.3.3.10 2031 年三跑道系統情況的模擬結果顯示，所有易受空氣污染影響地方的累積二氧化氮、可吸入懸浮粒子、微細懸浮粒子、二氧化硫及一氧化碳水平均符合相關的空氣質素指標。**圖則 MCL/P132/ES/5-3-001 及 MCL/P132/ES/5-3-002** 分別顯示二氧化氮及微細懸浮粒子在地面 1.5 米上的年均濃度等量線，反映機場以外的易受空氣污染影響地方均符合相關空氣質素指標。至於機場島上，除持續監測室外空氣質素外，機管局亦監測室內空氣質素，為旅客及員工保持良好的室內空氣環境。一號客運大樓、二號客運大樓、海天客運碼頭及北衛星客運廊均達到及保持環保署「辦公室及公眾場所室內空氣質素檢定計劃」的「良好級」室內空氣質素。

5.3.3.11 比較三跑道系統與雙跑道系統（即沒有三跑道系統運作）情況下的污染物年均水平，二氧化氮、可吸入懸浮粒子及微細懸浮粒子的增幅分別少於 1 微克／立方米、0.2 微克／立方米及 0.1 微克／立方米，可見轉變相對並不顯著。

5.3.3.12 至於沙螺灣，雖然位於機場的順風方向（機場主要吹東風），但預計在三跑道系統運作情況下，其年均二氧化氮濃度將較雙跑道系統運作情況下為低，顯示三跑道系統將會對沙螺灣帶來環境效益，主要原因包括：

- 大部分飛機將由南跑道（雙跑道系統情況）改至由中跑道（三跑道系統情況）起飛；及
- 在可行情況下，將安排南跑道在夜間 2300 至 0659 時段處於備用狀態。

5.3.3.13 二氧化氮是與機場運作相關的主要空氣污染物。在三跑道系統情況下，於主要易受影響地方的累積年均二氧化氮影響，其空氣污染源頭的分布載於**表 5.1**。主要排放源來自周圍環境排放，在大部分情況下佔二氧化氮總濃度超過 60%，其後是鄰近基建排放（10 至 30%）及機場相關排放（<10%）（沙螺灣除外）。

表 5.1： 2031 年（三跑道系統）情況的二氧化氮年均排放源分布

地區	累積影響（微克／立方米）	周圍環境排放（微克／立方米）	鄰近基建排放（微克／立方米）	機場相關排放（微克／立方米）
東涌	33	22	9	2
東涌西	30	22	6	2
東涌東	28	22	4	2
沙螺灣	36	20	4	12
屯門[1]	38	27	9	2[1]

註：

[1] 屯門地區以 PATH 模型進行的分析將機場相關排放計入周圍環境排放。

5.3.3.14 基於上述評估，結論認為工程項目的營運將不會造成負面的剩餘空氣質素影響。

5.4 生命危害

5.4.1 簡介

5.4.1.1 發展三跑道系統將需要擴建現有航油加油栓系統及在現有航空燃油儲存庫安裝額外加油栓泵。由於三跑道系統的拓地工程，在建議拓地範圍下的現有海底航油管道將需要進行改道。

5.4.1.2 有關評估已根據環評研究概要進行，以評估因以下各項造成的風險：

- 在現有航油管道及貯存設施附近進行的建築工程；
- 新航油管道（海底及地下）及在機場擴建範圍新建停機位為飛機加油的新燃油加油栓系統運作；及
- 貯存危險品（即機場禁區車輛／地勤設備燃油）的新設施。

5.4.1.3 有關評估已識別與這些活動相關的危險情況，並進行定量風險評估，以按照一系列已識別危險情況，確定個人風險及社會風險水平。定量風險評估的主要工作包括危險識別、次數評估、後果模擬分析、風險總和及識別緩解措施。評估得出的風險水平已與《環境影響評估程序的技術備忘錄》附件 4 規定的生命危害評估準則進行比較。

5.4.1.4 危險識別涉及檢閱香港國際機場及世界各地機場以往發生的事故，以及採用「結構化假設」技巧進行危險識別工作坊，然後在次數評估中，進一步評估已識別的危險情況，採用故障樹分析及事故樹分析技巧，以分析危險的發生次數。更新的危險比率已輸入 RiskTool 模型，以評估整體的個人及社會風險。

5.4.1.5 進行後果分析，以確定飛機燃油及機場禁區車輛燃油（汽油及柴油）在各個已識別情況下的洩漏量，以及評估對員工與旅客造成的相應安全風險。在車輛燃油方面，採用 PHAST 軟件進行後果模擬分析，至於飛機燃油槽火，則採用 PoolFire6 軟件熱輻射模型進行後果模擬分析。

5.4.1.6 風險總和採用 RiskTool 程式，以得出個人及社會風險水平。在危險識別工作坊中確定安全措施，以及就在「合理而實際可行情況下可承擔的最低風險」範圍的風險水平進行成本效益分析。

5.4.2 潛在危險及風險

5.4.2.1 在施工及營運階段的工地以外個人風險低於每年 1×10^{-5}（即低於每年 10 萬分之一的死亡機會）的準則，因此符合《環境影響評估程序的技術備忘錄》附件 4 規定的《香港風險指引》。

5.4.2.2 就社會風險而言，施工階段風險主要來自在現有海底管道附近建造新海底管道，以及在現有地下管道附近興建連接一號客運大樓及中場範圍的機場禁區隧道而造成的潛在影響。經評估後，整體社會風險在可接受範圍內。

5.4.2.3 營運階段的整體社會風險主要來自與航油加油栓井閥門運作相關的風險，而經評估後，有關風險在「合理而實際可行情況下可承擔的最低風險」範圍內。不確定性分析已予進行，結果顯示，透過採用保守的假設／參數，已將不確定性減至最少，認為在營運階段評估的風險水平不會超出《香港風險指引》規定。

5.4.2.4 建議就三跑道計劃實行一系列緩解措施，以進一步減低風險水平。研究識別了有助減低風險水平的施工階段緩解措施，包括實行海上交通管理的防範措施；向建築工人發出清晰指示，避免接近現有加油栓網絡／管道位置，以及在投入運作前，測試及檢查管道是否無損等。營運階段的緩解措施包括進行改善審核工作，以加強現有的加油作業方法，並提升合規情況。

5.4.2.5 實行緩解措施後，風險被視為在「合理而實際可行情況下可承擔的最低風險」範圍內，且符合《香港風險指引》。

5.5 噪音影響

5.5.1 簡介

5.5.1.1 與工程項目施工及營運階段相關的潛在噪音影響，已按照環評研究概要第 3.4.5 節及附錄 C 第 I 節，以及《環境影響評估程序的技術備忘錄》附件 5 及 13 訂明的技術規定進行評估。

5.5.2 飛機噪音

5.5.2.1 飛機噪音評估根據環評研究概要訂明的規定編製，以及採用《環境影響評估程序的技術備忘錄》訂明的噪音準則（飛機噪音預測等量線 25 及 30）。有關評估涵蓋全港，尤其着重在航道下及接近航道，以及香港國際機場附近的地區。

5.5.2.2 飛機噪音評估根據國際民航組織及美國聯邦航空局訂立的指引進行。定量評估採用美國聯邦航空局的綜合噪音模型 7.0dsu1 版本（於 2013 年 5 月底推出，並於 2013 年 9 月更新）進行，有關結果按飛機噪音預測衡量標準，以飛機噪音預測等量線的形式呈列。噪音模擬分析採用來自國際航空運輸協會編製的航空交通量預測數據[9]，以及來自英國國家航空交通服務有限公司按照國際航空運輸協會的航空交通量預測進行的全空域及機場模型模擬數據，作為主要輸入數據。評估採用的假設、輸入數據、運作模式、噪音源清單及緩解措施已獲得民航處確認。

5.5.2.3 此外，研究亦根據 2011 年[10]香港國際機場的航空運作數據，編製了飛機噪音預測等量線圖，以描述現有飛機噪音環境，而有關航空運作數據是按民航處提供的運作紀錄及雷達數據計算得出。

5.5.2.4 除了現有噪音緩解措施外，民航處一直探討可行的短期措施，以進一步減低現有機場運作所造成的飛機噪音影響。自 2012 年 2 月起，民航處實施了一套飛行程序，從而讓可使用衛星導航技術飛行的飛機，在向機場東北方向起飛及轉入西博寮海峽時，更緊貼航道的中線飛行，與航道附近地區保持距離，從而減低飛機噪音對這些地區的影響。

5.5.2.5 此外，自 2002 年 7 月起，所有在香港起降的亞音速噴射機，必須符合《國際民航公約》附件 16 第三章第 II 部第 I 卷訂明的噪音標準（「第三章標準」）。為進一步改善本地噪音環境，以及紓緩飛機噪音對本地社區的影響，自 2014 年 3 月底起，民航處不准航空公司以僅僅符合第三章噪音標準噪音水平較高的飛機（根據民航處 2013 年 11 月 26 日之《航行情報資料通報》32/13），在 2300 至 0659 時段內操作。此外，待檢討此措施後，民航處可能考慮在現有雙跑道操作下，延長禁止時段至全日。

5.5.2.6 此外，機管局正進行詳細研究，制訂環境收費／獎勵計劃，以鼓勵航空公司採用較寧靜的飛機機種，並會在全面諮詢航空業界後推出有關計劃。香港國際機場亦會實施夜間航班需求管理，確保在雙跑道系統的餘下運作年期，噪音預測等量線不會伸延而至新的易受噪音影響地方。

5.5.2.7 在機場仍然以現有雙跑道系統運作下，北大嶼山沿岸的部分村落會受到飛機噪音影響，所以機管局會在第三條跑道投入運作前，為新增受影響村落的所有村屋，提供隔音窗及空調以消減飛機噪音對居民的影響。

[9]包括預測直至 2038 年的香港國際機場飛機起降量、每班航機的出發地及目的地、飛機類型及貨運或客運航班。

[10]以 2011 年數據作為現有噪音環境資料，是由於那是評估開展時的最近期全年數據，並被視為具代表性的現行飛機噪音環境數據。

5.5.2.8 根據環評研究概要，三跑道系統工程項目的運作評估情況包括：(1)最高飛機噪音水平的運作模式，指最高飛機噪音排放情況（在環評中確定為 2030 年）；(2)過渡階段運作模式，指關閉現有北跑道而擬建的第三條跑道與現有南跑道同時運作的階段（在環評中確定為 2021 年）；及(3)三跑道系統全面運作並達到設計容量（在環評中確定為 2032 年）。

5.5.2.9 有關評估已識別多項飛機噪音緩解措施，並將於三跑道系統按主要運作模式運作時實行，作為香港國際機場的標準運作程序。這些措施包括下列各項，並已顯示在**圖則 MCL/P132/ES/5-5-001**：

- 在可行情況下，安排現有南跑道於夜間 2300 至 0659 時段處於備用狀態；
- 規定飛機於夜間 2300 至 0659 時段，在可接受的操作及安全情況下，向東方起飛的航機採用經西博寮海峽的南行航線，有關安排符合現有的雙跑道系統夜間運作規定；
- 已設計一條新的進場航道 6，讓設有「所需導航性能」的飛機於夜間 2300 至 0659 時段優先採用西面方向（即跑道 25 方向）進場；於 2030 年，估計有高達 95%飛機可優先採用此新航道 6 抵港，取代目前直線進場航道；及
- 在風速及風力許可的情況下，實行優先跑道使用計劃。於夜間時段，在飛機起飛架次較多時採用西行航道，在飛機降落架次較多時則採用東行航道。

5.5.2.10 綜合噪音模型的模擬分析已考慮上述飛機噪音緩解措施，並預測未來三跑道系統的潛在飛機噪音影響。

5.5.2.11 就 2021 年的過渡階段運作情況而言，鄰近機場的沙螺灣及北大嶼山沿岸的部分村屋，仍會處於飛機噪音預測等量線 25 的範圍內。如上文第 5.5.2.7 段所述，在三跑道投入運作前，受影響村屋／持牌建築物會獲提供隔音窗及空調，作為間接噪音緩解措施。但於只有兩條跑道運作的過渡階段，上述部分措施如安排南跑道處於備用狀態將未能推行。然而，2021 年的飛機噪音預測等量線 25 不會伸延至東涌的任何現有或已規劃的易受噪音影響地方。

5.5.2.12 就 2030 年及 2032 年的情況而言，由於沙螺灣及北大嶼山沿岸部分村落鄰近機場島，飛機噪音預測等量線 25 仍會稍為覆蓋這些地區。然而，隨着三跑道系統全面投入運作，以及於夜間時段安排南跑道處於備用狀態，影響會大幅減低。2030 年的飛機噪音預測等量線已顯示於**圖則 MCL/P132/ES/5-5-002**。

5.5.2.13 除**第 5.5.2.9 段**所述的措施外，建議在制訂樂安排綜合發展區的總綱發展藍圖時，應確保在飛機噪音預測等量線 25 範圍內，不會設置易受噪音影響的土地用途。另一方面，如上所述在第三條跑道投入運作後（包括在 2021 年、2030 年及 2032 年等運作情況下），沙螺灣及北大嶼山沿岸部分村落的一些村屋將仍處於飛機噪音預測等量線 25 的範圍內。但該等村屋已如上文**第 5.5.2.7 段**所述提供隔音窗及空調以消減飛機噪音對居民的影響，因此，工程項目運作不會造成負面剩餘飛機噪音影響。將來的村屋須根據現行的政府政策及指引作計劃。

5.5.3 固定噪音源

5.5.3.1 在營運階段的潛在固定噪音源包括飛機在地面運作（即飛機滑行、運作及維修測試輔助動力裝置及引擎）、旅客捷運系統、行李處理系統及通風系統／通風井。就固定噪音源已進行個別及累積評估，亦已識別同期進行的其他項目，並按情況納入累積影響評估，同時亦已就固定噪音影響評估識別具代表性的易受噪音影響地方。

5.5.3.2 擬建的旅客捷運系統與最近的易受噪音影響地方之間的水平距離最少達 200 米，而行李處理系統及建議興建的廢水回收處理廠等其他地底設施會全面圍封，因此預計擬建的旅客捷運系統或其他地底設施不會造成顯著及負面的噪音影響。

5.5.3.3 根據環評研究概要，已評估的機場運作模式包括最高飛機噪音水平的運作模式（因工程項目運作而產生最高飛機噪音排放）、過渡階段模式，以及達到設計容量的全面運作模式。

5.5.3.4 在最高飛機噪音水平的運作模式、過渡階段運作模式及全面運作模式情況下，與飛機滑行相關的預測噪音水平在所有具代表性的易受噪音影響地方，均符合相關日間／傍晚及夜間噪音準則。在所有三個情況下，亦預計輔助動力裝置運作的噪音水平在所有具代表性的易受噪音影響地方，均符合相關日間／傍晚及夜間噪音準則。

5.5.3.5 建議使用隔音罩作為噪音緩解措施，以減輕來自飛機引擎起動測試設施的噪音影響。透過實行這項建議的緩解措施，預期所有易受噪音影響地方的整體噪音水平將符合相關日間／傍晚及夜間噪音準則。因此，預計固定噪音源不會對現有及已規劃易受噪音影響地方造成負面的剩餘噪音影響。

5.5.4 建築噪音

5.5.4.1 潛在建築噪音影響的定量評估已根據環評研究概要的要求進行。在施工階段的主要潛在噪音源包括拓地工程、在新開拓土地及現有機場島的建築工程，水泥廠、瀝青廠、工地運輸通道、躉船碇泊處及石料加工廠，以及海底航油管道及 11 千伏海底電纜改道工程，此外亦已識別同期進行的其他項目，並納入累積影響評估中。

5.5.4.2 有關評估根據標準聲學原理及環保署的《管制建築工程噪音（撞擊式打樁除外）技術備忘錄》指引進行。按照初步的建築計劃及預計採用的機動設備，對具代表性易受噪音影響地方的潛在建築噪音影響進行了評估。

5.5.4.3 興建旅客捷運系統、行李處理系統及海底航油管道可能會產生經地層傳導的噪音影響。當中，旅客捷運系統及行李處理系統將以明挖回填法興建，而非鑽爆或鑽挖法，而地下建築工程亦不涉及岩石穿破或開挖隧道工程，因此預計不會造成經地層傳導的噪音影響。預期涉及海底航油管道改道的工程與最接近的易受噪音影響地方距離最少 1.8 公里，有關地方將不會受定向鑽挖產生的振動影響。因此，預計在施工階段不會產生經地層傳導的噪音影響。

5.5.4.4 採用靜音機器及可移動隔音屏障及隔音罩等緩解措施，預計在所有易受噪音影響地方的建築噪音水平，將會符合《環境影響評估程序的技術備忘錄》訂明的噪音標準。因此，預計工程項目不會有負面的剩餘建築噪音影響。

5.5.5 道路交通噪音

5.5.5.1 環評研究概要規定，道路交通噪音影響的評估範圍包括工程項目界線起計 300 米範圍內的區域。由於最接近的已識別易受噪音影響地方，均位於擬建三跑道系統項目的道路走線的 300 米評估範圍以外，因此，不會對易受噪音影響的地方造成負面道路交通噪音影響。

5.5.6 海上交通噪音

5.5.6.1 根據《英國標準 4142:1997 影響住宅及工業混合發展區的工業噪音評估方法》指引及《機場 2030 規劃大綱工程可行性及環境研究－海上交通影響評估》的資料，海上交通影響評估範圍已確定為距離船隻活動範圍 1,350 米以內。由於在 1,350 米評估範圍內並無識別任何易受噪音影響地方，而具代表性的易受噪音影響地方均距離與機場活動有關的海上船隻活動路線超過 1,700 米，因此預計在營運期間，與機場活動相關的船隻不會造成負面海上交通噪音影響。

5.6 水質

5.6.1 簡介

5.6.1.1 根據環評研究概要，水質影響評估的研究範圍涵蓋西北部水質管制區、西北部附水質管制區、后海灣水質管制區及西部緩衝區水質管制區，並已識別可能受工程項目影響的冷卻海水進水口、水務署沖廁水進水口、避風塘、泳灘、珊瑚群落、漁業易受影響的地方等易受水污染影響地方以及生態易受影響的地方。

5.6.1.2 評估水質影響的準則是依照《環境影響評估程序的技術備忘錄》和西北部水質管制區、西北部附水質管制區、后海灣水質管制區及西部緩衝區水質管制區的水質指標，同時亦按情況採用其他本地及國際相關準則[11]。

5.6.1.3 採用認可的三維水動力模型－西部海港模型（來自 2000 - 2001 年 Deltares 的模型更新版）為施工及營運階段進行了定量分析。這個模型涵蓋工程項目的研究範圍及珠江口與擔杆海峽，並因應工程項目的部分特定情況作修訂。有關評估已識別在施工及營運階段同期進行的其他項目，並按情況將其納入累積影響評估。

5.6.2 施工階段

5.6.2.1 在施工階段對水質造成影響的主要潛在源頭包括拓地工程、改動現有北面海堤、海底航油管道及 11 千伏海底電纜改道、建造新雨水渠排水口及改建現有排水口、建造新跑道進場燈及香港國際機場進口航道區指點標的打樁活動、建築工地徑流及排水、建築工人及一般施工活動產生的污水。值得注意的是，以免挖方法拓地，以及採用定向鑽挖法建造海底航油管道，可避免對海床造成干擾，從而大幅減少建議工程在施工階段的潛在水質影響。此外，採取深層水泥拌合法於污泥坑進行地質改良工程，可避免在拓地時挖走污染沉積物，更符合環保原則。

5.6.2.2 就海事建築工程相關的潛在水質影響已進行定量評估，當中包括拓地工程高峰期及懸浮固體排放量最高時期。在施工期間，其他可能影響水質的工程主要在陸上進行，並已進行定性評估。

5.6.2.3 評估資料顯示，在進行海上填料活動前，透過施工設計完成至少 200 米長的前緣的部分海堤，以及在適用情況下設置雙層淤泥屏障及隔泥網的緩解措施，工程項目施工將不會引致在易受水污染影響地方超出懸浮固體水深平均含量準則。但是在評估同期進行的其他工程項目的累積影響後，預計在部分易受水污染影響地方的懸浮固體濃度會超標。然而，有關結果顯示，該累積超標主要由於對同期進行的其他項目就懸浮固體排放的保守假設，而非由三跑道系統工程所致。該保守假設是基於相關工程項目可容許的最高懸浮固體排放量，但根據所得資料顯示，過往實際的排放量遠低於可容許的最高排放量。因此，預計工程項目不會產生負面的剩餘水質影響。

5.6.2.4 此外，根據定量評估結果，預計 11 千伏海底電纜改道、以深層水泥拌合法進行地質改良工程，以及拓地的加載工程不會對水質造成不可接受的影響。

5.6.2.5 其他建築工程包括海底航油管道改道、建造雨水渠排水口、新跑道進場燈及香港國際機場進口航道區指點標的打樁活動等，將實行良好工地措施及建議的緩解措施，以將潛在水質影響減至最少。因此預計這些建築工程、一般工地排水及建築工人產生的污水不會對水質造成顯著影響。

[11]採用的其他相關標準包括水務署的沖廁水水質準則；珊瑚的沉積物沉降及懸浮固體準則；環保署一項生態毒理學研究的無可見效應濃度；英國貝介類水域指令；歐盟的環境質素標準指令；以及美國環境保護局國家建議水質準則：最高濃度基準及連續濃度基準。

5.6.2.6 根據上述評估結果，預計在工程項目施工階段不會出現負面的剩餘水質影響。

5.6.3 營運階段

5.6.3.1 在營運階段對水質造成影響的主要潛在源頭，包括開拓新土地後引起的水動力變化；機場西端形成內灣水域、污水排放、再用經處理的廢水、已使用的冷卻水排放、雨水排放、燃料意外溢漏，以及可能在機場北面通航水域進行維護性疏浚。值得注意的是，在機場布局的早期研究中，已考慮工程項目實際土地範圍可能對水動力造成的影響。這些早期研究成為目前拓地範圍的基礎，從而將與工程項目相關的水動力及水質變化減至最低。

5.6.3.2 就有三跑道系統運作及沒有三跑道系統運作的情況下，進行潛在影響的定量評估。當中考慮到研究範圍內其他已規劃及既定的同期進行項目，並採納 2026 年為預測最高污染量的評估年度。

5.6.3.3 有關結果顯示，雖然預測在部分易受水污染影響地方的懸浮固體、總無機氮及非離子氨會有輕微超標，但已識別所有超標情況均不是由工程項目所致。因此，工程項目不會在研究範圍帶來負面的水動力及水質變化。

5.6.3.4 就其他營運階段工程而言，已建議適當的設計及防範措施，以確保污水排放、再用經處理的廢水及燃料意外溢漏不會對水質造成負面影響。此外，評估結果亦顯示，工程項目不會導致機場北面通航水域出現顯著的沉積情況，因此，無須因實行工程項目而進行維護性疏浚。

5.7 污水收集及處理

5.7.1 簡介

5.7.1.1 根據環評研究概要第 3.4.7 節及附錄 D2 規定的要求，已就工程項目對公共污水收集系統、污水處理及處置設施的影響進行評估。

5.7.1.2 根據三跑道系統投入運作 15 年後（即 2038 年）的飛機起降量、客運量及貨運量的預測，工程項目會產生總污水量每天 43,500 立方米。按照這個基準，工程項目對北大嶼山現有／已規劃的污水收集系統（包括東涌污水泵房及小濠灣污水處理廠的污水集水區）造成的影響已進行評估。

5.7.2 潛在影響

5.7.2.1 三跑道系統的污水收集系統會根據渠務署發布的所有相關標準及指引設計、操作及維修。除現有的污水氣味管理措施外，機管局會為三跑道系統的污水收集系統增設硫化氫監測及其他措施，以更有效避免污水發出氣味。在落實上述措施後，預計新的污水收集系統不會造成由污水氣味帶來的負面影響。

5.7.2.2 根據水力評估結果，從機場排水井至東涌污水泵房的現有引力污水渠處理容量，將於 2027 年年底前達到飽和。因此，機管局建議在現有引力污水渠（直徑 1,050 毫米）附近興建一條直徑 1,200 毫米的新引力污水渠，將機場及東涌其他副集水區產生的污水量改引到新引力污水渠。機管局會考慮研究保留建議廢棄的污水渠（即現有直徑 1,050 毫米的引力污水渠），作為設有溢流系統的緊急後備污水渠的可行性，但須取決於日後新建引力污水渠的設計。這項污水渠改善工程將會為污水渠提供充足設計容量，從而將工程項目產生的污水輸送至東涌污水泵房。污水渠改善工程將於 2026 年年底前完成（在處理容量達到飽和前可有約一年的緩衝期），而規劃工作於 2022 年展開（假設規劃需時一年，設計及建造需時三年）。

5.7.2.3 機管局會對受影響的引力污水渠進行緩解工程，並於 2026 年年底前完成。由於當項目投入運作後將會開始排放額外污水，而污水增加的速度可能會較預測快，因此，建議機管局為工程項目進行環境監察及審核，以監察污水量增長情況，並於 2022 年或在受影響引力污水渠的污水流量超出污水渠設計容量的 80%時（以兩者較早發生者為準），開始規劃改善工程，以確保在污水量超出污水渠設計處理容量前，適時完成緩解工程。

5.7.2.4 根據評估結果，來自機場及相關規劃數據區的總最高污水量將於 2023 年，超出東涌污水泵房現有設計最高流量處理能力，但須視乎東涌新市鎮擴展範圍的未來發展而定。協議編號 CE6/2012 的政府工程現正進行，以勘測研究、設計及建造東涌污水泵房至小濠灣污水處理廠的額外污水泵喉，以提高污水收集系統運作的可靠性。這個項目計劃於 2015 年動工，並於 2022 年年底完成。根據渠務署在協議編號 CE6/2012 下的最新污水收集系統影響評估報告，將會採用直徑為 1,200 毫米的雙管道污水泵喉，以輸送來自東涌及機場的預計污水流量到小濠灣污水處理廠，這污水泵喉足以處理估計達每秒 3,648 公升的最高設計污水流量[12]。

5.7.2.5 基於評估結果，現有小濠灣污水處理廠的設計容量，足以應付工程項目及相關規劃數據區在 2038 年出現污水量情況下產生的估計平均旱季流量總和。但是，估計於 2026 年後，小濠灣污水處理廠的處理量將會超出其設計最高流量。現已知悉相關政府部門將會提升小濠灣污水處理廠的處理能

[12]環保署已同意在東涌污水泵房保留每天 43,500 立方米的流量（平均旱季流量），以處理經擴建機場排出的總污水量；而機管局將會與環保署及渠務署緊密聯繫，以確保工程項目與東涌污水泵房的改善工程在時間上能夠有效 配合。

力，以應付來自相關污水集水區（包括擴建後的機場及東涌新市鎮擴展範圍）未來發展項目的污水處理需求。現已知悉環保署將會監察污水量的增長情況，並在必要時適當協調小濠灣污水處理廠所需改善工程。

5.7.2.6 在引力污水渠、東涌污水泵房及小濠灣污水處理廠進行改善工程後，無須為工程項目設立任何中央預先處理設施或獨立污水處理廠。如果引力污水渠、東涌污水泵房及小濠灣污水處理廠的改善工程分別於 2026 年、2022 年年底及 2026 年完成，則無須為工程項目提供任何臨時污水處理設施。

5.8 廢物管理

5.8.1 簡介

5.8.1.1 評估已識別在工程項目的施工及營運階段產生的廢物種類，並已按照環評研究概要第 3.4.8 節及《環境影響評估程序的技術備忘錄》附件 7 及附件 15 分別概述的準則及指引，衡量這些廢物可能對環境帶來的影響。

5.8.2 施工階段

5.8.2.1 工程項目的發展取向，是以不同設計方案及／或施工方法避免或減少產生廢物。建議以免挖方法進行地質改良，以完全避免大量挖走及處置任何疏浚物料。建議的斜面海堤方案可重用現有北面海堤的護面岩石。建議以定向鑽挖法進行海底航油管道改道，可避免挖掘海床，從而避免挖走及處置任何疏浚物料及減低對海洋環境造成的相關影響。同樣，建議以水力噴注方法進行 11 千伏海底電纜改道工程，以免產生及處置海泥。

5.8.2.2 施工活動產生的主要廢物種類，包括在現有機場島／建議拓地範圍進行挖掘工程、拆卸工程、海堤改造、打樁工作及上層建築物的建築工程，以及以定向鑽挖法為現有海底管道改道過程中產生的惰性拆建物料；高爾夫球場範圍場地清理、二號客運大樓擴建工程及各種上層建築物的建築工程產生的非惰性拆建物料；安裝電纜接口範圍的挖掘工作產生的海泥；建造各種隧道、設施及建築物的地基／打樁／建造地下室／挖掘工程產生的污泥坑及海泥；施工機械及設備的保養及檢修產生的化學廢物；建築工人產生的一般垃圾；以及在新建海堤積聚的漂流垃圾。

5.8.2.3 為了將挖掘範圍減至最少，並最大限度地重用工地範圍產生的惰性拆建物料，各種設施、建築物及隧道工程的挖掘工作及施工計劃已經過審慎規劃及制定。方案設計估算在 2015 年至 2022 年所產生的惰性拆建物料總量約為 9,543,500 立方米，大多數物料來自旅客捷運系統及行李處理系統隧道、新旅客捷運系統車廠及機場禁區隧道的挖掘工程，以及第三條跑道客運廊及其他設施的打樁工程。在惰性拆建物料總量中估計約有 3,639,230 立方米（即約 38%）可在工地範圍重用作為建議拓地工程的填料。其餘 5,904,270 立方米（即約 62%）的惰性拆建物料，大部分於填土工程完成後產生，所以須運往工地以外任何已識別需要填料的項目使用及／或政府的公眾填料接收設施，讓香港任何其他項目善用。即使在工地範圍最大限度地重用惰性拆建物料，估計工程項目亦須在 2016 年至 2018 年期間就填土工程輸入約 10,911,770 立方米的公眾填料。

5.8.2.4 根據方案設計資料，估計在 2016 年至 2021 年期間將產生約 96,200 立方米的非惰性拆建物料。承辦商會在工地範圍分開非惰性拆建物料及惰性拆建物料。可循環再用材料（例如金屬）將由信譽良好的持牌回收商從非惰性拆建物料中分揀收集，其餘不可循環再用的廢物，將由信譽良好的持牌廢物回收商在指定的垃圾堆填區處置。

5.8.2.5 估計從 2015 年至 2022 年各種建造工程將產生合共約 777,860 立方米海泥。其中大部分海泥，即約 767,660 立方米（約 98.7%）將來自隧道、建築物、進場燈及香港國際機場進口航道區新指點標的地基／打樁工程，以及新旅客捷運系統車廠的挖掘工程。這些海泥將在工地範圍處理及重用作為回填物料，以避免須於工地範圍以外處置。其餘小部分海泥，即約 10,200 立方米（約 1.3%），估計來自在 2015/16 年安裝電纜接口的前期挖掘工程。由於這些沉積物不符合總體施工計劃而無法在工地範圍處理及重用作回填物料（即估計這些沉積物會在建議拓地工程大部分填土工作預定動工前超過一年產生），這類材料須在公海處置（適用於 L 類沉積物）或在公海的指定地點處置（適用於 M_p 類沉積物）。

5.8.2.6 建築工人每天產生的一般廢物量估計最多約為 9,100 公斤。將制定建築廢物管理計劃，以優先提供及安排廢料再造設施，將送往堆填區的建築廢物減至最少。不可循環再用的廢物，將在指定堆填區處置。透過適當設計人工海堤，可避免廢物積聚或將廢物積聚減至最少，估計在施工的每一年從新建海堤收集約 65 立方米的漂流垃圾。漂流垃圾將適當地分類並回收利用，或在指定的垃圾堆填區處置。估計施工會產生少量化學廢物，而這些化學廢物將根據《廢物處置（化學廢物）（一般）規例》適當處理、貯存、標識及處置。

5.8.2.7 若所有已識別的廢料均嚴格根據相關法例及建議規定處理、運送及重用／處置，並適當地實行建議的良好工地措施及緩解措施，預計在施工階段將不會對環境帶來不可接受的影響。

表 5.2： 施工階段產生廢物的概述

廢物類別	估計產生的廢物總量
惰性拆建物料	約 3,639,230 立方米會在工地範圍重用作填料
	約 5,904,270 立方米會被運往工地以外
非惰性拆建物料	約 96,200 立方米在工地分揀出可循環再用物料後運往堆填區處置
被挖出海泥	約 10,200 立方米須在公海處置（適用於 L 類沉積物）或在公海的指定地點處置（適用於 Mp 類沉積物）
	約 767,660 立方米海泥將在工地範圍處理及重用作為回填物料
化學廢物	估計少量
一般廢物	每天最多約 9,100 公斤
漂流垃圾	從新建海堤每年收集約 65 立方米

5.8.3 營運階段

5.8.3.1 營運階段產生的主要廢物種類，包括來自機場客運廊、飛機機艙、客運大樓、辦公室、商業機構（例如餐廳、零售商店）及各種機場基建設施在營運中產生的一般垃圾，以及保養、檢修及維修各種機電設備產生的化學廢物。如上文所述，預期人工海堤亦會積聚漂流垃圾。在建議的新廢水處理廠建成後，這座處理廠亦會根據相關指引及規例處置所產生的污泥。

5.8.3.2 根據客運量在 2038 年（2023 年三跑道系統投入運作 15 年後）的預測，估計工程項目每年將產生一般垃圾約 46,190 公噸。目前機場會從一般垃圾中分揀可循環再造廢料（如硬紙板、紙張、金屬、塑料、玻璃瓶、廚餘等）循環再造，擴建後的機場亦會採取相同措施，而不可循環再造的廢物將在指定垃圾堆填區處置。

5.8.3.3 已適當設計新建人工海堤，務求海岸線不會形成任何急彎或突然凹陷，從而避免垃圾積聚或將垃圾積聚減至最少。基於海堤經過適當的設計，估計每年從新建人工海堤收集到的漂流垃圾約為 65 立方米，漂流垃圾將按適當情況分類及回收再造，或在指定的垃圾堆填區處置。

5.8.3.4 由於工程項目營運階段產生的化學廢物數量，取決於設備保養規定及所使用的設備數量，因此在現階段難以量化將會產生的化學廢物數量。根據機場的現行規定，所有化學廢物須依照《廢物處置（化學廢物）（一般）規例》適當處理、貯存、標識及處置。

5.8.3.5 根據現有廢水處理廠的運作記錄，估計擬建的新廢水處理廠每天將產生約 0.23 公噸脫水污泥，而這些脫水污泥將貯存於密閉容器或吊斗中，然後由信譽良好的持牌廢物回收商運往指定的垃圾堆填區處置。污泥將會妥善處理及管理以將氣味引起的負面影響，以及因吸引蟲害及其他致病媒而對操作人員帶來的潛在健康風險減至最少。

5.8.3.6 若所有已識別的廢料均嚴格根據相關法例規定處理、運送及處置，並適當地實施建議的緩解措施的情況下，預計在營運階段將不會對環境帶來不可接受的影響。

5.9 土地污染

5.9.1 簡介

5.9.1.1 就工程項目相關的潛在土地污染事宜，已根據環評研究概要第 3.4.9 節所指按照《環境影響評估程序的技術備忘錄》附件 19 第 3.1 及 3.2 段的指引進行評估，並已按照環評研究概要附錄 E2 所載的要求，編製工程項目的污染評估計劃，該計劃於 2014 年 2 月獲環保署批准。

5.9.1.2 為了確定工程項目範圍內或附近範圍過去及現時的土地用途，包括可能受污染土地用途，故此進行了文獻研究及實地勘測，亦已向相關政府部門索取其他相關資料。

5.9.2 潛在影響

5.9.2.1 根據在土地污染評估範圍實地評核現時及過去土地用途的結果，評估範圍不屬於環保署《受污染土地勘察及整治實踐指南》（2011 年）表 2.3 列出的潛在污染土地用途類別，但高爾夫球場、地下及地面燃料貯存庫、緊急發電裝置、燃料貯存室及機場禁區加油站則除外。

5.9.2.2 根據從環保署取得的資料，在所有評估範圍內均沒有任何化學廢物溢漏或洩漏的紀錄。根據消防處提供的資料，在評估範圍內並無發生危險品溢漏或洩漏事故的記錄。實地勘測調查亦沒有發現評估範圍內存在任何潛在土地污染源或污染迹象，惟高爾夫球場、地下及地面燃料貯存庫、緊急發電裝置、燃料貯存室及機場禁區加油站除外。

5.9.2.3 根據高爾夫球場的環境許可證規定，高爾夫球場及草皮不得使用人造化肥及農藥。雖然高爾夫球場保養設施內沒有發現土地污染迹象，但相關保養活動一直進行，故此在高爾夫球場交還給機管局時可能發現土地受污染。高爾夫球場環境許可證規定，Airport Management Services Limited（AMSL）須在運作後進行土壤取樣及測試工作，以識別任何土地污染問題，並在必要時淨化土地。AMSL 在高爾夫球場營運期限屆滿後，屆時將按需要進行所有必要的測試及改善工作。因此，預計待高爾夫球場交還予機管局時，將不會存在任何土地污染問題，或者已圓滿處理任何土地污染問題，故此，預期將不會因土地污染而帶來不可接受的影響。

5.9.2.4 至於在二號客運大樓擴建範圍，在二號客運大樓北面及南面現有兩個地下燃料貯存庫、兩個地面燃料貯存庫，以及兩個緊急發電裝置。此外，擴建二號客運大樓時將會拆卸額外兩個地面燃料貯存庫，而在機場禁區則須搬遷一個加油站及一個燃料貯存室。建議在這些範圍開始施工前，應制定及實施取樣及測試計劃，包括取樣地點的數量與取樣點深度。

5.9.2.5 鑑於目前無法進入部分評估範圍進行實地勘測，因此根據相關圖則，建議日後就可能受污染範圍進行實地調查。待可進入這些範圍後，將作進一步實地勘測，以識別有沒有須關注的土地污染事宜。在這些範圍開始任何實地調查工作及在施工前，如需要可根據進一步實地調查結果，就進行額外的實地調查工作編製一份補充污染評估計劃，並提交予環保署批准。不過，預期在這些範圍與可能溢漏或洩漏燃料相關的任何潛在土地污染事宜，將不會造成任何不可解決的影響。

5.9.2.6 完成實地調查後，並在建議建築工程於高爾夫球場、地下及地面燃料貯存庫、緊急發電裝置、機場禁區加油站及燃料貯存室開始前，將會編製一份污染評估報告，並將有關報告提交予環保署批准。如須進行改善，則會在開始進行建議的改善計劃及任何建築工程之前，編製改善行動計劃及改善報告並取得環保署批准，因此，預期不會因土地污染而帶來不可接受的影響。

5.9.2.7 建議在環評中為處理、運送及棄置受污染物料（如有）制定緩解措施，並定期進行實地審核，以將可能對工作人員造成的健康及安全負面影響減至最少。

5.10 陸地生態

5.10.1 簡介

5.10.1.1 工程項目在施工及營運期間對陸地生態造成的潛在影響，已根據環評研究概要第 3.4.10 節及附錄 F 列明的相關規定，以及《環境影響評估程序的技術備忘錄》附件 8 及附件 16 中所指的相關準則及指引進行評估。陸地生態的研究範圍涵蓋機場島、北大嶼山與沙洲之間的範圍。

5.10.1.2 已進行文獻研究，以識別研究範圍內生態易受影響的陸地生境，並在完成陸地實地調查後更新文獻研究紀錄，以補充數據不足，並提供最新資料。在研究範圍或可能受工程項目影響的範圍內，主要生態易受影響的陸地生境，包括大蠔河具特殊科學價值地點、磡頭灘具特殊科學價值地點、龍鼓洲、白洲及沙洲具特殊科學價值地點。

5.10.1.3 於 2012 年 9 月至 2013 年 9 月為這次環評研究進行陸地實地調查，包括對位於研究範圍內但工地範圍外的生境，進行生境地圖製作、植物調查，以及其他相關的陸地與水生動物調查（例如大型無脊椎動物、兩棲及爬行動物及水生動物調查）。鑑於缺乏拓地範圍及近海地區鳥類飛行活動資料，特別為研究鳥類活動而進行了為期 12 個月的鳥類實地調查，包括船上樣條線及陸上調查。船上樣條線調查在北大嶼山水域進行，調查鳥類使用該範圍的情況。陸上調查在機場島的三個調查站及沙洲一個調查站進行，另外，還在沙洲鷺鳥林進行額外鷺鳥林調查。

5.10.2 實地調查結果

5.10.2.1 實地調查結果及文獻研究補充資料顯示，在北大嶼山開放水域記錄到的主要鳥群是鷺鳥。鷺鳥群包括小白鷺、大白鷺、岩鷺及夜鷺。調查顯示這些物種廣泛分布於研究範圍，大多數棲息於北大嶼山、沙洲及龍鼓洲海岸公園的沿岸生境及龍鼓水道沿線。在沙洲發現鷺鳥林（即鷺鳥的繁殖地），這些鷺鳥也常見於北大嶼山的人工海岸線，包括機場工地及海上建築工地。雖然調查結果錄得這種鳥群於整個北大嶼山水域廣泛分布，但是較少在建議拓地範圍內記錄到，因此，建議拓地範圍對這種鳥群而言並非十分重要。

5.10.2.2 實地調查結果錄得海鳥主要分布於空曠範圍，而於沿岸地區則較少見。在香港出現的海鳥數量與季節有很大關係。在四個季節對海鳥進行的分析顯示，冬季的海鳥數量相對最多，這是由於海鷗（例如紅嘴鷗及休氏銀鷗）度冬，而於其他季節海鳥數量則較少。度冬海鷗大部分分布於龍鼓水道一帶，以及沙洲及龍鼓洲海岸公園。調查錄得這些物種較少在沿海水域棲息，亦通常不會在建議拓地範圍出現。調查結果顯示，建議拓地範圍並非海鳥及陸鳥的重要生境。黑鳶主要在海上活動，因其普遍存在的習性而廣泛分布於北大嶼山水域，因此建議拓地範圍對這些物種而言並非十分重要。

5.10.2.3 根據所收集的資料，所有已識別的鳥種在機場島附近的飛行活動並不明顯。研究範圍內的主要雀鳥飛行活動則與鷺鳥往返覓食地有關。

5.10.3 潛在影響

5.10.3.1 評估潛在陸地生態影響以文獻研究及實地調查結果為依據。評估結果認為，由於建議拓地工程而損失現有機場島北面 650 公頃的開放水域，不會對陸地生境造成任何直接損失。因拓地工程而損失的現有機場島北海岸沿線 5.9 公里的人工海堤，將在完成興建新人工海堤後重置，新海堤總長 13 公里。

5.10.3.2 由於在建議拓地範圍棲息的鳥類數量較少，且甚少鳥類以此作為覓食地，因此在施工及營運階段，在這個範圍內損失覓食地所造成的影響較小。基於在建議拓地範圍附近沒有重要的鳥類生境或遷徙

通道，預期對鳥類飛行活動造成的潛在滋擾屬微不足道。鑑於北大嶼山生態易受影響的地方與工程項目範圍的距離較遠，預計建議工程項目的施工及運作不會對北大嶼山的生態資源造成顯著影響。

5.10.3.3 評估認為，整體而言，在工程項目的施工及營運階段，對北大嶼山（包括機場島）的陸地生境、植物及動物物種造成的影響，屬於低或微不足道，但在施工階段則對沙洲鷺鳥林造成潛在影響。由於須進行海底航油管道改道工程，在上沙洲須建造管道鑽孔出土位置，有關工程可能對沙洲鷺鳥林造成中等程度的影響，因此必須制定保護鷺鳥林的緩解措施。

5.10.3.4 建議的緩解措施，包括將定向鑽挖法的管道鑽孔出土位置及平面躉船（如需要）設於遠離沙洲鷺鳥林的地方；保護鷺鳥為繁殖而築巢的植物；以及避免於夜間及鷺鳥繁殖季節（即 4 月至 7 月）在上沙洲施工。

5.10.3.5 由於鷺鳥林的界線可能隨着時間改變，建議在定向鑽挖活動開始前進行施工前調查，從而更新最新的鷺鳥林範圍。實施建議緩解措施後，對陸地生態造成的潛在影響將被降至低，因此，預計在施工及營運階段不會造成負面的剩餘影響。

5.11 海洋生態

5.11.1 簡介

5.11.1.1 工程項目的施工及營運對海洋生態造成的潛在影響，已依照環評研究概要第 3.4.10 節及附錄 F 所指的相關要求，以及《環境影響評估程序的技術備忘錄》附件 8 與附件 16 所指的相關準則及指引進行評估。海洋生態影響評估的研究範圍與水質影響評估的研究範圍相同，包括西北部水質管制區、西北部附水質管制區、后海灣水質管制區及西部緩衝區水質管制區，當中包括中華白海豚的主要棲息地。

5.11.1.2 中華白海豚棲息於香港西部水域，近年來數量正減少。調查資料主要來自漁農自然護理署過往長達 20 多年時間，對小型鯨豚類進行長期監測計劃所收集的數據，當中並不包括香港國際機場進口航道區 （即海事禁區範圍）的調查資料。為補充工程項目的詳細基線資料，環評研究開展為期 12 至 14 個月的中華白海豚重點調查，調查範圍包括建議拓地範圍，特別是現有香港國際機場進口航道區。對中華白海豚進行的調查，包括船上樣條線調查、陸上經緯儀追蹤調查，及以靜態聲音監測形式的水底聲音調查評估。

5.11.1.3 除了中華白海豚的調查外，亦進行全面的基線生態文獻研究以識別資料不足之處。針對建議拓地範圍，特別是現有香港國際機場進口航道區內建議拓地範圍進行海洋生態調查，包括潮間、亞潮帶軟底及硬底生境，以及海洋水域；此外，在北大嶼山海岸（從欣澳以東至大澳以西）、沙洲及龍鼓洲海岸公園，以及大小磨刀洲進行最新的核實調查。在適當情況下，與拓地範圍內的生境有相似生態特徵的參考地點亦會進行調查，以便作生態評估。

5.11.2 實地調查結果

5.11.2.1 透過綜合現存的研究資料，以及目前在拓地範圍及現時香港國際機場進口航道區進行的實地調查所獲得的關鍵數據，得以全面評估建議施工範圍對中華白海豚的重要性。雖然在兩個調查範圍（機場北面及機場西面）內的中華白海豚數量屬中等偏低，但在這些範圍內海豚的密度（基於 12 至 14 個月所獲得的資料），與過往已知的中華白海豚重要棲息地（例如大小磨刀洲範圍及西南大嶼山）的密度相若。儘管與最重要的中華白海豚棲息地（西北大嶼山及西大嶼山）作比較，機場北面及機場西面的中華白海豚密度較低，但在香港水域的中華白海豚數量正減少的情況下，東北大嶼山（覆蓋建議拓地範圍）及西南大嶼山範圍仍被視為重要棲息地。在 2012 年 12 月至 2013 年 12 月進行的靜態聲音監測調查的資料顯示，中華白海豚夜間在機場北面的活動較日間多，然而，未有資料可將這觀察結果與中華白海豚在其他棲息地的夜間活動作比較。

5.11.2.2 於機場北面及機場西面的調查範圍內，一些中華白海豚進行各種活動，這範圍屬於牠們的一般棲息地及更廣泛活動範圍的其中一部分。雖然這些範圍似乎並非中華白海豚的主要覓食區，但收集的數據顯示，這些範圍是牠們往返大小磨刀洲東面及深水角覓食區，以及沙洲及龍鼓洲海岸公園西面及西大嶼山覓食區的主要來回游弋範圍。在過去香港對中華白海豚的研究中，這些重點調查區域並未發現有明顯的價值，但近年來生境的轉變（如機場北面海天客運碼頭啟用及隨之而產生的船舶交通、現有機場島東北面的港珠澳大橋香港口岸及機場西面與南面的港珠澳大橋香港接線正在進行大量工程），有機會導致中華白海豚可用空間的使用方式發生變化，因此在研究期間中華白海豚使用這些研究範圍的情況可能較過往為多。

5.11.2.3 根據文獻研究資料與實地調查數據，評估建議拓地範圍內潮間帶、潮下軟底與硬底以及海洋水域生境的生態價值。現有機場島的人工海堤沿線調查顯示，物種的多樣性與均勻度屬低中水平，而且未錄得具存護重要性的潮間帶物種。拓地範圍內的潮下軟底生境錄得多毛目環節動物物種最豐富，數量最多。就潮下硬底生境而言，在建議拓地範圍赤鱲角北面的現有人工海堤沿線錄得獨立柳珊瑚群

落 (Gorgonian *Guaiagorgia* sp.)，該珊瑚群覆蓋率低，常見於香港水域西部。沿着現有機場島東北面拓地範圍外的海堤，錄得覆蓋率較低的杯狀珊瑚 (*Balanophyllia* sp.) 。在拓地範圍內的開放水域錄得六種具存護重要性的海洋魚類，除了無斑鷂鱝（只有在範圍內進行拖網調查時錄得相對較低密度），其他魚類均曾在拓地範圍外出現。沿着現有機場島的人工海堤、潮下軟底與硬底生境，以及在拓地範圍內的海洋水域的生態價值因而屬低至中高。

5.11.2.4 根據文獻研究資料與實地調查數據，評估以下地點的生態價值：北大嶼山海岸沿線的潮間帶、潮下軟底與硬底及海洋水域等生境，以及西北部水質管制區及南區水質管制區內四個認定為具海洋存護價值的地點。評估地點包括磡頭灘具特殊科學價值地點、沙洲及龍鼓洲海岸公園、計劃中的大小磨刀海岸公園及擬議的西南大嶼山海岸公園，這些地點均在拓地範圍之外，但在研究範圍之內。這些生境可能受到工程項目的間接影響，但預計影響屬不顯著。

5.11.2.5 沿大蠔灣、東涌灣、磡頭及深屈灣的北大嶼山海岸分布的紅樹林與潮間帶泥灘生境，均被視為重要的潮間帶生境。在磡頭及大蠔灣發現的海草床經核實有三種海草，並在深屈灣發現一處存在貝克喜鹽草(*Halophila beccarii)*的新地點。在深屈灣、磡頭、東涌灣及大蠔灣錄得大量馬蹄蟹幼體及亞成體馬蹄蟹，這表示這些區域可能是馬蹄蟹在香港的部分繁殖地。沿北大嶼山海岸的潮間帶溪流錄得具存護重要性的八種魚類與一種蟹類，包括已發現的管海馬(*Hippocampus kuda)*及海龍(*Syngnathoides biaculeatus* 及 *Syngnathus schlegeli)*。就潮下軟底生境而言，在拓地範圍外的北大嶼山發現一條文昌魚(*Branchiostoma belcheri)*，在沙洲及龍鼓洲海岸公園內發現覆蓋率較低的杯狀珊瑚 (*Balanophyllia* sp.)與非造礁珊瑚(*Paracyathus rotundatus)*。就潮下硬底生境而言，在拓地範圍外但研究範圍內一般錄得數量較低的底棲動物與覆蓋率較低的杯狀珊瑚 (*Balanophyllia* sp.)。就開放的海洋水域生境而言，在機場島北面拓地範圍以外、沙洲及龍鼓洲海岸公園和大小磨刀洲錄得中等數量的海洋動物，確認當中共有 20 種具存護重要性的物種，包括 17 種魚類、一種海螺及兩種馬蹄蟹。概括而言，西北部水質管制區內四處具有海洋保育價值的地點，整體具有高生態價值，而潮間帶、潮下及海洋水域生境的生態價值被評為低至高。然而，已識別的認定為具存護價值的地點均位於拓地範圍以外，並只會受到工程項目不顯著的間接影響。

5.11.3 潛在影響

5.11.3.1 擬建三跑道系統工程項目所選的布局及施工方法，在設計上避免及減低潛在生態影響。透過有系統的方案評估及改良，將所需土地減少約 20%。在施工方法上，已摒除撞擊式打樁和水底爆破工程，以避免對中華白海豚構成高度滋擾及受傷風險，並採用深層水泥拌合法等措施以減低對海洋環境的干擾。作為一項預防措施，亦會避免在 3 月至 6 月的中華白海豚生育高峰期間進行新跑道進場燈及指點標的鑽孔打樁工程。

5.11.3.2 儘管如此，建議的拓地工程將導致永久性損失 672 公頃[13]海床（約 40%是已覆蓋的污泥坑）。在海床的海堤腳外，將會建造約 10 公頃不同寬度的防沖刷護坦（實際所需寬度將取決於詳細設計）。防沖刷護坦將會由石塊或碎石組成，可提供硬基讓底棲動物重返此處棲息繁殖。此外，會損失 650 公頃供海洋魚類、中華白海豚及相關海底生物使用的開放水域，以及軟珊瑚覆蓋率較低的 5.9 公里人工海堤。

5.11.3.3 就中華白海豚而言，已評估施工及營運階段對損失棲息地、來回游弋範圍及整體干擾中華白海豚活動造成的影響。採用上述措施後，評估認為很多影響已屬不顯著或低程度。不過，工程項目將可能對香港水域的中華白海豚種群造成一些影響，這些影響主要包括因拓地工程所損失的中華白海豚棲

[13] 建議拓地範圍為 650 公頃。由於淨海堤腳施工範圍為 12 公頃（22 公頃的擬建海堤腳減現有 10 公頃海堤腳），在海堤腳外，將建造約 10 公頃不同寬度的防沖刷護坦（實際所需寬度將取決於詳細設計），因此將會損失的開放水域雖為 650 公頃，但損失的海床生境將為 672 公頃。

息地、減少機場島東面至西面之間的來回游弋範圍及相關的生境分裂及承載能力影響，以及來自海天客運碼頭的快船所造成的影響。

5.11.3.4 建議拓地範圍佔珠江口中華白海豚種群棲息地範圍的極小部分，且僅佔香港棲息地範圍的 2.5%，但這仍然是一些中華白海豚在香港的部分活動範圍。同時，海天客運碼頭的快船將須途經中華白海豚密度屬中等或高的區域，因此須要管制以減低對中華白海豚的滋擾及碰撞風險。

5.11.3.5 已評估在施工及營運階段對研究範圍內海岸公園的功能及質素的潛在干擾。對沙洲及龍鼓洲海岸公園可能造成的間接干擾，包括因拓地導致棲息地逐漸損失、海上交通及船隻噪音、損失中華白海豚的覓食資源及高速船干擾的相應影響。然而，由於建設三跑道系統工程項目，中華白海豚的活動範圍可能會由機場北面，移往沙洲及龍鼓洲海岸公園。沙洲及龍鼓洲海岸公園生境質素的轉變，包括可能損失的中華白海豚覓食資源及水質體系的水動力變化而可能出現的影響屬低中程度。在實施緩解措施包括限制工程船隻航行速度，以及下文**第 5.11.3.10 段**的保護中華白海豚措施後，預計剩餘影響屬可接受。

5.11.3.6 已評估三跑道系統工程項目在施工及營運期間，對計劃中的大小磨刀海岸公園的潛在間接干擾，包括對來回游弋範圍（機場島以北）的影響、海上交通流動、船隻噪音，以及因水動力和水質改變可能導致的干擾。假如中華白海豚使用新來回游弋範圍（擴建後的機場島以北）的程度比現有來回游弋範圍（現有機場島以北）減少，牠們可能會較少游往大小磨刀洲一帶，因而可能會對該範圍的中華白海豚數量造成負面影響。就海上交通流動而言，預計海天客運碼頭的快船交通增長並不重大，不會影響計劃中的大小磨刀海岸公園的功能及質素。對計劃中的大小磨刀海岸公園的潛在干擾，包括拓地所造成的水動力及水質體系變化，以及中華白海豚覓食資源相關的潛在影響作出評估。由於北大嶼山水域的魚類的流動性高，並有大量供中華白海豚覓食的資源，故評估認為，計劃中的大小磨刀海岸公園漁業資源的可持續發展，特別是中華白海豚的覓食資源，將不會受到顯著影響。然而，從審慎角度考慮，施工階段對中華白海豚在計劃中的大小磨刀海岸公園活動的潛在影響程度屬中等，因此建議採取適當的緩解措施，特別是透過連接計劃中的大小磨刀海岸公園，以建立一個更大面積的海岸公園。

5.11.3.7 擬議的西南大嶼山海岸公園距離三跑道系統的施工範圍較遠，因此預期發展三跑道系統，將不會對擬議的海岸公園的質素或功能造成任何顯著影響。

5.11.3.8 除中華白海豚以外，其他海洋動物種群可能受到不顯著至中等程度的影響。鑑於拓地工程及興建海堤將導致永久損失下潮帶軟底生境及開放水域，預計相關影響屬中等。

5.11.3.9 為了將工程項目在施工及營運階段可能對中華白海豚及海洋生態造成的影響減至最少、緩解及補償有關影響，已經制訂一系列措施。如上所述，其中一項建議，是將拓地範圍減少至 650 公頃，以將對海洋資源生境（包括中華白海豚種群的棲息地）損失的影響減至最少。此外，已建議採用非傳統施工方法，以減少對海床及海洋生境造成的直接及間接干擾至最低程度。這些方法包括使用免挖的深層水泥拌合法；在基岩層以定向鑽挖法進行海底航油管道改道；以水力噴注法進行海底電纜改道。為減低對水質及中華白海豚可能受到的相關影響，在進行海上填料活動前將建設至少 200 米的前緣海堤及敷設淤泥屏障。

5.11.3.10 建議實施保護中華白海豚及海洋生態的特定緩解措施，包括以下各項：

- 在施工前進行珊瑚潛水調查，作為預防措施，以研究移植珊瑚位置的可行性；
- 避免在中華白海豚生育高峰期進行鑽孔打樁活動，作為一項預防措施；
- 在進行地質改良工程（例如深層水泥拌合）、就海底電纜進行水力噴注、於安裝接口位置進行挖掘、建造海堤及進行鑽孔打樁工程期間，設立海豚管制區；

- 對躉船上的建築設備採取隔音措施；
- 制定溢漏應變計劃作為預防措施；
- 限制工程船隻駛經中華白海豚可能出沒的範圍時的速度不得超過 10 海浬；及
- 海天客運碼頭往來珠海及澳門的快船改為經沙洲及龍鼓洲海岸公園北面航行，並且在中華白海豚數量多的範圍船速不得超過 15 海浬。

5.11.3.11 此外，建議設立一個約 2,400 公頃的新海岸公園，將計劃中的大小磨刀海岸公園與現有沙洲及龍鼓洲海岸公園連結起來**(見圖則 MCL/P132/ES/5-11-001)**。建議的新海岸公園總面積遠超過所損失的 672 公頃海床的生境，預計可緩解棲息地損失、生境分裂、改變棲息地使用形式，以及減少來自海上交通，尤其是高速船的噪音及干擾，從而提升對中華白海豚的保育。值得注意的是，新海岸公園將會鄰近內地設立的珠江口中華白海豚國家級自然保護區，從而連接在香港及內地之間的受保護生境。政府當局承諾會根據《海岸公園條例》所規定的法定程序尋求將三跑道系統工程項目以北約 2,400 公頃的水域指定為海岸公園，作為三跑道系統工程項目導致的永久生境損失的緩解措施。機管局將會提供協助務求在約 2023 年（暫定）完成有關劃定，以便配合三跑道系統的全面運作。另外，亦建議採取多項環境提升措施，以加強北大嶼山水域的海洋生態與漁業資源。這些措施包括部分海堤採用改善生態環境的設計，從而促進日後擴建的香港國際機場進口航道區內潮間及亞潮帶動物群在此棲息繁殖；研究敷設人工魚礁的可行性；制定海洋研究計劃，以支持保護海洋生態；制定教育計劃，為本地學校團體及公眾提供平台，以認識更多有關本地海洋生態及中華白海豚生態及推廣環保教育與生態旅遊，並將會成立環保提升基金以支持上述活動。

5.11.3.12 在實施建議的緩解措施後，工程項目施工及營運階段可能產生的剩餘影響將會減少，在種群的層面上，預計不會對珠江口或香港中華白海豚種群造成顯著的影響。同樣，在施工及營運階段可能對中華白海豚以外的海洋物種造成的影響，亦可緩解至可接受程度。

Mott MacDonald

5.12 漁業

5.12.1 簡介

5.12.1.1 根據環評研究概要第 3.4.11 節及附錄 G 以及《環境影響評估程序的技術備忘錄》附件 9 及附件 17，已評估工程項目的施工及營運對漁業造成的潛在影響。漁業影響評估的研究範圍與水質影響評估的研究範圍相同，包括西北部水質管制區、西北部附水質管制區、后海灣水質管制區及西部緩衝區水質管制區。

5.12.1.2 漁業影響評估是根據文獻研究及漁業調查收集所得的資料進行。由於保安理由，船隻不可進入香港國際機場進口航道區，因此，在該航道區進行漁業調查可補充資料的不足。對可能會受三跑道系統項目影響的海洋生境進行的漁業調查，包括拖網、圍網、刺網、手釣、人工魚礁、魚苗及幼魚調查，並已進行漁業訪問調查，以更新及補充研究範圍內的漁業資源及捕魚活動狀況，從而作出全面的漁業影響評估。

5.12.2 實地調查結果

5.12.2.1 根據文獻研究及最新的漁業調查結果，在研究範圍內對漁業重要的地點，包括北大嶼山水域漁業資源產卵區、沙洲及龍鼓洲海岸公園、沙洲及龍鼓洲海岸公園的人工魚礁及在計劃中的大小磨刀海岸公園敷設的人工魚礁、馬灣海魚養殖區、大澳的捕撈漁業高產量區域、就港珠澳大橋 – 香港口岸項目建議劃定為海岸公園的大小磨刀洲一帶，以及后海灣泥灘的蠔養殖區。

5.12.2.2 在拓地範圍內並無水產養殖活動或人工魚礁，捕魚運作整體程度屬中等。漁業產量以生物多寡及漁獲量計，分別屬低及中等，而大部分主要物種屬沒有或低商業價值，魚苗和幼魚密度及魚類屬科的豐富度均屬低。

5.12.2.3 已評估位於拓地範圍外，四個可能會受工程項目影響的鄰近地區，當中包括大小磨刀洲、赤鱲角西面及北面水域，以及沙洲及龍鼓洲海岸公園。

5.12.3 潛在影響

5.12.3.1 三跑道系統項目可能造成漁業影響的工程，包括建議的拓地工程、11 千伏海底電纜改道、為海底航油管道改道工程在沙洲及龍鼓洲海岸公園內進行實地勘測及建設臨時浮台、在第三條跑道兩端設置進場燈，以及沿未來的香港國際機場進口航道區界線設置指點標。這些工程可導致赤鱲角北面水域永久及暫時損失捕魚區、直接損失漁業生境(及資源)，以及直接損失產卵場的潛在影響。此外，亦會因水質可能變差而對漁業生境造成間接干擾，對水產養殖地點、人工魚礁造成的間接影響，以及對捕魚活動的干擾；因水底噪音、水動力及潮汐改變、海水進水口所產生的水流對漁業資源造成的干擾、飛機噪音對海洋魚類的間接干擾；以及因擴展香港國際機場進口航道區而成為漁業禁捕區的潛在影響。

5.12.3.2 在建議拓地範圍水域內漁民捕魚活動的活躍程度屬中等。拓地工程會導致合共損失（永久加暫時損失）約 1,392 公頃的捕魚區，當中包括施工階段 410 公頃[14]的永久損失，建築工程開始時的影響程度屬於低，待拓地工程完成後影響程度則屬中等。在營運階段，永久損失的捕魚區面積將為 768 公頃[15]，影響程度亦屬中等。

5.12.3.3 672 公頃[16]的漁業生境(及資源)將會永久損失，自建築工程進行起計的影響屬低等程度，待拓地工程完成後影響程度則屬中等。建議設立約 2,400 公頃的大型海岸公園（圖則 MCL/P132/ES/5-11-001），將會改善現有沙洲及龍鼓洲海岸公園、計劃中的大小磨刀海岸公園、珠江口中華白海豚自然保護區與現有／未來的香港國際機場進口航道區之間的生態連繫，從而彌補漁業生境（及資源）/ 捕魚區的損失。此外，根據《海岸公園條例》及《海岸公園及海岸保護區規例》推行一系列管制及限制措施，包括管制捕魚活動、限制船速在 10 海浬或以下及管制其他人為滋擾，將會有助進一步恢復北大嶼山水域及鄰近地區的漁業資源。設立建議的新海岸公園後，將會促進擬設的新海岸公園與鄰近水域內的漁業資源保育，並帶來積極的協同作用。因此，預計在設立建議的新海岸公園後不會對漁業生境(及資源)損失造成負面剩餘影響。

5.12.3.4 由於建議的海岸公園會採取相關保護措施，將會令漁業資源得以恢復，加上連接海洋保護區所產生的協同作用，將會令鄰近的捕魚區受惠。按照其他設立海洋保護區以提升捕魚效率的成功個案，建議設立新海岸公園作為捕魚區損失的補償措施，將會緩解潛在影響至沒有負面剩餘影響。

5.12.3.5 然而，為進一步改善香港西面水域的漁業資源及支援漁業的可持續發展，除建議的緩解措施外，亦建議實行多項提升漁業措施，包括在未來經擴大的香港國際機場進口航道區內部分海堤採用改善生態環境的設計；考慮在適當位置敷設人工魚礁以吸引稚魚；以及實行提升漁業策略；並將會成立漁業提升基金以支持上述活動。

[14] 410 公頃=建議的 650 公頃拓地範圍-240 公頃現有香港國際機場進口航道區。

[15] 768 公頃=建議的 650 公頃拓地範圍-240 公頃現有香港國際機場進口航道區+358 公頃建議香港國際機場進口航道區。

[16]672 公頃=建議的 650 公頃拓地範圍+ 22 公頃建議海堤腳範圍+10 公頃防冲刷護坦-10 公頃現有海堤腳範圍。

5.13 景觀及視覺

5.13.1 簡介

5.13.1.1 有關工程項目已根據環評研究概要第 3.4.12 節及附錄 H 以及《環境影響評估程序的技術備忘錄》附件 10 及 18，進行了景觀及視覺影響評估。經檢視現有的相關規劃及發展管制框架，結果顯示擬建的三跑道系統整體符合目前的土地用途，與相關的規劃及發展管制框架並無衝突。

5.13.1.2 識別及評估對現有景觀及易受視覺影響的地方／人士的主要影響源頭，包括建議拓地的施工及營運、擴建二號客運大樓及相關基礎設施、新建客運廊及其他機場建築物、鋪設 11 千伏海底電纜及安裝接口，以及海底航油管道的鑽孔出土位置。值得注意的是，在工程項目的設計上，已避免造成影響或將影響減至最少，例如拓地範圍位於現時機場北面，距離大部分易受視覺影響的地方／人士最遠，而採用定向鑽挖法建設海底航油管道，亦可將影響景觀資源的範圍減至最小。

5.13.1.3 在景觀及視覺影響評估的研究範圍內，合共識別了可能受到三跑道系統影響的 19 個景觀資源、11 個具景觀特色的地方及 79 項具代表性的易受視覺影響地方／人士。此外，亦進行了概括的樹木調查，以確定對現有樹木大致造成的潛在影響。

5.13.2 施工階段

5.13.2.1 根據影響評估結果，建議在施工時實行涵蓋所有相關景觀及視覺範疇的緩解措施。這些措施包括將施工範圍縮至最小、縮短施工期、減少施工的海陸交通量及施工機械、分階段施工、豎立圍板、控制晚間的燈光、在無植被的地面噴草、保護現有樹木，以及移植受影響的樹木。

5.13.2.2 實行建議的緩解措施後，預計所有景觀資源及具景觀特色的地方會因三跑道系統的施工而受到輕微或沒有實質的剩餘影響，或預計不會受到影響，但以下各項除外：

景觀資源

- 由於開拓新土地將導致損失 650 公頃海岸水域，預計鄰近赤鱲角的北大嶼山海岸水域會受到顯著的影響。
- 評估範圍內的路旁美化植物，在實施緩解措施後，預計會受到中等程度的影響。

具景觀特色的地方

- 由於海上的施工活動明顯可見，以及損失 650 公頃具景觀特色的地方，預計沿岸水域景觀會受到顯著的剩餘影響。

5.13.2.3 實行緩解措施後，預計在施工階段，所有易受視覺影響的地方／人士會因三跑道系統而受到輕微或沒有實質的剩餘影響，或預計不會受到影響，但以下易受視覺影響的地方／人士除外：

- 北大嶼山水域及龍鼓水道旅遊船隻的乘客／駕駛員以及沙洲島遊客預計將感受到大程度的視覺變化，加上他們對視覺的敏感度高，因此有顯著的影響。
- 於東涌（包括東堤灣畔、海堤灣畔、映灣園、第 53 至 56 區）、沿屯門南面海岸、香港黃金海岸及小欖的居民；香港天際萬豪酒店、香港國際機場客運大樓及富豪機場酒店；昂坪 360 纜車乘客；於彌勒山、鳳凰山、大東山、北大嶼郊野公園、南大嶼郊野公園及觀景山的遠足人士，預計將感受到中等程度的視覺變化，加上他們對視覺的敏感度高，因此影響程度屬中等。

- 暢榮路沿線的車輛及港鐵乘客／駕駛人士、亞洲國際博覽館的旅客／訪客、商用飛機乘客、擬建的香港接線的乘客／駕駛人士以及北大嶼山水域及龍鼓水道的渡輪乘客，預計他們感受到的視覺變化及對視覺的敏感度均為中等，因此影響程度屬中等。

5.13.3 營運階段

5.13.3.1 根據影響評估結果，建議在營運時實行涵蓋所有相關景觀及視覺範疇的緩解措施。這些措施包括在拓地邊緣採用合適的景觀設計、合適及美觀的建築物／結構物外牆設計以達到良好的融合及協調效果、合適的燈光及街道設計、恢復受影響地方的原貌、實行綠化措施、進行補償植樹、使用適當的建築物料及顏色、適當設計行人天橋、綠化隔音屏障及隔音罩、合適的街景及燈光照明設計以及美化種植。

5.13.3.2 已評估在營運階段實行緩解措施後，對景觀資源及具景觀特色的地方造成的剩餘景觀影響。預計所有景觀資源及具景觀特色的地方會因三跑道系統而受到輕微或沒有實質的剩餘影響，或預計不會受到影響，但北大嶼山海岸水域及沿岸水域景觀則因永久損失約 650 公頃的海岸水域，在營運階段仍受到顯著的剩餘影響。然而，該永久損失是建設三跑道系統所需的最少拓地範圍，再者，更大範圍的北大嶼山海岸水域及沿岸水域景觀將不會受到三跑道系統的影響，並會在營運階段繼續為可享用的景觀資源。

5.13.3.3 實行建議的緩解措施後，預計除北大嶼山水域及龍鼓水道旅遊船隻的乘客／駕駛員以及沙洲島遊客會受到中等程度的剩餘影響外，所有其他易受視覺影響的地方／人士會受到輕微或沒有實質的剩餘影響，或預計不會受三跑道系統影響。

5.13.3.4 根據《環境影響評估程序的技術備忘錄》附件 10 及 18 所載的評估影響準則及指引，在施工及營運階段實行緩解措施後，整體而言，擬建三跑道系統的剩餘景觀及視覺影響屬大致上可接受。

5.14 文化遺產

5.14.1 簡介

5.14.1.1 已根據環評研究概要第 3.4.13 節的規定，評估文化遺產影響，當中包括海洋考古調查，以及陸地考古及文物建築研究，以評估研究範圍內對已知或潛在文化遺產的影響。文化遺產影響評估根據《環境影響評估程序的技術備忘錄》附件 10 及 19 的規定進行，而海洋考古調查的要求亦載於環評研究概要附錄 I。

5.14.2 海洋考古

5.14.2.1 海洋考古調查的範圍涵蓋所有可能對海洋考古資源造成影響的海上活動，包括：

- 在現有機場島北面拓地約 650 公頃；
- 安裝新的跑道進場燈；及
- 11 千伏海底電纜改道。

5.14.2.2 海洋考古調查研究範圍不包括海底航油管道改道工程（包括相關的海上實地勘測與鑽掘工程），原因是海上實地勘測工作影響的海床面積非常小，而管道將以穿過海底基岩方式建造。採用這種建造方法，將會避免對海洋考古資源造成直接影響，而振動所產生的間接影響風險亦屬不顯著。

