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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 Black Point. 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:

- List of 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 at Black Point. Full details of the assessment 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)	<p>Air Sensitive Receivers (ASRs) were identified in accordance with the criteria in <i>EIAO-TM Annex 12</i>. Within 500 m of the Project site boundary, no ASR was identified. The nearest identified ASRs are:</p> <ul style="list-style-type: none"> • A1: Sheung Pak Nai at 7,500 m. Residential. Max height: 10 m; • A2: EPD Office at WENT Landfill at 3,200 m. Office. Max Height: 10 m; • A3: Black Point Power Station – Administration Building at 600 m. Office. Max Height 6 m; • A4: Proposed Karting Track (ASR which is expected to be in operation during the construction of the LNG Terminal) at 1,700 m. Recreational; • A5: Concrete Batching Plant - Site Office at 1,050 m. Office. Max Height: 6 m; • A6: Open Storage at 1,170 m; • A7: Hong Kong Oil - Site Office at 1,300 m. Office. Max Height: 6 m; and • A8: Open Storage at 1,500 m.
Key Environmental Problems Avoided/ Environmental Outcomes	<ul style="list-style-type: none"> • The location of the site is remote from inhabited areas avoiding extensive impacts on air sensitive receivers
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 pipeline gas heaters were continuous, when in reality total emissions will, on average, be significantly lower. • 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.
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.

- AIR QUALITY -	
Key Operational Impacts	<p>LNG Terminal Impacts:</p> <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 and background levels of ozone. <p>Cumulative Impacts (LNG terminal and BPPS):</p> <ul style="list-style-type: none"> <i>Short-Term (hourly) Cumulative NO₂ Impact:</i> For ASRs A1 and A2, the worst case wind angles for emissions from the LNG terminal and the BPPS are similar and hence cumulative NO₂ impact is expected. A3 is located within the BPPS site and a short-term cumulative NO₂ impact is not expected. Cumulative maximum hourly NO₂ impacts at Ha Pak Nai and Sheung Pak Nai are within the hourly NO₂ criterion. It should be noted that the maximum hourly NO₂ concentrations at A1 and A2 attributable to the LNG terminal emissions are predicted using a very conservative approach, assuming continuous emissions from all resources <i>Cumulative Daily and Annual NO₂ Impacts:</i> The results indicate that the cumulative daily and annual NO₂ impacts at all identified ASRs are well within the Air Quality Objective (AQO). The contribution from the LNG terminal emissions is very minor even under the worst case scenario that has been modelled.
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 minimize the potential fugitive dust emissions and also gaseous emission from construction plant. <p>Operational Phase:</p> <ul style="list-style-type: none"> No exceedances of the AQO criteria are anticipated at the ASRs and therefore no mitigation measures are required.
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	<p>The assessment and the impacts are acceptable and in compliance with the EIAO-TM Annexes 4 and 12 and applicable assessment standards/criteria.</p>

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 at Black Point. 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 village house at Lung Kwu Sheung Tan (N1) which is located at approximately 1.6 km away from the site. No planned NSR is identified within 2 km from the site.
Key Environmental Problems Avoided/ Environmental Outcomes	<ul style="list-style-type: none"> The location of the site is remote from inhabited areas avoiding extensive impacts on noise sensitive receivers
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 EIAO-TM. 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 EIAO-TM. 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, 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 35 - 44 dB(A), which are below the daytime construction noise criterion of 75 dB(A) throughout the construction period. It must be noted that a conservative set of assumptions has been adopted in the analysis. <p>Restricted Hours:</p> <ul style="list-style-type: none"> The predicted noise levels 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 33 dB(A) which is below the stipulated noise criterion during daytime and night-time period.

- NOISE -	
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 plus a hill located 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 at Black Point. 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>Fisheries Resources:</p> <ul style="list-style-type: none"> Spawning/Nursery Grounds: Fisheries Spawning Ground in North Lantau; Artificial Reef Deployment Area: Sha Chau and Lung Kwu Chau, Airport; and Fish Culture Zone: Ma Wan. <p>Marine Ecological Resources:</p> <ul style="list-style-type: none"> Seagrass Beds: Pak Nai; Marine Park: Designated Sha Chau and Lung Kwu Chau; Intertidal Mudflats: Pak Nai; Mangroves: Pak Nai; Horseshoe Crab Nursery Grounds: Pak Nai, Sham Wat Wan, Sha Lo Wan, Tung Chung Bay; Protection Zone: Chinese White Dolphin Protection Zone in Mainland Waters; and, Marine Mammal Habitat in NW Lantau. <p>Water Quality SRs:</p> <ul style="list-style-type: none"> Gazetted Beaches: Butterfly Beach, Tuen Mun Beaches; Non-gazetted Beaches: Lung Kwu Sheung Tan, Lung Kwu Tan,; Seawater Intakes: Black Point Power Station, Castle Peak Power

