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15

SUMMARY OF ENVIRONMENTAL OUTCOMES

15.1

INTRODUCTION

This section summarises the key environmental outcomes arising from the assessments completed in this EIA Report for the LNG terminal at South Soko and its associated facilities (subsea pipeline and utilities). For each of the environmental components assessed, a summary of key environmental sensitive receivers is completed, together with an overview of the key potential environmental impacts and key mitigation measures, highlighting their benefits where necessary.

The summary of each of the components is structured as follows:

- Key Sensitive Receivers;
- Key Environmental Problems Avoided/ Environmental Outcomes;
- Assessment Methodology and Criteria;
- Construction Impacts;
- Operational Impacts;
- Key Mitigation Measures;
- Residual Impacts; and
- Compliance with the guidelines and criteria of the *Environmental Impact Assessment Ordinance - Technical Memorandum (EIAO-TM)*.

15.2

AIR QUALITY

Table 15.1 presents a summary of the findings of the assessment of impacts to air quality as a result of the construction and operation of the LNG terminal and its associated facilities (subsea pipeline and utilities) at South Soko. Full details of the assessment and mitigation measures are presented in Section 4 of this EIA Report.

Table 15.1 Summary of Environmental Assessment and Outcomes – Air Quality

- AIR QUALITY -	
Air Sensitive Receivers (ASRs)	<ul style="list-style-type: none"> In accordance with the Study Brief, the study area for the air quality assessment is generally defined by a distance of 500 m from the boundary of the Project site. Air Sensitive Receivers (ASRs) were identified in accordance with the criteria in <i>EIAO-TM Annex 12</i>. The nearest ASR is identified as the Staff Quarters of Shek Pik Prison (A1), which is approximately 6.4 km away from the site boundary. The nearest ASR to the Gas Receiving Station is the Administration Building at Black Point Power Station (~ 360 m).
Key Environmental Issues Avoided/ Environmental Outcomes	<ul style="list-style-type: none"> Air sensitive receivers have been avoided by choosing a remote location for the LNG terminal and an offshore pipeline route to BPPS (base case) which will avoid ASRs during its construction phase.
Assessment Methodology and Criteria	<ul style="list-style-type: none"> An air dispersion model, Industrial Source Complex (ISCST3), recommended in the EPD's Guideline of Choice of Models and Model Parameter, was employed to predict the air quality impacts. The "rural" dispersion mode was used in the model run. In addition, the local terrain has also been incorporated into the model to account for terrain-induced impacts to dispersion. A highly conservative approach was adopted during the air quality impact assessment modelling exercise by assuming that the emissions from the submerged combustion vaporiser (SCVs), LNG carrier generators and gas turbines were continuous. The total emission rates indicated that NO₂ is the critical air pollutant in this Study; therefore, isopleths of predicted maximum hourly, daily average and annual average concentrations of NO₂ at 1.5 m and 10 m above ground level were plotted, taking the background concentrations into consideration for comparison with the relevant criteria.
Key Construction Impacts	<ul style="list-style-type: none"> Potential dust nuisance from dust generating activities and gaseous emission from construction plant during construction of the LNG terminal have been considered. The dust and gaseous emissions from the construction activities were found to be minimal and an impact on air quality at the ASR is not anticipated.
Key Operational Impacts	<ul style="list-style-type: none"> The emission of key pollutants at all identified ASRs are well within the respective AQO criteria, even allowing for the very conservative assumptions used for the project-related emissions.
Key Mitigation Measures	<p>Construction Phase:</p> <ul style="list-style-type: none"> Dust control measures stipulated in the Air Pollution Control (Construction Dust) Regulation will be implemented during the construction of the LNG terminal to reduce the potential fugitive dust emissions and also gaseous emission from construction plant. <p>Operational Phase:</p> <ul style="list-style-type: none"> No exceedance of the AQO criteria is anticipated at the ASRs and therefore no mitigation measures are required.

- AIR QUALITY -	
Residual Impacts	<p>Construction Phase:</p> <ul style="list-style-type: none"> With the implementation of the recommended dust control measures, no residual impacts are anticipated. <p>Operational Phase:</p> <ul style="list-style-type: none"> No adverse residual operational air quality impact is anticipated.
Compliance with EIAO-TM	The assessment and the impacts are acceptable and in compliance with the <i>EIAO-TM Annexes 4 and 12</i> and applicable assessment standards/criteria.

15.3

NOISE

Table 15.2 presents a summary of the findings of the assessment of impacts to ambient noise as a result of the construction and operation of the LNG terminal and its associated facilities (subsea pipeline and utilities) at South Soko. Full details of the noise assessment are presented in Section 5 of this EIA Report.

Table 15.2 Summary of Environmental Assessment and Outcomes - Noise

- NOISE -	
Noise Sensitive Receivers (NSRs)	<ul style="list-style-type: none"> The nearest NSR is identified as the Staff Quarters of the Shek Pik Prison on Lantau Island (N1) which is located approximately 6.4 km away from the site. According to the Concept Plan for Lantau prepared by Lantau Development Task Force, there are no planned or committed uses within 7km from the site.
Key Environmental Problems Avoided / Environmental Outcomes	<ul style="list-style-type: none"> NSRs have been avoided by choosing a remote location for the LNG terminal and an offshore pipeline route to BPPS which will avoid NSRs during its construction phase.
Assessment Methodology and Criteria	<p>Construction Phase:</p> <ul style="list-style-type: none"> The methodology for the noise impact assessment is in accordance with the procedures outlined in the GW-TM, which is issued under the NCO and the <i>EIAO-TM</i>. Using a conservative approach, each work activity has been assumed to operate simultaneously. Based on the construction programme, cumulative noise impact throughout the construction phase has been assessed. The construction noise assessment for construction works carried out during restricted hours (e.g. night-time works) has been carried out in accordance with the requirements of the GW-TM. <p>Operational Phase:</p> <ul style="list-style-type: none"> The methodology for the noise impact assessment is in accordance with the procedures outlined in the ISO 9613(2) and IND-TM, which is issued under the NCO and the <i>EIAO-TM</i>. Assessment results have been predicted in a conservative approach without other attenuations due to foliage of trees and shrubs, ground effects and buildings in which the equipment is placed. In addition, the corrections of tonality, impulsiveness and intermittency, if any,

- NOISE -	
	have been omitted from the assessment due to the large separation between the equipment and the NSRs.
Key Construction Impacts	<p>Normal Working Hours:</p> <ul style="list-style-type: none"> The unmitigated construction noise levels at the NSR N1 have been predicted and are in the range of 20 – 70 dB(A), which are below the daytime construction noise criterion of 75 dB(A) throughout the construction period. <p>Restricted Hours:</p> <ul style="list-style-type: none"> The installation of the water main and electric cable will not be carried out during the restricted hours close to the landing point and on land at Shek Pik, and the predicted noise levels for other construction activities are within the ANLs stipulated in GW-TM throughout the restricted hours.
Key Operational Impacts	<ul style="list-style-type: none"> The most conservative case noise levels at the NSR N1 during the operational phase of the LNG terminal have been predicted to be 29 dB(A) which is below the ANLs stipulated in the IND-TM during both daytime and night-time period.
Key Mitigation Measures	<p>Construction Phase:</p> <ul style="list-style-type: none"> The predicted noise levels are low and below the daytime and night time criteria as a result of the considerable separation distance between the NSR and the Project. Mitigation measures are not required. <p>Operational Phase:</p> <ul style="list-style-type: none"> The predicted noise levels are below the daytime and night time criteria as a result of the considerable separation distance between the NSR and the Project. Mitigation measures are not required.
Residual Impacts	<ul style="list-style-type: none"> No adverse residual construction or operational noise impact is anticipated.
Compliance with EIAO-TM	<ul style="list-style-type: none"> The assessment and the impacts are acceptable and in compliance with the <i>EIAO-TM Annexes 5 and 13</i> and applicable assessment standards and criteria.