5.14.2.3 海洋考古調查是以古物古蹟辦事處發布的《海洋考古調查指引》為依據，當中列明下列工作：

- 基線研究；
- 地質測量；
- 確定潛在考古價值；及
- 潛水員目視調查。

5.14.2.4 由於根據有關範圍的歷史紀錄，以及早於 1993 年進行最初機場建築工程時，發現一枚 19 世紀大炮（及隨後修復），基線研究結果確定有關範圍整體具有高潛在考古價值。然而，研究結果亦確定，污泥坑的施工及運作已導致約 28%的海洋考古調查研究範圍受到影響，因此污泥坑範圍被視為沒有潛在考古價值。

5.14.2.5 根據基線研究結果，顯示有必要進行進一步調查，並於 2012 年 12 月完成了地質測量，當中包括使用旁測聲納測量、地震剖面儀、雙頻及多聲束回聲測深儀。數據分析顯示在海洋考古調查研究範圍內共有 41 處聲納感應，其中 22 處被視為具有潛在考古價值。於 2013 年 3 月，就這 22 處聲納感應以磁動計調查方式完成了進一步調查。磁動計調查在這 22 處聲納感應的 25 米半徑範圍內，共探測到 180 處電磁感應。經更詳細研究有關結果及考慮相關因素後，最終有 57 處電磁感應及 11 處聲納感應被視為具有潛在考古價值，並須進行目視檢查。

5.14.2.6 就進行潛水員目視調查，根據《古物及古蹟條例》申請挖掘及搜尋古物牌照，有關牌照於 2013 年 6 月 28 日發出。潛水員調查於 2013 年 7 月及 8 月進行，期間找到所有 11 處聲納感應及 57 處電磁感應，並確定為近代廢棄物。於海床調查期間未有發現海洋考古遺物。

5.14.2.7 有關結果認為，海洋考古調查研究範圍內沒有具海洋考古價值的資源。因此，預期不會對海洋考古資源造成負面影響，並無須實行緩解措施。

5.14.3 陸地文化遺產

5.14.3.1 陸地文化遺產影響評估採納自陸上工程項目界線起計的 500 米半徑範圍，作為研究範圍。評估包括位於上沙洲（飛機燃料接收設施的位置）的海底航油管道鑽孔出土位置，以及現有機場島。為識別研究範圍內的任何基線陸地文化遺產資源，進行了文獻及有關資料研究。文獻研究識別了六個具有考古研究價值的地點及兩項文物建築，全部或部分位於 500 米研究範圍內。當中蝦螺灣具考古研究價值的地點及沙洲具考古研究價值的地點位於工程項目範圍內，但在建築工程範圍之外。在文獻研究中，並無識別到其他具有潛在考古價值的地點或文物建築。在上沙洲進行的實地調查亦未發現任何其他文物建築。

5.14.3.2 工程項目範圍內具有考古研究價值的地點受到的潛在影響，是考慮距離最近的建築活動性質及接近程度進行評估。在蝦螺灣具考古研究價值的地點附近進行的建築活動，涉及興建新高架道路及更改現有路線。然而，在施工或營運階段均不會伸延至蝦螺灣遺址範圍，因此已避免造成直接影響。由於鑽孔打樁工程的規模小且設有約 25 米的緩衝距離，評估認為有關工程造成的潛在間接影響屬不顯著。

5.14.3.3 就沙洲具考古研究價值的地點而言，採用定向鑽挖法會避免因海底航油管道施工而造成直接影響。由於鑽探工程的每個鑽孔直徑少於一米，且鑽探深度大多在海床以下約 50 米，評估認為鑽探工程造成的潛在間接影響屬不顯著。為沙洲（在 11 千伏海底電纜改道工程期間）提供臨時電力的臨時發電裝置及電纜，將會設置在目前已鋪路面的地方，因此不會造成直接影響。陸地考古評估認為，在施工或營運階段不會對已識別的具考古研究價值的地點造成影響，故無須實行緩解措施。

5.14.3.4 就研究範圍內的兩項文物建築（位於東涌的東涌小炮台及沙洲天后廟）而言，由於工程項目範圍內並無文物建築資源，故確定不會造成直接影響。由於建築工程範圍與文物建築之間有遠距離的緩衝（約 400 米或以上），評估認為振動、噪音或視覺干擾不太可能造成間接影響。文物建築評估認為，在施工或營運階段不會對文物建築資源造成影響，故無須實行緩解措施。

5.15 健康影響

5.15.1 簡介

5.15.1.1 在工程項目營運期間所產生的空氣污染物及飛機噪音排放，已根據環評研究概要第 3.4.14 節，以及附錄 A 第 II 節與附錄 C 第 II 節的要求進行潛在健康影響評估。這是首次就香港的運輸基建項目進行健康影響評估。

5.15.2 空氣污染物

5.15.2.1 健康影響評估主要評估毒性空氣污染物及空氣質素指標表列的污染物。進行文獻研究後，確定了進行健康影響評估的最佳步驟及方法，並識別呼吸為主要攝入途徑。

5.15.2.2 已查閱的多份文獻均按照急性、慢性非癌病風險與致癌風險釐定健康風險，工程項目的評估亦以此為基礎。評估方法的步驟如下：（i）識別危害；（ii）評估受影響程度；（iii）攝入量反應評估；及（iv）風險評估。

5.15.2.3 評估採用三個層次選出主要的毒性空氣污染物。第一層涉及定量篩選，考慮毒性空氣污染物的排放量與毒性程度。第二層與第三層則選取其他相關或較受關注的化學物：

- 第一層：根據排放物毒性值的計算結果進行篩選
- 第二層：參照國際癌症研究機構第一類（人類致癌物）化學物
- 第三層：參照其他相關機場研究中確定的毒性空氣污染物

5.15.2.4 評估結果顯示，因三跑道系統運作影響人類的短期（即 1 小時／24 小時）及長期（即一年）毒性空氣污染物濃度，將符合相應的急性及慢性非癌病風險準則，因此，三跑道系統造成的急性及慢性非癌病風險均屬可接受水平。相對沒有三跑道系統運作的情況下，由毒性空氣污染物導致的致癌風險預測最高增加約 1.14×10^{-5}，屬可接受水平。

5.15.2.5 就短期接觸空氣質素指標表列的污染物而言，一氧化碳（1 小時）、二氧化氮（1 小時）及二氧化硫（10 分鐘）在評估範圍內符合空氣質素指標。與雙跑道系統比較，因三跑道系統運作，估計每年由於短期接觸二氧化氮、可吸入懸浮粒子及二氧化硫而引致入院及早逝（短期死亡風險）的最大額外風險增幅亦相對地小（即每年早逝風險預測最高增加約 1.27×10^{-5}）。因此，短期接觸有關空氣質素指標表列的污染物而引致的短期健康風險屬可接受水平。

5.15.2.6 若以三跑道系統及雙跑道系統運作比較，評估範圍內二氧化氮、可吸入懸浮粒子、微細懸浮粒子及二氧化硫年均濃度的增加幅度少於 3%。此外，與雙跑道系統比較，因三跑道系統運作，估計每年由於長期接觸微細懸浮粒子而引致早逝（長期死亡風險）的最大額外風險增幅亦相對地小。因此，長期接觸有關空氣質素指標表列的污染物而引致的長期健康影響屬可接受水平。

5.15.3 飛機噪音

5.15.3.1 有關飛機噪音的健康影響評估已根據環評研究概要訂明的要求進行。由於《環境影響評估程序的技術備忘錄》沒有與飛機噪音相關的健康影響評估指引或標準，因此在參考本地及海外相關做法後，擬定健康影響評估的最佳步驟及方法。

5.15.3.2 就環境噪音可能引致的潛在健康影響，已進行文獻研究。研究結果顯示，觀察到環境噪音（包括飛機噪音）與煩擾及報稱睡眠影響有正面關連。此外，一些關注小學兒童的研究，亦指出了飛機噪音對兒童在學校環境的學習影響。

5.15.3.3 健康影響評估集中分析於 2030 年（即最高飛機噪音水平運作模式的年份）三跑道系統與雙跑道系統運作下的健康影響變化，並以鄰近飛機噪音預測等量線 25 的人口稠密地區，包括沙螺灣、東涌、北大嶼山、馬灣及小欖，作為整體評估範圍。這項評估包括對煩擾及報稱睡眠影響兩大範疇作出定量分析，亦就飛機噪音所引致的其他潛在健康影響分析對兒童學習的影響。

5.15.3.4 健康影響評估的結果顯示，在三跑道系統運作下，將來在評估範圍內可能感受煩擾及報稱睡眠受影響的人數會減少（受影響人數分別減少約 10%及 50%）。

5.15.3.5 就飛機噪音對兒童的學習影響而言，評估發現在三跑道情況下，位於小欖地區一間幼稚園受到的噪音影響區間介乎 55 至 60 分貝。然而，由於現場的飛機噪音水平會被背景實地錄得的噪音水平 60 分貝所遮蓋，因此對該幼稚園學生的學習不會造成顯著影響。

5.15.3.6 相對於沒有三跑道系統運作的情況下，三跑道系統運作對評估範圍內可能感受煩擾及報稱睡眠受影響的人數會減少；另一方面，工程項目運作對兒童學習的影響並不顯著。因此，評估認為在評估範圍內與工程項目飛機噪音相關的整體健康影響屬極微。

5.16 影響概述

5.16.1.1 環境影響評估報告中各方面的環境影響概述載列於**表 5.3**。

表 5.3： 環境影響概述

評估點	評估結果	相關標準／準則	估計超標程度	考慮的避免措施	建議的緩解措施	剩餘影響
空氣質素影響－施工階段						
500 米評估範圍內的易受空氣污染影響地方	▪ 在實行緩解措施情況下，所有易受空氣污染影響地方的每小時總懸浮粒子水平符合標準，每日的可吸入懸浮粒子和微細懸浮粒子水平亦符合空氣質素指標 ▪ 在實行緩解措施情況下，所有易受空氣污染影響地方的每年可吸入懸浮粒子及每年微細懸浮粒子水平，均符合空氣質素指標	▪ 《環境影響評估程序的技術備忘錄》附件 4 及 12 ▪ 《空氣污染管制條例》 ▪ 空氣質素指標	透過實行緩解措施，所有易受空氣污染影響地方的預測累積總懸浮粒子、可吸入懸浮粒子及微細懸浮粒子水平，將會符合相關總懸浮粒子準則，可吸入懸浮粒子及微細懸浮粒子水平亦會符合相關的空氣質素指標	不適用	▪ 《空氣污染管制（建造工程塵埃）規例》規定的相關措施 ▪ 在所有活躍工地範圍進行重型建築活動時灑水，次數為每天 12 次或在 24 小時工作時每兩小時 1 次 ▪ 80%的堆料區以不透水物料覆蓋，在裝載運送任何易生塵埃物料前，立即在這些物料上灑水 ▪ 良好的塵埃控制措施 ▪ 環保署就水泥廠指明工序制定的相關指引 ▪ 環保署就瀝青廠指明工序制定的相關指引 ▪ 環保署就石料加工廠指明工序制定的相關指引	預計不會有負面的剩餘影響。
空氣質素影響－營運階段						
五公里評估範圍內的易受空氣污染影響地方	所有易受空氣污染影響地方的二氧化氮、可吸入懸浮粒子、微細懸浮粒子、二氧化硫及一氧化碳水平，將符合空氣質素指標	▪ 《環境影響評估程序的技術備忘錄》附件 4 及 12 ▪ 《空氣污染管制條例》 ▪ 空氣質素指標	預計在已識別易受空氣污染影響地方並無不符合空氣質素指標的情況	機管局已推行多項措施，以減少機場活動及運作的空氣污染物排放，其中包括： ▪ 自 2008 年起，禁止所有機場禁區內的車輛引擎空轉，惟已受豁免的特定車輛除外； ▪ 在 2014 年年底前禁止所有飛機在廊前停機位使用輔助動力裝置； ▪ 在 2017 年年底前，機場禁區內行駛的所有房車必須為電動車； ▪ 在 2018 年年底前，增設電動車及電動地勤設備充電站數目至 290 個； ▪ 就現有地勤設備排放表現進行檢討，探討有助進一步控制空氣污染物排放的措施； ▪ 在招標或更新合約時，與專營服務商探討加快以較潔淨型號取代舊款機場禁區車輛及地勤設備的可行性； ▪ 所有新增的機場禁區車輛必須為節約燃料型號，並以此為發牌的先決條件； ▪ 在飛行區提供最潔淨的柴油及汽油； ▪ 規定機管局所有柴油車輛必須使用 B5 生物柴油；及 ▪ 為機場禁區的車輛及地勤設備設置液化石油氣加氣站。	不適用	預計不會有負面的剩餘影響。
生命危害－施工階段						
因建築工程鄰近以下地方而造成風	▪ 個人風險水平低於每年 1×10^{-5}；	《環境影響評估程序的技術備忘錄》	不適用	由於社會風險水平在可接受範圍內，	儘管因社會風險水平在可接受範圍而	預計不會有負面的剩餘影響。

評估點	評估結果	相關標準／準則	估計超標程度	考慮的避免措施	建議的緩解措施	剩餘影響
險： ▪ 現有航油管道；及 ▪ 貯存設施	及 ▪ 社會風險水平在可接受範圍內	附件 4		因此無須採取緩解措施	無須採取緩解措施，但仍已就一般最佳方法提出以下建議措施： ▪ 應制訂防範措施，要求躉船在颱風期間駛走； ▪ 應制訂適當的海上交通管理系統，以將可能引致沉船或物件墜落的碰撞風險減至最小；及 ▪ 在進行任何建築工程前，應清楚指明全部現有加油栓網絡的位置。	
生命危害－營運階段						
因以下各項運作而造成風險： ▪ 新航油管道（海底及地下）； ▪ 在機場擴建範圍新建停機位為飛機加油的新燃油加油栓系統；及 ▪ 機場禁區汽油加油站	▪ 個人風險水平低於每年 1 x 10^{-5}；及 ▪ 社會風險水平在「合理而實際可行情況下可承擔的最低風險」範圍	《環境影響評估程序的技術備忘錄》附件 4	不適用	▪ 新海底管道須採取與現有管道相若的塗層標準 ▪ 在測試及投入運作期間，應檢查新海底管道是否無損 ▪ 在展開任何建築工程前，將會向第三方建築承包商提供竣工圖則，有關圖則顯示工地的地下航油管道路線及水平 ▪ 第三方建築承包商須進行地下管道探測工作，以在展開工程前，確定地下管道的確實路線 ▪ 應以洩漏偵測系統進行地下管道監察工作 ▪ 應進行研究，以確保新管道能應付計劃的未來負荷量 ▪ 須就加油栓網絡進行新的壓力波動計算工作 ▪ 應就新系統進行適當的壓降計算工作	▪ 進行改善審核工作，以加強現有的加油作業方法，並提升合規情況。 ▪ 在加油過程中，於可行情況下放置四個圓錐筒，顯示自新燃油加油栓系統的飛機加油點起計的加油區。在適當時，機管局會與航空公司及其加油服務營運商就這項建議進行溝通。在機管局日後的安全審核中，將會檢核這項建議的實行情況。	▪ 個人風險水平低於每年 1 x 10^{-5}；及 ▪ 社會風險水平在「合理而實際可行情況下可承擔的最低風險」範圍。
噪音影響－飛機噪音						
飛機噪音 全港地區	飛機噪音預測等量線 25 及飛機噪音預測等量線 30	飛機噪音預測等量線 25 用於所有住宅樓宇、酒店、教育機構、禮拜場所、法院以及醫院；飛機噪音預測等量線 30 則用於辦公室 （參考資料：《環境影響評估程序的技術備忘錄》附件 5 表 1A）	樂安排部分在規劃中的土地用途	以下是現時為現有機場運作所採用的消減噪音影響措施，這些措施在日後機場運作中亦會繼續執行： ▪ 在安全飛行運作許可下，向東北起飛的飛機須採用國際民航組織制定的噪音消減起飛程序；及 ▪ 鼓勵所有於晚上 11 時至上午 7 時從東北進入香港國際機場的飛機使用持續降落模式。	▪ 在可行情況下，安排現有南跑道於夜間 2300 至 0659 時段處於備用狀態； ▪ 規定飛機於夜間 2300 至 0659 時段，在可接受的操作及安全情況下，向東方起飛的航機採用經西博寮海峽的南行航線，有關安排符合現有的雙跑道系統夜間運作規定； ▪ 已設計一條新的進場航道 6，讓設有「所需航道性能」的飛機於夜間 2300 至 0659 時段優先採用西面方向（即跑道 25 方向）進場；於 2030 年，估計有高達 95%飛機可優先採用此新航道 6 抵港，取代目前直線進場航道； ▪ 在風速及風力許可的情況下，實行優先跑道使用計劃。於夜間時段，在飛機起飛架次較多時採用西行航道，在飛機降落架次較多時則採用東行航道；及 ▪ 在制訂樂安排綜合發展區的總綱發	不適用

評估點	評估結果	相關標準／準則	估計超標程度	考慮的避免措施	建議的緩解措施	剩餘影響
					展藍圖時，應確保在飛機噪音預測等量線 25 範圍內，不會設置易受噪音影響的土地用途[17]。	
噪音影響－固定噪音源						
已根據數個最高噪音水平的假設情況，對照 70 分貝(A)（日間／傍晚時段）或 60 分貝(A)（夜間時段）的準則劃定評估範圍。	透過實行建議的免受影響及緩解措施，固定噪音源（包括飛機滑行以及飛機引擎起動測試設施及輔助動力裝置的運作的地面噪音源）的累積噪音水平，在所有具代表性易受噪音影響地方均符合相關日間／傍晚及夜間噪音準則	▪ 《噪音管制條例》； ▪ 《環境影響評估程序的技術備忘錄》；《環評條例》下相關指南；及 ▪ 《管制非住用處所、非公眾地方或非建築地盤噪音技術備忘錄》。	透過實行免受影響及緩解措施，預計所有具代表性易受噪音影響地方將不會超出有關噪音準則。	於日間／傍晚及夜間時段，工程項目的固定設備應遵從最高許可聲功率級的要求。	飛機引擎起動測試設施須裝設可減低噪音最少 15 分貝(A)的隔音罩，以符合相關的日間、傍晚及夜間固定噪音準則。	預計不會有負面的剩餘影響。
噪音影響－建築噪音						
已選取易受噪音影響地方的首層地區（在不同方向最接近噪音源）作為評估點。	透過實行建議的免受影響及緩解措施，所有具代表性易受噪音影響地方的累積噪音水平，將會符合日間建築噪音準則。	▪ 《噪音管制條例》； ▪ 《環境影響評估程序的技術備忘錄》；《環評條例》下相關指南；及 ▪ 《管制建築工程噪音（撞擊式打樁除外）技術備忘錄》。	透過實行免受影響及緩解措施，預計任何具代表性易受噪音影響地方將不會超出日間建築噪音準則。	有助在噪音源減低噪音的良好工地措施如下： ▪ 工地內只可使用保養良好的設備，而設備在施工期間亦應作定期維修 ▪ 間歇使用的機器及設備在非使用期間關掉或調至最低 ▪ 在可行情況下，如已知設備會向某方向發出強烈噪音，應調動設備的朝向，令噪音遠離易受噪音影響地方 ▪ 在可行情況下，流動設備應安置在遠離易受噪音影響地方的位置 ▪ 在可行情況下，有效利用堆存物料及其他結構物，以阻隔工地建築活動的噪音	▪ 採用靜音機器 ▪ 採用可移動隔音屏障 ▪ 採用隔音罩／隔音棚	預計不會有負面的剩餘影響。
噪音影響－交通噪音						
道路交通噪音影響的評估範圍包括工程項目界線起計 300 米範圍及工程項目進行的工程。 就海上交通噪音，評估範圍已對照有關標準劃定，在範圍界線的預測海上交通噪音，較最近的易受噪音影響地方的現有背景噪音水平低 10 分貝(A)。	就道路交通噪音而言，由於附近的易受噪音影響地方，均位於三跑道系統工程項目建議道路走線的 300 米評估範圍以外，因此，預計建議的道路走線不會造成負面的噪音影響。 在海上交通噪音方面，由於在評估範圍內並無任何易受噪音影響地方，因此預計不會造成負面的噪音影響。	▪ 《噪音管制條例》；及 ▪ 《環境影響評估程序的技術備忘錄》；《環評條例》下相關指南。	不適用	不適用	不適用	預計不會有負面的道路交通噪音影響。 預計不會有負面的海上交通噪音影響。

[17]機管局會在第三跑道投入運作前，為新增受影響村落的所有村屋，提供隔音窗及空調以消減飛機噪音對居民的影響。

評估點	評估結果	相關標準／準則	估計超標程度	考慮的避免措施	建議的緩解措施	剩餘影響
水質影響－施工階段						
於下列範圍內的易受水污染影響地方： ▪ 西北部水質管制區； ▪ 西北部附水質管制區； ▪ 后海灣水質管制區；及 ▪ 西部緩衝區水質管制區	▪ 不會超出沉積準則 ▪ 不會因進行海底電纜改道工程而令易受水污染影響地方的溶解氧降低，所以不會對水質造成負面影響 ▪ 不會因海底電纜改道工程釋出的污染物而對水質造成負面影響 ▪ 不會因進行深層水泥拌合工程釋出的污染孔隙水而對水質造成負面影響 ▪ 不會因填土釋出的污染孔隙水而對水質造成負面影響 ▪ 在工程項目實行緩解措施下，不會超出懸浮固體水深平均含量準則，但在實行緩解措施的累積情況下，部分易受水污染影響地方的懸浮固體水深平均含量會超出準則（主要由於對同期進行的其他項目的海上建築工程作出保守假設） ▪ 就所有其他建築工程而言（例如海底航油管道鑽探、雨水渠排水口的建造／改建、新跑道進場燈及香港國際機場進口航道區指點標打樁活動、建築工地徑流及排水、建築工人及一般施工活動產生的污水），在實施適用的建議設計／建築方法及建議緩解措施後，預計不會對水質造成負面影響。	▪ 《環境影響評估程序的技術備忘錄》附件 6 及 14 ▪ 《水污染管制條例》 ▪ 西北部水質管制區水質指標 ▪ 西北部附水質管制區水質指標 ▪ 后海灣水質管制區水質指標 ▪ 西部緩衝區水質管制區水質指標 ▪ 水務署的沖廁水進水口水質準則 ▪ 珊瑚的沉積物沉降及懸浮固體準則、「珊瑚礁區域污染管制標準及準則」 ▪ 英國議會有關貝介類水域水質要求的指令（貝介類水域指令） ▪ 歐洲議會及歐盟委員會就水資源政策範圍內的環境質素標準於 2008 年 12 月 16 日發布的 2008/105/EC 指令 ▪ 美國環境保護局的最高濃度基準 ▪ 美國環境保護局的連續濃度基準	就工程項目本身在實行緩解措施下的懸浮固體： ▪ 所有易受水污染影響的地方均不會超出懸浮固體水深平均含量準則 在實行緩解措施下，所有易受水污染影響地方的累積懸浮固體水深平均含量均不會超出準則，惟以下地點除外： ▪ C20－水務署青衣海水進水口 – 高於標準最多每公升 2.5 毫克（主要因為同期進行的項目） ▪ CR3－大小磨刀洲的硬珊瑚 – 高於標準最多每公升 1.26 毫克（主要因同期進行的項目作出保守的假設[18]） ▪ C7a－香港國際機場冷卻水進水口（北面） – 高於標準最多每公升 16.91 毫克（實行進一步緩解措施後不會超出準則） ▪ C8－日後香港口岸的冷卻水進水口 – 高於標準最多每公升 1.23 毫克（實行進一步緩解措施後不會超出準則） ▪ E12－深水角 – 高於標準最多每公升 4.4 毫克（主要由於對同期進行的大嶼山物流園項目作出保守的假設。然而，現階段並沒有這項同期進行項目的實施計劃，而日後於這位置進行的工程項目亦需要進行環評，藉以將這項同期進行項目相關的潛在水質影響減至最少。）	▪ 以免挖方法為拓地進行地質改良，避免排出懸浮固體及污染物； ▪ 採用定向鑽挖法建造海底航油管道； ▪ 只在浮動平台上進行焊接工程，而且不須在沙洲的管道鑽孔出土位置存放大量化學物； ▪ 在沙洲的管道無須排水； ▪ 在坑的較高位置築起小型混凝土壆牆，並在沙洲管道鑽孔出土位置設置遮擋物，以防止雨水流入造成泥土徑流； ▪ 在機場島開展工程起點，以閉環系統進行鑽探，並會處理及重用鑽液； ▪ 利用水力噴注法，以及封閉式抓斗進行 11 千伏海底電纜改道的接口安裝挖掘工程，以將懸浮固體及污染物的排放減至最少；及 ▪ 在旱季進行排水口連接工程。	▪ 限制與拓地工程相關的每天最高生產率不得高於水質評估中假設的最高生產率； ▪ 限制砂墊層及海上填料活動的細顆粒含量； ▪ 在海上填料工程進行前提前完成 200 米的海堤／完成部分海堤； ▪ 在指定工程活躍範圍周圍設立雙層淤泥屏障系統； ▪ 在指定易受水污染影響的地方設置雙層淤泥屏障及／或隔泥網系統； ▪ 使用封閉式抓斗及淤泥屏障進行安裝接口挖掘工程； ▪ 使用封閉式抓斗、鐵殼及淤泥屏障進行打樁活動； ▪ 實施《專業人士環保事務諮詢委員會專業守則─建築工地的排水渠》（ProPECC Note PN 1/94）中載列的指引； ▪ 為建築工人提供化糞式廁所； ▪ 根據《水污染管制條例》的規定在排放廢水前處理廢水； ▪ 根據《廢物處置（化學廢物）（一般）規例》及《包裝、標識及存放化學廢物的工作守則》處理化學廢物；及 ▪ 為沙洲進行的工程實施「零排放」政策。	預計不會產生負面的剩餘影響。
水質影響－營運階段						
於下列範圍內的易受水污染影響地方： ▪ 西北部水質管制區； ▪ 西北部附水質管制區； ▪ 后海灣水質管制區；及 ▪ 西部緩衝區水質管制區	▪ 預計不會因水動力變化而對水質造成負面影響，但部分易受水污染影響地方會輕微超出水質準則； ▪ 預計不會因機場西端形成內灣水域而對水質造成負面影響； ▪ 預計不會因污水排放而對水質造成	▪ 《環境影響評估程序的技術備忘錄》附件 6 及 14 ▪ 《水污染管制條例》 ▪ 西北部水質管制區水質指標 ▪ 西北部附水質管制區水質指標 ▪ 后海灣水質管制區水質指標	預測在以下地點，下列參數將會輕微超出準則： 懸浮固體 *（每月水深平均值）* C3 – 最多每公升 12.0 毫克 C5 – 最多每公升 13.2 毫克 C6 – 最多每公升 14.9 毫克	▪ 連接小濠灣污水處理廠的污水處理網絡，以進行污水處理； ▪ 再用經處理的廢水，以減低污水排放及食水用量； ▪ 將海底航油管道置於海床岩石下，避免海上船隻及洩漏航油可能造成	▪ 根據《水污染管制條例》的規定在排放廢水前處理廢水； ▪ 根據《廢物處置（化學廢物）（一般）規例》及《包裝、標識及存放化學廢物的工作守則》處理化學廢物；	預計不會產生負面的剩餘影響。

[18] 保守假設是基於相關同期進行的工程項目可容許的最高峰懸浮固體排放量，但根據所得資料顯示，過往實際的排放量遠低可容許的最高排放量。

評估點	評估結果	相關標準／準則	估計超標程度	考慮的避免措施	建議的緩解措施	剩餘影響
	負面影響； ▪ 預計不會因已使用的冷卻水排放而對水質造成負面影響； ▪ 預計不會因雨水排放而對水質造成負面影響； ▪ 實行建議的設計方案後，預計不會因再用廢水而對水質造成負面影響； ▪ 實施建議的設計及應變方案後，預計不會因燃料意外溢漏而對水質造成負面影響；及 ▪ 無須對機場北面通航水域進行維護性疏浚。	▪ 西部緩衝區水質管制區水質指標 ▪ 水務署的沖廁水進水口水質準則 ▪ 冷卻水排放準則（例如美國環境保護局的連續濃度基準及 Ma *et al.* 進行的生態毒理學研究（1998年））	總無機氮 *（年度水深平均值）* C1 - 最多每公升 0.62 毫克 C9 - 最多每公升 1.05 毫克 E1 - 最多每公升 3.61 毫克 非離子氨 *（年度水深平均值）* C9 - 最多每公升 0.026 毫克 E1 - 最多每公升 0.134 毫克 雖然預測到會超出準則，但評估結果顯示超出準則並非因進行工程項目所致， 而是因為高背景水平。	的破壞； ▪ 妥善設計拓地方案，避免拓地範圍及附近水域的水動力出現重大變化；及 ▪ 只限合資格及曾接受訓練的人員操作燃料供應及加油系統。	▪ 安裝及維修路邊集水溝，以隔開及沖走雨水中的淤泥及砂粒； ▪ 在雨水渠安裝及維修集油器； ▪ 收集清洗飛機及車輛時產生的徑流，並將其排放到污水渠或分流到臨時貯存設施，以便在工地範圍以外處理； ▪ 航油管道及消防栓系統的設計應具備適當的保護功能，並設有壓力／洩漏探測系統； ▪ 於停機坪及停機位範圍安裝「防漏系統」；及 ▪ 實行緊急應變計劃，以應付溢漏事故。	
污水收集及處理影響－施工階段						
請參閱「水質影響－施工階段」的相關部分						
污水收集及處理影響－營運階段						
▪ 由機場排水井至東涌污水泵房的引力污水渠 ▪ 東涌污水泵房 ▪ 由東涌污水泵房至小濠灣污水處理廠的污水泵喉 ▪ 小濠灣污水處理廠	▪ 由機場排水井至東涌污水泵房的現有引力污水渠處理容量，將於 2027 年年底前達到飽和 ▪ 東涌污水泵房的處理量將會在 2023 年超出其泵送能力 ▪ 由東涌污水泵房至小濠灣污水處理廠的污水泵喉不會受到負面影響 ▪ 小濠灣污水處理廠的每日處理能力不會受到負面影響 ▪ 從 2026 年起，小濠灣污水處理廠的處理量將會超出其最高流量處理能力	▪ 環保署發表的《Guidelines for Estimating Sewage Flows for Sewage Infrastructure Planning》1.0 版 ▪ 渠務署發表的《Sewerage Manual》第一部分	不適用	不適用	▪ 三跑道系統的污水收集系統根據渠務署發布的所有相關標準及指引設計、操作及維修。除現有的污水氣味管理措施外，機管局會為三跑道系統的污水收集系統增設硫化氫監測及其他措施，以更有效避免污水發出氣味。 ▪ 機管局同意於 2026 年年底前就受影響的引力污水渠實行及完成改善工程（在處理容量達到飽和前可有約一年的緩衝期），而規劃工作於 2022 年展開（假設規劃需時一年，設計及建造需時三年）。機管局為工程項目進行環境監察及審核時，亦應監察污水量增長情況，並於 2022 年或在受影響引力污水渠的污水流量超出污水渠設計容量的 80%時（以兩者較早發生者為準），開始規劃改善工程，以確保在污水量超出污水渠設計處理容量前，適時完成緩解工程。 ▪ 渠務署現正進行協議編號 CE6/2012 的政府工程，以勘測研究、設計及建造東涌污水泵房至小濠灣污水處理廠的額外污水泵喉，這項工程會提高污水收集系統運作的可靠性。工程計劃於 2015 年開始施工，並於 2022 年年底完成。東涌污水泵房按協議編號 CE6/2012 完成後，足以應付工程項目所產生的最高設計污水流量[19]。 ▪ 環保署將會監察污水流量增長情況，並在必要時適當協調小濠灣污水處理廠的所需改善工程。	預計不會有負面的剩餘影響。

[19]環保署已同意在東涌污水泵房保留每天 43,500 立方米的流量（平均旱季流量），以處理經擴建機場排出的總污水量；而機管局將會與環保署及渠務署緊密聯繫，以確保工程項目與東涌污水泵房的改善工程在時間上能夠有效 配合。

評估點	評估結果	相關標準／準則	估計超標程度	考慮的避免措施	建議的緩解措施	剩餘影響
廢物管理影響－施工階段						
工程項目範圍	▪ 在現有機場島／建議拓地範圍進行挖掘、打樁及拆卸工程，以及以定向鑽挖法將現有海底管道改道，將產生約 9,543,500 立方米（原地廢物量）惰性拆建物料； ▪ 高爾夫球場場地清理、二號客運大樓擴建的拆卸工程，以及各種上層建築物建築工程將產生約 96,200 立方米（原地廢物量）的非惰性拆建物料； ▪ 安裝電纜接口範圍的挖掘工程將產生約 10,200 立方米（原地廢物量）的海泥； ▪ 建造各種隧道、設施、建築物及旅客捷運系統車廠的地基／打樁／挖掘工程將產生約 767,660 立方米（原地廢物量）的海泥； ▪ 施工機械及設備的保養及檢修產生的少量化學廢物； ▪ 建築工人每天產生最高達 9,100 公斤的一般垃圾；及 ▪ 每年從新建海堤收集到的漂流垃圾約 65 立方米。	▪ 《環境影響評估程序的技術備忘錄》附件 7 及 15； ▪ 香港法例第 354 章《廢物處置條例》； ▪ 香港法例第 354C 章《廢物處置（化學廢物）（一般）規例》； ▪ 香港法例第 354N 章《廢物處置（建築廢物處置收費）規例》； ▪ 香港法例第 123 章《建築物條例》； ▪ 香港法例第 28 章《土地（雜項條文）條例》； ▪ 香港法例第 466 章《海上傾倒物料條例》；及 ▪ 香港法例第 132BK 章《公眾潔淨及防止妨擾規例》。	不適用	▪ 利用免挖方法進行地質改良，將完全避免大量挖走及處置任何疏浚物料； ▪ 大部分斜面海堤方案，將可重用現有北面海堤的護面岩石，以將產生的廢物減至最少； ▪ 優先使用其他同期進行的項目及政府公眾填料接收設施提供的合適填料； ▪ 在可行情況下將挖掘範圍減至最小，並最大限度地重用在工地範圍產生的惰性拆建物料，並審慎地規劃及制定相關建築工程（尤其是隧道工程）及施工計劃； ▪ 建造各種隧道、設施、建築物及旅客捷運系統車廠的地基／打樁／挖掘工程產生的所有海泥，經處理後將在工地範圍重用作回填物料，因而無須處置海泥； ▪ 以定向鑽挖法建造新管道將可避免挖掘海床；及 ▪ 使用水力噴注法敷設新電纜，將可避免產生及處置海泥。	▪ 實行良好工地措施，以及就拆建物料推行減少廢物措施 ▪ 在海上處置安裝電纜接口挖掘工程產生的海泥 ▪ 根據《包裝、標識及存放化學廢物的工作守則》處置化學廢物，以及在持牌化學廢物回收／處理廠處置化學廢物 ▪ 委聘信譽良好的持牌廢物回收商，在指定垃圾堆填區處置一般垃圾及漂流垃圾	預計不會有負面的剩餘影響。
廢物管理影響－營運階段						
工程項目範圍	▪ 機場客運廊、飛機機艙、客運大樓、辦公室、商業場所及各項機場基建設施在營運過程產生的一般垃圾，每年約 46,190 公噸； ▪ 保養、檢修及維修各種機電設備產生的化學廢物； ▪ 每年從新建人工海堤收集到的漂流垃圾約 65 立方米；及 ▪ 建議設立的廢水處理廠每天產生約 0.23 公噸脫水污泥	▪ 香港法例第 354 章《廢物處置條例》；及 ▪ 香港法例第 354C 章《廢物處置（化學廢物）（一般）規例》。	不適用	▪ 目前在機場實行的措施，是從一般垃圾中分揀可循環再造廢料（如硬紙板、紙張、金屬、塑料、玻璃瓶、廚餘等）循環再造，擴建後的機場亦應採取這項措施；及 ▪ 擴建後機場島的人工海堤已妥為設計，可避免海岸線形成的任何急彎或突然凹陷位置而容易積聚漂流垃圾。	▪ 委聘信譽良好的持牌廢物回收商每天收集一般垃圾，以及在指定垃圾堆填區處置一般垃圾 ▪ 根據《包裝、標識及存放化學廢物的工作守則》處置化學廢物，以及在持牌化學廢物回收／處理廠處置化學廢物 ▪ 定期清理在人工海堤積聚的漂流垃圾，以及在指定垃圾堆填區將漂流垃圾與一般垃圾一同處置 ▪ 委聘信譽良好的持牌廢物回收商，在指定垃圾堆填區處置貯存於密閉容器或吊斗中的脫水污泥	預計不會有負面的剩餘影響。
土地污染－施工階段						
工程項目內可能受污染的土地範圍	對可能受污染範圍的過去／現有土地用途進行土地污染評估，確定土地污染影響。 可能受污染土地範圍包括： ▪ 高爾夫球場場地 ▪ 二號客運大樓擴建範圍（地下及地面燃料貯存範圍及緊急發電裝置） ▪ 現有機場禁區設施（加油站及燃料貯存室）	▪ 《環境影響評估程序的技術備忘錄》附件 19 第 3 段； ▪ 《受污染土地的評估和整治指引》； ▪ 《按風險而釐定的土地污染整治標準的使用指引》；及 ▪ 《受污染土地勘察及整治實踐指南》。	不適用 （由於所有可能受污染土地範圍仍在運作中，因此所有取樣及測試工作須在這些範圍的工程施工前進行。）	不適用	▪ 如識別到土壤受到污染，應於工地範圍挖掘及處理；及 ▪ 應實施建議的環境緩解措施及安全措施、進度監控及／或確認取樣／測試工作。	預計不會有負面的剩餘影響。
土地污染－營運階段						
不適用	不適用	不適用	不適用	不適用	不適用	不適用
陸地生態影響－施工及營運階段						
大蠔河具特殊科學價值地點、磡頭灘	在施工及營運階段對研究範圍內的陸	▪ 《環境影響評估程序的技術備忘	不適用	不適用	不適用	無

評估點	評估結果	相關標準／準則	估計超標程度	考慮的避免措施	建議的緩解措施	剩餘影響
具特殊科學價值地點、龍鼓洲、白洲及沙洲具特殊科學價值地點； 就研究在拓地範圍及附近水域的鳥類活動，對現有機場島北面公海進行評估； 以深屈灣到大蠔灣的北大嶼山海岸線起計 500 米內的所有陸地範圍；及 沙洲及龍鼓洲海岸公園邊界範圍內的所有陸地範圍。	地生境、植物及動物物種的影響屬低或微不足道	錄》附件 8 及 16。				
沙洲鷺鳥林	沙洲鷺鳥林：航油管道安裝工程將會造成中等程度的影響，但在營運階段將不會有影響	▪ 《環境影響評估程序的技術備忘錄》，特別是附件 8 及 16。	不適用	▪ 避免對鷺鳥林造成直接影響－管道鑽孔出土位置應設於鷺鳥林範圍外 ▪ 應避免於夜間及鷺鳥繁殖季節（即 4 月至 7 月）在上沙洲施工	▪ 保護築巢植物－保護鷺鳥築巢的植物。	無
海洋生態影響－施工及營運階段						
礮頭灘具特殊科學價值地點、沙洲及龍鼓洲海岸公園、計劃中的大小磨刀海岸公園、擬議的西南大嶼山海岸公園、潮間帶、潮下帶硬底生境、潮下帶軟底生境，以及開放水域生境	進行拓地及相關工程造成的暫時／永久生境損失： ▪ 對潮間及潮下帶硬底生境的影響程度屬低中程度； ▪ 對開放水域生境的影響程度屬中等； ▪ 對沙洲及龍鼓洲海岸公園岩岸的影響程度屬低； ▪ 對潮下帶軟底生境的影響程度屬不顯著至中等； ▪ 對沙洲附近的開放水域及三跑道系統兩端及西北面水域的影響程度屬不顯著 失去承載能力及生境分裂、物種分布、數量及使用生境的模式轉變： ▪ 影響程度屬低 排放懸浮固體及相關的水質改變： ▪ 對珊瑚的影響程度屬低至中等 ▪ 對其他生境影響程度屬不顯著至低 從孔隙水釋出污染物、油／化學品溢漏、水動力改變、與水動力改變相關的水質改變、因水質變差而間接干擾生境： ▪ 影響程度屬不顯著至低 輸入及運送海洋填料及填土工程、打樁工程及相關水底噪音： ▪ 影響程度屬於低 海水進水口產生的水流、飛機噪音對海洋動物產生的間接干擾： ▪ 影響程度屬不顯著至低	▪ 《環境影響評估程序的技術備忘錄》附件 8 及 16 ▪ 《水污染管制條例》 ▪ 西北部水質管制區水質指標 ▪ 西北部附水質管制區水質指標 ▪ 后海灣水質管制區水質指標 ▪ 西部緩衝區水質管制區水質指標 ▪ 珊瑚的沉積物沉降及懸浮固體準則、「珊瑚礁區域污染管制標準及準則」	預計不會超標	上文詳列關於水質方面的相關免受影響措施	▪ 拓地範圍減至最少 ▪ 採用最低風險／干擾的施工方法 ▪ 考慮風險／干擾最低的其他管道改道走線 ▪ 考慮在進行改道工程後以其他方法處理現有管道 ▪ 嚴格執行不傾倒政策 ▪ 實施良好工地措施 ▪ 上文詳列施工及營運階段的相關水質緩解措施 ▪ 在施工階段前進行珊瑚潛水調查以檢視移植珊瑚物種的可能性 ▪ 溢漏應變計劃 ▪ 建議設立面積約 2,400 公頃的新海岸公園，將計劃中的大小磨刀海岸公園與現有沙洲及龍鼓洲海岸公園連結起來[20]	預計不會有負面的剩餘影響。
機場島北面、沙洲附近、以及機場及沙洲之間海域的中華白海豚棲息地	進行拓地及相關工程對海豚棲息地造成的暫時／永久損失： ▪ 對機場島北面海洋水域的影響程度	▪ 《環境影響評估程序的技術備忘錄》附件 8 及 16； ▪ 《水污染管制條例》	不適用	上文詳列關於水質方面的相關免受影響措施	▪ 上文詳列施工及營運階段的相關水質緩解措施 ▪ 對躉船上的建築設備採取隔音措施	預計不會有任何負面的剩餘影響。

[20]除了建議的緩解措施外，亦建議採取多項環境提升措施，包括敷設人工魚礁、在部分海堤採用改善生態環境的設計、制訂海洋研究計劃以支持保護海洋生態、推廣環保教育與生態旅遊，以及成立環保提升基金。

評估點	評估結果	相關標準／準則	估計超標程度	考慮的避免措施	建議的緩解措施	剩餘影響
	屬低至高 ▪ 對其他地點的影響程度屬不顯著 失去承載能力： ▪ 對海洋水域及中華白海豚棲息地的影響程度屬中等 生境分裂： ▪ 對海洋水域及中華白海豚棲息地的影響程度屬中等 損失中華白海豚來回游弋範圍以及中華白海豚核心棲息範圍之間的連繫： ▪ 對機場島北面來回游弋範圍的影響程度屬中等 暫時損失底棲生境使中華白海豚失去覓食資源： ▪ 對海洋水域的影響程度屬低 對中華白海豚來回游弋範圍及核心棲息範圍之間的連繫的干擾： ▪ 對現有機場島北面的來回游弋範圍的影響程度屬中等 物種分布、數量及棲息地使用情況的轉變： ▪ 影響程度屬中等 水質改變： ▪ 影響程度屬不顯著至低 輸入及運送海洋填料及填海工程對海洋生物的影響： ▪ 影響程度屬低 施工所增加的聲音干擾： ▪ 11 千伏海底電纜及航油管道改道造成的影響程度屬不顯著；進場燈及指點標的鑽孔打樁造成的影響程度屬低；一般施工造成的影響程度屬低至中等。 夜間施工所增加的干擾： ▪ 影響程度屬中等 船隻及渡輪交通量改變所增加的聲音干擾： ▪ 施工階段的影響程度屬低至中等；營運階段的影響程度屬中高 海上交通使中華白海豚受傷的風險／死亡率增加： ▪ 工程船隻的影響程度屬低；高速船的影響程度屬高。 海上交通使中華白海豚的游動模式改變： ▪ 施工階段的影響程度屬低至中等；營運階段的影響程度屬中至高 對海岸公園的功能及質素造成的干擾： ▪ 對沙洲及龍鼓洲海岸公園的影響程度屬低至中等；對擬議的西南大嶼山海岸公園的影響程度屬低；對計	▪ 西北部水質管制區水質指標 ▪ 西北部附水質管制區水質指標 ▪ 后海灣水質管制區水質指標 ▪ 西部緩衝區水質管制區水質指標 ▪ 珊瑚的沉積物沉降及懸浮固體準則、「珊瑚礁區域污染管制標準及準則」			▪ 設立海豚管制區 ▪ 鑽孔打樁工程避免在中華白海豚生育高峰期進行 ▪ 制定溢漏應變計劃 ▪ 限制工程船隻速度及訓練船長 ▪ 設立面積約 2,400 公頃的新海岸公園，將計劃中的大小磨刀海岸公園與現有沙洲及龍鼓洲海岸公園連結起來 ▪ 限制海天客運碼頭快船的船速及更改航道	

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	劃中的大小磨刀海岸公園的影響程度屬中等 因進行新拓地工程改變水動力流體及水質： ▪ 影響程度屬低 建議的新海岸公園及香港國際機場進口航道區擴展對中華白海豚的次級影響： ▪ 有正面的次級影響					
漁業影響－施工階段						
西北部水質管制區、西北部附水質管制區、后海灣水質管制區及西部緩衝區水質管制區	▪ 由開始施工起計直接損失捕魚區的影響程度屬低至中等。 ▪ 由開始施工起計直接損失漁業生境（及資源）的影響程度屬低至中等。 ▪ 因 11 千伏海底電纜及海底燃油管道改道而直接損失漁業生境（及資源）的影響程度屬不顯著。 ▪ 直接損失產卵及育幼場的影響程度屬低。 ▪ 水質變差的間接干擾影響程度屬不顯著至低。 ▪ 對水產養殖場的間接影響程度屬不顯著。 ▪ 對人工魚礁的間接影響程度屬低。 ▪ 對捕魚活動的影響程度屬低。 ▪ 與水底聲音有關的漁業資源干擾影響程度屬低。	▪ 《環境影響評估程序的技術備忘錄》附件 9 及 17 ▪ 《漁業保護條例》 ▪ 《海魚養殖條例》 ▪ 《海岸公園條例》	不適用	上文詳述有關水質方面的相關免受影響措施	▪ 上文詳述於施工階段的相關水質緩解措施 ▪ 拓地範圍減至最少 ▪ 採取風險／干擾最低的施工方法 ▪ 考慮風險／干擾最低的其他管道改道走線 ▪ 考慮在進行改道工程後以其他方法處理現有管道 ▪ 嚴格執行不傾倒政策 ▪ 實施良好工地措施	預計不會有負面的剩餘影響。
漁業影響－營運階段						
西北部水質管制區、西北部附水質管制區、后海灣水質管制區及西部緩衝區水質管制區	▪ 直接損失捕魚區的影響程度屬中等。 ▪ 對捕魚活動造成干擾的影響程度屬低。 ▪ 直接損失漁業生境（及資源）的影響程度屬中等。 ▪ 直接損失產卵及育幼場的影響程度屬低。 ▪ 對水動力及潮汐影響變化的影響程度屬低。 ▪ 因水質變差而間接干擾漁業生境的影響程度屬不顯著。 ▪ 海水進水口產生的水流的影響程度屬低。 ▪ 因飛機噪音造成間接干擾的影響程度屬不顯著。 ▪ 實行建議的新海岸公園及就工程項目擴展香港國際機場進口航道區後，對漁業資源的保育有正面影	▪ 《環境影響評估程序的技術備忘錄》附件 9 及 17 ▪ 《漁業保護條例》 ▪ 《海魚養殖條例》 ▪ 《海岸公園條例》	不適用	上文詳述有關水質方面的相關免受影響措施	▪ 上文詳述於營運階段的相關水質緩解措施 ▪ 建議設立面積約 2,400 公頃的新海岸公園，將現有／計劃中的海岸公園及擴大的香港國際機場進口航道區連結起來[21]	預計不會有負面的剩餘影響。

[21]除了建議的緩解措施外，亦建議實行多項提升漁業措施以進一步改善香港西面水域的漁業資源及支援漁業的可持續發展，包括在未來經擴大的香港國際機場進口航道區內部分海堤採用改善生態環境的設計，而擴大的香港國際機場進口航道區禁止船隻進入，包括漁船；考慮在適當位置敷設人工魚礁以吸引稚魚；實行提升漁業策略；以及成立漁業提升基金。

評估點	評估結果	相關標準／準則	估計超標程度	考慮的避免措施	建議的緩解措施	剩餘影響
	響，對捕魚活動的影響程度屬低。					
景觀及視覺影響－施工階段						
可能受工程項目影響的已識別景觀資源、具景觀特色的地方及易受視覺影響的地方／人士	在施工階段實行緩解措施後，預計所有景觀資源及具景觀特色的地方會因三跑道系統受到輕微或沒有實質的剩餘影響，或預期不會受到影響，但以下各項除外： ▪ 預計北大嶼山海岸水域及沿岸水域景觀會受到顯著的剩餘影響 ▪ 評估範圍內的路旁美化植物預計會受到中等程度的影響 在施工階段實行緩解措施後，預計所有易受視覺影響的地方／人士會因三跑道系統受到輕微或沒有實質的剩餘影響，或預計不會受到影響，但以下各項除外： ▪ 北大嶼山水域及龍鼓水道旅遊船隻的乘客／駕駛員以及沙洲島遊客預計將受到顯著的剩餘影響。 ▪ 東涌（包括東堤灣畔、海堤灣畔、映灣園、第 53 至 56 區）、沿屯門南面海岸、香港黃金海岸及小欖的居民；亞洲國際博覽館、香港天際萬豪酒店、香港國際機場客運大樓及富豪機場酒店的旅客／訪客；昂坪 360 纜車乘客；彌勒山、鳳凰山、大東山、北大嶼郊野公園、南大嶼郊野公園及觀景山的遠足人士，預計將受到中等程度的剩餘影響。 ▪ 暢榮路沿線的車輛及港鐵乘客／駕駛人士、商用飛機乘客、擬建的香港接線的使用者／駕駛人士以及北大嶼山水域及龍鼓水道的渡輪乘客，預計他們將受到中等程度的剩餘影響。	▪ 《環境影響評估程序的技術備忘錄》附件 3、10、11、18、20 及 21； ▪ 香港規劃標準與準則； ▪ 香港 2030 規劃遠景與策略最後報告； ▪ 香港具景觀價值地點研究； ▪ 《環境影響評估條例指南》第 8/2010 號； ▪ 《城市規劃條例》； ▪ 《林區及郊區條例》； ▪ 《郊野公園條例》； ▪ 《前濱及海床（填海工程）條例》； ▪ 《海岸公園條例》； ▪ 《保護瀕危動植物物種條例》； ▪ 赤鱲角分區計劃大綱核准圖（編號 S/I-CLK/12）； ▪ 東涌市中心地區分區計劃大綱核准圖（編號 S/I-TCTC/18）； ▪ 政府刊物（1991）《Tree Planting and Maintenance in Hong Kong》（跨部門景觀技術小組）[11-23]； ▪ 土力工程處刊物（第 1/2009 號）—《Prescriptive Measures for Man-made Slopes and Retaining Walls》； ▪ 土力工程處第 1/2011 號—《Technical Guidelines on Landscape Treatment for Slopes Land Administration Office Instruction》(LAOI) D-12 節-Tree Preservation； ▪ 地政總署作業備考第 7/2007 號－《Tree Preservation and Tree Removal Application for Building Development in Private Projects》； ▪ 發展局技術通告（工務）第 2/2012 號《Allocation of Space for Quality Greening on Roads》； ▪ 發展局技術通告（工務）第 3/2012 號《Site Coverage of Greenery for Government Building Projects》； ▪ 發展局技術通告（工務）第 2/2013 號《Greening on Footbridges and Flyovers》； ▪ 環境運輸及工務局技術通告（工務）第 2/2004 號－《Maintenance of Vegetation and Hard Landscape Features》；	不適用	▪ 施工範圍及承建商臨時工作範圍應縮至最小，以避免對附近景觀造成影響； ▪ 在可行情況下將施工期縮至最短； ▪ 遮蓋所有燈光及將夜間施工時間縮至最短，以控制夜間燈光；及 ▪ 施工期間須小心保護所有現有樹木。	▪ 分階段施工，以減低在施工階段造成的視覺影響； ▪ 在可行情況下保持最少的建築交通量（陸地及海上），包括施工機械、工程船隻及躉船； ▪ 在工地豎立顏色不顯眼的裝飾網屏幕或施工圍板； ▪ 在可行情況下將不能避免受工程影響的樹木移植； ▪ 避免設置過高或過大的建築物及結構物；及 ▪ 拓地工程後在可行情況下盡快在滑行道及跑道周圍進行前期噴草。	根據相關的評估影響的準則及指引，在實行緩解措施後，工程項目的景觀及視覺整體剩餘影響大致上可接受。

評估點	評估結果	相關標準／準則	估計超標程度	考慮的避免措施	建議的緩解措施	剩餘影響
		▪ 環境運輸及工務局技術通告（工務）第 29/2004 號－《Registration of Old and Valuable Trees, and Guidelines for their Preservation》； ▪ 環境運輸及工務局技術通告（工務）第 36/2004 號－《The Advisory Committee on the Appearance of Bridges and Associated Structures (ACABAS)》； ▪ 環境運輸及工務局技術通告（工務）第 5/2005 號－《Protection of Natural Streams/Rivers from Adverse Impacts Arising from Construction Works》； ▪ 環境運輸及工務局技術通告（工務）第 10/2013 號－《Tree Preservation》； ▪ 工務科技術通告第 25/93 號－《Control of Visual Impact of Slopes》； ▪ 工務局技術通告第 17/2000 號－《Improvement to the Appearance of slopes》（與工務科技術通告第 25/93 號相關）； ▪ 工務局技術通告第 7/2002 號－《Tree Planting in Public Works》； ▪ 發展局綠化、園境及樹木管理組發行的《Latest Proper Planting Practices and other relevant guidelines》；及 ▪ 最新的香港國際機場獲批准植物物種列表。				
景觀及視覺影響－營運階段						
可能受工程項目影響的已識別景觀資源、具景觀特色的地方及易受視覺影響的地方／人士	在營運階段實行緩解措施後，預計所有景觀資源及具景觀特色的地方會因三跑道系統而受到輕微或沒有實質的剩餘影響，或預計不會受到影響，但以下各項除外： ▪ 北大嶼山海岸水域及沿岸水域景觀在營運階段仍受到顯著的影響 在營運階段實行緩解措施後，預計所有易受視覺影響地方／人士會因三跑道系統受到輕微或沒有實質的剩餘影響，或預計不會受到影響，但以下各項除外： ▪ 預計北大嶼山水域及龍鼓水道旅遊船隻的乘客／駕駛員及沙洲島遊客會受到中等程度的剩餘影響	與施工階段所列者相同。	不適用	妥善設定照明裝置的朝向，將不必要的透光及眩光減至最少。	▪ 拓地邊緣合適的景觀設計； ▪ 須適當設計所有地上結構物，包括通風井、緊急及消防通道等； ▪ 適當設計建築物及結構物的比例、高度及體積（視覺重量）； ▪ 在建成的結構物中使用適當的建築物料及顏色，以營造整體一致的視覺效果； ▪ 實行綠化措施，包括垂直綠化、綠化樓頂、路邊種植及外圍屏障種植； ▪ 就所有砍伐的樹木提供獲相關政府部門同意的補償植樹計劃； ▪ 適當設計街景（例如：路面鋪砌、指示牌、街道設施、燈光照明等）； ▪ 修復在施工期間受影響的所有街景範圍以及硬景及園景範圍至原貌或更佳質素（進行屏障種植、路邊種植等）；	根據相關的評估影響準則及指引，在實行緩解措施後，工程項目的景觀及視覺整體剩餘影響大致上可接受。

評估點	評估結果	相關標準／準則	估計超標程度	考慮的避免措施	建議的緩解措施	剩餘影響
					▪ 在高架道路結構進行美化種植；及 ▪ 適當設計行人天橋、隔音屏障及密封式隔音罩，加入綠化（屏障種植／攀緣植物／花槽）及色彩美化措施；	
文化遺產影響－施工階段						
海洋考古評估範圍內的文化遺產及陸地文化遺產 500 米評估範圍內的區域	預測並無影響	文化遺產影響評估的指引 海洋考古調查指引	無	不適用	無需任何措施	不適用
文化遺產影響－營運階段						
海洋考古評估範圍內的文化遺產及陸地文化遺產 500 米評估範圍內的區域	預測並無影響	文化遺產影響評估的指引 海洋考古調查指引	無	不適用	無需任何措施	不適用
健康影響－空中排放						
五公里評估範圍內對人類的影響	因接觸毒性空氣污染物的急性及慢性受影響程度符合有關國際準則值。由毒性空氣污染物導致的致癌風險預測最高增加約 1.14×10^{-5}，屬可接受水平。就空氣質素指標表列的污染物而言，估計由於短期接觸而引致入院及早逝的風險相對地小。因長期接觸而引致早逝的風險亦相對地小。	▪ 國際準則值（如世界衞生組織、IRIS、環境健康危險評估辦公室等） ▪ 健康風險／影響評估指引（如世界衞生組織）	不適用	在營運階段就減低潛在空氣質素影響採取的措施	在營運階段就緩解潛在空氣質素影響採取的措施	不適用
健康影響－飛機噪音						
鄰近飛機噪音預測等量線 25 的人口稠密地區	相對沒有三跑道系統運作的情況的受影響人數變化： ▪ 煩擾：減少約 10% ▪ 睡眠影響：減少約 50%	健康風險／影響評估指引（如世界衞生組織及歐洲環境署）	不適用	減低潛在飛機噪音影響相關的措施	緩解潛在飛機噪音影響相關的措施	不適用

6. 環境監察及審核

6.1.1.1 將會推行環境監察及審核計劃，以審查建議的緩解措施成效及符合相關法例法規的情況。環境監察及審核工作的詳情，載於為工程項目獨立編製的《環境監察及審核手冊》，環境監察及審核的具體規定概述如下：

6.1.1.2 空氣

- 監察施工階段的總懸浮粒子。
- 機管局已定期監察機場島的室外及室內空氣質素，因此在營運階段無須額外進行空氣質素監察工作。

6.1.1.3 生命危害

- 定期檢查，以確保有助減低飛機加油運作相關風險的措施得以妥善進行。

6.1.1.4 噪音

- 為管理飛機噪音，定期審閱飛機噪音相關運作數據，並繼續與社區聯繫。
- 在項目營運前，對香港國際機場內的主要固定設備及飛機引擎起動測試設施的隔音罩進行噪音水平測試。
- 在施工期間監察噪音水平。

6.1.1.5 水質

- 在海事建築工程期間監察水質（包括對深層水泥拌合進行特定監察）。
- 在所有海事建築工程完成後，進行完工後監測。
- 在廢水處理設施投入運作時進行水質監測。

6.1.1.6 污水

- 定期為工程項目監察污水量增長情況，確保在污水量超出污水渠設計容量前，及時完成受影響引力污水渠的緩解工程。
- 就三跑道系統的污水收集系統進行硫化氫監測工作，以確保不會造成由污水氣味帶來的負面影響。

6.1.1.7 廢物

- 定期巡查工地，以確定落實廢物管理計劃。
- 定期沿人工海堤巡查，以檢查海堤有否積聚漂流垃圾。

6.1.1.8 土地污染

- 定期審核處理或貯存化學物及化學廢物的所有相關程序及設施。

6.1.1.9 陸地生態

- 在鷺鳥繁殖季節對沙洲鷺鳥林進行施工前調查。

6.1.1.10 海洋生態

- 進行基線、施工、完工後及營運階段監察，包括海豚監察（船上樣條線、陸上經緯儀追蹤及靜態聲音監測）。
- 在機場島北面及東北面的人工海堤及建議的沙洲鑽孔出土位置進行施工前珊瑚潛水調查。

6.1.1.11 漁業

- 建議的水質監察計劃將包括對漁業重要的地點，並會反映水質緩解措施的執行情況，包括其對減低漁業影響的有效性，因此無須針對漁業的影響進行監察工作。

6.1.1.12 景觀及視覺

- 在施工及營運階段，檢查景觀及視覺緩解措施的實行情況。

7. 結論

7.1.1.1 機場的發展需要每五年檢討一次，作為持續總體規劃過程的一部分，在《2030 規劃大綱》研究過程中已進行多項可行性研究，確定了現有機場的擴建需要，以應付直至 2030 年的預測航空交通需求量。隨後進行了一系列工程研究、環境評估及公眾參與活動，以評估各個方案，並制訂最可取的機場布局方案。這些研究結果及持份者參與活動收集的意見已按情況納入環評研究中。

7.1.1.2 根據在《2030 規劃大綱》階段進行的工程及環境評估，以及其後的環評研究，機管局已承諾實行數項主要設計、施工及運作措施，以消除或大大減低工程項目的部分環境影響，包括對海洋生態、水質、空氣質素、噪音及健康事宜的影響。然而，即使實行這些設計及規劃策略，工程項目仍然會對環境造成影響，而有關影響已在環評中進行全面及科學化的評估，並建議有效及可行的緩解措施，將潛在影響減至最少。

7.1.1.3 根據環評研究概要及《環境影響評估程序的技術備忘錄》的相關要求，環評研究已識別及評估工程項目施工及營運可能造成的潛在環境影響。各技術評估結果的概要載於**表 7.1**。

表 7.1： 環評研究結果概要

環境範疇	施工階段		營運階段	
	沒有緩解措施	有緩解措施	沒有緩解措施	有緩解措施
空氣質素	若干影響	可接受	可接受	不適用
生命危害	可接受	不適用	若干影響	合理而實際可行情況下可承擔的最低風險
噪音	若干影響	可接受	若干影響	可接受
水質	若干影響	可接受	可接受	不適用
污水收集及處理	不適用	不適用	若干影響	可接受
廢物	若干影響	可接受	若干影響	可接受
土地污染	潛在影響	可接受	不適用	不適用
陸地生態	若干影響	可接受	可接受	不適用
海洋生態	若干影響	可接受	若干影響	可接受
漁業	若干影響	可接受	若干影響	可接受
景觀及視覺	若干影響	可接受	若干影響	可接受
文化遺產	可接受	不適用	可接受	不適用
健康	不適用	不適用	若干影響	可接受

7.1.1.4 根據各項評估的結果，環評研究的結論認為工程項目在環境考慮方面屬可接受，並符合相關環境法例及標準。透過實行建議的環境緩解措施，預計工程項目不會造成不可接受的負面剩餘影響。全面的環境監察及審核計劃將予實施，以檢查緩解措施的實行及符合環保法規的情況。

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最可取機場布局方案

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擴建香港國際機場成為三跑道系統

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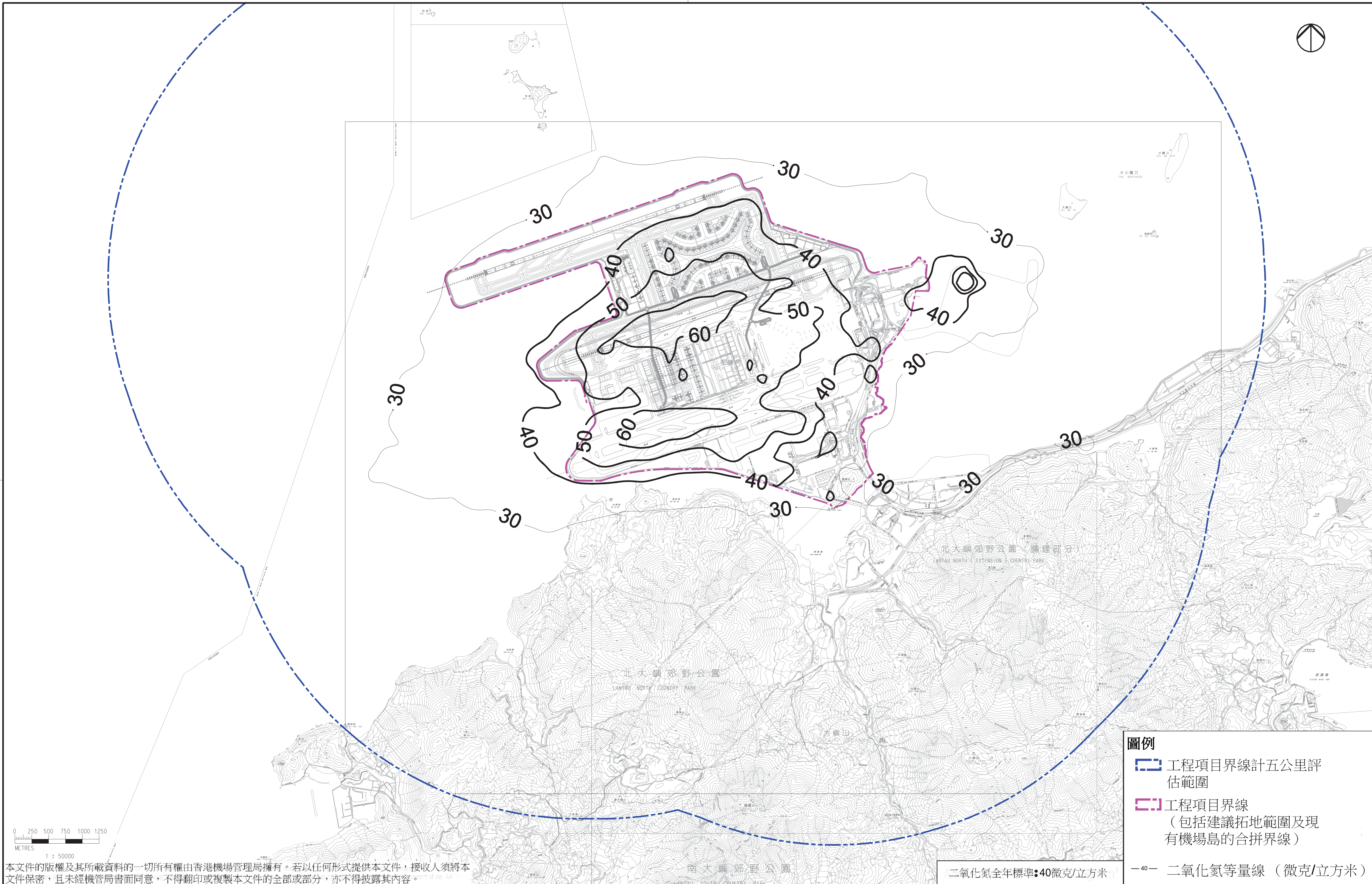

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2031年二氧化氮在地面1.5米上的累積年均濃度等量線（機場島及東涌範圍）

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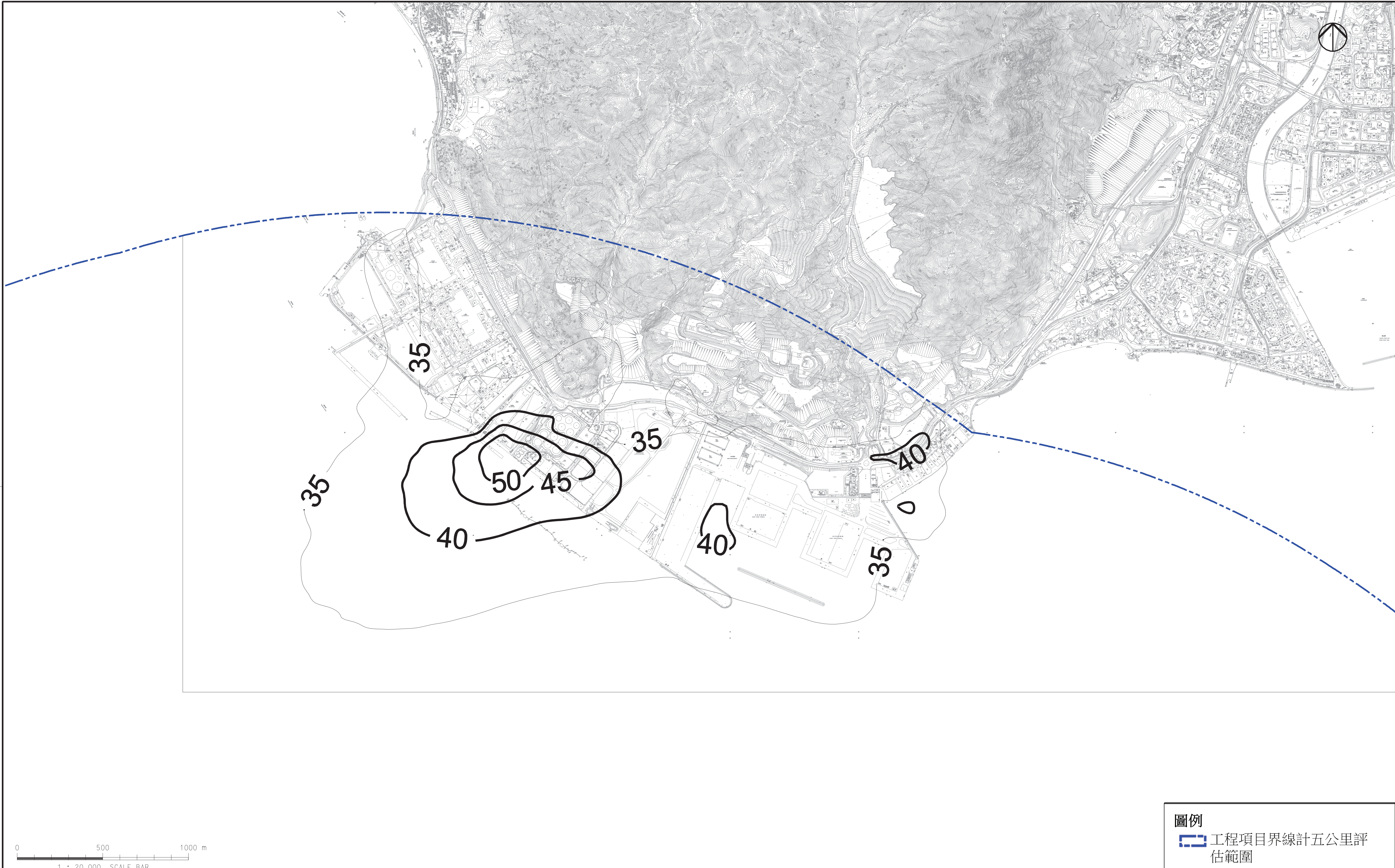

二氧化氮全年標準：40微克/立方米

圖例

工程項目界線計五公里評估範圍

—40— 二氧化氮等量線（微克/立方米）

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2031年二氧化氮在地面1.5米上的累積年均濃度等量線（屯門範圍）

