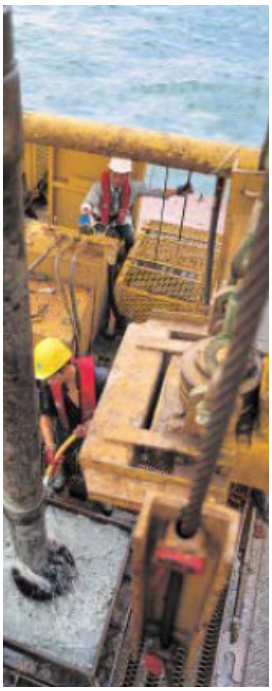
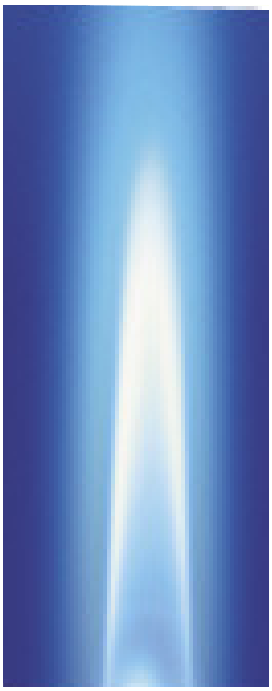


Installation of Submarine Gas Pipelines and Associated Facilities from To Kwa Wan to North Point for Former Kai Tak Airport Development

Consultancy Services for
Feasibility Study and Detailed Design

配合舊啓德機場發展計劃之土瓜灣至北角海底煤氣管道及相關設施之建造工程可行性及詳細設計顧問服務

Environmental Impact Assessment – Executive Summary

環境影響評估－行政摘要

June 2010

二零一零年六月

The Hong Kong and China Gas Company Limited
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Content

Tables

Figures

1. Introduction

An existing twin 400mm diameter submarine gas pipelines across the Victoria Harbour were constructed by Hong Kong China Gas Company Limited in the early 1970s to supply town gas from Kowloon to the Hong Kong Island. The existing twin 400mm diameter submarine gas pipelines are currently aligned 200m west of and parallel to the Former Kai Tak Airport (KTA) runway between a pigging station at the existing seawall at To Kwa Wan (TKW) and a pigging station at North Point (NP). The submarine gas pipelines are buried in a trench beneath the seabed and protected with rockfill. Owing to the proposed Cruise Terminal Development (CTD) and Central Kowloon Route (CKR) projects, the existing twin 400mm diameter submarine gas pipelines were requested to be diverted.

The “submarine gas pipeline” component of the Project is classified as Designated Project under item H.2 of Part I of Schedule 2 of the Environmental Impact Assessment Ordinance (EIAO) (Cap. 499). The dredging operation associated with the formation of trench for installation of submarine gas pipelines is classified as Designated Project under item C.12(b) of Part I of Schedule 2 of the Environmental Impact Assessment Ordinance (Cap. 499) as it is less than 100m from a seawater intake point. An Environmental Permit (EP) issued under the EIAO is required for the construction and operation of the designated project.

An Environmental Impact Assessment (EIA) Study has been undertaken to provide information on the nature and extent of environmental impacts arising from the construction of the proposed designated project and related activities taking place concurrently and to contribute to decisions on the overall environmental acceptability of the Project.

This Executive Summary provides the key findings of the EIA Report, including an assessment of potential water quality, waste, marine ecology, fisheries, landscape, cultural heritage, noise and construction dust impacts from the construction and operation of the Project, and recommendations for mitigation measures to comply with environmental legislations and guidelines.

2. Project Description

2.1 Background

The Project comprises construction of a new gas pipeline network from To Kwa Wan to North Point so as to replace the existing one affected by the proposed Cruise Terminal dredging works adjacent to the existing Kai Tak runway and the proposed Central Kowloon Route crossing the Kowloon Bay at To Kwa Wan. The gas pipeline network will consist of a twin submarine gas pipeline across the Victoria Harbour, two new pigging stations and associated land sections. The route of the proposed gas pipeline network is shown in **Figure 1.1**. The proposed Project is to construct and operate a twin submarine gas pipeline, two new pigging stations and associated land sections. The scope of the proposed Project comprises the following:

- twin submarine gas pipelines across the Victoria Harbour from To Kwa Wan to North Point (a designated project under EIA Ordinance);
- two land gas pipelines at To Kwa Wan and North Point respectively (non designated project under EIA Ordinance); and
- two pigging stations for pigging operation at To Kwa Wan and North Point respectively (non designated project under EIA Ordinance).

The site boundary of the proposed Project covers three main areas, namely: Victoria Harbour, To Kwa Wan and North Point. The Victoria Harbour area concerned is currently the To Kwa Wan Typhoon Shelter, government mooring area, Eastern Fairway and the Eastern Quarantine and Immigration Anchorage Area. The landfall site at To Kwa Wan will be on previously reclaimed land. The pipeline at To Kwa Wan will run through part of the previously reclaimed land after landing. The use of landing point at To Kwa Wan has been zoned as other specific used ("OU") according to the latest information from Planning Department. The landfall site at North Point will be on previously reclaimed land. The pipeline at North Point will connect to existing gas pipeline at Java Road after landing. The use of landing point at North Point is within North Point Police Station.

The Project will ensure that the replacement of the existing gas facilities from To Kwa Wan to North Point are completed in 2014 and the new facilities are in service before the de-commissioning of the existing facilities. The decommissioning / removal works of the existing cross-harbour submarine pipelines and gas pigging stations are not included in the scope of the proposed Project.

The construction of the proposed Project is scheduled to commence in January 2012 for completion by June 2014.

2.2 Do-nothing Scenario

The existing twin 400mm diameter submarine gas pipelines from To Kwa Wan to North Point were laid below the existing seabed. They were crucial for the supply of town gas to the Hong Kong Island. The proposed submarine gas pipelines and pigging stations are essential to maintain the gas supply from Kowloon to the Hong Kong Island as conflict between the proposed Cruise Terminal dredging works and CKR projects and the existing twin 400mm diameter steel submarine gas pipelines aligned 200m west of and parallel to the Former Kai Tak Airport (KTA) runway between a pigging station at the existing seawall

at MTK and a pigging station at NP means diversion of the existing submarine gas pipelines to allow gas to supply from Kowloon to the Hong Kong Island is inevitable. Without the project, the town gas supply to the Hong Kong Island will be interrupted.

2.3 Consideration of Alternatives

2.3.1 Alignment Options

There are several major installations and underground structures within the study area which are considered to be physical constraints to the alignment of the proposed submarine gas pipelines. These include To Kwa Wan and Kwun Tong Typhoon Shelters, Small Craft Mooring Buoys, Government Mooring Buoys, Eastern Quarantine and Immigration Anchorage, Hung Hom and Eastern Fairways, To Kwa Wan, North Point and Kwun Tong Sewage Outfalls, and Island Eastern Corridor. The choice of landing points of the submarine gas pipelines is limited by foundations/pier structures of the Island Eastern Corridor and utilities and infrastructure along the coast of Hong Kong Island East and South East Kowloon. The choice of pigging stations locations and land gas pipelines alignment is limited by existing planting area and trees near the coast of Hong Kong Island East and South East Kowloon.

As shown in **Figure 2.1**, the proposed submarine gas pipelines are bounded by To Kwa Wan and North Point Sewage Outfall and the Eastern Quarantine and Immigration Anchorage, the existing To Kwa Wan Typhoon Shelter, sewage outfall for To Kwa Wan Sewage Treatment Works, seawater intake for Quarry Bay Salt Water Pumping Station, foundations/pier structures of Island Eastern Corridor while the proposed pigging stations and land gas pipelines are bounded by proposed extension of To Kwa Wan Sewage Treatment Works and proposed extension of Man Hong Street Playground.

By considering the constraints discussed above, the most feasible submarine gas pipelines alignment and landing points are as follows:

For the submarine portion, the shortest and the most feasible route for this portion is an alignment between the dictated landing points at the open space near Hoi Shum Park and at the waterfront area next to North Point Police Station in a manner as shown in **Figure 2.1** such that the impact on water quality, coral communities, sediment management and marine archaeology be minimized and impact on underwater infrastructure and marine traffic is minimal.

