

Civil Engineering and Development
Department

**Agreement No. CE 12/2015(CE)
Technical Study on Developments
at Siu Ho Wan and the Associated
Transport Infrastructures –
Feasibility Study**

Final Executive Summary

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This report takes into account the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number 244613

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1 Introduction

1.1 Background

1.1.1 On 21 July 2015, Civil Engineering and Development Department (CEDD) of the Government of the Hong Kong Special Administrative Region appointed Ove Arup and Partners Hong Kong Limited to provide consultancy services for Agreement No. CE 12/2015 (CE) ‘Technical Study on Developments at Siu Ho Wan and the Associated Transport Infrastructures – Feasibility Study’ (This Study).

1.1.2 The Study Area covers the waters off Siu Ho Wan and the landside site at Siu Ho Wan is shown in **Figure 1.1**. Siu Ho Wan (SHW) Reclamation and Landside Development near the North Lantau Highway are two independent projects. They are also geographically separated by the North Lantau Highway and MTRCL Siu Ho Wan Depot; besides, their nature of works, engineering constraints and implementation programme are different. Nevertheless, if these two projects were considered in a single technical feasibility study, more synergy could be achieved from planning perspective and efficient study effort is expected.

1.1.3 The following two reports were separately prepared as required under the Study Brief and each of these reports presents their respective considerations and implementation programme:

- i) Report on Updated Broad Technical Assessment for Reclamation
- ii) Report on Broad Technical Assessment for Landside Development

1.1.4 The scope of the Study is to carry out the preliminary engineering feasibility and determine the broad feasible extent for SHW Reclamation and Landside Development, formulate preliminary land use themes, assess preliminary traffic and transport impacts and recommend technically feasible schemes for the transport infrastructures including both potential road and railway connections with the proposed East Lantau Metropolis via Mui Wo.

1.1.5 Notwithstanding the above, the findings of this Study do not represent that the proposed SHW development has been confirmed to be implemented as the implementation will depend on many other critical

factors, such as detailed feasibility study, financial viability, social impact, detailed technical studies, policy directions, etc.

1.2 Study Objectives

1.2.1 The main objectives of this Study are discussed below:

1.2.2 For SHW Reclamation and Landside Development

- (a) to assess the preliminary engineering feasibility;
- (b) to determine the broad feasible extent of reclamation/development;
- (c) to propose the preliminary land use themes;

1.2.3 For the Transport Infrastructures

- (d) to assess the preliminary traffic and transport impacts;
- (e) to recommend technically feasible schemes based on a broad-brush approach.

1.2.4 The specific objectives of the Assignment are:

- (a) to conduct Preliminary Traffic and Transport Impact Assessment (TTIA) for the Project;
- (b) to conduct a Preliminary Geotechnical Appraisal (GA) including desktop study and site investigation with a view to identifying any potentially difficult ground conditions for the Project;
- (c) to recommend preliminary land use theme for both SHW Reclamation and Landside Development;
- (d) to review, examine and update the BTA for SHW Reclamation completed under the ELSS Study;
- (e) to prepare a separate BTA for Landside Development;
- (f) to conduct site-specific field monitoring survey for CWD, study the abundance and behaviour of CWD in the waters around the potential sites of SHW and Lung Kwu Tan Reclamations and conduct preliminary review on CWD for SHW Reclamation;
- (g) to review and examine the required clearance between SHW Reclamation and The Brothers Marine Park (BMP);
- (h) to recommend the technically feasible schemes and the associated road and other necessary accesses for SHW Reclamation;
- (i) to conduct ecological site walk survey and identify any critical issues for Landside Development from the ecological point of view;
- (j) to recommend the technically feasible site formation schemes and the associated road and other necessary accesses for Landside

Development;

- (k) to take into account and to co-ordinate with the relevant parties of the relevant studies and possible interface projects (e.g. SHW Depot Topside Development, Topside Development at HKBCF, TCNTE, etc.) to minimise the potential implications on the interface projects; and
- (l) to recommend the implementation programme and estimate the approximate cost of the project.

1.3 Purpose of this Report

- 1.3.1** This Executive Summary presents a brief account on the key findings of technical assessments conducted under this Study.

1.4 Nomenclature and Abbreviations

- 1.4.1** The following table lists out the abbreviated titles of government bureaux, departments, offices, statutory bodies and public organizations:

Abbreviation	Full title
AAHK	Airport Authority Hong Kong
ACE	Advisory Council on the Environment
AFCD	Agriculture, Fisheries and Conservation Department
AMO	Antiquities and Monuments Office of the Leisure and Cultural Services Department
CAD	Civil Aviation Department
CEDD	Civil Engineering and Development Department
CEO	Civil Engineering Office of CEDD
CPLD	Committee on Planning and Land Development
DEVB	Development Bureau
DSD	Drainage Services Department
EACSB	Engineering and Associated Consultants Selection Board
EPD	Environmental Protection Department
ETWB	The then Environment, Transport and Works Bureau
GEO	Geotechnical Engineering Office of the CEDD
GFS	Government Flying Service
HKSARG	Hong Kong Special Administrative Region Government
HyD	Highways Department
LanDAC	Lantau Development Advisory Committee
LandsD	Lands Department
LCSD	Leisure and Cultural Services Department

Abbreviation	Full title
LegCo	The Legislative Council
MD	Marine Department
MTRCL	MTR Corporation Limited
PlanD	Planning Department
RDO	Railway Development Office of HyD
TD	Transport Department
THB	Transport and Housing Bureau
TPB	Town Planning Board
TPDM	Transport Planning & Design Manual
WSD	Water Supplies Department

1.4.2

The following table lists out the meaning of abbreviation for expressions adopted in this report:

Abbreviation	Full title
AHR	Airport Height Restriction
API	Aerial Photograph Interpretation
AOI	Area of Influence
ASRs	Air Sensitive Receivers
ATC	Annual Traffic Census
AVA	Air Ventilation Assessment
AQOs	Air Quality Objectives
BDTM	Base District Traffic Model
BMP	The Brothers Marine Park
BTA	Broad Technical Assessment
C&D material	Construction and Demolition Material
CEIA	Cumulative Environmental Impact Assessment for the Three Potential Nearshore Reclamation Sites in the Western Waters of Hong Kong
CV	Curriculum Vitae
CZ	Consultation Zone
CWD	Chinese White Dolphins
DEVB TC(W)	Development Bureau Technical Circular (Works)
DO	Dissolved Oxygen
DR	Director's Representative
EIA	Environmental Impact Assessment
EIAO	Environmental Impact Assessment Ordinance, Cap 499
ELM	East Lantau Metropolis
ELSS	Enhancing Land Supply Strategy: Reclamation outside Victoria Harbour and Rock Cavern Development
EP	Environmental Permit issued under EIAO
ERA	Estimating using Risk Analysis defined under PAH
ETWB TC(W)	Technical Circulars (Works) issued by the then Environment, Transport and Works Bureau

Abbreviation	Full title
EVA	Emergency Vehicular Access
FSP	Fine Suspended Particulates
GA	Geotechnical Appraisal
GASP	Geotechnical Area Studies Programme
G/IC	Government, Institution or Community
GIS	Geographic Information System
GVTCS	Goods Vehicle Trip Characteristics
HKBCF	Hong Kong Boundary Crossing Facilities Islands
HKIA	Hong Kong International Airport
HKLR	Hong Kong Link Road
HZMB	Hong Kong – Zhuhai – Macao Bridge
IMS	Integrated Management System
ISO	International Organization for Standardization
IDC	Islands District Council
LATM	Local Area Traffic Model
LMPO	Land (Miscellaneous Provisions) Ordinance (Cap28)
LP	Layout Plan
LVIA	Landscape and Visual Impact Assessment
MDN	Marine Department Notice
NEF	Noise Exposure Forecast
NENT	North East New Territories
NDAs	New Development Areas
NLH	North Lantau Highway
NSRs	Noise Sensitive Receivers
NTHA	Natural Terrain Hazard Assessment
NTN	New Territories North
NWNT	Northwest New Territories
OD	Origin-destination
OZP	Outline Zoning Plan
PAH	Project Administration Handbook by the HKSAR Government
PAM	Passive Acoustic Monitoring
PHI	Potentially Hazardous Installations
PE	Public Engagement
PMP Study	Consolidated Economic Development Strategy for Lantau and Preliminary Market Positioning Study for Commercial Land Uses in Major Developments of Lantau
PR	Plot Ratio
PT	Public Transport
PWP	Public Works Programme
RCD	Rock Cavern Development
RSP	Respirable suspended particulates
QA	Quality Assurance
QRA	Quantitative Risk Assessment

Abbreviation	Full title
SDM	Structures Design Manual
SEA	Strategic Environmental Assessment
SHW	Siu Ho Wan
SHWWTW	Siu Ho Wan Water Treatment Works
SI	Site Investigation
SIW (TCL) Station	Siu Ho Wan Railway Station along Tung Chung Line proposed by MTRCL (<i>under separate study</i>)
SIW (ELM) Station	Siu Ho Wan Railway Station along the proposed rail line between North Lantau and East Lantau Metropolis (<i>under this Study</i>)
SMBWTW	Silvermine Bay Water Treatment Works
SPR	Stores and Procurement Regulations
SSKA	Sham Shui Kok Anchorages
SSSI	Site of Special Scientific Interest
STM	Strategic Transport Model
STT	Short Term Tenancy
STW	Sewerage Treatment Works
TBM	Tunnel Boring Machine
TCE	Tung Chung East
TCFWSR	Tung Chung Fresh Water Service Reservoir
TCL	Tung Chung Line
TCNTE	Tung Chung New Town Extension
TCS	Travel Characteristics Survey
TFS	Technical Feasibility Statement
TGLA	Temporary Govt. Land Allocation
TM – CLKL	Tuen Mun – Chek Lap Kok Link
TPEDM	Territorial Population and Employment Data Matrices
TPIS	Town Planning Information System
TPO	Town Planning Ordinance
TSP	Total Suspended Particulate
TTIAs	Traffic and Transport Impact Assessments
WBTC	Technical circulars issued by the then Works Bureau, the then Works Branch, the then Lands & Works Branch or the then Public Works Department
WCZ	Water Control Zone
WG	Working Group
WP	Working Paper
WTW	Water Treatment Works
3RS	Three-runway system

2 Potential Development Extent

2.1 General

2.1.1 The maximum potential extent of reclamation and landslide developments at SHW have been defined considering various key spatial and functional requirements and limitations. These maximum potential development extents are solely established for preliminary technical assessment at the early stage of the project for early identification of key issues, and do not represent the recommended development extent.