- WATER QUALITY -	
	Station, Tuen Mun Area 38, Airport.
Key Environmental Problems Avoided/ Environmental Outcomes	<ul style="list-style-type: none"> Water quality impacts have been avoided by positioning the LNG terminal adjacent to the BPPS, hence avoiding the installation of the subsea pipeline. Potential layouts were examined on the basis of their potential environmental impacts. In the preferred layout dredging volumes have been reduced to approximately 3.15 Mm³, thus reducing impacts to water quality of Black Point.
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 2004 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>: Potential impacts arising from the proposed dredging or jetting works are predicted to be largely confined to the specific works areas. The predicted elevations of suspended sediment concentrations are transient in nature and not predicted to cause adverse impacts to water quality at the sensitive receivers. <i>Water Quality (Dissolved Oxygen, Nutrients, and Heavy Metals)</i>: The effects of increased SS concentrations as a result of the proposed works on levels of dissolved oxygen, biochemical oxygen demand and nutrients (as unionised ammonia) are predicted to be minimal. Where such effects exist, they will be transient, localised in extent and of a small magnitude. <i>Hydrotest Water</i>: Should hydrotest water, from tanks and the gas pipeline, be discharged in the vicinity of Black Point, dispersion would be rapid and concentrations of antifoulants would rapidly diminish. No adverse impacts to water quality would, therefore, be expected to occur. <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.

- WATER QUALITY-	
Key Operational Impacts	<ul style="list-style-type: none"> • <i>Hydrodynamics:</i> Modelling results show that the presence of the reclamation is likely to alter tidal currents and introduces a localised sheltering effect in the vicinity of the existing intake of the Black Point Power Station. The impact to the flushing capacity of the whole Deep Bay region is considered to be insignificant. • <i>Suspended Sediments:</i> Maintenance dredging requirement is expected to be required once every five years and will be restricted to specific 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. • <i>Cooled Water Discharge:</i> No non-compliance with the WQO has been predicted. The results 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 LNG, contaminated site run-off are not predicted to cause unacceptable impacts to the water quality sensitive receivers.
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.</p> <p>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 a sufficient distance from water quality sensitive receivers so that 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 Working 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. <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.

- WATER QUALITY -	
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 at Black Point. 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 Black Point 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 resultant layout has a reduction in dredging volumes which has brought about an overall reduction in waste management impacts.
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 3.15 Mm³ of marine sediment will be dredged. It is estimated that about 87% of the sediments are uncontaminated and could be disposed of at open sea disposal site. About 9% of the sediment will be disposed of open sea dedicated site. The remaining 4% will have to be disposed of at the confined marine disposal site. 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"> Industrial waste, chemical waste, sewage and general refuse will be produced during the operational phase of the LNG terminal. The potential environmental impacts 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 minimize potential adverse environmental impacts associated with

- WASTE MANAGEMENT -	
	<p>handling, collection and disposal of waste arising from the construction and operation of the proposed LNG terminal.</p> <ul style="list-style-type: none"> Proposed measures are based on good management, control and good site practices.
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, minimal 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 <i>EIAO-TM Annexes 7 and 15</i> 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 at Black Point. 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>A number of floral and faunal species of conservation interest have been identified within the Study Area:</p> <ul style="list-style-type: none"> Two locally protected plant species, i.e., Pitcher Plant <i>Nepenthes mirabilis</i> and Bamboo Orchid <i>Arundina graminifolia</i>, were recorded in shrubland at the west of the headland. Three bird species of conservation interest, the Black Kite, White-bellied Sea Eagle and Greater Coucal, were recorded within the Study Area. None of these bird species were sighted within habitats that would be directly affected by the Project. Two uncommon (Yellow Pansy and Tailed Sulphur) and two rare (Spotted Sawtooth and Red Lacewing) butterfly species were recorded within the Study Area. None of these butterfly species were sighted within habitats to be directly affected by the Project. A Lesser Spiny Frog was found in the seasonal stream, which is a habitat that would not be directly affected by the Project. A protected snake species (Burmese Python <i>Python molurus</i>) was recorded in the drainage channel next to the power station area. A Japanese Pipistrelle, the most common bat species in Hong Kong, was recorded within the power station area.
Key Environmental Problems Avoided/ Environmental Outcomes	<ul style="list-style-type: none"> Disturbance to terrestrial ecological resources of acknowledged conservation significance has been avoided as a result of the site selection process 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 over a period of 6 months to update and field check the validity of the information