For To Kwa Wan, the most feasible landing point is at the area to the north of existing DSD To Kwa Wan Sewage Treatment Works and then connected to a new pigging station located at adjacent to the future Hoi Sham Park extension close to the existing Sewage Treatment Plant.

For North Point, the most feasible landing point inside the North Point Police Station and then connected to a new pigging station located at the same area.

2.3.2 Pigging Station Locations

Thirteen options were considered for the selection of site on the Kowloon side for the construction of new pigging station. The feasible site identified for the construction of To Kwa Wan pigging station was the site adjacent to the existing Preliminary Treatment Plant which is classified as “Other Specified Use (OU)” while the others are all zoned “Open Space” or occupied by existing buildings. As the proposed To Kwa Wan pigging station does not require substantial site formation works and demolition of existing buildings, it’s environmental nuisance (e.g. dust, noise and landscape impact) to the general public would be minimized

during construction and operation stage of the pigging station. A waterfront promenade of at least 25m wide would be available next to the proposed To Kwa Wan pigging station.

Seventeen options were considered for the selection of site on the Hong Kong side for the construction of new pigging station. The feasible site identified for the construction of North Point pigging station was the site inside the compound of the North Point Police Station where the existing North Point pigging station was located which is classified as "Government, Institute and Community" and "Road". The location of proposed North Point pigging station has been agreed with Hong Kong Police Force. As the North Point pigging station would be inside the compound of existing North Point Police Station, it's environmental nuisance (e.g. dust, noise and landscape impact) to the general public would be minimized during construction and operation stage of the pigging station. The valuable open space within the district would not be affected.

2.3.3 Construction Methods

The methods commonly used to install submarine gas pipelines include "jetting (trenching)", "jetting (injection)", "horizontal directional drilling", and dredging to form the trench followed by "float and sink", "bottom pull" or "lay barge" followed by backfilling to protect the pipeline. For this project the jetting technique is not feasible.

Jetting installation involves the use of water jets to loosen the seabed material sufficiently to allow the pipe to be pulled into the seabed with significant disturbance to the seabed. Horizontal directional drilling involves taking the pipelines directly from the start to end point by underground drilling with no surface disturbance being necessary. Dredging involves the removal of marine sediments from the seabed to form the trench, into which the submarine gas pipelines are laid by possible methods including Bottom Pull, Lay Barge or the Float and Sink Method. Backfill material would be placed on top to protect the pipeline and minimize the cross section of dredging and backfilling works. A typical cross section of the submarine gas pipelines are provided in **Figure 2.2**. Design of the cross section and the resulting amount of marine sediments to be dredged from the seabed to form the trench will be depending on the required minimum cover and the existing seabed level for the Bottom Pull, Lay Barge or the Float and Sink Method is adopted for submarine gas pipelines installation.

An analysis of different construction methods and techniques to minimise impacts on water quality, marine ecology, fisheries and waste was carried out. Details of the analysis are presented in the EIA report.

2.3.4 Best Practical Method

By comparing the pros and cons of the various construction methods, grab dredging, followed by pipe laying i.e. "Bottom Pull" method across the fairway, "Float and Sink" method near the landing point and either "Bottom Pull" or "Lay Barge" for other sections of the submarine gas pipelines followed by protection of the submarine gas pipelines by backfilling are the most practical construction method for the installation of the proposed submarine gas pipelines.

Based on the ground investigation and laboratory testing data, the seabed material within the works area of the project consist of about 30% of contaminated sediment. The contamination level of the sediment along the dredging area at Victoria Harbour was high in terms of heavy metals such as Cu, Ni, Zn, Pb, Hg and high molecular weight Polycyclic Aromatic Hydrocarbons (PAHs). Contaminated sediment (Type 3) was located near the To Kwa Wan Typhoon Shelters. Contaminated sediment (Type 2) was located near both proposed pigging stations at North Point and To Kwa Wan which is extended up to about the middle of

proposed gas pipelines in Victoria Harbour. Based on ground investigation the sediment immediately below the seabed comprises mostly very soft slurry deposit which are soft, fine, dark grey and black, clay/silt (contaminated marine deposit), therefore the disturbance to the contaminated marine sediment must be minimized. Jetting is not feasible for such marine sediment properties under the seabed. The jet machine would eject plumes of fluidised soft fine slurry, clay and silt out of the sides of the machine and these plumes of fluidised marine sediment would become entrained in the water column along the tidal flow and cause adverse impacts on water quality and ecological sensitive receivers in the vicinity.

The identified very soft clay would require a slope gradient of about 1 in 3 on the sides of the trench for stability. Additional and repeated passes would be required to achieve the required trench width and depths. This would increase the volume of contaminated marine sediment being ploughed up and thus increase the spread of highly contaminated substances. This also indicates that the jetting method would not be effective in the soft mud and slurry ground conditions. Furthermore, the contaminated slurry on the sides of the trench at the top layer of the seabed would tend to collapse into the trench formed by jetting with steep gradient and the required armour rock protection cover cannot be achieved accordingly.

The jetting method would result in extensive pollution in heavily contaminated ground. The jetting force would cause transportation/movement of contaminated sediment and fine particle of contaminants from its original locations to other parts of the Victoria Harbour which would be unacceptable and should be avoided. The jetting method is thus not feasible in the project area.

The proposed submarine gas pipelines should be laid at a minimum depth of 3m incorporating a rock armour protection layer or at a minimum depth of 5m should the trench be back-filled with original seabed material in accordance with the requirement of CEDD/Port Works. Trench of minimum 3m covered with armour rock would be adopted in the design in order to provide adequate protection to the pipelines and to ensure safety. At the fairway, the designed minimum cover is at least 4m, with rock armour protection. The dredging quantity is kept to a minimum of about 300,000m^3 while the filling level at the seabed would match to the existing seabed level. Hydrographical surveys of seabed levels would be conducted before and after construction to ensure the original seabed level is restored.

The assessment results, recommendations and conclusions have been addressed in this EIA report based on the proposed construction techniques or methods.

2.4 Selection of the Preferred Option

The discussions presented in the EIA report have examined the rationale behind the selection of the preferred alignment and pigging stations locations, the preferred construction method and the issue of timing. The environmental and physical constraints have been presented along with the preferred alignment and pigging stations locations for the Project. The submarine gas pipelines alignment avoids direct impacts to the coral areas while the pigging stations avoids the use of open space and direct impacts to plantings and trees. The alignment presented on **Figure 2.1**, therefore, represents the preferred alignment for the gas pipelines and pigging stations taking into account ecological, water quality and marine traffic constraints.

By comparing the pros and cons of the various construction methods, the preferred construction method is grab dredging, followed by pipelaying i.e. “Bottom Pull” method across the fairway, “Float and Sink” method near the landing point and either “Bottom Pull” or “Lay Barge” for other sections of the submarine gas pipelines followed by protection of the submarine gas pipelines by backfilling of armour rock.

This proposed alignment and construction methods for the gas pipelines have been studied in detail as part of the EIA Report. The selection of this position was taken after a holistic review of the environmental constraints (corals, plantings and trees), physical constraints (navigation channel), the results of the water quality modelling and noise assessment exercise and the form and appearance of the proposed above ground structures with visual mitigation measures.

3. Environmental Impacts

The environmental impacts associated with the construction and operation of the submarine gas pipelines are summarised in the following sections.

3.1 Water Quality

The water quality impact during the proposed dredging works for installation of submarine gas pipelines has been quantitatively assessed using the Delft3D Model. Suspended solids are identified as the most critical water quality parameter during the dredging operations. The worst-case scenarios for the dredging works have been assessed and adverse water quality impact was not predicted. The implementation of the appropriate mitigation measures could effectively minimize any potential water quality impacts upon seawater and cooling water intakes.

3.1.1 Impact Assessment

Major water quality impact associated with dredging activities is the elevation of suspended solids (SS) within the marine water column. With reference to the construction programme and likely concurrent projects, representative worst case scenarios has been selected for modelling and assessment. Their acceptabilities in terms of comparing the predicted SS results with various standards are provided in **Table 3.1**. Provided the recommended mitigation measures are implemented, no unacceptable water quality impact due to construction of the submarine gas pipelines as well as the other concurrent marine works is expected.