15.4

WATER QUALITY

Table 15.3 presents a summary of the findings of the assessment of impacts to water quality as a result of the construction and operation of the LNG terminal and its associated facilities (subsea pipeline and utilities) at South Soko. Full details of the assessment are presented in *Section 6* of this *EIA Report*.

Table 15.3 Summary of Environmental Assessment and Outcomes – Water Quality

- WATER QUALITY -	
Sensitive Receivers (SRs)	<p>The following Sensitive Receivers have been identified:</p> <p>Fisheries Resources:</p> <ul style="list-style-type: none"> • Fisheries Spawning/Nursery Grounds: Spawning/Nursery Grounds in South Lantau, Spawning Ground in North Lantau; • Artificial Reef Deployment Area: Sha Chau and Lung Kwu Chau, Northeast Airport; • Fish Fry Habitat: Pak Tso Wan; • Fish Culture Zone: Cheung Sha Wan FCZ, Ma Wan; and • Oyster Production Area: Pak Nai. <p>Marine Ecological Resources:</p> <ul style="list-style-type: none"> • Seagrass Beds: Pak Nai, Tung Chung Bay; • Marine Park: Sha Chau and Lung Kwu Chau; • Potential Marine Parks: Fan Lau, Soko Islands • Intertidal Mudflats: Pak Nai, Yi O, Shui Hau Wan; • Mangroves: Pak Nai, Tung Chung Bay, Fan Lau Tung Wan; • Horseshoe Crab Nursery Grounds: Pak Nai, Sham Wat Wan, Tai O, Yi O, Sha Lo Wan, Tong Fuk Miu Wan, Tung Chung Bay; • Protection Zone: Chinese White Dolphin Protection Zone in Mainland Waters; • Subtidal Hard Bottom Habitat (coral): South of South Soko; and • Marine Mammal Habitats in SW, W and NW Lantau. <p>Water Quality:</p> <ul style="list-style-type: none"> • Gazetted Beaches: Butterfly Beach, Tuen Mun Beaches, Tong Fuk, Upper Cheung Sha Beach, Lower Cheung Sha Beach, Pui O Wan; • Non-gazetted Beaches: Lung Kwu Sheung Tan, Lung Kwu Tan, Fan Lau Sai Wan, Fan Lau Tung Wan, Tsin Yue Wan; and • Seawater Intakes: Black Point Power Station, Castle Peak Power Station, Tuen Mun Area 38, Tuen Mun Flushing Water, Airport, Pumping Station at Tai Kwai Wan.
Key Environmental Issues Avoided / Environmental Outcomes	<ul style="list-style-type: none"> • Potential layouts were examined on the basis of their potential environmental impacts. The adopted modified layout ⁽¹⁾ has reduced the reclamation to approximately 0.6 ha (from 13 ha of the base case design adopted in Pre-EIA studies). • The relocation of the jetty to the south east has also meant that dredging volumes are reduced to approximately 1.32 Mm³ ⁽²⁾ from > 5 Mm³ at the terminal thus avoiding extensive impacts to water quality surrounding South Soko Island. • Less marine mud has to be dredged and disposed offsite, therefore, reducing impacts to water quality. • Impacts to water quality have been reduced by the adoption of

(1) Please refer to Section 15.7 for details on this issue.

(2) Please refer to Section 15.7 for details on this issue.

- WATER QUALITY -	
	<p>optimal techniques during the installation of some sections of the pipeline, water main and cable.</p>
Assessment Methodology and Criteria	<ul style="list-style-type: none"> The potential impacts due to the construction and operation of the Project and associated developments were assessed following the <i>EIAO-TM Annex 6</i> guidelines and the impacts evaluated based on the criteria in <i>EIAO-TM Annex 14</i>. Impacts due to the dispersion of fine sediment in suspension during the construction of the proposed LNG terminal and associated facilities have been assessed using computational modelling. The simulation of operational impacts on water quality has also been studied by means of computational modelling. The models have been used to simulate the effects of cooled water discharges on temperature and water quality (due to antifoulants). Analysis of EPD routine water quality data from the years of 1998 to 2006 has been undertaken to determine the allowable increase in suspended solids concentrations.
Key Construction Impacts	<ul style="list-style-type: none"> <i>Suspended Sediments (SS)</i>: The majority of SS elevations in water have been predicted to remain within relatively close proximity to the dredging or jetting works and, as such, the majority of sediment has been predicted to settle within relatively close proximity to the works areas. Thus, no unacceptable impacts are expected to be posed by the works. Some mitigation measures, in the form of silt curtains, have been proposed at specific sensitive receivers to limit dispersion of SS. <i>Water Quality (Dissolved Oxygen, Nutrients, and Heavy Metals)</i>: The dispersion of sediment due to dredging/jetting operations is not expected to impact the general water quality of the receiving waters. Effects will be transient, localised in extent, of small magnitude and compliant with applicable standards. <i>Hydrotest Water</i>: Should hydrotest water, from tanks and the gas pipeline, be discharged in the vicinity of South Soko, dispersion would be rapid and concentrations of antifoulants would rapidly diminish. No adverse impacts to water quality would, therefore, be expected to occur. It must be noted that discharges of pipeline hydrotest water are however not recommended in the wet season as the dispersion of pollutants will be less effective with respect to the dry season. <i>Other Discharges</i>: Wastewater discharges, land based construction activities, vessel discharges and contaminants are not predicted to cause unacceptable impacts to the water quality sensitive receivers.
Key Operational Impacts	<ul style="list-style-type: none"> <i>Hydrodynamics</i>: The terminal footprint is relatively small and as such, adverse impacts to hydrodynamics were demonstrated as not to occur. No adverse impacts to water quality as a result of these minor changes in hydrodynamics were predicted. <i>Suspended Sediments</i>: Maintenance dredging requirement is expected to be required once every ten years and will be restricted to specific small areas. Although increases in suspended solids in the water column may occur, these would be expected to be compliant with applicable standards, hence, any associated impacts are expected to be of a relatively low scale, temporary and localised to the works area.

- WATER QUALITY -	
	<ul style="list-style-type: none"> • <i>Cooled Water Discharge:</i> There are no water quality sensitive receivers in the immediate vicinity of the proposed discharge point. The results of the modelling exercise indicate that the dispersion of cooled water is rapid and not expected to cause an unacceptable impact. • <i>Residual Chlorine Dispersion:</i> Due to the low total residual chlorine concentration at the outfall (0.3 mg L⁻¹), the small extent of the area affected (calculated through computational modelling) and the fact that no sensitive receivers would be affected, no unacceptable impacts from residual chlorine discharge to water quality are expected to occur. • <i>Other Discharges:</i> On-site wastewater discharges, vessel discharges, accidental spill of fuel or LNG, contaminated site run-off are not predicted to cause unacceptable impacts to the water quality sensitive receivers. In the event of a spillage, contingency actions will be enforced to control the spill.
Key Mitigation Measures	<p>The water quality modelling works have indicated that the works can proceed at the recommended working rates without causing unacceptable impacts to water quality sensitive receivers. In instances where there are exceedances of the applicable standards, they have been predicted to be transient and therefore not of concern. Unacceptable impacts to water quality sensitive receivers have largely been avoided through the adoption of the following measures:</p> <ul style="list-style-type: none"> • <i>Siting:</i> A number of locations were studied for the LNG terminal and the associated pipeline, water main and cable routes, with the principal aim of avoiding direct impacts to sensitive receivers. • <i>Reduction in Indirect Impacts:</i> The LNG terminal and the associated pipeline, water main and cable routes are located at distances from water quality sensitive receivers where the dispersion of sediments from the construction works does not affect the receivers at levels of concern (as defined by the WQO and tolerance criterion). • <i>Adoption of Acceptable Construction Rates:</i> The modelling work has demonstrated that the selected working rates for the dredging and jetting operations will not cause unacceptable impacts to the receiving water quality. • <i>Silt Curtains:</i> At a couple of specific sensitive receivers the adoption of silt curtains during dredging/jetting will limit the dispersion of suspended sediment. With this measure in place impacts are predicted to be acceptable. <p>Aside from these pro-active measures that have been adopted, a number of operational constraints and good site practice measures for dredging and construction run-off are also recommended.</p>
Residual Impacts	<ul style="list-style-type: none"> • No unacceptable residual impacts have been predicted to occur during the construction phase. Given the immediate dilution of the cooled water discharges from the terminal outfall and that the limited volume of sewage generated would be treated on site before being discharged in accordance with the EPD's required standards, residual environmental impacts during the operation phase are not expected
Compliance with EIAO-TM	<ul style="list-style-type: none"> • The assessment and the impacts are acceptable and in compliance with the EIAO-TM Annexes 6 and 14 and applicable assessment standards/criteria.