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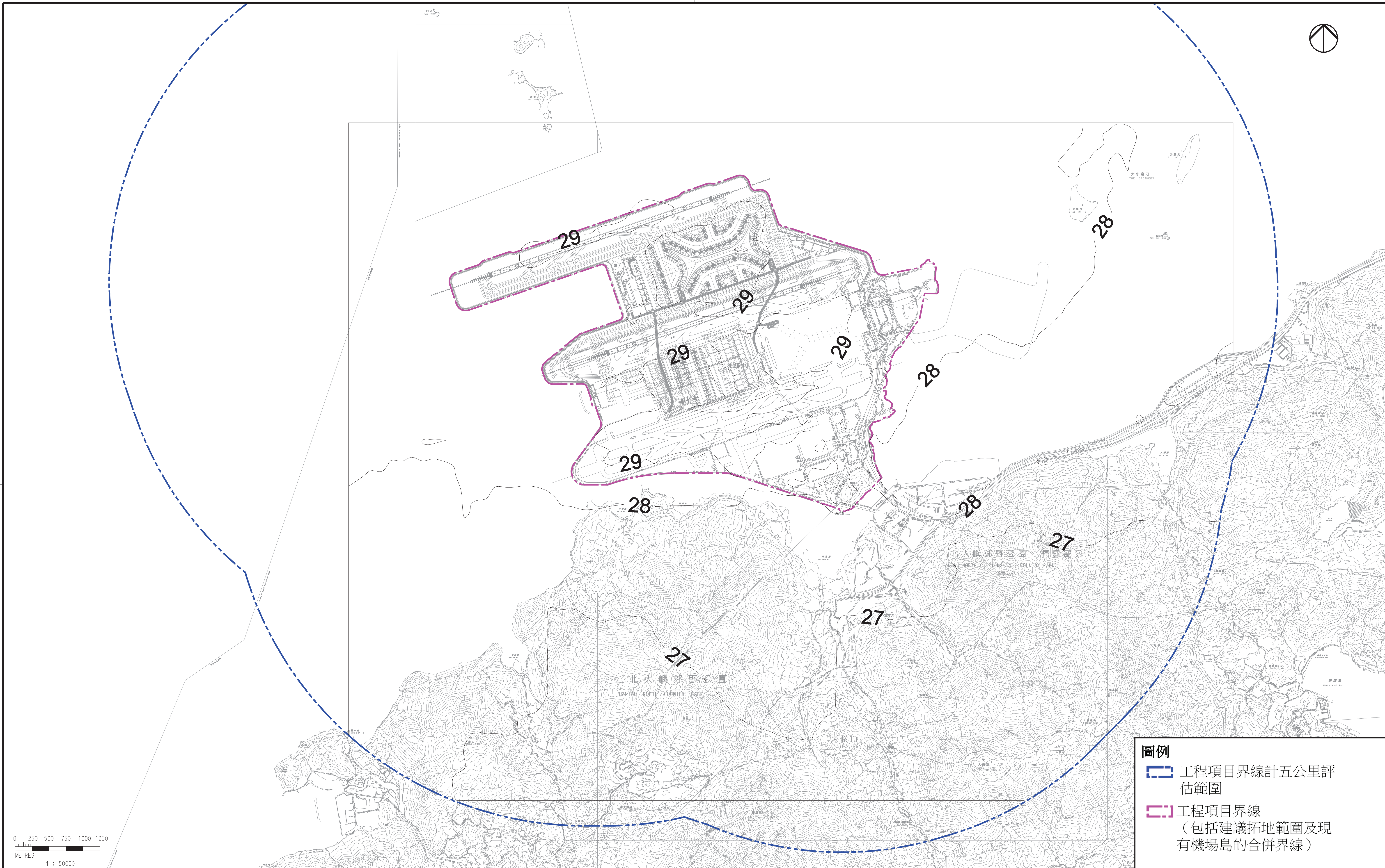

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2031年微細懸浮粒子在地面1.5米上的累積年均濃度等量線（機場島及東涌範圍）

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Filename: G:\env\project\226428\13 Drawing Deliverables\13 EIA Chapter\Revised Final Draft EIA\MCL_P132_EIA_5-3-022 - Contours of Cumulative Annual FSP Concentrations at 1.5m above Ground during Operational Phase (Lantau Area).dgn

0 500 1000 m

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圖例

工程項目界線計五公里評估範圍

—40— 微細懸浮粒子等量線 (微克/立方米)

微細懸浮粒子全年標準: 35 微克/立方米

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2031年微細懸浮粒子在地面1.5米上的累積年均濃度等量線 (屯門範圍)

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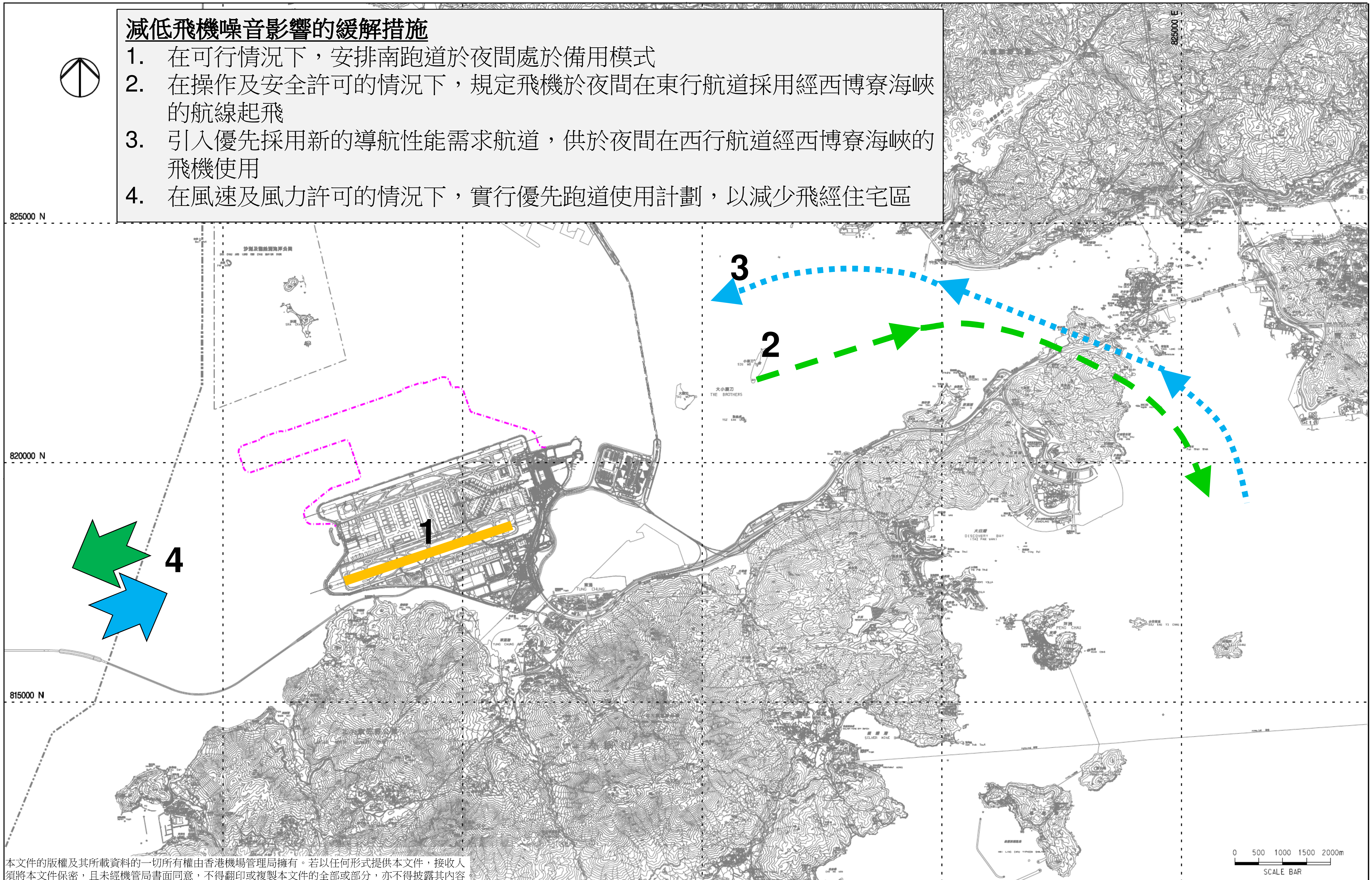
Filename: G:\env\project\226428\13 Drawing Deliverables\13 EIA Chapter\Revised Final Draft EIA\MCL_P132_EIA_5-3-025 - Contours of Cumulative Annual FSP Concentrations at 1.5m above Ground during Operational Phase (Tuen Mun Area).dgn

減低飛機噪音影響的緩解措施

1. 在可行情況下，安排南跑道於夜間處於備用模式
2. 在操作及安全許可的情況下，規定飛機於夜間在東行航道採用經西博寮海峽的航線起飛
3. 引入優先採用新的導航性能需求航道，供於夜間在西行航道經西博寮海峽的飛機使用
4. 在風速及風力許可的情況下，實行優先跑道使用計劃，以減少飛經住宅區



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減低飛機噪音影響的緩解措施

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擴建香港國際機場成為三跑道系統

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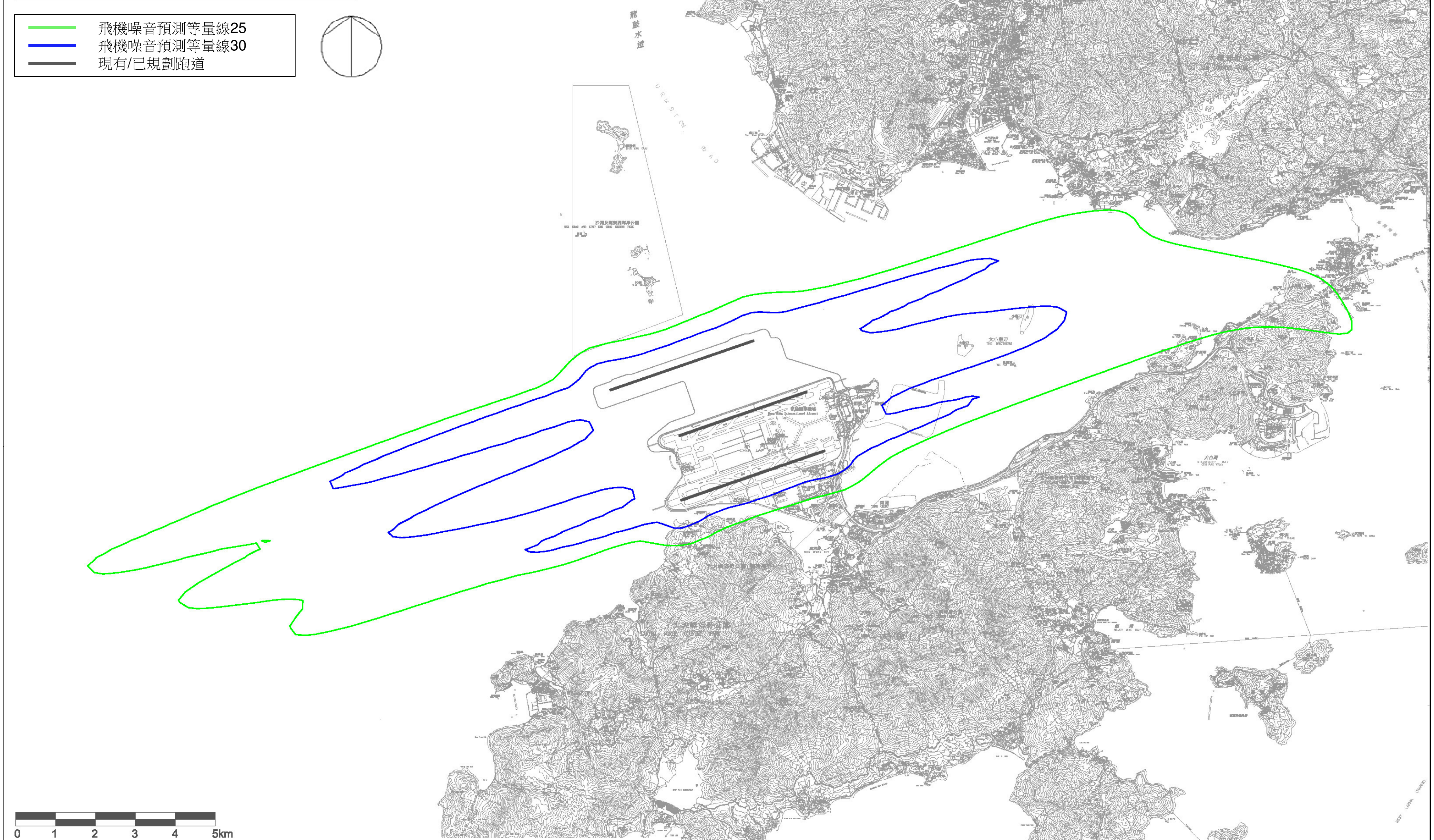
2030年飛機噪音預測等量線



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擴建香港國際機場成為三跑道系統

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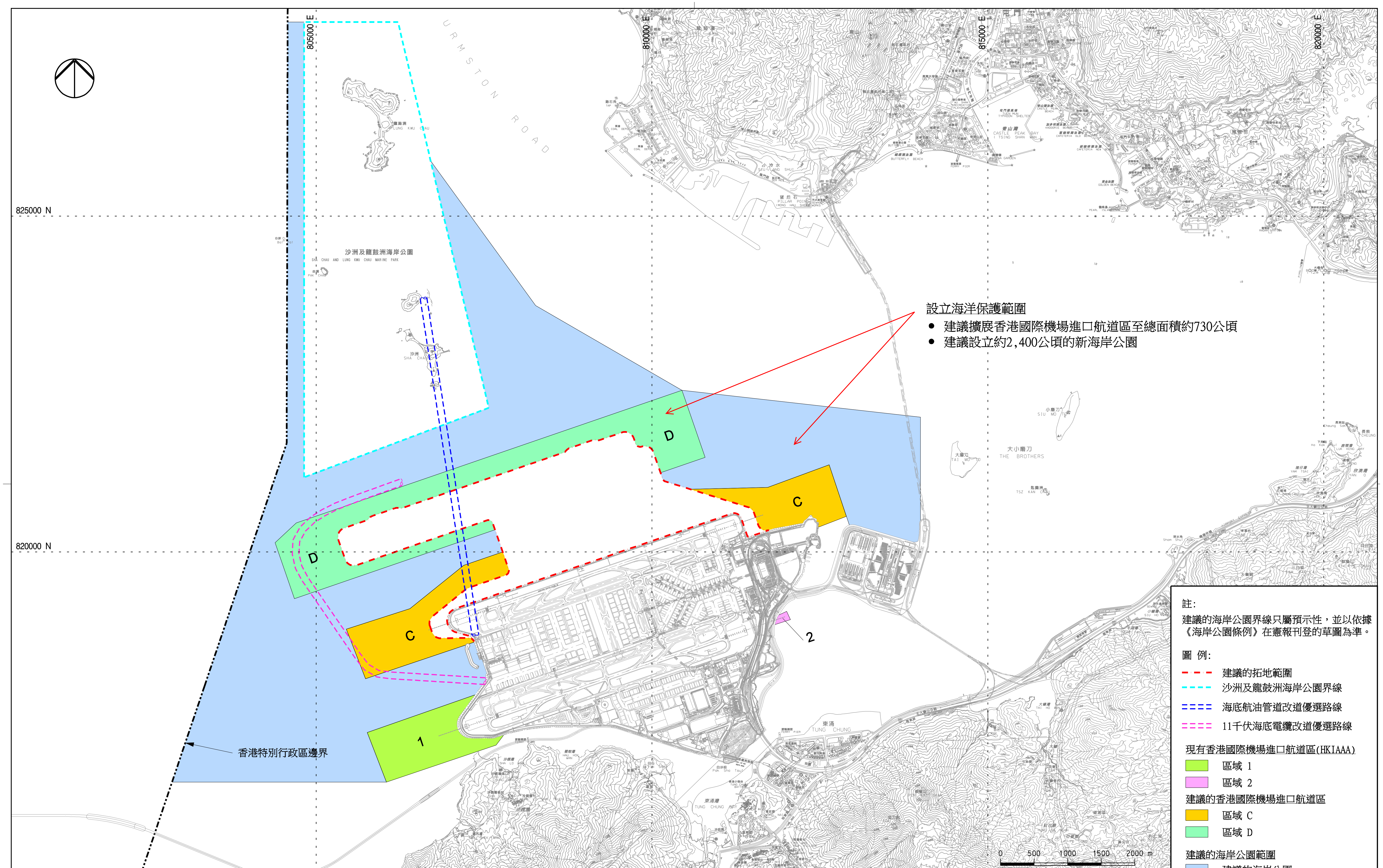

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建議的海岸公園及擬擴展的機場進口航道區

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擴建香港國際機場成為三跑道系統

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Expansion of Hong Kong International Airport into a Three-Runway System

Environmental Impact Assessment Report (Final)

Volume 1 – Main Text

June 2014

Airport Authority Hong Kong

Expansion of Hong Kong International Airport into a Three-Runway System

Environmental Impact Assessment Report (Final)

Main Text

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Airport Authority Hong Kong

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Drawing No. MCL/P132/EIA/5-2-058	Cumulative Result – Contour of Tier 1 Tenth Maximum Daily FSP Concentration (µg/m^3) at 1.5 m above Ground at Year 2021 during Construction Phase (Mitigated)
Drawing No. MCL/P132/EIA/5-2-059	Not used
Drawing No. MCL/P132/EIA/5-2-060	Not used
Drawing No. MCL/P132/EIA/5-2-061	Cumulative Result – Contour of Tier 2 Tenth Maximum Daily RSP Concentration (µg/m^3) at 1.5 m above Ground at Year 2018 during Construction Phase (Mitigated)
Drawing No. MCL/P132/EIA/5-2-062	Cumulative Result – Contour of Tier 2 Tenth Maximum Daily RSP Concentration (µg/m^3) at 1.5 m above Ground at Year 2021 during Construction Phase (Mitigated)
Drawing No. MCL/P132/EIA/5-2-063	Cumulative Result – Contour of Annual Average RSP Concentration (µg/m^3) at 1.5 m above Ground at Year 2018 during Construction Phase (Unmitigated)
Drawing No. MCL/P132/EIA/5-2-064	Cumulative Result – Contour of Annual Average RSP Concentration (µg/m^3) at 1.5 m above Ground at Year 2021 during Construction Phase (Unmitigated)
Drawing No. MCL/P132/EIA/5-2-065	Cumulative Result – Contour of Annual Average RSP Concentration (µg/m^3) at 1.5 m above Ground at Year 2018 during Construction Phase (Mitigated)
Drawing No. MCL/P132/EIA/5-2-066	Cumulative Result – Contour of Annual Average RSP Concentration (µg/m^3) at 1.5 m above Ground at Year 2021 during Construction Phase (Mitigated)
Drawing No. MCL/P132/EIA/5-2-067	Cumulative Result – Contour of Annual Average FSP Concentration (µg/m^3) at 1.5 m above Ground at Year 2018 during Construction Phase (Unmitigated)
Drawing No. MCL/P132/EIA/5-2-068	Cumulative Result – Contour of Annual Average FSP Concentration (µg/m^3) at 1.5 m above Ground at Year 2021 during Construction Phase (Unmitigated)
Drawing No. MCL/P132/EIA/5-2-069	Cumulative Result – Contour of Annual Average FSP Concentration (µg/m^3) at 1.5 m above Ground at Year 2018 during Construction Phase (Mitigated)
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Drawing No. MCL/P132/EIA/5-3-003	Locations of Operation Phase Air Sensitive Receivers (Lantau East)
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Drawing No. MCL/P132/EIA/12-010	Survey Transect for Other Terrestrial and Aquatic Fauna Surveys – Sham Wat
Drawing No. MCL/P132/EIA/12-011	Survey Transect for Other Terrestrial and Aquatic Fauna Surveys – Sha Lo Wan, Hau Hok Wan and San Tau
Drawing No. MCL/P132/EIA/12-012	Survey Transect for Other Terrestrial and Aquatic Fauna Surveys – Tung Chung Bay
Drawing No. MCL/P132/EIA/12-013	Survey Transect for Other Terrestrial and Aquatic Fauna Surveys – Scenic Hill
Drawing No. MCL/P132/EIA/12-014	Survey Transect for Other Terrestrial and Aquatic Fauna Surveys – Tai Ho
Drawing No. MCL/P132/EIA/12-015	Survey Transect for Other Terrestrial Survey – Sha Chau
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Drawing No. MCL/P132/EIA/12-016 a2	Boat Survey – Distribution of Different Bird Groups
Drawing No. MCL/P132/EIA/12-016 a3	Boat Survey – Distribution of All Birds in Different Seasons
Drawing No. MCL/P132/EIA/12-016 a4	Boat Survey – Distribution of Ardeids in Different Seasons
Drawing No. MCL/P132/EIA/12-016 a5	Boat Survey – Distribution of Landbirds in Different Seasons
Drawing No. MCL/P132/EIA/12-016 a6	Boat Survey – Distribution of Seabirds in Different Seasons
Drawing No. MCL/P132/EIA/12-016 a7	Boat Survey – Distribution of Waterbirds in Different Seasons
Drawing No. MCL/P132/EIA/12-016 a8	Boat Survey – Distribution of Black Kite
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Drawing No. MCL/P132/EIA/12-016 b1	Boat Survey – Flight Height of All Birds
Drawing No. MCL/P132/EIA/12-016 b2	Boat Survey – Flight Height of Ardeids
Drawing No. MCL/P132/EIA/12-016 b3	Boat Survey – Flight Height of Black Kite
Drawing No. MCL/P132/EIA/12-016 b4	Boat Survey – Flight Height of Landbirds
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Drawing No. MCL/P132/EIA/12-016 c1	Boat Survey – Behaviour of All Birds
Drawing No. MCL/P132/EIA/12-016 c2	Boat Survey – Behaviour of Ardeids
Drawing No. MCL/P132/EIA/12-016 c3	Boat Survey – Behaviour of Black Kite
Drawing No. MCL/P132/EIA/12-016 c4	Boat Survey – Behaviour of Seabirds
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Drawing No. MCL/P132/EIA/12-019	Floral Species of Conservation Interest – Sham Wat and San Shek Wan
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Drawing No. MCL/P132/EIA/12-024	Terrestrial Faunal Species of Conservation Interest Identified from Literature Review (Sha Chau and Tree Island)
Drawing No. MCL/P132/EIA/12-025a	Avifauna Species of Conservation Interest Identified from Literature Review (Sham Wat)
Drawing No. MCL/P132/EIA/12-025b	Terrestrial Faunal Species of Conservation Interest Identified from Literature Review (Sham Wat)
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Drawing No. MCL/P132/EIA/12-027b	Terrestrial Faunal Species of Conservation Interest Identified from Literature Review (San Shek Wan to Tung Chung Bay)
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Drawing No. MCL/P132/EIA/12-030	Avifauna Species of Conservation Interest Recorded during Ecological Field Survey (Sha Chau and Tree Island)
Drawing No. MCL/P132/EIA/12-031a	Avifauna Species of Conservation Interest Recorded during Ecological Field Survey (Sham Wat)
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Drawing No. MCL/P132/EIA/12-034a	Avifauna Species of Conservation Interest Recorded during Ecological Field Survey (Pak Mong to Tai Ho)
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Appendices

Abbreviations

2RS	Two-Runway System
3RS	Three-Runway System
AAB	Antiquities Advisory Board
AADT	Annual Average Daily Traffic
AAHK	Airport Authority Hong Kong
AAT	Asia Airfreight Terminal Co. Ltd.
ABT	Aichi Biodiversity Targets
AC	Alternating Current
ACABAS	The Advisory Committee on the Appearance of Bridges and Associated Structures
ACC	Apron Control Centre
ACDM	Airport Collaborative Decision Making
ACE	Advisory Council on the Environment
ACRP	Airport Cooperative Research Program
ADM	Arrivals only, Departures only, Mixed
ADWF	Average Dry Weather Flow
AEGL	Acute Exposure Guideline
AEL	Airport Express Line
AERMOD	AERMIC (American Meteorological Society / Environmental Protection Agency Regulatory Model Improvement Committee) model
AFCD	Agriculture, Fisheries and Conservation Department
AFFC	Airport Freight Forwarding Centre Co. Ltd.
AFRF	Aviation Fuel Receiving Facility
AFSC	Aviation Fuel Supply Company
AFTF	Aviation Fuel Tank Farm
AGL	Airfield Ground Light
AHR	Airport Height Restriction
AIP	Aeronautical Information Publication
AIR	Aerospace Information Report
AIS	APM Interchange Station Automatic Identification System (*referred in Chapter 13 only*)
ALARP	As Low As Reasonably Practicable
ALOFT-FT	A Large Outdoor Fire Plume Trajectory Model – Flat Terrain
AMO	Antiquities and Monuments Office
AMSL	Airport Management Services Ltd.
ANA	Aircraft Noise Assessment
ANL	Acceptable Noise Level
ANP	Aircraft Noise and Performance
AOM	Airport Operation Manual
AP	Authorised Person Attributable Proportion (*referred in Chapter 17 only*)
APCO	Air Pollution Control Ordinance
APM	Automated People Mover
APU	Auxiliary Power Unit
AQMS	Air Quality Monitoring Station
AQG	Air Quality Guideline
AQO	Air Quality Objective
AR	Artificial Reef
ARAS	Alternative Replacement Airport Site Study

ARD	Airport Related Development
ARP	Aerospace Recommended Practice
ASR	Air Sensitive Receiver Area Sensitivity Rating (*referred in Chapters 7 and 17 only*)
ASTI	Hong Kong Air Transport System Long Term Planning and Investigation Studies
ATC	Annual Traffic Census
ATCT	Air Traffic Control Tower
ATM	Air Traffic Movement
ATSDR	Agency for Toxic Substances and Disease Registry
AV	Acute Reference Dose-response Value
AWE	AsiaWorld-Expo
AWTC	Airport World Trade Centre
BAU	Business As Usual
BFFM2	Boeing Fuel Flow Method 2
BHS	Baggage Handling System
BMP	The Brothers Marine Park
BO	Buildings Ordinance
BOD	Biochemical Oxygen Demand
BOD_5	5-day Biochemical Oxygen Demand
C	Commercial
C&D	Construction and Demolition
C&DMMP	Construction and Demolition Material Management Plan
C&I	Commercial and Industrial
CAD	Civil Aviation Department
CalEPA / CEPA	California Environmental Protection Agency
CALINE4	California Line Source Dispersion Model, version 4
CAP	Contamination Assessment Plan
CAR	Contamination Assessment Report
CARB	California Air Resources
CASL	China Aircraft Services Limited
CBA	Cost Benefit Analysis
CBD	United Nations Convention on Biological Diversity
CCC	Criterion Continuous Concentration
CCPC	Centre for Coastal Pollution and Conservation
CD	Chart Datum
CDA	Continuous Descent Approach Comprehensive Development Area (*referred in Chapter 15 only*)
CDSM	Cement Deep Soil Mixing
CEDD	Civil Engineering and Development Department
CEPT	Chemically Enhanced Primary Treatment
CFS	Centre of Food Safety
CHIA	Cultural Heritage Impact Assessment
CI	Compression Ignition
CIQ	Custom, Immigration and Quarantine
CITES	The Convention on International Trade in Endangered Species of Wild Fauna and Flora
CKS	Chu Kong Shipping Enterprises (Group) Co. Ltd.
CLG	Community Liaison Group
CLP	CLP Power Hong Kong Ltd.
CMC	Criteria Maximum Concentration
CMP	Contaminated Mud Pit
CMRSPS	Chung Mun Road Sewage Pumping Station
CNAC	China National Aviation Corporation

CNL	Corrected Noise Level
CNP	Construction Noise Permit
CNS	Central Nervous System
CO	Carbon Monoxide
COC	Chemical of Concern
COD	Cause of Death
COPC	Chemical of Potential Concern
CPCS	Cathay Pacific Catering Services
CPPP	Castle Peak Power Plant
CPWMs	Circular Pollution Wind Mapping
CR	Concentration Response
CSM	Cutter Soil Mixing
CV	Coefficient of Variation
CWD	Chinese White Dolphin
CWP	Chemical Waste Producer
CYRSPS	Chung Yan Road Sewage Pumping Station
DALY	Disability-Adjusted Life Year
DASO	Dumping at Sea Ordinance
DBO	Design, Build and Operate
DC	Distance Attenuation
DCM	Deep Cement Mixing
DDT	Dichloro Diphenyl Trichloroethane
DEP	Director of Environmental Protection
DEVB	Development Bureau
DEZ	Dolphin Exclusion Zone
DG	Dangerous Goods
DGPS	Differential Global Positioning System
DJM	Deep Jet Mixing
DO	Dissolved Oxygen
DPM	Diesel Particulate Matter
DP	Designated Project
DSD	Drainage Services Department
DSM	Deep Soil Mixing
E&M	Electrical and Mechanical
EAR	Ecological Acoustic Recorder
EC	Elemental Carbon
ECAC	European Civil Aviation Conference
EDMS	Emission and Dispersion Modeling System
EEA	European Environment Agency
EEF	Environmental Enhancement Fund
EIA	Environmental Impact Assessment
EIAO	Environmental Impact Assessment Ordinance
EIAO-TM	Technical Memorandum on Environmental Impact Assessment Process issued under the Environmental Impact Assessment Ordinance
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
EM&A	Environmental Monitoring and Audit
EMFAC-HK	Emission Factors Hong Kong Model
EMSD	Electrical and Mechanical Services Department
END	Environmental Noise Directive
ENNAH	European Network on Noise and Health
EP	Environmental Permit
EPA	U.S. Environmental Protection Agency

EPD	Environmental Protection Department
EP_oN	Expert Panel on Noise
EPS	Expanded Polystyrene
ERUF	Engine Run-Up Facility
ESB	Emergency Stop Button
ESD	Emergency Shut-down
ET	Environmental Team
ETA	Event Tree Analysis
ETWB	Environment, Transport and Works Bureau
EU	European Union
EU EQS	European Union's Environmental Quality Standards
EV	Electric Vehicle
FAA	Federal Aviation Administration
FCZ	Fish Culture Zone
FDM	Fugitive Dust Model
FES	Fisheries Enhancement Strategy
FIUO	Factories and Industrial Undertakings Ordinance
FOA	First Order Approximation
FOCA	Federal Office of Civil Aviation
FOD	Foreign Object Debris
FSD	Fire Services Department
FSP	Fine Suspended Particulates ($PM_{2.5}$)
FTA	Fault Tree Analysis
G/IC	Government, Institutional or Community
GB	Green Belt
GDP	Gross Domestic Product
GEO	Geotechnical Engineering Office
GESF	Guidelines for Estimating Sewage Flows for Sewage Infrastructure Planning Version 1.0
GFA	Gross Floor Area
GFS	Government Flying Service
GI	Ground Investigation
GIC	Green Island Cement
GIS	Geographic Information System
GPS	Global Positioning System
GRPD	Greater Pearl River Delta
GSE	Ground Service Equipment
GTC	Ground Transportation Centre
GUFF	Global Unit Flow Factors
GW-TM	Technical Memoranda on Noise from Construction Work other than Percussive Piling
H_2S	Hydrogen Sulphide
HACTL	Hong Kong Air Cargo Terminal
HAECO	Hong Kong Aircraft Engineering Company Limited
HATS	Harbour Area Treatment Scheme
HAZID	Hazard Identification Workshop
HC	Hydrocarbon
HDD	Horizontal Directional Drilling
HGV	Heavy Goods Vehicle
HIA	Health Impact Assessment Heritage Impact Assessment (*referred in Chapter 16 only*)
HKBAC	Hong Kong Business Aviation Centre
HKBCF	Hong Kong Boundary Crossing Facilities
HKCRP	Hong Kong Cetaceans Research Project

HKD	Hong Kong Dollar
HKIA	Hong Kong International Airport
HKIAAA	Hong Kong International Airport Approach Area
HKIEd	Hong Kong Institute of Education
HKLR	Hong Kong Link Road
HKO	Hong Kong Observatory
HKOAMO	Hong Kong Observatory Airport Meteorological Office
HKPSG	Hong Kong Planning Standards and Guidelines
HKSAR	Hong Kong Special Administrative Region
HKU	The University of Hong Kong
HKUST	The Hong Kong University of Science and Technology
HSF	High Speed Ferry
HSR	Human Receptor
HyD	Highways Department
HZMB	Hong Kong – Zhuhai – Macao Bridge
IAC	Integrated Airport Control Centre
IAQ	Indoor Air Quality
IARC	International Agency for Research on Cancer
IATA	International Air Transport Association
ICAF	Implied Cost for Averting a Fatality
ICAO	International Civil Aviation Organization
ID	Intake-DALY
IEC	Independent Environmental Checker
Ifs	Influencing Factors
IHD	Ischaemic Heart Disease
IND	Intake-Incidence-DALY
IND-TM	Technical Memorandum for the Assessment of Noise from Places other than Domestic Premises, Public Places of Construction Sites
INM	Integrated Noise Model
IRIS	Integrated Risk Information System
ISO	International Organization for Standardization
ITT	Intermodal Transfer Terminus
IUCN	International Union for Conservation of Nature
IUR	Inhalation Unit Risk
IWMF	Integrated Waste Management Facilities
JWGSDEP	Joint Working Group on Sustainable Development and Environmental Protection
KFBG	Kadoorie Farm and Botanic Garden
KTCB	Kwai Tsing Container Basin
KTD	Kai Tak Development
LAOI	Land Administration Office Instruction
LAX	Los Angeles International Airport
LCA	Landscape Character Area
LCEL	Lower Chemical Exceedance Level
LCP	Concept Plan for Lantau
LCSD	Leisure and Cultural Services Department
LDPN	Land Department Practice Note
LDV	Light Duty Vehicle
LED	Light-emitting Diode
LFL	Lower Flammability Limit
LGV	Light Goods Vehicle
LIDAR	Light Detection and Ranging
LIS	Low Integrity Shipwrecks
LKC	Lung Kwu Chau

LLP	Lantau Logistics Park
LMOB	Lean Material Overboard
LOAEL	Lowest Observed Adverse Effect Level
LPG	Liquefied Petroleum Gas
LR	Landscape Resource
LTO	Landing and Take-off
LVIA	Landscape and Visual Impact Assessment
MAI	Marine Archaeological Investigation
MPA	Marine Protected Area
MBT	Monobutyltin
MCC3	Marginally Compliant Chapter 3
MD	Marine Department
MDF	New Contaminated Mud Marine Disposal Facility at HKIA East/ East Sha Chau Area
MEFES	Marine Ecology and Fisheries Enhancement Strategy
MFC	Marine Fill Committee
MGV	Medium Goods Vehicle
MLP	Master Layout Plan
MM5	Fifth-Generation Penn State / NCAR Mesoscale Model
MMHK	Mott MacDonald Hong Kong
MOSRP	Maritime Oil Spill Response Plan
MP2030	Hong Kong International Airport Master Plan 2030
MRL	Minimal Risk Level
MTIA	Marine Traffic Impact Assessment
MTOW	Maximum Take-off Weight
MTR	Mass Transit Railway
N/A	Not Applicable
N/M	Not Measured
NAMP	New Airport Master Plan
NATS	National Air Traffic Services
NCD	North Commercial District
NCO	Noise Control Ordinance
NEF	Noise Exposure Forecast
NGO	Non-Governmental Organisation
NH_3-N	Ammonia Nitrogen
NLDI	North Lantau Development Investigation
NLH	North Lantau Highway
NO	Nitrogen Monoxide
NO_2	Nitrogen Dioxide
NO_2-N	Nitrite
NO_3-N	Nitrate
NOAEL	No Observed Adverse Effect Level
NOEC	No Observable Effect Concentration
NOTAM	Notice to Airmen
NO_x	Nitrogen Oxides
NPD	Noise-Power-Distance
NSR	Noise Sensitive Receiver
NWNT	North West New Territories
O	Open Space
O_3	Ozone
OC	Organochlorines
OEHHA	Office of Environmental Health Hazard Assessment
OGP	International Oil and Gas Producers Association
OIR12	Offshore Incident Record 12

OLM	Ozone Limiting Method
OPRC	Convention on Oil Pollution Preparedness, Response and Co-operation
Ortho-P	Ortho Phosphorus
OSHA	Occupational Safety and Health Administration
OU	Other Specified Uses
OVT	Old and Valuable Tree
OWTF	Organic Wastes Treatment Facilities
OZP	Outline Zoning Plan
PADS	Port and Airport Development Strategy
PAFF	Permanent Aviation Fuel Facility
PAH	Poly-aromatic Hydrocarbons / Polycyclic Aromatic Hydrocarbons
PAM	Passive Acoustic Monitoring
PATH	Pollutants in the Atmosphere and their Transport over Hong Kong model
Pb	Lead
PC	Passenger Car
PCB	Polychlorinated Biphenyls
PCR	Petroleum Carbon Ranges
PCRAMMET	PCRAMMET meteorological program
PD	Principal Datum
PDZ	Planning Data Zones
PET	Polyethylene Terephthalate
PFA	Pulverised Fuel Ash
PFC	Public Fill Committee
PFRF	Public Fill Reception Facilities
PFS	Petrol Filling Station
PH1	North Station (PH1)
PH5	South Station (PH5)
PHAST	Process Hazard Analysis Software Tool
PHDTCW	Public Housing Development at Tung Chung West Area 39
PIARC	Permanent International Association of Road Congresses
PINCHE	Policy Interpretation Network on Children's Health and Environment
PlanD	Planning Department
PLC	Programmable Logic Controller
PLL	Potential Loss of Life
PME	Powered Mechanical Equipment
PN	Practice Notes
PNAP	Practice Notes for Authorised Persons
PNL	Predicted Noise Level
POM	Polycyclic Organic Matter
POP	Persistent Organic Pollutant
PPVL	Pillar Point Valley Landfill
PRC	Peoples' Republic of China
PRCWDNR	Pearl River Chinese White Dolphin Nature Reserve
PRD	Pearl River Delta
PRDEZ	Pearl River Delta Economic Zone
PRDTC	Potential Residential Development at Tung Chung Area 54
PRE	Pearl River Estuary
PRH	Public Rental Housing
ProPECC	Professional Persons Environmental Consultative Committee
ProPECC PN	Professional Persons Environmental Consultative Committee Practice Note
PS	Pumping Station
PSDH	Project for the Sustainable Development of Heathrow
PTO	Power Take-Off

PVC	Polyvinyl Chloride
PVD	Prefabricated Vertical Drains
QPME	Quality Powered Mechanical Equipment
QRA	Quantitative Risk Assessment
RAP	Remediation Action Plan
RBC	Risk-based Concentration
RBRGs	Risk-Based Remediation Goals
RCV	Refuse Collection Vehicle
REL	Reference Exposure Level
RF	Radius to Fix
RFC	Reference Concentration
RIVM	National Institute of Public Health and Environmental Protection
RNP	Required Navigation Performance
RODP	Recommended Outline Development Plan
ROV	Remote Operated Vehicle
RQ	Risk Quotient
RR	Remediation Report Relative Risk (*referred in Chapter 17 only*)
RRL	Roughness of reclaimed land
RSE	Resident Site Engineer
RSP	Respirable Suspended Particulates (PM_{10})
RTT	River Trade Terminal
SAE	Society of Automotive Engineers
MBR	Membrane Bioreactor
SC	Sonar Contact
SCADA	Supervisory Control and Data Acquisition
SCLKC	Sha Chau and Lung Kwu Chau
SCLKCMP	Sha Chau and Lung Kwu Chau Marine Park
SCP	Sand Compaction Piles
SEA	Strategic Environmental Assessment
SEP	Surface Emissive Power
SHW	Siu Ho Wan
SHWSTW	Siu Ho Wan Sewage Treatment Works
SI	Site Investigation
SID	Standard Instrument Departure
SISTW	Stonecutters Island Sewage Treatment Works
SKC	Shek Kwu Chau
SLW	Sha Lo Wan
SM1	Sewerage Manual – Part 1
SMS	Safety Management System
SO_2	Sulphur Dioxide
SPL	Sound Pressure Level
SQR	Sediment Quality Report
SS	Suspended Solids
SSMP	Soil Sampling and Monitoring Plan
SSR	Secondary Surveillance Radar
SSRC	The Social Sciences Research Centre of The University of Hong Kong
SSSI	Site of Special Scientific Interest
SSTP	Sediment Sampling and Testing Plan
STAR	Standard Instrument Arrival
STF	Sludge Treatment Facilities
STW	Sewage Treatment Works
SVE	Soil Vapour Extraction

sVOC	Semi-Volatile Organic Compound
SWIFT	Structured What If Technique
SWL	Sound Power Level
SWLMP	Southwest Lantau Marine Park
SWPH	Seawater Pumping House
T1	Terminal 1
T2	Terminal 2
T3	Terminal 3
TAAM	Total Airspace and Airport Modeler
TAP	Toxic Air Pollutant
TBG	Technical Briefing Group
TBM	Tunnel Boring Machine
TBT	Tributyltin
TC	Tung Chung
TC(W)	Technical Circular (Works)
TCDD	2,3,7,8-Tetrachlorodibenzo-*p*-dioxin
TCH	Terrestrial Cultural Heritage
TCLP	Toxicity Characteristics Leaching Procedure
TCNTE	Tung Chung New Town Extension
TCSPS	Tung Chung Sewage Pumping Station
TCTC	Tung Chung Town Centre
TF	Track to Fix
TIMs	Time-In-Modes
TIN	Total Inorganic Nitrogen
TKN	Total Kjeldahl Nitrogen
TM	Technical Memorandum
TM- EIAO	Technical Memorandum Environmental Impact Assessment Ordinance
TM-CLKL	Tuen Mun – Chek Lap Kok Link
TM-DSS	Technical Memorandum on Standards for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters
TMP	Turfgrass Management Plan
TMWB	Tuen Mun Western Bypass
TNO	Toegepast Natuurwetenschappelijk Onderzoek
Total P	Total Phosphorus
TP	Technical Paper
TPEDM	Territorial Population and Employment Data Matrices
TPRP	Tree Preservation and Removal Proposal
TRC	Third Runway Concourse
TSHD	Trailer Suction Hopper Dredger
TSP	Total Suspended Particulate
TTAL	Tsang Tsui Ash Lagoon
UCEL	Upper Chemical Exceedance Level
UCS	Unconfined Compressive Strength
UFL	Upper Flammable Limit
UIA	Unionised Ammonia
UK	United Kingdom
UKHO	UK Hydrographic Office
UKPOA	United Kingdom Onshore Pipeline Operators Association
USAF	United States Air Force
USEPA	United States Environmental Protection Agency
USHHS	United States Department of Health and Human Services
UTS	Universal Treatment Standards
VHF	Very High Frequency

VOC	Volatile Organic Compound
VP	Viewpoint
VPF	Value of Preventing Fatality
VSR	Visually Sensitive Receiver
w/w	Weight per Weight
WBTC	Works Branch Technical Circular
WCZ	Water Control Zone
WDO	Waste Disposal Ordinance
WEL	Western Express Line
WENT	West New Territories Landfill
WFS	Worldwide Flight Services Fuelling (HK) Ltd.
WGS	World Geodetic System
WH-LSD	Western Harbour – Lantau Strategic Development
WHM	Western Harbour Model
WHO	World Health Organization
WMP	Waste Management Plan
WPCO	Water Pollution Control Ordinance
WQO	Water Quality Objective
WSD	Water Supplies Department
WSR	Water Sensitive Receiver
WTO	World Tourism Organisation
XRL	Express Rail Link
ZVI	Zone of Visual Influence

Expansion of Hong Kong International Airport into a Three-Runway System

Environmental Monitoring and Audit Manual

June 2014

Airport Authority Hong Kong

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1. Introduction

1.1 Purpose of the Manual

1.1.1.1 The purpose of this Environmental Monitoring and Audit (EM&A) Manual (hereafter referred to as the Manual) is to guide the setup of an EM&A programme to ensure compliance with the Environmental Impact Assessment (EIA) study recommendations, to assess the effectiveness of the recommended mitigation measures and to identify any further need for additional mitigation measures or remedial action. This Manual outlines the monitoring and audit programme proposed for the "Expansion of Hong Kong International Airport into a Three-Runway System" (the project).

1.2 Project Description

1.2.1.1 The project will consist of a new third runway with associated taxiways, aprons (or aircraft stands), as well as new passenger concourse buildings and expansion of the existing Terminal 2 building. Included in the project will be related airside and landside works and associated ancillary and supporting facilities.

1.2.2 Land Formation

1.2.2.1 Based on the preferred airport development option identified, land is required to be formed to the north of the existing airport island, which will provide a platform for the development. The proposed land formation works will mainly include:

- Land formation of not more than 650 ha to the north of the existing airport island with partial construction over the contaminated mud pits (CMP). The area of land formation is defined to be the area at and above the high water mark of +2.3 mPD; and
- Modification and integration of the existing seawall at the northern, western and eastern sides of the existing North Runway into the new land formation and re-provisioning of new seawall around the land formation.

1.2.3 Airfield Facilities

1.2.3.1 The proposed airfield facilities will mainly include:

- Construction of a third runway, related taxiway systems, associated airfield infrastructure, aircraft navigational aids, approach lighting systems and new Hong Kong International Airport Approach Area (HKIAAA) beacons;
- Construction of the third runway passenger concourse aprons;
- Temporary closure and modification of the existing North Runway along with related taxiway systems; and
- Expansion of the freighter aprons in the existing Midfield area between the existing North and South runways.

1.2.4 Passenger Facilities

1.2.4.1 The proposed passenger facilities will mainly include:

- Construction of the third runway passenger concourse (TRC) and passenger fixed link bridges;
- Expansion of the existing passenger Terminal 2 (T2);
- Extension of the automated people mover (APM) and associated depot and maintenance / stabling areas; and
- Expansion of the baggage handling system (BHS) and associated baggage halls and early bag store.

1.2.5 Ancillary Facilities

1.2.5.1 New ancillary facilities will be provided to support the operational needs of the third runway passenger concourse and airfield facilities. These ancillary facilities will be located on the west and east sides of the proposed land formation area (i.e. within the western support area and the eastern support area respectively) and will accommodate utility buildings, airport support developments, air cargo staging, catering, aircraft maintenance, aircraft engine run-up (engine testing) facilities, ground services equipment area, early bag storage facility, fire station, fire training facility, petrol fuelling station, new air traffic control towers (ATCTs), Hong Kong Observatory (HKO) facility, mobile phone system antenna towers, stores, security gate houses, etc.

1.2.6 Infrastructure and Utilities

1.2.6.1 The proposed infrastructure and utilities will mainly include:

- Expansion of the landside and airside road network in the passenger, cargo and maintenance areas and landside transportation facilities, including new car parks;
- Construction of new airside road access, including the construction of new airside road tunnels and ramps, to connect the new third runway facilities with the existing airport;
- Modification to existing and construction of new land based infrastructure including the seawater cooling and flushing system, stormwater drainage system, greywater system, sewerage network and potable water supply, Towngas supply, 132 kV / 11 kV and other power supply networks; communication networks; and
- Modifications and re-provisions to existing marine facilities including the underwater aviation fuel pipelines between HKIA and the off-airport fuel receiving facilities at Sha Chau, the associated underwater 11 kV cable and pilot cable and sea rescue boat points.

1.2.6.2 The key project components are shown in **Drawing No. MCL/P132/EMA/1-001** to **MCL/P132/EMA/1-004**.

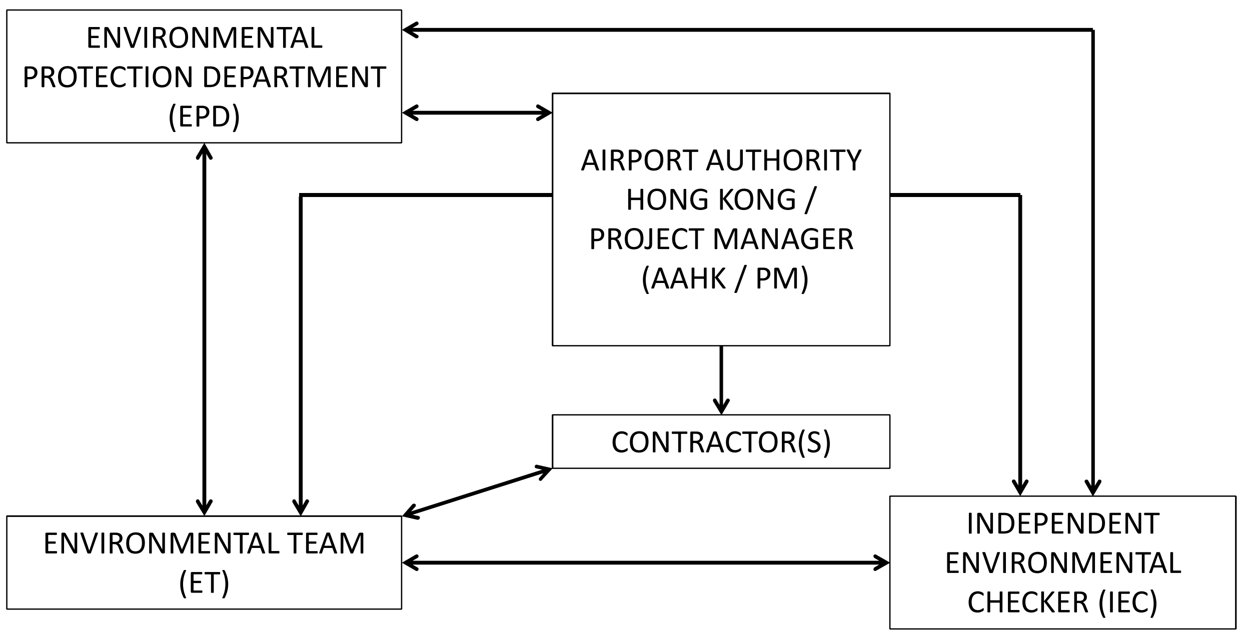
1.3 Tentative Construction Programme

1.3.1.1 The tentative programme for operation of the three-runway system (3RS) will be in 2023. Given the scale and complexity of the project, construction and the concurrent runway operational configuration will be implemented in phases. The tentative construction programme is provided in **Appendix A**. This programme is subject to further changes during the course of the scheme design and detailed design stage.

1.4 Project Organisation

1.4.1.1 The proposed project organisation is shown in **Chart 1-1** below.

Chart 1-1: Project Organisation Chart



1.4.2 Airport Authority Hong Kong (AAHK)

1.4.2.1 AAHK is the project proponent for the development of the project, and will assume overall responsibility for the project.

1.4.3 Environmental Protection Department (EPD)

1.4.3.1 EPD is the statutory enforcement body for environmental protection matters in Hong Kong.

1.4.4 Project Manager (PM)

1.4.4.1 The Project Manager (PM) or the PM's Representative is responsible for overseeing the construction works and for ensuring that the works are undertaken by the Contractor in accordance with the specification and contract requirements. The duties and responsibilities of the PM with respect to EM&A include:

- To monitor the Contractor's compliance with Contract Specifications, including the effective implementation and operation of the environmental mitigation measures;
- To employ an Independent Environmental Checker (IEC) to audit the results of the EM&A works carried out by the Environmental Team (ET);
- To monitor Contractors' compliance with the requirements in the Environmental Permit (EP) and EM&A Manual;
- To facilitate ET's implementation of the EM&A programme;
- Participate in joint site inspection by the ET and IEC;
- To oversee the implementation of the agreed Event and Action Plan in the event of any exceedance; and
- To adhere to the procedures for carrying out complaint investigation.

1.4.5 The Contractor

1.4.5.1 The Contractor should report to the AAHK / PM. The duties and responsibilities of the Contractor include:

- To comply with the relevant contract conditions and specifications on environmental protection;
- To facilitate ET's monitoring and site inspection activities;
- To participate in the site inspections undertake by the ET and IEC, and undertake any corrective actions;

- To provide information / advice to the ET regarding works programme and activities which may contribute to the generation of adverse environmental impacts;
- To submit proposals on mitigation measures in case of exceedance of action and limit levels in accordance with the Event and Action Plans;
- To implement measures to reduce impact where action and limit levels are exceeded; and
- To adhere to the procedures for carrying out complaint investigation.

1.4.6 Environmental Team (ET)

1.4.6.1 The ET should be employed by the AAHK / PM to conduct the EM&A programme. The ET should be managed by the ET Leader. ET Leader should have relevant professional qualifications in environmental control and possess at least seven years of experience in EM&A. Suitably qualified staff should be included in the ET, and resources for the implementation of the EM&A programme should be allocated in the time under the Contract, to enable fulfilment of the project's EM&A requirements as specified in the EM&A Manual during construction of the Project. The ET should report to AAHK / PM and the duties should include:

- To monitor and audit various environmental parameters as required in this EM&A Manual;
- To analyse the environmental monitoring and audit data, review the success of EM&A programme and the adequacy of mitigation measures implemented, confirm the validity of the EIA predictions and identify any adverse environmental impacts arising;
- To monitor compliance with conditions in the EP, environmental protection, pollution prevention and control regulations and contract specifications;
- To audit environmental conditions on site;
- To report on the environmental monitoring and audit results to EPD, the AAHK / PM, the IEC and Contractor(s) or their delegated representatives;
- To recommend suitable mitigation measures to the Contractor(s) in the case of exceedance of action and limit levels in accordance with the Event and Action Plans;
- To liaise with the IEC on all environmental performance matters, and ensure timely submission of all relevant EM&A pro forma for IEC's approval;
- To provide advice to the Contractor(s) on environmental improvement, awareness and enhancement matters, etc. on site;
- To adhere to the procedures for carrying out complaint investigation;
- To prepare reports on the environmental monitoring data and the site environmental conditions;

- To submit the EM&A report to Environmental Protection Department (EPD) timely;
- To review proposals of mitigation measures from the Contractor(s) in case of exceedance of action and limit levels, in accordance with the Event and Action Plan;
- To carry out site inspection to investigate and audit the Contractor's site practice, equipment and work methodologies with respect to pollution control and mitigation measures; and
- On an as-need basis, to review Contractor's works methodology paper from environmental perspective.

1.4.7 Independent Environmental Checker (IEC)

1.4.7.1 The IEC is empowered to audit the environmental performance of construction, but is independent from the management of construction works. As such, the IEC should not be in any way an associated body of the Contractor or the ET for the project. The IEC should be employed by the AAHK / PM prior to the commencement of the construction of the project. The IEC should be a person who has relevant professional qualifications in environmental control and at least seven years of experience in EM&A and environmental management. The duties and responsibilities of the IEC are:

- To provide proactive advice to the AAHK / PM on EM&A matters related to the project;
- To review and verify the monitoring data and all submissions in connection with the EP and EM&A Manual submitted by the ET;
- To arrange and conduct regular, at least monthly site inspections of the works during the construction phase, and to carry out ad hoc inspections if significant environmental problems are identified;
- To check compliance with the agreed Event and Action Plan in the event of any exceedance;
- To check compliance with the procedures for carrying out complaint investigation;
- To check the effectiveness of corrective measures;
- To feedback audit results to the ET by signing off relevant EM&A pro forma;
- To check that mitigation measures are effectively implemented;
- To report the works conducted, and the findings, recommendations and improvements of the site inspections, after reviewing ET's and Contractor's works, to the AAHK / PM on a monthly basis;
- To verify the investigation result of the environmental complaint cases and the effectiveness of corrective measures;
- To verify EM&A report that has been certified by ET leader; and

- To audit EIA recommendations and requirements against the status of implementation of environmental mitigation measures on site.

2. Air Quality Impact

2.1 Construction Air Quality Monitoring

2.1.1 General

2.1.1.1 The project is anticipated to give rise to construction dust impacts. The key activities that would potentially result in dust emissions include land formation works; construction works on the newly formed land and on the existing airport island; operation of concrete batching plants, asphalt batching plants, crushing plant, and barging points; haul roads; diversion of submarine fuel pipeline; diversion of submarine 11 kV cable; and modifications to existing outfalls. Construction phase dust monitoring is considered necessary to check and ensure compliance that the relevant recommended mitigation measures are properly implemented.

2.1.1.2 The key objectives of the construction phase dust monitoring are:

- To identify the extent of dust impact during construction phase on sensitive receivers;
- To audit the compliance of the Contractor with regard to dust control, contract conditions and the relevant dust impact criteria;
- To determine the effectiveness of mitigation measures to control fugitive dust emission from activities during the construction phase;
- To recommend further mitigation measures if found to be necessary; and
- To comply with action and limit levels for air quality as defined in this Manual.

2.1.2 Air Quality Parameters

2.1.2.1 Monitoring and audit of 24-hour Respirable Suspended Particulates (RSP or PM_{10}) and 24-hour Fine Suspended Particulates (FSP or $PM_{2.5}$) levels are not proposed. This is because even under the hypothetical worst case Tier 1 mitigated scenario both 24-hour RSP and 24-hour FSP would comply with the corresponding Air Quality Objectives (AQO) at all Air Sensitive Receivers (ASR) throughout the construction period, except the limited non-compliance with the AQO for 24-hour RSP at up to three ASR in three of the nine construction years. Hence no significant RSP or FSP impacts are anticipated. Therefore, only 1-hour Total Suspended Particulates (TSP) will be monitored and audited at the proposed monitoring locations. Details of the proposed monitoring locations are presented in **Section 2.1.5**.

2.1.2.2 One-hour TSP levels shall be measured to indicate the impacts of construction dust on air quality. The TSP levels shall be measured by following the standard high volume sampling method as set out in the Title 40 of the Code of Federal Regulations, Chapter 1 (Part 50), Appendix B. Upon approval of the AAHK / PM, as an alternative to using high volume sampling method, 1-hour TSP levels can be measured by direct reading methods which are capable of producing comparable results as that by the high volume sampling method, to indicate short event impacts.

2.1.2.3 All relevant data including temperature, pressure, weather conditions, elapsed-time meter reading for the start and stop of the sampler, identification and weight of the filter paper, and any other local atmospheric factors affecting or affected by site conditions etc. shall be recorded down in detail. A sample data sheet is shown in **Appendix B**. The ET may develop project specific data sheet to suit this EM&A programme.

2.1.3 Monitoring Equipment

2.1.3.1 High volume sampler (HVS) shall be used for carrying out the 1-hour TSP monitoring.

2.1.3.2 The ET is responsible for provision of the monitoring equipment. They shall ensure that sufficient number of samplers with an appropriate calibration kit is available for carrying out the baseline monitoring, regular impact monitoring and ad hoc monitoring. The samplers shall be equipped with an electronic mass flow controller and be calibrated against a traceable standard at regular intervals. All the equipment, calibration kit, filter papers, etc. shall be clearly labelled.

2.1.3.3 Initial calibration of dust monitoring equipment shall be conducted upon installation and thereafter at bi-monthly intervals. The transfer standard shall be traceable to the internationally recognised primary standard and be calibrated annually. The calibration data shall be properly documented for future reference by the concerned parties such as the IEC. All the data shall be shall be converted into standard temperature and pressure condition.

2.1.3.4 The flow-rate of the sampler before and after the sampling exercise with the filter in position shall be verified to be constant and be recorded down in the data sheet as shown in **Appendix B**.

2.1.3.5 If the ET proposes to use a direct reading dust meter to measure 1-hour TSP levels, they shall submit sufficient information to IEC to prove that the instrument is capable of achieving a comparable result as that the HVS and may be used for the 1-hour sampling. The instrument shall also be calibrated regularly, and the 1-hour sampling shall be determined periodically by HVS to check the validity and accuracy of the results measured by direct reading method.

2.1.3.6 Wind data monitoring equipment shall also be provided and set up at conspicuous locations for logging wind speed and wind direction near to the dust monitoring locations. The equipment installation location shall be proposed by the ET and agreed with the IEC. For installation and operation of wind data monitoring equipment, the following points shall be observed:

- The wind sensors shall be installed on masts at an elevated level 10 m above ground so that they are clear of obstructions or turbulence caused by the buildings;
- The wind data shall be captured by a data logger. The data recorded in the data logger shall be downloaded periodically for analysis at least once a month;
- The wind data monitoring equipment shall be re-calibrated at least once every six months; and
- Wind direction shall be divided into 16 sectors of 22.5 degrees each.

2.1.3.7 In exceptional situations, the ET may propose alternative methods to obtain representative wind data upon approval from the AAHK / PM and agreement from the IEC.

2.1.4 Laboratory Measurement / Analysis

2.1.4.1 A clean laboratory with constant temperature and humidity control, and equipped with necessary measuring and conditioning instruments, to handle the dust samples collected, shall be available for sample analysis, and equipment calibration and maintenance. The laboratory should be HOKLAS accredited or other internationally accredited laboratory.

2.1.4.2 If a site laboratory is set up or a non-HOKLAS accredited laboratory is hired for carrying out the laboratory analysis, the laboratory equipment shall be approved by the AAHK / PM and the measurement procedures should be witnessed by the IEC. Measurement performed by the laboratory shall be demonstrated to the satisfaction of the AAHK / PM and the IEC. IEC shall conduct regular audit to the measurement performed by the laboratory to ensure the accuracy of measurement results. The ET shall provide the AAHK / PM with one copy of the Title 40 of the Code of Federal regulations, Chapter 1 (part 50), Appendix B for his reference.

2.1.4.3 Filter paper of 8” X 10” shall be labelled before sampling of TSP. It shall be a clean filter paper with no pin holes, and shall be conditioned in a humidity controlled chamber for over 24-hour and be pre-weighed before use for the sampling.

2.1.4.4 After sampling, the filter paper loaded with dust shall be kept in a clean and tightly sealed plastic bag. The filter paper is then returned to the laboratory for reconditioning in the humidity controlled chamber followed by accurate weighing by an electronic balance with a readout down to 0.1 mg. The balance shall be regularly calibrated against a traceable standard.

2.1.4.5 All the collected samples shall be kept in a good condition for six months before disposal.

2.1.5 Monitoring Locations

2.1.5.1 Two separate air quality monitoring locations are proposed and summarised in **Table 2-1** and shown in **Drawing No. MCL/P132/EMA/2-001**. The status and locations of dust sensitive receivers may change after issuing this Manual. If such cases exist, the ET should propose updated monitoring locations and seek agreement from EPD, and agreement from the AAHK / PM and IEC before baseline monitoring commences.

Table 2-1: Construction Air Quality Monitoring Stations

ID	ID Adopted in EIA	Description	Monitoring Parameters
AR1	TC-13	Seaview Crescent Block 1	1-hour TSP
AR2	ST-1	Village house at Tin Sum	1-hour TSP

2.1.5.2 When alternative monitoring locations are proposed, the following criteria, as far as practicable, shall be followed:

- At the site boundary or such locations close to the major dust emission source;
- Close to the sensitive receptors; and
- Take into account the prevailing meteorological conditions.

2.1.5.3 Monitoring equipment must be positioned, sited and orientated properly. The ET should agree with the AAHK / PM in consultation with the IEC on the position of the samplers for the installation of the monitoring equipment. When positioning the samplers, the following points shall be noted:

- A horizontal platform with appropriate support to secure the samplers against gusty wind shall be provided;
- No two samplers shall be placed less than 2 m apart;
- The distance between the sampler and an obstacle, such as buildings, must be at least twice the height that the obstacle protrudes above the sampler;
- A minimum of 2 m of separation from walls, parapets and penthouses is required for rooftop samplers;
- A minimum of 2 m separation from any supporting structure, measured horizontally is required;
- No furnace or incinerator flue is nearby;
- Airflow around the sampler is unrestricted;
- The sampler is more than 20 m from the dripline;
- Any wire fence and gate, to protect the sampler, shall not cause any obstruction during monitoring;
- Permission must be obtained to set up the samplers and to obtain access to the monitoring stations; and
- A secured supply of electricity is needed to operate the samplers.

2.1.5.4 The ET may, depending on site conditions and monitoring results, decide whether additional monitoring locations should be included or any monitoring locations could be removed / relocated during any stage of the construction phase.

2.1.6 Baseline Monitoring

2.1.6.1 Baseline monitoring should be conducted at all designated monitoring locations, see **Table 2-1**, for at least 14 consecutive days before commencement of construction work to obtain ambient 1-hour TSP samples. The commencement date of baseline monitoring shall be agreed between the ET / IEC / AAHK / PM to ensure timely submission of the baseline monitoring report to EPD. The selected baseline monitoring stations should reflect baseline conditions at the stations. One-hour TSP sampling shall also be done at least three times per day when the highest dust impacts are expected. The baseline monitoring will provide data for the determination of the appropriate action levels with the limit levels set against statutory or otherwise agreed limits. General meteorological conditions (wind speed, wind direction and precipitation) and notes regarding any significant adjacent dust producing sources should also be recorded throughout the baseline monitoring period.

2.1.6.2 Before commencing the baseline monitoring, the ET shall inform the IEC of the baseline monitoring programme such that the IEC can conduct on-site audit to ensure accuracy of the baseline monitoring results. During the baseline monitoring, there should not be any construction dust generating activities in the vicinity of the monitoring stations.

2.1.6.3 In case the baseline monitoring cannot be carried out at the designated monitoring locations during the baseline monitoring period, the ET shall carry out the monitoring at alternative locations that can effectively represent the baseline conditions at the impact monitoring locations. The alternative baseline monitoring locations should be approved by the AAHK / PM and agreed with the IEC.

2.1.6.4 In exceptional cases, when insufficient baseline monitoring data or questionable results are obtained, the ET should liaise with the IEC and EPD to agree on an appropriate set of data to be used as baseline reference and submit to EPD for approval.

2.1.6.5 Ambient conditions may vary seasonally and should be reviewed once every six months. If the ET considers that significant changes in the ambient conditions have risen, a repeat of the baseline monitoring may be carried out to update the baseline levels and air quality criteria, after consultation and agreement with the AAHK / PM, the IEC and the EPD. The monitoring should be undertaken at times when the Contractor’s activities are not generating dust, at least in the proximity of the monitoring stations. Should change in ambient conditions be determined, the baseline levels and, in turn, the air quality criteria, shall be revised. The revised baseline levels and air quality criteria shall be agreed with the IEC and EPD.

2.1.7 Impact Monitoring

2.1.7.1 The monthly schedule of the compliance and impact monitoring programme should be drawn up by the ET one month prior to the commencement of the scheduled construction period.

2.1.7.2 The ET should carry out impact monitoring during the throughout the entire course of the Works. For 1-hour TSP monitoring, the sampling frequency of at least three times in every six days should be undertaken when the highest dust impact is expected to occur. Highest dust impacts will be determined **by the actual construction site condition, program and the works to be carried out.** Before commencing the impact monitoring, the ET should inform the IEC of the impact monitoring programme such that the IEC can conduct on-site audit to ensure accuracy of the impact monitoring results.

2.1.7.3 In case of non-compliance with the air quality criteria, more frequent monitoring exercise, as specified in the Event and Action Plan, should be conducted within 24 hours after the result is obtained. This additional monitoring shall be continued until the excessive dust emission or the deterioration in air quality is rectified.

2.1.8 Event and Action Plan

2.1.8.1 The baseline monitoring results form the basis for determining the air quality criteria for the impact monitoring. The ET should compare the impact monitoring results with air quality criteria set up for 1-hour TSP. **Table 2-2** shows the air quality criteria, namely action and limit (AL) Levels to be used. Should non-compliance of the air quality criteria occurs, actions in accordance with the Event and Action Plan in **Table 2-3** should be carried out.

Table 2-2: Typical Action and Limit Levels for Air Quality

Parameters	Action Level	Limit Level
1-hour TSP Level in µg/m^3	For baseline level ≤ 384 µg/m^3, Action level = (130% of baseline level + Limit level)/2 For baseline level > 384 µg/m^3, Action level = Limit level	500

Table 2-3: Typical Event and Action Plan for Air Quality

	Action			
Event	ET	IEC	AAHK / PM	Contractor
Action Level				
1. Exceedance for one sample	1. Identify source, investigate the causes of exceedance and propose remedial measures; 2. Inform IEC and AAHK / PM; 3. Repeat measurement to confirm finding; 4. Increase monitoring frequency to daily.	1. Check monitoring data submitted by ET; 2. Check Contractor's working method.	1. Notify Contractor.	1. Rectify any unacceptable practice; 2. Amend working methods if appropriate.
2. Exceedance for two or more consecutive samples	1. Identify source; 2. Inform IEC and AAHK / PM; 3. Advise the AAHK / PM on the effectiveness of the proposed remedial measures; 4. Increase monitoring frequency to daily; 5. Discuss with IEC and Contractor on remedial actions required 6. If exceedance continues, arrange	1. Check monitoring data submitted by ET; 2. Check Contractor's working method 3. Discuss with ET and Contractor on possible remedial measures; 4. Advise AAHK / PM on the effectiveness of the proposed remedial measures; 5. Supervisor implementation of	1. Confirm receipt of notification of failure in writing; 2. Notify Contractor; 3. Ensure remedial measures properly implemented.	1. Submit proposals for remedial actions to IEC within three working days of notification; 2. Implement the agreed proposals; 3. Amend proposal if appropriate.

Event	Action			
	ET	IEC	AAHK / PM	Contractor
	meeting with IEC and AAHK / PM 7. If exceedance stops, cease additional monitoring.	remedial measures.		
Limit Level				
1. Exceedance for one sample	1. Identify the source, investigate the causes of exceedance and propose remedial measures; 2. Inform AAHK / PM and Contractor. If the exceedance is valid, inform EPD; 3. Repeat measurement to confirm finding; 4. Increase monitoring frequency to daily; 5. Assess effectiveness of Contractor's remedial actions and keep IEC, EPD and AAHK / PM informed of the results.	1. Check monitoring data submitted by ET; 2. Check Contractor's working method; 3. Discuss with ET and Contractor on possible remedial measures; 4. Advise AAHK / PM on the effectiveness of the proposed remedial measures; 5. Monitor the implementation of remedial measures.	1. Confirm receipt of notification of failure in writing; 2. Notify Contractor; 3. Ensure remedial measures properly implemented.	1. Take immediate action to avoid further exceedance; 2. Submit proposals for remedial actions to IEC within three working days of notification; 3. Implement the agreed proposals; 4. Amend proposal if appropriate.
2. Exceedance for two or more consecutive sample	1. Notify IEC, AAHK / PM, Contractor and EPD; 2. Identify source; 3. Repeat measurement to confirm finding; 4. Increase monitoring frequency to daily; 5. Carry out analysis of Contractor's working procedures to determine possible mitigation to be implemented; 6. Arrange meeting with IEC and AAHK / PM to discuss the remedial actions to be taken; 7. Assess effectiveness of Contractor's remedial actions and keep IEC, EPD and AAHK / PM informed of the results; 8. If exceedance stops, cease additional	1. Check monitoring data submitted by ET; 2. Check Contractor's working method; 3. Discuss amongst AAHK / PM, ET, and Contractor on the potential remedial actions; 4. Review Contractor's remedial actions whenever necessary to assure their effectiveness and advise AAHK / PM accordingly; 5. Monitor the implementation of remedial measures.	1. Confirm receipt of notification of failure in writing; 2. Notify Contractor; 3. In consultation with the IEC, agree with the Contractor on the remedial measures to be implemented; 4. Ensure remedial measures properly implemented; 5. If exceedance continues, consider what portion of the work is responsible and instruct the Contractor to stop that portion of work until the exceedance is abated.	1. Take immediate action to avoid further exceedance; 2. Submit proposals for remedial actions to IEC within three working days of notification; 3. Implement the agreed proposals; 4. Resubmit proposals if problem still not under control; 5. Stop the relevant portion of works as determined by AAHK / PM until the exceedance is abated.

	Action			
Event	ET	IEC	AAHK / PM	Contractor
	monitoring.			

2.1.9 Mitigation Measures

2.1.9.1 Appropriate dust suppression measures should be adopted as required under the Air Pollution Control (Construction Dust) Regulation as well as the Specified Process licences for the concrete batching plants, asphalt batching plants and rock crushing plant. A control programme can be instigated to monitor the construction process in order to enforce dust controls and modify methods of works where feasible to reduce the dust emission down to acceptable levels. The implementation schedule of the recommended air quality mitigation measures is presented in **Appendix C**.

2.2 Operational Air Quality Monitoring

2.2.1.1 No exceedance has been predicted at the ASRs. The current airport air quality monitoring stations shall be maintained. No additional air quality monitoring station is required.

3. Hazard to Human Life

3.1 Introduction

3.1.1.1 A hazard identification workshop has been conducted to identify potential hazards associated with the construction and operation phase of the project. Mitigation measures have also been explored to prevent the hazards from happening and they will be implemented in the project.

3.1.1.2 A hazard assessment has been conducted which concluded that the risk level for the construction phase is within the acceptable region and mitigation measure is not required. The risk level for the operation phase has been evaluated to be in ALARP region and the major risk contributor is aircraft refuelling operation. Practicable and cost effective mitigations have been proposed to reduce the risk of aircraft refuelling operation.

3.2 Recommendation

3.2.1.1 The recommended measures as outlined in the Implementation Schedule included as **Appendix C** in this EM&A Manual should be implemented to meet the EIAO-TM requirements.

4. Noise Impact

4.1 Aircraft Noise Monitoring

4.1.1 Aircraft Noise Monitoring and Audit Requirements

4.1.1.1 As per the requirements set out in Section 7, Appendix C of the EIA Study Brief, the aircraft noise monitoring and audit plan shall:

- Provide data and information for verifying predictions on the effectiveness of measures to mitigate aircraft noise impact of the Project;
- Formulate audit requirements, including any necessary compliance and post-project audit program, in order to review the monitoring data and identify any remedial works, as necessary, required to address unacceptable or unanticipated aircraft noise impacts; and
- Provide tools, procedures and supplementary information, including noise descriptor and flight tracks, which are useful and relevant for communicating the aircraft noise of the Project to the general public.