Table 3.1: Summary of Predicted SS for all Scenarios

	Corals	Fish Culture Zone	Cooling Water Intakes	Flushing Water Intakes
Installation of Submarine Gas Pipeline Only				
Dry Season				
Maximum SS (mg L^{-1}) *	0.1	0.0	7.7	7.5
Exceedance	No	No	No	No
Wet Season				
Maximum SS (mg L^{-1}) *	0.2	0.0	5.9	6.7
Exceedance	No	No	No	No
Installation of Submarine Gas Pipeline with Concurrent Projects				
Dry Season				
Maximum SS (mg L^{-1}) *	0.6	0.6	49.8†	8.9
Exceedance	No	No	No	No
Wet Season				
Maximum SS (mg L^{-1}) *	0.9	0.6	39.3†	8.2
Exceedance	No	No	No	No

* For corals and Fish Culture Zones, maximum depth-averaged SS elevations are shown; for cooling water and flushing water intakes, maximum surface SS concentrations are shown

† The Project (installation of submarine gas pipeline) only contribute insignificantly to the high SS concentrations at WSR C15. No water quality criterion was found for the cooling water intake. Nevertheless, silt screen was recommended by the concurrent project Wan Chai Development Phase II and Central-Wan Chai Bypass to reduce the SS impacts on the WSR.

Dissolved oxygen (DO) exceedances were predicted in wet season. The level of DO depletion and minimum predicted depth-averaged DO for water sensitive receivers with DO exceedances are provided in **Table 3.2**. Predicted changes for DO by the subject Project are small (maximum depletion of 0.1 mgL^{-1}) and within the ranges of natural variations experienced in the study area. However, as ambient depth-averaged DO levels in wet season recorded did not comply with the water quality objectives (WQO) criteria, this inevitably resulted that the predicted minimum DO values for the subject Project in wet season at various WSRs would not be able to meet the WQO criteria. As the predicted changes for DO by the subject project are small, no adverse residual water quality impact is expected.

Table 3.2: Summary of Predicted DO Exceedance for all Scenarios

	Water Quality Sensitive Receivers with Exceedance of Depth-averaged DO level		
	Fish Culture Zone (F1 and F2)	**Cooling Water Intakes (C2 to C28)**	**Flushing Water Intakes (WSD5 to 7, 10 to 12, 15 and 16)**
Installation of Submarine Gas Pipeline Only			
Wet Season			
DO Depletion (mg L^{-1})	0	0	0
Minimum Depth-Averaged DO (mg L^{-1}) *	3.6 – 4.5	3.3	3.3
Exceedance	Yes*	Yes*	Yes*
Installation of Submarine Gas Pipeline with Concurrent Projects			
Wet Season			
DO Depletion (mg L^{-1})	0	0.1 – 0.7†	0 – 0.1
Minimum Depth-Averaged DO (mg L^{-1}) *	3.6 – 4.5	3.3	3.3
Exceedance	Yes*	Yes*	Yes*

* Please refer to discussion in second paragraph in Section 3.1.1.

† The Project (installation of submarine gas pipeline) only contribute insignificantly to the low Depth-averaged DO concentrations at WSR C15. No water quality criterion was found for the cooling water intake. Nevertheless, silt screen was recommended by the concurrent project Wan Chai Development Phase II and Central-Wan Chai Bypass to reduce the DO impacts on the WSR.

Hydrostatic test of the gas pipeline system will lead to effluent containing elevated concentrations of SS that will enter into the surrounding water. It was however expected that the above water quality impact will be temporary and localised during construction only. Provided the recommended mitigation measure is implemented and the effluent discharge complied with the Technical Memorandum on Standards for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters (TM-DSS) standards, no unacceptable water quality impact due to effluent arising from hydrostatic test is expected.

General construction activities associated with the construction of the submarine gas pipelines will lead to construction site runoff containing elevated concentrations of SS and associated contaminants that will enter into the marine water. It was however expected that the above water quality impacts will be temporary and localised during construction only. Provided the recommended mitigation measures are implemented and all construction site/works area discharges complied with the TM-DSS standards, no unacceptable water quality impact due to construction of the submarine gas pipelines is expected.

3.1.2 Mitigation Measures

Implementation of the following mitigation measures is recommended during dredging to minimise the potential SS impact:

- Dredging shall be carried out by closed grab dredger to minimize release of sediment and other contaminants during dredging;
- The maximum production rate for dredging from the seabed for installation of the submarine gas pipelines shall not be more than 4,000m^3 per day (and no more than 1 closed grab dredger);
- Deployment of frame type silt curtain to fully enclose the grab while dredging works are in progress. The frame type silt curtain shall be extended to the seabed to cover the entire water column to minimize the potential SS impact;
- all vessels should be sized so that adequate clearance is maintained between vessels and the seabed in all tide conditions, to ensure that undue turbidity is not generated by turbulence from vessel movement or propeller wash;
- the speed of all vessels shall be controlled within the works area to prevent propeller wash from stirring up the seabed sediments;
- all barges / dredgers used shall be fitted with tight fitting seals to their bottom openings to prevent leakage of material;
- construction activities shall not cause foam, oil, grease, scum, litter or other objectionable matter to be present on the water within the site or dumping grounds;
- barges or hopper shall not be filled to a level that will cause the overflow of materials or polluted water during loading or transportation; and
- before commencement of dredging works, the holder of the Environmental Permit shall submit detailed proposal of the design and arrangement of the frame type silt curtain to EPD for approval.

There will be no unacceptable residual water quality impact due to the proposed dredging works. An environmental monitoring and audit programme is proposed to ensure that all the recommended mitigation measures are implemented properly.

3.2 Waste

A review of the sediment quality data from the marine site investigation indicated that the majority (74%) of the marine sediments to be dredged along the proposed submarine gas pipelines were classified as Category L. A summary of classification of the vibrocore samples is provided in **Table 3.3**.

Table 3.3: Summary of Classification of Vibrocore Samples

Category	Number of Samples
Category L	93
Category M	5
Category H	25
Category H (10 x > LCEL)	2

3.2.1 Impact Assessment

The total volume of dredged sediment from the construction of the submarine gas pipelines requiring marine disposal was estimated in the engineering design study to be 267,603m^3. The volume of dredged sediment suitable for open sea disposal (Type 1) was estimated to be approximately 187,179m^3. The volume of contaminated sediment requiring confined marine disposal (Type 2) was estimated to be approximately 76,936m^3. The volume of contaminated sediment requiring special treatment or disposal

(Type 3) was estimated to be approximately 3,488m^3. Allocation of marine disposal sites and all necessary permits would be applied from relevant authorities for disposal of dredged sediment. Project Proponent would obtain confirmation from CEDD/Marine Fill Committee (MFC) on the disposal options before commencement of the Project. With the implementation of the recommended mitigation measures and management procedures in accordance with the requirements of ETWB TCW No. 34/2002, no adverse residual impact was predicted.

Waste types generated by the construction activities are likely to include C&D material (from excavation works for construction of the landing points), general refuse from the workforce, and chemical waste from the maintenance of construction plant and equipment. **Table 3.4** provides a summary of the various waste types likely to be generated during the construction activities for the proposed submarine gas pipelines, together with the recommended handling and disposal methods.