15.5

WASTE MANAGEMENT

Table 15.4 presents a summary of the findings of the assessment of impacts to waste management as a result of the construction and operation of the LNG terminal and its associated facilities (subsea pipeline and utilities) at South Soko. The details of the assessment are presented in full in Section 7 of this EIA Report.

Table 15.4 Summary of Environmental Assessment and Outcomes – Waste Management

- WASTE MANAGEMENT -	
Assessment Methodology and Criteria	<p>The potential environmental impacts associated with the handling and disposal of waste arising from the construction and operation of the LNG terminal at South Soko are assessed in accordance with the criteria presented in Annexes 7 and 15 of the EIAO-TM:</p> <ul style="list-style-type: none"> • Estimation of the types and quantities of the wastes to be generated; • Assessment of the secondary environmental impacts due to the management of waste with respect to potential hazards, air and odour emissions, noise, wastewater discharges and traffic; and • Assessment of the potential impacts on the capacity of waste collection, transfer and disposal facilities.
Key Environmental Problems Avoided/ Environmental Outcomes	<ul style="list-style-type: none"> • Potential layouts were examined on the basis of their potential environmental impacts. The relocation of the jetty to the south east has reduced the dredging volumes to approximately 1.32 Mm³ ⁽¹⁾ from > 5 Mm³ at the terminal. This has brought about an overall reduction of waste (in the form of marine sediments) in comparison with the Pre-EIA Study layout and Project Profile layout.
Key Construction Impacts	<p>The key potential impacts during the construction phase are related to wastes generated from site clearance, site formation, blasting, dredging, reclamation, seawall construction, filling and concreting.</p> <ul style="list-style-type: none"> • It is estimated that a total of approximate 3.89 Mm³ ⁽²⁾ of marine sediment will be dredged for the whole project (terminal, submarine pipeline, watermain and cable). It is estimated that about 60% of the sediments are uncontaminated. About 24% of the sediments (which passed the biological screening) will be disposed of at open sea dedicated site. The remaining 16% of the sediments may have to be disposed of at a confined marine disposal site. • Due to limited space on site, all the excavated rock generated from the site formation works will be disposed off site at quarries, at fill banks, or used by other concurrent projects. • Other wastes produced during the construction phase are of small quantity and will be disposed of accordingly to their nature and relevant regulations, avoiding any potential adverse impact.
Key Operational Impacts	<ul style="list-style-type: none"> • Small amounts of industrial waste, chemical waste, sewage and general refuse will be produced during the operational phase of the LNG terminal. The potential environmental impacts

(1) Please refer to Section 15.7 for details on this issue.

(2) Please refer to Section 15.7 for details on this issue.

- WASTE MANAGEMENT -	
	associated with the storage, handling, collection, transport and disposal of these will meet the criteria specified in the EIAO-TM, thus no unacceptable operational waste management impact is anticipated.
Key Mitigation Measures	<ul style="list-style-type: none"> A number of mitigation measures have been proposed to avoid or reduce potential adverse environmental impacts associated with handling, collection and disposal of waste arising from the construction and operation of the proposed LNG terminal.
Residual Impacts	<ul style="list-style-type: none"> With the implementation of the recommended mitigation measures, in particular the establishment and implementation of the Waste Management Plan, no adverse residual impacts are anticipated from the construction and operation of the LNG terminal.
Compliance with EIAO-TM	<ul style="list-style-type: none"> The assessment and the impacts are acceptable and in compliance with the EIAO-TM Annexes 7 and 15 and applicable assessment standards/criteria.

15.6

TERRESTRIAL ECOLOGY

Table 15.5 presents a summary of the findings of the assessment of impacts to terrestrial ecology as a result of the construction and operation of the LNG terminal and its associated facilities at South Soko (watermain and cable onshore connections at Shek Pik). The details of the assessment are presented in full in Section 8 of this EIA Report.

Table 15.5 Summary of Environmental Assessment and Outcomes – Terrestrial Ecology

- TERRESTRIAL ECOLOGY -	
Flora and Fauna of Ecological Interest	<p>Many of the habitats on South Soko Island were observed to be highly modified and disturbed as a result of village developments up to the 1960s, the construction of a Detention Centre in 1980s and its subsequent demolition in the 1990s. Few areas of undisturbed habitat remain on South Soko and large portions have been developed. Consequently, there is a lack of rare flora and fauna aside from the following species of conservation interest were recorded within the Study Area (covering all areas 500m from the Project Boundary).</p> <p>South Soko:</p> <ul style="list-style-type: none"> A protected and rare orchid: the Golden Eulophia <i>Eupholia flava</i>. Eleven bird species of conservation interest. An uncommon reptile, the Plumbeous Water Snake, was recorded in the drainage channel of the disturbed area. The protected reptile Common Rat Snake <i>Ptyas mucosus</i> was recorded in the abandoned wet agricultural land located at the southeast of the island. Three uncommon dragonfly species and, fifteen uncommon and two rare butterfly species were recorded. <p>Shek Pik:</p> <ul style="list-style-type: none"> A protected plant species <i>Pavetta hongkongensis</i> was found within the Study Area at Shek Pik during the survey. One locally protected bat species Japanese Pipistrelle <i>Pipistrellus abramus</i> was recorded within the Study Area.

- TERRESTRIAL ECOLOGY -	
	<ul style="list-style-type: none"> • Eight bird species of conservation interest. • An endemic and protected amphibian species, the Romer’s Tree Frog <i>Philautus romeri</i> was heard at the plantation during a night survey at Shek Pik. • Four uncommon butterfly species were recorded within the Study Area.
Key Environmental Issues Avoided/ Environmental Outcomes	<ul style="list-style-type: none"> • Disturbance to terrestrial ecological resources of acknowledged conservation significance (i.e. parks, natural reserves, etc.) has been avoided as a result of the site/route selection process of the LNG terminal. • Potential layouts were examined on the basis of their potential environmental impacts. The selected layout has reduced the area of terrestrial habitat impacted by the footprint of the LNG terminal.
Assessment Methodology and Criteria	<ul style="list-style-type: none"> • Following a literature review of available ecological information characterising the Study Area, surveys were conducted to update and field check the validity of the information gathered in the review and to fill information gaps. The baseline surveys covered a period of 10 months during both dry and wet seasons for South Soko and Shek Pik. • All habitats were surveyed for vegetation, mammals, birds, herpetofauna and aquatic fauna. • The potential impacts due to the construction and operation of the proposed LNG terminal were assessed following the <i>EIAO-TM Annex 16</i> guidelines and the impacts evaluated based on the criteria in <i>EIAO-TM Annex 8</i>.
Key Construction Impacts	<p>South Soko ⁽¹⁾:</p> <ul style="list-style-type: none"> • Permanent loss of secondary woodland (approximately 0.2 ha), plantation (approximately 2.8 ha), shrubland (approximately 7.3 ha), abandoned wet agricultural land (approximately 0.5 ha), grassland (approximately 1.8 ha), and disturbed area (approximately 5.3 ha) due to the construction of the LNG terminal platform. • Need to transplant floral species (Golden Eulophia) of conservation interest. • Temporarily loss of approximately 0.5 ha of plantation, approximately 1.0 ha of shrubland and approximately 0.3 ha of disturbed area. • Potential loss of foraging and feeding ground of the associated wildlife. <p>Shek Pik:</p> <ul style="list-style-type: none"> • Permanent loss of plantation (approximately 0.004 ha) and developed area (approximately 0.02 ha) due to the installation of the water tank (Option 1). • Permanent loss of developed area (approximately 0.01 ha) due to the installation of the water tank (Option 2). • Temporary loss of developed area (approximately 0.1 ha), due to the trenching work for the installation of electricity cable. • Temporary loss of developed area (approximately 0.02 ha), due to the trenching work for the installation of water main. • Potential loss of foraging and feeding ground of the associated wildlife.