4.1.2 Program Elements

4.1.2.1 Taking into account the EIA Study Brief requirements as described above, it is proposed that the aircraft noise monitoring and audit plan should consist of the following key elements:

- An exercise by AAHK to verify predictions on the effectiveness of measures to mitigate aircraft noise impact and the preparation of a Prediction Verification Report;
- Review Report, prepared on an annual basis by AAHK, for detailing the compliance with noise abatement procedures and unanticipated events, as well as any further necessary investigation and/or remedial action(s);
- Noise Contour Report, prepared in at least every five years by AAHK, to compare actual airport operation to forecast airport operation with respect to aircraft noise, taking into account data collected on actual aircraft operational levels, fleet mix, runway and flight track utilizations; and produce an updated noise contour using the most currently available and internationally accepted noise modelling methodology

4.1.2.2 In additional to the above reporting requirements, AAHK shall continue to engage with the neighbouring communities in the vicinity of HKIA, other stakeholders and interested parties on aircraft noise issues associated with the operation of the project.

4.1.3 Prediction Verification

4.1.3.1 The purpose of this task is for verification of predictions on the effectiveness of measures to mitigate aircraft noise impact of the project. This verification exercise shall be undertaken upon availability of relevant airport operation data for the first full year operation of the proposed third runway as described in **Chapter 4** of the EIA Report. A Prediction Verification Report, certified by the ET Leader and verified by the IEC, shall be submitted to EPD for approval. The need to continue such prediction verification exercise afterwards would depend on the results and should be agreed with EPD.

4.1.3.2 As part of the prediction verification exercise, AAHK should collect radar data showing airport and flight operations for the first full year operation of the proposed third runway from CAD. Based on the radar data collected, the AAHK should carry out aircraft noise contour simulation. Similar approach adopted to process radar data for the prevailing scenario contour as presented in Chapter 7 of the EIA report might be applied (individual radar data be pre-processed and annual daily average noise contours be produced by INM for daily results) and the detailed methodology shall be agreed with EPD. The computational model to be used shall also be agreed with EPD prior to the analysis.

4.1.3.3 The NEF25 contour prepared based on radar data should be compared against the noise contours presented in Chapter 7 of the EIA report for verifying the effectiveness of measures to mitigate the aircraft noise impact of the project. If the comparison of contours shows a reasonable converge, this would imply the aircraft noise prediction by computer simulation with forecast, assumptions and proposal of mitigation measures would reliably reflect that by actual airport and flight operations. In case discrepancies are observed, explanation shall be given and analysed as part of the Prediction Verification Report.

4.1.3.4 It shall be noted that the noise contours presented in Chapter 7 of the EIA report are based on reasonable assumptions and input data including air traffic forecast, runway mode of operation, flight tracks and flight track utilisation, and proposed mitigation measures. Therefore, whilst it is being compared with the one generated by actual airport and flight operations, variances within reasonable ranges are envisaged and considered acceptable. Having said that, it is essential to ensure that with the mitigation measures recommended in the EIA report, no additional noise sensitive receivers should be subject to adverse environmental impact under the requirements of the EIAO-TM. Detailed examination should be followed especially for those areas with major variances and the underneath rationale(s) will be elaborated.

4.1.4 Review Report

4.1.4.1 The Review Report, prepared on an annual basis by AAHK, shall include an analysis of how well aircraft flight follow each of the aircraft noise mitigation measures recommended in Chapter 7 of the EIA report. Information to be collected shall include available radar data showing airport and flight operations from CAD, and this is to be analysed in terms of flight tracks and runway utilisation for checking the effective implementation of the noise reduction measures. AAHK may make references to available operational noise data collated by the relevant authorities. Wind record in the year should also be collected from Hong Kong Observatory. The Review Report should review the data collected including measured noise levels at representative locations, statistics of flight tracks, flight tracks dispersion and aircraft using proposed mitigation measures and existing noise mitigation measures, etc.

4.1.4.2 The annual review and reporting process will allow AAHK to measure exactly how it stands compared to predicted operations used in the preparation of the EIA Report. If there are any major variances / discrepancies / abnormalities that are observed during the ongoing process of data collection and analysis for preparation of the annual review when compared with the assumptions / measures adopted in the assessment, early investigation shall be carried out for identification of the possible causes of the variances / discrepancies / abnormalities and whether these would significantly affect the aircraft noise environment.

4.1.5 Noise Contour Report

4.1.5.1 As the aircraft noise impact assessment was undertaken on the basis of projected air traffic movements and estimated fleet mix, it is recommended that at regular intervals of at least every five years during the first 20 operational years of the project, actual flight data obtained from local Air Traffic Control radar systems should be acquired and analysed with a similar aircraft noise modelling methodology to confirm the representativeness of the earlier noise analyses. The first Noise Contour Report shall be prepared for upon availability of airport operation data for the first full year operation of the third runway, which is planned for commissioning in 2021 as described in **Chapter 4** of the EIA report. Similar approach adopted to process radar data for prevailing scenario contour might be applied and the detailed methodology shall be agreed with EPD.

4.1.5.2 At such time that it is determined that the noise contours obtained using actual airport data may start to encroach onto any additional noise sensitive receivers, additional analysis would be necessary. The need and feasibility of introducing additional mitigation measures should also be assessed to ensure that no adverse environmental impact would be resulted from the implementation of the project with respect to aircraft noise.

4.1.6 Community Liaison

4.1.6.1 AAHK has been actively engaging with neighbouring communities in the vicinity of the airport, other stakeholders groups and interested parties to communicate issues and gauge views on aircraft noise and other environmental aspects. Briefings and airport visits are organised to explain subjects including but not limited to flight paths under the planned three-runway system and the proposed aircraft noise mitigation measures. These engagement activities will continue after commencement of the project and a community liaison plan that presents details of the planned programme, including proposed communication channels, tools, procedures and supplementary information, including noise descriptor and flight tracks in accordance with Section 7.3, Appendix C of the Study Brief and activities that would facilitate communications with stakeholders on aircraft noise issues, will be developed by AAHK as part of the detailed Aircraft Noise Monitoring and Audit Plan presented in **Section 4.1.7** below.

4.1.7 Detailed Aircraft Noise Monitoring and Audit Plan

4.1.7.1 The above subsections set out a clear EM&A framework with respect to aircraft noise. It is not yet mature to define all the monitoring and audit details as at the course of assessment whilst the EM&A task will only be started with operation commencement of the Project (i.e., 2021) because computation model and data analysis tools are in rapid evolution nowadays.

4.1.7.2 Prior to commencement of Project operation, a detailed EM&A Plan, proposing (i) work programme; (ii) actual data collection; (iii) methodologies / procedures, including proposed computation model, to process data into indicators of measures / assumptions adopted; (iv) quality control and assurance procedure; (v) action / investigation plan if any non-compliance, including associated action and limit levels; (vi) community liaison plan; (vii) relevant proforma forming part of the reports; (viii) any foreseeable uncertainties, etc, should be submitted to EPD for agreement. Before submission to the Director of Environmental Protection for approval, the detailed EM&A Plan shall be certified by the ET Leader and verified by the IEC as conforming to the information and recommendations described in the EIA Report, and taking into account any specific requirements with respect to the latest in-situ conditions of the project.

4.1.7.3 When developing the detailed plan, references should be made to relevant international guidelines such as SAE ARP4721 Part 1 – Monitoring Aircraft Noise and Operations in the Vicinity of Airports: System Description, Acquisition, and Operation, if applicable, for the purpose of review and describe the project operation. Moreover, as mentioned before that the aircraft noise EM&A would be commenced in 2021, the latest monitoring and audit practice / presentation adopted by similar international airports should be reviewed and reference during the course of preparation of this detailed plan.

4.2 Fixed Noise Sources Monitoring

4.2.1 Maximum Permissible Sound Power Levels of Fixed Plant

4.2.1.1 The maximum permissible sound power levels of the identified fixed noise sources of the project were predicted in the EIA report. The specified sound power levels should be implemented and refined by the Contractor as appropriate to ensure that the noise impact associated with the fixed plant operations would comply with the noise standards stipulated in the EIAO-TM and NCO.

4.2.2 Commissioning Test

4.2.2.1 Prior to the operation of the project, the Contractor should conduct noise commissioning tests for all major fixed plant noise sources (excluding the ground noise sources associated with the aircraft taxiing and the operation of APUs) within HKIA to ensure the noise emission at the fixed plant noise source comply with the EIA report assessed scenario. The test should be carried out by a qualified person possessing at least seven years of noise control experience and a corporate membership of Hong Kong Institute of Acoustics or equivalent. The noise commissioning test report should be submitted to the ET Leader, IEC and AAHK / PM for approval. The ET and IEC should review design changes to ensure the cumulative noise impact from fixed noise sources comply with the EIA Report assessed scenario.

4.2.2.2 Noise commissioning tests are also required for noise enclosure of aircraft engine run-up facilities. ISO 10847 – In-situ determination of insertion loss of outdoor noise barriers of all types shall be employed to ensure the required noise reduction (insertion loss) in the EIA report (at least 15 dB(A)) would be achieved. The test should be carried out by a qualified person possessing at least seven years of noise control experience and a corporate membership of Hong Kong Institute of Acoustics or equivalent. The noise commissioning test report should be submitted to the ET Leader, IEC and AAHK / PM for approval.

4.2.2.3 No adverse noise impacts are anticipated from aircraft taxiing and APU operation, hence no environmental monitoring and audit is proposed.

4.2.3 Mitigation Measures

4.2.3.1 The relevant noise mitigation measures have been recommended in the EIA Report. The implementation schedule of the mitigation measures are given in **Appendix C**.

4.3 Construction Airborne Noise Monitoring

4.3.1 Noise Parameter

4.3.1.1 The construction noise level should be measured in terms of the A-weighted equivalent continuous sound pressure level (Leq). Leq (30 minutes) should be used as the monitoring parameter for the time period between 0700-1900 hours on normal weekdays. For all other time periods, a Construction Noise Permit (CNP) under the Noise Control Ordinance (NCO) would apply.

4.3.1.2 As supplementary information for data auditing, statistical results such as L_{10} and L_{90} should also be obtained for reference. A sample data record sheet is shown in **Appendix B**.

4.3.2 Monitoring Equipment

4.3.2.1 As referred to in the Technical Memorandum (TM) issued under the NCO, sound level meters in compliance with the International Electrotechnical Commission Publications 651:1979 (Type 1) and 804:1985 (Type 1) specifications should be used for carrying out the noise monitoring. Immediately prior to and following each noise measurement the accuracy of the sound level meter should be checked using an acoustic calibrator generating a known sound pressure level at a known frequency. Measurements may be accepted as valid only if the calibration level from before and after the nose measurement agrees to within 1.0 dB.

4.3.2.2 Noise measurements should not be made in accordance with standard acoustical principles and practices in relation to weather conditions.

4.3.2.3 The ET is responsible for the availability of monitoring equipment and should ensure that sufficient noise measuring equipment and associated instrumentation are available for carrying out the baseline monitoring, regular impact monitoring and ad hoc monitoring. All the equipment and associated instrumentation should be clearly labelled.

4.3.3 Monitoring Locations

4.3.3.1 The noise monitoring locations as shown in **Drawing No. MCL/P132/EMA/4-001** are summarised in **Table 4-1**. The status and locations of noise sensitive receivers may change after issuing this manual. If such case exists, the ET should propose updated monitoring locations and seek approval from the AAHK / PM and agreement from the IEC and EPD of the proposal.

Table 4-1: Construction Noise Monitoring Stations

ID	ID adopted in EIA	Description
NM1	TC-1	Seaview Crescent Block 1
NM2	TC-5	Tung Chung West Development (Monitoring to start after occupation of development in 2023/24, subject to the construction programme of the Project)
NM3	TC-30	Ho Yu College
NM4	TC-37	Ching Chung Hau Po Won Primary School
NM5	TS-1	House, Tin Sum
NM6	SLW-1	House No. 1, Sha Lo Wan

4.3.3.2 When alternative monitoring locations are proposed, the monitoring locations should be chosen based on the following criteria:

- Monitoring at sensitive receivers close to the major site activities which are likely to have noise impacts;
- Monitoring at the noise sensitive receivers as defined in the Technical Memorandum; and
- Assurance of minimal disturbance to the occupants during monitoring.

4.3.3.3 The monitoring station should normally be at a point 1 m from the exterior of the sensitive receivers building facade and be at position 1.2 m above the ground. If there is a problem with access to the normal monitoring position, an alternative position may be chosen, and a correction to the measurements should be made. For reference, a correction of +3 dB(A) should be made to the free field measurements. The ET should agree with the IEC on the monitoring position and the corrections adopted. Once the positions for the monitoring stations are chosen, the baseline monitoring and the impact monitoring should be carried out at the same positions.

4.3.4 Baseline Monitoring

4.3.4.1 The ET should carry out baseline noise monitoring prior to the commencement of the project-related construction activities. The baseline monitoring should be carried out daily for a period of at least two weeks. The commencement date of baseline monitoring shall be agreed between the ET / IEC / AAHK / PM to ensure timely submission of the baseline monitoring report to EPD. Before commencing the baseline monitoring, the ET should develop and submit to the IEC the baseline monitoring programme such that the IEC can conduct on-site audit to check accuracy of the baseline monitoring results.

4.3.4.2 There should not be any construction activities in the vicinity of the stations during the baseline monitoring.

4.3.4.3 In exceptional cases, when insufficient baseline monitoring data or questionable results are obtained, the ET should liaise with EPD, IEC and the AAHK / PM to agree on an appropriate set of data to be used as a baseline reference and submit to the AAHK / PM and IEC for agreement and EPD for approval.

4.3.5 Impact Monitoring

4.3.5.1 Noise monitoring should be carried out at all the designated monitoring stations when there are project-related construction activities undertaken. The monitoring frequency should depend on the scale of the construction activities. The following is an initial guide on the regular monitoring frequency for each station on a weekly basis when noise generating activities are underway:

- One set of measurements between 0700-1900 hours on normal weekdays;

4.3.5.2 If construction works are extended to include works during the hours of 1900-0700 as well as public holidays and Sundays, additional impact monitoring (including monitoring locations) during respective periods of restricted hours should be subject to the CNP requirements by EPD. Applicable permits under NCO should also be obtained by the Contractor.

4.3.5.3 For schools located near the HKIA (e.g. NM2 and NM3), noise monitoring should be carried out at the monitoring stations for the schools during the school examination periods. The ET should liaise with the school's personnel and the Examination Authority to ascertain the exact dates and times of all examination periods during the course of the contract.

4.3.5.4 In case of non-compliance with the construction noise criteria, more frequent monitoring, as specified in the Event and Action Plan in **Table 4-3**, should be carried out. This additional monitoring should be continued until the recorded noise levels are rectified or proved to be irrelevant to the construction activities.

4.3.6 Event and Action Plan for Noise

4.3.6.1 The action and limit levels for construction noise are defined in **Table 4-2**. Should non-compliance of the criteria occur, action in accordance with the Event and Action Plan in **Table 4-3**, should be carried out.

Table 4-2: Typical Action and Limit Levels for Construction Noise

Time Period	Action	Limit
0700-1900 hours on normal weekdays	When one valid documented complaint is received.	75* dB(A)

Note: * reduce to 70 dB(A) for schools and 65 dB(A) during school examination periods.

Table 4-3: Event and Action Plan for Construction Noise

	Action			
Event	**ET**	**IEC**	**AAHK / PM**	**Contractor**
Action Level	1. Notify AAHK / PM, IEC and Contractor; 2. Carry out investigation; 3. Report the results of investigation to the IEC, AAHK / PM and Contractor; 4. Discuss with the IEC and Contractor on remedial measures required; 5. Increase monitoring frequency to check mitigation effectiveness.	1. Review the investigation results submitted by the ET; 2. Review the proposed remedial measures by the Contractor and advise the AAHK / PM accordingly; 3. Advise AAHK / PM on the effectiveness of the proposed remedial measures.	1. Confirm receipt of notification of failure in writing; 2. Notify Contractor; 3. In consolidation with the IEC, agree with the Contractor on the remedial measures to be implemented; 4. Supervise the implementation of remedial measures.	1. Submit noise mitigation proposals to IEC and AAHK / PM; 2. Implement noise mitigation proposals.
Limit Level	1. Inform IEC, AAHK / PM and Contractor; 2. Repeat measurements to confirm findings; 3. Inform EPD after confirming the validity of exceedance; 4. Increase monitoring frequency; 5. Identify source and investigate the cause of exceedance; 6. Carry out analysis of Contractor's working procedures; 7. Discus with the IEC, Contractor and AAHK / PM on remedial measures required; 8. Assess effectiveness of Contractor's remedial actions and keep IEC, EPD and AAHK / PM informed of the results; 9. If exceedance stops, cease additional monitoring.	1. Discuss amongst AAHK / PM, ET and Contractor on the potential remedial actions; 2. Review contractor's remedial actions whenever necessary to assure their effectiveness and advise AAHK / PM accordingly.	1. Confirm receipt of notification of failure in writing; 2. Notify Contractor; 3. In consolidation with the IEC, agree with the Contractor on the remedial measures to be implemented; 4. Supervise the implementation of remedial measures; 5. If exceedance continues, consider stopping the Contractor to continue working on that portion of work which causes the exceedance until the exceedance is abated.	1. Take immediate action to avoid further exceedance; 2. Submit proposals for remedial actions to IEC and AAHK / PM within three working days of notification; 3. Implement the agreed proposals; 4. Submit further proposal if problem still not under control; 5. Stop the relevant portion of works as instructed by AAHK / PM until the exceedance is abated.

4.3.7 Mitigation Measures

4.3.7.1 Recommended construction noise control and mitigation measures are proposed in the EIA report. The Contractor should be responsible for the design and implementation of these measures under the supervision of the AAHK / PM and be monitored by the ET. The implementation schedule of the recommended noise mitigation measures is presented in **Appendix C**.

4.4 Road Traffic and Marine Traffic Noise Monitoring

4.4.1.1 No adverse road or marine traffic noise impacts are anticipated from operation of the project, hence no environmental monitoring and audit is proposed.

5. Water Quality Impact

5.1 Construction Water Quality Monitoring

5.1.1 Introduction

5.1.1.1 The main potential water quality impact during construction phase is the release of suspended solids (SS) during land formation. Water jetting and field joint excavation works for the submarine cable diversion may also generate some SS release. Environmental monitoring for these marine works are described in **Section 5.1.8**.

5.1.1.2 The potential risk of contaminants released from pore water during ground improvement via deep cement mixing (DCM) within the CMP area has also been identified as a concern. While the results of the water quality impact assessment suggests that potential contaminant release from pore water would be insignificant, it is recognised that full scale ground improvement works over the completed and capped CMPs has not previously been implemented in Hong Kong. Therefore, specific environmental monitoring for the initial DCM activities are included as part of the EM&A requirements and are described in **Section 5.1.9**.

5.1.2 Water Quality Parameters

5.1.2.1 Monitoring of Dissolved Oxygen (DO), Dissolved Oxygen Saturation (DO%), pH, temperature, turbidity, salinity, Suspended Solid (SS) as well as current speed and direction should be undertaken at all designated monitoring locations.

5.1.2.2 For monitoring of DCM works, there will be an initial intensive monitoring of temperature, alkalinity, heavy metals and nutrients at designated DCM-specific monitoring stations. Thereafter, alkalinity and two representative heavy metals will be monitored.

5.1.2.3 The general and DCM-specific monitoring locations are described in **Section 5.1.5**. All parameters should be measured in-situ whereas SS, alkalinity, heavy metals and nutrients should be determined by laboratory. DO should be presented in mg/L and in % saturation.

5.1.2.4 Other relevant data should also be recorded, including monitoring location, time, tidal stages, weather conditions, sea conditions and any special phenomena and work underway at the construction site.

5.1.3 Sampling Procedures and Monitoring Equipment

5.1.3.1 Water samples for all monitoring parameters should be collected, stored, preserved and analysis according to the Standard Methods, APHA 22nd ed. and/or other methods as agreed by the EPD. In-situ measurements at monitoring locations including temperature, DO, turbidity, salinity and water depth should be collected by equipment with the characteristics and functions listed in the following sections.

5.1.3.2 Sample data record sheets are shown in **Appendix B**.

5.1.3.3 The monitoring equipment and facilities should be provided by the ET.

Dissolved Oxygen and Temperature Measuring Equipment

5.1.3.4 The instrument should be portable and weatherproof using a DC power source. It should have a membrane electrode with automatic temperature compensation complete with a cable. The equipment should be capable of measuring:

- A dissolved oxygen level in the range of 0-20 mg/L and 0-200 % saturation; and
- A temperature of 0-45 degree Celsius with a capability of measuring to ±0.1 degree Celsius

pH Measuring Equipment

5.1.3.5 A portable pH meter capable of measuring a range between 0.0 and 14.0 should be provided to measure pH under the specified conditions accordingly to the Standard Methods, APHA.

Turbidity Measurement Instrument

5.1.3.6 The instrument should be portable and weatherproof using a DC power source. It should have a photoelectric sensor capable of measuring turbidity between 0-1000 NTU.

Salinity

5.1.3.7 A portable salinometer capable of measuring salinity in the range of 0-40 mg/L should be provided for measuring salinity of the water at each monitoring location.

Alkalinity

5.1.3.8 A digital titrator capable of dispensing 0.002ml at one single dispense should be provided to measure the amount of sulphuric acid used in determination of alkalinity.

Nutrient, Heavy Metals and Suspended Solids (SS)

5.1.3.9 A water sampler comprises a transparent PVC cylinder, with a capacity of not less than two litres, and could be effectively sealed with latex cups at both ends should be used. The sampler should have a positive latching system to keep it open and prevent premature closure until released by a messenger when the sampler is at the selected water depth (Kahlsico Water Sampler or a similar instrument approved by the ET and AAHK / PM).

5.1.3.10 Water samples for nutrient, heavy metals and SS analysis should be stored in high density polythene bottles with no preservative added, packed in ice (cooled to 4 ºC without being frozen), delivered to the laboratory and analysed as soon as possible after collection.

Water Depth Detector

5.1.3.11 A portable, battery-operated echo sounder should be used for the determination of water depth at each designated monitoring station. The unit would either be handheld of affixed to the bottom of the work boat, if the same vessel is to be used throughout the monitoring programme.

Positioning Device

5.1.3.12 A hand-held or boat-fixed type digital Global Positioning System (dGPS) with way point bearing indication or other equivalent instrument of similarly accuracy should be provided and used during monitoring to ensure the monitoring vessel is at the correct location before taking measurements.

Calibration of In-situ Instruments

5.1.3.13 All in-situ monitoring instrument should be checked, calibrated and certified by a laboratory accredited under HOKLAS (or other international accreditation scheme that is HOKLAS-equivalent) before use, and subsequently re-calibrated at three monthly intervals throughout all stages of the water quality monitoring. Responses of sensors and electrodes should be checked with certified standard solutions before each use.

5.1.3.14 Wet bulb calibration for a DO meter should be carried out before measurement at each monitoring location. A zero check in distilled water should be performed with the turbidity probe at least once per monitoring day. The probe should then be calibrated with a solution of known NTU. In addition, the turbidity probe should be calibrated at least twice per month to establish the relationship between turbidity readings (in NTU) and levels of suspended solids (in mg/L). Accuracy check of the digital titrator should be performed at least once per monitoring day.

5.1.3.15 For the on-site calibration of field equipment, the BS 127:1993, Guide to Field and On-site Test Methods for the Analysis of Waters should be observed.

5.1.3.16 Sufficient stocks of spare parts should be maintained for replacements when necessary. Backup monitoring equipment should also be made available so that monitoring can proceed uninterrupted even when some equipment is under maintenance, calibration etc.

5.1.4 Laboratory Measurement / Analysis

5.1.4.1 Analysis of nutrient, heavy metals and suspended solids should be carried out in a HOKLAS laboratory (or other international accredited laboratory that is HOKLAS-equivalent). Sufficient water samples should be collected at the monitoring stations for carrying out the laboratory nutrient, heavy metals and SS determination. The alkalinity, nutrient, heavy metals and SS determination work should start within 24 hours after collection of the water samples. The analysis of alkalinity, nutrient, heavy metals and SS should follow the standard methods summarised in **Table 5-1**.

Table 5-1: Laboratory analysis for SS, alkalinity, nutrient and heavy metals

Parameters	Instrumentation	Analytical Method	Reporting Limit
Suspended Solid (SS)	Analytical Balance	APHA 2540D	2 mg/L
Nutrient			
Ammonia as N	FIA	APHA 4500	0.01 mg/L
Unionised ammonia (NH_3)*	By calculation	By calculation	By calculation
Nitrite as N	FIA	APHA 4500	0.01 mg/L
Nitrate as N	FIA	APHA 4500	0.01 mg/L
TKN as N	Titration	APHA 4500	0.1 mg/L
Total Phosphorus	Colorimetric	APHA 4500	0.01 mg/L
Reactive Phosphorus	FIA	APHA 4500	0.01 mg/L
Heavy Metals			
Cadmium (Cd)	ICP-MS	USEPA 6020A	0.1 µg/L
Chromium (Cr)	ICP-MS	USEPA 6020A	0.2 µg/L
Copper (Cu)	ICP-MS	USEPA 6020A	0.2 µg/L
Nickel (Ni)	ICP-MS	USEPA 6020A	0.2 µg/L
Lead (Pb)	ICP-MS	USEPA 6020A	0.2 µg/L
Zinc (Zn)	ICP-MS	USEPA 6020A	1 µg/L
Arsenic (As)	ICP-MS	USEPA 6020A	1 µg/L
Silver (Ag)	ICP-MS	USEPA 6020A	0.1 µg/L
Mercury (Hg)	ICP-MS	APHA 7470A	0.05 µg/L

*Note: Calculation based on the laboratory result of ammonia nitrogen (NH_4-N) and in-situ measured pH, salinity and temperature.

5.1.4.2 If in-house or non-standard methods are proposed, details of the method verification should, if required, be submitted to EPD. In any circumstances, the sample testing should have comprehensive quality assurance and quality control programmes. The laboratory should be prepared to demonstrate the quality control programmes to EPD or their representative if and when required.

5.1.4.3 Additional duplicate samples may be required by EPD for inter laboratory calibration. Remaining samples after analysis should be kept by the laboratory for three months in case repeat analysis is required.

5.1.4.4 If a site laboratory is set up or a non-HOKLAS and non-international accredited laboratory is hired for carrying out the laboratory analysis, the laboratory equipment, analytical procedures, and quality control shall be approved by EPD. All the analysis shall be witnessed by the AAHK / PM. The ET Leader shall provide the AAHK / PM and IEC with one copy of the relevant chapters of the "APHA Standard Methods for the Examination of Water and Wastewater" 22nd edition and any other relevant document for their reference.

5.1.5 Monitoring Locations

General Monitoring Locations

5.1.5.1 A total of 25 water quality monitoring locations (comprising 14 impact stations, eight sensitive receiver stations and three control stations) have been proposed for the construction and post-construction phases. The coordinates are shown in **Table 5-2** and the locations are shown in **Drawing No. MCL/P132/EMA/5-001** and **MCL/P132/EMA/5-002**. The final locations and number of monitoring points should be agreed with EPD at least two weeks before undertaking any works.

Table 5-2: Water Quality Monitoring Stations (construction and post construction phases)

Monitoring Stations	Description	Coordinates		Parameters	Construction Activities Monitored
		Easting	Northing		
C1	Control	804247	815620	DO, pH, Temperature, Salinity, Turbidity, SS	From commencement of advance marine works (submarine 11 kV cable diversion) until completion of all marine filling works for land formation
C2	Control	806945	825682		
C3	Control	817803	822109		From commencement of land formation until completion of all marine filling works
IM1	Impact	806458	818351		From commencement of land formation until completion of all marine filling works
IM2	Impact	806193	818852		From commencement of land formation until completion of nearest 1 km of seawall
IM3	Impact	806019	819411		
IM4	Impact	805039	819570		
IM5	Impact	804924	820564		
IM6	Impact	805828	821060		
IM7	Impact	806835	821349		From commencement of land formation until completion of all marine filling works
IM8	Impact	807838	821695		From commencement of land formation until completion of nearest 1 km of seawall
IM9*	Impact	808811	822094	DO, pH, Temperature, Salinity, Turbidity, SS, Alkalinity	From commencement of land formation until completion of nearest 1 km of seawall

Monitoring Stations	Description	Coordinates		Parameters	Construction Activities Monitored
		Easting	Northing		
IM10*	Impact	809838	822240	*Heavy metals and nutrient	From commencement of land formation until completion of all marine filling works
IM11*	Impact	810545	821501		
IM12*	Impact	811519	821162		From commencement of land formation until completion of nearest 1 km of seawall
IM13	Impact (for submarine 11 kV cable diversion)	Mobile station (500 m envelope of water jetting works)		DO, pH, Temperature, Salinity, Turbidity, SS	From commencement until completion of water jetting works
IM14	Impact (for submarine 11 kV cable diversion)	Mobile station (500 m envelope of field joint excavation works)			From commencement until completion of field joint excavation works
SR1	Future Hong Kong-Zhuhai-Macao Bridge Hong Kong Boundary Crossing Facilities (HKBCF) Seawater Intake for cooling	812745	820085	DO, pH, Temperature, Salinity, Turbidity, SS	From commencement of advance marine works (submarine 11 kV cable diversion) until completion of all marine filling works for land formation
SR2	Planned marine park / hard corals at The Brothers / Tai Mo To	814166	821463		
SR3	Sha Chau and Lung Kwu Chau Marine Park / fishing and spawning grounds in North Lantau	807571	822147		
SR4	Sha Lo Wan	807798	816802		
SR5	San Tau Beach SSSI	810728	816230		
SR6	Tai Ho Bay, Near Tai Ho Stream SSSI	814663	817899		
SR7	Ma Wan Fish Culture Zone (FCZ)	823742	823636		
SR8	Seawater Intake	811593	820417		

Monitoring Stations	Description	Coordinates Easting	Northing	Parameters	Construction Activities Monitored
	for cooling at Hong Kong International Airport (East)				

* Denotes baseline monitoring stations and parameters for DCM-specific monitoring

5.1.5.2 For submarine 11 kV cable diversion works, two specific impact stations (IM13 and IM14) are proposed for the construction phase. These impact stations will be mobile stations located within a 500 m envelope of the respective water jetting / field joint excavation works. The indicative areas are shown in **Drawing No. MCL/P132/EMA/5-001**. Exact locations will depend on the tidal conditions (i.e. the impact station should always be downstream of the respective water jetting / field joint excavation works). In case where relocation of the impact stations is required, a minimum of 2 mobile impact stations at representative locations should be proposed by ET and approved by IEC and PM.

5.1.5.3 The status and locations of water sensitive receivers may change after issuing this Manual. If such case exists, the ET Leader should propose updated monitoring locations and seek approval from the IEC and EPD. The selection of these locations should follow the below criteria:

- Impact (IM) stations should be within the 500 m envelope of construction works;
- Sensitive receivers (SR) stations should be at close proximity to key sensitive receivers; and
- Control stations (C), as far as practicable, should be at representative locations of the water body being monitored while undisturbed by the project.

DCM-Specific Monitoring Locations

5.1.5.4 For the initial intensive DCM-specific water quality monitoring programme, monitoring should be conducted for a cluster of two or more DCM rigs working in close proximity. The ET should propose the DCM-specific water quality monitoring programme including the DCM works area to be monitored, the monitoring locations, and the commencement of monitoring, taking into account the DCM works area and programme. The proposal should be provided to EPD with the DCM works programme details for agreement prior to the DCM-specific monitoring. The locations of the DCM specific monitoring stations should be set up according to the below criteria.

For a combined DCM works area with longest diameter length smaller or equal to 200 m:

i. Two monitoring stations upstream of DCM works area;

ii. Three monitoring stations downstream and at 150 m envelope of DCM works area;

iii. Three monitoring stations downstream and at 250 m envelope of DCM works area;

iv. Monitoring stations should be at least 50 m apart;

v. Downstream monitoring stations should be perpendicular to the tidal direction.

For a combined DCM works area with longest diameter length larger than 200 m:

i. Two monitoring stations upstream of DCM works area;

ii. Five monitoring stations downstream and at 150 m envelope of DCM works area;

iii. Five monitoring stations downstream and at 250 m envelope of DCM works area;

iv. Downstream monitoring stations should be perpendicular to the tidal direction.

5.1.5.5 **Drawing No. MCL/P132/EMA/5-003** shows an indicative arrangement for works area smaller or equal to 200 m.

5.1.5.6 After completion of the initial intensive DCM-specific water quality monitoring programme, DCM monitoring locations will form part of the general monitoring locations presented in **Table 5-2**.

5.1.6 Baseline Monitoring

5.1.6.1 Baseline conditions for water quality shall be established and agreed with EPD prior to the commencement of works. The purpose of the baseline monitoring is to establish ambient conditions prior to the commencement of the marine works and to demonstrate the suitability of the proposed impact and control monitoring stations. The baseline conditions shall be established by measuring DO, DO%, pH, temperature, turbidity, salinity and SS at all designated stationary monitoring stations, plus nutrients and heavy metals at the "IM*" stations (which will provide the baseline water quality for the DCM-specific monitoring). The measurements should be taken three days per week, at mid-flood and mid-ebb tides, for at least four weeks prior to the commencement of marine works. The commencement date of baseline monitoring shall be agreed between the ET / IEC / AAHK / PM to ensure timely submission of the baseline monitoring report to EPD. Duplicate water samples should be taken and analysed.

5.1.6.2 There should not be any marine construction activities in the vicinity of the stations during the baseline monitoring.

5.1.6.3 In exceptional cases when insufficient baseline monitoring data or questionable results are obtained, the ET should seek approval from the IEC and EPD on an appropriate set of data to be used as baseline reference.

5.1.6.4 Baseline monitoring schedule should be faxed to EPD at least two weeks prior to the commencement of baseline monitoring. The interval between two sets of monitoring should be not less than 36 hours.

5.1.7 Efficiency of Silt Curtain System

5.1.7.1 Type II and/or Type III silt curtains[1] have been recommended in the EIA. These are to be implemented as a double layer arrangement. The indicative arrangement of the silt curtains to be adopted is shown in **Appendix D**. The ET should be responsible for conducting tests to confirm that the silt curtain system to be adopted satisfy the requirements in the EIA Report.

5.1.7.2 A pilot test should be carried out during the early stage of construction to confirm whether the silt removal efficiency of the double layer floating type silt curtains can achieve 61 % silt removal efficiency for sand blanket laying and marine filling activities. The pilot test should be undertaken during the highest current speed condition (covering both flood and ebb tide) and include measurements of current speed and direction, turbidity and suspended solids. The water quality monitoring points to be selected should be close to the locations of the marine works. If the pilot test is conducted in dry season, a verification test should be carried out during wet season at the highest current speed condition to re-confirm the findings. The details for the pilot study should be proposed by the ET and agreed with the IEC and EPD, taking into account of the Contractor's proposed actual locations of the works.

5.1.7.3 Regardless of the measured efficiency of the silt curtain system, the event and action plan should only be based on the monitoring results at the designated stationary monitoring stations.

5.1.8 General Impact Monitoring

5.1.8.1 During marine construction works, impact monitoring should be undertaken at all designated monitoring stations three days per week (refer to **Table 5-2** for the activities to be monitored). Monitoring should be undertaken at mid-flood (within ± 1.75 hour of the predicted time) and mid-ebb (within ± 1.75 hour of the predicted time) tides, with sampling / measurement at the designated stationary monitoring stations. The interval between two sets of monitoring should be not less than 36 hours except when the Action and/or Limit levels is/are exceeded, in which case the monitoring frequency should be increased. For DCM impact monitoring, please refer to **Section 5.1.9**

5.1.8.2 Two consecutive measurements of DO concentrations (mg/L), DO saturation (%) and turbidity (NTU) should be taken in-situ according to the stated sampling method. Where the difference in value between the first and second measurement of DO or turbidity parameters is more than 25 % of the value of the first reading, the reading should be discarded and further readings would be taken. Water samples for SS (mg/L) measurements should be collected at the same depths. Duplicate water samples should be taken and analysed.

[1] As defined by the United States Army Corporation of Engineers (USACE) classification system for silt curtains.

5.1.8.3 In addition to the above in-situ measurements, water temperature and pH should be determined at all designated monitoring stations at the same depths, as specified above. The monitoring location / position, time, weather conditions and any special phenomena should also be recorded.

5.1.9 DCM Impact Monitoring

Initial Intensive DCM Monitoring

5.1.9.1 According to the current design, DCM would be conducted within the contaminated mud pits during land formation. At the commencement of full-scale DCM works, ET is required to conduct an initial intensive DCM-specific water quality monitoring programme for a period of at least four weeks to ensure that the criteria for various contaminants are complied. This would be conducted for a cluster of DCM rigs as specified in **Section 5.1.5.4**.

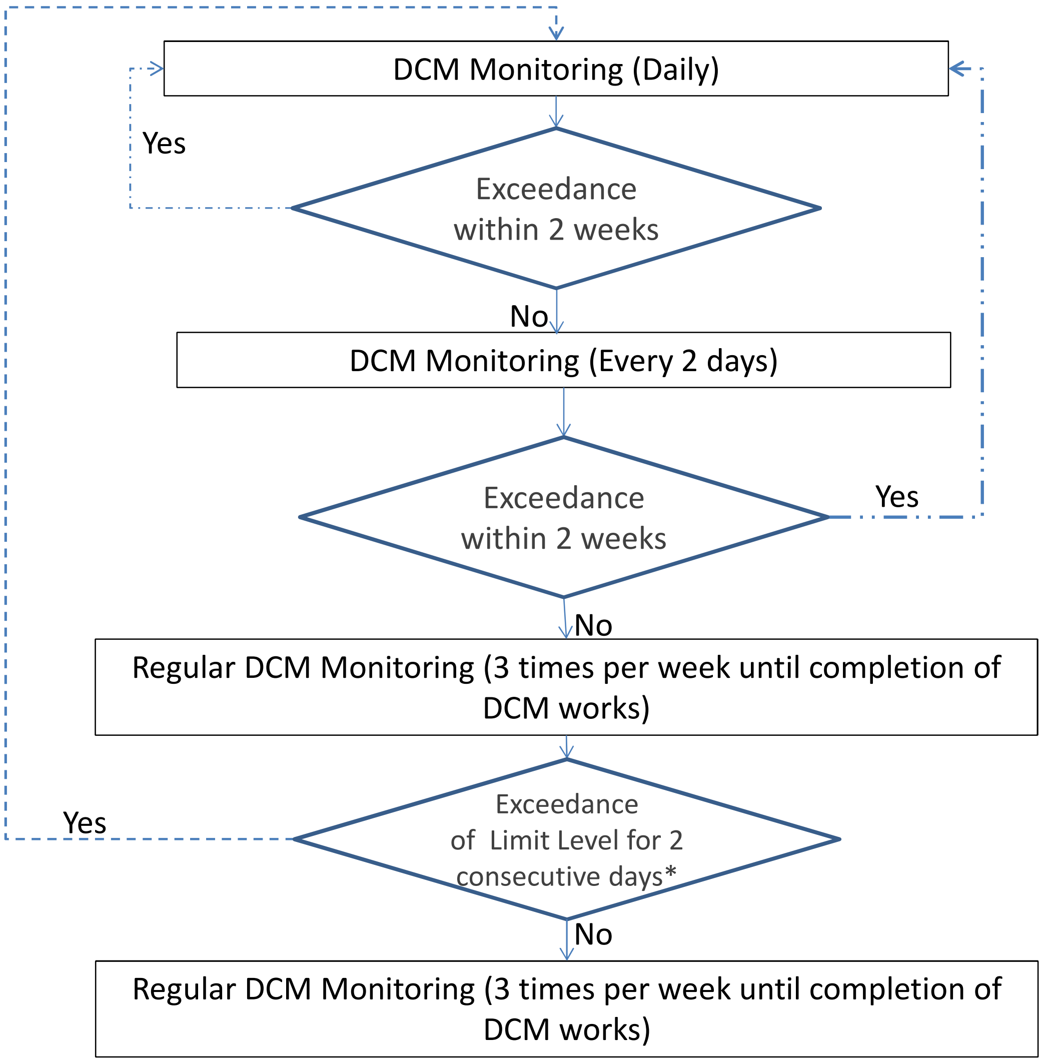
5.1.9.2 Daily monitoring at mid-flood (within ± 1.75 hour of the predicted time) and mid-ebb (within ± 1.75 hour of the predicted time) tides is required during the initial intensive DCM monitoring as shown in **Chart 5-1**. Two consecutive measurements of temperature (^{o}C) and alkalinity (ppm) should be taken in-situ according to the stated sampling method. Water samples for nutrient (mg/L) and heavy metals (µg/L) measurements should be collected at the same depths. Monitoring parameters for nutrients and heavy metals include those listed in **Table 5-1**. Duplicate water samples should be taken and analysed. If no exceedance is recorded within two weeks, then the monitoring frequency can be reduced to every two days. If no exceedance is recorded after another two weeks, the initial intensive DCM specific monitoring will be terminated and DCM monitoring will continue as part of the regular DCM monitoring.

Regular DCM Monitoring

5.1.9.3 After completion of the initial intensive DCM monitoring, regular DCM monitoring will be conducted as part of the general impact monitoring presented in **Section 5.1.8** for the remaining duration of the DCM works. During this period, alkalinity and two representative heavy metals will be monitored at all general monitoring stations in addition to those parameters specified in **Table 5-2**. The two representative heavy metals shall be proposed by the ET taking into account the findings of the initial intensive DCM monitoring. Two consecutive measurements of alkalinity (ppm) should be taken in-situ according to the stated sampling method, and water samples for heavy metals (µg/L) measurements should be collected at the same depths. Duplicate water samples should be taken and analysed.

5.1.9.4 During this regular DCM monitoring period, if there is any exceedance of the limit levels for alkalinity and the two representative heavy metals for two consecutive sampling days and such exceedance is confirmed by the ET (with verification by the IEC) to be a result of the DCM works, intensive DCM monitoring will be re-initiated as shown in **Chart 5-1**. Monitoring parameters during the intensive DCM monitoring will be the same as those conducted for the initial intensive DCM monitoring until such time as no further exceedances are detected and regular DCM monitoring resumes.

Chart 5-1: Flow Chart for DCM Monitoring



*Exceedances for alkalinity and the two representative heavy metals should be confirmed by ET and verified by IEC as project-related.

5.1.10 Post-Construction Monitoring

5.1.10.1 Upon completion of all marine construction works, a post project water quality monitoring exercise should be carried out for four weeks, in the same manner as the impact monitoring during construction phase.

5.1.11 Event and Action Plan for Water Quality

5.1.11.1 The action and limit (AL) levels for water quality (excluding sensitive receiver stations representing seawater intakes) are defined in **Table 5-3**.

Table 5-3: Action and Limit Levels for Water Quality

Parameters	Action Level	Limit Level
DO in mg/L (Surface, Middle & Bottom)	Surface and Middle 5 percentile of baseline data for surface and middle layer	Surface and Middle 5 mg/L or 1 percentile of baseline data for surface and middle layer for Fish Culture Zone (SR7) 4 mg/L or 1 percentile of baseline data for surface and middle layer for other stations
	Bottom 5 percentile of baseline data for bottom layer	Bottom 2 mg/L or 1 percentile of baseline data for surface and middle layer
Temperature in ^{o}C (for intensive DCM monitoring only)	1.8^{o}C above the temperature recorded at representative control stations at the same tide of the same day	2^{o}C above the temperature recorded at representative control stations at the same tide of the same day
SS in mg/L	95 percentile of baseline data or 120% of upstream control station at the same tide of the same day, whichever is higher	99 percentile of baseline data or 130% of upstream control station at the same tide of the same day, whichever is higher
Turbidity in NTU		
Alkalinity in ppm		
Nutrient		
Ammonia (NH_3)		
Unionised ammonia (NH_3) (with 0.021 mg/L as the upper limit)		
Nitrite (NO_2)		
Nitrate (NO_3)		
TKN		
Total Phosphorus		
Reactive Phosphorus		
Heavy Metals		
Cadmium (Cd)		0.2 µg/L
Chromium (Cr)		15 µg/L
Copper (Cu)		3.1 µg/L
Nickel (Ni)		8.2 µg/L
Lead (Pb)		7.2 µg/L
Zinc (Zn)		10 µg/L
Arsenic (As)		25 µg/L

Parameters	Action Level	Limit Level
Silver (Ag)		1.9 µg/L
Mercury (Hg)		0.05 µg/L

Notes:

1. For DO measurement, non-compliance occurs when monitoring result is lower than the limits.
2. For parameters other than DO, non-compliance of water quality results when monitoring results is higher than the limits.
3. Depth-averaged results are used unless specified otherwise.
4. All the figures given in the table are used for reference only and the EPD may amend the figures whenever necessary.
5. For all mobile impact stations, the baseline data will be represented by the nearest stationary monitoring station.

5.1.11.2 For sensitive receiver stations representing seawater intakes for cooling (e.g. SR1 and SR8), only the event and action level for SS parameter would be applicable (as the operation of these intakes would not be significant affected by the other water quality parameters). At these cooling water intakes, the AL levels for SS are dependent on the operational tolerance of individual intakes. The ET will propose suitable AL levels for SS at individual sensitive receiver stations representing seawater intakes, and this shall be agreed with the IEC and the respective operators of the intakes prior to commencement of construction activities.

5.1.11.3 The actions in accordance with the Event and Action Plan in **Table 5-4** and **Table 5-5** should be carried out if the water quality assessment criteria are exceeded at any designated monitoring points.

Table 5-4: Event and Action Plan for Water Quality

	Action			
Event	**ET**	**IEC**	**AAHK / PM**	**Contractor**
Action level being exceeded by one sampling day	1. Repeat in-situ measurement to confirm findings; 2. Identify reasons for non-compliance and sources of impact; 3. Inform IEC and Contractor; 4. Check monitoring data, all plant, equipment and Contractor's working methods; 5. Discuss mitigation measures with IEC and Contractor;	1. Discuss with ET and Contractor on the mitigation measures; 2. Review proposals on mitigation measures submitted by Contractor and advise AAHK / PM accordingly; 3. Assess the effectiveness of the implemented mitigation measures.	1. Discuss with IEC on the proposed mitigation measures; 2. Make agreement on the mitigation measures to be implemented; 3. Assess the effectiveness of the implemented mitigation measures.	1. Inform AAHK / PM and confirm notification of the non-compliance in writing; 2. Rectify unacceptable practice; 3. Check all plant and equipment; 4. Consider changes of working methods; 5. Discuss with ET and IEC and propose mitigation measures.

Event	Action: ET	Action: IEC	Action: AAHK / PM	Action: Contractor
	6. Repeat measurement on next day of exceedance.			
Action Level being exceeded by more than two consecutive sampling days	1. Repeat in-situ measurement to confirm findings; 2. Identify reasons for non-compliance and sources of impact; 3. Inform IEC and Contractor; 4. Check monitoring data, all plant, equipment and Contractor's working methods; 5. Discuss mitigation measures with IEC and Contractor; 6. Ensure mitigation measures are implemented; 7. Prepare to increase the monitoring frequency to daily; 8. Repeat measurement on next day of exceedance.	1. Discuss with ET and Contractor on the mitigation measures; 2. Review proposals on mitigation measures submitted by Contractor and advise AAHK / PM accordingly; 3. Assess the effectiveness of the implemented mitigation measures.	1. Discuss with IEC on the proposed mitigation measures; 2. Make agreement on the mitigation measures to be implemented; 3. Assess the effectiveness of the implemented mitigation measures.	1. Inform AAHK / PM and confirm notification of the non-compliance in writing; 2. Rectify unacceptable practice; 3. Check all plant and equipment; 4. Consider changes of working methods; 5. Discuss with ET and IEC and propose mitigation measures to IEC and AAHK / PM within 3 working days; 6. Implement the agreed mitigation measures.
Limit Level being exceeded by one sampling day	1. Repeat in-situ measurement to confirm findings; 2. Identify reasons for non-compliance and sources of impact; 3. Inform IEC, Contractor and EPD; 4. Check monitoring data, all plant, equipment and Contractor's working methods; 5. Discuss mitigation measures with IEC, AAHK / PM and Contractor; 6. Ensure mitigation	1. Discuss with ET and Contractor on the mitigation measures; 2. Review proposals on mitigation measures submitted by Contractor and advise AAHK / PM accordingly; 3. Assess the effectiveness of the implemented mitigation measures.	1. Discuss with IEC, ET and Contractor on the proposed mitigation measures; 2. Request Contractor to critically review the working methods; 3. Make agreement on the mitigation measures to be implemented; 4. Assess the effectiveness of the implemented mitigation measures.	1. Inform AAHK / PM and confirm notification of the non-compliance in writing; 2. Rectify unacceptable practice; 3. Check all plant and equipment; 4. Consider changes of working methods; 5. Discuss with ET, IEC and AAHK / PM and propose mitigation measures to IEC and AAHK / PM within three working days; 6. Implement the agreed mitigation

Event	Action: ET	Action: IEC	Action: AAHK / PM	Action: Contractor
	measures are implemented; 7. Increase the monitoring frequency to daily until no exceedance of limit level.			measures.
Limit Level being exceeded by more than one consecutive sampling days	1. Repeat in-situ measurement to confirm findings; 2. Identify reasons for non-compliance and sources of impact; 3. Inform IEC, Contractor and EPD; 4. Check monitoring data, al plant, equipment and Contractor's working methods; 5. Discuss mitigation measures with IEC, AAHK / PM and Contractor; 6. Ensure mitigation measures are implemented; 7. Increase the monitoring frequency to daily until no exceedance of limit level for two consecutive days.	1. Discuss with ET and Contractor on the mitigation measures; 2. Review proposals on mitigation measures submitted by Contractor and advise AAHK / PM accordingly; 3. Assess the effectiveness of the implemented mitigation measures.	1. Discuss with IEC, ET and Contractor on the proposed mitigation measures; 2. Request contractor to critically review the working methods; 3. Make agreement on the mitigation measures to be implemented; 4. Assess the effectiveness of the implemented mitigation measures; 5. Consider and instruct, if necessary, the Contractor to slow down or to stop all or part of the construction activities until no exceedance of limit level.	1. Inform AAHK / PM and confirm notification of the non-compliance in writing; 2. Rectify unacceptable practice; 3. Check all plant and equipment; 4. Consider changes of working methods; 5. Discuss with ET, IEC and AAHK / PM and propose mitigation measures to IEC and AAHK / PM within three working days; 6. Implement the agreed mitigation measures; 7. As directed by AAHK / PM, to slow down or to stop all or part of the construction activities.

Table 5-5: Event and Action Plan for DCM Process

Event	Action: ET	Action: IEC	Action: AAHK / PM	Action: Contractor
Action level being exceeded by one sampling day	1. Repeat in-situ measurement to confirm findings; 2. identify reasons for non-compliance and sources of impact; 3. Inform IEC and Contractor;	1. Discuss with ET and Contractor on the mitigation measures; 2. Review proposals on mitigation measures submitted by Contractor and advise AAHK / PM	1. Discuss with IEC on the proposed mitigation measures; 2. Make agreement on the mitigation measures to be implemented; 3. Assess the effectiveness of the	1. Inform AAHK / PM and confirm notification of the non-compliance in writing; 2. Rectify unacceptable practice; 3. Check all plant and equipment;

Event	Action: ET	IEC	AAHK / PM	Contractor
	4. Check monitoring data, all plant, equipment and Contractor's working methods; 5. Discuss mitigation measures with IEC and Contractor; 6. During intensive DCM monitoring, increase monitoring frequency in accordance with **Chart 5-1**. During regular DCM monitoring, repeat measurement on next day of exceedance.	accordingly; 3. Assess the effectiveness of the implemented mitigation measures.	implemented mitigation measures.	4. Consider changes of working methods; 5. Discuss with ET and IEC and propose mitigation measures.
Action Level being exceeded by more than two consecutive sampling days	1. Repeat in-situ measurement to confirm findings; 2. Identify reasons for non-compliance and sources of impact; 3. Inform IEC and Contractor; 4. Check monitoring data, all plant, equipment and Contractor's working methods; 5. Discuss mitigation measures with IEC and Contractor; 6. Ensure mitigation measures are implemented; 7. During intensive DCM monitoring, increase monitoring frequency in accordance with **Chart 5-1**. During regular DCM monitoring, repeat measurement on next day of exceedance and prepare to increase the	1. Discuss with ET and Contractor on the mitigation measures; 2. Review proposals on mitigation measures submitted by Contractor and advise AAHK / PM accordingly; 3. Assess the effectiveness of the implemented mitigation measures.	1. Discuss with IEC on the proposed mitigation measures; 2. Make agreement on the mitigation measures to be implemented; 3. Assess the effectiveness of the implemented mitigation measures.	1. Inform AAHK / PM and confirm notification of the non-compliance in writing; 2. Rectify unacceptable practice; 3. Check all plant and equipment; 4. Consider changes of working methods; 5. Discuss with ET and IEC and propose mitigation measures to IEC and AAHK / PM within 3 working days; 6. Implement the agreed mitigation measures. 7. As directed by AAHK / PM, to slow down all or part of the construction activities.

Event	Action: ET	IEC	AAHK / PM	Contractor
	monitoring frequency to daily.			
Limit Level being exceeded by one sampling day	1. Repeat in-situ measurement to confirm findings; 2. Identify reasons for non-compliance and sources of impact; 3. Inform IEC, Contractor and EPD; 4. Check monitoring data, all plant, equipment and Contractor's working methods; 5. Discuss mitigation measures with IEC, AAHK / PM and Contractor; 6. Ensure mitigation measures are implemented; 7. During intensive DCM monitoring, increase monitoring frequency in accordance with **Chart 5-1**. During regular DCM monitoring, increase the monitoring frequency to daily until no exceedance of limit level	1. Discuss with ET and Contractor on the mitigation measures; 2. Review proposals on mitigation measures submitted by Contractor and advise AAHK / PM accordingly; 3. Assess the effectiveness of the implemented mitigation measures.	1. Discuss with IEC, ET and Contractor on the proposed mitigation measures; 2. Request Contractor to critically review the working methods; 3. Make agreement on the mitigation measures to be implemented; 4. Assess the effectiveness of the implemented mitigation measures.	1. Inform AAHK / PM and confirm notification of the non-compliance in writing; 2. Rectify unacceptable practice; 3. Check all plant and equipment; 4. Consider changes of working methods; 5. Discuss with ET, IEC and AAHK / PM and propose mitigation measures to IEC and AAHK / PM within three working days; 6. Implement the agreed mitigation measures.
Limit Level being exceeded by more than one consecutive sampling days	1. Repeat in-situ measurement to confirm findings; 2. Identify reasons for non-compliance and sources of impact; 3. Inform IEC, Contractor and EPD; 4. Check monitoring data, al plant, equipment and Contractor's working methods; 5. Discuss mitigation	1. Discuss with ET and Contractor on the mitigation measures; 2. Review proposals on mitigation measures submitted by Contractor and advise AAHK / PM accordingly; 3. Assess the effectiveness of the implemented mitigation measures.	1. Discuss with IEC, ET and Contractor on the proposed mitigation measures; 2. Request contractor to critically review the working methods; 3. Make agreement on the mitigation measures to be implemented; 4. Assess the effectiveness of the implemented mitigation measures;	1. Inform AAHK / PM and confirm notification of the non-compliance in writing; 2. Rectify unacceptable practice; 3. Check all plant and equipment; 4. Consider changes of working methods; 5. Discuss with ET, IEC and AAHK / PM and propose mitigation measures to IEC and

Event	ET	IEC	AAHK / PM	Contractor
			Action	
	measures with IEC, AAHK / PM and Contractor; 6. Ensure mitigation measures are implemented; 7. During intensive DCM monitoring, increase monitoring frequency in accordance with **Chart 5-1**. During regular DCM monitoring, re-initiate the intensive DCM monitoring in accordance with **Chart 5-1**.		5. Consider and instruct, if necessary, the Contractor to slow down or to stop all or part of the construction activities until no exceedance of limit level.	AAHK / PM within three working days; 6. Implement the agreed mitigation measures; 7. As directed by AAHK / PM, to stop all or part of the construction activities.

5.1.12 Mitigation Measures

5.1.12.1 The implementation schedule of the recommended water quality mitigation measures is presented in **Appendix C**.

5.2 Operation Water Quality Monitoring

5.2.1 Introduction

5.2.1.1 As it has been assessed that there would not be any significant changes in the water quality during operation of the project, no marine water quality monitoring is considered necessary during the operation phase.

5.2.1.2 Water quality monitoring for the spent cooling water discharges will be undertaken in accordance with the future WPCO license conditions.

5.2.1.3 Water quality monitoring is proposed for the greywater treatment facility during commissioning of the facility to ensure the treated effluent quality complies with the reuse standards as defined in the EIA, which are reproduced in **Table 5.6**.

Table 5.6: Treated Effluent Quality Criteria for Greywater Treatment Facility

Parameters	Criteria Level
SS	≤ 5 mg/L
BOD_5	≤ 10 mg/L
COD	≤ 50 mg/L

Parameters	Criteria Level
Oil and Grease	≤ 10 mg/L
Surfactants (total)	≤ 5 mg/L
E. coli	< 1 count / 100ml
pH	6.0 – 9.0
Turbidity	< 2 NTU
Faecal Coliforms	Non detectable / 100ml

5.2.2 Commissioning Test for Greywater Treatment Facility

5.2.2.1 During commissioning of the greywater treatment facility, monitoring of pH, turbidity, SS, 5-day Biological Oxygen Demand (BOD_5), Chemical Oxygen Demand (COD), oil and grease, *E.coli,* faecal coliforms and surfactants for the treated effluent should be undertaken to ensure the treatment facility will be able to treat the greywater to levels in compliance with the reuse standards as listed in **Table 5.6**. Details of the proposed monitoring for treated effluent including the monitoring location, monitoring frequency, effluent sampling and testing methods should be proposed by ET, which will then be checked by IEC for agreement with AAHK / PM and EPD at least two weeks before commencement of the commissioning.

5.2.2.2 During operation of the greywater treatment facility, regular water quality monitoring for the treated effluent discharges will be undertaken, which shall monitor compliance of the treated effluent against both the reuse standard specified in **Table 5.6**, and the discharge standard (for discharge to foul sewer) as per the future WPCO license conditions for discharge to foul sewer. Reuse of the treated effluent shall be suspended if the monitoring results do not comply with the reuse standards. The treated greywater will be discharged to the sewerage system until the greywater treatment system resumes compliance.

6. Sewerage and Sewage Treatment Implications

6.1 Construction Phase Monitoring

6.1.1.1 After implementation of the recommended mitigation measure for sewage from construction workforce as detailed in **Appendix C**, no sewerage impacts are expected from the site during construction stage. No specific sewage monitoring during construction phase is thus required.

6.2 Operation Phase Monitoring

6.2.1.1 The gravity sewer from the airport discharge manhole to Tung Chung Sewage Pumping Station (TCSPS) will be upgraded by AAHK to cater for the ultimate design sewage flow from the expanded airport. AAHK will start planning construction of the gravity sewer upgrading in 2022 or when the sewage flow in the affected gravity sewer exceeds 80% of the design capacity of the sewer, whichever is earlier, so as to ensure timely completion of the mitigation works before the flow would exceed the design capacity of the sewer. For this, it is recommended that AAHK should conduct annual monitoring for the sewage flow build-up of the gravity sewer from the airport discharge manhole to TCSPS from 2020 onwards, i.e., one year before the scheduled commencement of operation of the proposed third runway.

6.2.1.2 Moreover, in order to ensure the additional sewage generated from the 3RS project would not impose adverse impacts in respect of sewage septicity and odour issues on the existing sewerage networks including the public sewerage system, it is recommended to start routine monitoring of hydrogen sulphide (H_2S) levels for the sewerage system of 3RS upon commencement of operation of the project,.

6.2.1.3 The ET should propose suitable method for carrying out the annual sewage flow monitoring for the concerned gravity sewer as well as details of the routine H_2S monitoring system for the sewerage system of 3RS, which shall be checked by IEC and agreed by AAHK / PM and EPD.

7. Waste Management Implications

7.1 Construction Phase Monitoring

7.1.1 Monitoring Requirements

7.1.1.1 The Contractor is responsible for waste management activities during construction phase. The Contractor must ensure that all wastes produced during the construction phase are handled, stored and disposed of in accordance with EPD's regulations and requirements and in line with good waste management practices. A Waste Management Plan (WMP) should be prepared and implemented by the Contractor in accordance with ETWB TC (W) No. 19/2005 Environmental Management on Construction Site. The Contractor also should refer to the Construction and Demolition Material Management Plan (C&DMMP) which will be submitted to Public Fill Committee (PFC) before commencement of construction of the project to facilitate him in the preparation of the WMP. The C&DMMP should provide ways to minimise the generation and maximise the reuse of the construction and demolition (C&D) material at the construction phase of the project. The C&DMMP should also describe the arrangement for collection and disposal of C&D materials to be generated from the construction phase.

7.1.1.2 During construction phase, the Contractor should perform regular site inspection (at least once per week) to determine if wastes are being managed in accordance with approved procedures and the WMP. Waste materials generated during the construction works, such as inert C&D material, general refuse and chemical wastes, are recommended to be monitored on a weekly basis to ensure that proper storage, transportation and disposal practices are being implemented. This monitoring of waste management practices will ensure that these solid and liquid wastes are not disposed into the nearby harbour waters. The Contractor would be responsible for the implementation of any mitigation measures to minimise waste or redress problems arising from the waste materials.

7.1.2 Audit Requirements

7.1.2.1 It is recommended that the waste generated during construction phase should be audited periodically (at least once per week) by ET to determine if wastes are being managed in accordance with approved procedures and the site Waste Management Plan. The audits should look at all aspects of waste management including waste generation, storage, transportation and disposal. An appropriate audit programme would be to undertake a first audit near the commencement of the construction works, and then to audit periodically thereafter. In addition, routine site inspections by the Contractor should check the implementation of the recommended good site practices and other waste management mitigation measures.

7.1.2.2 A summary of all key types of waste arising and the reuse and disposal methods proposed during the construction phase is presented in **Table 7-1**.

Table 7-1: Summary of Waste Arising during Construction Phase

Waste Type	Key Sources of Waste Generation	Timing of Waste Generation	Estimated Total Quantity of Waste Generation	Waste Reuse or Disposal	Handling Methods
Inert C&D Material	Excavation for APM & BHS tunnels, new APM depot and airside tunnels; piling works for TRC & other buildings; superstructure construction works; surplus surcharge material; modification of existing northern seawall; excavation and demolition as well as superstructure construction works for T2 expansion; excavation for improvement of road networks; and HDD for diversion of existing submarine pipelines	Q3 of 2015 to Q4 of 2 022	9,543,500 m^3 (in-situ volume)	About 3,639,230 m^3 of the inert C&D materials generated would be reused on-site as fill materials for the proposed land formation works. The remaining 5,904,270 m^3 would be delivered off-site to any identified projects that need fill materials and/or to the government's PFRF for beneficial use by other projects in Hong Kong.	Segregation of inert C&D material to avoid contamination from other waste arising Stockpile areas should be covered and applied with regular water spraying
Non-inert C&D Material	Site clearance of the golf course area; demolition works for T2 expansion; and superstructure construction works for various buildings / facilities	Q4 of 2016 to Q4 of 2 021	96,200 m^3 (in-situ volume)	The non-inert C&D material will be disposal of at landfills after on-site sorting and segregation of recyclable materials	Separation of non- inert C&D materials from inert C&D materials Stored in compatible containers in designated area on-site
Excavated Marine Sediments	Excavation at the cable field joint area	2015/16	About 10,200 m^3 (in-situ volume)	Type 1 open sea disposal for Category L sediment or Type 1 open sea disposal at dedicated sites for Category M_p sediment, according to PNAP ADV-21 (subject to endorsement by MFC of CEDD and EPD as well as obtaining dumping permit from EPD under DASO)	Stockpile with tarpaulin covers with earth bunds and sand bags barriers, if applicable.

Waste Type	Key Sources of Waste Generation	Timing of Waste Generation	Estimated Total Quantity of Waste Generation	Waste Reuse or Disposal	Handling Methods
	Piling works of the TRC, APM & BHS tunnels, airside tunnels and other facilities on the proposed land formation area	Q1 of 2017 to Q3 of 2022	About 705,350 m^3 (in-situ volume)	Treatment by cement mixing and stabilisation and on-site reuse of treated sediments as backfilling materials, although the treatment level / details and the reuse mode are under further development.	
	Piling works of marine sections of the approach lights for the third runway	2018 to 2019 (subject to detailed design)	Western approach lights: about 530 m^3 of marine sediments (in-situ volume) Eastern approach light s: about 1,060 m^3 of D CM-treated sediment (i n-situ volume)	Treatment by cement mixing and stabilisation and on-site reuse of treated sediments as backfilling materials, although the treatment level / details and the reuse mode are under further development.	
	Piling works of new HKIAAA beacons	2018 to 2019 (subject to detailed design)	About 220 m^3 (in-situ volume)	Treatment by cement mixing and stabilisation and on-site reuse of treated sediments as backfilling materials, although the treatment level / details and the reuse mode are under further development.	
	Basement works of T2 expansion	Q4 of 2016 to Q1 of 2 019	About 50,730 m^3 (in-situ volume)	Treatment by cement mixing and stabilisation and on-site reuse of treated sediments as backfilling materials, although the treatment level / details and the reuse mode are under further development.	
	Excavation works of APM depot	Q1 of 2018 to Q3 of 2 020	About 9,770 m^3 (in-situ volume)	Treatment by cement mixing and stabilisation and on-site reuse of treated sediments as backfilling materials, although the treatment level / details and the reuse mode are	

Waste Type	Key Sources of Waste Generation	Timing of Waste Generation	Estimated Total Quantity of Waste Generation	Waste Reuse or Disposal	Handling Methods
				under further development.	
Chemical Waste	Used cleansing fluids, solvents, lubricating oil, waste fuel, etc., from maintenance and servicing of construction plant and equipment	2015 to Early 2023	Anticipated as small quantity To be quantified in the site Waste Management Plan to be prepared by the Contractor	Disposal of at the Chemical Waste Treatment Centre or other licensed recycling facilities	Stored in compatible containers in designated area on-site
General Refuse & Floating Refuse	Food scraps, waste paper, empty containers, etc. generated from the construction workforce	2015 to Early 2023	General refuse: maximum daily arising of up to 9,100 kg	Encourage segregation of recyclable materials (e.g., paper, tin-cans, etc.) for collection by outside recyclers Collection of non-recyclable refuse by a reputable collector for disposal at de signated landfill sites.	Provide on-site collection points together with recycling bins
	Floating refuse trapped or accumulated in the newly constructed seawall	2015 to Early 2023	Floating refuse: roughly 65 m^3/year to be collected from the newly constructed seawall	Collection by a reputable waste collector for disposal at designated landfill sites	Provide on-site collection points

7.1.3 Mitigation Measures

7.1.3.1 The implementation schedule of the recommended waste management mitigation measures is presented in **Appendix C**.

7.2 Operation Phase Monitoring

7.2.1.1 Wastes produced during operation phase would be generated by a variety of landside and airside activities and mainly comprise of general refuse, chemical waste, sludge from greywater treatment plant and floating refuse that may be trapped on the artificial seawall of the expanded airport site.

7.2.1.2 During operation phase, weekly inspection should be carried out along the artificial seawall of the expanded airport island to check for any entrapment or accumulation of floating refuse by contractor. Where an appreciable amount of floating refuse is found on the artificial seawall during the weekly inspection, the locations of such refuse will be recorded and arrangements with the contractor will immediately be made to collect and clear the refuse from the seawall.

7.2.1.3 With the implementation of the recommended mitigation measures for handling, transportation and disposal of the identified waste arisings, no adverse residual impacts are anticipated during operation phase of the project. Therefore, no other specific waste monitoring during operation phase is required.

8. Land Contamination

8.1 Construction Phase Monitoring

8.1.1.1 Since some of the assessment areas (i.e. fuel tank room within T2 building, fuel tank room to the west of CAD antenna farm, seawater pump house and switching station, pumping station and fire training facility) were not accessible for site reconnaissance, further site reconnaissance would be conducted once these areas are accessible in order to identify any land contamination concern for the areas. Subject to the further site reconnaissance findings, a supplementary Contamination Assessment Plan (CAP) for additional site investigation (SI) (if necessary) may be prepared and submitted to EPD for endorsement prior to the commencement of SI at these areas.

8.1.1.2 Since all the areas identified with potential contamination issues are under on-going use, the SI works are proposed to be carried out after removal / decommissioning of the concerned facilities but prior to the commencement of construction works at those areas.

8.1.1.3 After completion of the SI, the Contamination Assessment Report (CAR) will be prepared and submitted to EPD for approval prior to the commencement of construction works at the golf course, the underground and above-ground fuel storage tank areas, emergency power generation units, airside petrol filling station and fuel tank room. Should remediation be required, Remediation Action Plan (RAP) and Remediation Report (RR) will be prepared for EPD's approval prior to commencement of the proposed remediation and any construction works respectively.

8.1.1.4 All soil and groundwater remediation works should be carried out to clean up to levels in compliance with the relevant Risk-based Remediation Goals (RBRG) prior to commencement of any construction works at all areas identified with contamination issues (if any).

8.1.1.5 During construction phase, environmental monitoring and audit (EM&A) is to be carried out in the form of regular site inspections. All related procedures and facilities for handling or storage of chemicals and chemical wastes will be audited regularly to ensure they are in order, intact and reported in the EM&A reports accordingly.

8.2 Operation Phase Monitoring

8.2.1.1 As land remediation is not anticipated during the operation phase, no environmental monitoring and audit for land contamination is considered necessary.

9. Terrestrial Ecological Impact

9.1 Ecological Mitigation Measures

9.1.1.1 Mitigation measures were recommended in accordance with Annex 16 of the EIAO-TM. The recommended mitigation measures extracted from **Section 12.7** of EIA Report are listed below and the implementation schedule is presented in **Appendix C**.

Avoidance

Land Formation Area

9.1.1.2 The land formation area is not located in a habitat of high ecological sensitivity, therefore the impact to terrestrial ecology is greatly avoided in the project design stage and no specific terrestrial ecological mitigation measures is deemed necessary for the loss of terrestrial habitat.

HDD Daylighting Location

9.1.1.3 The originally proposed daylighting location is immediately opposite the existing AFRF which minimises the pipe connection works. However given the presence of the egretry, the daylighting location is now shifted northwards. This measure aims to avoid direct impacts to the egretry (an avoidance measure based on the outcomes of the impact assessment) and furthermore, the daylighting location and mooring of flat top barge, if required, will be kept away from the egretry (original daylighting location refers to **Section 12.6.3.1** and alternative location specified as blue zone in **Drawing MCL-P132-EIA-12-035b**). The vegetation at the northeastern side of Sheung Sha Chau Island near the proposed daylighting location is short and shrubby which is less suitable for egretry use. Only a small works area (about 10 m x 10 m) will be needed at the tentative daylighting location. This alternative is chosen as the preferred option owing to the ecological concerns, despite a longer pipe connection being required. The final daylighting location within the blue zone is subject to further adjustment to avoid direct encroachment on the egretry, giving due consideration to the findings of the pre-construction monitoring for Sha Chau 、 egretry, to be conducted before the commencement of the HDD drilling works at HKIA. With the adjustment of the daylighting location, direct encroachment onto the egretry will be avoided.

Timing of Construction Works

9.1.1.4 All HDD and related construction works on Sheung Sha Chau Island will all be scheduled outside the ardeids' breeding season (between April and July). No night-time construction work will be allowed on Sheung Sha Chau Island during all seasons. With these avoidance measures the impact can be largely minimised.

Minimisation

Preservation of Nesting Vegetation

9.1.1.5 The HDD daylighting location proposed in the blue zone identified in **Drawing MCL-P132-EIA-12-35b** will be located within a rock area near the seashore, whilst the connecting pipelines will be aligned along the seashore (above the shoreline). This proposed arrangement will avoid the need for tree cutting, therefore trees that are used by ardeids for nesting will be preserved.

9.2 Pre-construction Egretry Survey

9.2.1.1 As a mitigation measure to avoid disturbance to the egretry, the HDD daylighting location and associated works will be conducted outside the Sha Chau egretry's boundary. The location of the HDD daylighting location is indicated as blue zone in **Drawing MCL-P132-EIA-12-035b** in EIA Report. It is noted that the egretry's status and location could change from time to time even in the absence of human disturbance. Therefore, a pre-construction survey is recommended to update the latest boundary of the egretry during the breeding season before commencement of the HDD drilling works at HKIA. The survey will update the latest boundary of the egretry and to ensure the daylighting location will avoid direct encroachment on the egretry. Subject to the pre-construction survey findings, the daylighting location/ works area will be adjusted to avoid the future egretry location.