Table 3.4: Summary of Waste Handling Procedures and Disposal Routes

Waste Material Type*	Total Quantity Generated	Quantity to be disposed off-site	Disposal	Handling
Marine Dredged Sediment (Uncontaminated, Type 1), Category L	187,179 m^3	187,179 m^3	MFC gazetted marine disposal ground – open sea disposal site	Minimise resuspension by use of closed grab, controlled loading and transfer
Marine Dredged Sediment (Contaminated, Type 2), Category M_f and H	76,936 m^3	76,936 m^3	East Sha Chau contaminated mud pit	Minimise resuspension by use of closed grab, tight seal on barges, controlled loading and transfer
Marine Dredged Sediment (Contaminated, Type 3) Category H_f	3,488 m^3	3,488 m^3	By containment of the sediments in geosynthetic containers and disposal at East Sha Chau contaminated mud pit	Minimise resuspension by use of closed grab, tight seal on barges, controlled loading and transfer
C&D Material	900 cubic meters (preliminary estimate)	Few hundred cubic meters (preliminary estimate)	To be reused on-site for construction of the associated landmain gas pipelines or To be disposed to public fill reception points for other beneficial uses or To be disposed to landfill	Segregate inert C&D material to avoid contamination from other waste arising
General Refuse	65 kg per day (preliminary estimate based on workforce of 100)	65 kg per day	Refuse station for compaction and containerisation and then to landfill	Provide on-site refuse collection points
Chemical Waste	Few cubic metres per month (preliminary estimate)	Few cubic metres per month (preliminary estimate)	Chemical Waste Treatment Centre	Recycle on-site or by licensed companies. Stored on-site within suitably designed containers

* In accordance with ETWBTC (Works) No. 34/2002, L means Category L Material, ≤Lower Chemical Exceedance Level , M_f means Category M Material, >Lower & ≤Upper Chemical Exceedance Level and has failed biological screening test, H means Category H Material, >Upper Chemical Exceedance Level & <10 x Lower Chemical Exceedance Level and biological screening test is not

required, H_f means Category H Material, >Upper Chemical Exceedance Level & >10 x Lower Chemical Exceedance Level and has failed biological screening test

3.2.2 Mitigation Measures

Recommendations for good site practices 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 handling procedures, separation of chemical wastes with appropriate treatment
- Provision of sufficient waste disposal points and regular collection of waste
- Barges filled with dredged sediment shall be towed away immediately for disposal. In doing so, odour is not anticipated to be an issue to distant sensitive receivers
- Well planned delivery programme for offsite disposal such that adverse impact from transporting sediment material is not anticipated
- Well maintained PME should be operated on site
- Regular cleaning and maintenance of the drainage systems for construction of the landing points
- Appropriate measures to minimise windblown litter and dust during transportation of waste by either covering trucks or by transporting wastes in enclosed containers

Provided that these wastes are handled, transported and disposed of using approved methods and that the recommended good site practices are strictly followed, adverse environmental impacts is not expected during the construction phase.

3.3 Marine Ecology

The ecological value of the marine ecological resource was evaluated based on the results of literatures review and field surveys. It was found that the marine benthic organisms found within the dredging area consist of pollution tolerant soft benthos which are in low diversity and is typical to benthos recorded in poor quality sediments. The inter-tidal survey confirmed that the inter-tidal communities colonizing the artificial seawall and concrete embanked wharf piles at To Kwa Wan and North Point landing points are common fouling organisms. Inter-tidal surveys were also conducted at the rocky shore at Hoi Sham Park where the inter-tidal community are covered with grease and pollutants. Diversity and abundance of inter-tidal fauna species recorded are similar to those at adjacent artificial seawall.

Benthic infauna were studied and all the species found in Victoria Harbour Water Control Zone were widely distributed along the coast of China and considered as the indicators of the presence of high organic loading in sediment. For the hard coral communities, low coverage of species *Oulastrea crispata* was found on sub-tidal habitat of To Kwa Wan breakwaters. Coral communities of varied coverage and species diversity were recorded in the coral sites Green Island, Sandy Bay, Cape Collinson, Tung Lung Chau and Junk Bay. Overall, it is evaluated that the inter-tidal, marine benthos and sub-tidal assemblages within the project boundary are of low ecological value.

3.3.1 Impact Assessment

Habitat loss in seabed and artificial seawall are both regarded as temporary since the dredged area will be backfilled and the seawall will be reinstated. The temporary loss of marine benthic and inter-tidal communities is regarded as of low significance owing to the low diversity and abundance of marine fauna

species found in the project area. Given the high commonness of the marine benthos and their capability of recolonization, the ecological impact in respect of the loss of marine benthic community and their habitat is considered as minor. Moreover, the potential impact of loss of inter-tidal communities is also regarded as minor given their low ecological value. Further, though two small colonies of hard coral (scleractinains) species *Oulastrea crispata* were found in the North Point seawall, the impact of potential loss of the two small colonies of hard coral is regarded as minor given the high commonness of the species and very small size of the colonies.

The potential indirect impact to the identified marine ecological sensitive receivers due to degradation of water quality was predicted by using water quality modelling. As mentioned and summarized in **Table 3.1,** the results indicated that the elevation of SS concentration and sedimentation rate are all within acceptable level around the identified marine ecological sensitive receivers. On the other hand, during the marine dive survey for this Project, low coverage of hard coral species *Oulastrea crispata* were found at the hard boulder in To Kwa Wan breakwaters. Given to the close proximity to the dredging area, the hard coral species *O. crispata* colonies attaching on the breakwaters hard boulder will have no adverse impact with proper mitigation measures implemented.

The dredging works to create a temporary trench at the seabed is considered as rather small in scale which would unlikely constitute significant effect on the water velocity and pressure of the Victoria Harbour. After installation of the pipeline, the trench would be backfilled and the seabed would recover to normal level. Given that no marine species of conservation concern were identified inhabiting the marine water in Victoria Harbour, the potential ecological impact due to changes in hydrology, hydrodynamics properties and flow regimes in Victoria Harbour is also considered as negligible.

As the design of the proposed submarine gas pipelines would minimize the frequency for maintenance or repair due to accidental breakage, no maintenance dredging is expected for the future operation of the proposed submarine gas pipelines. Therefore, no operation impact on marine organism is expected. Since the affected seabed would be backfilled, recolonization of benthic fauna is expected, and no maintenance dredging is required for the submarine gas pipelines, no unacceptable residual impact is expected.

3.3.2 Mitigation Measures

General mitigation measures proposed in **Section 3.1.2** to control the water quality level during construction period will also apply for marine ecology. In order to minimize the potential indirect impact to the coral community on the To Kwa Wan breakwater, it is recommended to deploy specific silt curtains to protect the identified coral colonies. Aside from the general frame type silt curtain, a second silt curtain is recommended to be installed between the dredger and the breakwater for protection of hard coral communities. Detailed design of this silt curtain shall be submitted to EPD and AFCD for agreement at least two weeks prior to project commencement. Recommendations for the silt curtain are listed below:

- The silt curtain shall be fabricated from permeable, durable, abrasion resistant membrane like geotextiles.
- The silt curtain shall be mounted on a floating boom structure surrounding the grab and should extend to the sea bottom.
- The curtain shall be 75m long and moved along with the dredger as the works progresses.
- The curtain shall be arranged so that at least 15m of the curtain shall extend past the dredger in each direction.
- The curtain shall remain in a suitable position between the dredger and the corals until the dredger is 250m from the corals.

With the implementation of the recommended mitigation measures, the potential impact to the coral communities colonizing the To Kwa Wan breakwaters would be minimized to an acceptable level. With the implementation of the recommended mitigation measures, it is anticipated that the potential ecological impact arising from the Project is anticipated to be acceptable.

3.4 Fisheries

Review of existing information on fisheries resources and fishing operations located within the Study Area have been undertaken. Impact to the fisheries due to the Project is not anticipated.

3.4.1 Impact Assessment

During construction phase, the construction barges would occupy a small working area on sea and restrict access of marine vessels. However, marine traffic impact assessment revealed that it was acceptable, the occupied works area will be mobilised as the works in progress, so the restricted marine area will be localised and implement in stages. Impact to the marine traffic in general is acceptable. Since there was no records of fish fry production and operation of trawlers within the proposed works area of the project, impact to fishing activities in the area are not expected owing to the small affected area and short period of disturbance during the phasing of works for dredging and installation of the submarine pipeline. Impact on future fishing operation is not anticipated as the rock armour will not protrude above the original seabed level.

Ma Wan Fish Culture Zone (approximately 16km apart) and Tung Lung Chau Fish Culture Zone (approximately 9km apart) are not predicted to be impacted by either suspended solids elevation, dissolved oxygen depletion or nutrient elevation as a result of the Project. Impact to the Fish Culture Zones and fisheries due to water quality in construction phase is not anticipated.

As potential impacts to fisheries resources and fishing operations arising from the formation of the submarine gas pipelines trench at the seabed are predicted to be temporary and localised, they are not expected to cause significant adverse impacts to any fishing grounds or species of importance to the fishery.