(1) Please note that Section 15.7 refers to additional excavation of shrubland in the northeast corner of the site. This area has not been accounted for in this table.

- TERRESTRIAL ECOLOGY -	
Key Operational Impacts	<p>South Soko:</p> <ul style="list-style-type: none"> Given the generally low level of human activity required to operate the terminal it is not expected that operational phase impacts will occur. In the unlikely event of leakage of LNG, the fire prevention system will be implemented, and consequently impacts to the terrestrial ecological resources through the spread of fire will be prevented. <p>Shek Pik:</p> <ul style="list-style-type: none"> No impacts are expected to arise from the operation of the water main or electricity cable at Shek Pik.
Key Mitigation Measures	<ul style="list-style-type: none"> The general policy for mitigation of significant ecological impacts has been addressed on the basis of <i>Annex 16</i> of the <i>EIAO-TM</i>. <ul style="list-style-type: none"> <i>Avoidance</i>: Disturbance to terrestrial ecological resources of acknowledged conservation significance has been avoided as a result of the site selection process of the LNG terminal and by focussing the development in previously disturbed areas. The routing of the cryogenic pipeline has also been aligned to avoid disturbance to the central areas of South Soko where the largest numbers of species of conservation interest were recorded. The Project Area at Shek Pik (mainly a developed area), was also not considered to constitute important wildlife or floristic habitat. The proposed pipeline/circuit route will also be located mainly in developed areas, along existing roads. <i>Minimisation</i>: The impacts on ecological resources due to the construction and operation of the LNG terminal are generally expected to be low and acceptable. The following conservation measures to reduce disturbance to surrounding habitats will be also taken: <ul style="list-style-type: none"> <i>Vegetation Loss</i>: The Golden Eulophia (9 individuals) recorded within the Project Area will be transplanted to a similar habitat, i.e., shrubland with open canopy and south facing, which can be found in the southern part of South Soko. <i>Appropriate Construction Practice</i>: Erect fences along the boundary of the works area before the commencement of works to prevent vehicle movements, and encroachment of personnel, onto adjacent areas; regularly check the work site boundaries to ensure that they are not breached and that damage does not occur to surrounding areas and reinstate temporarily affected areas. <i>Compensation</i>: The Project will provide compensatory planting of approximately 0.2 ha of secondary woodland, 1.9 ha of shrubland and 1.3 ha of grassland.
Residual Impacts	<p>South Soko:</p> <ul style="list-style-type: none"> Approximately 2.8 ha of plantation, 5.4 ha of shrubland, 0.5 ha of abandoned wet agricultural land, 0.5 ha of grassland and 5.4 ha of disturbed area will be lost. The affected areas are considered to be generally low quality habitats. No adverse residual impact due to the construction and operation of the LNG terminal is expected at South Soko after the implementation of the proposed mitigation measures including provision of approximately 0.2

- TERRESTRIAL ECOLOGY -	
	<p>ha of compensatory tree planting, approximately 1.9 ha of shrub planting, 1.3 ha of grass planting and transplantation of individuals of the Golden Eulophia.</p> <p>Shek Pik:</p> <ul style="list-style-type: none"> • Approximately 0.04 ha of developed area will be lost. The affected areas are considered to be low/negligible quality habitat. • No adverse residual impact due to the construction of electricity cable circuit and water main is expected.
Compliance with EIAO-TM	<ul style="list-style-type: none"> • The assessment and the impacts are acceptable and in compliance with the <i>EIAO-TM Annexes 8 and 16</i> and applicable assessment standards/criteria.

15.7

MARINE ECOLOGY

Table 15.6 presents a summary of the findings of the assessment of impacts to marine ecology as a result of the construction and operation of the LNG terminal and its associated facilities (subsea pipeline and utilities) at South Soko. The details of the assessment are presented in full in *Section 9* of this *EIA Report*.

As discussed in *Section 2*, following discussions with NGO groups and feedback from various Government departments concerning findings of the Marine Ecology assessment presented in *Section 9*, CAPCO re-examined the layout of the site to determine whether the amount of reclamation could be reduced further in the eastern bay of Tung Wan. The purpose of the reduction in reclamation was to reduce the disturbance to the marine habitats in Tung Wan and in particular the habitat of amphioxus (*Branchiostoma belcheri*). The layout review as part of the design process concluded the following:

- By removing the jetty in Tung Wan marine vessels during construction and operation of the terminal needed to access the site in Sai Wan during periods of adverse weather. This resulted in reduction in dredging in Tung Wan but a slight increase in dredging in Sai Wan to allow for access by construction barges.
- The northern coastline in Tung Wan did not require reclamation by relocating the Control Room, Maintenance Workshop and Administration building. The relocation resulted in a reduction in coastline loss but necessitated additional excavation into the hillside. The excavation works were not expected to cause unacceptable impacts to terrestrial ecology as they would take place in areas of low to moderate ecological value shrubland. No rare or protected fauna or flora have been recorded in this area.
- The changes above necessitated a minor relocation of facilities within the existing footprint of the site in order to comply with the safety

codes for the terminal design. No significant changes in environmental (eg air, noise, waste, landscape visual) or risk issues arose from these changes.

- The net reduction in dredging volumes from the above changes was 60,000 m³ resulting in a overall dredging volume of 3.89 Mm³ for the South Soko option.
- The net reduction in reclamation arising from the above changes was 1.1 ha resulting in a overall reclamation area of 0.6 ha.
- The net reduction in natural coastline loss was 150 m resulting in a overall loss of natural coastline of 300 m.
- The additional excavation volume produced by the slope cutting works was 60,000 m³ of soil and 240,000 m³ of rock.
- The overall Project Area was reduced from 38.6 ha to 36.5 ha as a result of the layout modification.

The discussion above has indicated that significant reduction in reclamation area and natural coastline loss have been achieved through the adoption of the modified layout. This is particularly significant in reducing the severity of any potential impacts to the reported habitat of amphioxus (*Branchiostoma belcheri*).

Table 15.6 Summary of Environmental Assessment and Outcomes – Marine Ecology

- MARINE ECOLOGY -	
Marine Ecology Sensitive Receivers	<p>The marine environment around the South Soko Island has been subject to disturbance in the past as a result of the reclamations in Sai Wan and Tung Wan. To the East of the South Soko Island lies the active South Cheung Chau Mid Disposal Ground and to the West the now inactive but gazetted Sand Dredging and Mud Disposal Area.</p> <p>The following ecological sensitive receivers were identified:</p> <ul style="list-style-type: none"> • Habitats of the Indo-pacific Humpback Dolphin and Finless Porpoise. • Marine Parks: Sha Chau and Lung Kwu Chau; • Proposed Marine Parks: Soko Island and Southwest Lantau • Intertidal Mudflats: Pak Nai, Tai O, Yi O, Shui Hau Wan; • Seagrass Beds: Pak Nai, Tung Chung Bay; • Mangroves: Pak Nai, Tung Chung Bay and Fan Lau Tung Wan; • Horseshoe Crab Nursery Grounds: Pak Nai, Sham Wat Wan, Tai O, Yi O, Sha Lo Wan, Tong Fuk Miu Wan, Tung Chung Bay; and • Protection Zone: Chinese White Dolphin Protection Zone in Mainland Waters.
Key Environmental	<ul style="list-style-type: none"> • Disturbance to marine ecologically sensitive habitats has been avoided as a result of the site/route selection process of the LNG