2.2 Reclamation

2.2.1 The maximum potential extent of reclamation at SHW was defined considering various key spatial and functional requirements and limitations, or collectively called as “considerations”. These considerations include:

- (a) North Lantau Refuse Transfer Station;
- (b) The Brothers Marine Park;
- (c) Chinese white dolphin habitat;
- (d) Existing Siu Ho Wan Sewage Treatment Works submarine outfall;
- (e) Existing contaminated mud pits south of The Brothers;
- (f) Tuen Mun-Chek Lap Kok Link southern viaduct (under construction);
- (g) Potential Strategic Road Link from SHW to ELM.
- (h) Existing MTRCL Siu Ho Wan Depot loading/unloading bay;
- (i) Existing drainage outfalls; and
- (j) Road P1 Siu Ho Wan Section from Tai Ho Wan to Sham Shui Kok

2.2.2 The locations of these considerations and the maximum potential SHW reclamation extent are shown in **Figure 2.1**. Discussion for considerations in formulating the reclamation extent is summarised in following paragraph.

2.2.3 For the eastern side of SHW reclamation extent, reference has been made for the works area between HKBCF and The Brothers Marine Park which is 150m. This 150m works area is also adopted for SHW

reclamation that delineate the minimum distance between BMP and SHW reclamation. While on the western side of the reclamation extent, 80m offset from the Contaminated Mud Pit is adopted as marine space for the sloping edge of the new seawall, and the space is also for undertaking possible foundation treatment works for the seawall. Besides, a minimum 200m off set from TM-CLKL southern viaduct is adopted to provide a buffer for noise impacts associated with the road traffic on the viaduct.

2.3 Landside Development

2.3.1 The major determining factors for the potential extent for landside development includes the Country Park, Priority Site of Enhanced Conservation in Tai Ho, PHI of SHWWTW and AHR. These major constraints and the maximum potential SHW landside development extent is presented in **Figure 2.2**.

2.3.2 At this preliminary stage, an offset distance of 30m has been assumed at the crest of the study area for landside development for construction of possible natural terrain mitigation works, drainage system re-provision, works area, etc. A smaller offset distance of 10m has been assumed at the west of study area next to the Priority Site of Enhanced Conservation in Tai Ho for works area during construction, where natural terrain mitigation works is not envisaged. The offset distance assumed at this early stage of project for the purpose of initial proposal of development extent and shall be further reviewed in future detailed design stage.

2.3.3 The potential extent for landside development overlaps with the Strategic Cavern Area (SCVA) No. 44 of the Cavern Master Plan prepared under Agreement No. CE 12/2012 (GE), Long-term Strategy for Cavern Development – Feasibility Study. The proposed landside development shall take account of the SCVA in order to preserve its cavern development potential as far as possible.

3 Land Use Themes

3.1 Initial Land Use Themes

3.1.1 Based on the assumed maximum potential reclamation and landside development extents, three initial land use themes were formulated for broad comparison. The three initial land use themes are Theme 1 “Optimized Residential”, Theme 2 “Mix of Residential and Education” and Theme 3 “Enhanced Tourism and Education”. Theme 1 focuses on providing a higher density residential community to ease the territorial housing demand; Theme 2 caters for both the territorial housing demand and educations, while Theme 3 focuses on tourism-related developments and the provision of tertiary level educations.

3.1.2 The relative performance of each theme has been qualitatively compared based on a set of guiding principles and evaluation criteria. The guiding principles include:

- (a) Enhance Land Supply for Territorial and Local Developments;
- (b) Conserve Natural Resources and Minimise Impacts on the Ecology;
- (c) Integrate with the Surrounding Developments in Siu Ho Wan and North Lantau to Achieve Synergy, in particular within the North Lantau Corridor;
- (d) Improve Accessibility and Strengthen the Linkages to the Residential/Job Clusters in Urban Core and Adjacent Residential/Job Clusters;
- (e) Create Attractive and Continuous Waterfront for Public Enjoyment;
- (f) Enable Cost-Effective Solution, Smooth Implementation and Holistic Developments, in particular for Transport Infrastructure;
- (g) Minimise Environmental Impacts.

3.1.3 From the evaluation, it is considered that Theme 2 “Mix of Residential and Education” performs better balance compared to Theme 1 and 3, in particular on aspects of achieving synergy with the existing and potential developments in Lantau, high value added employment opportunities as well as sensible building height profile at waterfront. It

echoes the planning direction of the “Northern Lantau Corridor” as suggested in the Sustainable Lantau Blueprint and the market positioning of SHW as a “Quality Living cum Knowledge Zone”. The possible lower density residential development and educational facilities could cater for the territorial housing demand and offer a generous amount of education/ training opportunities for different pillar industries.

3.1.4 Theme 2 was further developed and enhanced with plan and section shown in **Figures 3.1**. The land use budget and development parameters are summarized in **Tables 3.1** and **3.2** below.

3.1.5 Housing development in the west part of the reclamation (Site A) is optimized to be compatible with the waterfront location. As such the development intensity reaches a PR3 along the coastal edge. This establish a stepped building height profile in responding and integrating with topographical setting and the planned development nearby. It is also intended to create vibrant waterfront and public space in human scale to establish a balanced community for inhabitants and visitors. At the geographical centre of the west reclamation, an area for educational uses of PR3.

3.1.6 Due to the constraint of PHI CZ in Site B, the development intensity for the proposed commercial uses is PR0.2 (assuming maximum 300 occupants limitation). The Computer/ Data Process Centre, Clinical Laboratory or other similar use which are less labour-intensive planned for this area would provide supporting facilities to enrich the education and training/ retraining offer for the pillar industries as well as emerging industries. The housing site in the eastern reclamation outside the consultation zone (CZ) of the PHI is PR3 which do not exceed the existing AHR.

3.1.7 A smaller residential PR of 1.5 in areas along the landside (Site C) is envisaged as it is subject to AHR which will restrict their maximum height.

Table 3.1 Land Use Budget for Further updated Theme 2

Land Use	Area (ha)
Residential PR3 (Site A)	8.5
Residential PR3 (Site B)	5.8
Residential PR1.5 (Site C)	1.3
Educational PR3 (Site A)	7.6
Educational PR3 (Site C)	4.5
Commercial PR3 (Site A)	1.3
Computer/ Data Process Centre, Clinical Laboratory or Other Similar Uses PR0.2 (Site B)	19
GIC (Site A)	1.0
Open Space (including waterfront promenade)	8.9
Total	57.9

Table 3.2 Summary of Development Parameters for Further updated Theme 2

Domestic Sites ¹	No. of Flats ^{2&3}	Population ⁴
Residential PR3 (Site A)	1,983	5,276
Residential PR3 (Site B)	1,353	3,600
Residential PR1.5 (Site C)	152	403
Total	3,488	9,279

¹ A large site reduction factor of 0.7 has been applied to all development sites.

² Assumptions: At this early stage of the project, it may be premature to determine the public: private housing mix for the residential development. For the purpose of demonstration of land use theme and estimation of population, it is assumed that residential development of PR 4 or below are private housing, while that of PR5 or above are public housing.

³ Assumptions: average flat size for private residential PR1.5 and private residential PR3 is 90 sq.m. (based on Tung Chung New Town Extension (TCNTE))

⁴ Assumptions: person per flat for private housing is 2.66 (Based on Tung Chung New Town Extension (TCNTE))

Non-domestic Sites	GFA	Employment	Student
Commercial PR3 (Site A)	27,300 sq.m.	1,365 ⁵	0
Computer/ Data Process Centre, Clinical Laboratory or Other Similar Uses PR0.2 (Site B)	26,600 sq.m.	300 ⁶	0
Educational PR3 (Site A) ⁷	159,600 sq.m.	399	7,980
Educational PR3 (Site C) ⁶	94,500 sq.m.	236	4,725
Total	308,000 sq.m.	2,300	12,705

3.2 Potential Long-term Land Use Theme

3.2.1 A potential Long-term Land Use Theme assuming that the SHWWTW, SHWSTW, SHW Police Vehicle Pound, North Lantau Transfer Station, Organic Waste Treatment Facilities (OWTF) and potential columbarium developments in the area were relocated into suitable caverns have been studied. **Figure 3.2** shows the locations of these facilities. The possible land use theme are shown in **Figure 3.3**. About 34.7ha of additional land would be available for Long-term Development under this Study.

3.2.2 This potential long-term land use theme as well as the initial land use theme do not represent that the land use theme has been confirmed, and shall not pre-empt other possible land uses options for the site when the Government considers necessary to carry out a detailed planning and engineering study in future.

⁵ Assumptions: 20sq.m of GFA per worker is assumed based on the lower limit of the worker density for (general) business use in Ch.5 Industry, Guideline for Worker Densities, HKPSG.

⁶ The maximum no. of allowed employment within the SHWWTW PHI CZ is assumed as 300 in current stage of study, this will subject to quantitative risk assessment to be carried out in future study.

⁷ Assumptions: Assume 400sq.m of GFA per staff, and a staff : student ratio of 1:20 (i.e. 20sq.m of GFA per student). The staff : student ratio is with reference to City University, HK. The value shall be reviewed at later stage as the type of educational use is not decided yet and could include tertiary institutions, vocational training centres, etc. which would result in different ratios of GFA per worker.

4 Broad Technical Assessment

4.1 General

4.1.1 There are several on-going studies being carried out by others, the findings of which may result in additional development potential of SHW:- (i) the review of existing AHR at the Potential Development Sites (PDS) identified by CEDD under 2RS operations of HKIA conducted by CAD and the Preliminary Airspace Protection Plan for the future operations of 3RS of HKIA being conducted by AAHK; and (ii) the possible reduction of PHI CZ of SHW WTW from 1km to 400m due to the reduction of chlorine risk associated with SHWWTW by conversion from drum draw-off to cylinder draw-off under study by WSD.

4.1.2 Taking these into account, a scenario with buffer on the population had been explored for the purpose of broad technical assessment with an aim to testing the infrastructure capacity. Amongst the three initial land use themes discussed in section 3.1, Theme 1 “Optimized Residential” with maximum population would be the most critical case in terms of technical assessment. For broad technical assessment, a maximum development potential, where PR5 for residential developments and PR3 for commercial developments in general have been assumed. These assumptions correspond to the similar proposed development in Tung Chung East. Key issues identified from the BTA are highlighted in following sections.