Since no maintenance dredging is required in operation phase, no operation phase impact is predicted.

3.4.2 Mitigation Measures

Significant Impacts to fisheries resources and fishing operations have largely been avoided during construction through constraints on the works operations for installation of the submarine gas pipelines. The confinement of works area for dredging works and pipelines installation will be in phases to minimize the impact on marine traffic as well as fishing activities in the Victoria Harbour. Good construction practice and associated measures including deploying of silt curtain were recommended in Water Quality Assessment in **Section 3.1.2** to control water quality impacts to within acceptable levels, and are also expected to control impacts to fisheries resources. Hence, no fisheries-specific mitigation measures are required during construction of the proposed submarine gas pipelines.

To avoid accidental breakage of pipelines during the operation phase, precautionary measure will be implemented by backfilling of the pipeline trench with rock armour to the seabed level. This measure not only protects the pipelines from frequent maintenance and repairing, it also allows the recolonization of benthic fauna to the region to support the local fisheries.

3.5 Hazard to Life

3.5.1 Impact Assessment

A risk assessment study has been conducted for the relocation of the existing submarine gas pipeline and the associated facilities. The assessment has considered various failure causes for town gas leakage. Based on the evaluation of potential safety impacts, the risk associated with the proposed realigned gas facilities is considered low. Notwithstanding the low level of risk, risk minimisation measures have been incorporated into the design to further lower the risk and safeguard population in vicinity.

3.5.2 Mitigation Measures

Risk control and mitigation measures will be adopted to reduce the risk due to marine traffic, including:
- Proper general traffic management measures.
- Minimisation of works activity footprint – dredging and backfilling.
- Safety provision during dredging and backfilling.
- Liaison with relevant Government Departments before and during construction stage.
- Requirements during the submarine pipe pulling.

With the implementation of the above mitigation measures, the risk during the construction phase is expected to be low.

Risk mitigation measures to prevent the damage of submarine pipeline during operation which will be adopted are listed as follows:
- The submarine gas pipeline will be covered by armour rock, damage from marine vessels could be prevented.
- After the submarine pipeline is installed and will be tested to the design standards.
- According to HKCG's past record, pigging operation will normally be carried out once in every ten years.

The qualitative risk assessment of failure of the submarine pipe based on different failure causes is shown in **Table 3.5**. According to the risk matrix, for any high risk item, further risk mitigation measures should be considered as necessary to reduce the risk; for moderate risk item, further risk mitigation measures should be considered to reduce the risk to as low as reasonably practicable; and low risk item, further risk mitigation measures are not considered necessary since the risk is considered broadly acceptable.

Table 3.5: Risk Assessment of Different Failure Causes of the Submarine Pipelines during Operation

Scenario	Likelihood of Occurrence	Consequence to Public	Risk Level
External Causes			
Natural Event			
• Earthquake	Rare	Minor	Low
• Severe Environmental Event	Rare	Minor	Low
Third Party Damage	Rare	Minor	Low
Anchor Drop/ Drag	Unlikely	Minor	Low
Vessel Sinking	Unlikely	Minor	Low
Fishing	Rare	Minor	Low
Dredging Activity	Unlikely	Minor	Low
Internal Causes			

Scenario	Likelihood of Occurrence	Consequence to Public	Risk Level
Corrosion	Unlikely	Insignificant	Low
Material Defect	Rare	Minor	Low

Though it can be concluded that there are no insurmountable risks associated with the construction and operation of the proposed submarine pipelines and gas pigging stations based on the risk ranking analysis, a quantitative risk assessment has been conducted by HKCG. Both the offsite individual risk and societal risk results for the submarine gas pipelines and the two gas pigging stations have been found "Acceptable" as per risk guidelines in Hong Kong. Therefore, it can be concluded that the risk level of the Project to the surrounding public is low and acceptable.

3.6 Landscape

Landscape Impact Assessment were conducted to identify landscape baseline, potential impacts on the landscape resources and character areas, evaluate these identified impacts and recommend mitigation measures.

Two landscape resources, LR1 – Marine Area of To Kwa Wan, LR2 – Marine Area of North Point; and four landscape character areas, LCA1 – To Kwa Wan Plain, LCA2 – To Kwa Wan Waterfront Area, LCA3 – North Point Waterfront Area, LCA4 – North Point Urban Group were identified within the landscape assessment area.

3.6.1 Impact Assessment

As the proposed Project will be implemented in the urban areas and have no conflict with the existing landscape resources, potential adverse impacts on either landscape resources or landscape character areas are therefore not anticipated.

The To Kwa Wan Pigging Station and North Point pigging station are proposed on the existing concrete bare ground and car park respectively. Therefore, all the identified landscape resources will not be impacted by the proposed project during the construction period.

As dredging works will not require any operation such as reclamation and building cofferdam which would cause loss of water surface, no impacts on the marine areas are anticipated. As such, the proposed dredging works will not cause any impact on the existing landscape resources or landscape character areas.

Before implementation of mitigation measures, there could be a temporary and reversible impact on the character of the landscape character areas resulting from the construction works of pigging stations. However due to the urbanised nature of the landscape baseline, small scale of the proposed facilities and the simple nature of the installation works, the unmitigated magnitude of the landscape impact is negligible.

3.6.2 Mitigation Measures

Mitigation measures for reducing, offsetting and compensating for impacts during construction phase which have been designed into the project include:

- Screening of construction works by hoardings/noise barriers around Works area in visually unobtrusive colours, to screen Works.
- Hydroseeding or sheeting of stockpiles with visually unobtrusive material (in earth tone).

- Ensure no run-off into the harbour adjacent to the site.

Mitigation measures for the two pigging stations during the operational phase are identified for implementation in the approved planning permission applications for the two pigging stations under Section 16 of the Town Planning Ordinance. The operation mitigation measures identified in the approved planning permission applications are listed below:

- The design and finish of the gas pigging station will be aesthetically compatible with the surroundings
- Trellises will be constructed to screen the exposed pipes inside the proposed pigging stations
- A planting strip of 1.5m width will be reserved in front of the boundary wall of the proposed To Kwa Wan pigging station
- A 300mm wide planting strip will be provided at the seafront side along the boundary fence within the proposed North Point pigging station
- A 300mm wide planting strip together with a 2m high visual barrier inside the existing fence will be provided on the east boundary along Hoi Yu Street at North Point

As discussed, there will be no unacceptable landscape impacts due to the small scale of the works proposed in the Project and also the existing poor quality of the landscape character of the affected areas. Hence there will also be no unaccpetable residual landscape impacts during construction and operation phases on the Landscape Resources and Landscape Character Areas. In fact, some slight beneficial landscape impacts due to the introduction of green elements (i.e. screen plantings) through the implementation of operation mitigation measures identified in the approved planning permission applications for the two pigging stations under Section 16 of the Town Planning Ordinance into the existing urbanised environments are anticipated.

3.7 Cultural Heritage

A baseline review identified no submerged cultural heritage sites within the Study Area. A geophysical survey which covered a 200m corridor along the length of the proposed route of the submarine gas pipelines was conducted. The survey revealed 3 significant sonar contacts located less than 50m from the centre line. However, gas blanking is present across some sections of the study area. At these locations no geophysical survey was obtained and therefore no assessment could be made.

3.7.1 Impact Assessment

An underwater inspection of the 3 significant sonar contacts located less than 50m from the centre line and an additional 2 between 50 and 60m was conducted. All of the sonar contacts were identified as modern debris. Therefore, there was no indication of submerged cultural heritage. Therefore, no cultural heritage impact arising from marine works of the Project is anticipated at the areas where there is full geophysical survey coverage.

Assessment could not be made of the areas where there is gas masking, and therefore no survey data to make the assessment.

3.7.2 Mitigation Measures

Submerged cultural heritage were not identified at the areas with 100% geophysical survey coverage, therefore no mitigation measures or further action are considered necessary for these areas.

It is recommended that a monitoring brief is conducted during dredging at the locations where there is no geophysical survey due to 'gas masking'. The detailed requirements are set out in Appendix H2 of the EIA Report.