- MARINE ECOLOGY -	
Problems Avoided/ Environmental Outcomes	<p>terminal and the pipeline.</p> <ul style="list-style-type: none"> • Potential layouts were examined on the basis of their potential environmental impacts. The adopted modified layout has reduced the reclamation to approximately 0.6 ha (from 13 ha of the base case design adopted in Pre-EIA studies). • The relocation of the jetty to the south east has also meant that dredging volumes are reduced to approximately 1.32 Mm³ from > 5 Mm³ at the terminal thus avoiding extensive impacts to the marine ecology of South Soko. • Layout refinements have reduced the length of natural coastline affected by the development to approximately 300 m. • Impacts to marine ecology have been reduced through the adoption of dredging during the installation of the pipeline, and jetting during installation of the water main and cable. A 'Non-conventional' jetting machine will be utilised, as it does not use air to assist with discharge of the sediment. This results in less adverse effect on the water quality of the surrounding areas and thus to the marine ecosystems.
Assessment Methodology and Criteria	<ul style="list-style-type: none"> • A literature review was supplemented by a programme of intensive field surveys that have covered for intertidal and subtidal benthic assemblages, as well as marine mammals (land and vessel based surveys). • The survey programme covered 2004 - 2006 and all seasons. The survey programme represented the most intensive series of ecological studies ever conducted on the marine environment at the South Soko Island and its immediate environs. • The potential impacts due to the construction and operation of the proposed LNG terminal were assessed following the <i>EIAO-TM Annex 16</i> guidelines and the impacts evaluated based on criteria in <i>EIAO-TM Annex 8</i> and Guidance Notes.
Key Construction Impacts	<ul style="list-style-type: none"> • Potential construction phase impacts to marine ecological resources, as well as impacts to marine mammals, may arise from the permanent loss of habitat due to reclamation, disturbances to benthic habitats in the turning circle and approach channel, or through temporary changes to key water quality parameters, as a result of the dredging, reclamation and installation of the gas pipeline and submarine utilities. Organisms of ecological interest (i.e. colonies of False Pillow coral, <i>Pseudosiderastrea tayami</i> on the south coast of South Soko) may potentially be affected by construction activities. • Impacts arising from the proposed dredging or jetting works will be compliant with assessment criteria, transient and confined to the works areas and, therefore will not give rise to adverse impacts to marine ecological resources or marine mammals.
Key Operational Impacts	<ul style="list-style-type: none"> • Potential operational phase impacts to marine ecological resources, as well as impacts to marine mammals, may arise from the discharge of cooled water (reduction of ambient temperature and discharge of antifoulants), impingement and entrainment of marine life within the cooling system. • Operational phase adverse impacts to marine ecological resources are not expected to occur. Unacceptable impacts from discharges of cooled water and antifoulants are not anticipated to occur, as

- MARINE ECOLOGY -	
	<p>they will be localised to the direct vicinity of the outfall and will remain predominantly in the bed layer away from sensitive receivers.</p>
<p>Key Mitigation and Precautionary Measures</p>	<ul style="list-style-type: none"> • Impacts have largely been avoided during the construction and operation of the South Soko terminal through the following measures (in accordance with the <i>EIAO-TM</i>): <ul style="list-style-type: none"> • <i>Avoid Direct and Reduce Indirect Impacts to Ecologically Sensitive Habitats:</i> The site for the South Soko LNG terminal has been selected based on a review of alternative locations and has avoided the majority of key habitats for the Indo-pacific Humpback Dolphin (including Sha Chau and Lung Kwu Chau Marine Park, Peaked Hill Island, West Lantau) and Finless Porpoise (South Lantau and Po Toi Islands), and areas of high marine mammal sighting density. The terminal location has been selected on previously disturbed areas (former Detention Centre lined with an artificial shoreline) and a small reclamation (0.6 ha) confined to Sai Wan to avoid direct impacts to ecologically sensitive habitats. The jetty is also located in an area of low sightings of marine mammals. The dispersion of sediment from dredging and filling does not affect the receivers at levels of concern. • <i>Pipeline Alignment:</i> A number of alternative pipeline routes were studied and the preferred alignment avoids direct impacts to ecologically sensitive habitats within the Sha Chau and Lung Kwu Chau Marine Park, as well as several areas of high marine mammal sighting density. The alignment chosen for the pipeline is at a sufficient distance from ecologically sensitive receivers so that the transient elevation of suspended sediment concentrations from the installation works does not affect the receivers at levels of concern. • <i>Installation Equipment:</i> The use of dredgers along the route will reduce the severity of perturbations to water quality and hence allow compliance with the impact assessment criteria at sensitive receivers. The careful selection of installation equipment will help avoid impacts to sensitive ecological receivers, such as marine mammals. Additionally the deployment of silt curtains at specific locations will further reduce the dispersion of sediment. Percussive piling works in the marine environment will be conducted inside bubble jackets, so as to reduce underwater sound transmissions. • <i>Adoption of Acceptable Construction Rates:</i> The modelling work has demonstrated that the selected working rates for dredging and jetting works will not cause unacceptable impacts to the receiving water quality. Consequently, unacceptable indirect impacts to marine ecological resources have been avoided. • Specific mitigation measures have been designed to reduce impacts to the population of marine mammals which include restrictions on vessel speed, the use of pre-defined and regular routes by construction traffic, and the reduction of the impacts to water quality to acceptable levels (compliance with Water Quality Objectives - WQOs). • Additional (precautionary) measures have been identified to assist the protection of marine mammals including exclusion zones around the marine works areas during marine percussive piling for
<p>Key Mitigation and Precautionary Measures (cont'd)</p>	

- MARINE ECOLOGY -	
	<p>the jetty and during the grab dredging works for gas pipeline installation in North West Lantau waters.</p> <ul style="list-style-type: none"> • Marine percussive pile driving works will only take place during daylight operations and be scheduled to take place outside of the peak calving period of the Finless Porpoise, ie not during November through January. • Dredging for the turning circle and approach channel have been scheduled to take place outside of the peak calving period of the Finless Porpoise, ie not during November through January. • Dredging works for the submarine gas pipeline have been scheduled to take place outside of the peak calving period of the Indo-pacific Humpback Dolphin, ie not during March through August.
Residual Impacts	<p>The following residual ecological impacts have been identified:</p> <ul style="list-style-type: none"> • The loss of approximately 560 m of artificial shoreline/intertidal habitat, approximately 265 m of natural rocky shore/natural subtidal habitat and approximately 35 m of sandy shore which are of low to medium ecological value. The residual impact is considered to be acceptable, as the loss of these habitats will be compensated by the provision of 0.6 km of sloping rubble mound/rock or concrete armour seawalls that have been demonstrated to become recolonised by assemblages of a similar nature after construction. • The loss of approximately 0.6 ha of subtidal soft bottom assemblages within the reclamation site. The residual impact is considered to be acceptable as a result of previous reclamation works and is small in size. • Maintenance dredging of specific areas of the approach channel and turning is expected to be required once every 10 years. Since impact to water quality is expected to be compliant with current WQO standards, the residual impact associated with maintenance dredging is considered to be acceptable.
Compliance with EIAO-TM	<ul style="list-style-type: none"> • The assessment and the residual impacts are acceptable and in compliance with the <i>EIAO-TM Annexes 8 and 16</i> and applicable assessment standards/criteria.

15.8

FISHERIES

Table 15.7 presents a summary of the findings of the assessment of impacts to fisheries as a result of the construction and operation of the LNG terminal and its associated facilities (subsea pipeline and utilities) at South Soko. The details of the assessment are presented in full in *Section 10* of this *EIA Report*.