4.2 Preliminary Reclamation Study

4.2.1 The reclamation area is located within the Designated Area of Northshore Lantau with complex geological conditions and marble-bearing strata.

4.2.2 There is an existing submarine outfall located within the proposed reclamation site. This submarine outfall shall be protected and modified during the course of reclamation works. There are several marine facilities located in the vicinity of the proposed reclamation area that may be affected by the proposed reclamation development. These facilities include Pak Mong Pier, MTRCL depot berthing facility, Sham Shui Kok Anchorages No. 1 & No. 2 (Mooring Areas in The Brothers Marine Park), submarine outfall of Siu Ho Wan Sewage Treatment Works (SHWSTW), two mooring buoys, cardinal mark, North Lantau

Refuse Transfer Station and Liquid Chlorine Trans-shipment dock (**Figure 4.1**). The impact to these facilities due to the reclamation development shall be critically assessed. Mitigation measures such as relocation, re-provision shall be considered if necessary.

4.2.3 Pak Mong Pier (Item 1) is located in the immediate west of the drainage outlet of Tai Ho Wan below the North Lantau Highway, and is far from the western end of SHW reclamation.

4.2.4 MTRCL Siu Ho Wan Depot (Item 2) operated by MTRCL includes a vertical seawall, which provides marine access for barges to deliver new trains and extra-long tracks for MTRCL urban lines. Trains are unloaded from the barge to a set of rails which are then transported to the depot. There is no other feasible means of delivery of trains and extra-long tracks for urban lines.

4.2.5 The future Road P1 will intersect with the track connecting the existing vertical seawall and the SHW Depot. Hence, a vertical seawall will need to be re-provisioned to enable future loading of trains and tracks to the MTRCL Depot by marine means. The length of the vertical seawall to be provided shall be the same as the current length. The area immediately adjacent to the vertical seawall shall be free of other structures to facilitate lifting operations. Future Road P1 should also not pose any headroom constraint to their operation with respect to delivery of the trains and tracks. During construction stage, a temporary vertical seawall connecting to the SHW Depot will be required.

4.2.6 Sham Shui Kok Anchorages No. 1 & No. 2 (Item 3) were designated in year 2006 and are used by local vessels, river-trade and ocean-going vessels to anchor during typhoons and for mid-stream operation, i.e. transfer of goods between vessels. These anchorages are zoned as “Mooring Areas” within The Brothers Marine Park (BMP) was designated in end of year 2016. The extent of these mooring areas remain the same after the designation of BMP. These mooring areas are over 500m north of the proposed reclamation at Siu Ho Wan, and it is expected that the reclamation will not have any significant impact on the mooring sites.

4.2.7 Siu Ho Wan Sewage Treatment Works (SHWSTW) is a chemically enhanced primary treatment works designed to serve the population in Tung Chung New Town, HKIA, Discovery Bay and Hong Kong Disneyland Resort. The treated effluent of SHWSTW is discharged into

the marine waters of North Western Water Control Zone via a 1.15km long and 1.84m diameter submarine outfall (Item 4). The proposed reclamation straddles across this submarine outfall. A cardinal mark (Q.2m3M) is located at the shore of North Lantau to demarcate the location of submarine outfall. In order to minimise the potential impact on this submarine outfall, no reclamation is suggested to straddle over this existing submarine outfall and decking/bridge connection will be provided over the outfall. The cardinal mark will need to be relocated to the new edge of SHW reclamation (Item 6).

4.2.8 Two mooring buoys (Item 5) located at Sham Shui Kok are used by the Fire Services Department (FSD) and the Hong Kong Police Force (HKPF). Both departments use these mooring buoys during typhoons and for mooring practice. FSD practises vessel testing daily throughout the year, whilst the HKPF practises one to two times per week during typhoon season – around March to December. These mooring buoys will remain within The Brothers Marine Park, which has been designated in end year 2016.

4.2.9 North Lantau Refuse Transfer Station (Item 7) operated by EPD is located at Sham Shui Kok with a waterfront berthing facility for loading containerised wastes collected from Hong Kong International Airport and Tung Chung New Town on to Refuse Transfer Vessel “North Lantau” to the West New Territories Landfill (WENT) at Nim Wan. “North Lantau” travels to WENT and returns once per day, and it berths at the station. The impact due to the proposed SHW reclamation development and works on this facility is insignificant as the movement of refuse transfer vessel is twice (two-way) a day only, and the reclamation will not encroach upon this facility.

4.2.10 The Liquid Chlorine Trans-shipment dock (Item 8) operated by WSD handles cylinders of liquid chlorine delivered by barges for the use of WSD. According to WSD, liquid chlorine bottles are transported by barges from Jiangmen to Hong Kong every two weeks. The route of the vessel is via the waters around The Brothers to this location. As the proposed SHW reclamation does not encroach upon this trans-shipment dock, operation of this facility would be insignificant affected.

4.3 Preliminary Site Formation Study

4.3.1 Three preliminary site formation options were studied, including cut platform, elevated platform, and amalgamation of cut and elevated

platform. Among various options, cut platform is considered relatively more preferable in view of larger developable area, higher flexibility for future implementation and least landscape and visual impact (with proper slope and landscape design). The excavated fill can also be used for reclamation of SHW.

4.3.2 Given the overlapping of the potential extent for landside development and the SCVA No. 44 of the Cavern Master Plan, the proposed development shall take account of the SCVA in order to preserve its cavern development potential as far as possible, e.g. by optimising the development layout to allow for certain potential portal access to the SCVA.

4.3.3 The landside development site is located in steep sloping terrain and is subject to potential natural terrain hazards. NTHA shall be carried out in accordance with the guidelines given in GEO Report 138 and Technical Guidance Note TGN 36.

4.4 Environmental

General

4.4.1 Statutory EIA and town planning process will need to be carried out in future study to critically assess various key environmental impacts (e.g. air quality, noise, water quality, waste, ecology, fisheries, cultural heritage, landscape and visual, hazard to life, etc.) and to formulate appropriate mitigation.

4.4.2 Although the development area falls outside the coverage of the Aircraft Noise Exposure Forecast (NEF) 25 Contour for the future operation of 3RS of the HKIA, the area is in proximity to the HKIA which is a very busy airport operating on a 24 hour basis. Aircraft noise due to overflight of approaching and departing aircraft is anticipated in the area. The layout of the development shall be comprehensively planned and designed to minimise the impact of aircraft noise to the future occupants.

4.4.3 The existing NLH and the future Road P1 are the key emission sources. Locations of future Air Sensitive Receivers (ASRs) in the site may need to be located away from these sources with sufficient setback in order

to minimize significant adverse air quality impacts due to vehicular emission. Other mitigation measures, such as proper orientation of building layout, adoption of noise barrier or semi/full-enclosure along future Road P1, SHW Interchange and internal roads, adoption of acoustic design (e.g. silencers and enclosures), etc., may also be explored.

- 4.4.4** The chlorine storage at the SHWWTW may cause hazard to life issues to the workers during construction and future population in the area. A quantitative risk assessment (QRA) shall be conducted to evaluate such impact.

Reclamation

- 4.4.5** The proposed SHW reclamation area is in close vicinity to The Brothers Marine Park (BMP), which encompasses historic hotspots of CWD habitat. Site-specific CWD survey had been carried out under the Study between Feb 2016 and Apr 2017 to study the current occurrence and behaviour of CWD in shallow waters of SHW as well as the fine scale usage of CWD habitat. No CWD sightings were recorded at SHW during the monitoring period. This is likely due to the marine activities associated with the various construction projects. Nevertheless, the PAM had recorded some usage in the area of SHW by CWD at night time. This indicated that CWD may avoid the anthropogenic disturbance in the area during the day time, while utilising the area more frequently at night. It may not be impossible that CWD may not permanently abandon the area and come back, if the area is protected and maintained as suitable dolphin habitat in the future.

- 4.4.6** SHW reclamation would cause the permanent loss of about 82 ha of marine habitat. Waters in the vicinity of SHW, extending all the way south to the North Lantau coastline were once a very important feeding habitat for CWD in Hong Kong (Jefferson 2000; Hung 2008). Especially the Sham Shui Kok area was a very consistent hotspot for CWD - the most important in Northeast Lantau, and dolphins fed and socialized extensively in this region. This area had the highest densities of CWD in the entire area of Northeast Lantau (Hung 2008).

- 4.4.7** The SHW reclamation extent has been proposed to be reduced to maintain a separation of 150m from BMP. Nevertheless, the potential impact on the marine park can still be significant due to its close proximity to the important CWD habitat, if the disturbance from

reclamation is not properly addressed through stringent protection and mitigation measures.

4.4.8 Marine Park is a recognized site of conservation importance under Note 1, Annex 16 of Technical Memorandum of the Environmental Impact Assessment (EIA) Ordinance. Activities that may pollute the water body and cause nuisance to the Marine Park are prohibited or controlled under the Marine Parks Ordinance and the Marine Parks and Marine Reserves Regulation. Given the close proximity between the proposed SHW Reclamation site and BMP, water quality and ecological impacts arising from the proposed development would have to be assessed in detail in the EIA. Detailed assessment (including water quality modelling) should be made in the EIA study to ensure that there is no adverse impact to the ecology and functionality of BMP. On detailed assessment of separation distance of the works area from BMP, water quality and underwater noise impacts arising from the marine construction activities are important parameters to be considered since the most important purpose of BMP is to conserve the habitat for CWD which are sensitive to water quality and underwater noise impacts. The assessment to be conducted in the EIA should take into consideration whether sufficient avoidance or mitigation measures have been incorporated in the design and programming of marine construction activities to minimise water quality and underwater noise impacts, if any, on the CWD habitat in BMP.

4.4.9 The diurnal and seasonal patterns on habitat use of the area by CWD, i.e., at night and during dry seasons, could be used for formulation of possible mitigation measures to minimise the impacts on BMP. Possible mitigation measures may include but not limited to:

- (a) Use of non-dredging methods to reduce impact on water quality;
- (b) Land-based disposal of all wastes from the site to reduce the risk of water contamination;
- (c) Acoustic decoupling of any noisy equipment on barges to reduce noise disturbance to CWD;
- (d) Pump sand fill from some distance away from CWD habitat (i.e. east of reclamation and BMP) using trailer suction hopper dredger;
- (e) Deliver fill materials using land-based transport so as to reduce traffic volume of construction vessels;
- (f) Restriction on the construction vessels, such as speed and number of trips of vessel transport in the area (so as to reduce disturbance from construction vessels and reduce risk of ship strikes), no

stopover or anchoring within The Brothers Marine Park, all vessels to be equipped with Global Positioning System (GPS) and Automatic Identification System (AIS) for real time tracking and monitoring of their travel routings, speed, and anchorage points, etc.