9.2.1.2 The pre-construction survey shall be conducted once per month in the breeding season, i.e. between April and July, prior to the commencement of HDD drilling works. The survey works should be conducted by qualified ecologist with at least three years experience on egretry monitoring. Ardeid species and abundance shall be recorded whilst the latest boundary of the egretry shall be identified. The result of the egretry survey and the decision on HDD daylighting location shall be agreed with EPD and AFCD prior to the commencement of HDD drilling works.

9.2.1.3 During the works period, ecological monitoring shall be undertaken monthly at the HDD daylighting location on Sheung Sha Chau Island to identify and evaluate any impacts with appropriate actions taken as required to address and minimise any adverse impact found. Attention shall also be given to the months either side of the ardeids breeding season, i.e. March and August, to identify any early or late breeding activities that might be subject to disturbance. The monitoring during works period shall be undertaken by experienced ecologist competent in detecting any potential disturbance to the egretry.

10. Marine Ecological Impact

10.1 Introduction

10.1.1.1 The EIA has predicted the project would lead to some ecological impacts and has recommended a series of measures to avoid, minimise, and mitigate the impacts to an acceptable level. According to EIAO-TM Annex 16, an ecological EM&A programme would be needed to ensure the recommended measures are properly implemented. In addition, the EM&A programme also serves other purposes, including but not limited to verifying the accuracy of the ecological assessment study, detect any unpredicted ecological impacts and recommending adaptive management in response to unpredicted impacts.

10.1.1.2 It is recommended that an EM&A programme for ecology to be undertaken during the baseline (pre-construction), construction, post-construction and operation phases of the third runway project. The objectives of the pre-construction phase EM&A are to undertake baseline monitoring for the corals and CWDs.

10.1.1.3 The construction, post-construction and operational audit objectives are to ensure that the ecological mitigation measures recommended in the EIA are carried out as specified and are effective. The construction and operation phase monitoring will be to monitor the CWDs over the construction period and also determine the effectiveness of the mitigation on CWD numbers. The EM&A will also be undertaken to verify the predictions in the EIA.

10.2 Ecological Monitoring

10.2.1 Background

10.2.1.1 It is predicted in the EIA that there will be direct impact on the corals communities along the northern seawall of the existing airport island. A pre-construction phase dive survey is recommended in the EIA to review the feasibility of coral translocation and preparation of translocation and monitoring plan where necessary. It is also predicted in the EIA that the area immediately north of the existing airport platform, which is predominantly used as a travelling area for the CWD, will be affected by the project but that alternative routes for travelling east and west during construction phase and initial operational phase will be found by the CWD, potentially shifted to an area further north of the new platform.

10.2.1.2 In addition, habitat will be lost permanently as a result of the 3RS project and there will likely be construction phase disturbance to the CWDs movement and behaviour. Therefore, it is proposed to conduct ecological monitoring during the baseline, construction, post-construction and operation phases of the third runway project, with the aims to monitor the effects on the CWDs over the construction period, including the potential shift in the CWD travelling areas and habitat use, to monitor the effectiveness of the HSF speed and routing restrictions to the CWDs, as well as the proposed Marine Park (when it comes into operation) on CWD distribution and numbers. Post-construction refers to the 12 months period after the completion of marine works while operational monitoring refers to the completion of the 3RS project as a whole.

10.2.1.3 The CWD monitoring will be conducted by the ET, led by a CWD monitoring team leader with five years post-graduate experience in CWD monitoring. An overarching goal of these surveys is to provide a dataset that can be compatible with the AFCD long term monitoring, be stratified in such a way as to allow the calculation of density and abundance for the various different phases listed above and to facilitate the calculation of trends from these estimates, providing some assessment of how the project and cumulative effect may be impacting the CWDs.

10.2.1.4 Methods of the baseline, construction, post-construction and operation phase surveys will be as consistent as possible with the AFCD long-term monitoring programme to allow for direct comparison of results among different phases, thus allowing an evaluation of trends and impact assessments. Further details are provided below.

10.2.1.5 Regular meetings with the Authority and relevant Government Departments e.g. EPD and AFCD will be arranged on a quarterly basis when the construction phase surveys commence to review CWD distribution and abundance trends. It is expected that the 3RS reclamation activities would result in the temporary movement of CWDs away from 3RS works areas during the construction period and this may be reflected in a further decline in CWD abundance in the Northwest Lantau survey area over the period of construction. It is proposed that an appropriate action-limit level relating to CWD abundance during the 3RS construction phase is developed in agreement with AFCD and EPD prior to the commencement of construction, which should be based on the latest CWD survey findings including those collected from the baseline monitoring of this EM&A. Actions may also be explored where necessary for remediating unpredictable impacts or changes in abundance that are identified during the monitoring, recognising that actions that serve to prolong the period of reclamation activity may in themselves have an adverse impact on CWDs.

10.2.2 Pre-construction Phase Coral Dive Survey

10.2.2.1 It is proposed to conduct a pre-construction phase dive survey for corals along the northern and northeastern seawall of the existing airport island and at the daylighting location on Sha Chau that may subject to direct habitat loss and disturbance as a precautionary measure prior to marine construction works. The aim is to identify any coral colonies suitable for translocation. The potential for coral translocation will depend on the conservation value, the health status and the translocation feasibility. A detailed pre-construction coral survey plan with potential recipient sites and translocation plan will be prepared prior to the commencement of construction. The determination of the translocation will be based on the conservation importance of the coral species (including hard corals, soft corals and octocorals), the coral health conditions, size of the communities and feasibility for translocation (e.g. attached to large boulders but <50 cm in diameter and considered as manageable of translocation with minimal destruction of the coral communities). Locations of pre-construction coral dive surveys for the directly affected site are shown in **Drawing No. MCL/P132/EMA/10-001**, the locations for the potential recipient site(s) will be determined as part of the translocation plan. The preliminary methodology for coral dive survey will be as follows:

Coral Dive Survey at Directly Affected Site and Potential Recipient Site(s)

10.2.2.2 Based on the sub-tidal coral dive survey at hard substrates conducted in the EIA, the underwater visibility within the western Lantau waters are generally low. It is proposed to conduct the pre-construction survey at sites which would be directly affected by the project. Suitable substrates with coral communities will be identified, supervised by qualified marine ecologists with at least 5 years of coral dive survey experience.

10.2.2.3 The pre-construction survey will be conducted by spot-check dive followed by Rapid Ecological Assessment (REA) should coral communities recorded. The survey will be conducted at hard bottom subtidal habitats along the northern artificial seawall of the existing airport island, and at the proposed daylighting location on Sha Chau as shown in **Drawing No. MCL/P132/EMA/10-001** during daytime. If coral communities suitable for translocation are identified at these directly affected sites, coral dive surveys including spot-check dive followed by REA will also be conducted at potential recipient site(s).

10.2.2.4 The spot-check dive survey will be conducted by swimming in a search pattern along pre-determined areas at a density sufficient to cover any major coral areas and to assess the type of benthos existing in the proposed survey area, recording any presence of hard corals (order Scleractinia), octocorals (sub-class Octocorallia), and black corals (order Antipatharia). Information including estimated number of colonies, number of species, coral cover, and partial mortality (if any) will be recorded during the actual dive.

10.2.2.5 The following data will also be recorded during the survey:

- Temperature, time and date;
- Location (GPS);
- Depth range;
- Visibility;
- Substratum type (i.e. hard substratum seabed, intertidal rocky area); and
- Other invertebrates present.

10.2.2.6 Any special features encountered in the coral areas, such as non-typical reef structures, unusual coral species associations, unique or peculiar assemblages of the local incipient reef formations, and reefs that are almost completely dominated by one particular species, will be recorded.

10.2.2.7 Representative photographs of the habitat and coral species, and other ecological features will be taken to facilitate the determination of suitable similar habitats as recipient site.

Rapid Ecological Assessment Survey

10.2.2.8 With reference to the data collected during the spot-check dive survey, REA surveys will be carried out at locations where coral communities were identified and at potential recipient site(s). Transects of 100m in length will be laid following the contour of the seabed at areas where corals communities identified during the spot-check dives / at potential recipient site(s).

10.2.2.9 The REA survey will be conducted underwater in a two-tier approach to assess the sub-littoral substrata and benthic organisms in an area:

- Tier I assessed the relative coverage of major benthic groups and substrata.
- Tier II provided an inventory of sedentary/ sessile benthic taxa, which will be ranked in terms of their abundance at the survey site.

10.2.2.10 The taxon categories will be ranked in terms of relative abundance of individuals, rather than the contribution to benthic cover along each transect. The ranks will be made by visual assessments of abundance, rather than quantitative counts of each taxon.

10.2.2.11 The benthic coverage, taxon abundance, and ecological attributes of the transects will be recorded in a swath of about 2m wide, with about 1m on either side of the transects.

10.2.2.12 Representative photographs of any important ecological features and corals will be taken to facilitate the determination of suitable similar habitats as recipient site and as baseline information for future post-translocation monitoring.

10.2.3 CWD Monitoring Phases

10.2.3.1 Monitoring for CWDs is proposed to be conducted by vessel surveys at a frequency of two full surveys per month of the North Lantau and West Lantau transects, including focal follows, during the baseline, construction (with a review on the frequency after the first year), post-construction and operational phases, although the exact scope and frequency of the CWD monitoring effort will be finalised at the detailed design stage prior to commencement of construction in agreement with AFCD and EPD. The full surveys refer to completion of two survey transects for North Lantau and West Lantau and any required focal follows per month irrespective of the number of days effort required. Ad hoc monitoring of other CWD habitat areas will be undertaken as required and on an as needed basis to be determined during the course of the monitoring. The monitoring periods will be as follows:

1) *Baseline Monitoring* – 6 months of baseline surveys will be undertaken before the commencement of construction works at a frequency of two full surveys per month. The commencement date of baseline survey shall be agreed between the ET / IEC / AAHK / PM to ensure timely submission of the baseline monitoring report to EPD and relevant authorities. The purpose of the baseline monitoring is to establish pre-construction conditions prior to the commencement of the works and to demonstrate the suitability of the proposed monitoring methods.

2) *Construction Phase Monitoring* – This will be conducted for the duration of the marine construction works for the third runway project at a frequency of two full surveys per month with a review on the frequency after the first year. The purpose of the construction phase monitoring is to evaluate conditions during construction and provide data for the preparation of Marine Park establishment and management plan.

3) *Post Construction Phase Monitoring* – This will be conducted upon the completion of marine construction works for 12 months at a frequency of two full surveys per month. The purpose of the post construction phase monitoring is to evaluate conditions after completion of all marine works and collect data for the review of recovery of the marine environment.

4) *Operation Phase Monitoring* - This will be conducted for a period of at least 12 months after the implementation of proposed Marine Park at a frequency of two full surveys per month. The main purpose of the mitigation effectiveness monitoring is to detect any rebound in use of areas north and east of HKIA during the implementation of proposed Marine Park as mitigation for habitat loss for the airport expansion, and to evaluate the overall, long-terms impacts of the project on CWDs.

10.2.3.2 The vessel monitoring data will be used to monitor the effectiveness of the mitigation measures proposed for the amelioration of construction, post-construction and operation phase impacts. In addition to the proposed vessel transect monitoring, some additional monitoring is proposed in the form of land-based theodolite tracking, combined with underwater acoustic monitoring to provide additional information on CWD behaviour and occurrence during 3RS construction works to supplement the details on CWD abundance patterns obtained from vessel transect surveys. The main aim for these two monitoring types is to supplement the vessel transect survey findings detailed above and to help verifying the predictions in the EIA.

10.2.3.3 Land-based theodolite tracking is proposed to cover during the 6-months baseline and the duration of the construction phase to provide adequate seasonal data with the data serving to provide fine scale information on CWD behaviour and activity during construction, specifically swimming and movement patterns of CWD groups, and to further capture CWD response to vessels and travel patterns. The theodolite station established on Sha Chau is proposed to be used given its good aspect overlooking the proposed 3RS reclamation area north of HKIA. The frequency of the theodolite tracking will be determined prior to the commencement of the baseline and construction phases and agreed with the relevant Authorities..

10.2.3.4 Underwater acoustic monitoring using Passive Acoustic Monitoring (PAM) or equivalent devices as adopted in this EIA assessment will also be undertaken during the same periods including 6 months of baseline and within the whole construction period. Data would be used in tracking diurnal patterns of CWD presence and vocal activity as well as the noise characteristics of the underwater environment, for example vessel noise. Specifics of the land based survey work and associated potential PAM (or equivalent) surveys will be finalised prior to commencement of construction at the detailed design stage in agreement with AFCD and EPD. As the information obtained from these surveys does not quantify CWD abundance, no action / limit levels are proposed in association with these supplemental monitoring efforts. The frequency of the PAM will be determined prior to the commencement of the baseline and construction phases and agreed with the relevant Authorities.

10.2.3.5 In conjunction with the above monitoring efforts, given the uncertainty on the growth of HSF traffic from SkyPier / the ITT in future years, the EM&A will also monitor actual numbers of HSFs operating from SkyPier after the HZMB and HKBCF commence operations by obtaining HSF movement data from the SkyPier operators.

10.2.4 CWD Monitoring Methods

Small Vessel Line Transect Surveys

10.2.4.1 Vessel-based CWD surveys provide data for density and abundance estimation and other assessments using distance-sampling methodologies, specifically, line-transect analysis. These surveys also include photo-identification of individual dolphins within the works area to provide data on individual use of this specific area.

10.2.4.2 The surveys involve small vessel line-transect data collection and have been designed to be similar to, and consistent with, previous surveys for monitoring of small cetaceans in Hong Kong.

The survey was designed to provide systematic, quantitative measurements of density, abundance and habitat use by line transect methods.

10.2.4.3 The transects to be monitored will cover North Lantau and West Lantau and be consistent with the AFCD long-term monitoring programme during the baseline, construction, post-construction and operation phases. Ad hoc monitoring of other CWD surveys areas will be undertaken as required. This will provide a larger sample size for estimating the baseline densities and patterns of movement in the broader study area of the third runway project. The baseline, construction, post construction and operation phase line transects are shown in **Drawing No. MCL/P132/EMA/10-002**, and are subject to further review during the detailed design stage prior to commencement of construction in agreement with AFCD and EPD**.**

10.2.4.4 A 15-20 m vessel with a flying bridge observation platform and a team of three to four observers will be deployed to undertake the surveys. Two observers are to be on search effort at all times when following the transect lines, one using binoculars and the other using unaided eyes and recording data.

10.2.4.5 When CWDs are seen, they will be approached and photographed for photo-ID information (using a Canon 7D [or similar] camera and long 300 mm+ telephoto lens), then followed until they leave the study area. At that point, the boat returns (off effort) to the next survey line and begins to survey on effort again. CWD density (D), abundance (N), and their associated precision (CV) will be calculated using conventional line transect methods as detailed below:

$$\hat{D} = \frac{n\ \hat{f}(0)\ \hat{E}(s)}{2\ L\ \hat{g}(0)}$$

$$\hat{N} = \frac{n\ \hat{f}(0)\ \hat{E}(s)\ A}{2\ L\ \hat{g}(0)}$$

$$C\hat{V} = \sqrt{\frac{\hat{\mathrm{var}}\,(n)}{n^2} + \frac{\hat{\mathrm{var}}\,[\hat{f}(0)]}{[\hat{f}(0)]^2} + \frac{\hat{\mathrm{var}}\,[\hat{E}(s)]}{[\hat{E}(s)]^2} + \frac{\hat{\mathrm{var}}\,[\hat{g}(0)]}{[\hat{g}(0)]^2}}$$

10.2.4.6 Based on the vessel survey data, seasonal differences in dolphin density and use of the study area are then examined, using the solar seasons (Winter: December-February, Spring: March-May, Summer: June-August, Autumn: September-November) and/or oceanographic seasons (Dry: October-March, Wet: April-September).

10.2.4.7 Focal follows of individual dolphins will also be conducted, when conditions are suitable. These involve the boat following (at an appropriate distance to minimize disturbance) an identifiable individual dolphin for an extended period of time, and collecting detailed data on its location, behaviour, response to vessels, and associates. This type of data allows information to be gathered on the movement paths and travel corridors used by dolphins in the survey region. The data collected will be comparable to data being collected during focal follows in the AFCD-funded long-term monitoring surveys, and the combined dataset of both sets of focal follows allows the evaluation of travel corridors for the greater Hong Kong region to be undertaken, with emphasis on and near the land formation area. Time allocation between line transect surveys and focal follows will be decided based on the desire to obtain adequate samples of both types of data but two full transect surveys will be completed per month.

Land-based Surveys and Theodolite Tracking

10.2.4.8 Land-based monitoring has been able to obtain fine-scale information on the time of day and movement patterns of the CWDs. A digital theodolite (Sokkia/Sokkisha Model DT5 or similar equipment) with 30-power magnification and 5-s precision will be used to obtain the vertical and horizontal angle of each dolphin and vessel position. Angles are converted to geographic coordinates (latitude and longitude) and data will be recorded using *Pythagoras* software, Version 1.2 (Gailey & Ortega-Ortiz, 2002). This method delivers precise positions of multiple spatially distant targets in a short amount of time. The technique is fully non-invasive, and allows for time and cost-effective descriptions of dolphin habitat use patterns at all times of day (Würsig et al. 1991; Piwetz et al. 2012). Examples of modern statistical techniques to describe movements relative to habitat and anthropogenic influences are described in Gailey et al. (2007) and Lundquist et al. (2012).

10.2.4.9 Land-based observation and theodolite tracking stations will be set up at one location, facing east/south/west on the southern slopes of the island of Sha Chau. The proposed location (D) is shown with position coordinates, height of station and approximate distances of consistent theodolite tracking capabilities for CWDs in Table 10.3 and shown in **Drawing MCL/P132/EMA/10-003**. The surveys stations will be confirmed prior to the baseline and construction phases,

Table 10.3: Land-based Survey Station Details

Station	Location	Geographical Coordinates	Station Height (m)	Approx. Tracking Distance (km)
D	SHA CHAU	22° 20’ 43.5” N 113° 53’ 24.66” E	45.66	3

10.2.4.10 The frequency of the theodolite tracking will be determined prior to the commencement of the baseline and construction phases and agreed with the relevant Authorities. Overall, a total of 2 theodolite tracking days per month will be undertaken. Surveys will be undertaken during a period of about 5-6 hours per day from the monitoring station, with some days longer than this but others truncated due to weather-related deterioration of sighting conditions. Observers will search for dolphins using unaided eyes and handheld binoculars (7X 50). A theodolite tracking session will be initiated when an individual CWD or group of CWD is located. Where possible, a distinguishable individual will be selected, based on colouration, within the group. The focal individual is then continuously tracked via the theodolite, with a position recorded each time the dolphin surfaces. If an individual cannot be positively distinguished from other members, the group will be tracked by recording positions based on a central point within the group whenever the CWDs surface (Bejder, 2005; Martinez, 2010). Tracking continues until animals are lost from view, move beyond the range of reliable visibility (>1-3 km, depending on station height), or environmental conditions obstruct visibility (e.g., intense haze, Beaufort sea state >4, or sunset), at which the research effort will be terminated. During the baseline phase, in addition to the tracking of CWDs, all vessels that move within 2-3 km of the station will be tracked, with effort made to obtain at least two positions for each vessel. This will not be feasible during the construction phase in the direct construction area, and possibly for some space outside of it as well, due to the anticipated high volume of construction-related traffic.

<u>Theodolite Tracking Data Analysis</u>

10.2.4.11 Theodolite tracking will include focal follows of CWD groups and vessels (the latter, when possible). Focal follow data will be filtered to include only CWD tracks with greater than 2 positional fixes and 10 minutes or greater in duration. The ten minute window has been statistically validated for theodolite tracking analyses (Gailey et al. 2007, Lundquist 2012), and such a logical bound is also described in Turchin (1998). If two consecutive dolphin tracks are more than 5 min apart, they will be split and analysed separately. A broad time of day category is assigned for each track (morning = first position recorded before 12 pm; afternoon = first position recorded at 12 pm or later). CWD response variables that will be calculated for each track include mean reorientation rate, swimming speed and linearity. Reorientation rate is the degrees per minute of changes in direction of a tracked individual or group of CWDs. Mean swimming speed is calculated by dividing the distance travelled by the duration between two consecutive positions (Gailey et al. 2007). Linearity is an index of net movement ranging from 0 to 1, with 0 equating to no net movement and 1 equating to straight line movement. It is calculated by taking the sum of distances travelled for each leg and dividing by the net distance between the first and last fix of a track.

10.2.4.12 In order to evaluate variation in CWD movement patterns in the presence of vessels, it is necessary to establish a distance threshold. Consistent with general practice and the data gathered for the EIA of this study, when vessels are within 500m of the focal individual or group, they will be considered present. The 500m threshold was chosen since Sims et al. (2012) showed that most vessels exceeded background noise when less than 500m away, but not at greater distances. The threshold has been used in other marine mammal situations for similar reasons and direct measurement of animal reactions, such as in Lundquist et al. (2012) for southern right whales (*Eubalaena australis*). As it is not possible to record geographic locations of all targets simultaneously, positions for CWDs and vessels will be interpolated *post hoc* (i.e. during analysis in the lab), allowing for a more precise estimation of vessel distances from dolphins at a given time. All types of vessels within 500m are considered, including high speed ferries. The high speed ferries travel through the area much more rapidly than fishing, recreational, industrial vessels carrying cargo and will therefore be noted and assessed as a separate category.

10.2.4.13 *ArcMap* will be used to plot CWD and vessel positions, *Microsoft excel* will be used to conduct computational analysis of leg speed, and linearity and *R* statistical software will be used to perform statistical analyses. Data will be tested for normality and transformed if residuals are not normally distributed. Because dolphin focal follows tend to vary in duration, each CWD track is split into 10-minute segments. In order to reduce pseudo-replication, analysis will be run to determine the temporal lag at which two segments from the same focal group are no longer auto-correlated. Univariate statistical analyses (one-factor Analysis of Variance, ANOVA) will be run to evaluate variation between factors.

10.2.4.14 Similar to vessel-based surveys, seasonal differences in relative CWD occurrence and use of the study area will be examined for land-based surveys, using both the solar seasons (Winter: Dec-Feb, Spring: Mar-May, Summer: Jun-Aug, Autumn: Sep-Nov) and oceanographic seasons (Dry: Oct-Mar, Wet: Apr-Sep; see Chen et al. 2010). In addition, behavioural descriptions and potential avoidance/association by CWDs relative to vessels or other on-water anthropogenic activities will be analysed by multi-variate analyses as in Gailey et al. (2007) and Lundquist et al (2012).

Passive Acoustic Monitoring

10.2.4.15 Acoustic data will be gathered to listen for CWDs occurrence patterns and to obtain anthropogenic noise information simultaneously. This work involves a type of Passive Acoustic Monitor (PAM) (Wiggins and Hildebrand 2007) termed an Ecological Acoustic Recorder (EAR) (Lammers et al. 2008), with bottom-mounted broad-band recording capability operable from 20 Hz (for lower frequency anthropogenic noise) up to a flat response of 32kHz (for echolocating and communicating CWDs). The number and locations of EARs will be determined at the detailed design phase in agreement with AFCD and EPD but proposed to be positioned south of Sha Chau Island to coincide with the land based theodolite surveys. The frequency of the PAM will be determined prior to the commencement of the baseline and construction phases and agreed with the relevant Authorities.

10.2.4.16 Analysis (by a specialized team of acousticians) involves manually browsing through every acoustic recording and logging the occurrence of vessel transits and other unusual sounds. This approach for data analysis is adopted because generally high ambient noise conditions in these waters have meant that an automatic algorithm cannot be reliably used to detect dolphin sounds. All data therefore need to be re-played by computer and listened to by human ears for accurate assessment of dolphin group presence. Vessels will be logged when discrete transits passing the EAR can be differentiated from background noise, and thus there can be more than one vessel detection per file.

10.2.4.17 Comparisons of CWD and vessel sounds during theodolite tracks of those dolphins and vessels will be made *post hoc*, that is after both sets of data have been separately analysed in the laboratory, positions are known, and the positions can be compared to loudness and frequencies of those sounds.

10.2.4.18 A review of CWD sightings from the land-based survey data in relation to the EAR device will also be undertaken to provide data on the approximate locations of the CWDs at the time their signals are detected. Thus, overlaps of land-based CWD sightings and the EAR recorded sounds of CWDs will be analysed.

10.2.5 Review of Construction Phase CWD Monitoring Plan

10.2.5.1 Subject to details of the marine construction programme established during the detailed design stage, the aforementioned CWD monitoring programme will be reviewed by the ET. Where the CWD monitoring programme requires revision or updating according to the detailed construction programme, the ET will revise or update the monitoring programme accordingly, and the revised monitoring programme will be verified by IEC before submission to EPD and AFCD for approval prior to commencement of the marine construction works.

10.2.6 Cumulative Impacts for Travel Corridors/ Areas and Connectivity between Core Habitat Areas

10.2.6.1 It is clear from past and present data that the area north of the existing airport is used for a variety of CWD behavioural functions, including travel between Northwest and Northeast Lantau. The longer that cumulative construction activities exist in and near this general area, the greater will be the effect on efficient habitat use of CWD, with both the third runway project and the Hong Kong-Zhuhai-Macao Bridge Hong Kong Boundary Crossing Facilities (HKBCF) / Tuen Mun-Chek Lap Kok Link (TM-CLKL) projects forcing the CWDs to move further north towards the Tuen Mun. However, the corridor/ area between the new third runway project and waters to the north should still be available and useable for CWDs to transit between western and eastern waters north of the airport. As these implications could increase with all the projects being constructed and implemented concurrently, a long term monitoring programme, consistent with that being undertaken by AFCD, would be recommended in agreement with AFCD and EPD as discussed in **Section 10.2.4** above.

10.3 Ecological Audit Requirement

10.3.1 Baseline, Construction and Post-Construction Phases

10.3.1.1 Specific marine ecological mitigation and precautionary measures are proposed for the construction phase in the EIA report. The Project Design Team and Contractor should be responsible for the design and implementation of these measures under the supervision of the AAHK / PM and monitored by the ET. The implementation schedule of the recommended ecological mitigation measures is presented in **Appendix C**. The key construction phase mitigation and precautionary measures for the CWDs are:

- Acoustic decoupling of construction equipment;
- Construction vessel speed limits, predefined vessel routing and skipper training. A "Regular Marine Travel Routes Plan" will be prepared and submitted to the relevant Authority for approval within 2 months of the commencement of construction to define the routings for construction vessels within Hong Kong waters;

- Dolphin exclusion zones (DEZ) during ground improvement works (e.g. DCM), water jetting works for submarine cables diversion, open trench dredging at the field joint locations and seawall construction and also during bored piling work but as a precautionary measure only. A DEZ for night time works would be developed and specified before construction for evaluation by the Authorities;

- Chemical/ oil spill response plan; and

- SkyPier high speed ferries' speed and routing restrictions.

10.3.1.2 Further details are provided in the Implementation Schedule provided in **Appendix C**.

10.3.1.3 During the construction phase the ET will be required to undertake the following ecological audit measures of the recommended EIA mitigation and precautionary measures:

- Audit of acoustic decoupling for land formation works and the vessel restrictions requirements, as specified by the specifications prepared prior to commencement of marine construction works;

- Implementation and audit of the dolphin exclusion zone during marine works in accordance with the specification prepared prior to commencement of marine construction works;

- Audit the spill response plan during marine works in accordance with the specification prepared prior to commencement of marine construction works;

- Audit the "Regular Marine Travel Routes Plan" and the construction vessel adherence to this specification; and

- Audit of the SkyPier high speed ferries' speed and routing restrictions in accordance with the specification prepared prior to commencement of marine construction works.

10.3.1.4 During the pre-construction, construction and post-construction phases the ET will be required to undertake the following ecological audit measures of the recommended ecological monitoring. The IEC will be required to verify the findings of the ET audits.

- Audit the pre-construction coral dive survey is also proposed at the artificial seawall at northern and northeastern airport island, and the daylighting locations at Sha Chau to check the status of *Balanophyllia* sp. and other coral species and review the feasibility of translocation. A pre-construction coral dive survey plan and report will be prepared for agreement with the Authority (See **Section 10.2.2**);

- Audit the baseline, construction and post-construction phase dolphin monitoring, which may be revised or updated prior to commencement of marine construction works (see **Section 10.2.4**);

- Audit the actual numbers of HSFs operating from SkyPier after the HZMB and HKBCF commence operations by review of information obtained from the SkyPier operators;

- Audit the cumulative assessment construction phase dolphin monitoring in accordance with the specification prepared prior to commencement of marine construction works (see **Section 10.2.6**).

10.3.2 Operational Phase

10.3.2.1 Specific mitigation measures and precautionary measures for marine ecology during the operation phase should be implemented by AAHK. The implementation schedule of the recommended ecological mitigation measures is presented in **Appendix C**. The key operation phase mitigation measures and precautionary measures for the marine ecology are:

- Compensation of a Marine Park of size around 2,400 ha to connect between the existing Sha Chau and Lung Kwu Chau Marine Park and planned marine park at The Brothers for the loss of marine habitats in northern Lantau waters;
- Chemical/ Oil spill response plan; and
- SkyPier high speed ferries' speed and routing restrictions.

10.3.2.2 During the operational phase the ET will be required to undertake the following ecological audit measures of the recommended EIA mitigation measures for a period of 12 months. The IEC will be required to verify the findings of the ET audits.

- Audit the spill response plan once every 6 months for a period of one year; and
- Audit of the SkyPier high speed ferries' speed and routing restrictions in accordance with the specification prepared once every 3 months for a period of one year.

During the operational phase, the ET will be required to audit the operational phase CWD monitoring, which may be revised or updated prior to completion of the 3RS project (see **Section 10.2.4**).

11. Fisheries Impact

11.1 Introduction

11.1.1.1 The EIA conducted for the 3RS indicated there will be temporary and permanent loss of fisheries habitats (and resources) and fishing ground upon completion of construction of land formation and associated marine works. The sites of fisheries importance including the planned Brothers Marine Park, Sha Chau and Lung Kwu Chau Marine Park and the spawning ground for commercial fisheries resources in northern Lantau may also be affected indirectly during the construction and operational phases, as a result of change in water quality and hydrodynamics effect. A suite of mitigation measures for water quality has been proposed in the EIA, which could also minimise the impact on fisheries resources and fishing ground. Apart from this, a new marine protected area is proposed which will be connected with the existing SCLKCMP to the north, the proposed BMP to the east, the marine mammals conservation area at the Mainland waters to the west, with the extended HKIAAA as fisheries no-take zone.

11.1.1.2 The EIA has concluded that, with the implementation of the recommended water quality mitigation measures and proposed establishment of new Marine Park to compensate the permanent loss of fisheries habitats (and resources) and fishing ground, no adverse residual impact on fisheries is anticipated. Apart from the above mitigation measures, the consideration of alternative construction methods e.g. use of non-dredge ground improvement methods by DCM would also reduce the potential release of contaminant to the water column and reduce the indirect impact on fisheries resources. Water quality monitoring and audit has been proposed at locations covering sites of fisheries importance during construction and operation phases to monitor the effectiveness of the proposed mitigation measures, thus fisheries specific monitoring is considered not necessary.

11.2 Mitigation Measures

11.2.1.1 Recommended mitigation measures for water quality that would minimise the impacts on fisheries habitats (and resources), fishing ground and fisheries activities are proposed for the construction phase in the EIA report. The Project Design Team and Contractor should be responsible for the design and implementation of these measures under the supervision of the AAHK / PM and monitored by the ET. The implementation schedule of the recommended water quality mitigation measures is presented in **Appendix C**. Key operation phase mitigation measure for the fisheries is the establishment of a Marine Park of size around 2,400 ha for the loss of fisheries habitats (and resources) and fishing ground in northern Lantau waters.

12. Landscape and Visual Impact

12.1 Introduction

12.1.1.1 The EIA Report has recommended the EM&A for landscape and visual resources is undertaken during both the construction and operational phases of the project. The implementation and maintenance of landscape compensatory planting measures is a key aspect of this and shall be checked to ensure that they are fully realised and that potential conflicts between the proposed landscape measures and any other project works and operational requirements are resolved at the earliest possible date and without compromise to the intention of the mitigation measures. In addition, implementation of the mitigation measures recommended by the EIA shall be monitored through the construction phase site audit programme.

12.2 Baseline Monitoring

12.2.1.1 Baseline monitoring for the landscape and visual resources shall comprise a one off survey to be conducted prior to commencement of any construction works. The commencement date of baseline monitoring shall be agreed between the ET / IEC / AAHK / PM to ensure timely submission of the baseline monitoring report to EPD and relevant authorities.

12.2.1.2 This includes a vegetation survey of the entire site area and within compounds undertaken on an "area" basis. Representative vegetation types shall be identified along with typical species composition. An assessment of landscape character shall be made against which future change can be monitored. The landscape resources and elements of particular concern are to be noted.

12.2.1.3 A photographic record of the site at the time of the contractor's possession of the site shall be prepared by the contractor and approved the AAHK / PM. The approved photographic record shall be submitted to AAHK, ET, IEC and EPD for record.

12.2.1.4 The landscape and visual baseline shall be determined with reference to the Landscape Resources and Landscape Character Area maps included in the EIA Report.

12.3 Mitigation Measures

12.3.1.1 The following mitigation measures are proposed to avoid and reduce the identified impacts during the construction stage and are illustrated in **Drawing MCL/P132/EMA/12-001.1 to MCL/P132/EMA/12-001.6**:

- The construction area and contractor's temporary works areas shall be minimised to avoid impacts on adjacent landscape (**CM1**);
- Reduction of construction period to practical minimum (**CM2**);
- Phasing of the construction stage to reduce visual impacts during the construction phase (**CM3**);
- Construction traffic (land and sea) including construction plants, construction vessels and barges shall be kept to a practical minimum (**CM4**);

- Erection of decorative mesh screens or construction hoardings around works areas in visually unobtrusive colours (**CM5**);
- Avoidance of excessive height and bulk of site buildings and structures (**CM6**);
- Control of night-time lighting by hooding all lights and through minimisation of night working periods (**CM7**);
- All existing trees shall be carefully protected during construction. Detailed Tree Protection Specification shall be provided in the Contract Specification. Under this specification, the Contractor shall be required to submit, for approval, a detailed working method statement for the protection of trees prior to undertaking any works adjacent to all retained trees, including trees in contractor's works areas (**CM8**);
- Trees unavoidably affected by the works shall be transplanted where practical. A detailed Tree Transplanting Specification shall be provided in the Contract Specification, if applicable. Sufficient time for necessary tree root and crown preparation periods shall be allowed in the project programme (**CM9**); and
- Land formation works shall be followed with advanced hydroseeding around taxiways and runways as soon as practical (**CM10**).

12.3.1.2 The following mitigation measures are proposed to remedy and compensate unavoidable impacts during the operation phase (it should be noted that while the benefits of these mitigation measures will be felt in the operation phase, many of the measures are implemented either partially or entirely in the design phase):

- Sensitive landscape design of reclamation edge by incorporating different angles of gradient and the use of a range of armour rock sizes placed randomly in a riprap approach for an irregular appearance. Planting of native coastal plants shall be incorporated (**OM1**);
- All above ground structures, including, Vent Shafts, Emergency and Firemen's' Accesses etc. shall be, either fully integrated with the planned buildings, or sensitively designed in a manner that responds to the existing and planned urban context, and minimises potential adverse landscape and visual impacts (**OM2**);
- Sensitive design of buildings and structures in terms of scale, height and bulk (visual weight) (**OM3**);
- Use appropriate building materials and colours in built structures to create cohesive visual mass (**OM4**);
- Lighting units to be directional and minimise unnecessary light spill and glare (**OM5**);
- Greening measures, including vertical greening, green roofs, road verge planting and peripheral screen planting shall be implemented (**OM6**);
- Compensatory Tree Planting for all felled trees shall be provided to the satisfaction of relevant Government departments. Required numbers and locations of compensatory trees shall be

determined and agreed separately with Government during the Tree Felling Application process under the relevant technical circulars (**OM7**);

- Streetscape (e.g. paving, signage, street furniture, lighting etc.) shall be sensitively designed in a manner that responds to the existing and planned urban context, and minimises potential adverse landscape and visual impacts (**OM8**);
- All streetscape areas and hard and soft landscape areas disturbed during construction shall be reinstated to equal or better quality (due to implementation of screen planting, road verge planting etc.), to the satisfaction of the relevant Government departments (**OM9**);
- Aesthetic improvement planting of viaduct structure through greening of structure to mitigate visual impact of viaduct form (**OM10**); and
- Sensitive design of footbridges, noise barriers and enclosures with greening (screen planting / climbers / planters) and chromatic measures (**OM11**).

12.3.1.3 The operation phase measures listed above shall be adopted during the detailed design, and be built as part of the construction works so that they are in place at the date of commissioning of the 3RS (as stated in **Section 12.3.1.2** above).

12.4 Environmental Monitoring and Audit Requirements

12.4.1.1 An approved landscape contractor shall be employed by the contractor for the implementation of landscape construction works and subsequent maintenance operations during the 12-month establishment period. The establishment works shall be undertaken throughout the contractor's one year maintenance period which will be within the first operation year of the project.

12.4.1.2 All measures undertaken by both the contractor and the landscape contractor during the construction phase and first year of the operation phase shall be audited by a landscape architect, as a member of the ET, on a regular basis to ensure compliance with the intended aims of the measures. Site inspections shall be undertaken at least once every two months during the operation phase.

12.4.1.3 The broad scope of the audit is detailed below. Operation phase auditing will be restricted to the 12-months establishment works of the landscaping proposals, with the AAHK / PM taking over the maintenance and monitoring after this period, and thus only the items below concerning this period are relevant to the operation phase:

- The extent of the agreed works areas shall be regularly checked during the construction phase. Any trespass by the contractor outside the limit of works, including and damage to existing trees and woodland all noted and remedial action determined;
- The progress of the engineering works all be regularly reviewed on site to identify the earliest practical opportunities for the landscape works to be undertaken;
- All existing trees and vegetation within the study area which are not directly affected by the works shall be retained and protected;

- The methods of protecting existing vegetation proposed by the contractors shall be acceptable and enforced;
- All landscaping works shall be carried out in accordance with the specifications;
- The planting of trees and shrubs shall be carried out properly and within the right season as far as practical;
- The species and mix of the new trees and shrubs to be planted shall suitable; and
- The newly planted trees and grasses areas shall be maintained throughout the establishment period, particularly in respect of the following:
  - Regular watering, weeding and fertilising of all trees and shrub planting and areas of grass reinstatement;
  - Regular grass cutting for reinstated areas;
  - Firming up of trees after periods of strong winds;
  - Regular checks for eradication of pests, fungal infection, etc.;
  - Pruning of dead or broken branches; and
  - Prompt replacement of dead plants and regressing of failed areas of grass.

12.5 Monitoring Programs

12.5.1.1 The design, implementation and maintenance of landscape and visual mitigation measures shall be checked to ensure that any potential conflicts between the proposed landscape measures and any other works for the project would be resolved as early as practical without affecting the implementation of the mitigation measures.

12.5.1.2 Site inspection and audit shall be undertaken as necessary in the construction and operation phases.

Table 12-1: Monitoring Programme for Landscape and Visual

Stage	Monitoring Task	Monitoring Report	Form of Approval	Frequency
Detailed Design	Checking of design works against the recommendations of the landscape and visual impact assessments within the EIA shall be undertaken during detailed design and tender stage, to ensure that they fulfil the intention of the mitigation measures. Any changes to the design, including design changes on site shall also be checked.	Report by AAHK / PM confirming that the design conforms to requirements of EP.	Approved by Client	At the end of the Detailed Design Phase

Stage	Monitoring Task	Monitoring Report	Form of Approval	Frequency
Construction	Checking of the contractor's operations during the construction period.	Report on Contractor's compliance, by ET	Counter signature of report by IEC	Weekly
Establishment Works	Checking of the planting works during the twelve-month Establishment Period after completion of the construction works.	Report on Contractor's compliance, by ET	Counter signature of report by IEC	Every two months
Long Term Management (10 year)	Monitoring of the long-term management of the planting works in the period up to 10 years after completion of the construction works.	Report on Compliance by ET or Maintenance Agency as appropriate	Counter signature of report by Management Agency	Annually

Notes:

ET - Environmental Team (employed by Contractor)

EP - Environmental Permit

PM – Project Manager

12.5.2 Construction Phase & Establishment Period

12.5.2.1 An implementation programme will be prepared as required by EIAO-TM. Reference will be made to the ETWB TC(W) No. 2/2004 on Maintenance of Vegetation and Hard Landscape Features which defines the management and maintenance responsibilities for natural vegetation and landscape works, including both soft works and hard works, and authorities for tree preservation and felling. The format of the preliminary arrangement of implementation programme is listed in **Table 12-2** below.

Table 12-2: Preliminary Funding, Implementation, Management and Maintenance Proposal

Landscape and Visual Mitigation Measure ID No.	Funding Agency	Implementation Agency	Management Agency	Maintenance Agency
Construction Phase				
CM1 – CM10	AAHK	Contractor	-	-
Operation Phase				
OM1, OM5, OM8, OM10, OM11	AAHK	Design Engineer	AAHK	AAHK
OM2 – OM4	AAHK	Design Engineer	Building Operator	Building Operator

Landscape and Visual Mitigation Measure ID No.	Funding Agency	Implementation Agency	Management Agency	Maintenance Agency
OM6, OM7, OM9	AAHK	Contractor	AAHK	AAHK

12.5.2.2 The implementation of landscape construction works and subsequent maintenance operations during the 12-month establishment period must be supervised by a qualified Landscape Resident Site Staff (Registered Landscape Architect or Professional Member of the Hong Kong Institute of Landscape Architects).

12.5.2.3 Measures to mitigate landscape and visual impacts during construction shall be checked and monitored by a Registered Landscape Architect to ensure compliance with the intended aims of the measures.

12.5.2.4 The progress of the engineering works shall be regularly reviewed on site to identify the earliest practical opportunities for the landscape works to be undertaken.

12.5.2.5 The planting works shall be monitored during the first 10 years of the operation phase of the project. Any areas of vegetation which fails to establish, shall be corrected by the relevant management and maintenance parties at the earliest opportunity. The maintenance requirement of the planting works stated under the Ten-Year Management Programme is included in the monitoring requirement.

12.6 Event and Action Plan

12.6.1.1 Should non-compliance of the landscape and visual impacts occur, actions in accordance with the Event and Action Plan stated in **Table 12-3** below shall be carried out.

Table 12-3: Event and Action Plan for Landscape and Visual

Event Action Level	Action			
	ET	IEC	AAHK / PM	CONTRACTOR
Design Check	Check final design conforms to the requirements of EP and prepare report.	Check report. Recommend remedial design if necessary.	Undertake remedial if design necessary.	
Non-conformity on one occasion	Identify source. Inform IEC and AAHK / PM. Discuss remedial actions with IEC, AAHK / PM and Contractor. Monitor remedial actions until	Check report. Check Contractor's working method. Discuss with ET and Contractor on possible remedial measures. Advise AAHK / PM on effectiveness of proposed remedial	Notify Contractor. Ensure remedial measures are properly implemented.	Amend working methods to prevent recurrence of non-conformity. Rectify damage and undertake additional action necessary.

Event Action Level	Action			
	ET	IEC	AAHK / PM	CONTRACTOR
	rectification has been completed.	measures. Check implementation of remedial measures.		
Repeated Non-conformity	Identify source. Inform IEC and AAHK / PM. Increase monitoring frequency. Discuss remedial actions with IEC, AAHK / PM and Contractor. Monitor remedial actions until rectification has been completed. If non-conformity stops, cease additional monitoring.	Check monitoring report. Check Contractor's working method. Discuss with ET and Contractor on possible remedial measures. Advise AAHK / PM on effectiveness of proposed remedial measures. Supervise implementation of remedial measures.	Notify Contractor. Ensure remedial measures area properly implemented.	Amend working methods to prevent recurrence of non-conformity. Rectify damage and undertake additional action necessary.

Notes:

IEC - Independent Environmental Checker

13. Cultural Heritage

13.1.1.1 No environmental monitoring and audit is required for marine archaeology or terrestrial cultural heritage.

14. Environmental Auditing

14.1 Site Inspection

14.1.1.1 Site inspections provide a direct means to trigger and enforce the specified environmental protection and pollution control measures. They should be undertaken routinely by the ET to inspect the construction activities in order to ensure that appropriate environmental protection and pollution control mitigation measures are properly implemented. With well-defined pollution control and mitigation specifications and a well-established site inspection, deficiency and action reporting system, the site inspection is one of the most effective tools to enforce the environmental protection requirements on the construction site.

14.1.1.2 The ET Leader is responsible for formulating the environmental site inspection, the deficiency and action reporting system, and for carrying out the site inspection works. He should prepare a proposal for site inspection and deficiency and action reporting procedures to the IEC for agreement, and to AAHK / PM for approval. The Contractor's proposal for rectification would be made known to AAHK / PM and IEC.

14.1.1.3 Regular site inspections led by the ET leader should be carried out at least once per week. The areas of inspection should not be limited to the environmental situation, pollution control and mitigation measures within the site; it should also review the environmental situation outside the project sites which is likely to be affected, directly or indirectly, by the site activities. The ET should make reference to the following information in conducting the inspection:

- The EIA and EM&A recommendations on environmental protection and pollution control mitigation measures;
- The Environmental Permit conditions;
- On-going results of the EM&A programme;
- Works progress and programme;
- Individual works methodology proposals (which should include proposal on associated pollution control measures);
- Contract specifications on environmental protection;
- Relevant environmental protection and pollution control laws; and
- Previous site inspection results undertaken by the ET and others.

14.1.1.4 The Contractor should keep the ET Leader updated with all relevant information on the construction contract necessary for him to carry out the site inspections. Inspection results and associated recommendations for improvements to the environmental protection and pollution control works should be submitted to the IEC and the Contractor within 24-hours for reference and for taking immediate action. The Contractor should follow the procedures and time-frame stipulated in the environmental site inspection, and the deficiency and action reporting system formulated by the ET Leader, to report on any remedial measures subsequent to the site inspections.

14.1.1.5 The ET should also carry out ad hoc site inspections if significant environmental problems are identified. Inspections may also be required subsequent to receipt of an environmental complaint, or as part of the investigation work.

14.2 Compliance with Legal and Contractual Requirements

14.2.1.1 There are contractual environmental protection and pollution control requirements as well as environmental protection and pollution control laws in Hong Kong with which construction activities must comply.

14.2.1.2 In order that the works are in compliance with the contractual requirements, relevant sections (e.g. sections related to environmental measures) of works method statements submitted by the Contractor to AAHK / PM for approval should be sent to the ET Leader for vetting to see whether sufficient environmental protection and pollution control measures have been included.

14.2.1.3 The ET Leader should also keep himself informed of the progress and programme of the works to check that relevant environmental laws have not been violated, and that any foreseeable potential for violation can be prevented.

14.2.1.4 The Contractor should regularly copy relevant documents to the ET Leader so that works checking can be carried out. The document should at least include the updated Works Progress Reports, updated Works Programme, any application letters for different licences / permits under the environmental protection laws, and copies of all valid licences / permits. The site diary should also be made available for the ET Leader's inspection upon his request.

14.2.1.5 After reviewing the documentation, the ET Leader should advise the Contractor of any noncompliance with contractual and legislative requirements on environmental protection and pollution control for them to take follow-up actions, including any potential violation of requirements.

14.2.1.6 Upon receipt of the advice, the Contractor should undertake immediate action to correct the situation. AAHK / PM should follow up to ensure that appropriate action has been taken in order to satisfy contractual and legal requirements.

14.3 Environmental Complaints

14.3.1.1 Complaints should be referred to the ET for action. The ET should undertake the following procedures upon receipt of any valid complaint:

- The Contractor to log complaint and date of receipt onto the complaint database and inform AAHK / PM, ET and IEC immediately;

- The Contractor to investigate the complaint to determine its validity, and assess whether the source of the problem is due to construction works of the Project with the support of additional monitoring frequency, stations and parameters, if necessary;
- The Contractor to identify mitigation measures in consultation with IEC, ET and AAHK / PM if a complaint is valid and due to the construction works of the Project;
- The Contractor to implement the remedial measures as required by the AAHK / PM and to agree with the ET and IEC any additional monitoring frequency, stations and parameters, where necessary, for checking the effectiveness of the mitigation measures;
- AAHK / PM, ET and IEC to review the effectiveness of the Contractor's remedial measures and the updated situation;
- The ET to undertake additional monitoring and audit to verify the situation if necessary, and oversee that circumstances leading to the complaint do not recur;
- If the complaint is referred by the EPD, the Contractor is to prepare interim report on the status of the complaint investigation and follow-up actions stipulated above, including the details of the remedial measures and additional monitoring identified or already taken, for submission to EPD within the time frame assigned by the EPD; and
- The ET to record the details of the complaint, results of the investigation, subsequent actions taken to address the complaint and updated situation including the effectiveness of the remedial measures, supported by regular and additional monitoring results in the monthly EM&A reports.

14.3.1.2 Handling of environmental complaints should follow the environmental complaint flow diagram and reporting channel as presented in **Drawing No. MCL/P132/EMA/14-001**.

14.3.1.3 During the complaint investigation work, the Contractor and AAHK / PM should cooperate with the ET in providing all necessary information and assistance for completion of the investigation. If mitigation measures are identified in the investigation, the Contractor should promptly carry out the mitigation works. AAHK / PM should ensure that the measures have been carried out by the Contractor.

15. Reporting

15.1 Introduction

15.1.1.1 The reporting requirements of EM&A are based upon a paper-documented approach. However, the same information can be provided in an electronic medium upon agreeing the format with the IEC, AAHK / PM and EPD (for construction phase), and with AAHK / PM and EPD (for operation phase). This would enable a transition from a paper / historic and reactive approach to an electronic / real time proactive approach.

15.1.1.2 The types of reports that the ET Leader should prepare and submit include baseline monitoring report, monthly EM&A report, quarterly EM&A report, annual EM&A report and final EM&A review report. In accordance with Annex 21 of the EIAO-TM, a copy of the monthly, quarterly summary and final review EM&A reports should be submitted to the EPD. The exact details of the frequency, distribution and time frame for submission should be agreed with the IEC, AAHK / PM and EPD prior to commencement of works.

15.2 Baseline Monitoring Report

15.2.1.1 The ET Leader should prepare and submit a Baseline Environmental Monitoring Report within two weeks prior to commencement of construction works. Copies of the Baseline Environmental Monitoring Report should be submitted to the Contractor, the IEC, AAHK / PM and EPD. The ET Leader should liaise with the relevant parties on the exact number of copies they require. The report format and baseline monitoring data format should be agreed with the IEC, AAHK / PM and EPD prior to submission.

15.2.1.2 The baseline monitoring report should include at least the following:

i. Up to half a page of executive summary

ii. Brief project background information

iii. Drawings showing locations of the baseline monitoring stations

iv. An updated construction programme with milestones of environmental protection / mitigation activities annotated

v. Monitoring results (in both hard and diskette copies) together with the following information:

- Monitoring methodology
- Name of laboratory and types of equipment used and calibration details
- Parameters monitored
- Monitoring locations (and depth, where relevant)
- Monitoring date, time, frequency and duration

- Quality assurance (QA) / quality control (QC) results and detection limits

vi. Details of influencing factors, including:

- Major activities, if any, being carried out on the site during the period / monitoring
- Weather conditions during the period / monitoring
- Other factors which might affect results

vii. Determination of the action and limit Levels for each monitoring parameter and statistical analysis of the baseline data, the analysis should conclude if there is any significant difference between control and impact stations for the parameters monitored

viii. Revisions for inclusion in the EM&A Manual

ix. Comments and conclusions

15.3 Monthly EM&A Reports

15.3.1.1 The results and findings of all EM&A work carried out during the month should be recorded in the monthly EM&A reports prepared by the ET Leader. The EM&A report should be prepared and submitted within 10 working days after the end of each reporting month. Each monthly EM&A report should be submitted to the following parties: the Contractor, the IEC, AAHK / PM and the EPD. Before submission of the first EM&A report, the ET Leader should liaise with the parties on the required number of copies and format of the monthly reports in both hard copy and electronic medium.

15.3.1.2 The ET Leader should review the number and location of monitoring stations and parameters every six months, or on as needed basis, in order to cater for any changes in the surrounding environment and the nature of works in progress.

15.3.2 First Monthly EM&A Report

15.3.2.1 The first monthly EM&A report should include at least but not be limited to the following:

i. Executive summary (one to two pages):

- Breaches of action and limit levels
- Complaint log
- Notifications of any summons and status of prosecutions
- Changes made that affect the EM&A
- Future key issues

ii. Basic project information:

- Project organisation including key personnel contact names and telephone numbers
- Scope of works of the project
- Construction programme
- Works undertaken during the month with illustrations (such as location of works etc.)
- Drawings showing the project area, any environmental sensitive receivers and the locations of the monitoring and control stations(with coordinates of the monitoring locations).

iii. A brief summary of EM&A requirements including:

- All monitoring parameters
- Environmental quality performance limits (action and limit levels)
- Event-Action Plans
- Environmental mitigation measures, as recommended in the project EIA study final report
- Environmental requirements in contract documents

iv. Environmental status

- Advice on status of compliance with environmental permit including the status of submissions under the environmental permit

v. Implementation status

- Implementation status of environmental protection and pollution control / mitigation measures, as recommended in the EIA Report

vi. Monitoring results (in both hard and diskette copies) together with the following information:

- Monitoring methodology
- Name of laboratory and types of equipment used and calibration details
- Parameters monitored
- Monitoring locations
- Monitoring date, time frequency, and duration

- Weather conditions during the period / monitoring
- Graphical plots of the monitored parameters in the month annotated against
- The major activities being carried out on site during the period
- Weather conditions that may affect the monitoring results
- Any other factors which might affect the monitoring results
- QA / QC results and detection limits

vii. Analysis of monitoring results, non-compliance, complaints, and notifications of summons and status of prosecutions:

- Analysis and interpretation of monitoring results in the month
- Any non-compliance (exceedances) of the environmental quality performance limits (action and limit levels)
- Changes made that affect the EM&A during the month
- Complaints received (written or verbal) for each media, including locations and nature of complaints, investigation, liaison and consultation undertaken, actions and follow-up procedures taken, results and summary
- Notification of summons and status of prosecutions for breaches of current environmental protection / pollution control legislation, including locations and nature of the breaches, investigation, follow-up actions taken, results and summary
- Reasons for and the implications of non-compliance, complaints, summons and prosecutions including review of pollution sources and working procedures
- Actions taken in the event of non-compliance and deficiency, and follow-up actions related to earlier non-compliance

viii. Others

- An account of the future key issues as reviewed from the works programme and work method statements
- Comment on the solid and liquid waste management status during the month including waste generation and disposal records
- Outstanding issues and deficiencies

- Comments on effectiveness of the environmental management systems, practices, procedures and mitigation measures, recommendations (for example, any improvement in the EM&A programme) and conclusions

ix. Appendix

- Monitoring schedule for the present and next reporting period
- Cumulative statistics on complaints, notifications of summons and successful prosecutions
- Outstanding issues and deficiencies

15.3.3 Subsequent Monthly EM&A Reports

15.3.3.1 The subsequent monthly EM&A reports should include the following:

i. Executive summary (one to two pages):

- Breaches of action and limit levels
- Complaint log
- Notifications of any summons and status of prosecutions
- Changes made that affect the EM&A
- Future key issues

ii. Environmental status:

- Advice on status of compliance with environmental permit including the status of submissions under the environmental permit

iii. Implementation status:

- Implementation status of environmental protection and pollution control / mitigation measures, as recommended in the EIA Report

iv. Monitoring results (in both hard and diskette copies) together with the following information:

- Monitoring methodology
- Name of laboratory and types of equipment used and calibration details
- Parameters monitored
- Monitoring locations

- Monitoring date, time frequency, and duration
- Weather conditions during the period / monitoring
- Graphical plots of the monitored parameters in the month annotated against:
  - The major activities being carried out on site during the period
  - Weather conditions that may affect the monitoring results
  - Any other factors which might affect the monitoring results
  - QA / QC results and detection limits

v. Analysis of monitoring results, non-compliance, complaints, and notifications of summons and status of prosecutions:

- Analysis and interpretation of monitoring results in the month
- Any non-compliance (exceedances) of the environmental quality performance limits (action and limit levels)
- Changes made that affect the EM&A during the month
- Complaints received (written or verbal) for each media, including locations and nature of complaints, investigation, liaison and consultation undertaken, actions and follow-up procedures taken, results and summary
- Notification of summons and status of prosecutions for breaches of current environmental protection / pollution control legislation, including locations and nature of the breaches, investigation, follow-up actions taken, results and summary
- Reasons for and the implications of non-compliance, complaints, summons and prosecutions including review of pollution sources and working procedures
- Actions taken in the event of non-compliance and deficiency, and follow-up actions related to earlier non-compliance

vi. Others

- An account of the future key issues as reviewed from the works programme and work method statements
- Comment on the solid and liquid waste management status during the month including waste generation and disposal records
- Outstanding issues and deficiencies

- Comments on effectiveness of the environmental management systems, practices, procedures and mitigation measures, recommendations (for example, any improvement in the EM&A programme) and conclusions

vii. Appendix

- Monitoring schedule for the present and next reporting period
- Cumulative statistics on complaints, notifications of summons and successful prosecutions
- Outstanding issues and deficiencies

15.3.3.2 Some information concerning the EM&A works, such as the EM&A requirements would remain unchanged throughout the EM&A programme. In the subsequent monthly EM&A Reports, the first monthly EM&A Report can be referred instead of repeating the description of the unchanged information.

15.4 Quarterly EM&A Report

15.4.1.1 A quarterly EM&A report should be produced and should contain at least the following information. In addition, the first quarterly summary report should also confirm if the monitoring work is proving effective and that it is generating data with the necessary statistical power to categorically identify or confirm the absence of impact attributable to the works.

i. Up to half a page executive summary

ii. Basic project information including a synopsis of the project organization and programme, and a synopsis of works undertaken during the quarter

iii. A brief summary of EM&A requirements including:

- Monitoring parameters
- Environmental quality performance limits (Action and Limit levels)
- Environmental mitigation measures, as recommended in the project EIA Final Report

iv. Drawings showing the project area, environmental sensitive receivers and the locations of the monitoring and control stations

v. Implementation status of environmental protection and pollution control / mitigation measures, as recommended in the EIA Report

vi. Graphical plots of the monitored parameters over the past four months (the last month of the previous quarter and the present quarter) for representative monitoring stations annotated against:

- The major activities being carried out on site during the period
- Weather conditions during the period
- Any other factors which might affect the monitoring results

vii. Advice on the solid and liquid waste management during the quarter including waste generation and disposal records

viii. A summary of non-compliance (exceedances) of the environmental quality performance limits (Action and Limit levels)

ix. A brief review of the reasons for and the implications of any non-compliance, including a review of pollution sources and working procedures

x. A summary description of actions taken in the event of non-compliance and any follow-up procedures related to any earlier non-compliance

xi. A summary of all complaints received (written or verbal) for each media, liaison and consultation undertaken, actions and follow-up procedures taken

xii. Comments on the effectiveness and efficiency of the mitigation measures; recommendations on any improvements in the EM&A programme and conclusions for the quarter

xiii. Proponents' contacts and any hotline telephone number for the public to make enquiries.

15.5 Annual EM&A Report

15.5.1.1 An annual EM&A report should be produced and should contain at least the following information.

i. One to two pages of executive summary

ii. Basic project information including a synopsis of the project organization and programme, and a synopsis of works undertaken during the past 12 months

iii. A brief summary of EM&A requirements including:

- Monitoring parameters
- Environmental quality performance limits (Action and Limit levels)
- Environmental mitigation measures, as recommended in the project EIA Final Report

iv. Drawings showing the project area, environmental sensitive receivers and the locations of the monitoring and control stations

v. Implementation status of environmental protection and pollution control / mitigation measures, as recommended in the EIA Report

vi. Graphical plots of the monitored parameters over the past 12 months for representative monitoring stations annotated against:

- The major activities being carried out on site during the period
- Weather conditions during the period
- Any other factors which might affect the monitoring results

vii. Advice on the solid and liquid waste management during the past 12 months including waste generation and disposal records

viii. A summary of non-compliance (exceedances) of the environmental quality performance limits (Action and Limit levels)

ix. A brief review of the reasons for and the implications of any non-compliance, including a review of pollution sources and working procedures

x. A summary description of actions taken in the event of non-compliance and any follow-up procedures related to any earlier non-compliance

xi. A summary of all complaints received (written or verbal) for each media, liaison and consultation undertaken, actions and follow-up procedures taken

xii. Comments on the effectiveness and efficiency of the mitigation measures; recommendations on any improvements in the EM&A programme and conclusions for the quarter

xiii. Proponents' contacts and any hotline telephone number for the public to make enquiries.

15.6 Final EM&A Review Report

15.6.1.1 The EM&A program could be terminated upon completion of those construction activities that have the potential to cause significant environmental impacts, and / or the completion of post-construction monitoring requirements.

15.6.1.2 The proposed termination by the Contractor should only be implemented after the proposal has been endorsed by the IEC and AAHK / PM followed by final approval from the EPD.

15.6.1.3 The final EM&A report should include, inter alia, the following information:

i. An executive summary

ii. Basic project information including a synopsis of the project organization and programme, contacts of key management, and a synopsis of work undertaken during the entire construction period

iii. A brief summary of EM&A requirements including:

- Monitoring parameters
- Environmental quality performance limits (action and limit levels)
- Environmental mitigation measures, as recommended in the project EIA study final report

iv. Drawings showing the project area, any environmental sensitive receivers and the locations of the monitoring and control stations

v. Advice on the implementation status of environmental and pollution control / mitigation measures, as recommended in the project EIA study final report, summarised in the updated implementation status pro forma

vi. Graphical plots of the monitoring parameters over the construction period for representative monitoring stations, including the post-project monitoring annotated against:

- The major activities being carried out on site during the period
- Weather conditions during the period
- Any other factors which might affect the monitoring results
- The baseline condition

vii. Compare the EM&A data with the EIA predictions

viii. Effectiveness of the solid and liquid waste management

ix. A summary of non-compliance (exceedances) of the environmental quality performance limits (action and limit levels)

x. A brief account of the reasons the non-compliance including a review of pollution sources and working procedures

xi. A summary of the actions taken against the non-compliance

xii. A summary of all complaints received (written or verbal) for each media, liaison and consultation undertaken, actions and follow-up procedures taken

xiii. A review of the monitoring methodology adopted and with the benefit of hindsight, comment on its effectiveness (including cost effectiveness)

xiv. A summary of notifications of summons and successful prosecutions for breaches of the current environmental protection / pollution control legislations, locations and nature of the breaches, investigation, follow-up actions taken and results

xv. A review of the practicality and effectiveness of the EM&A programme (e.g. effectiveness and efficiency of the mitigation measures), and recommendation on any improvement in the EM&A programme

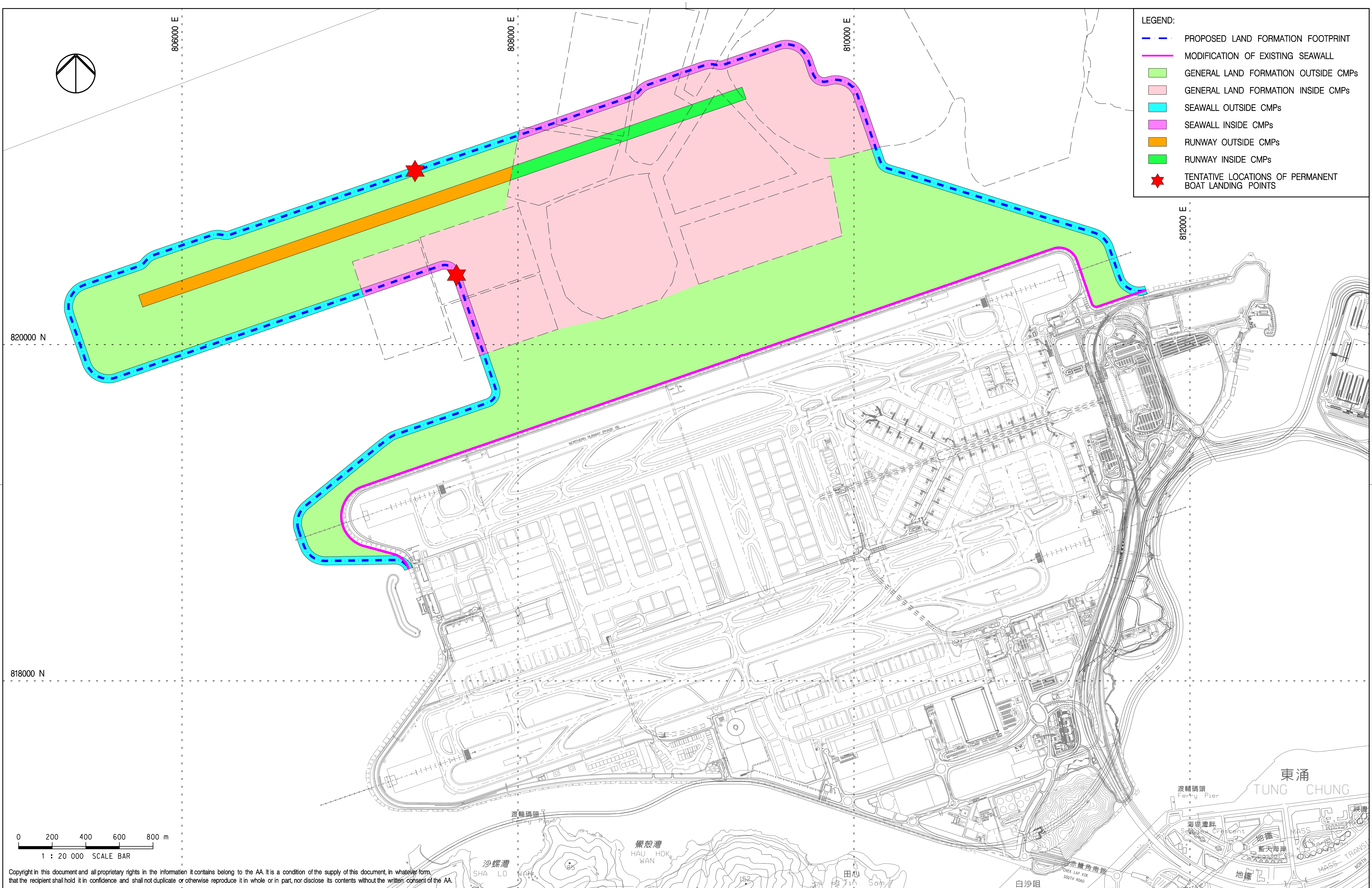
xvi. A conclusion to state the return of ambient and / or the predicted scenario as per EIA findings

15.7 Data Keeping

15.7.1.1 No site-based documents (such as monitoring field records, laboratory analysis records, site inspection forms, etc.) are required to be included in the EM&A reporting documents. However, any such document should be retained by the ET Leader / Monitoring Team and be ready for inspection upon request. All relevant information should be clearly and systematically recorded in the document. Monitoring data should also be recorded in digital format, and the software copy must be available upon request. Data format should be agreed with the IEC, AAHK / PM and EPD. All documents and data should be kept for at least one year following completion of the construction contract and one year after the completion of operation phase monitoring for construction phase EM&A and operational phase EM&A respectively.

15.8 Interim Notifications of Environmental Quality Limit Exceedances

15.8.1.1 For construction phase EM&A, with reference to the Event and Action Plan, when the environmental quality performance limits are exceeded, the ET Leader should immediately notify the IEC, AAHK / PM and EPD, as appropriate and should keep them informed of the results of the investigation, proposed remedial measures, actions taken, updated situation on site, need for further follow-up proposals, etc. A sample template for the interim notifications is shown in **Appendix E**. The ET Leader may modify the interim notification form for this EM&A programme, the format of which should be approved by AAHK / PM and agreed by the IEC.