Table 15.7 Summary of Environmental Assessment and Outcomes – Fisheries

- FISHERIES -	
Fisheries Sensitive Receivers	<ul style="list-style-type: none"> Nursery areas of commercial fisheries resources in south Lantau; Spawning grounds of commercial fisheries resources in north and south Lantau; and Artificial reefs in the Sha Chau & Lung Kwu Chau Marine Park.
Key Environmental Issues Avoided/ Environmental Outcomes	<ul style="list-style-type: none"> Potential layouts were examined on the basis of their potential environmental impacts. The adopted modified layout has allowed to reduce the reclamation to approximately 0.6 ha (from 13 ha of the base case design adopted in Pre-EIA studies). The relocation of the jetty to the south east has also meant that dredging volumes at the terminal are reduced to approximately 1.32 Mm³, thus reducing extensive potential impacts to the fisheries resources of South Soko. The submarine utilities will be buried in the seabed and protected. The protection measures will be either flush with, or below, the existing seabed level. This will avoid interference with fishing operations.
Assessment Methodology and Criteria	<ul style="list-style-type: none"> A literature review was conducted to establish the fisheries importance of the area surrounding the proposed South Soko LNG terminal. In addition to the desktop literature review, an extensive 9 month Ichthyoplankton and Fish Post-Larvae Survey, covering wet and dry seasons, was conducted to determine the sensitivity of the fisheries resources potentially impacted by the construction and operation of the LNG terminal and associated facilities. To this aim, abundance, composition and spatial distribution of the early life stages of the fish was assessed at a total of 20 sampling locations in W, SW and S Lantau as well as S Lamma. The potential impacts due to the construction and operation of the Project and associated developments were assessed following the <i>EIAO-TM Annex 17</i> guidelines and the impacts evaluated based on the criteria in <i>EIAO-TM Annex 9</i>.
Key Construction Impacts	<ul style="list-style-type: none"> Potential construction phase impacts to fisheries may arise from the permanent loss of marine habitat due to reclamation, disturbances to benthic habitats in the turning basin and approach channel, or through changes to key water quality parameters, as a result of the marine works (dredging, reclamation, watermain/pipeline/cable installation). Impacts arising from the proposed dredging or jetting works are predicted to be largely confined to the specific works areas and the predicted elevations in suspended sediment concentrations are not predicted to cause large areal exceedances of the assessment criterion. Adverse impacts to water quality are not predicted and neither are consequential impacts to any fishing grounds or species of importance to the fishery.
Key Operational	<ul style="list-style-type: none"> Potential key operational phase impacts to fisheries resources may

- FISHERIES -	
Impacts	<p>arise from the discharge of cooled water (reduction of ambient temperature and discharge of antifoulants), impingement and entrainment of fish and fish eggs within the cooling system.</p> <ul style="list-style-type: none"> Significant operational phase impacts to fisheries resources and fishing operations are not expected to occur. Entrainment of fisheries resources will be reduced through the appropriate design of the intake screens. Unacceptable impacts from discharges of cooled water are not anticipated to occur as the effects from these discharges will be localised to the lower layers of the water column in direct vicinity of the outfall. Compliance with the relevant discharge standards to control water quality impacts to within acceptable levels is also expected to control impacts to fisheries resources.
Key Mitigation Measures	<ul style="list-style-type: none"> Construction impacts to fisheries resources and fishing operations have largely been avoided through the planning and design of the marine works; in particular those associated with the backfilling and dredging. The main works have been designed to control water quality impacts to within acceptable levels and hence are also expected to control impacts to fisheries resources. No fisheries-specific mitigation measures are required during construction. Compliance with the relevant discharge standards to control water quality impacts to within acceptable levels is expected to control impacts to fisheries resources during the operational phase. Furthermore, entrainment of fisheries resources will be reduced through the appropriate design of the intake screens on the seawater intake. No additional fisheries-specific mitigation measures are required during operation.
Residual Impacts	<ul style="list-style-type: none"> The identified residual impact occurring during the construction phase is the permanent loss of approximately 0.6 ha of seabed associated with the LNG terminal reclamation. The limited habitat loss, the small-scale nature of fishing operations and the potential environmental benefits of the seawall combine to reduce the magnitude of this residual impact to within acceptable levels.
Compliance with EIAO-TM	<ul style="list-style-type: none"> The assessment and the impacts are acceptable and in compliance with the <i>EIAO-TM Annexes 9 and 17</i> and applicable assessment standards/criteria.

15.9

LANDSCAPE AND VISUAL IMPACT

Table 15.8 presents a summary of the findings of the assessment of impacts to the landscape and visual environment as a result of the construction and operation of the LNG terminal and its associated facilities at South Soko. The details of the assessment are presented in full in Section 11 of this EIA Report.

Table 15.8 Summary of Environmental Assessment and Outcomes – Landscape & Visual

- LANDSCAPE AND VISUAL -	
Visually Sensitive Receivers (VSRs), Landscape Resources (LRs) and Landscape Character Areas (LCAs)	<ul style="list-style-type: none"> Country Parks and Scenic lookouts (VSR 3, 4, 6, 7, 12 and 15); these include scenic lookouts and walking trails. Villages (VSR 1, 5, 13 and 14); views from Tai Long Wan Tsuen, Pui O, the Chi Ma Wan Peninsula and Shek Kwu Chau. Road Network (VSR 2 and 8); these include views seen by visitors and the local community when traversing along roads. Ocean viewpoints (VSR 9, 10 and 11); these include views seen by people on ferries and local boats. Secondary woodland (LR1), plantation (LR2), shrubland (LR3), backshore shrubland (LR4), grassland (LR5), abandoned wet and dry agricultural land (LR6), disturbed area (LR7), abandoned reservoir (LR8), rocky shoreline (LR9), sandy beaches (LR10), Artificial shore (LR11) and Tin Hau Temple (LR12) Island landscape (LCA1), abandoned institutional landscape (LCA2), offshore waters landscape (LCA3), inshore waters landscape (LCA4)
Key Environmental Problems Avoided	<ul style="list-style-type: none"> Sensitive VSRs have been avoided by choosing a remote location for the LNG terminal. Potential layouts were examined on the basis of their potential environmental impacts. In the selected layout, the positioning of the tanks has resulted in an improvement in visual impacts with respect to the Pre-EIA and the Project Profile layouts. Landscape impacts have been reduced through sighting of the majority of terminal's facilities on previously disturbed landscape resources.
Assessment Methodology and Criteria	<ul style="list-style-type: none"> The methodology of the LVIA is based on <i>Annexes 10 and 18</i> in the <i>EIAO-TM</i> under the <i>EIA Ordinance</i> and associated Guidance Notes. The landscape assessment considers the impact of the proposed development on the existing landscape and particularly on the landscape character units within 500 m of the development site. The visual assessment examines the impact of the proposed development on the existing views and the visual amenity, particularly from the Visually Sensitive Receivers (VSR) within the viewshed. In order to illustrate the visual impacts of the proposed LNG terminal, photomontages prepared from selected viewpoints compare the existing conditions with the view after construction. The residual impacts are evaluated qualitatively, in accordance with the requirements of <i>Annex 10</i> of the <i>EIAO-TM</i>.
Key Outcomes	<p>The proposed terminal will only be visible from a limited number of locations, and these impacts will only be significant at close proximity to the Soko Islands. The analysis has shown that at distances of greater than 1,260 m, the LNG terminal will not have a substantial negative impact on the visual environment.</p> <ul style="list-style-type: none"> As the Visually Sensitive Receivers (VSRs) within this distance are located in ocean areas, or from other islands in the Soko chain, the impact is greatly reduced as all visitors will experience this impact from marine vessels, or when visiting the Soko Islands. No VSRs located in residential areas, on public roads, or in publicly accessible lookouts or Country Parks will experience this impact.