- TERRESTRIAL ECOLOGY -	
	<p>gathered in the review and to fill information gaps.</p> <ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> Permanent loss (approximately 4.2 ha) and temporary loss (approximately 0.7 ha) of shrubland due to the construction of the tanks of the LNG terminal, including a temporary haul road and slope stabilization. Permanent loss of developed area (approximately 1 ha) due to the construction of the administrative buildings. 135 m of drainage channel. Need to transplant floral species of conservation interest (Pitcher Plant and Bamboo Orchid) and of foraging/ feeding habitat for the associated wildlife. Potential loss of foraging and feeding ground of the associated wildlife.
Key Operational Impacts	<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.
Mitigations	<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. <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 appropriate measures will be taken to further reduce impacts to terrestrial ecological resources: <ul style="list-style-type: none"> Vegetation Loss: The Pitcher Plants and Bamboo Orchids (both < 10 individuals) recorded within the Project Area will need to be transplanted to a similar habitat Appropriate Construction Practice: 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; avoid damage and disturbance to the remaining and surrounding natural habitats; and reinstate temporarily affected areas. <i>Compensation</i>: To compensate for the loss of 4.9 ha of shrubland for the construction of the terminal, haul road and storage tanks on the existing shrubland, at least 0.7 ha of shrubland will be planted at the newly formed slope within the Project Area along with 6 ha of enhancement shrubland planting.
Residual Impacts	<ul style="list-style-type: none"> The Project will involve the permanent loss of approximately 6.4 ha of shrubland. The affected habitats are considered to be of moderate

- TERRESTRIAL ECOLOGY -	
	<p>ecological value.</p> <ul style="list-style-type: none"> No adverse residual impact due to the construction and operation of the LNG terminal is expected after the implementation of the proposed mitigation measures including provision of 0.7 ha of compensatory planting and 6 ha of enhancement planting of shrubland, reinstatement of the temporary haul road and transplantation of Pitcher Plants and Bamboo Orchids.
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 at Black Point. The details of the assessment are presented in full in Section 9 of this EIA Report.

Table 15.6 Summary of Environmental Assessment and Outcomes – Marine Ecology

- MARINE ECOLOGY -	
Marine Ecology Sensitive Receivers	<p>The following ecological sensitive receivers were identified:</p> <ul style="list-style-type: none"> Habitats of the Indo-pacific Humpback Dolphin, Seagrass Beds: Pak Nai, Marine Park: Sha Chau and Lung Kwu Chau, Intertidal Mudflats, Mangrove and Horseshoe Crab Nursery Grounds: Pak Nai, Protection Zone: Chinese White Dolphin Protection Zone in Mainland Waters.
Key Environmental Problems Avoided/ Environmental Outcomes	<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 terminal. Impacts to marine ecology have been avoided by positioning the LNG terminal adjacent to the BPPS, hence by avoiding the installation of a submarine pipeline. Potential layouts were examined on the basis of their potential environmental impacts. In the preferred layout dredging volumes have been reduced to approximately 4 Mm³, thus reducing impacts to the marine ecology of Black Point.
Assessment Methodology and Criteria	<ul style="list-style-type: none"> A literature review was supplemented by detailed all season field surveys for intertidal and subtidal benthic assemblages, as well as marine mammals (land and vessel based surveys). 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>.
Key Construction	<ul style="list-style-type: none"> Potential construction phase impacts to marine ecological resources, as