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C	21MAR14	GENERAL REVISION	EY

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KEY PROJECT COMPONENTS – LAND FORMATION

Consultant's Signatures for Approval		Date
Design	DC	18OCT13
Checkers	DC	18OCT13
Design Supervisor	EC	21MAR14
Authorised Representative	AFK	21MAR14

EXPANSION OF HONG KONG INTERNATIONAL AIRPORT INTO A THREE-RUNWAY SYSTEM

Drawing No. MCL / P132 / EMA / 1-001

Scale at A3 1 : 20000

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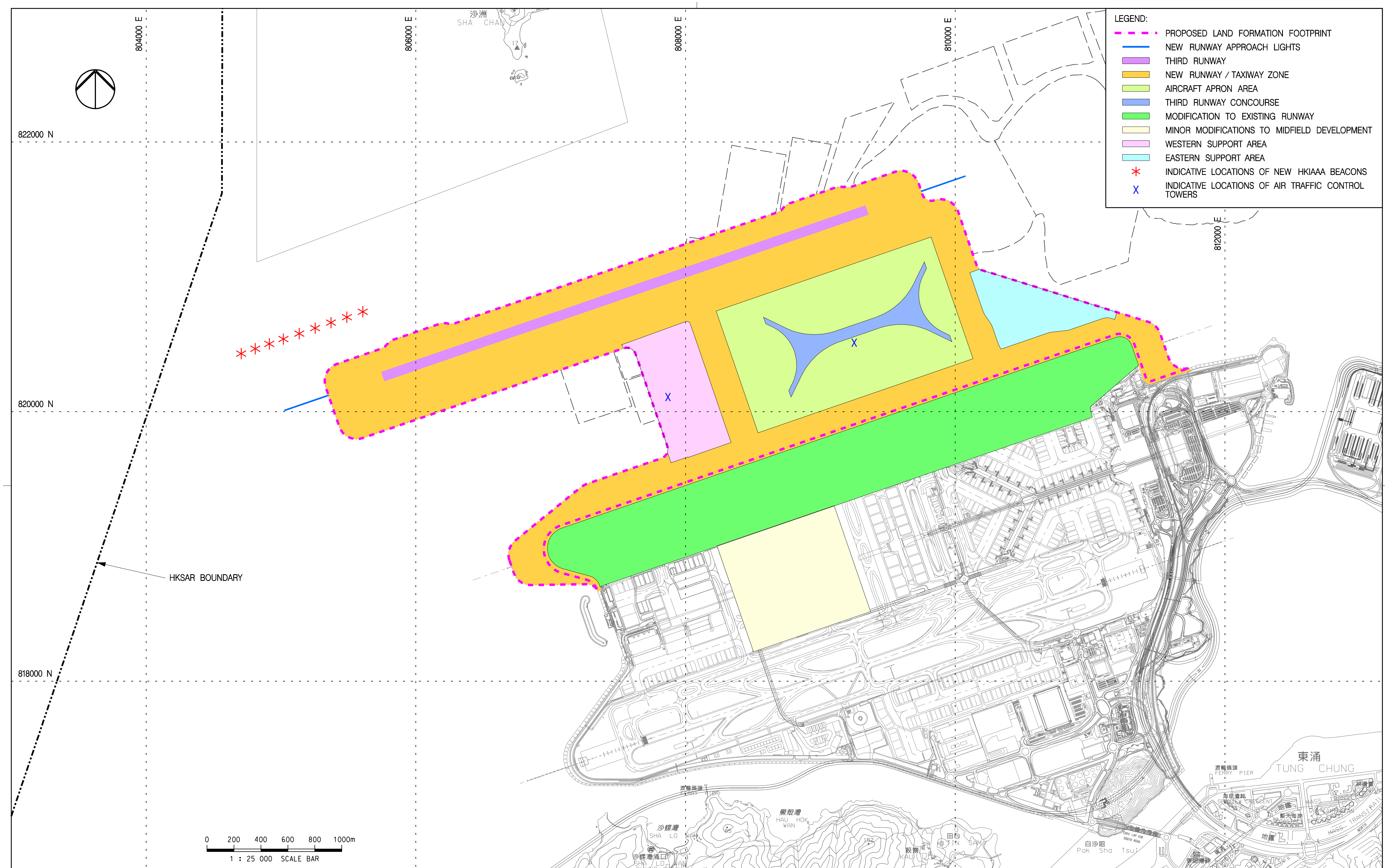

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KEY PROJECT COMPONENTS – AIRFIELD FACILITIES

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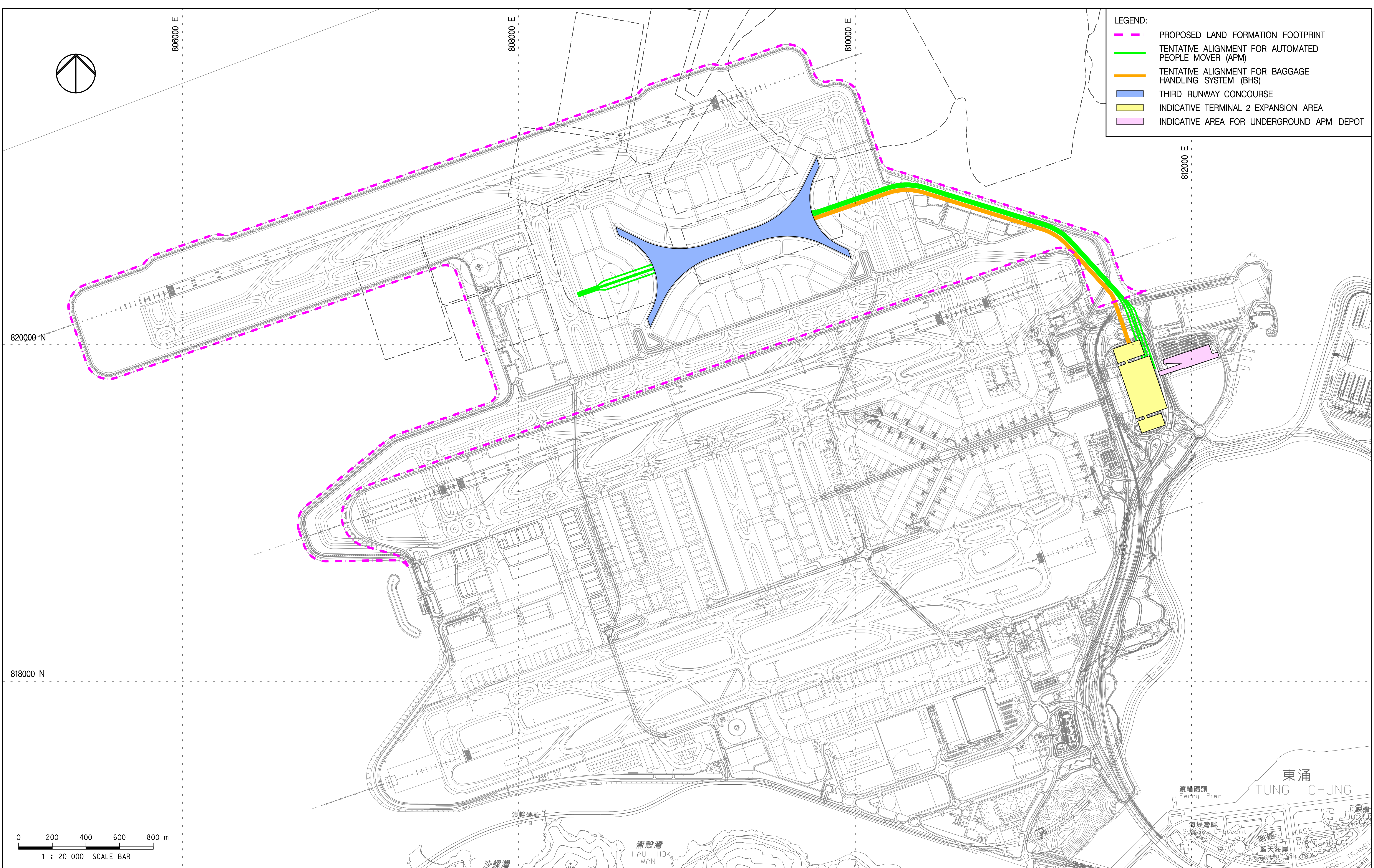

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KEY PROJECT COMPONENTS – PASSENGER FACILITIES

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Design Supervisor	EC	21MAR14
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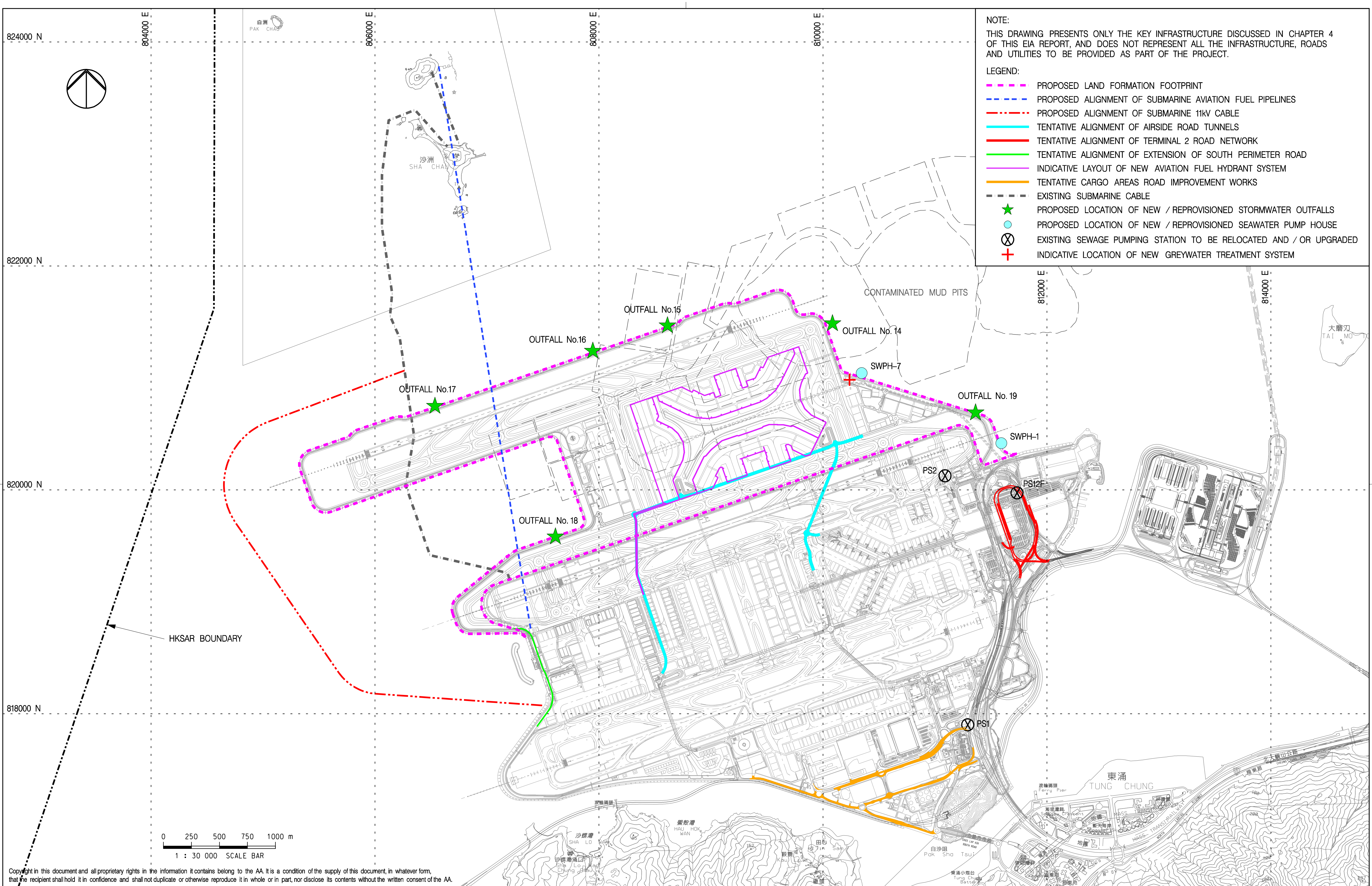
NOTE:

THIS DRAWING PRESENTS ONLY THE KEY INFRASTRUCTURE DISCUSSED IN CHAPTER 4 OF THIS EIA REPORT, AND DOES NOT REPRESENT ALL THE INFRASTRUCTURE, ROADS AND UTILITIES TO BE PROVIDED AS PART OF THE PROJECT.

LEGEND:

- PROPOSED LAND FORMATION FOOTPRINT
- PROPOSED ALIGNMENT OF SUBMARINE AVIATION FUEL PIPELINES
- PROPOSED ALIGNMENT OF SUBMARINE 11kV CABLE
- TENTATIVE ALIGNMENT OF AIRSIDE ROAD TUNNELS
- TENTATIVE ALIGNMENT OF TERMINAL 2 ROAD NETWORK
- TENTATIVE ALIGNMENT OF EXTENSION OF SOUTH PERIMETER ROAD
- INDICATIVE LAYOUT OF NEW AVIATION FUEL HYDRANT SYSTEM
- TENTATIVE CARGO AREAS ROAD IMPROVEMENT WORKS
- EXISTING SUBMARINE CABLE
- PROPOSED LOCATION OF NEW / REPROVISIONED STORMWATER OUTFALLS
- PROPOSED LOCATION OF NEW / REPROVISIONED SEAWATER PUMP HOUSE
- EXISTING SEWAGE PUMPING STATION TO BE RELOCATED AND / OR UPGRADED
- INDICATIVE LOCATION OF NEW GREYWATER TREATMENT SYSTEM



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KEY PROJECT COMPONENTS – ROAD NETWORK AND KEY INFRASTRUCTURE

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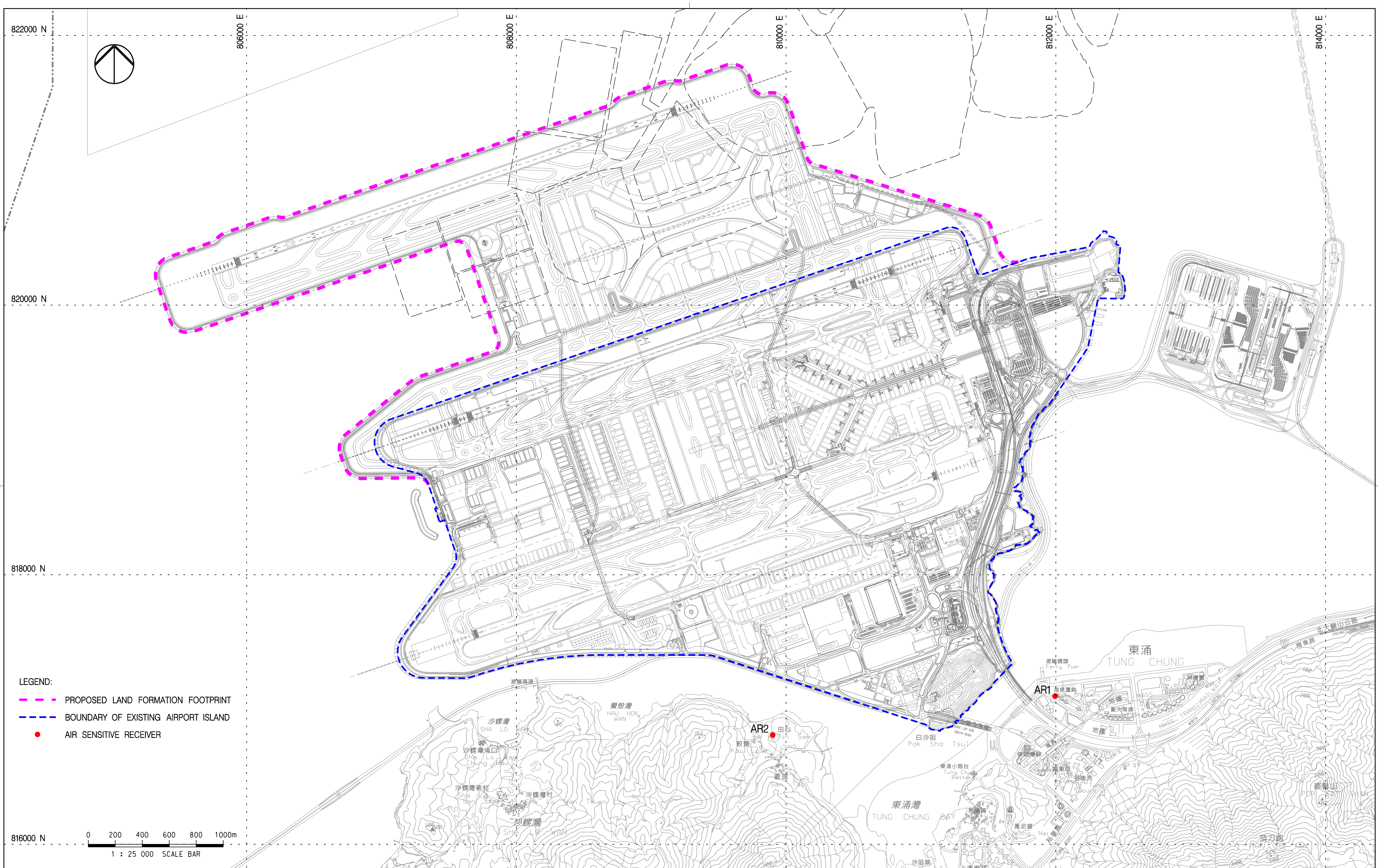

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AIR QUALITY MONITORING STATIONS (CONSTRUCTION)

Consultant's Signatures for Approval		Date
Design	FK	29NOV13
Checkers	FK	29NOV13
Design Supervisor	EC	21MAR14
Authorised Representative	AFK	21MAR14

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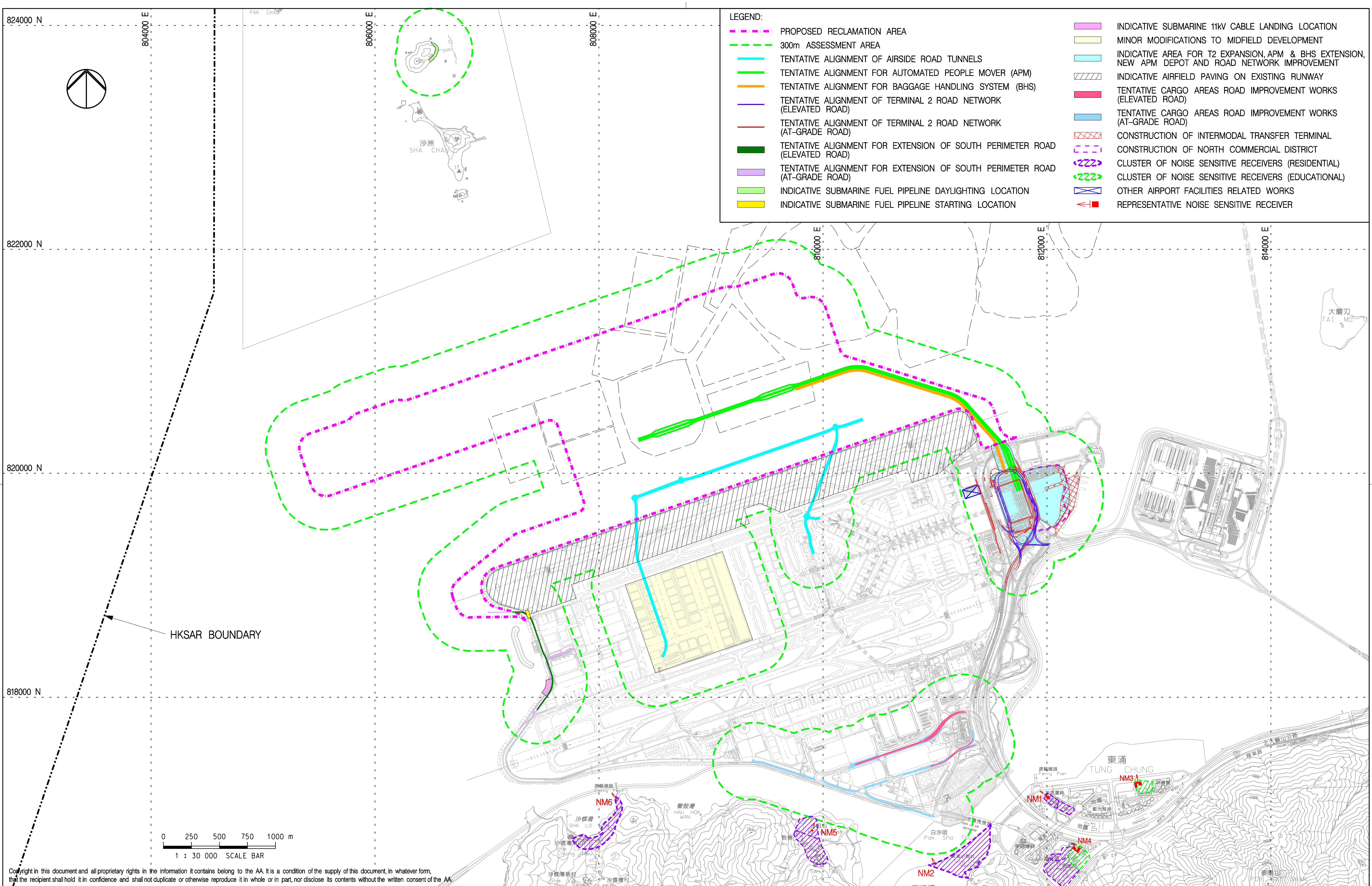

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PROPOSED LOCATIONS OF CONSTRUCTION NOISE MONITORING STATIONS

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Design Supervisor	EC	21MAR14
Authorised Representative	AFK	21MAR14

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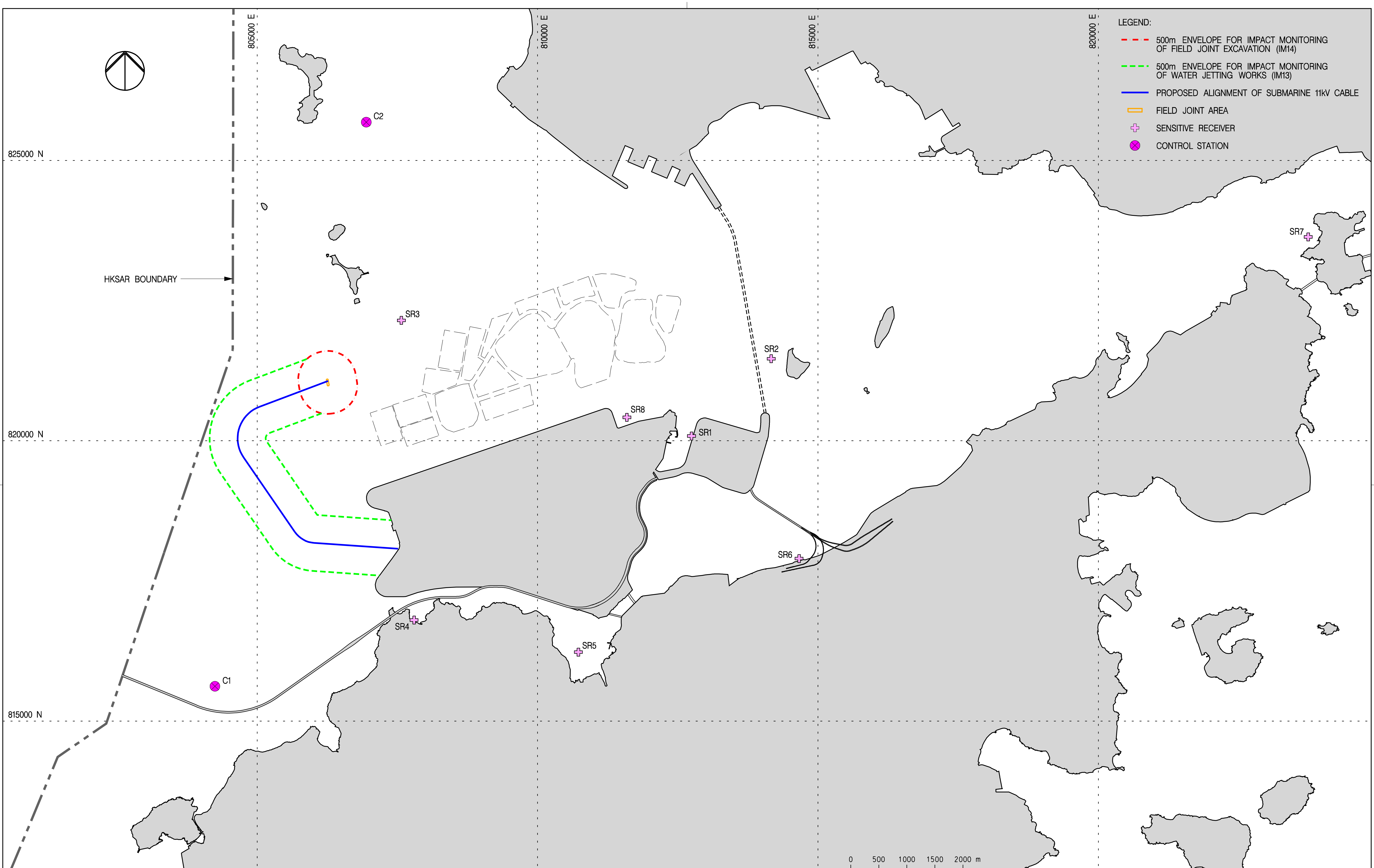
Rev. B

Filename: J:\308875\REPORT\ENV\EMA\140321\MCL-P132-EMA-4-001.dgn



Rev.	Date	Description	Checked
A	15OCT13	FIRST ISSUE	DC
B	18DEC13	GENERAL REVISION	FK
C	20FEB14	GENERAL REVISION	DC

香港國際機場 HONG KONG INTERNATIONAL AIRPORT
Airport Authority HKIA Tower, 1 Sky Plaza Road, Hong Kong International Airport, Lantau, Hong Kong
Tel : (852) 2188 7111 Fax : (852) 2824 0717

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Deltares
Ecosystems Limited
SDA Marine Limited
Urbis Limited
URS Limited

Title

WATER QUALITY MONITORING STATIONS FOR SUBMARINE 11kV CABLE DIVERSION WORKS

Consultant's Signatures for Approval		Date
Design	FK	15OCT13
Checkers	FK	15OCT13
Design Supervisor	EC	21MAR14
Authorised Representative	AFK	21MAR14

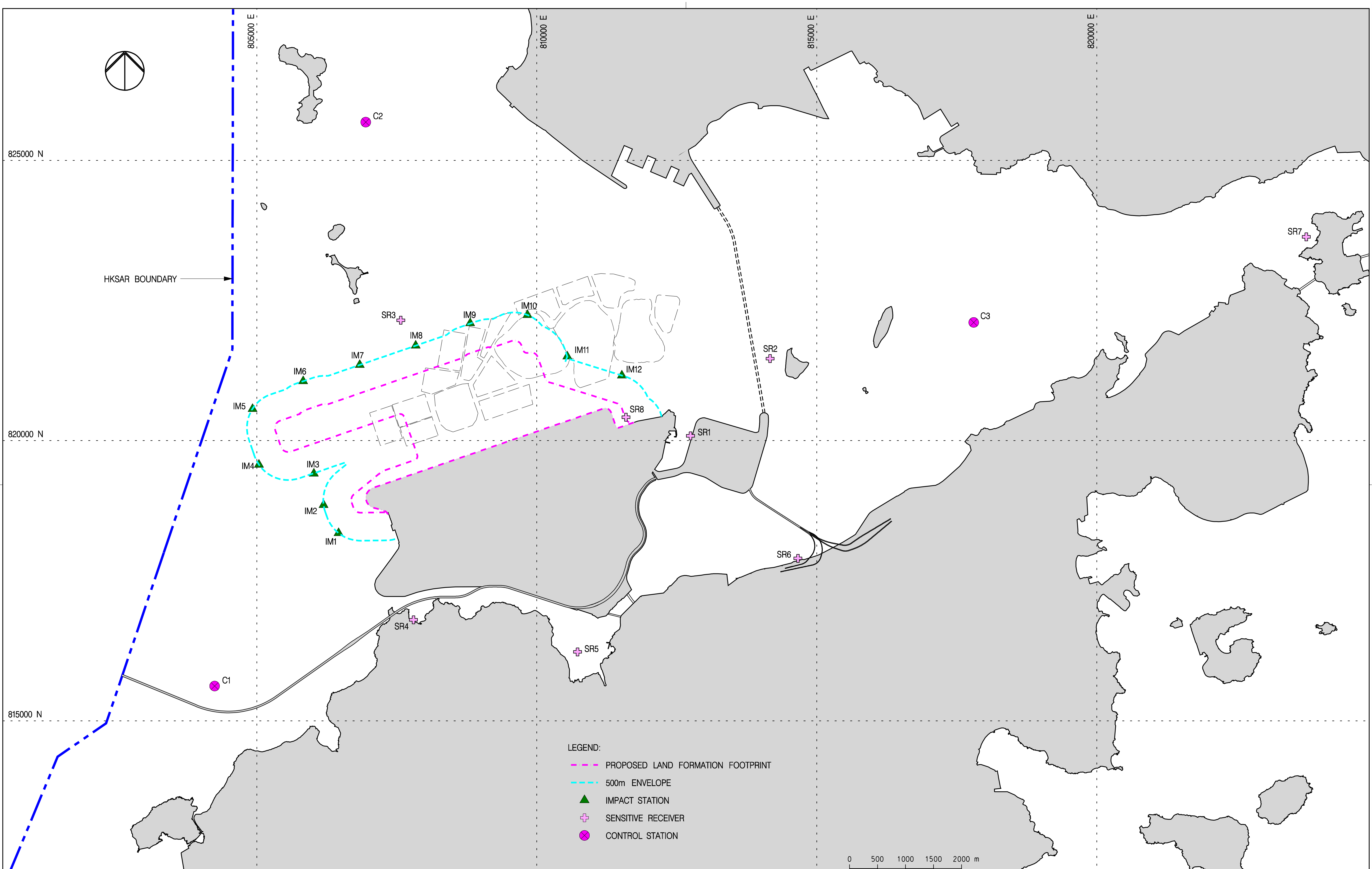
EXPANSION OF HONG KONG INTERNATIONAL AIRPORT INTO A THREE-RUNWAY SYSTEM

Drawing No. MCL / P132 / EMA / 5-001

Scale at A3 1 : 60000

Rev. C

Filename: J:\308875\REPORT\ENV\EMA\140321\MCL-P132-EMA-5-001.dgn



Rev.	Date	Description	Checked
A	19FEB14	FIRST ISSUE	DC

HONG KONG INTERNATIONAL AIRPORT 香港國際機場

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SDA Marine Limited
Urbis Limited
URS Limited

Title

WATER QUALITY MONITORING STATIONS FOR LAND FORMATION WORKS

Consultant's Signatures for Approval		Date
Design	FK	19FEB14
Checkers	FK	19FEB14
Design Supervisor	EC	21MAR14
Authorised Representative	AFK	21MAR14

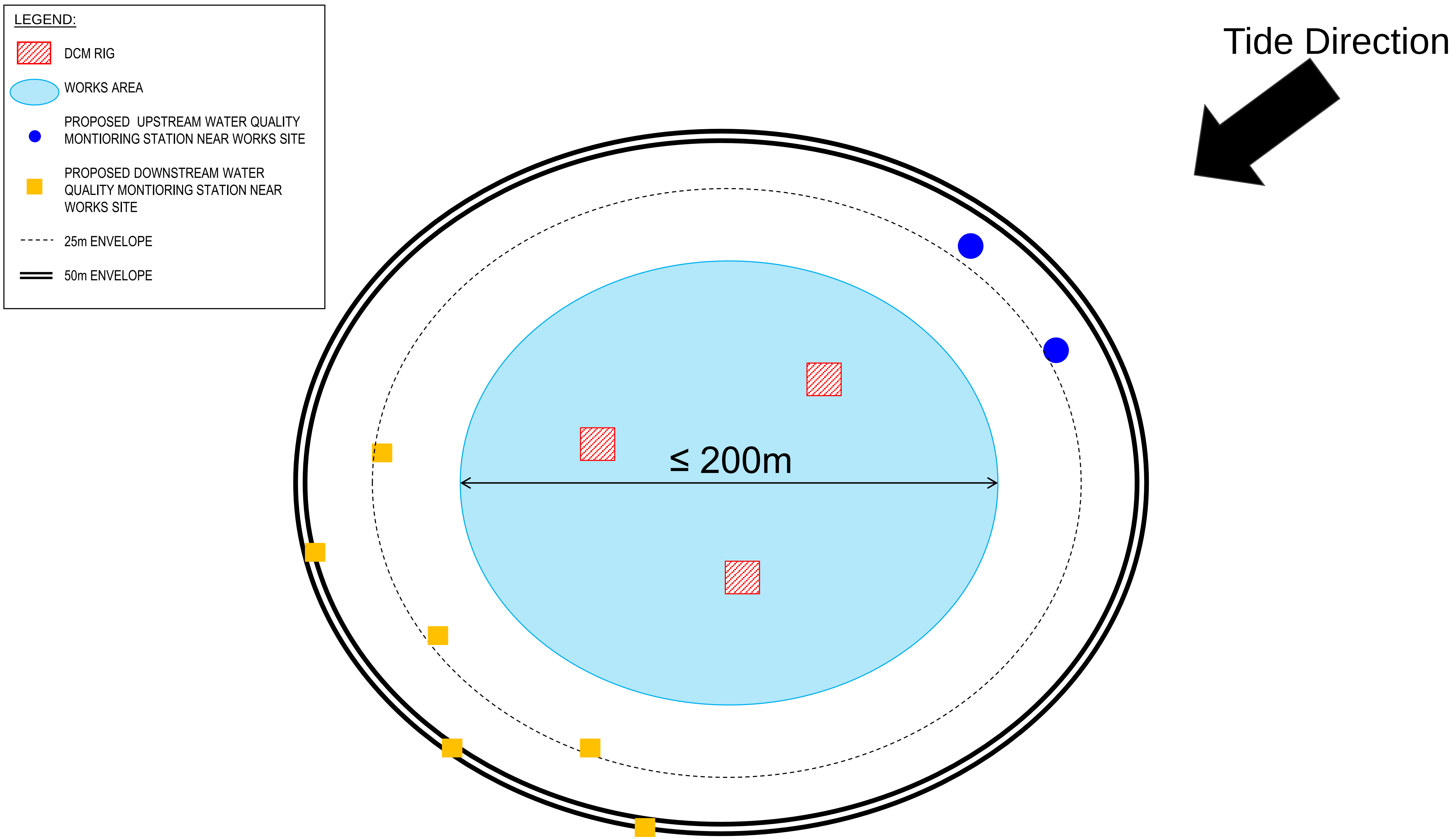
EXPANSION OF HONG KONG INTERNATIONAL AIRPORT INTO A THREE-RUNWAY SYSTEM

Drawing No. MCL / P132 / EMA / 5-002

Scale at A3 1 : 60000

Rev. A

Filename: J:\308875\REPORT\ENV\EMA\140321\MCL-P132-EMA-5-002.dgn



Rev.	Date	Description	Checked
A	24MAR14	GENERAL REVISION	DC

香港國際機場 HONG KONG INTERNATIONAL AIRPORT
Airport Authority HKIA Tower, 1 Sky Plaza Road, Hong Kong International Airport, Lantau, Hong Kong
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SDA Marine Limited
Urbis Limited
URS Scott Wilson Limited

Title

Indicative Locations for DCM Monitoring Stations

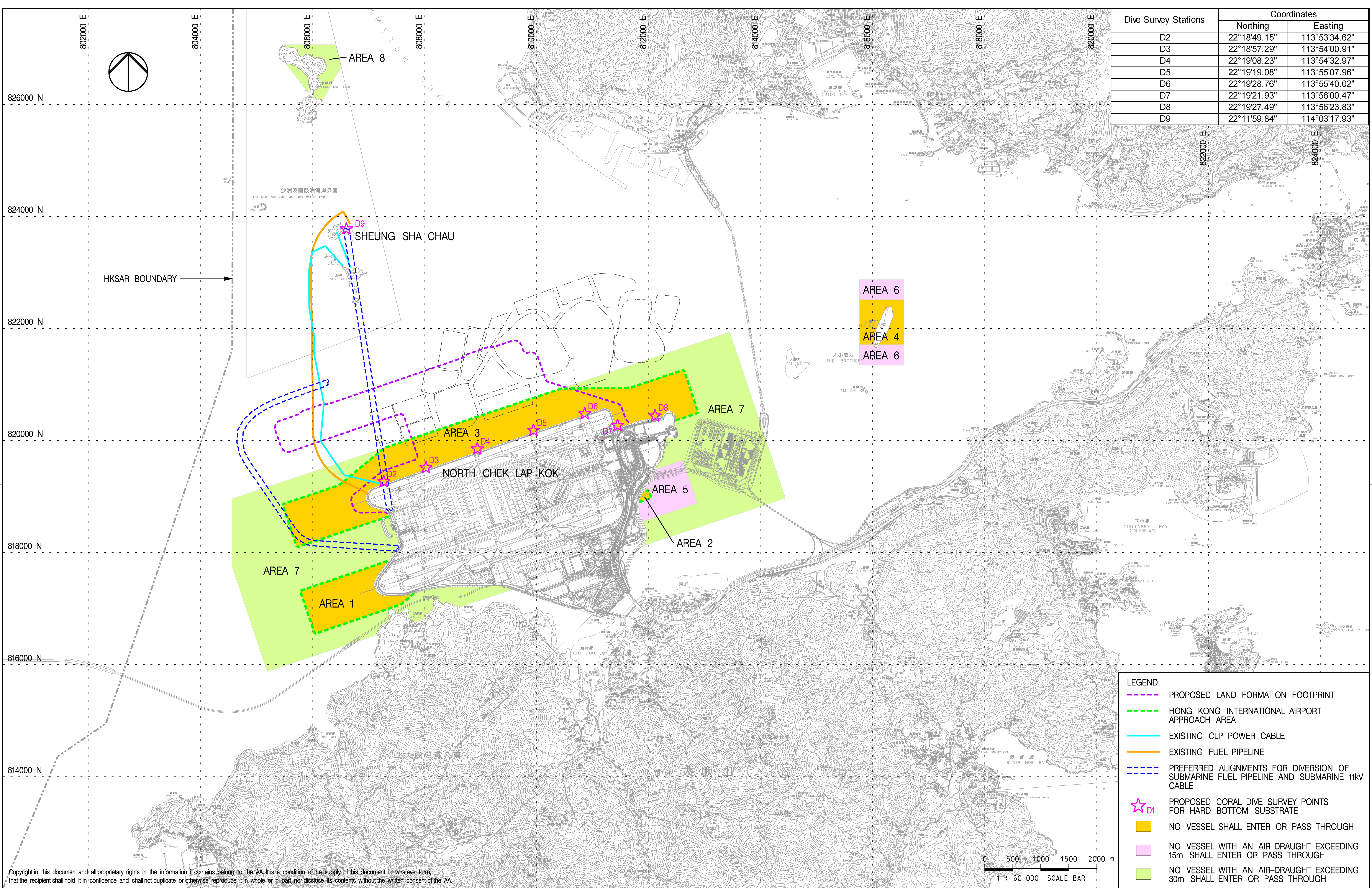
Consultant's Signatures for Approval		Date
Design	DC	24MAR14
Checkers	DC	24MAR14
Design Supervisor	EC	24MAR14
Authorised Representative	AFK	24MAR14

EXPANSION OF HONG KONG INTERNATIONAL AIRPORT INTO A THREE–RUNWAY SYSTEM

Drawing No. MCL/P132/EMA/5-003

Scale at A3

Rev. A



Dive Survey Stations	Coordinates	
	Northing	Easting
D2	22°18'49.15"	113°53'34.62"
D3	22°18'57.29"	113°54'00.91"
D4	22°19'08.23"	113°54'32.97"
D5	22°19'19.08"	113°55'07.96"
D6	22°19'28.76"	113°55'40.02"
D7	22°19'21.93"	113°56'00.47"
D8	22°19'27.49"	113°56'23.83"
D9	22°11'59.84"	114°03'17.93"

LEGEND:

- PROPOSED LAND FORMATION FOOTPRINT
- HONG KONG INTERNATIONAL AIRPORT APPROACH AREA
- EXISTING CLP POWER CABLE
- EXISTING FUEL PIPELINE
- PREFERRED ALIGNMENTS FOR DIVERSION OF SUBMARINE FUEL PIPELINE AND SUBMARINE 11kV CABLE
- D1 PROPOSED CORAL DIVE SURVEY POINTS FOR HARD BOTTOM SUBSTRATE
- NO VESSEL SHALL ENTER OR PASS THROUGH
- NO VESSEL WITH AN AIR-DRAUGHT EXCEEDING 15m SHALL ENTER OR PASS THROUGH
- NO VESSEL WITH AN AIR-DRAUGHT EXCEEDING 30m SHALL ENTER OR PASS THROUGH

Rev.	Date	Description	Checked
A	21FEB14	FIRST ISSUE	JC

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Urbis Limited
URS Limited

Title

PRECONSTRUCTION PHASE CORAL DIVE SURVEY LOCATIONS

Consultant's Signatures for Approval		Date
Design	GC	21FEB14
Checkers	GC	21FEB14
Design Supervisor	EC	21MAR14
Authorised Representative	AFK	21MAR14

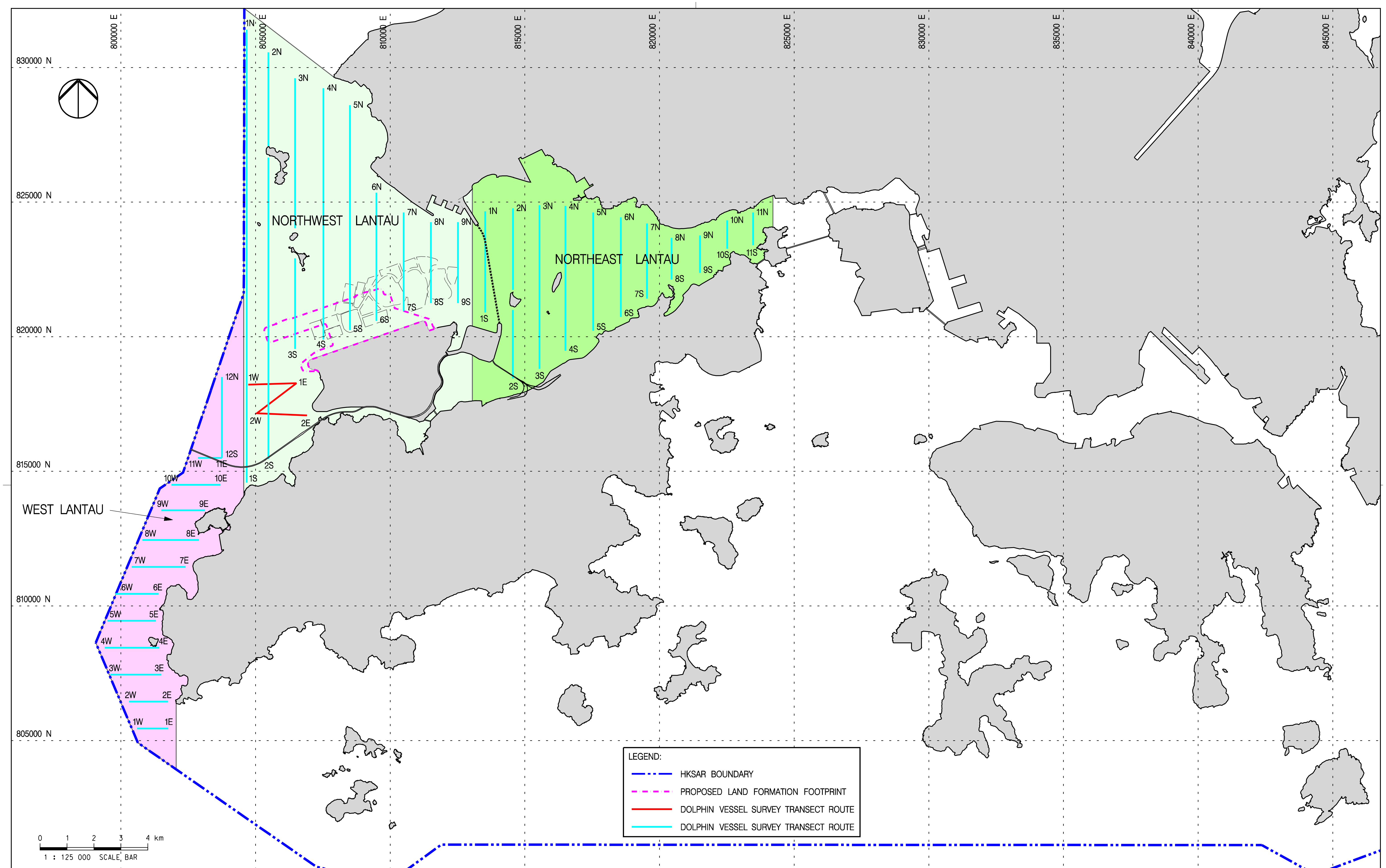
EXPANSION OF HONG KONG INTERNATIONAL AIRPORT INTO A THREE-RUNWAY SYSTEM

Drawing No. MCL / P132 / EMA / 10-001

Scale at A3 1 : 60000

Rev. A

Filename: J:\308875\REPORT\ENV\EMA\140321\MCL-P132-EMA-10-001.dgn



Rev.	Date	Description	Checked
A	21FEB14	FIRST ISSUE	JC
B	21MAR14	GENERAL REVISION	JC
C	19MAY14	GENERAL REVISION	JC

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Urbis Limited
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Title
VESSEL BASED DOLPHIN MONITORING TRANSECT IN BASELINE, CONSTRUCTION, POST-CONSTRUCTION AND OPERATION PHASE

Consultant's Signatures for Approval		Date
Design	JC	21FEB14
Checkers	JC	19MAY14
Design Supervisor	EC	19MAY14
Authorised Representative	AFK	19MAY14

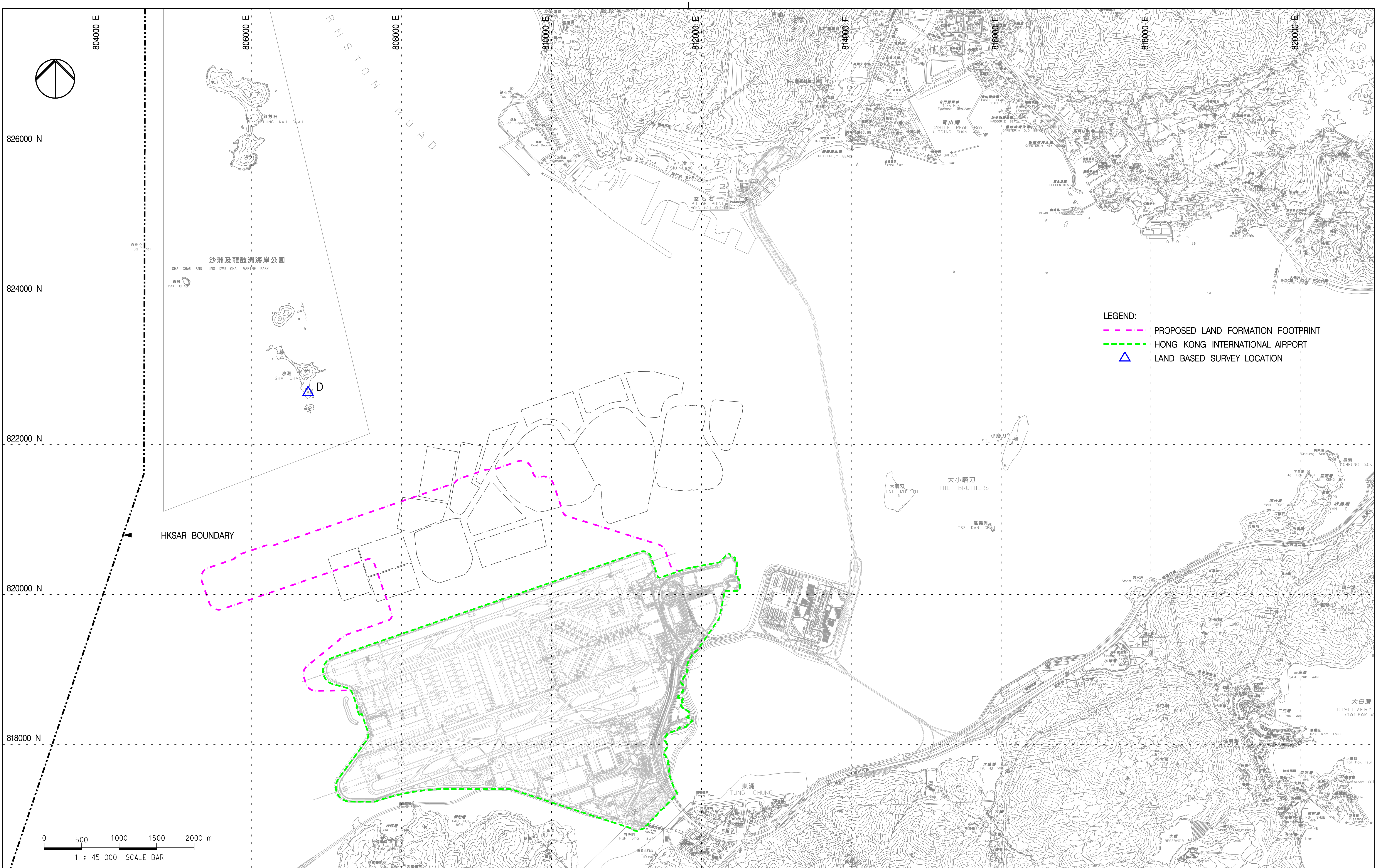
EXPANSION OF HONG KONG INTERNATIONAL AIRPORT INTO A THREE-RUNWAY SYSTEM

Drawing No. MCL / P132 / EMA / 10-002

Scale at A3 1 : 125000

Rev. C

Filename: J:\308875\REPORT\ENV\EMA\150519\MCL-P132-EMA-10-002.dgn



Rev.	Date	Description	Checked
A	05NOV13	FIRST ISSUE	GC
B	21MAR14	GENERAL REVISION	GC

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Title

LAND BASED DOLPHIN MONITORING IN BASELINE AND CONSTRUCTION PHASE

Consultant's Signatures for Approval		Date
Design	GC	05NOV13
Checkers	JC	05NOV13
Design Supervisor	EC	21MAR14
Authorised Representative	AFK	21MAR14

EXPANSION OF HONG KONG INTERNATIONAL AIRPORT INTO A THREE-RUNWAY SYSTEM

Drawing No.
MCL / P132 / EMA / 10-003

Scale at A3
1 : 45000

Rev.
B

Filename: J:\308875\REPORT\ENV\EMA\140321\MCL-P132-EMA-10-003.dgn

POTENTIAL MITIGATION MEASURES
CONSTRUCTION PHASE:

CM1 (L+V) - WORKS AREA MINIMISED
CM2 (V) - CONSTRUCTION PERIOD REDUCED TO PRACTICAL MINIMUM
CM3 (V) - PHASING OF THE CONSTRUCTION STAGE
CM4 (V) - CONSTRUCTION TRAFFIC (LAND AND SEA) REDUCED TO PRACTICAL MINIMUM
CM5 (V) - ERECTION OF DECORATIVE MESH SCREENS OR CONSTRUCTION HOARDINGS
CM6 (V) - AVOIDANCE OF EXCESSIVE HEIGHT AND BULK OF SITE BUILDINGS AND STRUCTURES
CM7 (V) - CONTROL OF NIGHT-TIME LIGHTING
CM8 (L) - PROTECT EXISTING TREES
CM9 (L) - TREES AFFECTED BY THE WORKS SHALL BE TRANSPLANTED
CM10 (L+V) - ADVANCED HYDROSEEDING AROUND TAXIWAYS AND RUNWAYS

POTENTIAL MITIGATION MEASURES
OPERATIONAL PHASE:

OM1 (V) - SENSITIVE LANDSCAPE DESIGN OF RECLAMATION EDGE
OM2 (V) - ALL ABOVE GROUND STRUCTURES SHALL BE SENSITIVELY DESIGNED
OM3 (V) - SENSITIVE DESIGN OF BUILDINGS AND STRUCTURES IN TERMS OF SCALE, HEIGHT AND BULK (VISUAL WEIGHT)
OM4 (V) - USE APPROPRIATE BUILDING MATERIALS AND COLOURS IN BUILT STRUCTURES
OM5 (V) - LIGHTING UNITS TO BE DIRECTIONAL AND MINIMISE UNNECESSARY LIGHT SPILL AND GLARE
OM6 (L+V) - GREENING MEASURES IMPLEMENTED
OM7 (L+V) - COMPENSATORY TREE PLANTING FOR ALL FELLED TREES
OM8 (L+V) - STREETSCAPE SHALL BE SENSITIVELY DESIGNED
OM9 (L+V) - ALL STREETSCAPE AREAS AND HARD AND SOFT LANDSCAPE AREAS DISTURBED DURING CONSTRUCTION SHALL BE REINSTATED
OM10 (V) - AESTHETIC IMPROVEMENT PLANTING OF VIADUCT STRUCTURE THROUGH GREENING OF STRUCTURE WHERE FEASIBLE
OM11 (V)- SENSITIVE DESIGN OF FOOTBRIDGES, NOISE BARRIERS AND ENCLOSURES WITH GREENING (SCREEN PLANTING/CLIMBERS/PLANTERS) AND CHROMATIC MEASURES

LEGEND:

Green	CM10, OM6
Brown	OM2, OM3, OM4, OM6
Light green	OM6, OM8, OM9
Red	OM6, OM10
Blue	OM1, OM6

NOTE:
COLOURED MITIGATION MEASURES ARE LOCATION SPECIFIC NON-COLOURED MITIGATION MEASURES CAN BE APPLIED THROUGHOUT THE PROJECT SITE BOUNDARY
L = LANDSCAPE MITIGATION MEASURE
V = VISUAL MITIGATION MEASURE

Rev.	Date	Description	Checked
-	21JAN14	FIRST ISSUE	AD
A	11FEB14	GENERAL REVISION	AD
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C	24MAR14	GENERAL REVISION	AD

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URS Limited

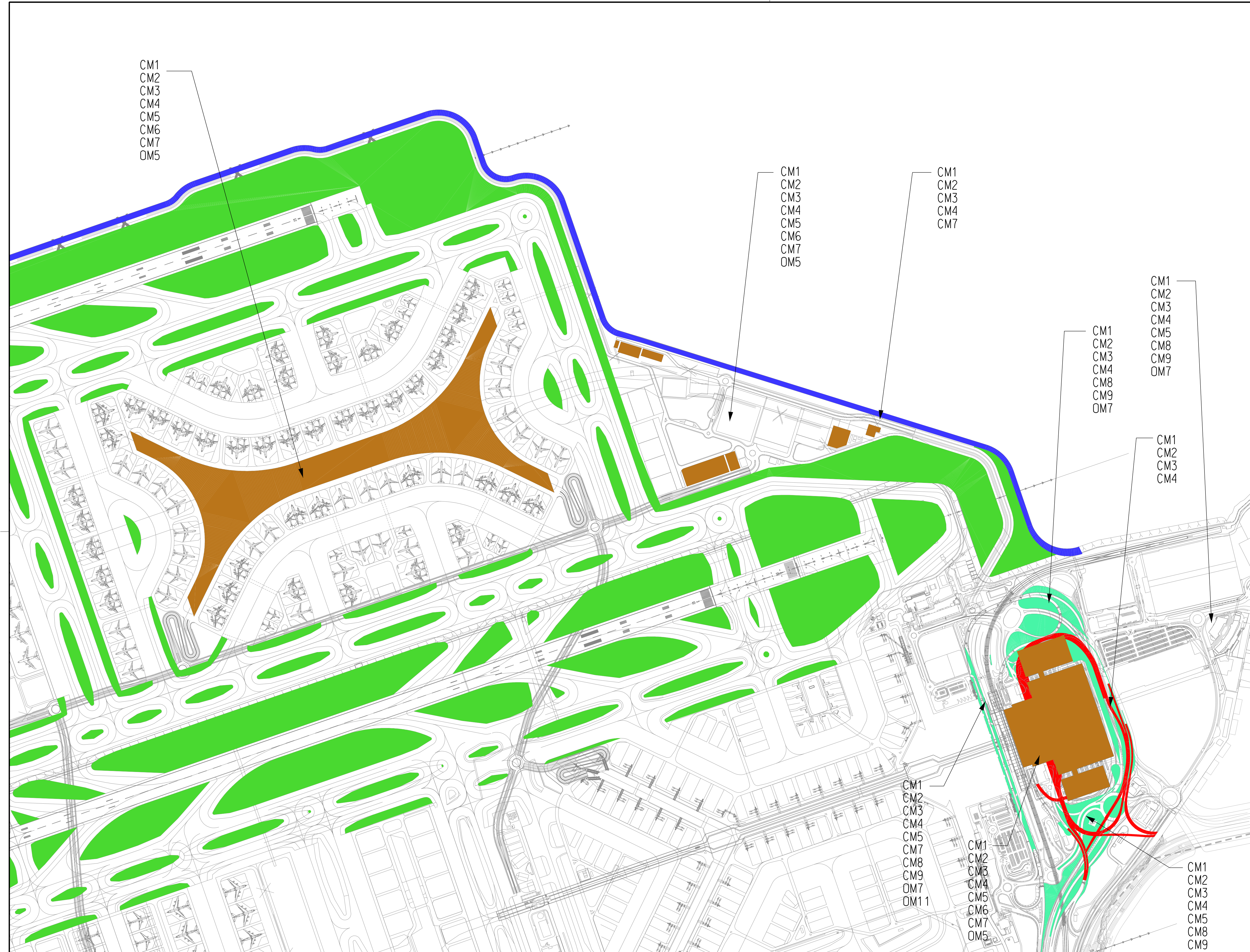
Title
LANDSCAPE AND VISUAL MITIGATION ARRANGEMENT PLAN - CHEK LAP KOK

Consultant's Signatures for Approval		Date
Design	PL	24MAR14
Checkers	TL	24MAR14
Design Supervisor		
Authorised Representative	AD	24MAR14

EXPANSION OF HONG KONG INTERNATIONAL AIRPORT INTO A THREE-RUNWAY SYSTEM

Drawing No. MCL / P132 / EMA / 12-001.1
Scale at A3 25000
Rev. C

Filename: I:\MC15\DGN-GA\MCL_P132_EMA_12-001.1.dgn



POTENTIAL MITIGATION MEASURES
CONSTRUCTION PHASE:

- CM1 (L+V) – WORKS AREA MINIMISED
- CM2 (V) – CONSTRUCTION PERIOD REDUCED TO PRACTICAL MINIMUM
- CM3 (V) – PHASING OF THE CONSTRUCTION STAGE
- CM4 (V) – CONSTRUCTION TRAFFIC (LAND AND SEA) REDUCED TO PRACTICAL MINIMUM
- CM5 (V) – ERECTION OF DECORATIVE MESH SCREENS OR CONSTRUCTION HOARDINGS
- CM6 (V) – AVOIDANCE OF EXCESSIVE HEIGHT AND BULK OF SITE BUILDINGS AND STRUCTURES
- CM7 (V) – CONTROL OF NIGHT-TIME LIGHTING
- CM8 (L) – PROTECT EXISTING TREES
- CM9 (L) – TREES AFFECTED BY THE WORKS SHALL BE TRANSPLANTED
- CM10 (L+V) – ADVANCED HYDROSEEDING AROUND TAXIWAYS AND RUNWAYS

POTENTIAL MITIGATION MEASURES
OPERATIONAL PHASE:

- OM1 (V) – SENSITIVE LANDSCAPE DESIGN OF RECLAMATION EDGE
- OM2 (V) – ALL ABOVE GROUND STRUCTURES SHALL BE SENSITIVELY DESIGNED
- OM3 (V) – SENSITIVE DESIGN OF BUILDINGS AND STRUCTURES IN TERMS OF SCALE, HEIGHT AND BULK (VISUAL WEIGHT)
- OM4 (V) – USE APPROPRIATE BUILDING MATERIALS AND COLOURS IN BUILT STRUCTURES
- OM5 (V) – LIGHTING UNITS TO BE DIRECTIONAL AND MINIMISE UNNECESSARY LIGHT SPILL AND GLARE
- OM6 (L+V) – GREENING MEASURES IMPLEMENTED
- OM7 (L+V) – COMPENSATORY TREE PLANTING FOR ALL FELLED TREES
- OM8 (L+V) – STREETSCAPE SHALL BE SENSITIVELY DESIGNED
- OM9 (L+V) – ALL STREETSCAPE AREAS AND HARD AND SOFT LANDSCAPE AREAS DISTURBED DURING CONSTRUCTION SHALL BE REINSTATED
- OM10 (V) – AESTHETIC IMPROVEMENT PLANTING OF VIADUCT STRUCTURE THROUGH GREENING OF STRUCTURE WHERE FEASIBLE
- OM11 (V)– SENSITIVE DESIGN OF FOOTBRIDGES, NOISE BARRIERS AND ENCLOSURES WITH GREENING (SCREEN PLANTING/CLIMBERS/PLANTERS) AND CHROMATIC MEASURES

LEGEND:

- CM10, OM6
- OM2, OM3, OM4, OM6
- OM6, OM8, OM9
- OM6, OM10
- OM1, OM6

0 100 200 300 400 500 m
1 : 12500 SCALE BAR

NOTE:
COLOURED MITIGATION MEASURES ARE LOCATION SPECIFIC NON-COLOURED MITIGATION MEASURES CAN BE APPLIED THROUGHOUT THE PROJECT SITE BOUNDARY
L = LANDSCAPE MITIGATION MEASURE
V = VISUAL MITIGATION MEASURE

Rev.	Date	Description	Checked
–	21JAN14	FIRST ISSUE	AD
A	11FEB14	GENERAL REVISION	AD
B	17MAR14	GENERAL REVISION	AD
C	24MAR14	GENERAL REVISION	AD

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Title
LANDSCAPE AND VISUAL MITIGATION ARRANGEMENT BLOW-UP PLAN – CHEK LAP KOK

Consultant's Signatures for Approval		Date
Design	PL	24MAR14
Checkers	TL	24MAR14
Design Supervisor		
Authorised Representative	AD	24MAR14

EXPANSION OF HONG KONG INTERNATIONAL AIRPORT INTO A THREE-RUNWAY SYSTEM

Drawing No. MCL / P132 / EMA / 12-001.2
Scale at A3 12500
Rev. C

Filename: I:\MC15\DGN-GA\MCL_P132_EMA_12-001.2.dgn

POTENTIAL MITIGATION MEASURES
CONSTRUCTION PHASE:

- CM1 (L+V) - WORKS AREA MINIMISED
- CM2 (V) - CONSTRUCTION PERIOD REDUCED TO PRACTICAL MINIMUM
- CM3 (V) - PHASING OF THE CONSTRUCTION STAGE
- CM4 (V) - CONSTRUCTION TRAFFIC (LAND AND SEA) REDUCED TO PRACTICAL MINIMUM
- CM5 (V) - ERECTION OF DECORATIVE MESH SCREENS OR CONSTRUCTION HOARDINGS
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- CM7 (V) - CONTROL OF NIGHT-TIME LIGHTING
- CM8 (L) - PROTECT EXISTING TREES
- CM9 (L) - TREES AFFECTED BY THE WORKS SHALL BE TRANSPLANTED
- CM10 (L+V) - ADVANCED HYDROSEEDING AROUND TAXIWAYS AND RUNWAYS

POTENTIAL MITIGATION MEASURES
OPERATIONAL PHASE:

- OM1 (V) - SENSITIVE LANDSCAPE DESIGN OF RECLAMATION EDGE
- OM2 (V) - ALL ABOVE GROUND STRUCTURES SHALL BE SENSITIVELY DESIGNED
- OM3 (V) - SENSITIVE DESIGN OF BUILDINGS AND STRUCTURES IN TERMS OF SCALE, HEIGHT AND BULK (VISUAL WEIGHT)
- OM4 (V) - USE APPROPRIATE BUILDING MATERIALS AND COLOURS IN BUILT STRUCTURES
- OM5 (V) - LIGHTING UNITS TO BE DIRECTIONAL AND MINIMISE UNNECESSARY LIGHT SPILL AND GLARE
- OM6 (L+V) - GREENING MEASURES IMPLEMENTED
- OM7 (L+V) - COMPENSATORY TREE PLANTING FOR ALL FELLED TREES
- OM8 (L+V) - STREETSCAPE SHALL BE SENSITIVELY DESIGNED
- OM9 (L+V) - ALL STREETSCAPE AREAS AND HARD AND SOFT LANDSCAPE AREAS DISTURBED DURING CONSTRUCTION SHALL BE REINSTATED
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- OM11 (V)- SENSITIVE DESIGN OF FOOTBRIDGES, NOISE BARRIERS AND ENCLOSURES WITH GREENING (SCREEN PLANTING/CLIMBERS/PLANTERS) AND CHROMATIC MEASURES

LEGEND:

- CM10, OM6
- OM2, OM3, OM4, OM6
- OM6, OM8, OM9
- OM6, OM10
- OM1, OM6

NOTE:
COLOURED MITIGATION MEASURES ARE LOCATION SPECIFIC NON-COLOURED MITIGATION MEASURES CAN BE APPLIED THROUGHOUT THE PROJECT SITE BOUNDARY
L = LANDSCAPE MITIGATION MEASURE
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Rev.	Date	Description	Checked
–	21JAN14	FIRST ISSUE	AD
A	11FEB14	GENERAL REVISION	AD
B	17MAR14	GENERAL REVISION	AD
C	24MAR14	GENERAL REVISION	AD

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URS Limited

Title
LANDSCAPE AND VISUAL MITIGATION ARRANGEMENT BLOW-UP PLAN - CHEK LAP KOK

Consultant's Signatures for Approval		Date
Design	PL	24MAR14
Checkers	TL	24MAR14
Design Supervisor		
Authorised Representative	AD	24MAR14

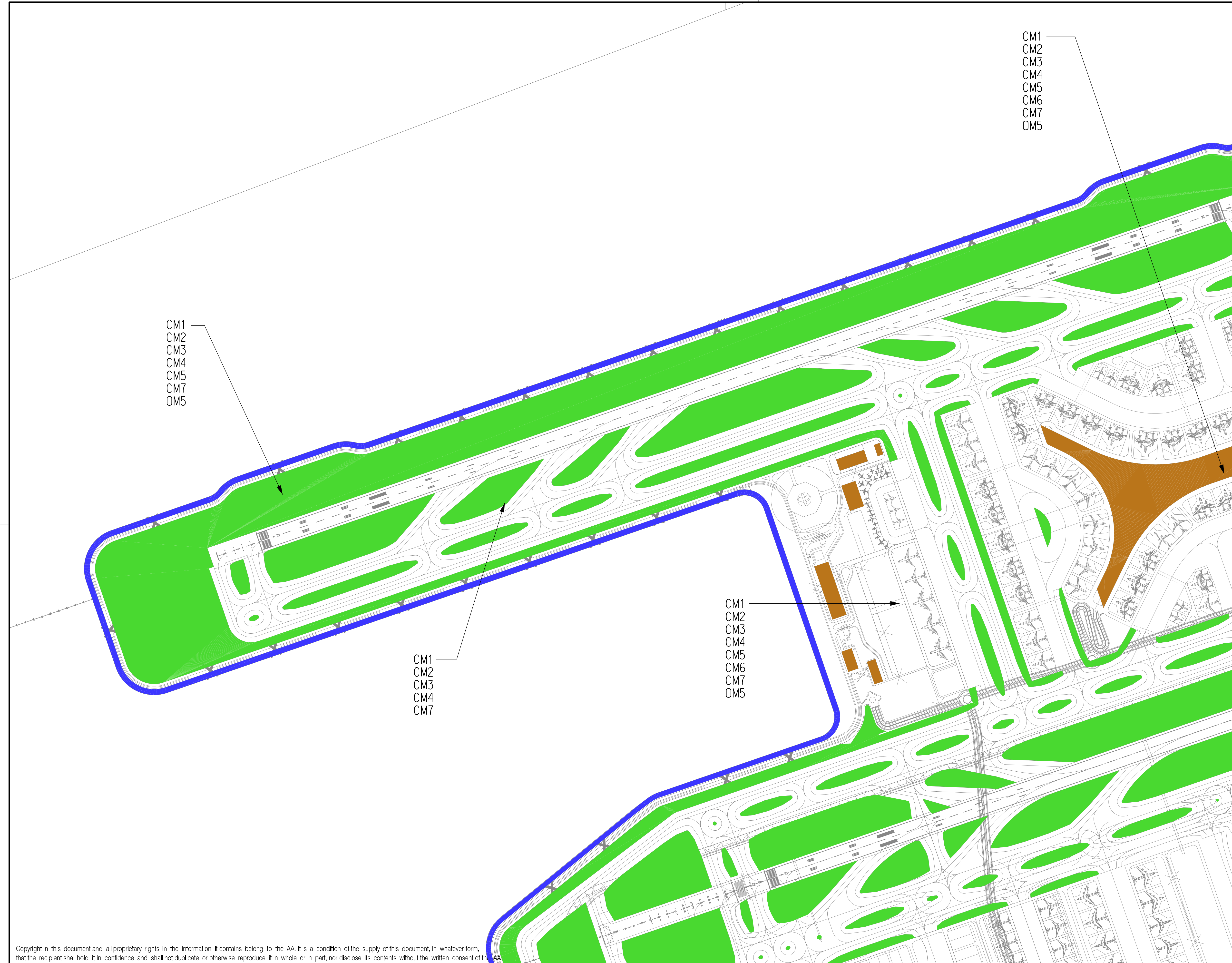
EXPANSION OF HONG KONG INTERNATIONAL AIRPORT INTO A THREE-RUNWAY SYSTEM

Drawing No. MCL / P132 / EMA / 12-001.3

Scale at A3 12500

Rev. C

Filename: I:\MC15\DGN-GA\MCL_P132_EMA_12-001.3.dgn



POTENTIAL MITIGATION MEASURES
CONSTRUCTION PHASE:

- CM1 (L+V) - WORKS AREA MINIMISED
- CM2 (V) - CONSTRUCTION PERIOD REDUCED TO PRACTICAL MINIMUM
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POTENTIAL MITIGATION MEASURES
OPERATIONAL PHASE:

- OM1 (V) - SENSITIVE LANDSCAPE DESIGN OF RECLAMATION EDGE
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LEGEND:

- CM10, OM6
- OM2, OM3, OM4, OM6
- OM6, OM8, OM9
- OM6, OM10
- OM1, OM6

0 100 200 300 400 500 m
1 : 12500 SCALE BAR

NOTE:
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L = LANDSCAPE MITIGATION MEASURE
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Rev.	Date	Description	Checked
-	21JAN14	FIRST ISSUE	AD
A	11FEB14	GENERAL REVISION	AD
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C	24MAR14	GENERAL REVISION	AD

香港國際機場 HONG KONG INTERNATIONAL AIRPORT

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Urbis Limited
URS Limited

Title
LANDSCAPE AND VISUAL MITIGATION ARRANGEMENT BLOW-UP PLAN - CHEK LAP KOK

Consultant's Signatures for Approval		Date
Design	PL	24MAR14
Checkers	TL	24MAR14
Design Supervisor		
Authorised Representative	AD	24MAR14

EXPANSION OF HONG KONG INTERNATIONAL AIRPORT INTO A THREE-RUNWAY SYSTEM

Drawing No. MCL / P132 / EMA / 12-001.4
Scale at A3 12500
Rev. C

Filename: I:\MC15\DGN-GA\MCL_P132_EMA_12-001.4.dgn

POTENTIAL MITIGATION MEASURES
CONSTRUCTION PHASE:
CM1 (L+V) - WORKS AREA MINIMISED
CM2 (V) - CONSTRUCTION PERIOD REDUCED TO PRACTICAL MINIMUM
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CM8 (L) - PROTECT EXISTING TREES
CM9 (L) - TREES AFFECTED BY THE WORKS SHALL BE TRANSPLANTED
CM10 (L+V) - ADVANCED HYDROSEEDING AROUND TAXIWAYS AND RUNWAYS

POTENTIAL MITIGATION MEASURES
OPERATIONAL PHASE:
OM1 (V) - SENSITIVE LANDSCAPE DESIGN OF RECLAMATION EDGE
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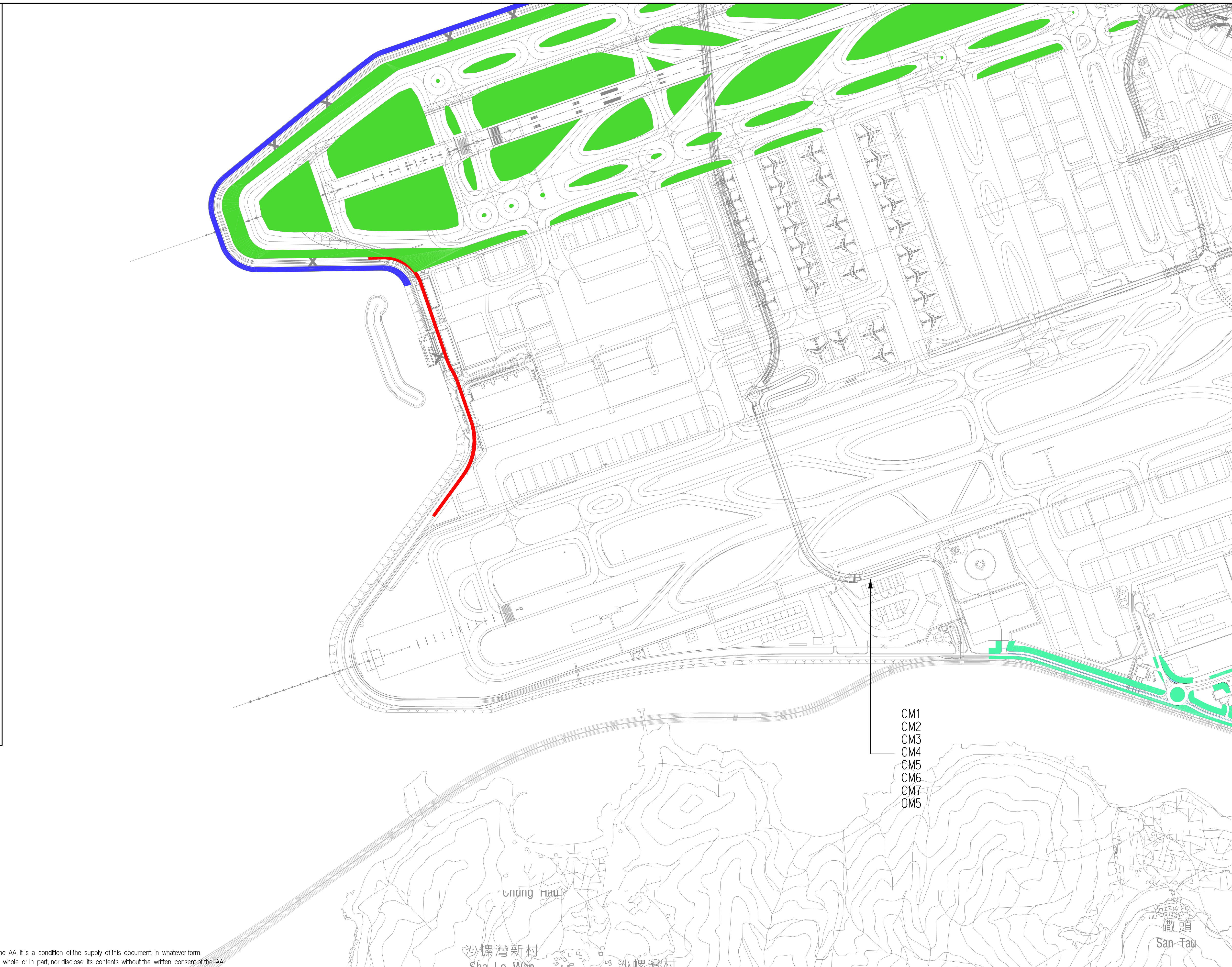
OM3 (V) - SENSITIVE DESIGN OF BUILDINGS AND STRUCTURES IN TERMS OF SCALE, HEIGHT AND BULK (VISUAL WEIGHT)
OM4 (V) - USE APPROPRIATE BUILDING MATERIALS AND COLOURS IN BUILT STRUCTURES
OM5 (V) - LIGHTING UNITS TO BE DIRECTIONAL AND MINIMISE UNNECESSARY LIGHT SPILL AND GLARE
OM6 (L+V) - GREENING MEASURES IMPLEMENTED
OM7 (L+V) - COMPENSATORY TREE PLANTING FOR ALL FELLED TREES
OM8 (L+V) - STREETSCAPE SHALL BE SENSITIVELY DESIGNED
OM9 (L+V) - ALL STREETSCAPE AREAS AND HARD AND SOFT LANDSCAPE AREAS DISTURBED DURING CONSTRUCTION SHALL BE REINSTATED
OM10 (V) - AESTHETIC IMPROVEMENT PLANTING OF VIADUCT STRUCTURE THROUGH GREENING OF STRUCTURE WHERE FEASIBLE
OM11 (V)- SENSITIVE DESIGN OF FOOTBRIDGES, NOISE BARRIERS AND ENCLOSURES WITH GREENING (SCREEN PLANTING/CLIMBERS/PLANTERS) AND CHROMATIC MEASURES