- (g) Avoid construction during the peak calving seasons of CWD, which is between March and June (Jefferson et al. 2012);
- (h) Use of Dolphin Exclusion Zones during construction;
- (i) Reclamation work to proceed from shore, rather than from the water;
- (j) No fast ferry service to the site during both construction and operation of project;
- (k) Explore compensation for habitat lost and residual impacts although they are not truly mitigation measures.

4.4.10 Other ecological impacts due to reclamation may include permanent loss of marine benthic habitat and soft substrate seabed which might be used by adult horseshoe crab, fishing grounds.

Landside Development

4.4.11 In order to field check and record the baseline ecological conditions of the potential development site and its surrounding area, a preliminary ecological site walk has been conducted between December 2015 and June 2016. The site walk included Habitat and Vegetation survey; terrestrial mammal survey; avifauna survey; herpetofauna survey; freshwater community survey; dragonfly and butterfly survey. 5 species of conservation importance, including Lamb of Tartary, Black-crowned Night Heron, Common Rat Snake, Romer's Tree Frog and Tiger Hawker were recorded within the proposed landside development site. Since birds, reptiles and dragonflies are relatively mobile, the direct mortality due to the site formation work is not expected. Generally, fauna of low mobility or low habitat use flexibility (i.e. Romer's Tree Frog) are more vulnerable to site formation, and might cause adverse ecological impact. Capture-and-translocation programme is recommended to minimise the potential impact on this species arising from the site formation works.

4.4.12 There is a bat roost in Tai Ho Wan which was a cave above the intertidal zone along the east shore of Tai Ho Bay. The bat cave is at about 500m from the proposed Landside Development site. To update the status of the bat cave reported by previous studies, bat survey was conducted between 2015 and 2016. Around 200 individuals of bat were recorded

within the bat cave. The 2 bat species recorded, namely Pomona Leaf-nosed Bat *Hipposideros pomona* and Least Horseshoe Bat *Rhinolophus pusillus* are considered as species of conservation concern.

4.4.13 To minimize the impact to the bat roost site, vibration due to construction activities shall be minimized as much as possible. In addition, direct lighting to Country Park or Tai Ho Priority Site should be prohibited and night-time lighting in the construction sites should be controlled to reduce potential impact to nocturnal fauna (e.g. bats). The potential impact on roosting bats shall be assessed in future study.

4.4.14 ‘Secondary Woodland’, ‘Shrubland and Grassland’, ‘Plantation’, ‘Watercourses’ and ‘Urbanised Development’ within the landside site will unavoidably be affected. Existing trees shall be retained and protected as far as possible. When avoidance is impossible, transplantation of plant species of conservation importance and compensation of affected habitats of high ecological value (e.g. woodland) shall be considered.

4.4.15 Offset distance from Lantau North (Extension) Country Park and Tai Ho Priority Site is recommended so as to minimise the potential ecological impact on these areas and to protect the riparian habitats of natural streams, particularly those supporting wildlife of conservation importance. The offset area will be used for screening woodland plantings, possible natural terrain mitigation works, drainage system re-provision and works area, etc.

4.4.16 There are several nos. of existing natural streams within the landside development area and these watercourses flow to Tai Ho Wan. The development shall minimize the impact to these natural streams as far as possible. Surface runoff from the landside development area might potentially affect the aquatic habitats and associated flora and fauna in Tai Ho Wan and Tai Ho Stream SSSI. Good site practice and temporary drainage system area recommended to reduce the potential impact of surface runoff to habitat, including Tai Ho Wan, and the associated fauna during construction phase. Besides, drainage system with gullies and grease and sediment traps could be installed to collect the surface runoff from the future development and to minimise adverse water quality to aquatic habitats (e.g. Tai Ho Wan).

4.4.17 The major habitats within the proposed landside development site are shrubby grassland and shrubland, which support low diversity and

abundance of wildlife. The potential impact of habitat fragmentation due to the proposed development is not anticipated to be significant. Provision of wildlife tunnel/corridor for non-volant fauna (e.g. reptile) is recommended as precautionary measure to minimise the impact of fragmentation of habitats and/or risks of roadkill.

4.5 Civil Works

Sewerage Works

4.5.1 SHWSTW is being relied upon for the treatment of the sewage arising from existing developments and planned developments in North Lantau including the Third Runway of HKIA and Tung Chung New Town Extension, etc. Based on the preliminary sewage flow from other concurrent project, it is noted that the design capacity of SHWSTW, i.e. 180,000m³/day, would be exceeded in Year 2034 even without the proposed SHW Reclamation and Landside Development. The additional sewage demand from proposed SHW development (with maximum development potential) will cause the exceedance to shift to Year 2029.

4.5.2 To cater for the uncommitted sewage arising from other developments in the catchment, a joint departmental working group is exploring the planning feasibility of the long-term expansion for the SHWSTW including the feasibility of relocating it inside a cavern. However, there is no scheduled completion date for the upgrading project. Therefore, should the proposed SHW development be planned for commissioning before the completion of the SHWSTW upgrading project, the proposed development would need to include an assessment for alternative sewage treatment as an interim measure. A new sewerage network and pumping stations would be required to collect sewage flow from the development which shall subsequently be conveyed to SHWSTW or proposed new treatment works for subsequent treatment and disposal.

Water Supply

4.5.3 The fresh and flushing water demand is estimated to be 21,950m³/day and 4,580m³/day respectively for SHW development (with maximum development potential).

4.5.4 The existing capacity of SHWWTW is 150,000m³/day. This is not adequate to meet the projected maximum mean daily demand of 248,480 m³/day within its water supply zone (including SHW development and other developments in North Lantau). The planned extension of SHWWTW to 300,000m³/day by the WSD and the associated water transfer facilities will therefore be required.

4.5.5 New fresh water services reservoir (approximately 19,000m³) located adjacent to SHWWTW is envisaged to be required to supply fresh water to SHW development.

Drainage System

4.5.6 According to the DSD drainage record plans, there are seven existing drainage outfalls along the existing shoreline, to which the runoff generated from the reclamation site will be conveyed.

4.5.7 For the reclamation area, U-channels will be provided mainly alongside the pedestrian route to intercept stormwater runoff within its sub-catchments in the site boundary. The channels are designed against a 50-year peak runoff in accordance with DSD's Stormwater Drainage Manual. The intercepted flow will be discharged to the nearby box culverts.

4.5.8 Drainage Impact Assessment is required to assess the potential drainage impacts arising from the proposed sites to the existing drainage system. Mitigation measures should be recommended, if necessary, to alleviate the impacts. The drainage impact assessment will be prepared in accordance with the requirement of ETWB TC(W) No. 2/2006 "Drainage Impact Assessment Process for Public Sector Projects". Climate change shall also be considered in future design of the drainage system.

4.5.9 For the landside development, the future drainage system shall cater for natural runoff from Lantau North (Extension) Country Park uphill. If the natural streams cannot be kept due to landside development, the natural streams will need to be diverted by providing perimeter channel to intercept the surface runoff.

5 Road Link

5.1 From North Lantau to East Lantau Metropolis

5.1.1 The study has explored various options of strategic road link between North Lantau to the proposed East Lantau Metropolis, possibly via Mui Wo.

5.1.2 Major constraints pertaining to the road link are summarized in **Figure 5.1**.

5.1.3 On the north side, options for the interchange location are identified along North Lantau Highway. The locations are shown in **Figure 5.2** as N1 to N3.

5.1.4 Among the three interchange points, N3 is considered more appropriate. Interchange point N1 is not feasible as the capacity of the Tai Ho Interchange is insufficient to cater for the increased traffic from ELM. The road alignment will also have significant environmental impact as it will pass through Ta Ho Wan and Priority Site for Enhanced Conservation. Interchange point N2 does not have sufficient traffic weaving distance in NLH from the TM-CLK Link to its west.

5.1.5 Interchange point N3 has sufficient weaving length and it considered better in traffic function and safety. Nevertheless, it requires land take in the Siu Ho Wan east reclamation area.

5.1.6 For road connection, a road tunnel between North Lantau and Southeast Lantau, possibly via Mui Wo, with reserve for potential future connection to the ELM can be further studied. However, the preferences and details of the road link will be highly dependent on the development plan for the ELM.

5.2 Road P1 SHW Section & Road Access to Reclamation Development

5.2.1 The Road P1 Siu Ho Wan Section and the interchange access are presented in **Figure 5.2**. The layout of the district distributors and local distributors are subject to the planning parcels of the Reclamation Development and are flexible.

5.2.2 At the west, a roundabout interchange is recommended to provide the main access to the Siu Ho Wan west reclamation area. The roundabout connects with both the Road P1 Siu Ho Wan Section and the Tai Ho roundabout to North Lantau Highway.

5.2.3 A secondary access in the form of “left-in left-out” free flow slip roads is also recommended to provide an alternative access to the west reclamation area.

5.2.4 At the east, an interchange is recommended to provide the road access to the east reclamation area from Road P1 Siu Ho Wan Section. The elevated Road P1 will go above the interchange to allow the rail track to maintain access to the waterfront.

5.3 Road Access to Landside Development

5.3.1 The access road has to connect between the Cheung Tung Road at approximately +10mPD and the site formation platforms at higher levels. The layout of the local distributors are subject to the planning parcels of the Landside Development and are flexible.

6 Railway Link

6.1 General

6.1.1 The Study studied the following scenarios of Railway link connecting North Lantau and Mui Wo for further connection to ELM:

(i) Scenario R1: Connecting to SIW from Southeast Lantau, possibly via Mui Wo; and

(ii) Scenario R2: Connecting to TCE from Southeast Lantau, possibly via Mui Wo.

6.1.2 Major constraints pertaining to the railway link are summarized in **Figure 5.1**.

6.2 Rail Tunnel Options Evaluation

6.2.1 Options of rail tunnel alignments for scenarios R1 and R2 have been preliminarily studied (**Figure 6.1**).

6.2.2 Based on an initial qualitative evaluation, it is considered that the option of connecting to TCE is more favourable due to its better performance in terms of route length, planning and land use, traffic/served population, interfacing issue with MTRCL, suitability for future connection to ELM/ HKBCF, engineering feasible and cost.