3.8 Noise

The construction noise impact assessment has been based on a best estimate of the construction sequence and plant inventory.

3.8.1 Impact Assessment

The potential noise impact that could arise from daytime construction activities of the Project has been evaluated. Construction noise level is predicted at unmitigated scenario with a range from 64 to 77 dB(A). The predicted construction noise impacts of different construction stages for the unmitigated scenario have been summarised in **Table 3.6** to **Table 3.8**.

Table 3.6: Unmitigated Noise Impact due to the Laying of Submarine Gas Main

NSR ID	Usage	Slant Distance (m)	Unmitigated Noise Level, dB(A)	Noise Criteria, dB(A)	Mitigation Measures Required?
To Kwa Wan					
SCH01	Institutional	370	66	70	No
SCH02	Institutional	346	68	70	No
WFM	Residential	449	64	75	No
SUV	Residential	427	64	75	No
North Point					
MHE	Residential	334	67	75	No
KCM	Residential	325	66	75	No
LKB	Commercial/ Residential	400	64	75	No
FSQ	Residential	209	70	75	No

Table 3.7: Unmitigated Noise Impact due to Landfall Site Construction

NSR ID	Usage	Slant Distance (m)	Unmitigated Noise Level, dB(A)	Noise Criteria, dB(A)	Mitigation Measures Required?
To Kwa Wan					
SCH01	Institutional	176	**73**	70	Yes
SCH02	Institutional	144	**75**	70	Yes
WFM	Residential	241	71	75	No
SUV	Residential	245	70	75	No
North Point					
MHE	Residential	159	74	75	No
KCM	Residential	124	73	75	No
LKB	Commercial/ Residential	246	70	75	No
FSQ	Residential	122	**77**	75	Yes

Note: **Bold** figure denotes exceedance of relevant noise criteria

Table 3.8: Unmitigated Noise Impact due to the Construction of Pigging Station

NSR ID	Usage	Slant Distance (m)	Unmitigated Noise Level, dB(A)	Noise Criteria, dB(A)	Mitigation Measures Required?
To Kwa Wan					
SCH01	Institutional	122	66	70	No
SCH02	Institutional	121	66	70	No
WFM	Residential	194	62	75	No
SUV	Residential	230	61	75	No
North Point					
MHE	Residential	144	65	75	No
KCM	Residential	190	62	75	No
LKB	Commercial/ Residential	197	62	75	No
FSQ	Residential	168	63	75	No

3.8.2 Mitigation Measures

With the use of quiet plant and the movable noise barriers, the construction noise impact can be mitigated to a range of 54 to 71 dB(A) which comply with the relevant noise criteria. The noise impact has been summarised in **Table 3.9**.

Table 3.9: Mitigated Noise Impact due to the Landfall Construction

NSR ID	Usage	Slant Distance (m)	Mitigated Noise Level, dB(A)	Noise Criteria, dB(A)
To Kwa Wan				
SCH01	Institutional	176	60	70
SCH02	Institutional	144	62	70
North Point				
FSQ	Residential	122	63	75

It is recommended that the Contractor should also adopt good working practices in order to minimise construction noise as far as possible, e.g.:

- The Contractor shall adopt the Code of Practice on Good Management Practice to Prevent Violation of the Noise Control Ordinance (Chapter 400) (for Construction Industry) published by EPD;
- The Contractor shall observe and comply with the statutory and non-statutory requirements and guidelines;
- Before commencing any work, the Contractor shall submit to the Engineer Representative for approval the method of working, equipment and noise mitigation measures intended to be used at the site;
- The Contractor shall devise and execute working methods to minimise the noise impact on the surrounding sensitive uses, and provide experienced personnel with suitable training to ensure that those methods are implemented;
- Noisy equipment and noisy activities should be located as far away from the NSRs as practical;
- Unused equipment should be turned off. Number of operating PME should be kept to a minimum and the parallel use of noisy equipment / machinery should be avoided;
- Regular maintenance of all plant and equipment; and
- Material stockpiles and other structures should be effectively utilised as noise barriers, where practicable.

The Contractor shall, from time to time, be aware of the noise impacts on the surrounding NSRs through adequate noise monitoring during the works so that adjustments could be made to control the construction noise levels. These requirements shall be triggered by an Event and Action Plan as part of the EM&A which shall be incorporated into the works contract in order to make it enforceable.

3.9 Construction Dust

Potential air quality impacts arising from the construction and operation of the submarine gas pipelines have been evaluated.

3.9.1 Imapct Assessment

A summary of construction activities and the potential dust emission sources is tabulated in **Table 3.10**.

Table 3.10: Construction Activities and Potential Dust Emission Sources

Construction Activities		Potential Emission Sources	No. of Plant Used*
Marine Works	Trench Dredging	Gasesous emission from barges	1-3
	Pipe Laying (at sea)	Gasesous emission from barges	1-5
	Pipe Laying (on land)	Dust generated from site vehicles and gasesous emission from construction plant	1-2
	Backfilling	Gasesous emission from barges	1-3
Land Works	Mobilizations/ Site Preparation	Dust generated from site vehicles and gasesous emission from construction plant	1
	Seawall demolition	Dust generated from site vehicles and gasesous emission from construction plant	1-2
	Seawall reinstatement	Dust generated from site vehicles and gasesous emission from construction plant	1
	Construction of pigging station – Surface reinstatement	Dust generated from site vehicles and gasesous emission from construction plant	1
	Construction of pigging station – Facilities installation	Dust generated from site vehicles and gasesous emission from construction plant	1

Note: [*] The no. of plant used is referred to Table 10.4 and Table 10.5 of the EIA report.

As the number of construction plant involved in the submarine gas pipelines laying activities at anytime on site will be limited, exceedance of AQOs emissions of gaseous pollutants from these construction plant is not anticipated. The number of plant required on site for the construction of the landing points will also be limited. Dust impact and SO_2 and NO_2 emissions from plants and site vehicles will be minimal.

3.9.2 Mitigation Measures

With the implementation of appropriate dust suppression measures stipulated in the Air Pollution Control (Construction Dust) Regulation, together with proper maintenance of equipment, adverse air quality impact is not anticipated. Recommended dust control measures include:

- The works area for site clearance shall be sprayed with water before, during and after the operation so as to maintain the entire surface wet;
- Restricting heights from which materials are to be dropped, as far as practicable to minimise the fugitive dust arising from unloading/ loading;

- Immediately before leaving a construction site, all vehicles shall be washed to remove any dusty materials from the bodies and wheels. However, all spraying of materials and surfaces should avoid excessive water usage;
- Where a vehicle leaving a construction site is carrying a load of dusty materials, the load shall be covered entirely by clean impervious sheeting to ensure that the dusty materials will not leak from the vehicle;
- Any stockpile of dusty materials shall be covered entirely by impervious sheeting; and/or placed in an area sheltered on the top and 4 sides;
- All dusty materials shall be sprayed with water immediately prior to any loading, unloading or transfer operation so as to maintain the dusty materials wet.

No air quality impact is anticipated at the operational phase since there will not have any operational phase emissions.

4. Environmental Monitoring and Audit

An environmental monitoring and audit (EM&A programme) has been recommended for implementation during construction of the Project to ensure compliance with environmental legislation and standards during Project implementation.

Monitoring of construction noise and water quality is recommended during construction of the Project to verify the effectiveness of the mitigation measures and to obtain a robust, defensible database of baseline information of noise and water quality before construction, and thereafter, to monitor any variation of noise and water quality from the baseline conditions and exceedances of relevant noise criteria and water quality objectives (WQOs) at the sensitive receivers during construction of the Project.

5. Conclusions

The EIA process has facilitated integration of environmental considerations into the design process for the Project. The principal measures identified are those achieved through careful routing of the gas mains and locating of the pigging stations and the installation methodology or gas mains design. Moreover, a number of mitigation measures have been identified to minimise the potential for adverse environmental impacts to occur. The mitigation measures are detailed in full in the Environmental Mitigation Implementation Schedule in Section 14 of the EIA Report. These measures would be implemented by Towngas and, if appropriate, enforced by EPD by means of the EIAO.