- MARINE ECOLOGY -	
Impacts	<p>well as impacts to marine mammals, 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 dredging and reclamation.</p> <ul style="list-style-type: none"> • Impacts arising from the proposed dredging or jetting works are predicted to be largely confined to the specific works areas and the predicted elevations of suspended sediment due to the Project are not predicted to cause large areal exceedances of the Water Quality Objectives (WQO), adverse impacts to water quality, and hence marine ecological resources or marine mammals, are not anticipated. • Irreversible and permanent loss of 16 ha of marine mammal habitat of medium ecological value would constitute an adverse impact of relatively high magnitude. Given the large areas of higher value surrounding marine mammal habitat the impact is not considered to be unacceptable.
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 the effects from these discharges will be localised to the direct vicinity of the outfall.
Key Mitigation and Precautionary Measures	<ul style="list-style-type: none"> • Impacts have largely been avoided during the construction and operation of the Black Point terminal through the following measures (in accordance with the <i>EIAO-TM</i>): <ul style="list-style-type: none"> • <i>Avoid Direct Impacts to Ecologically Sensitive Habitats:</i> Disturbance to marine ecologically sensitive habitats has been avoided as a result of the site selection process of the LNG terminal. • <i>Adoption of Acceptable Working Rates:</i> The modelling work has demonstrated that the selected working rates for the dredging will not cause unacceptable impacts to the receiving water quality. Consequently, unacceptable indirect impacts to marine ecological resources have been avoided. • Mitigation measures specific to marine ecology include the provision of rubble mound/armour rock seawalls on the edges of the reclamations to facilitate colonisation by intertidal and subtidal organisms. • 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 such as the inclusion of an exclusion zone around the marine works areas during marine percussive piling. • The use of bubble curtains may also attenuate a limited amount of the mid range frequency sound generated during percussive pile driving.
Residual Impacts	<ul style="list-style-type: none"> • The loss of approximately 600 m of natural rocky shore/intertidal habitat and approximately 120 m of artificial shoreline which are of low

- MARINE ECOLOGY -	
	<p>ecological value. The residual impact is considered to be acceptable, as the loss will be compensated by the provision of approx. 1.1 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;</p> <ul style="list-style-type: none"> • The loss of approx. 16 ha of subtidal soft bottom assemblages within the reclamation sites. The residual impact is considered to be acceptable as the habitat is of low ecological concern and relatively small in size in the context of surrounding similar habitat. • The loss of approx. 16 ha of marine waters within the reclamation sites. The residual impact is considered to be acceptable as the habitat forms only a small portion of the extensive home range of affected animals (typically over 100km²) and will not result in biologically significant impacts on vital rates or fitness of individual animals.. • Maintenance dredging of small specific areas of the approach channel and turning is expected to be required once every 4-5 years. Since impact to water quality is expected to be compliant with current WQO standards, the residual impact 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 at Black Point. 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"> • Spawning ground of commercial fisheries resources in north Lantau (2.7 km from the LNG terminal); • Oyster Production Area at Pak Nai; • Artificial reefs in the Sha Chau & Lung Kwu Chau Marine Park (located 6.4 km from the LNG terminal).
Key Environmental Problems Avoided/ Environmental Outcomes/ Environmental Outcomes	<ul style="list-style-type: none"> • Impacts to commercial fisheries have been avoided by positioning the LNG terminal adjacent to the BPPS, hence by avoiding the installation of a submarine pipeline. • Potential layouts were examined on the basis of their potential environmental impacts. In the preferred layout dredging volumes have been reduced to approximately 3 Mm³, thus reducing impacts to commercial fisheries Black Point.
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 Black Point LNG terminal. • The potential impacts due to the construction and operation of the

- FISHERIES -	
	<p>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>.</p>
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 dredging and reclamation. • Adult capture fisheries resources are unlikely to be adversely impacted by the LNG terminal as they will likely avoid the works areas. Although impacts to fish fry may occur through the permanent loss of habitat, the small size of the reclaimed area and the low fisheries and fish fry value of the habitat lost greatly reduce the significance of the impact to a level that is acceptable. • Impacts arising from the proposed dredging works are predicted to be largely confined to the specific works areas and to be temporary in nature. The predicted elevations of suspended sediment concentrations due to the Project are not predicted to exceed the assessment criteria over large areas or at sensitive receivers and they are not expected to cause adverse impacts to water quality or to any fishing grounds or species of importance to the fishery.
Key Operational Impacts	<ul style="list-style-type: none"> • Potential operational phase impacts to fisheries resources may 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. • 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.
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 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 16 ha of seabed required for the LNG terminal reclamation. • The combination of very 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.