6.2.3 The location of station in TCE is ideal in many aspects. It makes a more direct alignment from North Lantau and future ELM. It can serve a greater population in Tung Chung among other areas in North Lantau. The rail link could be expanded for further connection to HKBCF and Tuen Mun. This alignment is also in line with the concepts of strategic transport networks for Lantau in LanDAC TT SC Paper No. 12/2015.

6.2.4 On the other hand, the SIW station has extremely complicated interface issues with the MTRCL Siu Ho Wan Topside Development project which is at a more advanced stage.

6.3 Key Engineering Issues

6.3.1 In terms of ventilation, it is preliminarily envisaged that Longitudinal type (Push-pull) tunnel ventilation system will be employed in the tunnels for smoke control, which shall be capable to operate in both

forward and reverse directions (bi-directional) and to prevent hot smoke flowing from the incident tunnel to non-incident tunnel. As the new line will run under steep topography, ventilation building at middle of tunnel may not be practical. Thus, overhead ductworks inside the tunnels may need to be provided to achieve the push-pull ventilation strategy for each tunnel ventilation section.

6.3.2 Provision of Emergency Egress Point (EEP) and Emergency Access Point (EAP) at intermediate section of the tunnel could be challenging as the level difference between the rail track level and the access/ exit point at ground level will be significant. Cross passages may be an alternative option instead of provision of EEP. As for EAP, further liaison with FSD shall be carried out to discuss whether the extended distance between EAPs with appropriate mitigation measures in place such as Backup Access Vehicle (BAV) is considered acceptable.

6.3.3 For station, the MoA provision including Designated Emergency Entrance (DEE) and Supplementary Emergency Entrance (SEE) with Fire Separated Corridor and extended protected corridors if necessary shall be provided.

6.3.4 Regarding construction method, for the stations in TCE, the track level will need to be at approx. -20mPD to pass underneath TCL, AEL and NLH in Tung Chung. The station is envisaged to be constructed using cut-and-cover method.

6.3.5 Immediately south of TCE Station, to maintain the operation of TCL, AEL and NLH uninterrupted, construction of the tunnel by cut-and-cover method is not possible. Soft ground tunnelling technique will be required for constructing this section.

6.3.6 For the majority of the tunnels in rock, drill-and-blast or TBM are possible options for the construction method. It is envisaged that the tunnel alignment will run across four geological faults, namely, Park Mong Fault, Ngau Kwu long Fault, Tai Ho Fault and Yam O Fault. Particular attention shall be paid when developing appropriate measures during tunnel construction.

6.4 Other Key Issues

6.4.1 There are several key issues which will affect the choice of preferred tunnel corridor and the schematic design of road and rail links.

- 6.4.2** The ventilation buildings at North Lantau may be within the SCVA Nos. 44 and 45 of the Cavern Master Plan. The proposed alignment of rail links and ventilation buildings shall take account of this SCVAs in order not to affect their development potential.
- 6.4.3** NTHS will be required to assess whether the natural landslide hazards will affect the proposed ventilation buildings when the location is confirmed.
- 6.4.4** The preferences and details of the road and rail alignment in Southeast Lantau is highly dependent on the development plan for the ELM.
- 6.4.5** The PHI for SHWWTW could affect the feasibility of Siu Ho Wan Interchange, as there might be a possibility that the chlorine gas would immigrate into the tunnel through the portals. QRA shall be carried out in future studies for the PHI CZ of the water treatment works to assess in more detail the risk and the mitigation works required.
- 6.4.6** The land area at south of Cheung Tung Road adjacent to existing SHWSTW is a possible location of Administration Building for the road tunnel due to proximity to tunnel portal for fast response. However, there might be potential expansion of SHWSTW in that area as well which is also at an early stage of project. Continuous liaison shall be carried out in future studies.
- 6.4.7** For rail scenario R2 connecting to TCE, the TCE station shall allow flexibility for further connection to the possible rail link between TCE and HKBCF. Further liaison with HKBCF Topside Development on the rail alignment and implementation programme shall be carried out in future study.
- 6.4.8** For rail scenario R2 connecting to TCE, the TCE station and rail tunnel alignment run through the proposed TCE development area and the TCE OZP will possibly be affected. Further coordination with TCE to assess the impact on their OZP shall be carried out in future study.

7 Preliminary Traffic and Transport Impact Assessment

7.1 General

7.1.1 The preliminary TTIA was conducted under the Study to assess the traffic impacts of the SHW Reclamation and Landside Development under initial land use themes and with the consideration of other on-going and future developments such as ELM, NTN, Tung Chung, Sunny Bay, North Commercial District, SHW MTRCL depot, HKBCF, etc.

7.2 Base Case (without SHW Development)

7.2.1 Key findings of the Base Case TTIA are summarized below.

7.2.2 The traffic forecast indicates that in design year 2026, Lantau Link would operate within the manageable degree of congestion, whereas in design years 2031 onwards, Lantau Link would operate over the manageable degree of congestion. The forecast reconfirms the earlier findings of the previous studies, for example, Legco Paper No. CB(1)1096/04-05 (07) in 2005, which indicated that additional strategic road link is required to cater for the traffic demand incurred by North Lantau long-term development.

7.2.3 The junctions in the vicinity would be operating with ample capacity in design years 2026, 2031, 2036 and 2041, with a RC over 15% for signalised junctions and a DFC below 0.85 for priority junctions and roundabouts.

7.2.4 In the railway assessment, the preliminary result indicates that with upgrading of the signalling system, Tung Chung Line would operate within its capacity under 4 ppsm in all design years for the updated Initial Land Use Theme 2 (table 3.2 refers). The forecast is in line with the figures presented in LegCo Paper CB(1)1132/14-15(01) for Tung Chung New Town Extension in 2015.

7.3 Reference Case (with SHW Development)

7.3.1 Results of reference case with SHW development (assuming land use

theme with maximum development potential parameters) in design year 2031 are discussed below.

7.3.2 At strategic road level, Lantau Link (Tsing Ma Bridge) would operate over the manageable degree of congestion with a V/C ratio of 1.23, while TM-CLKL Northern Connection would operate within the manageable degree of congestion with a V/C ratio of 1.07 in design year 2031.

7.3.3 At local traffic network, all assessed major road junctions (i.e. Tai Ho Interchange, Road P1 Roundabout, and signalised junction at SHW MTRCL Depot Development access) in the vicinity would be operating at satisfactory level.

7.3.4 The railway forecast indicates that after upgrading of the signalling system, Tung Chung Line would operate within its capacity under 4 ppsm in design years for the updated Initial Land Use Theme 2 (table 3.2 refers).

8 Conclusion and Way Forward

- 8.1.1** Taking into considerations of the site constrains and opportunities, the maximum potential extents of SHW Reclamation and Landside Development were preliminarily studied. Three initial land use themes were formulated and subsequently evaluated against a set of guiding principles and criteria so that the relative performance of each element of the theme were compared. Based on the comparative evaluation, a land use theme was further developed and used for broad technical assessment.
- 8.1.2** There may be an increase in the development potential based on (i) the review of existing AHR at the PDS identified by CEDD under 2RS operations of HKIA conducted by CAD and the Preliminary Airspace Protection Plan for the future operations of 3RS of HKIA being conducted by AAHK and (ii) potential reduction of PHI CZ of SHWWTW due to the reduction of chlorine risk associated with SHWWTW by conversion from drum draw-off to cylinder draw-off under study by WSD.
- 8.1.3** Findings of the above studies will also have implications to the future land use that can be proposed in SHW. The future land use shall be reviewed in a holistic approach with the considerations of the land use compatibility of the proposed developments in the close vicinity.
- 8.1.4** Based on the preliminary sewage impact assessment, the additional sewage demand from proposed SHW development (with mazimum development potential) will exceed the design capacity of SHWSTW in Year 2029. A new sewerage network and pumping stations would be required to collect sewage flow from the development which shall subsequently be conveyed to SHWSTW or proposed new treatment works for subsequent treatment and disposal.
- 8.1.5** Regarding the fresh and flushing water demand, assessment shows that the existing capacity of SHWWTW is adequate to meet the projected maximum mean daily demand within its water supply zone (including SHW development and other developments in North Lantau). The planned extension of SHWWTW by the WSD and the associated water transfer facilities will therefore be required. New fresh water services

reservoir located adjacent to SHWWTW is envisaged to be required to supply fresh water to SHW development.

8.1.6 The CWD survey conducted under this Study indicates that no CWD sightings were recorded at SHW during day time but the PAM had recorded some usage in the area of SHW by CWD at night time. This CWD survey are preliminary only and were carried out in advance of the statutory Environmental Impact Assessment Ordinance (EIAO). In view of the on-going construction activities of HZMB-related Hong Kong projects, the survey findings under this Study will only be taken as reference to facilitate the broad CWD impact assessment at this stage, and will not be used as the sole baseline for subsequent CWD impact assessment. A more comprehensive CWD monitoring and impact assessment shall be carried out under the statutory Environmental Impact Assessment at a future stage of the project.

8.1.7 Also, statutory EIA and town planning process will need to be carried out in future study to critically assess various key environmental impacts (e.g. air quality, noise, water quality, waste, ecology, fisheries, cultural heritage, landscape and visual, hazard to life, etc.) and to formulate appropriate mitigation.

8.1.8 For road connection, a road tunnel between North Lantau and Southeast Lantau, possibly via Mui Wo, with reserve for a future connection to the ELM can be further studied. Siu Ho Wan Interchange (Interchange N3) is identified as the possible interchange between the North Lantau Highway and the road tunnel.

8.1.9 For rail connection, the connection to TCE is more technically feasible because of least interfacing issues with MTRCL and most direct alignment for possible connection to HKBCF and Tuen Mun which is in line with the concepts of strategic transport networks for Lantau in LanDAC TT SC Paper No. 12/2015. It also serves Tung Chung which has the greatest population in North Lantau.

8.1.10 There are several key issues affecting the choice of tunnel corridor and the schematic design of road and rail links which are subjected to review in the next stage study with reference to the latest development of other interfacing projects. These issues include:

- a) Development in ELM and Mui Wo – At the south, as the preferences and details of the road tunnel corridor will be highly

dependent on the development planning of the ELM and Mui Wo, it is suggested that the selection of the preferred options will need to be further studied at a later stage when more information of ELM is available.