One of the key environmental outcomes has been the ability to plan, design and ultimately construct the Project so that direct impacts to sensitive receivers are avoided, as far as practically possible. A detailed assessment of alternatives for routing the gas mains and locating the pigging stations was undertaken. A number of alternative gas mains routes were studied and the preferred alignment minimises impact on water quality and sediment management and avoids direct impacts to ecologically sensitive habitats and species such as corals and marine archaeology. A number of alternative pigging stations locations were studied and the preferred locations for pigging stations avoids encroach the Man Hong Street playground/open space area and proposed “Open Space”, avoids interface with the existing petrol/LPG filling stations and a waterfront promenade will be available next to the To Kwa Wan (TKW) pigging station for use by the general public which avoids direct impact on recreational uses serving the public and local residents.

In preparing the design and installation method for the gas mains, a key concern was to take steps so that indirect impacts to water quality sensitive receivers, through disturbance to the seabed, were avoided or minimised. Consequently, the following approaches were taken to achieve the above.

- Reduction in Indirect Impacts - The alignment chosen for the submarine gas pipelines was located at a sufficient distance from ecological sensitive receivers so that the temporary dispersion of sediment from the installation works was not predicted to affect the receivers at levels of concern (as defined by the WQO and tolerance criteria).

- Installation Equipment - The use of grab dredging, “bottom-pull” and “float and sink” along the entire route has minimized the severity of perturbations to water quality and hence allowed compliance with the WQOs at the sensitive receivers. This careful selection of installation equipment has helped avoid impacts to sensitive ecological receivers.

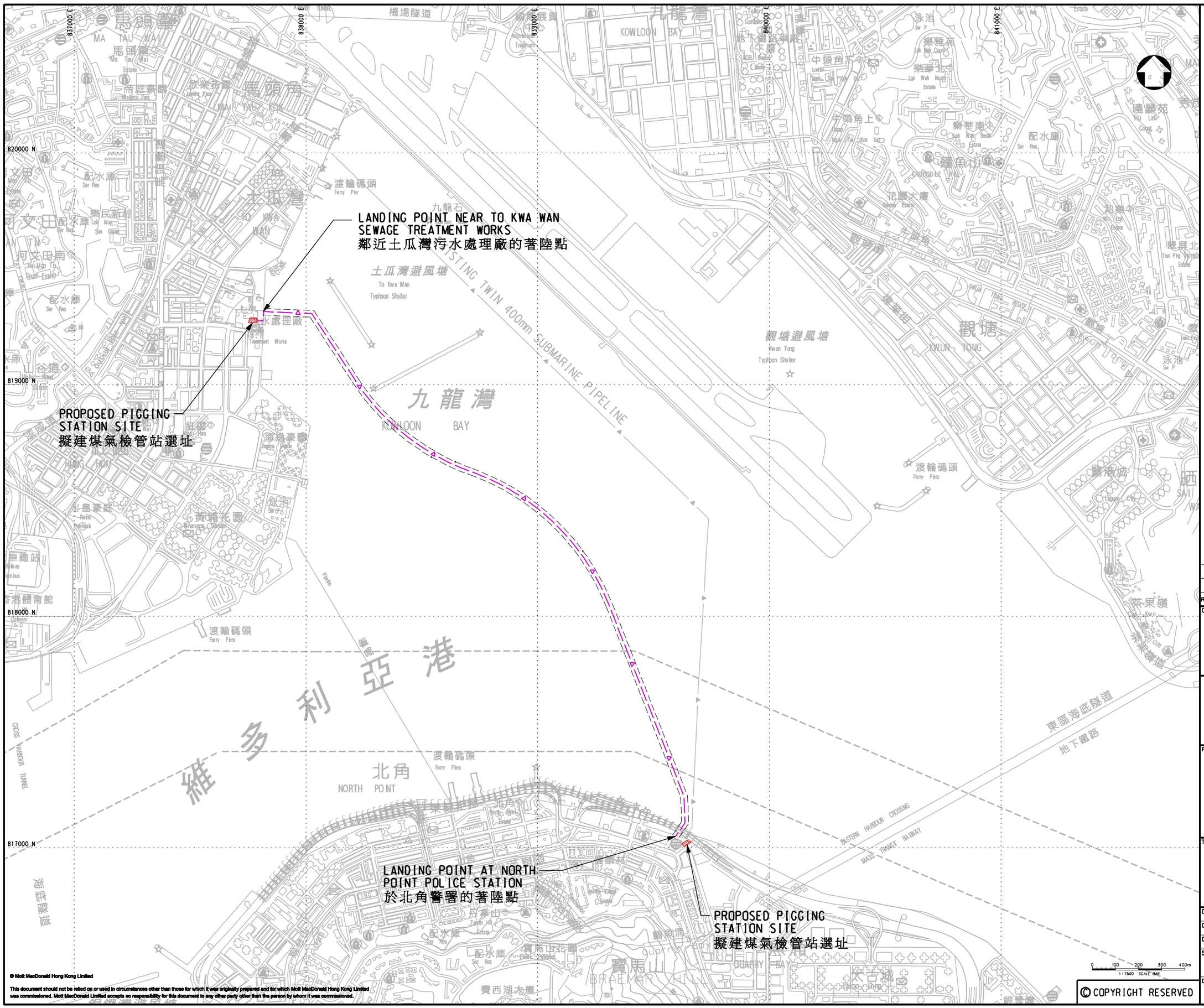
- Adoption of Acceptable Working Rates - The modelling work has demonstrated that the selected working rates for the dredging, “bottom-pull” and “float and sink” works will not cause unacceptable impacts to water quality. Consequently, unacceptable indirect impacts to marine ecological resources have been avoided.

In preparing the design of the pigging stations, a key concern is to take steps so that air quality, noise, waste management and landscape and visual impacts were minimised. Consequently, a boundary wall will be constructed to screen the above-ground pipeworks of TKW pigging station to minimise air quality and noise impact and a planting strip will be reserved in front of the boundary wall of the TKW pigging station to

soften its' visual appearance and thus minimises visual impact. A planting strip together with a visual barrier inside the existing fence on the east boundary along Hoi Yu Street of NP pigging station will be constructed to soften its' visual appearance and thus minimises visual impact. Landscape impact assessment for the two pigging stations are incorporated in the approved planning permission applications under Section 16 of the Town Planning Ordinance.

The primary objective of this Project is to construct a new gas pipeline network from To Kwa Wan to North Point so as to replace the existing one affected by the proposed Cruise Terminal dredging works adjacent to the existing Kai Tak runway and the proposed Central Kowloon Route crossing the Kowloon Bay at To Kwa Wan as they were requested to be diverted.

The new gas pipeline network would ensure the existing gas facilities from To Kwa Wan to North Point are replaced before the decommissioning of the existing facilities. With the proposed new gas pipeline network, the risk of no gas supply after the decommissioning of the existing facilities would be minimised. It would also minimise the requirement of constructing new gas production and distribution facilities in the highly congested urban areas with heavy traffic and congested underground utilities, and hence prevents associated environmental impacts arisen from those works.