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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 9 and 17 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 at Black Point. 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"> Public Areas (VSR1 and VSR6); Road Network; (VSR3, 4 and 5); these include views seen by visitors and the local community when traversing through roads. Ocean viewpoints (VSR 2); these include views seen by people on ferries and local boats It must be noted that there are no views from villages Plantation (LR1), shrubland (LR2), shrubby grassland (LR3), stream / channel (LR4), developed area (LR5), rocky shoreline (LR6), power station edge (LR7) Black Point coastal uplands (LCA1), Black Point industrial urban landscape (LCA2), offshore waters landscape (LCA3), inshore waters landscape (LCA4).
Key Environmental Problems Avoided/ Environmental Outcomes	<ul style="list-style-type: none"> Sensitive VSRs have been avoided by choosing a location for the LNG terminal away from densely populated areas. In the selected layout, the positioning of the tanks has been identified to avoid significant visual impacts.
Assessment Methodology and Criteria	<ul style="list-style-type: none"> The methodology of the LVIA is based on Annexes 10 and 18 in the EIAO-TM under the EIA Ordinance (Cap.499, S16) and applicable 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 analyses 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 Annex 10 of the EIAO-TM.
Key Outcomes	<ul style="list-style-type: none"> The installation of the LNG terminal will have a slight overall residual negative impact on the existing Landscape Character of Black Point,

- LANDSCAPE AND VISUAL -	
	<p>particularly the hill slope area.</p> <ul style="list-style-type: none"> As most of the Visually Sensitive Receivers (VSRs) within 1260m are located in ocean areas, the impact is greatly reduced as all visitors will experience this impact from marine vessels. No VSRs located in residential areas, on public roads, or in publicly accessible lookouts or Country Parks will experience this impact on the Landscape Character. The LNG terminal will have the potential to result in: significant landscape impacts on rocky shoreline; moderate landscape impacts on shrubland and stream / channel; slight/moderate landscape impacts on power station edge; slight landscape impacts on developed areas; and negligible landscape impacts on plantation and shrubby grassland. There will be moderate significant impacts on the existing Landscape Character of Black Point. The LNG will result in medium – significant impact on offshore waters, medium impacts on upland coastal areas, low impacts on industrial urban landscape and negligible impact on inshore waters.
Key Mitigation Measures	<ul style="list-style-type: none"> The analysis has shown that from nearly all of the VSRs there will be a low or negligible visual impact. However for those few VSRs that may experience an impact, the following Visual Mitigation Measures (VMM's) are proposed: <ul style="list-style-type: none"> <i>VMM 1 Design of Structures:</i> Where possible, building structures will utilise appropriate design to complement the surrounding landscape. Materials and finishes will be considered during detailed design. <i>VMM 2 Colours:</i> Colours for the terminal can be used to complement the surrounding area to the extent possible. Colours such as shades of light grey, and light brown may be utilised to reduce the visibility of the terminal where technically feasible. <i>VMM 3 Plantings:</i> Appropriate plantings will be installed where possible, to help 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: <ul style="list-style-type: none"> <i>LMM 1 – Cultivation of areas compacted during construction.</i> Areas compacted during the construction phase that are not required during the operations 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 embankment planting.</i> During the design process a soil stabilisation and embankment planting strategy will be developed to ensure that all land affected by slope excavation can be replanted. All soil preparation and the selection and provision of suitable growing medium will 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