- b)** Quantitative Risk Assessment (QRA) of PHI in SHWWTW and SMBWTW – The PHI for SHWWTW is a key constraint affecting the feasibility of Siu Ho Wan Interchange, QRA shall be carried out in future studies for the PHI CZ of the water treatment works to assess in more detail the risk and the mitigation works required. Attention is also drawn that the PHI CZ of SHWWTW could possibly be reduced from 1km to 400m subjected to possible update of WSD operations. Further liaison with WSD on the updates of PHI CZ shall be carried out in future studies.
- c)** Coordination of Road P1 Design with other interfacing project – The Road P1 Siu Ho Wan design will need to be further coordinated with the latest development in other interface projects, including the MTRCL Siu Ho Wan Depot Topside Development, the Tung Chung East New Town Extension and the Road P1 Sunny Bay Section.
- d)** The preferences and details of road alignment in Siu Ho Wan might encroach into the Strategic Cavern Areas (SCVAs) of the Cavern Master Plan. The proposed development shall take account of the SCVAs in order to preserve its cavern development potential as far as possible.
- e)** Implementation of Electronic Road Pricing System / Location of Toll Facilities - Subject to the implementation programme of the road link and the adoption of electronic road pricing system, it is possible that toll plaza will not be necessary. The most important criteria on the location of the toll facility is the tolling strategy on the traffic planning to ELM. While possible locations of toll facilities have been identified in the report, it is premature to determine the location of the toll facility at the current stage and shall be further investigated in future studies when more information on ELM is available.
- f)** Possible location of Administration Building for Road Tunnel in Siu Ho Wan – The land area at south of Cheung Tung Road adjacent to existing SHWSTW has been identified as a possible location of Administration Building due to proximity to tunnel portal for fast response. It is learned that there might be potential

expansion of SHWSTW in that area which is also at an early stage of project. Continuous liaison shall be carried out in future studies.

- g)** Further ground investigation works – The available ground information along the proposed road alignment is limited. More ground investigation works shall be carried out in future studies to confirm the geology along the road alignment. When more geotechnical information are available, the road tunnel portal design and preliminary blasting assessment can be carried out in future studies.
- h)** Programme Uncertainties – At this early stage of project, the derivation of a construction programme can only be ascertained in very broad terms. Factors such as site access, storage areas, construction plant etc. will all play a part in determining duration of the works.
- i)** Potential conflict between the alignment of the rail corridor, the possible HKBCF-TCE rail link and TCE OZP.

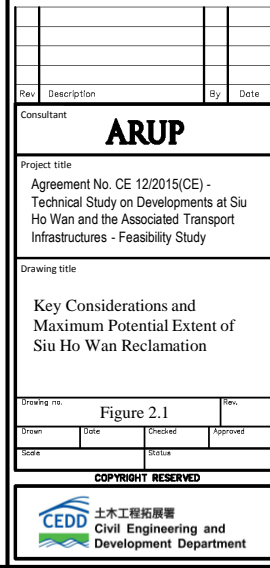
8.1.11 Regarding the findings of preliminary traffic impact assessment, the provision of Lantau Road P1 and Route 11 (Test Case 1) alone would not be sufficient in alleviating the traffic congestion in North Lantau. On the other hand, additional highway infrastructure with Road P1+ Route 11 + Tsing Yi-Lantau Link (Test Case 2) are identified as possible mitigation measures to alleviate traffic congestion in North Lantau. For the case with additional highway infrastructure comprising Road P1 + Route 11 + Road P1 extending to East of Sunny Bay Interchange (Test Case 3), the V/C ratio of Lantau Link is estimated to be marginally over 1.20 in design year 2041. Nevertheless, if the population in SHW is not based on the maximum development potential as discussed in 4.1, it may not be impossible that the V/C ratio of Lantau Link in 2041 could be reduced to slightly less than 1.2. Further assessment will be required in future study to ascertain this possibility.

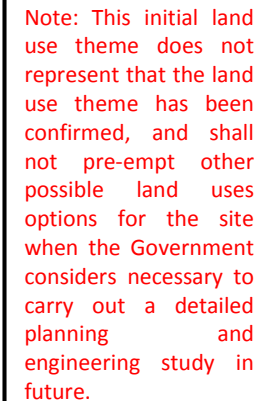
8.1.12 The railway forecast indicates that Tung Chung Line would operate within its capacity under 4 ppsm for design year 2041. This reveals that Tung Chung Line would have sufficient capacity to support the updated Initial Land Use Theme 2.

8.1.13 Test scenario under preliminary traffic impact assessment indicates that Tsing Yi – Lantau Link is a better provision to alleviate the traffic congestion in North Lantau in future. Connection between NWNT and

Hong Kong Island, via TCE is more preferable from transport planning point of view. A strategic highway corridor connecting North Lantau, ELM and Hong Kong Island, as assumed in test scenario D1, has better performance from transport planning point of view. It is worth highlighting again that the primary objectives of this Study, among others, are to test the technical feasibility of the proposed SHW development and define its maximum potential development extent. Hence, the recommendations of the Study, including the reclamation extent, land use themes, development parameters, etc., should only be regarded as preliminary proposals to facilitate the required broad technical assessments, but do not represent the development has been confirmed, nor to pre-empt other possible land uses options for the site.

Figures

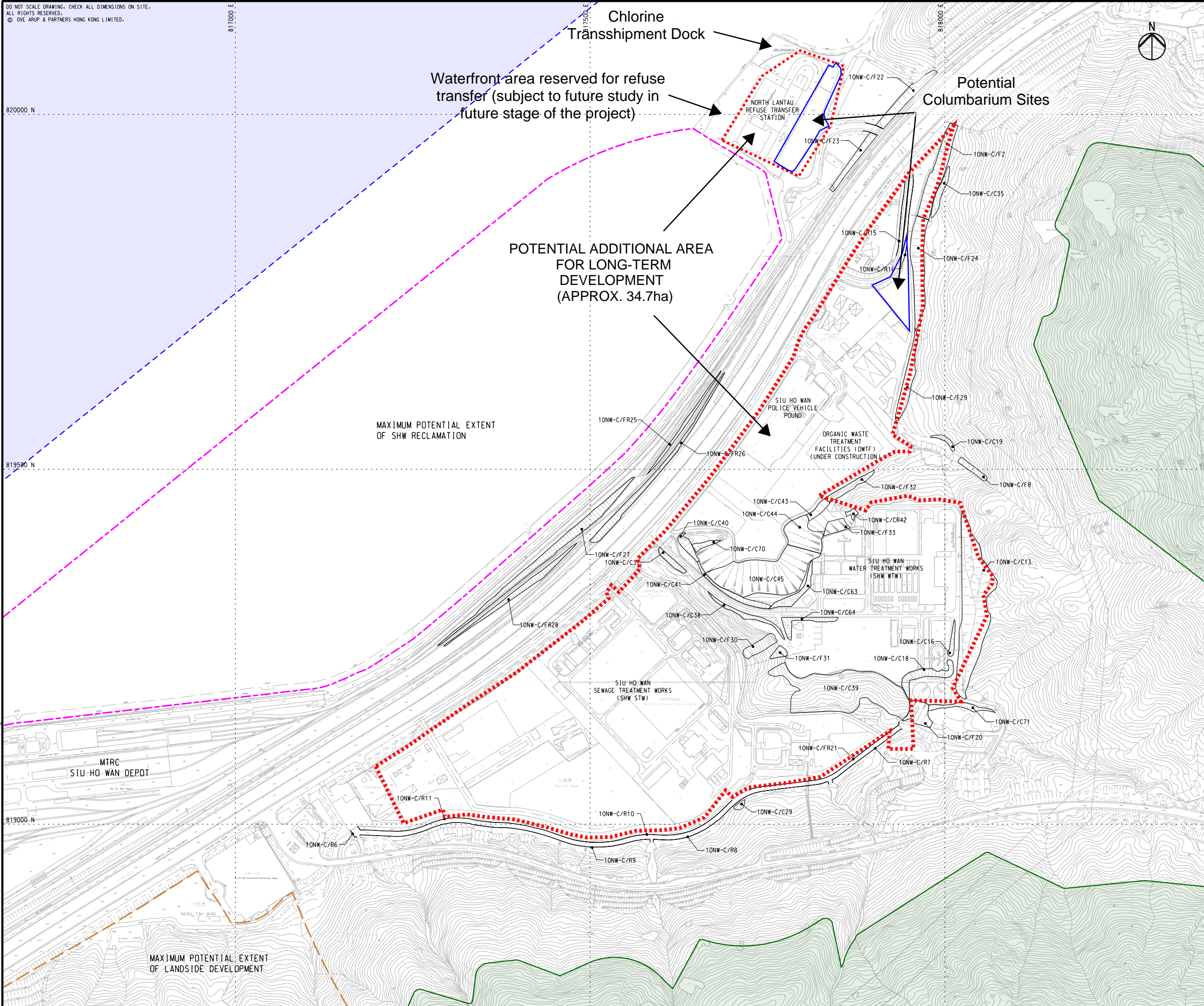




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KEY PLAN	
LEGEND	
	MAXIMUM POTENTIAL EXTENT OF LANDSIDE DEVELOPMENT
	MAXIMUM POTENTIAL EXTENT OF SHW RECLAMATION
	THE BROTHERS MARINE PARK
	GAZETTED COUNTRY PARK
	POTENTIAL ADDITIONAL AREA FOR LONG-TERM DEVELOPMENT

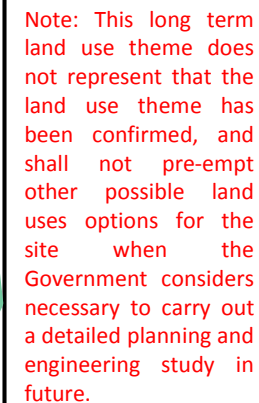
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Agreement No. CE12/2015(CE) -
Technical Study on Developments at
Siu Ho Wan and the Associated
Transport Infrastructures -
Feasibility Study