LEGEND: 圖例：

PROPOSED TWIN 450 SUBMARINE GAS MAIN
擬建雙管海底煤氣管道

Rev	Date	Drawn	Description	Ch'k'd	App'd
P2	APR 10	MING	GENERAL REVISION	BL	TI
P1	MAR 10	MING	FIRST ISSUE	BL	TI

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Project

INSTALLATION OF SUBMARINE GAS PIPELINES AND ASSOCIATED FACILITIES FROM TO KWA WAN TO NORTH POINT FOR FORMER KAI TAK AIRPORT DEVELOPMENT
配合舊啓德機場發展計劃之土瓜灣至北角海底煤氣管道及相關設施之建造工程

Title

GENERAL LAYOUT
概覽圖

Designed	DL		Eng.Chk.	TT	
Drawn	YKL		Coordination	DL	
Dwg.Chk.	DL		Approved	TI	

Scale 1:7500@A1

Project 237926

Status PRE

CAD File J:\237926\REPORT\ENV\ES1100407I\FIGURE 1-1.dgn

Drawing No. FIGURE 1.1 圖 1.1

Rev P2

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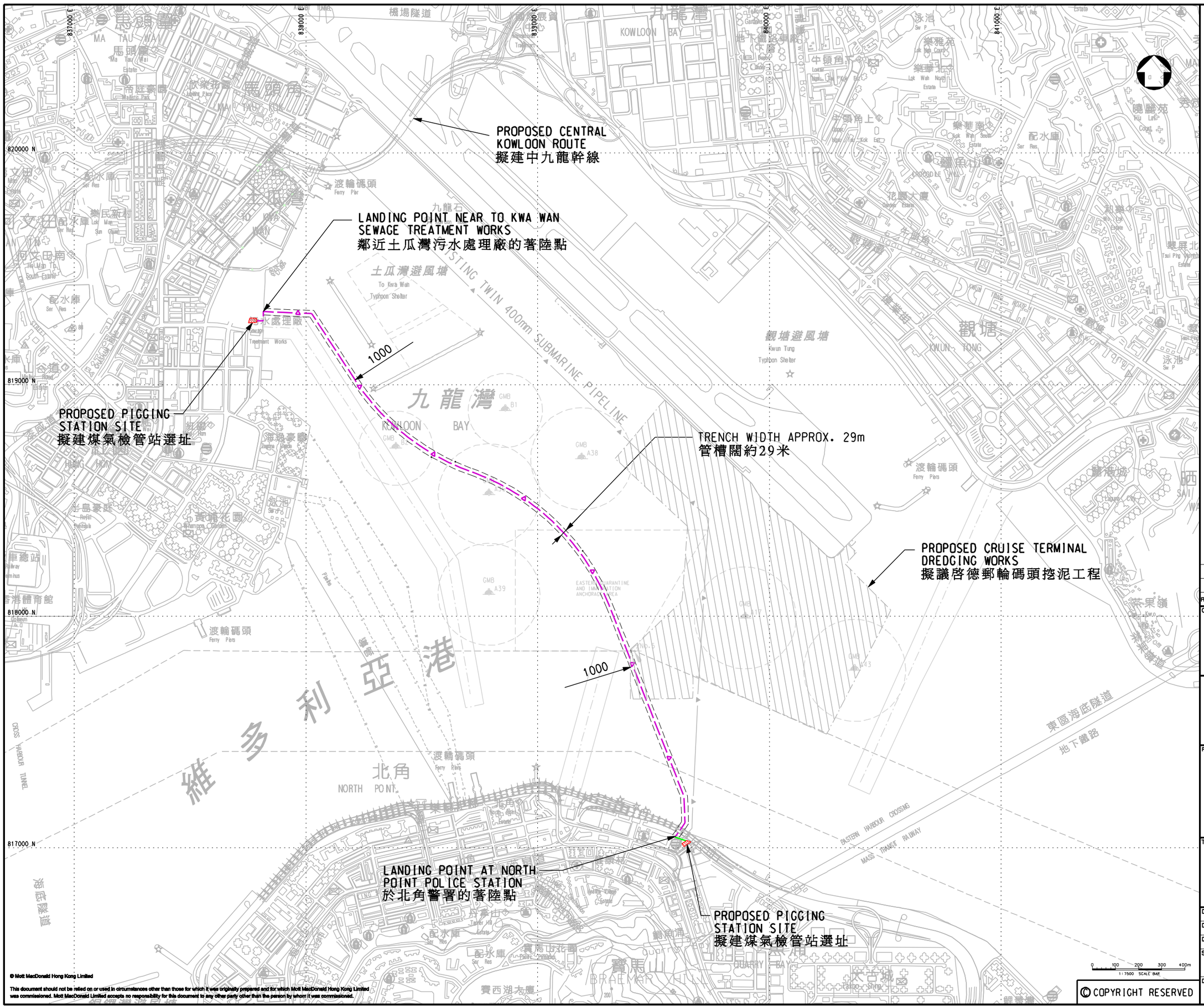
1:7500 SCALE BAR



LEGEND: 圖例：

- PROPOSED TWIN 450 SUBMARINE GAS MAIN 擬建雙管海底煤氣管道
- CONNECTION TO NEW PIGGING STATION 連接新煤氣檢管站

Rev	Date	Drawn	Description	Ch'k'd	App'd
P2	APR 10	MING	GENERAL REVISION	BL	TI
P1	MAR 10	MING	FIRST ISSUE	FY	TI

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配合舊啓德機場發展計劃之土瓜灣至北角海底煤氣管道及相關設施之建造工程

Title

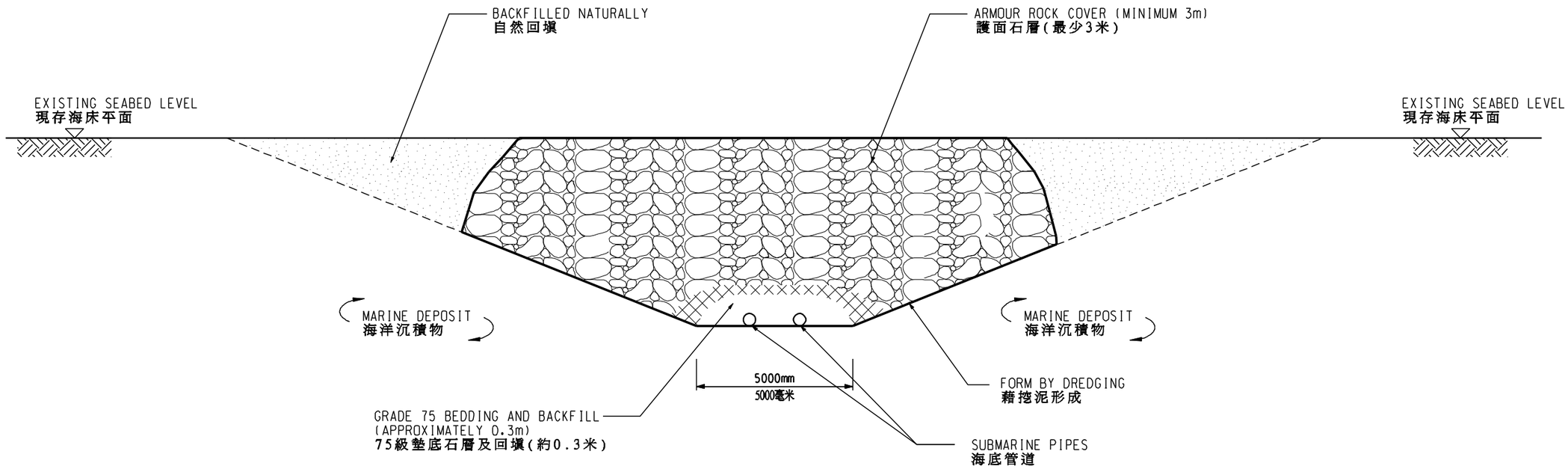
PHYSICAL CONSTRAINTS TO THE PROPOSED SUBMARINE GAS PIPELINES
擬建海底煤氣管道的物理限制

Designed	DL		Eng.Chk.	TT	
Drawn	YKL		Coordination	DL	
Dwg.Chk.	DL		Approved	TI	

Scale 1:7500@A1 | Project 237926 | Status PRE

CAD File J:\237926\REPORT\ENV\ES1100407I\FIGURE 2-1.dgn

Drawing No. FIGURE 2.1 圖2.1 | Rev P2



Rev	Date	Drawn	Description	Ch'k'd	App'd
P2	APR 10	MING	GENERAL REVISION	BL	TI
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Project

INSTALLATION OF SUBMARINE GAS PIPELINES AND ASSOCIATED FACILITIES FROM TO KWA WAN TO NORTH POINT FOR FORMER KAI TAK AIRPORT DEVELOPMENT
配合舊啓德機場發展計劃之土瓜灣至北角海底煤氣管道及相關設施之建造工程

Title

TYPICAL CROSS SECTION OF PIPELINE TRENCH
管槽典型橫切面

Designed	KL		Eng.Chk.	MT	
Drawn	YKL		Coordination	KL	
Dwg.Chk.	KL		Approved	TI	

Scale: N.T.S.
Project: 237926
CAD File: J:\237926\REPORT\ENV\ES\100407\FIGURE 2-2.dgn
Status: PRE
Drawing No.: FIGURE 2.2 圖2.2
Rev: P2