- LANDSCAPE AND VISUAL -	
	<p>carried out in accordance with the Landscape Details and the relevant best practice guidelines. Plant densities will be provided in future detailed design documents and will be selected so as to achieve a finished landscape that matches the surrounding, undisturbed, equivalent landscape types.</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 – 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 technically feasible. This includes the addition of pigments and aggregates in the finished slope that complement the existing geology of the area. • <i>LMM6 – 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>LMM7 – Early Planting Works.</i> Where technically feasible, new plantings are to be installed during the construction works. • <i>LMM8 – 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	<ul style="list-style-type: none"> • The proposed LNG terminal would be only visible from limited viewpoints, including the small number of visitors on the remote island of Lung Kwu Chau and the transient passengers on ferry routes. The residual level of visual impact is considered to be acceptable. • Potential glare and lighting impacts will be low due to the distances between the site and VSRs and careful lighting selection and placement. • There will be an impact on the landscape character of Black Point (i.e. loss of shrubland), however this is considered acceptable.
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 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 at Black Point. 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>Three terrestrial sites of cultural heritage importance have been identified:</p> <ul style="list-style-type: none"> • Two building structures at Terrace 1; • A WWII cave at Terrace 2; and • A stone structure at Terrace 3.
Key Environmental Problems Avoided / Environmental Outcomes	<ul style="list-style-type: none"> • None specific.
Assessment Methodology and Criteria	<ul style="list-style-type: none"> • The study methodology follows the criteria and guidelines as stated in <i>Annexes 10 and 19</i> of the <i>EIAO-TM</i> and the criteria for <i>Cultural Heritage Impact Assessment (CHIA)</i> and <i>Guidelines for Marine Archaeological Investigation (MAI)</i> as stated <i>EIA Study Brief No. ESB-126/2005</i>. • The baseline study included a desktop literature review and field surveys, namely: Historical Buildings and Features Survey, Terrestrial Archaeological Survey and a Marine Archaeological Investigation.
Key Impacts	<ul style="list-style-type: none"> • No Declared Monuments or Deemed Monuments located within the Project Area and no sites of cultural heritage protected under the AM Ordinance have been identified. Construction and operational impacts to sites of cultural heritage are thus not expected. • Direct loss of two building structures at Terrace 1, a WWII cave at Terrace 2 and a stone structure at Terrace 3 is expected due to the site formation works for the development within the Project Boundary. As these features are considered to have low heritage value, their loss is acceptable and no impact is expected. • One potential marine archaeological site (SC086) was identified from a review of geophysical data and magnetometer data review. A ROV survey and further detailed side scan sonar and multi beam survey was undertaken to inspect the nature and age of the site. The surveys indicated that SC086 is a motorized sampan. It is, therefore, considered to have no archaeological value. Since no marine archaeological resources were identified within the marine area of the proposed development, no impact is expected.
Mitigations	<p>Terrestrial Cultural Heritage Resources:</p> <ul style="list-style-type: none"> • A photographic and cartographic recording of the two building structures at Terrace 1, of the WWII cave at Terrace 2 and the stone structure at Terrace 3 will be undertaken following AMO's requirements. <p>Marine Archaeological Resources:</p> <ul style="list-style-type: none"> • As no marine archaeological interest sites have been identified, no impact is expected and thus no mitigation measures are considered necessary
Residual Impacts	<ul style="list-style-type: none"> • With the implementation of the 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 Black Point. 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 MQRA calculated 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 jetty, approach channel and turning basin have been located sufficiently far away from vessel fairways to avoid interference and additional risk potentially caused by existing shipping activities.
Key Outcomes	<ul style="list-style-type: none"> The results of the Marine Quantitative Risk Assessment of the LNG terminal at Black Point indicated that the individual risk for marine transit is acceptable whilst the societal risk of the marine transit is As Low As Reasonably Practicable (ALARP) for some areas of the marine transit as set out in HKSARG risk guidelines presented in Annex 4 of the EIAO TM. Access to Black Point site today requires marine transit through busy harbour traffic, and along densely populated areas, of: <ul style="list-style-type: none"> Western Hong Kong Island: Ap Lei Chau, Cyberport; Ma Wan Island and Tsing Ma Bridge; New Territories; Shame Tseng, Tsing Lung Tau, Gold Coast, Tuen Mun.
Key Mitigation Measures	<ul style="list-style-type: none"> Measures to mitigate the marine societal risk through these areas from ALARP to Acceptable are not considered to be implementable at this time by the relevant Authority due to their impact on other marine traffic in the busy Hong Kong environment. LNG transit through these areas is avoided by the selection of the South Soko site, where the risk of the marine transit has been assessed as Acceptable along the entire route.
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 at Black Point. 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"> Relevant data on the proposed facilities such as their preliminary layout drawings and design basis as well as population data in the vicinity were collected and reviewed. Quantitative Risk Study was conducted to identify risks, both generic and site specific risks. Review of literature and accident databases were also undertaken. These formed the basis for identifying credible scenarios for the HA Study. The frequencies, or the likelihood, of the various outcomes resulting from an LNG/gas release scenario were derived from historical databases and, where necessary, these were modified to take into account local factors. The consequences of each release were modelled using the PHAST consequence modelling package developed by Det Norske Veritas, Inc. (DNV). The consequence and frequency data were subsequently combined using ERM's proprietary software Riskplot™ to produce the required risk calculations. The results from the risk assessment were compared with the HKRG and, mitigation measures identified and assessed where appropriate. The HA study 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.
Key Problems Avoided	<ul style="list-style-type: none"> The LNG terminal has been located in a remote location avoiding densely populated areas. The closest villages are located at Lung Kwu Sheung Tan (approximately 2 km from the site) where the population is approx. 1,800. The closest developments to the site, other than BPPS, are small scale industrial complexes at Lung Kwu Sheung Tan.
Key Outcomes	<ul style="list-style-type: none"> The results indicate that the societal risks from the LNG terminal at Black Point are within the Acceptable Region of the <i>HK EIAO-TM</i>. The individual risks also meet the requirements of the HKRG.
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>