LEGEND:

- CM10, OM6 (green)
- OM2, OM3, OM4, OM6 (brown)
- OM6, OM8, OM9 (light green)
- OM6, OM10 (red)
- OM1, OM6 (blue)



NOTE:
COLOURED MITIGATION MEASURES ARE LOCATION SPECIFIC NON-COLOURED MITIGATION MEASURES CAN BE APPLIED THROUGHOUT THE PROJECT SITE BOUNDARY
L = LANDSCAPE MITIGATION MEASURE
V = VISUAL MITIGATION MEASURE

Rev.	Date	Description	Checked
–	21JAN14	FIRST ISSUE	AD
A	11FEB14	GENERAL REVISION	AD
B	17MAR14	GENERAL REVISION	AD
C	24MAR14	GENERAL REVISION	AD

香港國際機場 HONG KONG INTERNATIONAL AIRPORT

Mott MacDonald
In association with
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Atkins China Limited
Clymene Enterprises
Deltares
Ecosystems Limited
SDA Marine Limited
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Title
LANDSCAPE AND VISUAL MITIGATION ARRANGEMENT BLOW-UP PLAN – CHEK LAP KOK

Consultant's Signatures for Approval		Date
Design	PL	24MAR14
Checkers	TL	24MAR14
Design Supervisor		
Authorised Representative	AD	24MAR14

EXPANSION OF HONG KONG INTERNATIONAL AIRPORT INTO A THREE-RUNWAY SYSTEM

Drawing No. MCL / P132 / EMA / 12-001.5
Scale at A3 12500
Rev. C

Filename: I:\MC15\DGN-GA\MCL_P132_EMA_12-001.5.dgn

POTENTIAL MITIGATION MEASURES
CONSTRUCTION PHASE:

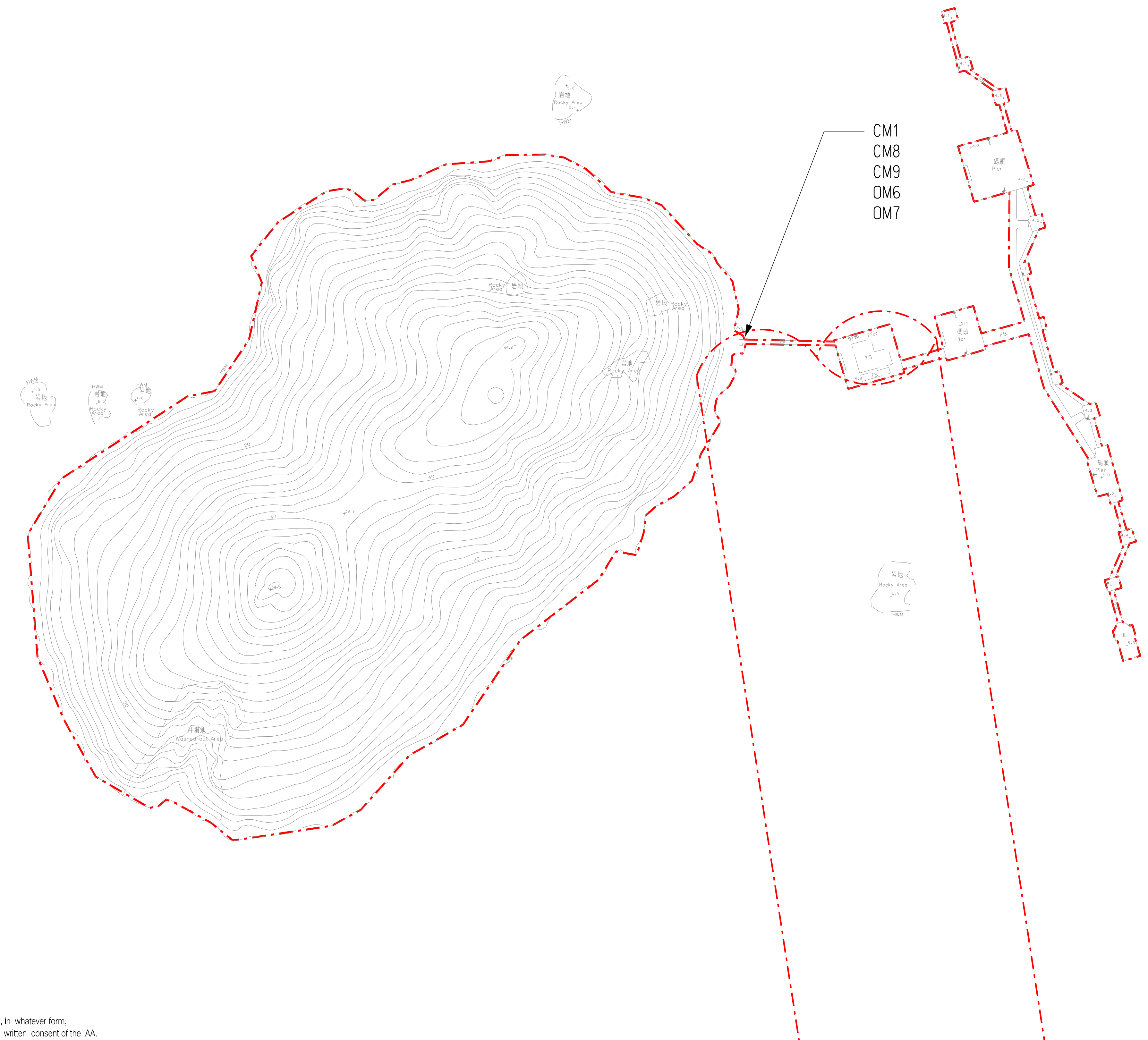
- CM1 (L+V) - WORKS AREA MINIMISED
- CM2 (V) - CONSTRUCTION PERIOD REDUCED TO PRACTICAL MINIMUM
- CM3 (V) - PHASING OF THE CONSTRUCTION STAGE
- CM4 (V) - CONSTRUCTION TRAFFIC (LAND AND SEA) REDUCED TO PRACTICAL MINIMUM
- CM5 (V) - ERECTION OF DECORATIVE MESH SCREENS OR CONSTRUCTION HOARDINGS
- CM6 (V) - AVOIDANCE OF EXCESSIVE HEIGHT AND BULK OF SITE BUILDINGS AND STRUCTURES
- CM7 (V) - CONTROL OF NIGHT-TIME LIGHTING
- CM8 (L) - PROTECT EXISTING TREES
- CM9 (L) - TREES AFFECTED BY THE WORKS SHALL BE TRANSPLANTED
- CM10 (L+V) - ADVANCED HYDROSEEDING AROUND TAXIWAYS AND RUNWAYS

POTENTIAL MITIGATION MEASURES
OPERATIONAL PHASE:

- OM1 (V) - SENSITIVE LANDSCAPE DESIGN OF RECLAMATION EDGE
- OM2 (V) - ALL ABOVE GROUND STRUCTURES SHALL BE SENSITIVELY DESIGNED
- OM3 (V) - SENSITIVE DESIGN OF BUILDINGS AND STRUCTURES IN TERMS OF SCALE, HEIGHT AND BULK (VISUAL WEIGHT)
- OM4 (V) - USE APPROPRIATE BUILDING MATERIALS AND COLOURS IN BUILT STRUCTURES
- OM5 (V) - LIGHTING UNITS TO BE DIRECTIONAL AND MINIMISE UNNECESSARY LIGHT SPILL AND GLARE
- OM6 (L+V) - GREENING MEASURES IMPLEMENTED
- OM7 (L+V) - COMPENSATORY TREE PLANTING FOR ALL FELLED TREES
- OM8 (L+V) - STREETSCAPE SHALL BE SENSITIVELY DESIGNED
- OM9 (L+V) - ALL STREETSCAPE AREAS AND HARD AND SOFT LANDSCAPE AREAS DISTURBED DURING CONSTRUCTION SHALL BE REINSTATED
- OM10 (V) - AESTHETIC IMPROVEMENT PLANTING OF VIADUCT STRUCTURE THROUGH GREENING OF STRUCTURE WHERE FEASIBLE
- OM11 (V)- SENSITIVE DESIGN OF FOOTBRIDGES, NOISE BARRIERS AND ENCLOSURES WITH GREENING (SCREEN PLANTING/CLIMBERS/PLANTERS) AND CHROMATIC MEASURES

PROJECT SITE BOUNDARY

NOTE:
COLOURED MITIGATION MEASURES ARE LOCATION SPECIFIC NON-COLOURED MITIGATION MEASURES CAN BE APPLIED THROUGHOUT THE PROJECT SITE BOUNDARY
L = LANDSCAPE MITIGATION MEASURE
V = VISUAL MITIGATION MEASURE



0 50 100 m
1 : 2 000 SCALE BAR

Rev.	Date	Description	Checked
-	11FEB14	FIRST ISSUE	AD
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URS Limited

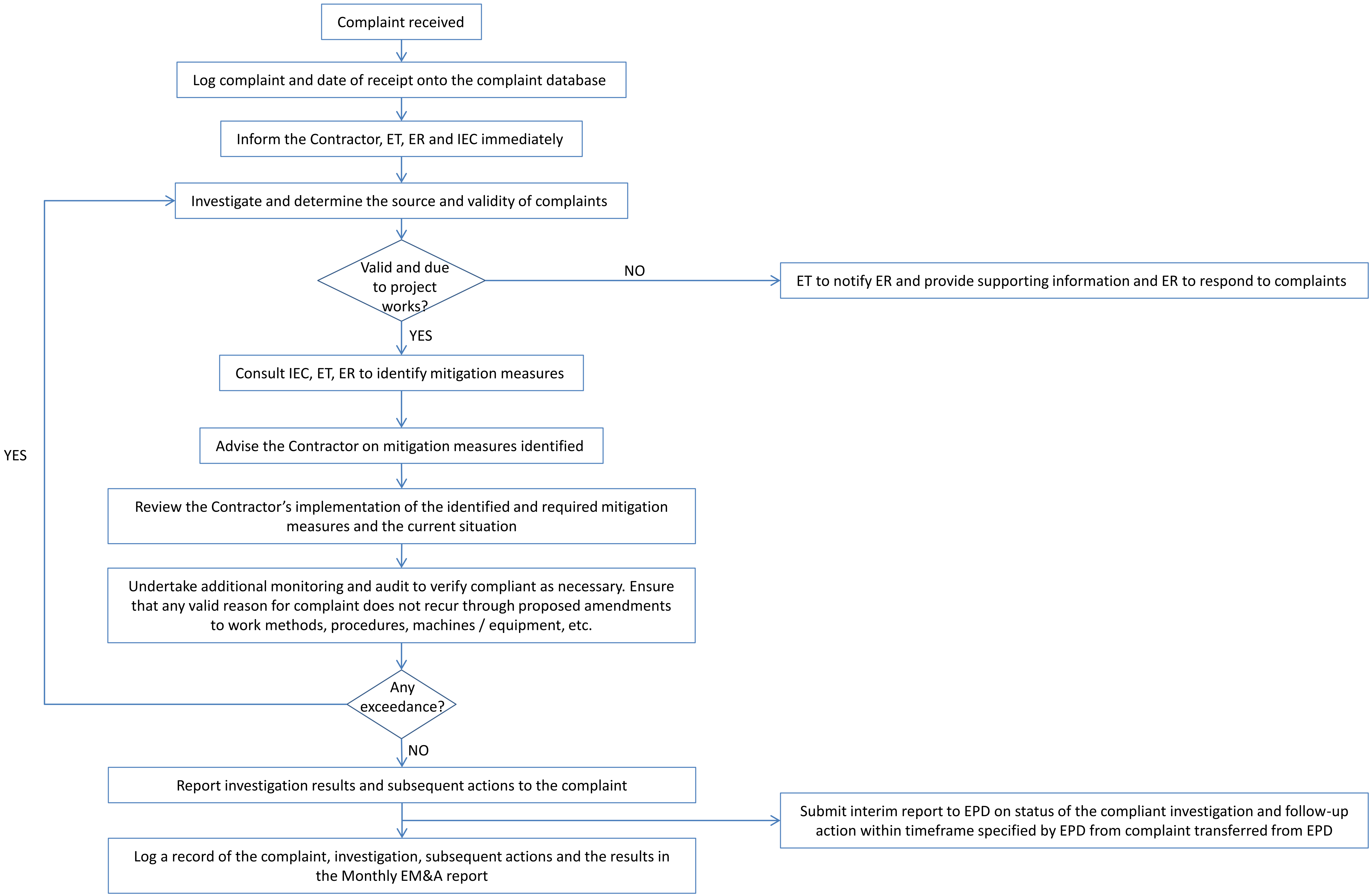
Title
LANDSCAPE AND VISUAL MITIGATION ARRANGEMENT PLAN - SHA CHAU

Consultant's Signatures for Approval		Date
Design	PL	24MAR14
Checkers	TL	24MAR14
Design Supervisor		
Authorised Representative	AD	24MAR14

EXPANSION OF HONG KONG INTERNATIONAL AIRPORT INTO A THREE-RUNWAY SYSTEM

Drawing No. MCL / P132 / EMA / 12-001.6
Scale at A3 2000
Rev. C

Filename: I:\MC15\DGN-GA\MCL_P132_EMA_12-001.6.dgn



Rev.	Date	Description	Checked
A		FIRST ISSUE	EC

香港國際機場 HONG KONG INTERNATIONAL AIRPORT

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Urbis Limited
URS Limited

Title
FLOW CHART OF COMPLAINT INVESTIGATION PROCEDURES

Consultant's Signatures for Approval		Date
Design	EY	15SEP13
Checkers	EY	15SEP13
Design Supervisor	EC	15SEP13
Authorised Representative	AFK	15SEP13

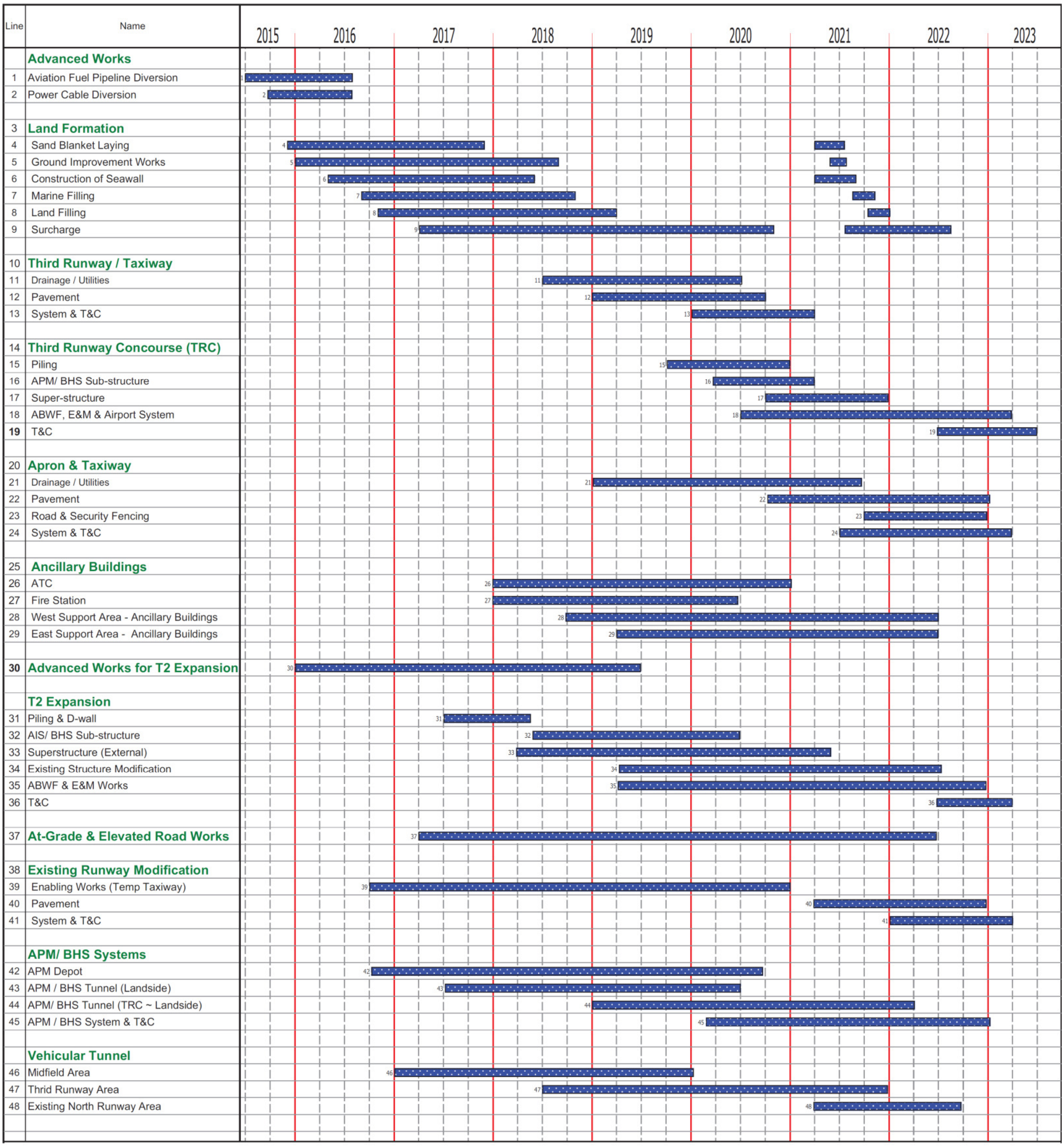
EXPANSION OF HONG KONG INTERNATIONAL AIRPORT INTO A THREE-RUNWAY SYSTEM

Drawing No. MCL / P132 / EMA /14-001

Scale at A3 –

Rev. A

Appendix A Tentative Construction Programme



Appendix B. Sample Environmental Monitoring Data Recording Sheets

Data Sheet for 1-hr TSP Monitoring by High Volume Sampler (HVS)

Monitoring Location		
Details of Location		
Sampler Identification		
Date & Time of Sampling		
Elapsed-time Meter Reading	Start (hour)	
	Stop (hour)	
Total Sampling Time (min.)		
Weather Conditions		Fine / Sunny / Cloudy / Rainy
Site Conditions		
Initial Flow Rate, Qsi	Pi (hpa)	
	Ti (°C)	
	Hi (cfm)	
	Qsi (Std. m^3)	
Final Flow Rate, Qsf	Pf (hpa)	
	Tf (°C)	
	Hf (cfm)	
	Qsf (Std. m^3)	
Average Flow Rate (Std.m^3)		
Total Volume (Std.m^3)		
Filter Identification No.		
Initial Wt. of Filter (g)		
Final wt. of Filter (g)		
Measured TSP Level (µg/m^3)		
Observations / Remarks		

	Name & Designation	Signature	Date
Field Operator:	____________	________	____________
Checked by:	____________	________	____________

Data Sheet for 1-hr TSP Monitoring by Dust Meter

Monitoring Location				
Details of Location				
Sampler Identification				
Date of Sampling				
Time of Sampling		1	2	3
Elapsed-time	Start Time			
Meter Reading	End Time			
Total Sampling Time (min.)				
Measured TSP Level (µg/m^3)				
Weather Conditions		Fine / Sunny / Cloudy / Rainy		
Site Conditions				
Observations / Remarks				

	Name & Designation	Signature	Date
Record by:	________________	__________	________________
Checked by:	________________	__________	________________

Noise Monitoring Field Record Sheet

Monitoring Location							
Details of Location							
Date of Monitoring							
Measurement Start Time (hh:mm)							
Measurement Time Length (min.)							
Weather Conditions	Fine / Sunny / Cloudy / Rainy						
Wind Speed (m/s)							
Noise Meter Model/Identification							
Calibrator Model/Identification							
Calibration Before Measurement (dB(A))							
Calibration After Measurement (dB(A))							
Measurement Result	5min	5min	5min	5min	5min	5min	30min
L_{90} (dB(A))							
L_{10} (dB(A))							
L_{eq} (dB(A))							
Major Construction Noise Source(s) During Monitoring							
Other Noise Source(s) During Monitoring							
Remarks							

	Name & Designation	Signature	Date
Record by:	______________	________	______________
Checked by:	______________	________	______________

Regular Water Quality Monitoring Data Record Sheet

Location			
Date			
Start Time (hh:mm)			
Weather			
Sea Conditions			
Tidal Mode			
Water Depth (m)			
Monitoring Results		1st reading	2nd reading or Duplicate
Salinity	(mg/l)		
Temperature	°C		
pH			
DO Saturation	(%)		
DO	(mg/l)		
Turbidity	(NTU)		
SS Sample ID			
SS	(mg/l)		
Observed construction activities	<100m from location		
	>100m from location		
Other Observations			

	Name & Designation	Signature	Date
Recorded by :	____________	____________	____________
Checked by:	____________	____________	____________

Note: The SS results are to be filled up once they are available from the laboratory.

DCM Water Quality Monitoring Data Record Sheet

Location			
Date			
Start Time (hh:mm)			
Weather			
Sea Conditions			
Tidal Mode			
Water Depth (m)			
Monitoring Results		1st reading	2nd reading or Duplicate
Salinity	(mg/l)		
Temperature	°C		
pH			
DO Saturation	(%)		
DO	(mg/l)		
Sample ID			
Ammonia as N	(mg/l)		
Unionised ammonia	(mg/l)		
Nitrite as N	(mg/l)		
Nitrate as N	(mg/l)		
TKN as N	(mg/l)		
Total Phosphorus	(mg/l)		
Reactive Phosphorus	(mg/l)		
Cadmium (Cd)	(µg/l)		
Chromium (Cr)	(µg/l)		
Copper (Cu)	(µg/l)		
Nickel (Ni)	(µg/l)		
Lead (Pb)	(µg/l)		
Zinc (Zn)	(µg/l)		
Arsenic (As)	(µg/l)		
Observed construction activities	<100m from location		
	>100m from location		
Other Observations			

	Name & Designation	Signature	Date
Recorded by :	______________	______________	______________
Checked by:	______________	______________	______________

Note: The nutrients and heavy metals results are to be filled up once they are available from the laboratory.

Appendix C. Implementation Schedule for Environment Mitigation Measures

Table 1: Implementation Schedule

EIA Ref.	EM&A Ref.	Environmental Protection Measures	Location / Duration of measures Timing of completion of measures	Implementation Agent	Implementation Stage Des	C	O	Relevant Legislation & Guidelines
Air Quality Impact – Construction Phase								
5.2.6.2	2.1	**Dust Control Measures** Water spraying for 12 times a day or once every two hours for 24-hour working at all active works area.	Within construction site / Duration of the construction phase	Contractor		✓		EIA recommendations
5.2.6.3	2.1	Covering of at least 80% of the stockpiling area by impervious sheets. Water spraying of all dusty materials immediately prior to any loading transfer operation so as to keep the dusty material wet during material handling.	Within construction site / Duration of the construction phase	Contractor		✓		EIA recommendations
5.2.6.4	2.1	Dust control practices as stipulated in the Air Pollution Control (Construction Dust) Regulation should be adopted. These practices include: Good Site Management ▪ Good site management is important to help reducing potential air quality impact down to an acceptable level. As a general guide, the Contractor should maintain high standard of housekeeping to prevent emission of fugitive dust. Loading, unloading, handling and storage of raw materials, wastes or by-products should be carried out in a manner so as to minimise the release of visible dust emission. Any piles of materials accumulated on or around the work areas should be cleaned up regularly. Cleaning, repair and maintenance of all plant facilities within the work areas should be carried out in a manner minimising generation of fugitive dust emissions. The material should be handled properly to prevent fugitive dust emission before cleaning. Disturbed Parts of the Roads ▪ Each and every main temporary access should be paved with concrete, bituminous hardcore materials or metal plates and kept clear of dusty materials; or ▪ Unpaved parts of the road should be sprayed with water or a dust suppression chemical so as to keep the entire road surface wet.	Within construction site / Duration of the construction phase	Contractor		✓		Air Pollution Control (Construction Dust) Regulation

EIA Ref.	EM&A Ref.	Environmental Protection Measures	Location / Duration of measures Timing of completion of measures	Implementation Agent	Implementation Stage Des C O	Relevant Legislation & Guidelines
		Exposed Earth ▪ Exposed earth should be properly treated by compaction, hydroseeding, vegetation planting or seating with latex, vinyl, bitumen within six months after the last construction activity on the site or part of the site where the exposed earth lies. Loading, Unloading or Transfer of Dusty Materials ▪ All dusty materials should be sprayed with water immediately prior to any loading or transfer operation so as to keep the dusty material wet. Debris Handling ▪ Any debris should be covered entirely by impervious sheeting or stored in a debris collection area sheltered on the top and the three sides. ▪ Before debris is dumped into a chute, water should be sprayed so that it remains wet when it is dumped. Transport of Dusty Materials ▪ Vehicle used for transporting dusty materials/spoils should be covered with tarpaulin or similar material. The cover should extend over the edges of the sides and tailboards. Wheel washing ▪ Vehicle wheel washing facilities should be provided at each construction site exit. Immediately before leaving the construction site, every vehicle should be washed to remove any dusty materials from its body and wheels. Use of vehicles ▪ The speed of the trucks within the site should be controlled to about 10km/hour in order to reduce adverse dust impacts and secure the safe movement around the site. ▪ Immediately before leaving the construction site, every vehicle should be washed to remove any dusty materials from its body and wheels. ▪ Where a vehicle leaving the construction site is carrying a load of dusty materials, the load should be covered entirely by clean impervious sheeting to ensure that the dusty				

EIA Ref.	EM&A Ref.	Environmental Protection Measures	Location / Duration of measures Timing of completion of measures	Implementation Agent	Implementation Stage Des	C	O	Relevant Legislation & Guidelines
		materials do not leak from the vehicle. Site hoarding ▪ Where a site boundary adjoins a road, street, service lane or other area accessible to the public, hoarding of not less than 2.4m high from ground level should be provided along the entire length of that portion of the site boundary except for a site entrance or exit.						
5.2.6.5	2.1	**Best Practices for Concrete Batching Plant** The relevant best practices for dust control as stipulated in the Guidance Note on the Best Practicable Means for Cement Works (Concrete Batching Plant) BPM 3/2 as well as in the future Specified Process licence should be adopted. The best practices are recommended to be applied to both the land based and floating concrete batching plants. Best practices include: Cement and other dusty materials ▪ The loading, unloading, handling, transfer or storage of cement, pulverised fuel ash (PFA) and/or other equally dusty materials shall be carried in a totally enclosed system acceptable to EPD. All dust-laden air or waste gas generated by the process operations shall be properly extracted and vented to fabric filtering system to meet the required emission limit. ▪ Cement, PFA and/or other equally dusty materials shall be stored in storage silo fitted with audible high level alarms to warn of over-filling. The high-level alarm indicators shall be interlocked with the material filling line such that in the event of the silo approaching an overfilling condition, an audible alarm will operate, and after 1 minute or less the material filling line will be closed. ▪ Vents of all silos shall be fitted with fabric filtering system to meet the required emission limit. ▪ Vents of cement/PFA weighing scale shall be fitted with fabric filtering system to meet the required emission limit. ▪ Seating of pressure relief valves of all silos shall be checked, and the valves re-seated if necessary, before each	Within Concrete Batching Plant / Duration of the construction phase	Contractor		✓		Guidance Note on the Best Practicable Means for Cement Works (Concrete Batching Plant) BPM 3/2

EIA Ref.	EM&A Ref.	Environmental Protection Measures	Location / Duration of measures Timing of completion of measures	Implementation Agent	Implementation Stage Des C O	Relevant Legislation & Guidelines
		delivery. Other raw materials ▪ The loading, unloading, handling, transfer or storage of other raw materials which may generate airborne dust emissions such as crushed rock, sand, stone aggregate, shall be carried out in such a manner to prevent or minimize dust emissions. ▪ The materials shall be adequately wetted prior to and during the loading, unloading and handling operations. Manual or automatic water spraying system shall be provided at all unloading areas, stock piles and material discharge points. ▪ All receiving hoppers for unloading relevant materials shall be enclosed on three sides up to 3 m above the unloading point. In no case shall these hoppers be used as the material storage devices. ▪ The belt conveyor for handling materials shall be enclosed on top and two sides with a metal board at the bottom to eliminate any dust emission due to wind-whipping effect. Other type of enclosure will also be accepted by EPD if it can be demonstrated that the proposed enclosure can achieve same performance. ▪ All conveyor transfer points shall be totally enclosed. Openings for the passage of conveyors shall be fitted with adequate flexible seals. ▪ Scrapers shall be provided at the turning points of all conveyors to remove dust adhered to the belt surface. ▪ Conveyors discharged to stockpiles of relevant materials shall be arranged to minimize free fall as far as practicable. All free falling transfer points from conveyors to stockpiles shall be enclosed with chute(s) and water sprayed. ▪ Aggregates with a nominal size less than or equal to 5 mm should be stored in totally enclosed structure such as storage bin and should not be handled in open area. Where there is sufficient buffer area surrounding the concrete batching plant, ground stockpiling may be used. ▪ The stockpile shall be enclosed at least on top and three sides and with flexible curtain to cover the entrance side.				

EIA Ref.	EM&A Ref.	Environmental Protection Measures	Location / Duration of measures Timing of completion of measures	Implementation Agent	Implementation Stage Des C O	Relevant Legislation & Guidelines
		▪ Aggregates with a nominal size greater than 5 mm should preferably be stored in a totally enclosed structure. If open stockpiling is used, the stockpile shall be enclosed on three sides with the enclosure wall sufficiently higher than the top of the stockpile to prevent wind whipping. ▪ The opening between the storage bin and weighing scale of the materials shall be fully enclosed. Loading of materials for batching ▪ Concrete truck shall be loaded in such a way as to minimise airborne dust emissions. The following control measures shall be implemented: (a) Pre-mixing the materials in a totally enclosed concrete mixer before loading the materials into the concrete truck is recommended. All dust-laden air generated by the pre-mixing process as well as the loading process shall be totally vented to fabric filtering system to meet the required emission limit. (b) If truck mixing batching or other types of batching method is used, effective dust control measures acceptable to EPD shall be adopted. The dust control measures must have been demonstrated to EPD that they are capable to collect and vent all dust-laden air generated by the material loading/mixing to dust arrestment plant to meet the required emission limit. ▪ The loading bay shall be totally enclosed during the loading process. Vehicles ▪ All practicable measures shall be taken to prevent or minimize the dust emission caused by vehicle movement. ▪ All access and route roads within the premises shall be paved and adequately wetted. Housekeeping ▪ A high standard of housekeeping shall be maintained. All spillages or deposits of materials on ground, support structures or roofs shall be cleaned up promptly by a cleaning method acceptable to EPD. Any dumping of				

EIA Ref.	EM&A Ref.	Environmental Protection Measures	Location / Duration of measures Timing of completion of measures	Implementation Agent	Implementation Stage Des	 C	 O	Relevant Legislation & Guidelines
		materials at open area shall be prohibited.						
5.2.6.6	2.1	**Best Practices for Asphaltic Concrete Plant** The relevant best practices for dust control as stipulated in the Guidance Note on the Best Practicable Means for Tar and Bitumen Works (Asphaltic Concrete Plant) BPM 15 (94) as well as in the future Specified Process licence should be adopted. These include: Design of Chimney ▪ The chimney shall not be less than 3 metres plus the building height or 8 metres above ground level, whichever is the greater ▪ The efflux velocity of gases from the main chimney shall not be less than 12 m/s at full load condition ▪ The flue gas exit temperature shall not be less than the acid dew point ▪ Release of the chimney shall be directed vertically upwards and not be restricted or deflected Cold feed side ▪ The aggregates with a nominal size less than or equal to 5 mm shall be stored in totally enclosed structure such as storage bin and shall not be handled in open area. ▪ Where there is sufficient buffer area surrounding the plant, ground stockpiling may be used. The stockpile shall be enclosed at least on top and three sides and with flexible curtain to cover the entrance side. If these aggregates are stored above the feeding hopper, they shall be enclosed at least on top and three sides and be wetted on the surface to prevent wind-whipping. ▪ The aggregates with a nominal size greater than 5 mm should preferably be stored in totally enclosed structure. Aggregates stockpile that is above the feeding hopper shall be enclosed at least on top and three sides. If open stockpiling is used, the stockpiles shall be enclosed on three sides with the enclosure wall sufficiently higher than the top of the stockpile to prevent wind whipping. ▪ Belt conveyors shall be enclosed on top and two sides and	Within Asphaltic Concrete Plant / Duration of the construction phase	Contractor		✓		Guidance Note on the Best Practicable Means for Tar and Bitumen Works (Asphaltic Concrete Plant) BPM 15 (94)

EIA Ref.	EM&A Ref.	Environmental Protection Measures	Location / Duration of measures Timing of completion of measures	Implementation Agent	Implementation Stage Des C O	Relevant Legislation & Guidelines
		provided with a metal board at the bottom to eliminate any dust emission due to the wind-whipping effect. Other type of enclosure will also be accepted by EPD if it can be demonstrated that the proposed enclosure can be achieve the same performance. ▪ Scrapers shall be provided at the turning points of all belt conveyors inside the chute of the transfer points to remove dust adhered to the belt surface. ▪ All conveyor transfer points shall be totally enclosed. Openings for the passages of conveyors shall be fitted with adequate flexible seals. ▪ All materials returned from dust collection system shall be transferred in enclosed system and shall be stored inside bins or enclosures. Hot feed side ▪ The inlet and outlet of the rotary dryer shall be enclosed and ducted to a dust extraction and collection system such as a fabric filter. The particulate and gaseous concentration at the exhaust outlet of the dust collector shall not exceed the required limiting values. ▪ The bucket elevator shall be totally enclosed and the air be extracted and ducted to a dust collection system to meet the required particulates limiting value ▪ All vibratory screens shall be totally enclosed and dust tight with close-fitted access inspection opening. Gaskets shall be installed to seal off any cracks and edges of any inspection openings. ▪ Chutes for carrying hot material shall be rigid and preferably fitted with abrasion resistant plate inside. They shall be inspected daily for leakages. ▪ All hot bins shall be totally enclosed and dust tight with close-fitted access inspection opening. Gaskets shall be installed to seal off any cracks and edges of any inspection openings. The air shall be extracted and ducted to a dust collection system to meet the required particulates limiting value. ▪ Appropriate control measures shall be adopted in order to				

EIA Ref.	EM&A Ref.	Environmental Protection Measures	Location / Duration of measures Timing of completion of measures	Implementation Agent	Implementation Stage Des C O	Relevant Legislation & Guidelines
		meet the required bitumen emission limit as well as the ambient odour level (2 odour units). Material transportation ▪ The loading, unloading, handling, transfer or storage of other raw materials which may generate airborne dust emissions such as crushed rocks, sands, stone aggregates, reject fines, shall be carried out in such a manner as to minimize dust emissions. ▪ Roadways from the entrance of the plant to the product loading points and/or any other working areas where there are regular movements of vehicles shall be paved or hard surfaced. ▪ Haul roads inside the Works shall be adequately wetted with water and/or chemical suppressants by water trucks or water sprayers. Control of emissions from bitumen decanting ▪ The heating temperature of the particular bitumen type and grade shall not exceed the corresponding temperature limit of the same type listed in Appendix 1 of the Guidance Note. ▪ Tamper-free high temperature cut-off device shall be provided to shut off the fuel supply or electricity in case the upper limit for bitumen temperature is reached. ▪ Proper chimney for the discharge of bitumen fumes shall be provided at high level. ▪ The emission of bitumen fumes shall not exceed the required emission limit. ▪ The air-to-fuel ratio shall be properly controlled to allow complete combustion of the fuel. The fuel burners, if any, shall be maintained properly and free from carbon deposits in the burner nozzles. Liquid fuel ▪ The receipt, handling and storage of liquid fuel shall be carried out so as to prevent the release of emissions of organic vapours and/or other noxious and offensive emissions to the air. Housekeeping				

EIA Ref.	EM&A Ref.	Environmental Protection Measures	Location / Duration of measures Timing of completion of measures	Implementation Agent	Implementation Stage Des	C	O	Relevant Legislation & Guidelines
		▪ A high standard of housekeeping shall be maintained. Waste material, spillage and scattered piles gathered beneath belt conveyors, inside and around enclosures shall be cleared frequently. The minimum clearing frequency is on a weekly basis.						
5.2.6.7	2.1	**Best Practices for Rock Crushing Plants** The relevant best practices for dust control as stipulated in the Guidance Note on the Best Practicable Means for Mineral Works (Stone Crushing Plant) BPM 11/1 (95) as well as in the future Specified Process licence should be adopted. These include: Crushers ▪ The outlet of all primary crushers, and both inlet and outlet of all secondary and tertiary crushers, if not installed inside a reasonably dust tight housing, shall be enclosed and ducted to a dust extraction and collection system such as a fabric filter. ▪ The inlet hopper of the primary crushers shall be enclosed on top and 3 sides to contain the emissions during dumping of rocks from trucks. The rock while still on the trucks shall be wetted before dumping. ▪ Water sprayers shall be installed and operated in strategic locations at the feeding inlet of crushers. ▪ Crusher enclosures shall be rigid and be fitted with self-closing doors and close-fitting entrances and exits. Where conveyors pass through the crusher enclosures, flexible covers shall be installed at entries and exits of the conveyors to the enclosure. Vibratory screens and grizzlies ▪ All vibratory screens shall be totally enclosed in a housing. Screenhouses shall be rigid and reasonably dust tight with self-closing doors or close-fitted entrances and exits for access. Where conveyors pass through the screenhouse, flexible covers shall be installed at entries and exits of the conveyors to the housing. Where containment of dust within the screenhouse structure is not successful then a dust	Within Crushing Plant / Duration of the construction phase	Contractor		✓		Guidance Note on the Best Practicable Means for Mineral Works (Stone Crushing Plant) BPM 11/1 (95)

EIA Ref.	EM&A Ref.	Environmental Protection Measures	Location / Duration of measures Timing of completion of measures	Implementation Agent	Implementation Stage Des C O	Relevant Legislation & Guidelines
		extraction and collection system shall be provided. ▪ All grizzlies shall be enclosed on top and 3 sides and sufficient water sprayers shall be installed at their feeding and outlet areas. Belt conveyors ▪ Except for those conveyors which are placed within a totally enclosed structure such as a screenhouse or those erected at the ground level, all conveyors shall be totally enclosed with windshield on top and 2 sides. ▪ Effective belt scraper such as the pre-cleaner blades made by hard wearing materials and provided with pneumatic tensioner, or equivalent device, shall be installed at the head pulley of designated conveyor as required to dislodge fine dust particles that may adhere to the belt surface and to reduce carry-back of fine materials on the return belt. Bottom plates shall also be provided for the conveyor unless it has been demonstrated that the corresponding belt scraper is effective and well maintained to prevent falling material from the return belt. ▪ Except for those transfer points which are placed within a totally enclosed structure such as a screenhouse, all transfer points to and from conveyors shall be enclosed. Where containment of dust within the enclosure is not successful, then water sprayers shall be provided. Openings for any enclosed structure for the passage of conveyors shall be fitted with flexible seals. Storage piles and bins ▪ Where practicable, free falling transfer points from conveyors to stockpiles shall be fitted with flexible curtains or be enclosed with chutes designed to minimize the drop height. Water sprays shall also be used where required. ▪ The surface of all surge piles and stockpiles of blasted rocks or aggregates shall be kept sufficiently wet by water spraying wherever practicable. ▪ All open stockpiles for aggregates of size in excess of 5 mm shall be kept sufficiently wet by water spraying where practicable.				

EIA Ref.	EM&A Ref.	Environmental Protection Measures	Location / Duration of measures Timing of completion of measures	Implementation Agent	Implementation Stage Des	C	O	Relevant Legislation & Guidelines
		▪ The stockpiles of aggregates 5 mm in size or less shall be enclosed on 3 sides or suitably located to minimize wind-whipping. Save for fluctuations in stock or production, the average stockpile shall stay within the enclosure walls and in no case the height of the stockpile shall exceed twice the height of the enclosure walls. ▪ Scattered piles gathered beneath belt conveyors, inside and around enclosures shall be cleared regularly. Rock drilling equipment ▪ Appropriate dust control equipment such as a dust extraction and collection system shall be used during rock drilling activities.						
Air Quality Impact – Operation Phase								
Not applicable								
Hazard to Human Life – Construction Phase								
Table 6.40	3.2	Precautionary measures should be established to request barges to move away during typhoons	Construction Site / Construction Period	Contractor		✓		-
Table 6.40	3.2	An appropriate marine traffic management system should be established to minimize risk of ship collision	Construction Site / Construction Period	Contractor		✓		-
Table 6.40	3.2	Location of all existing hydrant networks should be clearly identified prior to any construction works	Construction Site / Construction Period	Contractor		✓		-
Hazard to Human Life – Operation Phase								
Table 6.40	3.2	A similar coating standard shall be applied to the new submarine pipeline as for the existing pipeline	Jet Fuel Submarine Pipeline / Submarine Pipeline Design and Construction Period	Design Engineer & Contractor	✓	✓		-
Table 6.40	3.2	Checking on the integrity of the new submarine pipeline, e.g. by pigging, should be conducted during testing and commission	Jet Fuel Submarine Pipeline / Testing and Commissioning	Contractor		✓	✓	-
Table 6.40	3.2	After the fuel hydrant system is in operation, the as-built drawings of the underground jet fuel pipeline will be kept by AAHK. Before the commencement of any construction works, as-built drawings showing the alignment and level of the	Jet Fuel Underground Pipeline / Operation Period of the Pipeline	AAHK / Contractor			✓	-

EIA Ref.	EM&A Ref.	Environmental Protection Measures	Location / Duration of measures Timing of completion of measures	Implementation Agent	Implementation Stage Des	 C	 O	Relevant Legislation & Guidelines
		underground fuel pipelines for the work area will be provided to the third party construction contractors.						
Table 6.40	3.2	After the fuel hydrant system is in operation, third party construction contractors are required to undertake underground pipeline detection works to ascertain the exact alignment of the underground pipeline before the commencement of works.	Jet Fuel Underground Pipeline / Operation Period of the Pipeline	AAHK / Contractor			✓	-
Table 6.40	3.2	Monitoring of underground pipelines by the Leak Detection System which will give signal to the operator should fuel leakage occur.	Jet Fuel Underground Pipeline / Operation Period of the Pipeline	Aviation Fuel System Operator			✓	-
Table 6.40	3.2	Study should be conducted to ensure the new pipeline can withstand the planned future loading.	Jet Fuel Underground Pipeline / Pipeline Design Period	Design Engineer	✓			-
Table 6.40	3.2	New pressure surge calculations are required because of the changed characteristics of the hydrant network	Jet Fuel Hydrant System/Pipeline Design Period	Design Engineer	✓			-
Table 6.40	3.2	There is a need to check the appropriate pressure drop calculations have been undertaken for the new system	Jet Fuel Hydrant System/Pipeline Design Period	Design Engineer	✓			-
Table 6.41	3.2	Improvement audit to reinforce existing refuelling practices and to achieve better compliance	Jet Fuel Hydrant System/Operation Period	AAHK			✓	-
Table 6.41	3.2	During refuelling process, four cones are to be put in place to indicate the 6 m refuelling zone from aircraft fuelling point for the new fuel hydrant system where practicable. AAHK will communicate this recommendation to airlines and their refuelling operators as appropriate. Proper implementation of this recommendation will be checked in AAHK's future safety audits.	Hydrant pit valve/Aircraft refuelling operation	AAHK / Airlines / Into-plane operator			✓	-
Noise Impact – Aircraft Noise								
7.3.5.3	4.1	**Aircraft Noise Mitigation Measures under Primary Operating Mode** Aircraft noise mitigation measures as listed below shall be implemented to minimise the impact of aircraft noise on NSRs situated near the flight paths or in the vicinity of HKIA: ▪ Putting the existing south runway on standby where possible	Airport operation/ Operation Period	AAHK, CAD			✓	-

EIA Ref.	EM&A Ref.	Environmental Protection Measures	Location / Duration of measures Timing of completion of measures	Implementation Agent	Implementation Stage Des	C	O	Relevant Legislation & Guidelines
		at night between 2300 and 0659; ▪ Requiring departures to take the southbound route via West Lamma Channel during east flow at night from 2300 to 0659, subject to acceptable operational and safety consideration; ▪ Assigning a new arrival Required Navigation Performance Track 6 for preferential use in the runway 25 direction between 2300 and 0659; and ▪ Implementing a preferential runway use programme when wind conditions allow such that west flow is used when departures dominate while east flow is used when arrivals dominate during night-time.						
7.3.5.3	4.1	**Consideration of Aircraft Noise in developing MLP for planned development at CDA site in Lok On Pai** In developing the MLP for the CDA site in Lok On Pai, the alignment of the NEF25 contour line should be taken into account to ensure that no noise sensitive uses are situated within the NEF25 contour in the planned development.	CDA site in Lok On Pai / during preparation of MLP	Planning Department	✓			EIAO-TM Annex 5
Noise Impact – Fixed Noise Sources								
7.4.9.1	4.2	**Ground Noise Source (Operation of Aircraft Engine Run-up Facilities)** Noise enclosure with required noise reduction of at least 15 dBA at the ERUFs should be incorporated.	Within the Project site / During operation phase / Throughout operation phase	Design Architect / Contractor	✓		✓	EIAO and Noise Control Ordinance
Noise Impact – Construction Phase								
7.5.6	4.3	**Good Site Practice** Good site practice and noise management can significantly reduce the impact of construction site activities on nearby NSRs. The following package of measures should be followed during each phase of construction: ▪ only well-maintained plant to be operated on-site and plant should be serviced regularly during the construction works; ▪ machines and plant that may be in intermittent use to be shut down between work periods or should be throttled down to a minimum; ▪ plant known to emit noise strongly in one direction, should,	Within the Project site / During construction phase / Prior to commencement of operation	Contractor		✓		EIAO and Noise Control Ordinance

EIA Ref.	EM&A Ref.	Environmental Protection Measures	Location / Duration of measures Timing of completion of measures	Implementation Agent	Implementation Stage Des	C	O	Relevant Legislation & Guidelines
		▪ where possible, be orientated to direct noise away from the NSRs; ▪ mobile plant should be sited as far away from NSRs as possible; and ▪ material stockpiles and other structures to be effectively utilised, where practicable, to screen noise from on-site construction activities.						
7.5.6	4.3	**Adoption of QPME** QPME should be adopted as far as applicable.	Within the Project site / During construction phase / Prior to commencement of operation	Contractor		✓		EIAO and Noise Control Ordinance
7.5.6	4.3	**Use of Movable Noise Barriers** Movable noise barriers should be placed along the active works area and mobile plants to block the direct line of sight between PME and the NSRs.	Within the Project site / During construction phase / Prior to commencement of operation	Contractor		✓		EIAO and Noise Control Ordinance
7.5.6	4.3	**Use of Noise Enclosure/ Acoustic Shed** Noise enclosure or acoustic shed should be used to cover stationary PME such as air compressor and generator.	Within the Project site / During construction phase / Prior to commencement of operation	Contractor		✓		EIAO, EIAO Guidance Note No.9/2010. and Noise Control Ordinance
Water Quality Impact – Construction Phase								
8.8.1.2 and 8.8.1.3	5.1	**Marine Construction Activities** <u>General Measures to be Applied to All Works Areas</u> ▪ Barges or hoppers shall not be filled to a level which will cause overflow of materials or pollution of water during loading or transportation; ▪ Use of Lean Material Overboard (LMOB) systems shall be prohibited; ▪ Excess materials shall be cleaned from the decks and exposed fittings of barges and hopper dredgers before the vessels are moved; ▪ Plants should not be operated with leaking pipes and any pipe leakages shall be repaired quickly; ▪ Adequate freeboard shall be maintained on barges to reduce the likelihood of decks being washed by wave action; ▪ All vessels shall be sized such that adequate clearance is	Within construction site / Duration of the construction phase	Contractor		✓		ProPECC Note PN 1/94 EIA recommendations

EIA Ref.	EM&A Ref.	Environmental Protection Measures	Location / Duration of measures Timing of completion of measures	Implementation Agent	Implementation Stage Des C O	Relevant Legislation & Guidelines
		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; ▪ 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; and ▪ For ground improvement activities including DCM, the wash water from cleaning of the drilling shaft should be appropriately treated before discharge. The Contractor should ensure the waste water meets the WPCO/TM requirements before discharge. No direct discharge of contaminated water is permitted. <u>Specific Measures to be Applied to All Works Areas</u> ▪ The daily maximum production rates shall not exceed those assumed in the water quality assessment in the EIA report; ▪ A maximum of 10 % fines content to be adopted for sand blanket and 20 % fines content for marine filling below +2.5 mPD prior to substantial completion of seawall (until end of Year 2017) shall be specified in the works contract document; ▪ An advance seawall of at least 200m to be constructed (comprising either rows of contiguous permanent steel cells completed above high tide mark or partially completed seawalls with rock core to high tide mark and filter layer on the inner side) prior to commencement of marine filling activities. <u>Specific Measures to be Applied to Land Formation Activities prior to Commencement of Marine Filling Works</u> ▪ Double layer 'Type III' silt curtains to be applied around the active eastern works areas prior to commencement of sand blanket laying activities. The silt curtains shall be configured to minimise SS release during ebb tides. A silt curtain efficiency test shall be conducted to validate the performance of the silt curtains; ▪ Double layer silt curtains to enclose WSRs C7a and silt screens installed at the intake points for both WSR C7a and C8 prior to commencement of construction; and				

EIA Ref.	EM&A Ref.	Environmental Protection Measures	Location / Duration of measures Timing of completion of measures	Implementation Agent	Implementation Stage Des	C	O	Relevant Legislation & Guidelines
		▪ The silt curtains and silt screens should be regularly checked and maintained. Specific Measures to be Applied to Land Formation Activities during Marine Filling Works ▪ Double layer ‘Type II’ or ‘Type III’ silt curtains to be applied around the eastern openings between partially completed seawalls prior to commencement of marine filling activities. The silt curtains shall be configured to minimise SS release during ebb tides; ▪ Double layer silt curtains to be applied at the south-western opening prior to commencement of marine filling activities; ▪ Double layer silt curtain to enclose WSR C7a and silt screens installed at the intake points for both WSR C7a and C8 prior to commencement of marine filling activities; and ▪ The silt curtains and silt screens should be regularly checked and maintained. Specific Measures to be Applied to the Field Joint Excavation Works for the Submarine Cable Diversion ▪ Only closed grabs designed and maintained to avoid spillage shall be used and should seal tightly when operated. Excavated materials shall be disposed at designated marine disposal area in accordance with the Dumping and Sea Ordinance (DASO) permit conditions; and ▪ Silt curtains surrounding the closed grab dredger to be deployed as a precautionary measure .						
8.8.1.4	5.1	**Modification of the Existing Seawall** Silt curtains shall be deployed around the seawall modification activities to completely enclose the active works areas, and care should be taken to avoid splashing of rockfill / rock armour into the surrounding marine environment. For the connecting sections with the existing outfalls, works for these connection areas should be undertaken during the dry season in order that individual drainage culvert cells may be isolated for interconnection works.	At the existing northern seawall / Duration of the construction phase	Contractor		✓		EIA recommendations

EIA Ref.	EM&A Ref.	Environmental Protection Measures	Location / Duration of measures Timing of completion of measures	Implementation Agent	Implementation Stage Des	C	O	Relevant Legislation & Guidelines
8.8.1.5	5.1	**Construction of New Stormwater Outfalls and Modifications to Existing Outfalls** During operation of the temporary drainage channel, runoff control measures such as bunding or silt fence shall be provided on both sides of the channel to prevent accumulation and release of SS via the temporary channel. Measures should also be taken to minimise the ingress of site drainage into the culvert excavations.	Within construction site / Duration of the construction phase	Contractor		✓		EIA recommendations
8.8.1.6 8.8.1.7	5.1	**Piling Activities for Construction of New Runway Approach Lights and HKIAAA Marker Beacons** Silt curtains shall be deployed around the piling activities to completely enclose the piling works and care should be taken to avoid spillage of excavated materials into the surrounding marine environment. <u>For construction of the eastern approach lights at the CMPs</u> ▪ Ground improvement via DCM using a close-spaced layout shall be completed prior to commencement of piling works; ▪ Steel casings shall be installed to enclose the excavation area prior to commencement of excavation; ▪ The excavated materials shall be removed using a closed grab within the steel casings; ▪ No discharge of the cement mixed materials into the marine environment will be allowed; and ▪ Excavated materials shall be treated and reused on-site.	Within construction site / Duration of the construction phase	Contractor		✓		EIA recommendations
8.8.1.8	5.1	**Construction Site Runoff and Drainage** The site practices outlined in ProPECC Note PN 1/94 should be followed as far as practicable in order to minimise surface runoff and the chance of erosion. The following measures are recommended: ▪ Install perimeter cut-off drains to direct off-site water around the site and implement internal drainage, erosion and sedimentation control facilities. Channels, earth bunds or sand bag barriers should be provided on site to direct storm water to silt removal facilities. The design of the temporary on-site drainage system should be undertaken by the	Within construction site / Duration of the construction phase	Contractor		✓		ProPECC Note PN 1/94

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		Contractors prior to the commencement of construction (for works areas located on the existing Airport island) or as soon as the new land is completed (for works areas located on the new landform); ▪ Sand/silt removal facilities such as sand/silt traps and sediment basins should be provided to remove sand/silt particles from runoff to meet the requirements of the TM-DSS standards under the WPCO. The design of efficient silt removal facilities should make reference to the guidelines in Appendix A1 of ProPECC Note PN 1/94. Sizes may vary depending upon the flow rate. The detailed design of the sand/silt traps should be undertaken by the Contractors prior to the commencement of construction; ▪ All drainage facilities and erosion and sediment control structures should be regularly inspected and maintained to ensure proper and efficient operation at all times and particularly during rainstorms. Deposited silt and grit should be regularly removed, at the onset of and after each rainstorm to ensure that these facilities are functioning properly; ▪ Measures should be taken to minimize the ingress of site drainage into excavations. If excavation of trenches in wet periods is necessary, they should be dug and backfilled in short sections wherever practicable. Water pumped out from foundation excavations should be discharged into storm drains via silt removal facilities; ▪ In the event that contaminated groundwater is identified at excavation areas, this should be treated on-site using a suitable wastewater treatment process. The effluent should be treated according to the requirements of the TM-DSS standards under the WPCO prior to discharge to foul sewers or collected for proper disposal off-site. No direct discharge of contaminated groundwater is permitted; ▪ All vehicles and plant should be cleaned before leaving a construction site to ensure no earth, mud, debris and the like is deposited by them on roads. An adequately designed and sited wheel washing facility should be provided at construction site exits. Wash-water should have sand and				

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		silt settled out and removed regularly to ensure the continued efficiency of the process. The section of access road leading to, and exiting from, the wheel-wash bay to the public road should be paved with sufficient backfall toward the wheel-wash bay to prevent vehicle tracking of soil and silty water to public roads and drains. All washwater should be treated according to the requirements of the TM-DSS standards under the WPCO prior to discharge; ▪ Open stockpiles of construction materials or construction wastes on-site should be covered with tarpaulin or similar fabric during rainstorms. Measures should be taken to prevent the construction materials, soil, silt or debris from washing away into the drainage system; ▪ Manholes (including newly constructed ones) should be adequately covered and temporarily sealed so as to prevent silt, construction materials or debris being washed into the drainage system and to prevent stormwater runoff being directed into foul sewers; and ▪ Precautionary measures should be taken at any time of the year when rainstorms are likely. Actions to be taken when a rainstorm is imminent or forecasted are summarized in Appendix A2 of ProPECC Note PN 1/94. This includes actions to be taken during and/or after rainstorms. Particular attention should be paid to the control of silty surface runoff during storm events.						
8.8.1.9	5.1	**Sewage Effluent from Construction Workforce** ▪ Temporary sanitary facilities, such as portable chemical toilets, should be employed on-site where necessary to handle sewage from the workforce. A licensed contractor should be employed to provide appropriate and adequate portable toilets and be responsible for appropriate disposal and maintenance.	Within construction site / During construction phase	Contractor		✓		ProPECC Note PN 1/94
8.8.1.10 8.8.1.11	5.1	**General Construction Activities** ▪ Construction solid waste, debris and refuse generated on-site should be collected, handled and disposed of properly to avoid entering any nearby storm water drain. Stockpiles of cement and other construction materials should be kept	Within construction site / During construction phase	Contractor		✓		ProPECC Note PN 1/94

EIA Ref.	EM&A Ref.	Environmental Protection Measures	Location / Duration of measures Timing of completion of measures	Implementation Agent	Implementation Stage Des	C	O	Relevant Legislation & Guidelines
		covered when not being used. ▪ Oils and fuels should only be stored in designated areas which have pollution prevention facilities. To prevent spillage of fuels and solvents to any nearby storm water drain, all fuel tanks and storage areas should be provided with locks and be sited on sealed areas, within bunds of a capacity equal to 110% of the storage capacity of the largest tank. The bund should be drained of rainwater after a rain event.						
8.8.1.12 8.8.1.13	5.1	**Drilling Activities for the Submarine Aviation Fuel Pipelines** To prevent potential water quality impacts at Sha Chau, the following measures shall be applied: ▪ A 'zero-discharge' policy shall be applied for all activities to be conducted at Sha Chau; ▪ No bulk storage of chemicals shall be permitted; and ▪ A containment pit shall be constructed around the drill holes. This containment pit shall be lined with impermeable lining and bunded on the outside to prevent inflow from off-site areas. At the airport island side of the drilling works, the following measures shall be applied for treatment of wastewater: ▪ During pipe cleaning, appropriate desilting or sedimentation device should be provided on site for treatment before discharge. The Contractor should ensure discharge water from the sedimentation tank meet the WPCO/TM requirements before discharge. ▪ Drilling fluid used in drilling activities should be reconditioned and reused as far as possible. Temporary enclosed storage locations should be provided on-site for any unused chemicals that needs to be transported away after all the related construction activities are completed. The requirements in ProPECC Note PN 1/94 should be adhered to in the handling and disposal of bentonite slurries.	Within construction site / During construction phase	Contractor		✓		EIA recommendations and ProPECC Note PN 1/94
Water Quality Impact – Operation Phase								

EIA Ref.	EM&A Ref.	Environmental Protection Measures	Location / Duration of measures Timing of completion of measures	Implementation Agent	Implementation Stage Des	C	O	Relevant Legislation & Guidelines
8.8.2.2	5.2	**Floating Refuse** ▪ Regular inspection should be carried out along the artificial seawall to check for any accumulation of floating refuse, and if necessary, regular removal of accumulated / floating refuse should be undertaken.	During operation phase	Contractor			✓	EIA recommendations
8.8.2.3	5.2	**Storm Water Discharges** For stormwater discharges, the following measures should be applied to minimise contaminants in runoff: ▪ Install and maintain roadside gullies to trap and remove silt and grit from stormwater; ▪ Install and maintain oil/grease interceptors for removal of oil and fuel from stormwater; and ▪ Runoff from aircraft and vehicle washing activities should be intercepted and discharged to foul sewer or diverted to temporary storage for subsequent removal and treatment offsite.	During design and operation phase	Design Consultant / AAHK	✓		✓	TM-DSS, Water Pollution Control Ordinance
8.8.2.4	5.2	**Fuel Spillage** Precautionary measures for fuel management and spill response should include the following: ▪ Fuel pipelines and hydrant systems should be designed with adequate protection and pressure / leakage detection systems; ▪ A 'spill trap containment system' should be designed and provided at aircraft apron and stand areas; ▪ An emergency spill response plan should be in place to provide timely and effective response and remediation of spillage events; ▪ Spill response equipment should be available on site and regularly checked and maintained; ▪ Operation of the fuel supply and refuelling systems should be restricted to qualified and trained personnel with adequate knowledge of the spill response procedures in place; ▪ A penalty system should be set up to discourage poor	During design and operation phase	Design Consultant / AAHK	✓		✓	TM-DSS, Water Pollution Control Ordinance

EIA Ref.	EM&A Ref.	Environmental Protection Measures	Location / Duration of measures Timing of completion of measures	Implementation Agent	Implementation Stage Des	C	O	Relevant Legislation & Guidelines
		practices associated with maintenance of aircraft, vehicle and refueling systems by Airport tenants and franchisees; and ▪ Detailed records of all spillage events should be kept and maintained.						
Sewerage and Sewage Treatment Implication – Operation Phase								
9.7.1	6.2	The planned sewerage system will be designed in accordance with all the relevant standards and guidelines published by DSD. The planned and existing sewerage network are maintained and operated by AAHK in accordance with the Sewerage Manual published by DSD. In addition to continuing the odour control arrangements currently undertaken by AAHK, maintaining the design maximum retention time of the planned pumping station to not more than 2 hours, monitoring the H_2S level once the 3RS is in operation and adoption of active septicity management measures that can effectively contain any future septicity problems will be included in the design for the planned 3RS sewerage system.	Sewerage system for 3RS within the expanded airport island / during design and operation phase	Design Consultant / AAHK	✓		✓	EIA recommendations
9.7.2	6.2	AAHK undertakes to upgrade the existing gravity sewer by constructing a new gravity sewer with a diameter of 1,200 mm adjacent to the existing gravity sewer (1,050 mm in diameter) and then diverting the sewage flow arising from the airport and other sub-catchment in Tung Chung to the new gravity sewer. The recommended measures to mitigate the secondary impacts on air quality, noise, waste management, water quality and trees arising from the construction works associated with the sewer upgrading works should also be implemented.	Gravity sewers from the airport discharge manhole to TCSPS / 2026	Design Consultant / Contractor			✓	Water Pollution Control Ordinance
9.7.3	6.2	TCSPS is being upgraded to increase its design capacity to cater for the future sewage arising from the catchment including the project.	TCSPS/ by end 2022	DSD (Design and construction of TCSPS upgrading is currently underway under the DSD's Agreement No. 6/2012)			✓	Water Pollution Control Ordinance
9.7.4	6.2	SHWSTS will be upgraded to increase its design capacity to	SHWSTS/ by 2026	EPD			✓	Water Pollution Control

EIA Ref.	EM&A Ref.	Environmental Protection Measures	Location / Duration of measures Timing of completion of measures	Implementation Agent	Implementation Stage Des	C	O	Relevant Legislation & Guidelines
		cater for the future sewage arising from the catchment including the project.						Ordinance
Waste Management Implication – Construction Phase								
10.5.1.1	7.1	Opportunities to minimise waste generation and maximise the reuse of waste materials generated by the project have been incorporated where possible into the planning, design and construction stages, and the following measures have been recommended: ▪ The relevant construction methods (particularly for the tunnel works) and construction programme have been carefully planned and developed to minimise the extent of excavation and to maximise the on-site reuse of inert C&D materials generated by the project as far as practicable. Temporary stockpiling areas will also be provided to facilitate on-site reuse of inert C&D materials. ▪ Priority should be given to collect and reuse suitable inert C&D materials generated from other concurrent projects and the Government's PFRF as fill materials for the proposed land formation works. ▪ Only non-dredged ground improvement methods should be adopted in order to completely avoid the need for dredging and disposal of marine sediment for the proposed land formation work. ▪ Excavation work for constructing the APM tunnels, BHS tunnels and airside tunnels will not be down to the CMPs beneath the fill materials in order to avoid excavating any sediments. ▪ For the marine sediments expected to be excavated from the piling works of TRC, APM & BHS tunnels, airside tunnels and other facilities on the proposed land formation area, piling work of marine sections of the approach lights and HKIAAA beacons, basement works for some of T2 expansion area and excavation works for the proposed APM depot should be treated and reused on-site as backfilling materials, although required treatment level / detail and the specific re-use mode are under development.	Project Site Area / During design and construction phase	Design Consultant / Contractor	✓	✓		Waste Disposal Ordinance

EIA Ref.	EM&A Ref.	Environmental Protection Measures	Location / Duration of measures Timing of completion of measures	Implementation Agent	Implementation Stage Des	 C	 O	Relevant Legislation & Guidelines
10.5.1.2	7.1	The following good site practices should be performed during the construction activities include: ▪ Nomination of an approved person, such as a site manager, to be responsible for good site practices, arrangements for collection and effective disposal to an appropriate facility, of all wastes generated at the site. ▪ Training of site personnel in proper waste management and chemical waste handling procedures. ▪ Provision of sufficient waste disposal points and regular collection for disposal. ▪ Appropriate measures to minimise windblown litter and dust during transportation of waste by either covering trucks by tarpaulin/ similar material or by transporting wastes in enclosed containers. The cover should be extended over the edges of the sides and tailboards. ▪ Stockpiles of C&D materials should be kept wet or covered by impervious sheets to avoid wind-blown dust. ▪ All dusty materials including C&D materials should be sprayed with water immediately prior to any loading transfer operation so as to keep the dusty material wet during material handling at the barging points/ stockpile areas. ▪ C&D materials to be delivered to and from the project site by barges or by trucks should be kept wet or covered to avoid wind-blown dust. ▪ The speed of the trucks including dump trucks carrying C&D or waste materials within the site should be controlled to about 10 km/hour in order to reduce the adverse dust impact and secure the safe movement around the site. ▪ To avoid or minimise dust emission during transport of C&D or waste materials within the site, each and every main temporary access should be paved with concrete, bituminous hardcore materials or metal plates and kept clear of dusty materials. Unpaved parts of the road should be sprayed with water or a dust suppression chemical so as to keep the entire road surface wet.	Project Site Area / Construction Phase	Contractor		✓		Waste Disposal Ordinance
10.5.1.3	7.1	The following practices should be performed to achieve waste	Project Site Area /	Contractor		✓		Waste Disposal

EIA Ref.	EM&A Ref.	Environmental Protection Measures	Location / Duration of measures	Implementation Agent	Implementation Stage			Relevant Legislation & Guidelines
			Timing of completion of measures		Des	C	O	
		reduction include: ▪ Use of steel or aluminium formworks and falseworks for temporary works as far as practicable. ▪ Adoption of repetitive design to allow reuse of formworks as far as practicable ▪ Segregation and storage of different types of waste in different containers, skips or stockpiles to enhance reuse or recycling of materials and their proper disposal. ▪ Encourage collection of aluminium cans, PET bottles and paper by providing separate labelled bins to enable these wastes to be segregated from other general refuse generated by the work force. ▪ Any unused chemicals or those with remaining functional capacity should be collected for reused as far as practicable. ▪ Proper storage and site practices to minimise the potential for damage or contamination of construction materials. ▪ Plan and stock construction materials carefully to minimise amount of waste generated and avoid unnecessary generation of waste.	Construction Phase					Ordinance
10.5.1.5	7.1	Inert and non-inert C&D materials should be handled and stored separately to avoid mixing the two types of materials.	Project Site Area / Construction Phase	Contractor		✓		Waste Disposal Ordinance
10.5.1.5	7.1	Any recyclable materials should be segregated from the non-inert C&D materials for collection by reputable licensed recyclers whereas the non-recyclable waste materials should be disposed of at the designated landfill site by a reputable licensed waste collector.	Project Site Area / Construction Phase	Contractor		✓		Waste Disposal Ordinance
10.5.1.6	7.1	A trip-ticket system promulgated shall be developed in order to monitor the off-site delivery of surplus inert C&D materials that could not be reused on-site for the proposed land formation work at the PFRF and to control fly tipping.	Project Site Area / Construction Phase	Contractor		✓		DEVB TC(W) No. 6/2010
10.5.1.6	7.1	The Contractor should prepare and implement a Waste Management Plan detailing various waste arising and waste management practices.	Construction Phase	Contractor		✓		Technical Circular (Works) No. 19/2005 Environmental Management on Construction Site

EIA Ref.	EM&A Ref.	Environmental Protection Measures	Location / Duration of measures Timing of completion of measures	Implementation Agent	Implementation Stage Des	C	O	Relevant Legislation & Guidelines
10.5.1.16	7.1	The following mitigation measures are recommended during excavation and treatment of the sediments: ▪ On-site remediation should be carried out in an enclosed area in order to minimise odour/dust emissions; ▪ The loading, unloading, handling, transfer or storage of treated and untreated sediment should be carried out in such a manner to prevent or minimise dust emissions; ▪ All practical measures, including but not limited to speed control for vehicles, should be taken to minimise dust emission; ▪ Good housekeeping should be maintained at all times at the sediment treatment facility and storage area; ▪ Treated and untreated sediment should be clearly separated and stored separately; and ▪ Surface runoff from the enclosed area should be properly collected and stored separately, and then properly treated to levels in compliance with the relevant effluent standards as required by the Water Pollution Control Ordinance before final discharge.	Project Site Area / Construction Phase	Contractor		✓		ProPECC Note PN 1/94
10.5.1.18	7.1	The marine sediments to be removed from the cable field joint area would be disposed of at the designated disposal sites to be allocated by the MFC. The following mitigation measures should be strictly followed to minimise potential impacts on water quality during transportation of the sediments requiring Type 1 disposal: ▪ Bottom opening of barges shall be fitted with tight fitting seals to prevent leakage of material. ▪ Monitoring of the barge loading shall be conducted to ensure that loss of material does not take place during transportation. Transport barges or vessels shall be equipped with automatic self-monitoring devices as specified by EPD. ▪ Barges or hopper barges shall not be filled to a level that would cause the overflow of materials or sediment laden water during loading or transportation.	Project Site Area / Construction Phase	Contractor		✓		PNAP ADV-21 Waste Disposal Ordinacne

EIA Ref.	EM&A Ref.	Environmental Protection Measures	Location / Duration of measures Timing of completion of measures	Implementation Agent	Implementation Stage			Relevant Legislation & Guidelines
					Des	C	O	
10.5.1.19	7.1	Contractor should register with the EPD as a chemical waste producer and to follow the relevant guidelines. The following measures should be implemented: ▪ Good quality containers compatible with the chemical wastes should be used; ▪ Incompatible chemicals should be stored separately; ▪ Appropriate labels must be securely attached on each chemical waste container indicating the corresponding chemical characteristics of the chemical waste, such as explosive, flammable, oxidizing, irritant, toxic, harmful, corrosive, etc; ▪ The contractor will use a licensed collector to transport and dispose of the chemical wastes at the approved Chemical Waste Treatment Centre or other licensed recycling facilities, in accordance with the Waste Disposal (Chemical Waste) (General) Regulation.	Project Site Area / Construction Phase	Contractor		✓		Waste Disposal Ordinance Code of Practice on the Packaging Labelling and Storage of Chemical Wastes Waste Disposal (Chemical Waste) (General) Regulation
10.5.1.20	7.1	General refuse should be stored in enclosed bins or compaction units separated from inert C&D material. A reputable waste collector should be employed by the contractor to remove general refuse from the site for disposal at designated landfill sites. An enclosed and covered area should be provided to reduce the occurrence of 'wind blown' light material.	Project Site Area / Construction Phase	Contractor		✓		Waste Disposal Ordinance
10.5.1.21	7.1	The future artificial seawall of the proposed Airport expansion area should be designed to achieve a shoreline that does not have any sharp turns or abrupt indentation in order to avoid or minimise any trapped or accumulated refuse.	Design Stage	Design Consultant	✓			
10.5.1.21	7.1	The construction contractors will be required to regularly check and clean any refuse trapped or accumulated along the newly constructed seawall. Such refuse will then be stored and disposed of together with the general refuse.	Project Site Area / Construction Phase	Contractor		✓		Waste Disposal Ordinance
Waste Management Implication – Operation Phase								
10.5.2.1	7.2	General refuse should be temporarily stored in proper container with covers, which should be regularly cleaned and checked for maintenance. General refuse should be collected on daily basis and delivered to the refuse collection point	Project Site Area / Operation Phase	AAHK			✓	Waste Disposal Ordinance