- LANDSCAPE AND VISUAL -	
	<ul style="list-style-type: none"> • The siting of the LNG terminal will have an overall moderate negative impact on the existing Landscape Character of South Soko Island, and to a lesser extent, the Soko Islands as a whole. • The LNG terminal will have the potential to result in: significant landscape impacts on sandy beaches and the Tin Hau Temple; moderate- significant landscape impacts on secondary woodland; moderate impacts on rocky shoreline, plantation, grassland, disturbed area and artificial shore; slight-moderate impacts on shrubland; slight impacts on abandoned wet and dry agricultural land; and, negligible impacts on backshore shrubland and the abandoned reservoir. • There will be moderate to significant impacts on the existing Landscape Character of the Soko Islands. The LNG will result in significant adverse impacts on island landscape (LCA1), moderate - significant impacts on inshore water landscape (LCA4), moderate impacts on offshore waters landscape (LCA3) and slight - moderate impact on Abandoned Institutional Landscape (LCA2).
Key Mitigation Measures	<p>The analysis has shown that 10 of the 15 VSRs selected for analysis, will experience a negligible visual impact. However for the VSRs that may experience an impact, the following Visual Mitigation Measures (VMMs) are proposed:</p> <ul style="list-style-type: none"> • <i>VMM 1 Design of Structures:</i> Where possible, built structures should utilise appropriate designs to complement the surrounding landscape. Materials and finishes will also be considered during detailed design. • <i>VMM 2 Colours:</i> Colours for the terminal can be used to complement the surrounding area. Lighter colours such as shades of light grey and light brown may be utilised where technically feasible to reduce the visibility of the terminal. • <i>VMM 3 Plantings:</i> Appropriate new plantings will be installed where appropriate, to integrate the new structures into the surrounding landscape. • To reduce the potential impacts on the existing Landscape Resources and provide a potential enhancement of the existing landscape quality, Landscape Mitigation Measures (LMM) are proposed and will be installed progressively throughout the construction of the LNG terminal in accordance with future Landscape Specification and relevant best practice guidelines: • <i>LMM 1 – Cultivation of areas compacted during construction.</i> Areas compacted during the construction phase that are not required during the operation phase, are to be cultivated to a depth of up to 300mm in accordance with the future Landscape Specification. • <i>LMM 2 – Soil stabilisation and planting.</i> During the design phase, a soil stabilisation and embankment planting strategy will be developed to ensure that land affected by slope excavation can be replanted. Soil preparation and the selection and provision of suitable growing medium is to be completed in accordance with the relevant best practice guidelines. • <i>LMM 3 – Tree and shrub planting.</i> Planting of trees and shrubs is to be carried out in accordance with the Landscape Details and the relevant best practice guidelines. Plant species and densities are to be provided in future detailed design documents and are to be selected so as to

- LANDSCAPE AND VISUAL -	
	<p>achieve a finished landscape that matches the surrounding equivalent landscape.</p> <ul style="list-style-type: none"> • <i>LMM4 – Utilising natural rock for reclamation.</i> The reclamation areas shall utilise natural rocks for the engineered sea-walls. • <i>LMM5 – Natural accretion of sand.</i> It is anticipated that sand will naturally form at the base of the new sea walls creating a beach area similar to the existing beach. This process is dependent on natural forces, but is likely to occur within ten years. It must be noted that this is a natural process and is out of the control of the project proponent. • <i>LMM6 – Cut Stabilisation.</i> Areas of cut to be stabilised for operational requirements. Materials and finishes of stabilisation to be selected to complement the surrounding landscape where this is technically feasible. This includes the addition of pigments and aggregates in the finished slope that complement the existing geology of the area. • <i>LMM7 – Bench Plantings.</i> Cut Slopes to have benches created to allow for plantings. Plantings will include Shrubs and climbers to minimise the visual impact of the slope and mitigate impact on vegetation. • <i>LMM8 - Relocation.</i> Landscape Resources of value to be re-located where practically feasible. • <i>LMM9 – Landscape Berm/Planter</i> 2 metre high landscape berm/ planter is to be constructed. Fast growing indigenous tree species to be installed to help screen the tanks and reduce the scale of the development. • <i>LMM10 – New Access</i> Construction of a new pier to allow public access to the southern area of the site. • <i>LMM11 – Early Planting Works.</i> Where technically feasible, new plantings are to be installed as early as possible during the construction works. • <i>LMM12 – Site hoardings to be compatible with the surrounding environment.</i> Where possible site hoardings to be coloured to complement the surrounding areas. Colours such as green and light brown are recommended.
Residual Impacts	<p>No significant adverse residual impacts have been identified:</p> <ul style="list-style-type: none"> • Compensatory planting of indigenous species will mitigate the effects of the development on the many of the landscape resources. The effects on the rocky shoreline can be partially mitigated by the use of natural rock in the reclamation areas. Relocation will fully mitigate the impact on Tin Hau Temple. • Visually the mainland-based viewing locations are located on the periphery of the viewshed, from which the proposed development will be, at worst, a minor change to the view. Most land-based viewing locations will be too far removed from the proposed LNG terminal to even be aware of the change. All land-based viewing locations would also require days of exceptionally clear visibility to discern any change. • The Landscape and Visual Mitigation Measures proposed will help to mitigate the impacts on the Landscape Character Areas. Overall the residual impacts on the LCA's are assessed as moderate.

- LANDSCAPE AND VISUAL -	
	<ul style="list-style-type: none"> Potential night time glow and visibility of maritime and aviation lighting may be visible on clear nights from land based and ocean based viewing locations, however given the lighting already in existence on North Soko, the many other night lighting sources as well as lighting associated with shipping and maritime uses, the additional night lighting of South Soko LNG terminal is considered acceptable.
Compliance with EIAO-TM	<ul style="list-style-type: none"> The assessment and the impacts are <i>acceptable with mitigation</i> and in compliance with the <i>EIAO-TM Annexes 10 and 18</i> and applicable assessment standards/criteria.

15.10

CULTURAL HERITAGE

Table 15.9 presents a summary of the findings of the assessment of impacts to cultural heritage as a result of the construction and operation of the LNG terminal and its associated facilities (subsea pipeline and utilities) at South Soko. The details of the assessment are presented in full in Section 12 of this EIA Report.

Table 15.9 Summary of Environmental Assessment and Outcomes – Cultural Heritage

- CULTURAL HERITAGE -	
Sensitive Receivers	<p>The following terrestrial cultural heritage resources have been identified:</p> <p>Shek Pik:</p> <ul style="list-style-type: none"> The Shek Pik Rock Carving Declared Monument; An abandoned Hung Shing Temple; and The Shek Pik Tung Wan archaeological site (including Site F). <p>South Soko:</p> <ul style="list-style-type: none"> Tin Hau Temple; 27 Graves and an associated tablet; Eight earth shrines; and The Tai A Chau archaeological site with six distinct archaeological deposit areas (namely Sites A to E, and G - Site F being at Shek Pik).
Key Environmental Issues Avoided/ Environmental Outcomes	<ul style="list-style-type: none"> Potential layouts were examined on the basis of their potential environmental impacts. The selected layout has reduced the area impacted by the footprint of the LNG terminal reducing the impact on cultural heritage sites present on South Soko. The routings of the cable and watermain have avoided the heritage/archaeological sites at Shek Pik.
Assessment Methodology and Criteria	<ul style="list-style-type: none"> The study methodology follows the criteria and guidelines as stated in Annexes 10 and 19 of the EIAO-TM and the criteria for Cultural Heritage Impact Assessment (CHIA) and Guidelines for Marine Archaeological Investigation (MAI) as stated EIA Study Brief No. ESB-126/2005. The baseline study included a desktop literature review and intensive field surveys, namely: Historical Buildings and Features Survey (including grave, shrine and tablet survey), Terrestrial Archaeological Survey and a Marine Archaeological Investigation.
Key Impacts	<ul style="list-style-type: none"> The landtake for the LNG terminal will cause direct impacts to:

- CULTURAL HERITAGE -	
	<ul style="list-style-type: none"> • The Tai A Chau Tin Hau Temple; • 21 graves and one associated tablet; • 7 earth shrines; and • Part of the Tai A Chau archaeological site. • Archaeological surveys undertaken within the Project Area indicate that five archaeological deposit areas (Sites A to D and G) lie within the entire Tai A Chau archaeological site. Site E, with three discrete archaeological deposit areas, is outside the Tai A Chau archaeological site. • The surveys revealed that many of the sites, A-E in particular, have been disturbed to varying degrees in the past due to natural erosion or the construction and demolition of the Detention Centre. • The other areas of the Tai A Chau archaeological site falling within the surveyed area are considered to have negligible archaeological potential. • In terms of potential impacts on Tai A Chau archaeological deposits, all sites except Site G are expected to be impacted to some degree. • Six potential shipwrecks were identified within the Study Area, five of which are motorized sampan or work boat and are considered of no archaeological value. The sixth, has been confirmed to no longer exist within the proposed pipeline route. Thus, no impacts to marine archaeological resources are expected.
Key Mitigation Measures	<ul style="list-style-type: none"> • It is recommended that the Tai A Chau Tin Hau Temple is relocated to a site with a similar cultural landscape and archaeological survey be undertaken to confirm if archaeological potential exists at the site. If archaeological deposits are identified, appropriate mitigation measures should be provided prior to relocation. The Study Team in consultation with the local seafarers and village representatives have identified a location to the west of Pak Tso Wan. Prior to relocation, a photographic and cartographic record will be prepared, in accordance with the AMO's requirements. • As the seven impacted earth shrines are simple in structure with little architectural value, they are considered to have low cultural heritage value. Relocation of the earth shrines to another location on the Island is considered acceptable. Prior to relocation, a photographic and cartographic record will be prepared, in accordance with the AMO's requirements. • 21 graves and the associated tablets are located within/outside the fence line of the Project where impact to them exist, and need to be relocated. Most of them are of little heritage value and thus impact to them are considered acceptable. However, G006, G015, G017 and G019, are dated pre-1950 and of some heritage value, it is recommended that cartographic and photographic records be undertaken prior to removal of these four graves following AMO's requirements. • An <i>Archaeological Action Plan (AAP)</i> following the <i>Criteria for Cultural Heritage Impact Assessment</i> as stated in the <i>Study Brief No. ESB-126/2006</i> will be prepared detailing the archaeological actions required to mitigate impacted archaeological deposits (i.e. Site A to E). The plan will include the following: <ul style="list-style-type: none"> a) a detailed plan for rescue excavation for Sites B to E and impacted area of Site A; b) a detailed plan for archaeological monitoring (watching brief) at the buffer areas for Sites A to E; and

- CULTURAL HERITAGE -	
	<p>c) a contingency plan to address possible arrangement when significant archaeological findings are unearthed for items (a) and (b).</p> <p>Sufficient funding, time and personnel will be allowed to implement the plan prior to construction work commencement. The AAP will be submitted and agreed with AMO by the project proponent prior to licence application by a qualified archaeologist.</p> <ul style="list-style-type: none"> No impacts to marine archaeological resources have been identified and hence no specific mitigation measures are necessary.
Residual Impacts	<ul style="list-style-type: none"> With the implementation of proposed mitigation measures, no residual impact is expected.
Compliance with EIAO-TM	<ul style="list-style-type: none"> The assessment and the residual impacts are acceptable and in compliance with the <i>EIAO-TM Annexes 10 and 19</i> and applicable assessment standards and criteria.

15.11

QUANTITATIVE RISK - MARINE

Table 15.10 presents a summary of the findings of the assessment of impacts to quantitative risk as a result of the marine transit of the LNG carrier to the LNG terminal at South Soko. The details of the assessment are presented in full in the *Black Point and South Soko LNG Terminal Marine Quantitative Risk Assessment - MQRA (DNV, 2006)*.

Table 15.10 Summary of Environmental Assessment and Outcomes - Quantitative Risk - Marine

QUANTITATIVE RISK ASSESSMENT -MARINE -	
Assessment Methodology and Criteria	<ul style="list-style-type: none"> The objective of the MQRA was to calculate the risks from potential carrier-related incidents to the land-based and transient marine human populations along the carrier route. The methodology involved four main components: quantitative risk assessment, release frequency calculation, consequence assessment, and risk assessment.
Key Environmental Problems Avoided/ Environmental Outcomes	<ul style="list-style-type: none"> The location of the South Soko Island provides for very low numbers of surrounding land and marine-based populations with exposure to both the terminal site and the marine transit. Access to the terminal would be from the south, avoiding HK SAR's main shipping fairways.
Key Outcomes	<ul style="list-style-type: none"> The individual risk results for the transit route to South Soko are acceptable per the individual risk criteria set out in <i>Annex 4</i> of the <i>EIAO-TM</i>, which is a level of 10^{-5} per year (one in 100,000 years), or less. The societal risk results for the transit route to South Soko lie in the acceptable region of the societal risk criteria curve set out in <i>Annex 4</i> of the <i>EIAO-TM</i>.
Mitigation	<ul style="list-style-type: none"> No unacceptable risks are foreseen as a result of the transit of the LNG

QUANTITATIVE RISK ASSESSMENT -MARINE -	
Measures	carrier to South Soko. No mitigation measures are thus deemed necessary.
Compliance with EIAO-TM	<ul style="list-style-type: none"> The assessment and the impacts are in compliance with the EIAO-TM Annex 4.

15.12

QUANTITATIVE RISK - TERMINAL

Table 15.11 presents a summary of the findings of the assessment of impacts to quantitative risk as a result of the construction and operation of the LNG terminal and its associated facilities (subsea pipeline and utilities) at South Soko. The details of the assessment are presented in full in *Section 13* of this *EIA Report*.

Table 15.11 Summary of Environmental Assessment and Outcomes - Quantitative Risk - Terminal

QUANTITATIVE RISK ASSESSMENT - TERMINAL	
Assessment Methodology and Criteria	<ul style="list-style-type: none"> The Quantitative Risk Assessment (QRA) study undertaken for the proposed LNG terminal at South Soko has assessed the risk associated with the terminal as well as the associated facilities: the subsea pipeline from South Soko to Black Point Power Station (BPPS) and the Gas Receiving Station (GRS) at BPPS. The HA study of the LNG terminal includes all planned facilities at the site, unloading operations at the jetty, LNG storage tanks, sendout pumps, LNG vaporisers and the boil-off gas system. The methodology involved five main components: review of baseline data (review of LNG terminal layout and surrounding population), risk assessment on generic and site specific risks, frequencies and likelihood calculation, consequence assessment and risk assessment. The results from the risk assessment were compared with the HKRG and, mitigation measures identified and assessed where appropriate.
Key Environmental Issues Avoided	<ul style="list-style-type: none"> The LNG terminal has been located in a remote location avoiding populated areas.
Key Outcomes	<p>LNG terminal:</p> <ul style="list-style-type: none"> The results indicate that the societal and individual risks from the proposed facility are within the Acceptable Region and comply respectively with <i>Annex 4</i> of the <i>EIAO-TM</i>. <p>Submarine Gas Pipeline:</p> <ul style="list-style-type: none"> The FN curves for all sections of the pipeline lie within the Acceptable Region. IR for all sections are predicted to be less than the 1×10^{-5} per year as per <i>Annex 4</i> of the <i>EIAO-TM</i>. <p>Gas Receiving Station:</p> <ul style="list-style-type: none"> The individual risk is less than 1×10^{-5} per year (i.e. less than one in every 100,000 years) everywhere on site and at the site boundary, and hence meets the requirements of <i>Annex 4</i> of the <i>EIAO-TM</i>. It can be seen that the societal risk for the GRS is within the Acceptable Region as per <i>Annex 4</i> of the <i>EIAO-TM</i>.
Mitigation Measures	<ul style="list-style-type: none"> No unacceptable risks are foreseen as a result of the operation of the LNG terminal and submarine gas pipeline. No mitigation measures are thus deemed necessary.
Compliance with EIAO-TM	<ul style="list-style-type: none"> The assessment and the impacts are in compliance with the <i>EIAO-TM Annex 4</i>.