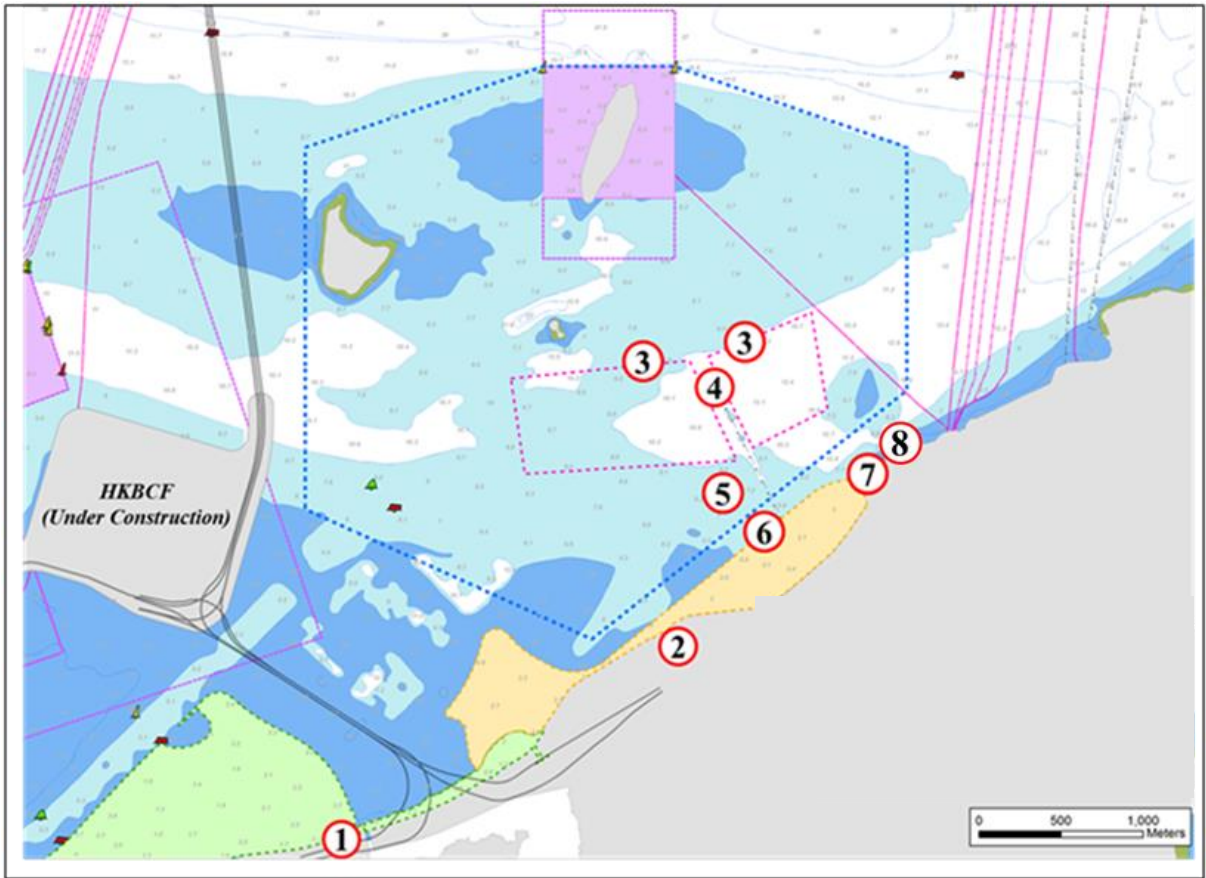
Drawing title
**LONG TERM
DEVELOPMENT AREA**

Drawing no. Figure 3.2		Rev. B	
Drawn RL	Date 06/16	Checked KL	Approved HS
Scale 1:2500 @A1	Status PRELIMINARY		



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LEGEND

- - - - - The Brothers Marine Park
- Proposed SHW Reclamation
- Proposed Tung Chung Reclamation (under separate study)

- 1 Pak Mong Pier
- 2 MTRC Siu Ho Wan Depot Berthing Facility
- 3 Mooring Areas in The Brothers Marine Park
- 4 Submarine outfall of Siu Ho Wan Sewage Treatment Works
- 5 Mooring Buoys
- 6 Cardinal mark
- 7 North Lantau Refuse Transfer Station
- 8 Liquid Chlorine Trans-shipment dock

Rev	Description	By	Date

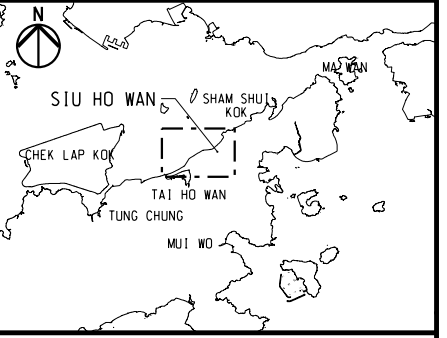
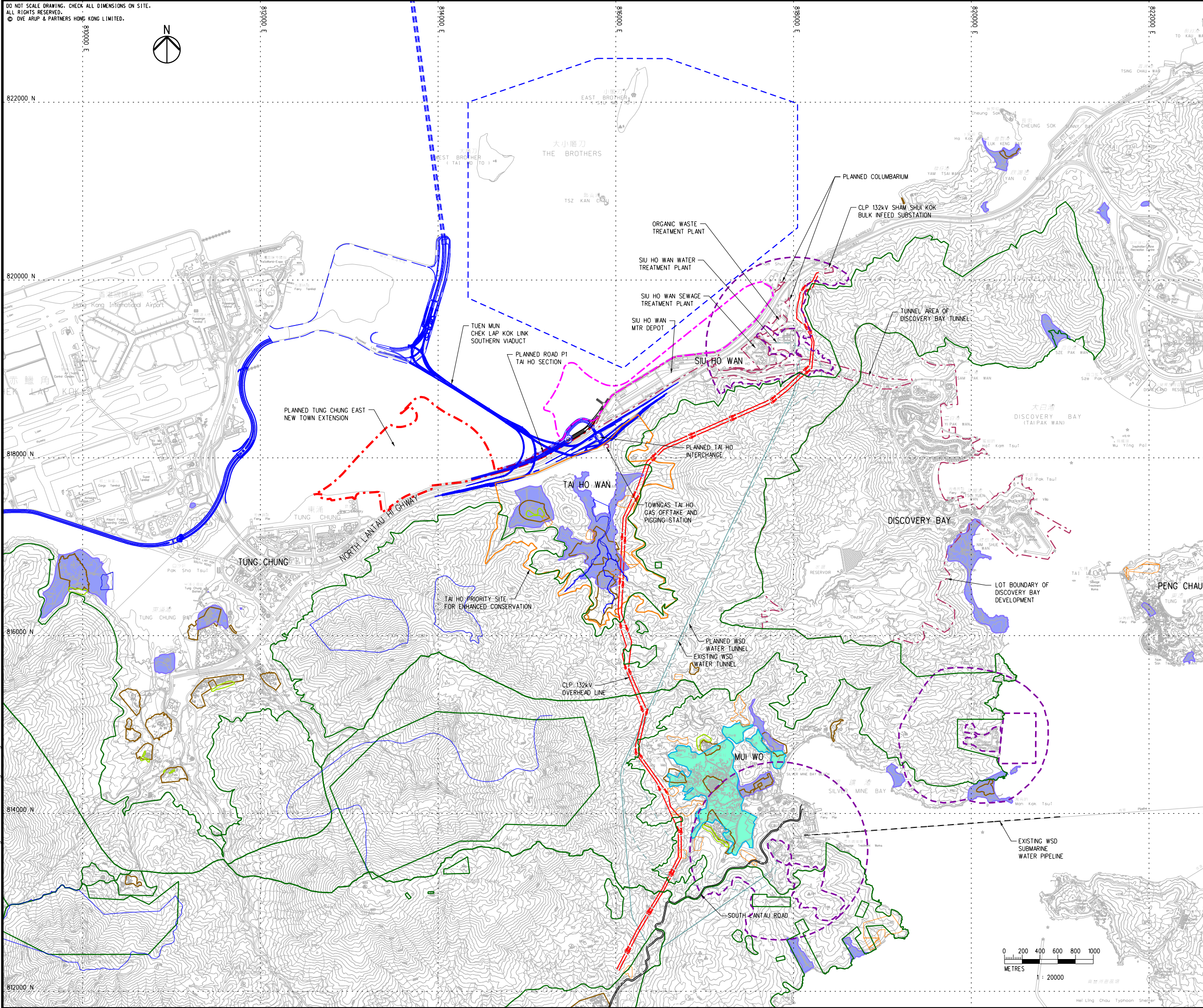
Consultant			
ARUP			
Project title			
Agreement No. CE 12/2015(CE) - Technical Study on Developments at Siu Ho Wan and the Associated Transport Infrastructures - Feasibility Study			
Drawing title			
Existing Key Marine Facilities			
Drawing no.		Rev.	
Figure 4.1			
Drawn	Date	Checked	Approved
Scale	Status		

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KEY PLAN

LEGEND:

- PROPOSED RECLAMATION AREA
- THE BROTHERS MARINE PARK
- GAZETTED COUNTRY PARK BOUNDARY
- CONSULTATION ZONE OF POTENTIALLY HAZARDOUS INSTALLATION (PHI)
- PRIORITY SITES FOR ENHANCED CONSERVATION
- SITE OF ARCHAEOLOGICAL INTEREST
- VILLAGE ENVIRONS
- SITE OF SPECIAL SCIENTIFIC INTEREST
- EXTENT OF ECOLOGICAL CONSTRAINT (INCLUDING FRESHWATER AND MARSH LAND) (REFERENCE FROM FINAL ENVIRONMENTAL IMPACT ASSESSMENT REPORT - SEPT 2005 - CE49/2002 (DS))
- FUNG SHUI WOODLAND
- POTENTIAL HAZARD CONSULTATION ZONE
- BURIAL GROUND
- PLANNED WATER TUNNEL
- CLP 132kV OVERHEAD LINE

D	FINAL TP23	LFM	12/17
C	REVISED FINAL TP4	LFM	09/16
B	FINAL TP4	LFM	08/16
A	DRAFT TP3	LFM	12/15
Rev	Description	By	Date

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Agreement No. CE12/2015(CE) -
Technical Study on Developments at
Siu Ho Wan and the Associated
Transport Infrastructures -
Feasibility Study

Drawing title
**CONSTRAINTS MAP FOR
STRATEGIC LINK TO
NORTH LANTAU**

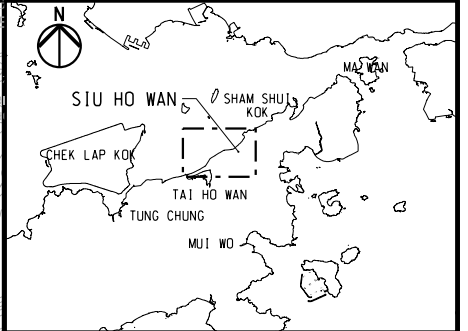
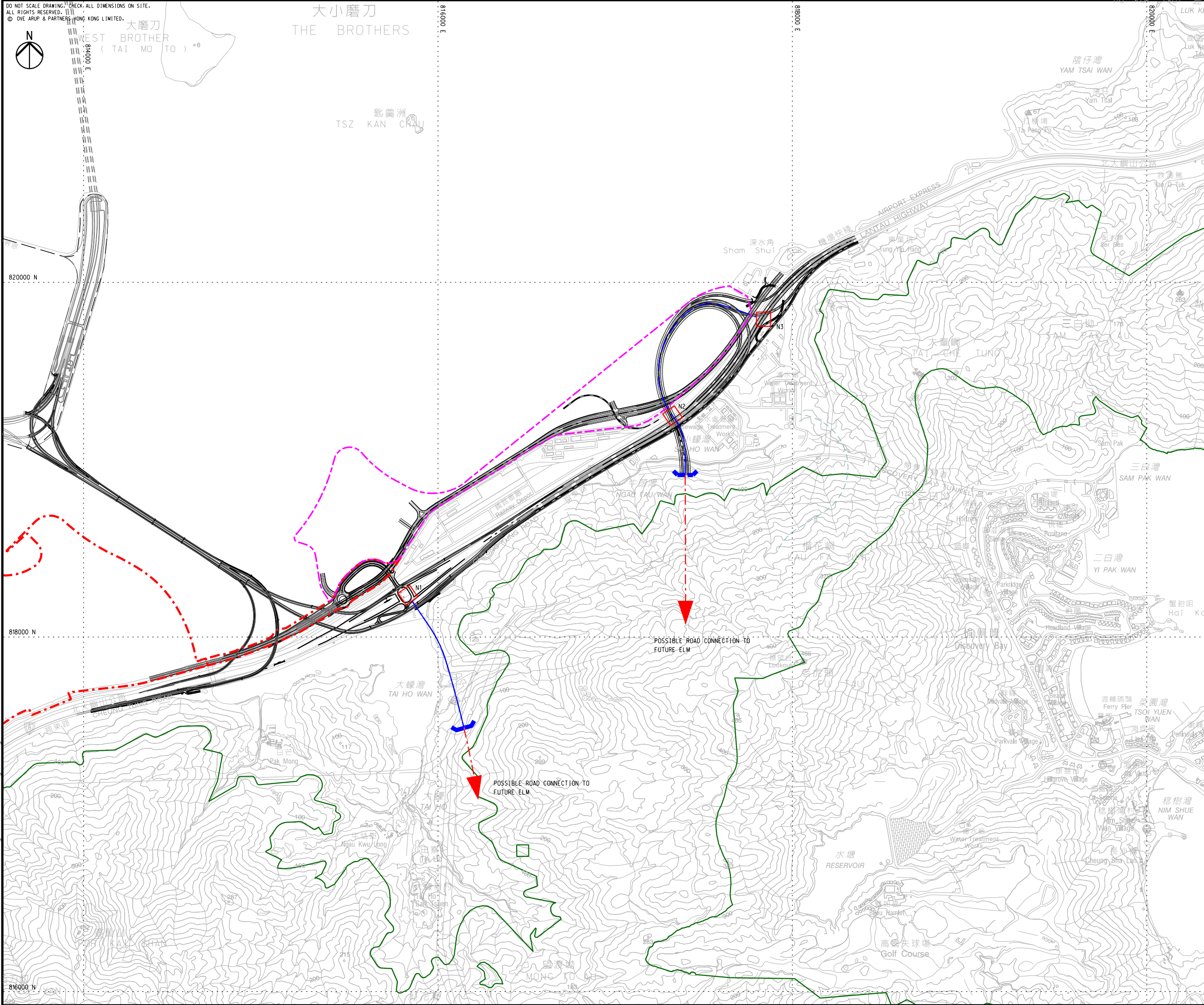
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Drawn	SYU	Date	08/15
Checked	LFM	Approved	KW
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KEY PLAN

LEGEND:

- GAZETTED COUNTRY PARK BOUNDARY
- PROPOSED RECLAMATION AREA
- INTERCHANGE POINT / LANDING POINT
- AT GRADE ROAD / VIADUCT
- - - TUNNEL
- - - ▶ POSSIBLE ROAD CONNECTION TO FUTURE ELM

D	FINAL TP23	LFM	12/17
C	REVISED FINAL TP4	LFM	10/17
B	DRAFT TP4	SPN	05/16
A	DRAFT TP3	LFM	12/15
Rev	Description	By	Date

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Contract No. and Title

Agreement No. CE12/2015(CE) -
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Siu Ho Wan and the Associated
Transport Infrastructures -
Feasibility Study

Drawing title

ROUTING OPTIONS FOR STRATEGIC LINK TO NORTH LANTAU

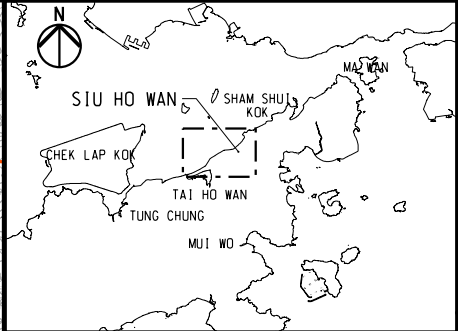
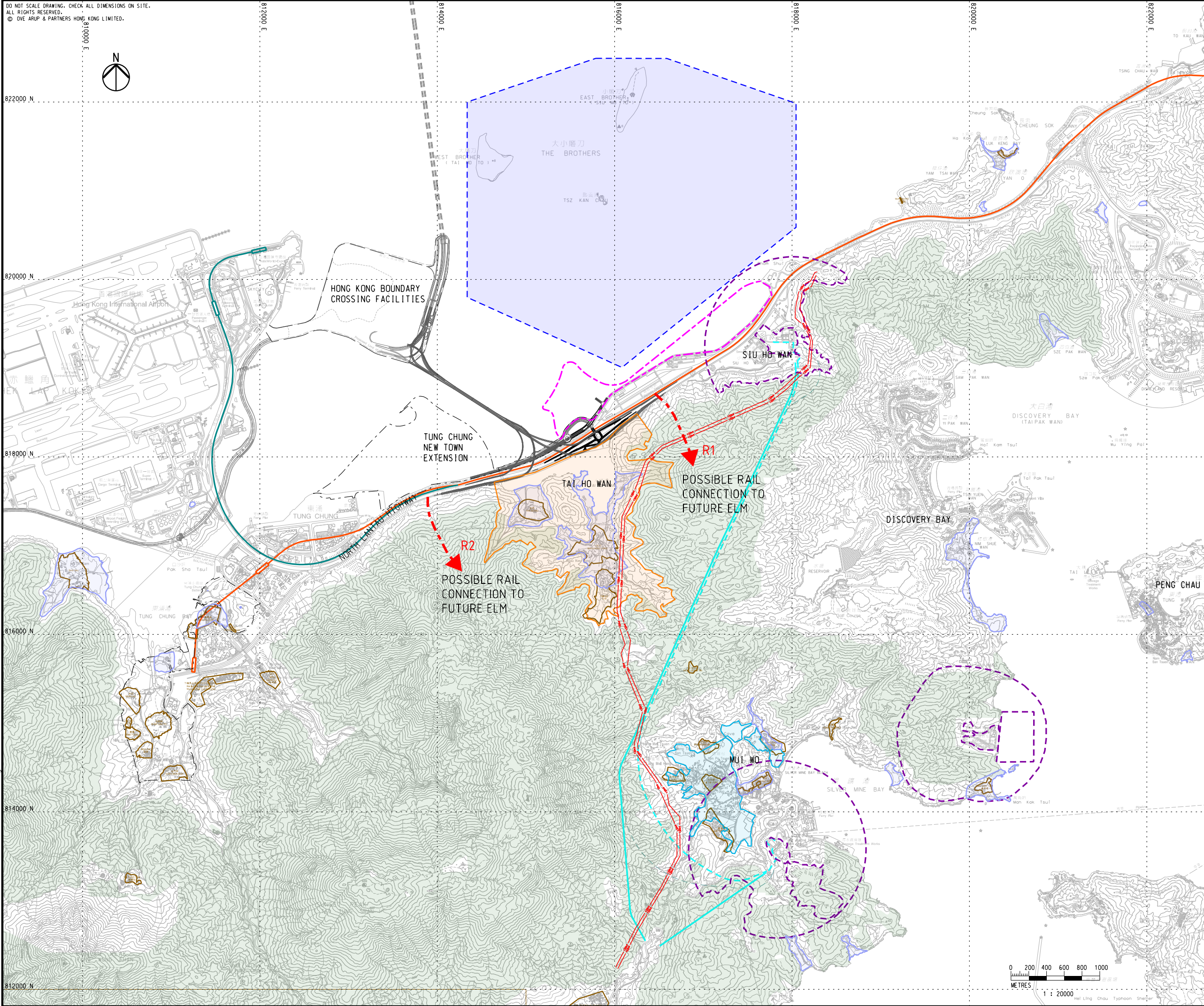
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Drawn SYU	Date 08/15	Checked KKC	Approved HS
Scale 1:10000 @A1	Status PRELIMINARY		

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KEY PLAN

LEGEND:

- PROPOSED RECLAMATION AREA
- THE BROTHERS MARINE PARK
- GAZETTED COUNTRY PARK BOUNDARY
- CONSULTATION ZONE OF POTENTIALLY HAZARDOUS INSTALLATION (PHI)
- PRIORITY SITES FOR ENHANCED CONSERVATION
- SITE OF ARCHAEOLOGICAL INTEREST
- VILLAGE ENVIRONS
- EXTENT OF ECOLOGICAL CONSTRAINT (INCLUDING FRESHWATER AND MARSHLAND) (REFERENCE FROM FINAL ENVIRONMENTAL IMPACT ASSESSMENT REPORT - SEPT 2005 - CE49/2002 (OS))
- AS-BUILT SIU HO WAN / SILVERMINE BAY AQUEDUCT
- PROPOSED WATER TUNNEL
- CLP 132KV OVERHEAD LINE
- EXISTING TUNG CHUNG LINE
- EXISTING AIRPORT EXPRESS LINE
- POSSIBLE RAIL CONNECTION TO FUTURE ELM

Rev	Description	By	Date
C	THIRD ISSUE	JS	12/17
B	SECOND ISSUE	JS	11/17
A	FIRST ISSUE	JS	01/16

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Feasibility Study

Drawing title
PROPOSED RAILWAY
ALIGNMENT TO SIU HO WAN
AND TUNG CHUNG

Drawing no.	Figure 6.1	Rev.	C
Drawn	AC	Date	12/15
Checked	JW	Approved	HS
Scale	1:20000 @A1	Status	PRELIMINARY

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