EIA Ref.	EM&A Ref.	Environmental Protection Measures	Location / Duration of measures Timing of completion of measures	Implementation Agent	Implementation Stage Des	C	O	Relevant Legislation & Guidelines
		accordingly. A reputable waste collector should be employed to remove the general refuse regularly for off-site disposal at designated landfill sites in order to avoid odour nuisance or pest/vermin problem. The following waste recycling initiatives should be implemented at the expanded airport: ▪ Recycling facilities should be provided in prominent areas in passenger terminal buildings to facilitate separation of recyclable waste by passengers; ▪ Recycling facilities should also be provided in refuse rooms of the passenger terminal buildings to facilitate separation of recyclable waste by tenants; ▪ Food waste recycling programme should be implemented at the airport to collect and recycle food waste; ▪ Food waste can be delivered to EPD's Organic Waste Treatment Facilities for recycling as compost; ▪ Food & beverage tenants are encouraged to recycle waste cooking oil (e.g., recycling of waste cooking oil to biodiesel); ▪ AAHK has stepped up on-site waste separation and recycling at the Airside Waste Station to raise the amount of recyclable materials recovered from aircraft cabin waste.						
10.5.2.2	7.2	Operators of the relevant facilities should register with EPD as a chemical waste producer and follow the guidelines stated in the "Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes". Good quality containers compatible with the chemical wastes should be used, and incompatible chemicals should be stored separately. Appropriate labels should be securely attached on each chemical waste container indicating the corresponding chemical characteristics of the chemical waste, such as explosive, flammable, oxidizing, irritant, toxic, harmful, corrosive, etc. Licensed collector should be deployed to transport and dispose of the chemical wastes at the approved Chemical Waste Treatment Centre or other licensed recycling facilities, in accordance with the Waste Disposal (Chemical Waste) (General) Regulation.	Project Site Area / Operation Phase	AAHK / Operators			✓	Waste Disposal Ordinance Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes Waste Disposal (Chemical Waste) (General) Regulation
10.5.2.3 to 10.5.2.5	7.2	Regular cleaning and inspection of seawall. If refuse is found during inspection, arrangements should be made to remove the refuse.	Project Site Area / Operation Phase	Contractor			✓	Waste Disposal Ordinance

EIA Ref.	EM&A Ref.	Environmental Protection Measures	Location / Duration of measures Timing of completion of measures	Implementation Agent	Implementation Stage Des	C	O	Relevant Legislation & Guidelines
Land Contamination – Construction Phase								
11.10.1.2 to 11.10.1.3	8.1	For areas inaccessible during site reconnaissance survey: ▪ Further site reconnaissance would be conducted once the areas are accessible in order to identify any land contamination concern for the areas. ▪ Subject to further site reconnaissance findings, a supplementary Contamination Assessment Plan (CAP) for additional site investigation (SI) (if necessary) may be prepared and submitted to EPD for endorsement prior to the commencement of SI at these areas. ▪ After completion of SI, the Contamination Assessment Report (CAR) will be prepared and submitted to EPD for approval prior to start of the proposed construction works at the golf course, the underground and above-ground fuel storage tank areas, emergency power generation units, airside petrol filling station and fuel tank room. ▪ Should remediation be required, Remediation Action Plan (RAP) and Remediation Report (RR) will be prepared for EPD's approval prior to commencement of the proposed remediation and any construction works respectively.	Project Site Area inaccessible during site reconnaissance / Prior to Construction Phase	AAHK/ Contractor	✓			Guidance Note for Contaminated Land Assessment and Remediation Guidance Manual for Use of Risk-based Remediation Goals for Contaminated Land Management Practice Guide for Investigation and Remediation of Contaminated Land
11.8.1.2	8.1	If contaminated soil is identified, the following mitigation measures are for the excavation and transportation of contaminated materials (if any): ▪ To minimize the incidents of construction workers coming in contact with any contaminated materials, bulk earth-moving excavation equipment should be employed; ▪ Contact with contaminated materials can be minimised by wearing appropriate clothing and personal protective equipment such as gloves and masks (especially when working directly with contaminated material), provision of washing facilities and prohibition of smoking and eating on site; ▪ Stockpiling of contaminated excavated materials on site should be avoided as far as possible; ▪ The use of any contaminated soil for landscaping purpose should be avoided unless pre-treatment was carried out;	Project Site Area / Construction Phase	Contractor		✓		Waste Disposal Ordinance (Cap 354) Waste Disposal (Chemical Waste) (General) Regulation (Cap 354)

EIA Ref.	EM&A Ref.	Environmental Protection Measures	Location / Duration of measures Timing of completion of measures	Implementation Agent	Implementation Stage Des	C	O	Relevant Legislation & Guidelines
		▪ Vehicles containing any excavated materials should be suitably covered to reduce dust emissions and/or release of contaminated wastewater; ▪ Truck bodies and tailgates should be sealed to prevent any discharge; ▪ Only licensed waste haulers should be used to collect and transport contaminated material to treatment/disposal site and should be equipped with tracking system to avoid fly tipping; ▪ Speed control for trucks carrying contaminated materials should be exercised. 8km/h is the recommended speed limit; ▪ Strictly observe all relevant regulations in relation to waste handling, such as Waste Disposal Ordinance (Cap 354), Waste Disposal (Chemical Waste) (General) Regulation (Cap 354) and obtain all necessary permits where required; and ▪ Maintain records of waste generation and disposal quantities and disposal arrangements.						
Terrestrial Ecological Impact – Construction Phase								
12.10.1.1	9.2	**Pre-construction Egretry Survey** Conduct ecological survey for Sha Chau egretry to update the latest boundary of the egretry.	Breeding season (April - July) prior to commencement of HDD drilling works at HKIA	Environmental Team*		✓		EIAO
12.7.2.3 and 12.7.2.6	9.1	**Avoidance and Minimisation of Direct Impact to Egretry** The daylighting location will avoid direct encroachment to the Sheung Sha Chau egretry. The daylighting location and mooring of flat top barge, if required, will be kept away from the egretry. In any event, controls such as demarcation of construction site boundary and confining the lighting within the site will be practised to minimise disturbance to off-site habitat at Sheung Sha Chau Island.	During construction phase at Sheung Sha Chau Island	AAHK /Contractor	✓	✓		EIAO
12.7.2.5	9.1	**Preservation of Nesting Vegetation** The proposed daylighting location and the arrangement of connecting pipeline will avoid the need of tree cutting, therefore the trees that are used by ardeids for nesting will be preserved.	During construction phase at Sheung Sha Chau Island	Contractor		✓		EIAO

EIA Ref.	EM&A Ref.	Environmental Protection Measures	Location / Duration of measures Timing of completion of measures	Implementation Agent	Implementation Stage Des	C	O	Relevant Legislation & Guidelines
12.7.2.4	9.1	**Timing the Pipe Connection Works outside Ardeid's Breeding Season** All HDD and related construction works on Sheung Sha Chau Island will be scheduled outside the ardeids' breeding season (between April and July). No night-time construction work will be allowed on Sheung Sha Chau Island during all seasons.	During construction phase at Sheung Sha Chau Island	AAHK/ Contractor	✓	✓		Wild Animals Protection Ordinance; EIAO
Marine Ecological Impact – Pre-construction Phase								
13.11.4.1	10.2.2	Pre-construction phase Coral Dive Survey	HKIAAA artificial seawall	Environmental Team*	✓			EIAO
Marine Ecological Impact – Construction Phase								
13.11.1.3 to 13.11.1.6	-	**Minimisation of Land Formation Area** Minimise the overall size of the land formation needed for the additional facilities to minimise the overall loss of habitat for marine resources, especially the CWD population.	Land formation footprint / during detailed design phase to completion of construction	Design Engineer and Contractor	✓	✓		EIAO
13.11.1.7 to 13.11.1.10	-	**Use of Construction Methods with Minimal Risk/Disturbance** ▪ Use of non-dredge method for the main land formation and ancillary works including the diversion of the aviation fuel pipeline to the AFRF; ▪ Use of Deep Cement Mixing (DCM) method instead of conventional seabed dredging for the land formation works to reduce the risk of negative impacts through the elevation of suspended solids and contaminants on CWDs, fisheries and the marine environment; ▪ Use of bored piling in short duration to form the new approach lights and marker beacons for the new runway; ▪ Avoid bored piling during CWD peak calving season (Mar to Jun); and ▪ Use of horizontal directional drilling (HDD) method and water jetting methods for placement of submarine cables and pipelines to minimise the disturbance to the CWDs and other marine ecological resources.	During construction phase at marine works area	Contractor		✓		EIAO
13.11.2.1 to	-	**Mitigation for Indirect Disturbance due to Deterioration of Water Quality**	All works area during the construction phase	Contractor		✓		EIAO

EIA Ref.	EM&A Ref.	Environmental Protection Measures	Location / Duration of measures Timing of completion of measures	Implementation Agent	Implementation Stage Des	C	O	Relevant Legislation & Guidelines
13.11.2.7		▪ Water quality mitigation measures during construction phases include consideration of alternative construction methods, deployment of silt curtain and good site practices; ▪ Alternative construction methods including use of non-dredge methods for ground improvement (e.g. Deep Cement Mixing (DCM), prefabricated vertical drains (PVD), sand compaction piles, steel cells, stone columns and vertical sand drains); ▪ Use of bored piling in short duration to form the new approach lights and marker beacons for the new runway; and ▪ Use of horizontal directional drilling (HDD) method and water jetting methods for placement of undersea cables and pipelines to minimise the disturbance to the CWDs and other marine ecological resources.						
13.11.1.12	-	**Strict Enforcement of No-Dumping Policy** ▪ A policy prohibiting dumping of wastes, chemicals, oil, trash, plastic, or any other substance that would potentially be harmful to dolphins and/or their habitat in the work area; ▪ Mandatory educational programme of the no-dumpling policy be made available to all construction site personnel for all project-related works; ▪ Fines for infractions should be implemented; and ▪ Unscheduled, on-site audits shall be implemented.	All works area during the construction phase	Contractor		✓		EIAO
13.11.1.13	-	**Good Construction Site Practices** ▪ Regular inspection of the integrity and effectiveness of all silt curtains and monitoring of effluents to ensure that any discharge meets effluent discharge guidelines. ▪ Keep the number of working or stationary vessels present on-site to the minimum anytime ▪ Unscheduled, on-site audits for all good site practice restrictions should be conducted, and fines or penalties sufficient to be an effective deterrent need to be levied against violators.	All works area during the construction phase	Contractor		✓		EIAO

EIA Ref.	EM&A Ref.	Environmental Protection Measures	Location / Duration of measures Timing of completion of measures	Implementation Agent	Implementation Stage Des	C	O	Relevant Legislation & Guidelines
13.11.5.4 to 13.11.5.13	10.3.1	**SkyPier High Speed Ferries' Speed Restrictions and Route Diversions** ▪ SkyPier HSFs operating to / from Zhuhai and Macau would divert north of SCLKC Marine Park with a 15 knot speed limit to apply for the part-journeys that cross high CWD abundance grid squares as indicatively shown in **Drawing No. MCL/P132/EIA/13-023**. Both the alignment of the northerly route and the portion of routings to be subject to the speed limit of 15 knots shall be finalised prior to commencement of construction based on the future review of up-to-date CWD abundance and EM&A data and taking reference to changes in total SkyPier HSF numbers. ▪ A maximum of 10 knots will be enforced through the designated SCLKC Marine Park area at all times.	Area between the footprint and SCLKC Marine Park during construction phase	AAHK	✓	✓		EIAO
13.11.5.14 to 13.11.5.18	10.3.1	**Dolphin Exclusion Zone** Establishment of a 24 hr Dolphin Exclusion Zone (DEZ) with a 250 m radius around the land formation works areas. ▪ A DEZ would also be implemented during ground improvement works (e.g. DCM), water jetting works for submarine cables diversion, open trench dredging at the field joint locations and seawall construction. ▪ A DEZ would also be implemented during bored piling work but as a precautionary measure only.	Marine waters around land formation works area during construction phase	Environmental Team*	✓	✓		EIAO
13.11.5.19	10.3.1	**Acoustic Decoupling of Construction Equipment** ▪ Air compressors and other noisy equipment that must be mounted on steel barges should be acoustically-decoupled to the greatest extent feasible, for instance by using rubber or air-filled tyres. ▪ Specific acoustic decoupling measures shall be specified during the detailed design of the project for use during the land formation works.	Around coastal works area during construction phase	Contractor	✓	✓		EIAO
13.11.5.20	10.3.1	**Spill Response Plan** ▪ An oil and hazardous chemical spill response plan is proposed to be established during the construction phase as a precautionary measure so that appropriate actions to prevent or reduce risks to CWDs can be undertaken in the	Construction phase	Contractor	✓	✓		EIAO

EIA Ref.	EM&A Ref.	Environmental Protection Measures	Location / Duration of measures Timing of completion of measures	Implementation Agent	Implementation Stage Des	C	O	Relevant Legislation & Guidelines
		event of an accidental spillage.						
13.11.5.21 to 13.11.5.23	10.3.1	**Construction Vessel Speed Limits and Skipper Training** ▪ A speed limit of 10 knots should be strictly observed for construction vessels at areas with the highest CWD densities (as currently indicated by the 1 x 1 km grid squares in Figure 6 of **Appendix 13.2**). ▪ Vessels traversing through the work areas should be required to use predefined and regular routes (which would presumably become known to resident dolphins) to reduce disturbance to cetaceans due to vessel movements. Specific marine routes shall be specified by the Contractor prior to construction commencing.	All areas north and west of Lantau Island during construction phase	Contractor	✓	✓		EIAO
Marine Ecological Impact – Operation Phase								
13.11.5.24 to 13.11.5.43	10.3.2	**Establishment of New Marine Protected Areas/Linking of Existing Marine Parks** ▪ establishment of a new marine park matrix that would comprise a new marine protection area around HKIA, adding an area of 2,400 ha and also providing critical linkages between the current SCLKCMP (an area of 1,200 ha) and the planned BMP (an area of 850 ha). Together, all three marine parks would make up 4,450 ha of CWD marine park area. ▪ A speed limit of 10 knots for all vessels to travel within the marine parks areas. ▪ A detailed study initiated and led by AAHK will be carried out during the construction phase to review relevant previous studies and collate available information on the ecological characters of the proposed area for marine park designation and review available survey data marine traffic and planned development projects in the vicinity. Based on the findings, ecological profiles of the proposed area for marine park designation would be established and the extent and location of the proposed marine park be determined. ▪ A management plan for the proposed marine park will be proposed in consultation with AFCD, covering information on the responsible departments for operation and management	Around the airport island / Operational Phase	AAHK	✓		✓	EIAO

EIA Ref.	EM&A Ref.	Environmental Protection Measures	Location / Duration of measures Timing of completion of measures	Implementation Agent	Implementation Stage Des	C	O	Relevant Legislation & Guidelines
		(O&M) of the marine park, as well as the O&M duties of each of the departments involved. The management plan will be submitted to Director of Environmental Protection (DEP) for approval before the commissioning of the 3RS project.						
13.11.5.44 to 13.11.5.50	10.3.2	**SkyPier High Speed Ferries' Speed Restrictions and Route Diversions** ▪ A speed limit of 15 knots for SkyPier HSFs operating to and from Zhuhai and Macau continue to divert north of SCLKCMP transiting through those areas with the relatively-high CWD densities. ▪ A speed limit of 10 knots for all vessels to travel within the marine parks areas.	Around the airport island / Operational Phase	AAHK (outside Marine Park) AFCD (inside Marine Park)			✓	EIAO
13.11.5.51 to 13.11.5.52	10.3.2	**Operational Spill Response Plan** ▪ Fuel pipelines and hydrant systems should be designed with adequate protection and pressure / leakage detection systems. ▪ A 'spill trap containment system' should be designed and provided at aircraft apron and stand areas. ▪ An emergency spill response plan should be in place to provide timely and effective response and remediation of spillage events. ▪ Spill response equipment should be available on site and regularly checked and maintained. ▪ Operation of the fuel supply and refuelling systems should be restricted to qualified and trained personnel with adequate knowledge of the spill response procedures in place. ▪ A penalty system should be set up to discourage poor practices associated with maintenance of aircraft, vehicle and refuelling systems by airport tenants and franchisees. ▪ Detailed records of all spillage events should be kept and maintained.	Operational Phase	AAHK			✓	EIAO
Fisheries Impact – Construction Phase								
14.9.1.2	-	**Minimisation of Land Formation Area**	Land formation footprint /	Design Engineer	✓	✓	✓	EIAO

EIA Ref.	EM&A Ref.	Environmental Protection Measures	Location / Duration of measures Timing of completion of measures	Implementation Agent	Implementation Stage Des	C	O	Relevant Legislation & Guidelines
to 14.9.1.5		▪ Minimise the overall size of the land formation needed for the additional facilities to minimise the overall loss of habitat for fisheries resources.	during detailed design phase to completion of construction	and Contractor				
14.9.1.6	-	**Use of Construction Methods with Minimal Risk/Disturbance** ▪ Use of non-dredge method for the main land formation and ancillary works including the diversion of the aviation fuel pipeline to the AFRF; ▪ Use of Deep Cement Mixing (DCM) method instead of conventional seabed dredging for the land formation works to reduce the risk of negative impacts through the elevation of suspended solids and contaminants on fisheries and the marine environment; ▪ Use of bored piling in short duration to form the new approach lights and marker beacons for the new runway; and ▪ Use of horizontal directional drilling (HDD) method and water jetting methods for placement of undersea cables and pipelines to minimise the disturbance to fisheries resources.	During construction phase at marine works area	Contractor		✓		EIAO
14.9.1.11	-	**Strict Enforcement of No-Dumping Policy** ▪ A policy prohibiting dumping of wastes, chemicals, oil, trash, plastic, or any other substance that would potentially be harmful to dolphins and/or their habitat in the work area; ▪ Mandatory educational programme of the no-dumpling policy be made available to all construction site personnel for all project-related works; ▪ Fines for infractions should be implemented; and ▪ Unscheduled, on-site audits shall be implemented.	All works area during the construction phase	Contractor		✓		EIAO
14.9.1.12	-	**Good Construction Site Practices** ▪ Regular inspection of the integrity and effectiveness of all silt curtains and monitoring of effluents to ensure that any discharge meets effluent discharge guidelines. ▪ Keep the number of working or stationary vessels present on-site to the minimum anytime ▪ Unscheduled, on-site audits for all good site practice restrictions should be conducted, and fines or penalties	All works area during the construction phase	Contractor		✓		EIAO

EIA Ref.	EM&A Ref.	Environmental Protection Measures	Location / Duration of measures Timing of completion of measures	Implementation Agent	Implementation Stage Des	C	O	Relevant Legislation & Guidelines
		sufficient to be an effective deterrent need to be levied against violators.						
14.9.1.13 to 14.9.1.18	-	**Mitigation for Indirect Disturbance due to Deterioration of Water Quality** ▪ Water quality mitigation measures during construction phases include consideration of alternative construction methods, deployment of silt curtain and good site practices. ▪ Alternative construction methods including use of non-dredge methods for ground improvement (e.g. Deep Cement Mixing (DCM), prefabricated vertical drains (PVD), sand compaction piles, steel cells, stone columns and vertical sand drains) ▪ Use of bored piling in short duration to form the new approach lights and marker beacons for the new runway; ▪ Use of horizontal directional drilling (HDD) method and water jetting methods for placement of undersea cables and pipelines to minimise the disturbance to fisheries resources.	All works area during the construction phase	Contractor		✓		EIAO
Fisheries Impact – Operation Phase								
14.9.1.19 to 14.9.1.30	11.2	**Compensation for the Loss of Fisheries Habitats (and Resources) and Fishing Ground** ▪ Establishment of marine park at north, west and east of the proposed land formation footprint and HKIAAA extension. ▪ All these marine protected areas with regulation of fishing activities. The potential fisheries resources recovery due to the enhanced protection measures apply for Marine Park and the synergic effect of the connected marine protected areas will benefit to the adjacent fishing grounds.	Operational Phase	AAHK	✓		✓	EIAO
Landscape and Visual Impact – Construction Phase								
Table 15.6	12.3	**CM1 -** The construction area and contractor's temporary works areas should be minimised to avoid impacts on adjacent landscape.	All works areas for duration of works; Upon handover and completion of works.	Contractor		✓		
Table	12.3	**CM2 -** Reduction of construction period to practical minimum.	All works areas for	Contractor		✓		

EIA Ref.	EM&A Ref.	Environmental Protection Measures	Location / Duration of measures Timing of completion of measures	Implementation Agent	Implementation Stage Des	 C	 O	Relevant Legislation & Guidelines
15.6			duration of works; Upon handover and completion of works.					
Table 15.6	12.3	**CM3 -** Phasing of the construction stage to reduce visual impacts during the construction phase.	All works areas for duration of works; Upon handover and completion of works.	Contractor		✓		
Table 15.6	12.3	**CM4 -** Construction traffic (land and sea) including construction plants, construction vessels and barges should be kept to a practical minimum.	All works areas for duration of works; Upon handover and completion of works.	Contractor		✓		
Table 15.6	12.3	**CM5 -** Erection of decorative mesh screens or construction hoardings around works areas in visually unobtrusive colours.	All works areas for duration of works; Upon handover and completion of works. – may be disassembled in phases	Contractor		✓		
Table 15.6	12.3	**CM6 -** Avoidance of excessive height and bulk of site buildings and structures.	New passenger concourse, terminal 2 expansion and other proposed airport related buildings and structures under the project; Upon handover and completion of works.	Design Engineer	✓			
Table 15.6	12.3	**CM7** - Control of night-time lighting by hooding all lights and through minimisation of night working periods.	All works areas for duration of works; Upon handover and completion of works. – may be disassembled in phases	Contractor		✓		EIAO Guidance Note No. 8/2010;
Table 15.6	12.3	**CM8 -** All existing trees shall be carefully protected during construction. Detailed Tree Protection Specification shall be provided in the Contract Specification. Under this specification, the Contractor shall be required to submit, for approval, a	All existing trees to be retained; Upon handover and completion of works.	Contractor	✓	✓		Protection of Endangered Species of Animals and Plants Ordinance (Cap 586);

EIA Ref.	EM&A Ref.	Environmental Protection Measures	Location / Duration of measures Timing of completion of measures	Implementation Agent	Implementation Stage Des	C	O	Relevant Legislation & Guidelines
		detailed working method statement for the protection of trees prior to undertaking any works adjacent to all retained trees, including trees in contractor's works areas.						Land Administration Office, Lands Department Practice Note 7/2007 - Tree Preservation and Tree Removal Application for Building Development in Private Projects; Hong Kong International Airport Approved Plant Species List (Revision 3: June. 2007); GEO 1/2011 – Technical Guidelines on Landscape Treatment for Slopes Land Administration Office Instruction (LAOI) Section D-12 – Tree Preservation; ETWB TCW No. 2/2004 – Maintenance of Vegetation and Hard Landscape Features; ETWB TCW No. 29/2004 – Registration of Old and Valuable Trees, and Guidelines for their Preservation; ETWB TCW No. 10/2013 - Tree Preservation; ETWB (2/2007) - General Guidelines on Tree Pruning; GLTMS (12/2012) - Guidelines for Tree Risk

EIA Ref.	EM&A Ref.	Environmental Protection Measures	Location / Duration of measures Timing of completion of measures	Implementation Agent	Implementation Stage Des	C	O	Relevant Legislation & Guidelines
								Assessment and Management on an Area Basis and on a Tree Basis; GLTMS (3/2012) - Minimising Tree Risks (leaflet).
Table 15.6	12.3	**CM9 -** Trees unavoidably affected by the works shall be transplanted where practical. A detailed Tree Transplanting Specification shall be provided in the Contract Specification, if applicable. Sufficient time for necessary tree root and crown preparation periods shall be allowed in the project programme.	All existing trees to be affected by the works; Upon handover and completion of works.	Contractor	✓	✓		Protection of Endangered Species of Animals and Plants Ordinance (Cap 586); Land Administration Office, Lands Department Practice Note 7/2007 - Tree Preservation and Tree Removal Application for Building Development in Private Projects; Hong Kong International Airport Approved Plant Species List (Revision 3: June. 2007); GEO 1/2011 – Technical Guidelines on Landscape Treatment for Slopes Land Administration Office Instruction (LAOI) Section D-12 – Tree Preservation; ETWB TCW No. 2/2004 – Maintenance of Vegetation and Hard Landscape Features; ETWB TCW No. 29/2004 – Registration

EIA Ref.	EM&A Ref.	Environmental Protection Measures	Location / Duration of measures Timing of completion of measures	Implementation Agent	Implementation Stage Des	C	O	Relevant Legislation & Guidelines
								of Old and Valuable Trees, and Guidelines for their Preservation; ETWB TCW No. 10/2013 - Tree Preservation; ETWB (2/2007) - General Guidelines on Tree Pruning; GLTMS (12/2012) - Guidelines for Tree Risk Assessment and Management on an Area Basis and on a Tree Basis; GLTMS (3/2012) - Minimising Tree Risks (leaflet).
Table 15.6	12.3	**CM10 -** Land formation works shall be followed with advanced hydroseeding around taxiways and runways as soon as practical.	All affected existing grass areas around runways and verges/Duration of works; Upon handover and completion of works.	Contractor	✓	✓		
Landscape and Visual Impact – Operation Phase								
Table 15.7	12.3	**OM1** - Sensitive landscape design of reclamation edge by incorporating different angles of gradient and the use of a range of armour rock sizes placed randomly in a riprap approach for an irregular appearance. Planting of native coastal plants shall be incorporated.	New land formation edge ; Completion of Design Stage.	Design Engineer	✓			
Table 15.7	12.3	**OM2** - All above ground structures, including, Vent Shafts, Emergency and Firemen's' Accesses etc. shall be, either fully integrated with the planned buildings, or sensitively designed in a manner that responds to the existing and planned urban context, and minimises potential adverse landscape and visual impacts.	All locations of above ground structures; Completion of Design Stage.	Design Engineer	✓			ETWB TCW No. 36/2004 The Advisory Committee on the Appearance of Bridges and Associated Structures (ACABAS).

EIA Ref.	EM&A Ref.	Environmental Protection Measures	Location / Duration of measures Timing of completion of measures	Implementation Agent	Implementation Stage Des	C	O	Relevant Legislation & Guidelines
Table 15.7	12.3	**OM3** - Sensitive design of buildings and structures in terms of scale, height and bulk (visual weight).	All locations of above ground structures; Completion of Design Stage.	Design Engineer	✓			Hong Kong Planning Standards and Guidelines; Hong Kong 2030 Planning Vision and Strategy Final Report; DEVB TC (W) No.2/2013 Greening on Footbridges and Flyovers; ETWB TCW No. 36/2004 The Advisory Committee on the Appearance of Bridges and Associated Structures (ACABAS); PNAP 152 - Sustainable Building Design Guidelines.
Table 15.7	12.3	**OM4** - Use appropriate building materials and colours in built structures to create cohesive visual mass	All locations of above ground structures; Completion of Design Stage.	Design Engineer	✓			DEVB TC (W) No.2/2013 Greening on Footbridges and Flyovers; ETWB TCW No. 36/2004 The Advisory Committee on the Appearance of Bridges and Associated Structures (ACABAS).
Table 15.7	12.3	**OM5** - Lighting units to be directional and minimise unnecessary light spill and glare.	All locations within the project site boundary; Completion of Design Stage.	Design Engineer	✓			
Table 15.7	12.3	**OM6** - Greening measures, including vertical greening, green roofs, road verge planting and peripheral screen planting shall	All locations within the project site boundary	Contractor	✓		✓	Hong Kong International Airport Approved Plant

EIA Ref.	EM&A Ref.	Environmental Protection Measures	Location / Duration of measures Timing of completion of measures	Implementation Agent	Implementation Stage Des	 C	 O	Relevant Legislation & Guidelines
		be implemented.	where greening measures can be implemented as far as possible; Ongoing duration.					Species List (Revision 3: June. 2007); GEO publication (1/2009) – Prescriptive Measures for Man-made Slopes and Retaining Walls; GEO 1/2011 – Technical Guidelines on Landscape Treatment for Slopes Land Administration Office Instruction (LAOI) Section D-12 – Tree Preservation; DEVB TC (W) No.2/2012 Allocation of Space for Quality Greening on Roads; DEVB TC (W) No.3/2012 Site Coverage of Greenery for Government Building Projects; DEVB TC (W) No.2/2013 Greening on Footbridges and Flyovers; ETWB TCW No. 2/2004 – Maintenance of Vegetation and Hard Landscape Features; ETWB TCW No. 29/2004 – Registration of Old and Valuable Trees, and Guidelines for their Preservation;

EIA Ref.	EM&A Ref.	Environmental Protection Measures	Location / Duration of measures Timing of completion of measures	Implementation Agent	Implementation Stage Des	C	O	Relevant Legislation & Guidelines
								ETWB TCW No. 10/2013 - Tree Preservation; WBTC No. 7/2002 – Tree Planting in Public Works; PNAP 152 - Sustainable Building Design Guidelines.
Table 15.7	12.3	**OM7** - Compensatory Tree Planting for all felled trees shall be provided to the satisfaction of relevant Government departments. Required numbers and locations of compensatory trees shall be determined and agreed separately with Government during the Tree Felling Application process under the relevant technical circulars.	All trees effected by the works; Upon handover and completion of works.	Contractor	✓	✓	✓	Protection of Endangered Species of Animals and Plants Ordinance (Cap 586); Hong Kong International Airport Approved Plant Species List (Revision 3: June. 2007); Land Administration Office Instruction (LAOI) Section D-12 – Tree Preservation; ETWB TCW No. 2/2004 – Maintenance of Vegetation and Hard Landscape Features; ETWB TCW No. 29/2004 – Registration of Old and Valuable Trees, and Guidelines for their Preservation; ETWB TCW No. 10/2013 - Tree Preservation; WBTC No. 7/2002 – Tree Planting in Public Works;

EIA Ref.	EM&A Ref.	Environmental Protection Measures	Location / Duration of measures Timing of completion of measures	Implementation Agent	Implementation Stage Des	C	O	Relevant Legislation & Guidelines
								ETWB (2/2007) - General Guidelines on Tree Pruning.
Table 15.7	12.3	**OM8** - Streetscape (e.g. paving, signage, street furniture, lighting etc.) shall be sensitively designed in a manner that responds to the existing and planned urban context, and minimises potential adverse landscape and visual impacts.	All locations of streetscape treatment works; Completion of Design Stage.	Design Engineer	✓			ETWB TCW No. 2/2004 – Maintenance of Vegetation and Hard Landscape Features.
Table 15.7	12.3	**OM9** - All streetscape areas and hard and soft landscape areas disturbed during construction shall be reinstated to equal or better quality (due to implementation of screen planting, road verge planting etc.), to the satisfaction of the relevant Government departments.	All locations of streetscape treatment works; Upon handover and completion of works.	Contractor		✓		Land Administration Office, Lands Department Practice Note 7/2007 - Tree Preservation and Tree Removal Application for Building Development in Private Projects; Hong Kong International Airport Approved Plant Species List (Revision 3: June. 2007); GEO 1/2011 – Technical Guidelines on Landscape Treatment for Slopes; Land Administration Office Instruction (LAOI) Section D-12 – Tree Preservation; ETWB TCW No. 2/2004 – Maintenance of Vegetation and Hard Landscape Features; ETWB TCW No. 10/2013 - Tree Preservation; ETWB (2/2007) - General Guidelines on

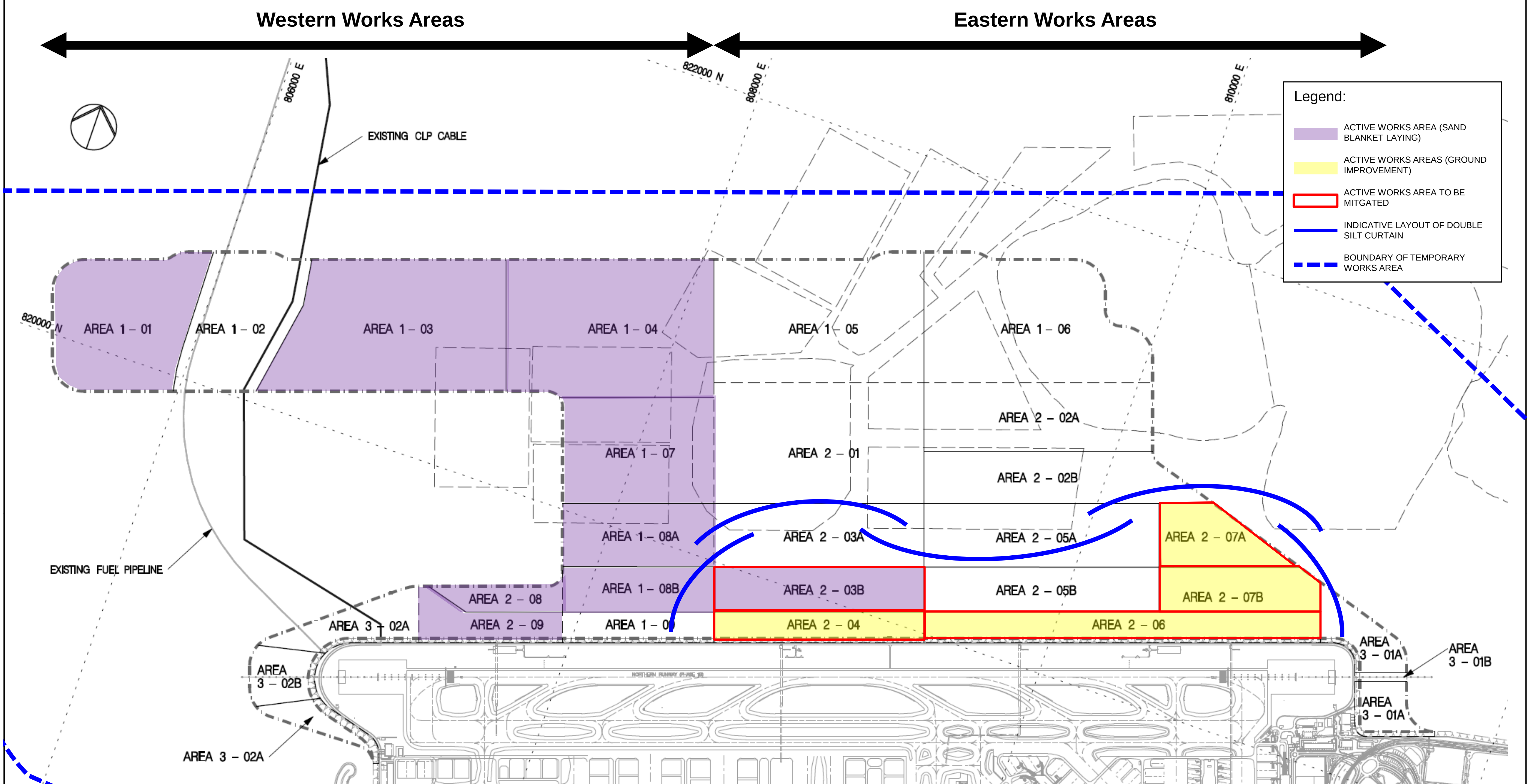
EIA Ref.	EM&A Ref.	Environmental Protection Measures	Location / Duration of measures Timing of completion of measures	Implementation Agent	Implementation Stage Des	C	O	Relevant Legislation & Guidelines
								Tree Pruning; GLTMS (12/2012) - Guidelines for Tree Risk Assessment and Management on an Area Basis and on a Tree Basis; GLTMS (3/2012) - Minimising Tree Risks (leaflet).
Table 15.7	12.3	**OM10** - Aesthetic improvement planting of viaduct structure through greening of structure to mitigate visual impact of viaduct form.	All locations of viaduct structures; Ongoing duration.	Design Engineer	✓	✓		Hong Kong International Airport Approved Plant Species List (Revision 3: June. 2007); DEVB TC (W) No.2/2013 Greening on Footbridges and Flyovers; ETWB TCW No. 36/2004 The Advisory Committee on the Appearance of Bridges and Associated Structures (ACABAS).
Table 15.7	12.3	**OM11 -** Sensitive design of footbridges, noise barriers and enclosures with greening (screen planting/climbers/planters) and chromatic measures.	All locations of viaduct structures; Ongoing duration.	Design Engineer	✓			Hong Kong International Airport Approved Plant Species List (Revision 3: June. 2007); DEVB TC (W) No.2/2013 Greening on Footbridges and Flyovers; ETWB TCW No. 36/2004 The Advisory Committee on the Appearance of Bridges and Associated

EIA Ref.	EM&A Ref.	Environmental Protection Measures	Location / Duration of measures Timing of completion of measures	Implementation Agent	Implementation Stage Des	 C	 O	Relevant Legislation & Guidelines
								Structures (ACABAS).
Cultural Heritage Impact – Construction Phase								
Not applicable								
Cultural Heritage Impact – Operation Phase								
Not applicable								
Health Impact – Aircraft Emissions								
Not applicable								
Health Impact – Aircraft Noise								
Not applicable								

Notes: Des=Design; C=Construction; O=Operation

* Environmental Team (ET) represents the ET specified in the Environmental Monitoring and Audit Manual.

Appendix D Configuration of Silt Curtains



Description

Based on Year 2016 Q1 results, adverse SS impacts not expected at WSRs located to the west of the project , thus silt curtain deployment should focus on south-eastern works areas during sand blanket laying activities.

Note:

- All silt curtains shall be located entirely within the boundary of the temporary works area
- The gaps between overlapping silt curtains are approx. 100m wide (to enable marine vessel access) with an overlapping length of at least 150m.
- The proposed silt curtain arrangement is indicative and subject to adjustment to suit the actual construction sequence, site conditions, marine traffic considerations, and the contractor's working methods.

Rev.	Date	Description	Checked
A	16MAY14	GENERAL REVISION	DC

香港國際機場 HONG KONG INTERNATIONAL AIRPORT

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Title
INDICATIVE CONFIGURATION OF MITIGATION MEASURES (SNAPSHOT FOR END OF 2016 Q1)

Consultant's Signatures for Approval		Date
Design	DC	16MAY14
Checkers	DC	16MAY14
Design Supervisor	EC	16MAY14
Authorised Representative	AFK	16MAY14

EXPANSION OF HONG KONG INTERNATIONAL AIRPORT INTO A THREE-RUNWAY SYSTEM

Drawing No. Figure 1

Scale at A3 1:17500

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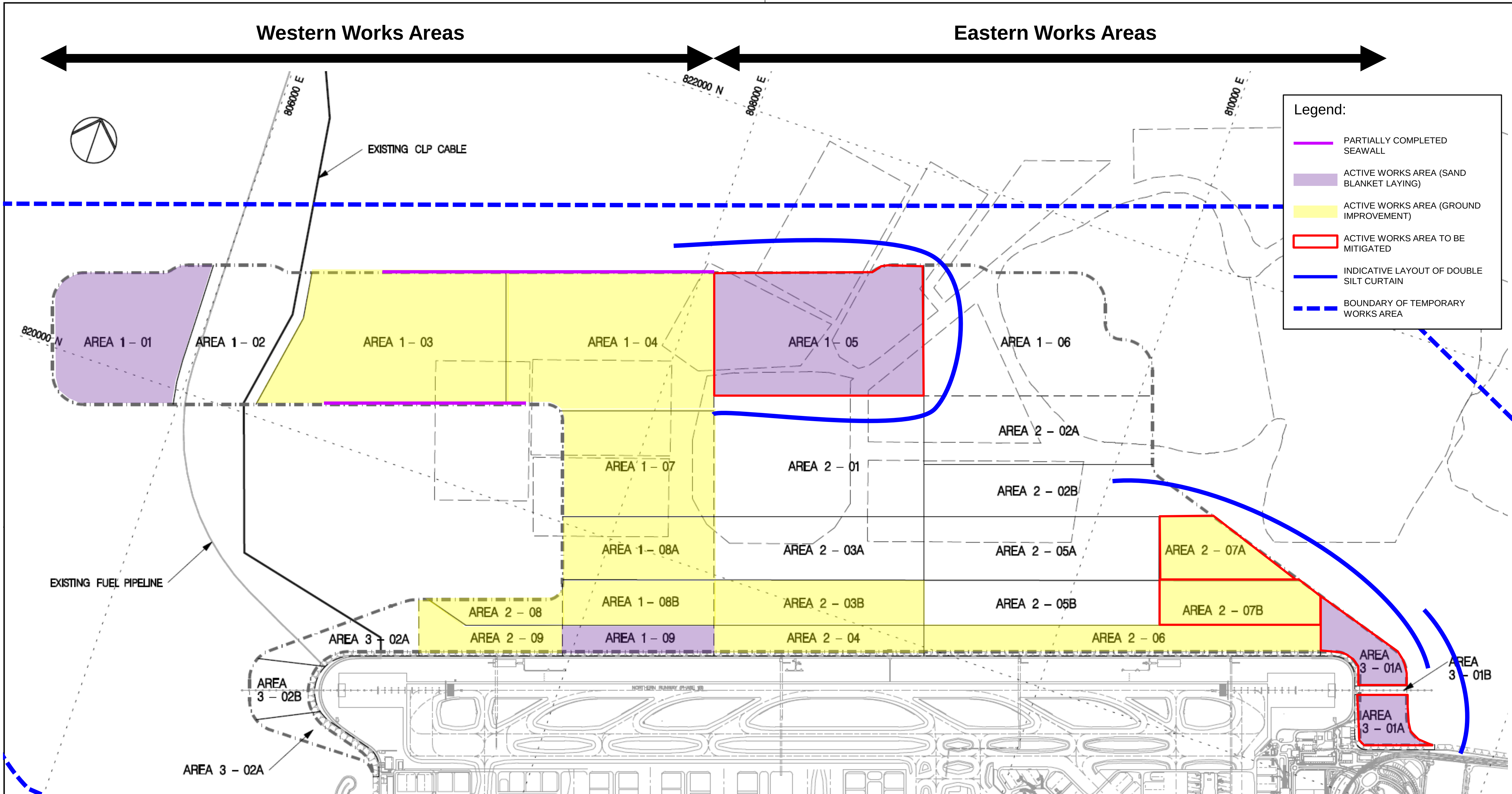

Description

Specific mitigation not required for ground improvement activities. Based on Year 2016 Q1 results, adverse SS impacts not expected at WSRs located to the west of the project, thus silt curtain deployment focus on sand blanket laying activities near the eastern side of the project boundary (at works area 1-05 and 3-01A). Additional silt curtain covering works areas 2-07A and 2-07B proposed as a precautionary measure. Due to the large extent of the works areas and the multiple works fronts, deployment of silt curtains to completely surround the works areas is not feasible. Hence silt curtain arrangement should target mitigation of potential SS impacts to WSRs located to the east and northeast of the project.

Note:

- All silt curtains shall be located entirely within the boundary of the temporary works area
- The gaps between overlapping silt curtains are approx. 100m wide (to enable marine vessel access) with an overlapping length of at least 150m.
- The proposed silt curtain arrangement is indicative and subject to adjustment to suit the actual construction sequence, site conditions, marine traffic considerations, and the contractor's working methods.

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Title: INDICATIVE CONFIGURATION OF MITIGATION MEASURES (SNAPSHOT FOR END OF 2016 Q2)

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Design	DC	16MAY14
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Design Supervisor	EC	16MAY14
Authorised Representative	AFK	16MAY14

EXPANSION OF HONG KONG INTERNATIONAL AIRPORT INTO A THREE-RUNWAY SYSTEM

Drawing No. Figure 2

Scale at A3 1:17500

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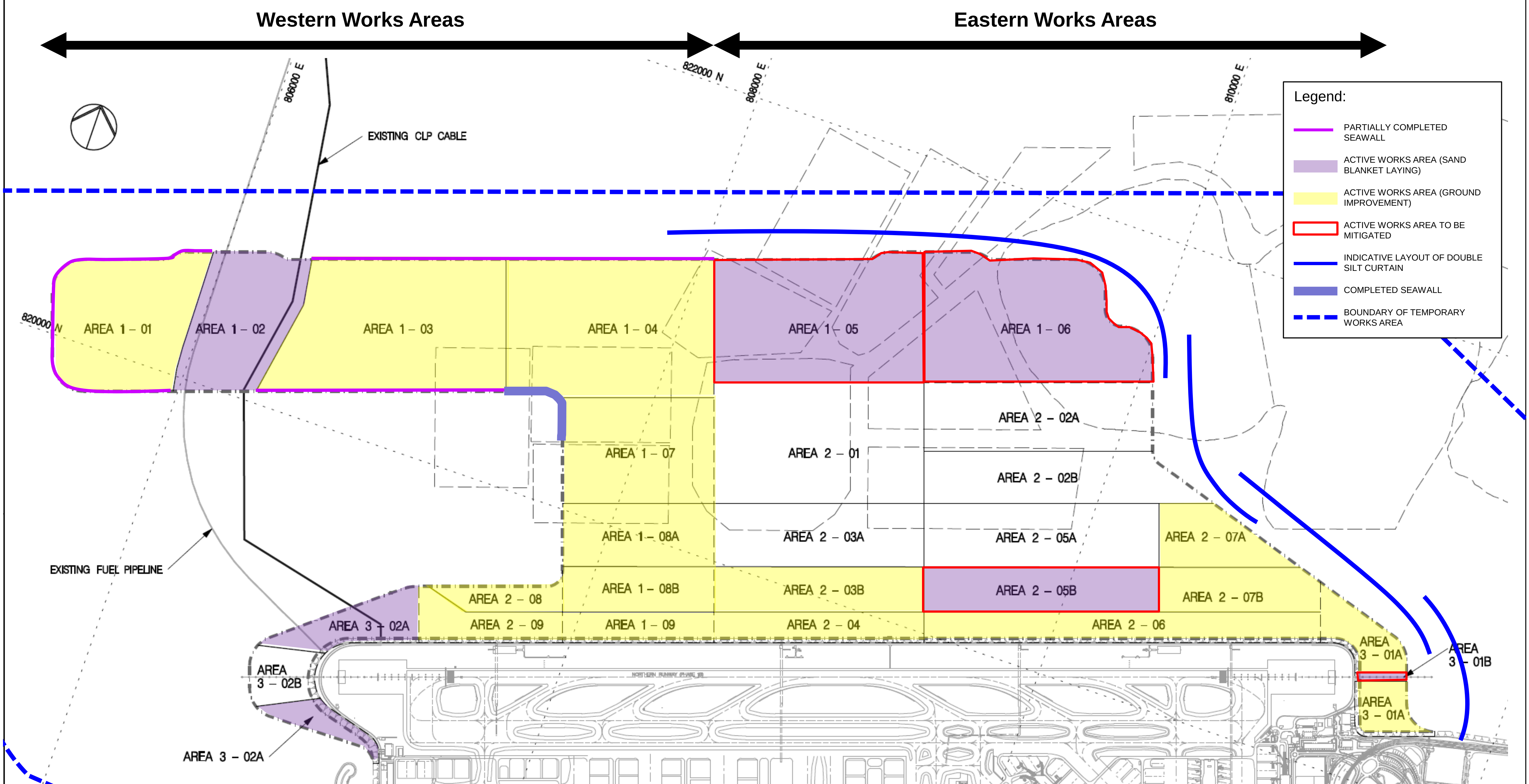

<u>Description</u>

Specific mitigation not required for ground improvement activities. Based on Year 2016 Q1 results, adverse SS impacts not expected at WSRs located to the west of the project, thus silt curtain deployment focus on sand blanket laying activities near the eastern side of the project boundary (at works area 1-05, 1-06, 2-05B and 3-01B). Silt curtain covering works areas 2-07A and 2-07B retained to further minimise SS release at the eastern works areas. Due to the large extent of the works areas and the multiple works fronts, deployment of silt curtains to completely surround the works areas is not feasible. Hence silt curtain arrangement should target mitigation of potential SS impacts to WSRs located to the east and northeast of the project.

Note:

- All silt curtains shall be located entirely within the boundary of the temporary works area
- The gaps between overlapping silt curtains are approx. 100m wide (to enable marine vessel access) with an overlapping length of at least 150m.
- The proposed silt curtain arrangement is indicative and subject to adjustment to suit the actual construction sequence, site conditions, marine traffic considerations, and the contractor's working methods.

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Consultant's Signatures for Approval		Date
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Design Supervisor	EC	16MAY14
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EXPANSION OF HONG KONG INTERNATIONAL AIRPORT INTO A THREE-RUNWAY SYSTEM

Drawing No. Figure 3

Scale at A3 1:17500

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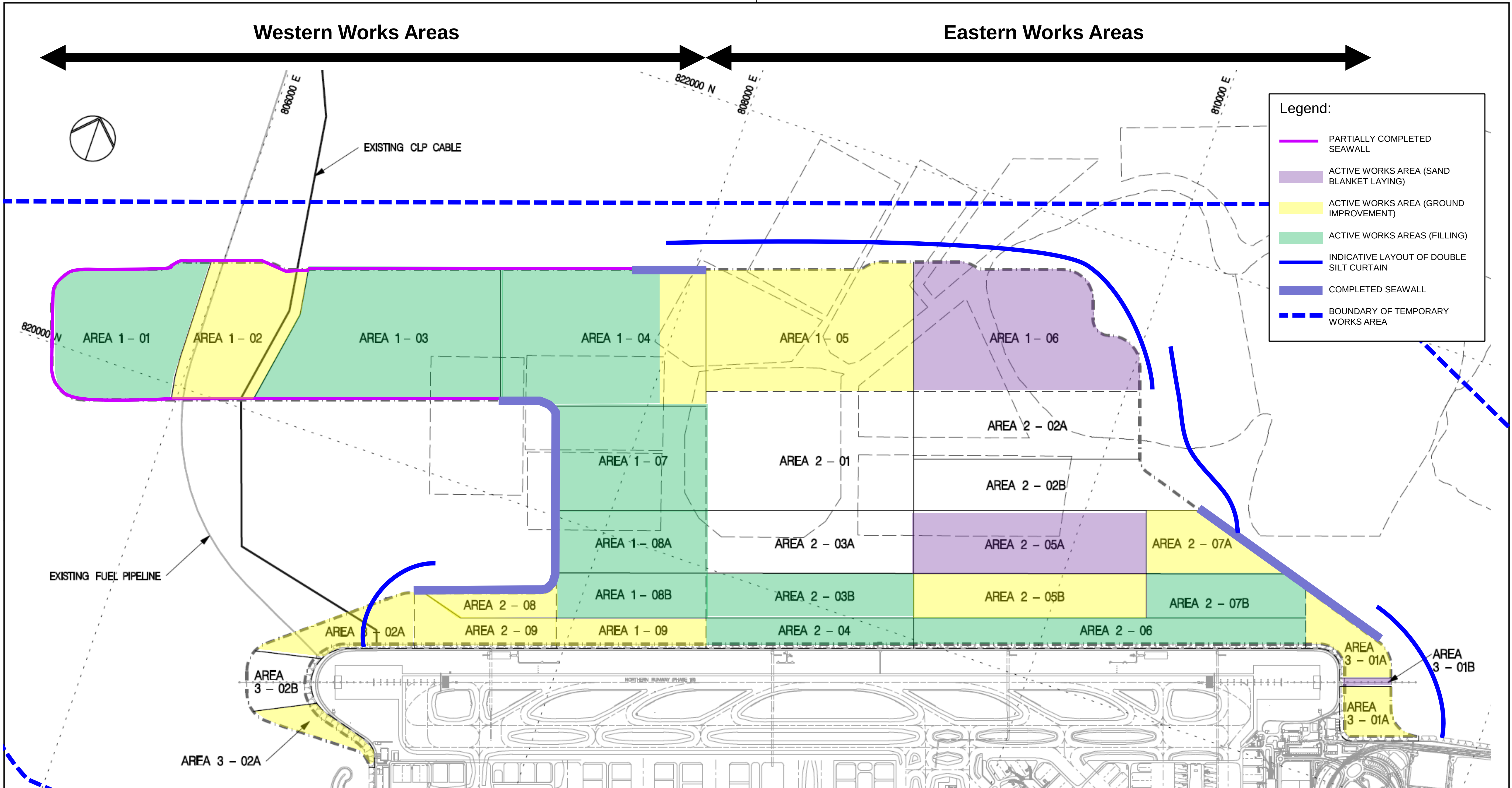

Description

Specific mitigation not required for ground improvement activities. With partial completion of the seawall, silt curtains can be more effectively deployed around all remaining seawall gaps to minimise SS release. Therefore, all active works areas (except works area 3-02A) would be mitigated.

Note:

- All silt curtains shall be located entirely within the boundary of the temporary works area
- The gaps between overlapping silt curtains are approx. 100m wide (to enable marine vessel access) with an overlapping length of at least 150m.
- The proposed silt curtain arrangement is indicative and subject to adjustment to suit the actual construction sequence, site conditions, marine traffic considerations, and the contractor's working methods.

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HONG KONG INTERNATIONAL AIRPORT 香港國際機場

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INDICATIVE CONFIGURATION OF MITIGATION MEASURES (SNAPSHOT FOR END OF 2016 Q4)

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Design Supervisor	EC	16MAY14
Authorised Representative	AFK	16MAY14

EXPANSION OF HONG KONG INTERNATIONAL AIRPORT INTO A THREE-RUNWAY SYSTEM

Drawing No. Figure 4

Scale at A3 1:17500

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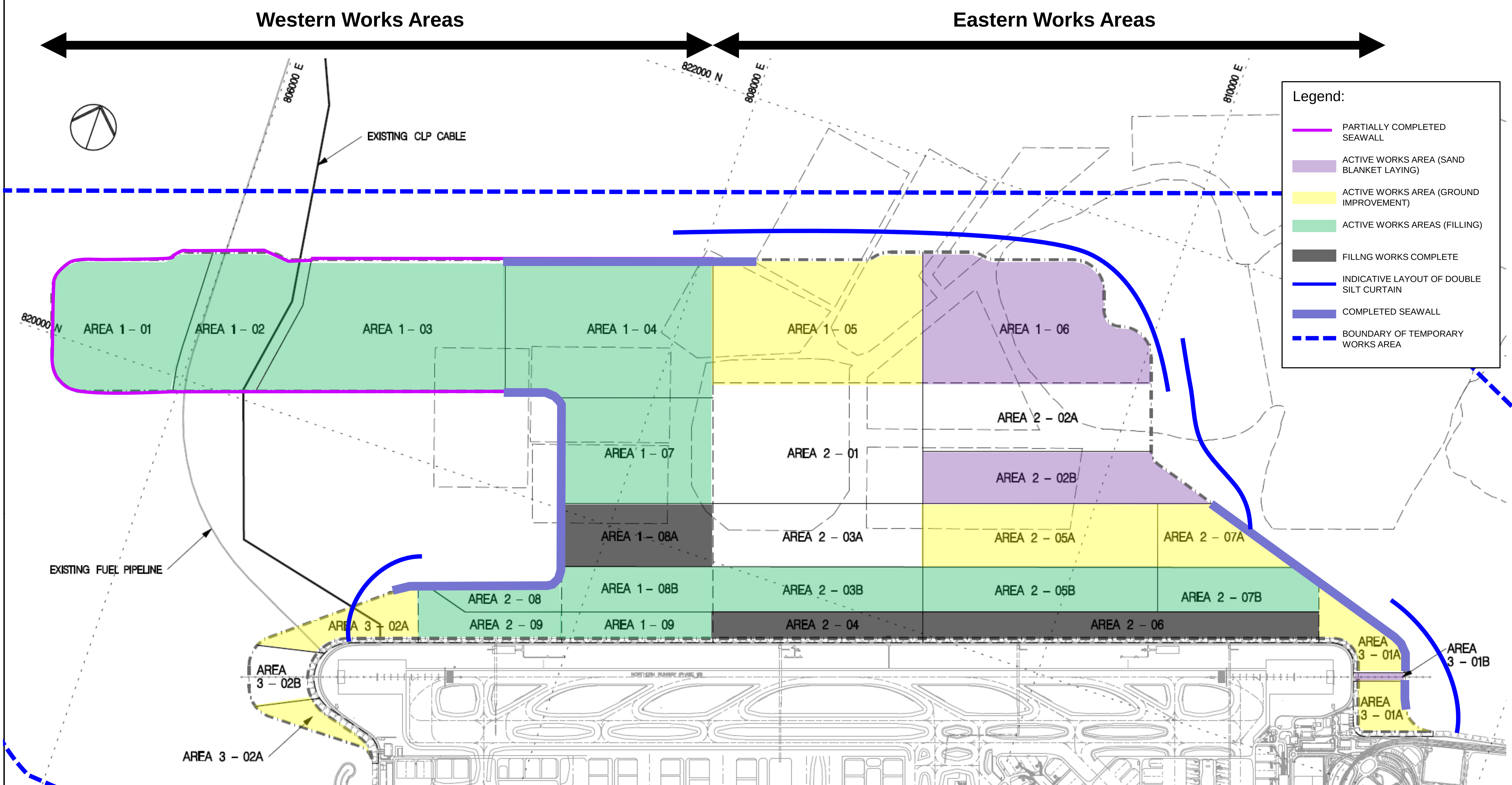

Description

Specific mitigation not required for ground improvement activities. With partial completion of the seawall, silt curtains can be more effectively deployed around all remaining seawall gaps to minimise SS release. Therefore, all active works areas (except works area 3-02A) would be mitigated.

Note:

- All silt curtains shall be located entirely within the boundary of the temporary works area
- The gaps between overlapping silt curtains are approx. 100m wide (to enable marine vessel access) with an overlapping length of at least 150m.
- The proposed silt curtain arrangement is indicative and subject to adjustment to suit the actual construction sequence, site conditions, marine traffic considerations, and the contractor's working methods.

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INDICATIVE CONFIGURATION OF MITIGATION MEASURES (SNAPSHOT FOR END OF 2017 Q1)

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Design Supervisor	EC	16MAY14
Authorised Representative	AFK	16MAY14

EXPANSION OF HONG KONG INTERNATIONAL AIRPORT INTO A THREE-RUNWAY SYSTEM

Drawing No. Figure 5

Scale at A3 1:17500

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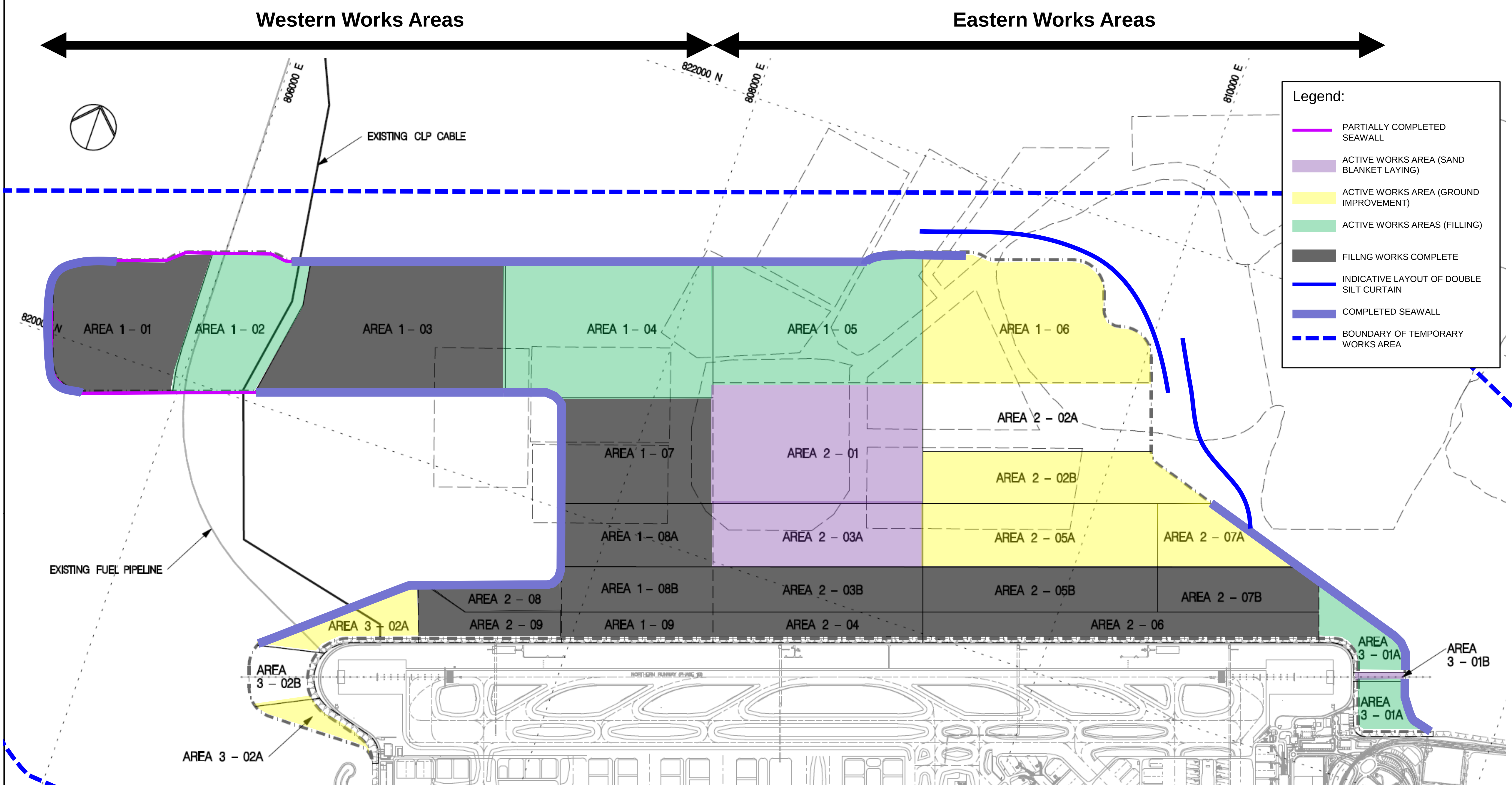

Description

Specific mitigation not required for ground improvement activities. With substantial completion of the seawall, silt curtains should be deployed at the main remaining seawall opening along the north-eastern side of the project area to minimise SS release. The smaller gaps located at the south-western and south-eastern tips would be largely closed off to dominant tidal flows, hence are not expected to contribute significant SS release.

Note:

- All silt curtains shall be located entirely within the boundary of the temporary works area
- The gaps between overlapping silt curtains are approx. 100m wide (to enable marine vessel access) with an overlapping length of at least 150m.
- The proposed silt curtain arrangement is indicative and subject to adjustment to suit the actual construction sequence, site conditions, marine traffic considerations, and the contractor's working methods.

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A	16MAY14	GENERAL REVISION	DC

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Title
INDICATIVE CONFIGURATION OF MITIGATION MEASURES (SNAPSHOT FOR END OF 2017 Q2)

Consultant's Signatures for Approval		Date
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Design Supervisor	EC	16MAY14
Authorised Representative	AFK	16MAY14

EXPANSION OF HONG KONG INTERNATIONAL AIRPORT INTO A THREE-RUNWAY SYSTEM

Drawing No.
Figure 6

Scale at A3
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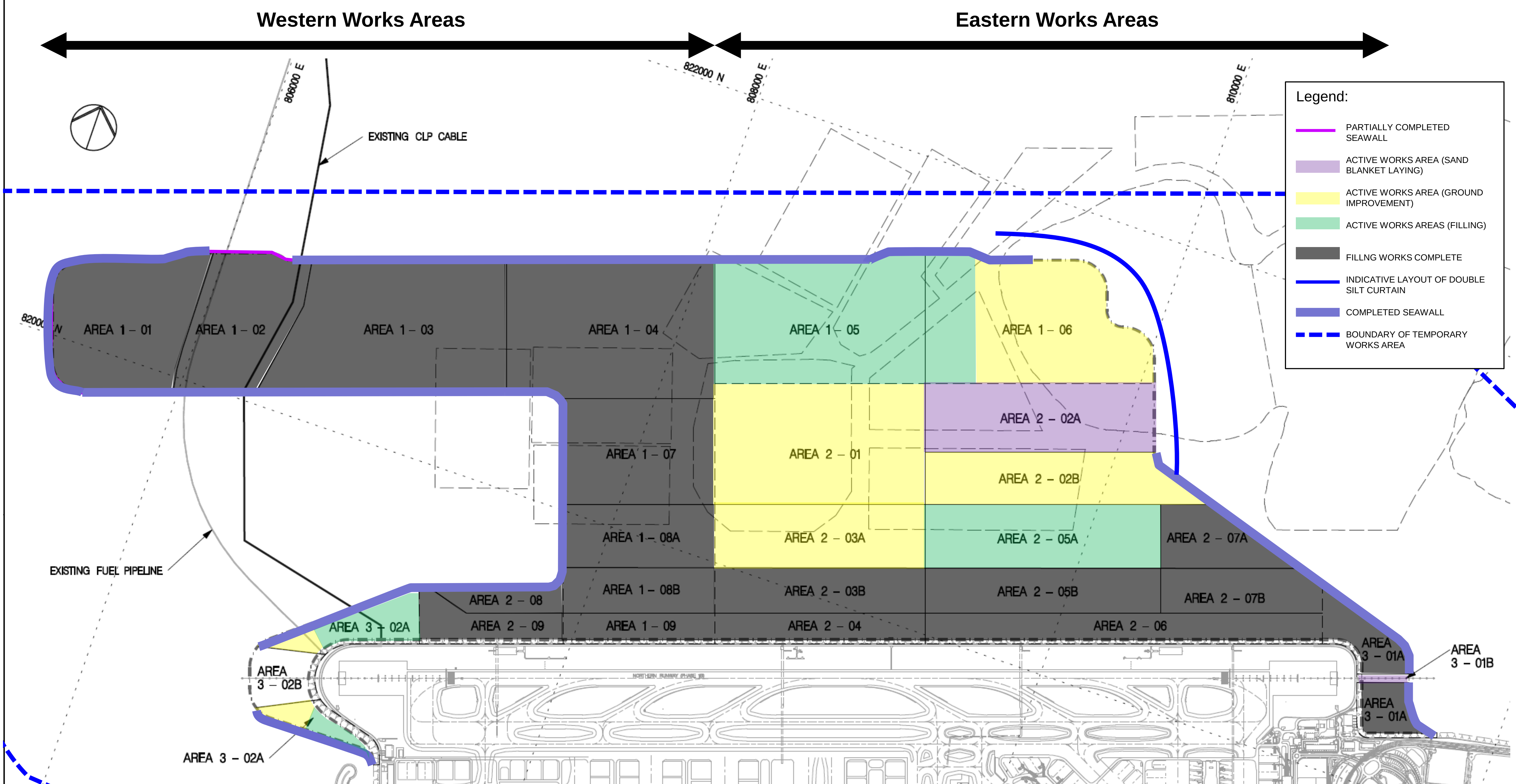

Description

Specific mitigation not required for ground improvement activities. With substantial completion of the seawall, silt curtains would be deployed at the main remaining seawall opening along the north-eastern side of the project area to minimise SS release. The smaller gaps located at the south-western and south-eastern tips would be closed off to dominant tidal flows, hence are not expected to contribute significant SS release.

Note:

- All silt curtains shall be located entirely within the boundary of the temporary works area
- The gaps between overlapping silt curtains are approx. 100m wide (to enable marine vessel access) with an overlapping length of at least 150m.
- The proposed silt curtain arrangement is indicative and subject to adjustment to suit the actual construction sequence, site conditions, marine traffic considerations, and the contractor’s working methods.

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Title: INDICATIVE CONFIGURATION OF MITIGATION MEASURES (SNAPSHOT FOR END OF 2017 Q3)

Consultant's Signatures for Approval		Date
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Design Supervisor	EC	16MAY14
Authorised Representative	AFK	16MAY14

EXPANSION OF HONG KONG INTERNATIONAL AIRPORT INTO A THREE-RUNWAY SYSTEM

Drawing No. Figure 7

Scale at A3 1:17500

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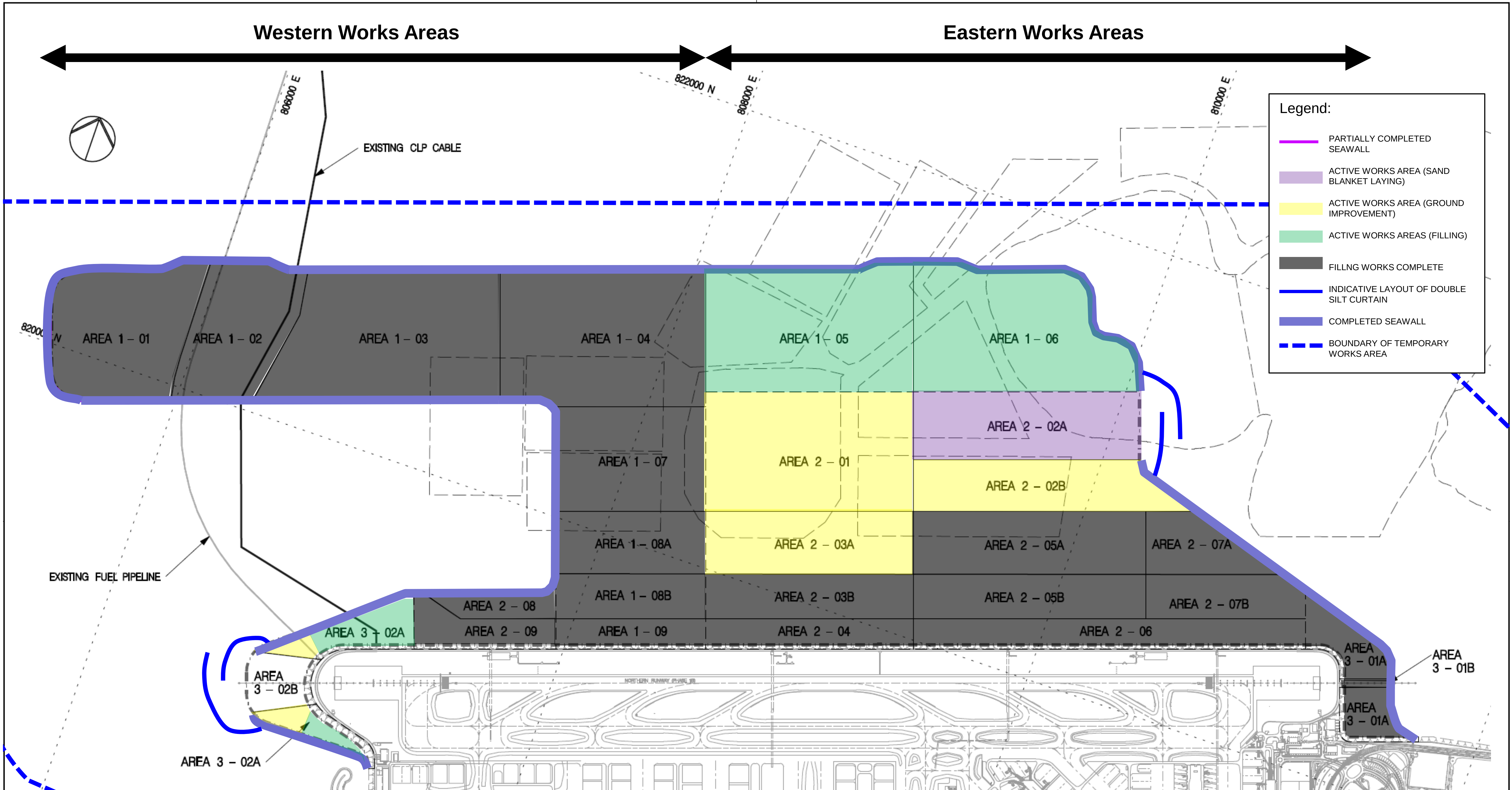

Description

Specific mitigation not required for ground improvement activities. With substantial completion of the seawall, silt curtains would be deployed at the remaining seawall opening along the eastern side of the project area to minimise SS release. With commencement of marine filling activities at works area 3-02A, silt curtains should also be deployed at this location as a precautionary measure to minimise SS release.

Note:

- All silt curtains shall be located entirely within the boundary of the temporary works area
- The gaps between overlapping silt curtains are approx. 100m wide (to enable marine vessel access) with an overlapping length of at least 150m.
- The proposed silt curtain arrangement is indicative and subject to adjustment to suit the actual construction sequence, site conditions, marine traffic considerations, and the contractor's working methods.

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Title: INDICATIVE CONFIGURATION OF MITIGATION MEASURES (SNAPSHOT FOR END OF 2017 Q4)

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Design Supervisor	EC	16MAY14
Authorised Representative	AFK	16MAY14

EXPANSION OF HONG KONG INTERNATIONAL AIRPORT INTO A THREE-RUNWAY SYSTEM

Drawing No. Figure 8

Scale at A3 1:17500

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Appendix E Sample Template for Interim Notifications

Sample template for the interim notifications of Environmental Quality Limits Exceedances

Incident Report on Action Level or Limit Level Non-compliance

Project	
Date	
Time	
Monitoring Location	
Parameter	
Action & Limit Levels	
Measured Level	
Possible reason for Action or Limit Level Non-compliance	
Actions taken / to be taken	
Remarks	

Location Plan

Prepared by:

Designation:

Signature:

Date: