

Hong Kong Offshore LNG Terminal Project

Piling Installation Plan

8 February 2021

Project No.: 0505354

Document details	
Document title	Hong Kong Offshore LNG Terminal Project
Document subtitle	Piling Installation Plan
Project No.	0505354
Date	8 February 2021
Version	2
Author	RY
Client Name	Hong Kong LNG Terminal Limited

Document history

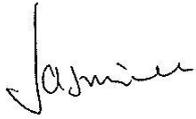
	Revision	Author	Reviewed by	ERM approval to issue		Comments
				Name	Date	
	0	RY	RC	JN	16/6/2020	N/A
	1	RY	RC	JN	1/9/2020	N/A
	2	RY	RC	JN	8/2/2021	N/A

Signature Page

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Piling Installation Plan



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**Hong Kong Offshore LNG Terminal - Works associated with the double berth
jetty at LNG Terminal
Environmental Certification Sheet
FEP-01/558/2018/A**

Reference Document/Plan

Document/ Plan to be Certified/ Verified:	Piling Installation Plan
Date of Report:	8 February 2021
Date received by ET:	8 February 2021
Date received by IEC:	8 February 2021

Reference EP Requirement

EP Condition:	Condition No. 2.8 of FEP-01/558/2018/A
Content:	<i>Piling Installation Plan</i>
<p>The Permit Holder shall, no later than 1 month before the commencement of construction of the Project, submit 3 hard copies and 1 electronic copy of a piling installation plan of the jetty to the Director for approval. The piling installation plan of the jetty shall include but not limited to the detailed design of the jetty, size of the jetty, type, number and diameter of the piles for the jetty, piling methods, type and number of piling plant, pile striking and penetration details, ramp-up piling procedure and environmental mitigation measures to avoid and minimize environmental impacts during construction of the jetty and underwater noise impact during piling works. The Project shall be designed and constructed in accordance with the information as contained in the approved piling installation plan of the jetty.</p>	

ET Certification

I hereby certify that the above referenced document/ plan complies with the above referenced condition of FEP-01/558/2018/A.	
Mr Raymond Chow, Environmental Team Leader:	 Date: 10 February 2021

IEC Verification

I hereby verify that the above referenced document/ plan complies with the above referenced condition of FEP-01/558/2018/A.	
Mr Arthur Lo, Independent Environmental Checker:	 Date: 10 February 2021

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1. INTRODUCTION

1.1 Background

To support the increased use of natural gas in Hong Kong from 2020 onwards, Castle Peak Power Company Limited (CAPCO) and The Hongkong Electric Co., Ltd. (HK Electric) have identified that the development of an offshore liquefied natural gas (LNG) receiving terminal in Hong Kong using Floating Storage and Regasification Unit (FSRU) technology ('the Hong Kong Offshore LNG Terminal Project') presents a viable additional gas supply option that will provide energy security through access to competitive gas supplies from world markets. The Project will involve the construction and operation of an offshore LNG import facility to be located in the southern waters of Hong Kong, a double berth jetty, and subsea pipelines that connect to the gas receiving stations (GRS) at the Black Point Power Station (BPPS) and the Lamma Power Station (LPS). The location plan is shown in **Figure 1.1**.

The Environmental Impact Assessment (EIA) Report for the Project was submitted to the Environmental Protection Department (EPD) of the Hong Kong Special Administrative Region Government in May 2018. The EIA Report (EIAO Register No. AEIAR-218/2018) was approved by EPD and the associated Environmental Permit (EP) (EP-558/2018) was issued in October 2018. An application for Further Environmental Permits (FEP) was made on 24 December 2019 to demarcate the works between the different parties. The following FEPs were issued on 17 January 2020 and the EP under EP-558/2018 was surrendered on 5 March 2020:

- the double berth jetty at LNG Terminal under the Hong Kong LNG Terminal Limited, joint venture between CAPCO and HK Electric (FEP-01/558/2018/A) ⁽¹⁾;
- the subsea gas pipeline for the BPPS and the associated GRS in the BPPS under CAPCO (FEP-03/558/2018/A) ⁽²⁾; and
- the subsea gas pipeline for the LPS and the associated GRS in the LPS under HK Electric (FEP-02/558/2018/A) ⁽³⁾.

In accordance with Condition 2.8 of the FEP of the LNG Terminal (FEP-01/558/2018/A) ('the Project'):

FEP No. FEP-01/558/2018/A, Condition 2.8:

"The Permit Holder shall, no later than 1 month before the commencement of construction of the Project, submit 3 hard copies and 1 electronic copy of a piling installation plan of the jetty to the Director for approval. The piling installation plan of the jetty shall include but not limited to the detailed design of the jetty, size of the jetty, type, number and diameter of the piles for the jetty, piling methods, type and number of piling plant, pile striking and penetration details, ramp-up piling procedure and environmental mitigation measures to avoid and minimize environmental impacts during construction of the jetty and underwater noise impact during piling works. The Project shall be designed and constructed in accordance with the information as contained in the approved piling installation plan of the jetty."

- (1) Application for variation of an environmental permit for FEP-01/558/2018 was undertaken and the latest FEP (FEP-01/558/2018/A) was issued on 6 November 2020.
- (2) Application for variation of an environmental permit for FEP-03/558/2018 was undertaken and the latest FEP (FEP-03/558/2018/A) was issued on 22 January 2021.
- (3) Application for variation of an environmental permit for FEP-02/558/2018 was undertaken and the latest FEP (FEP-02/558/2018/A) was issued on 22 December 2020.

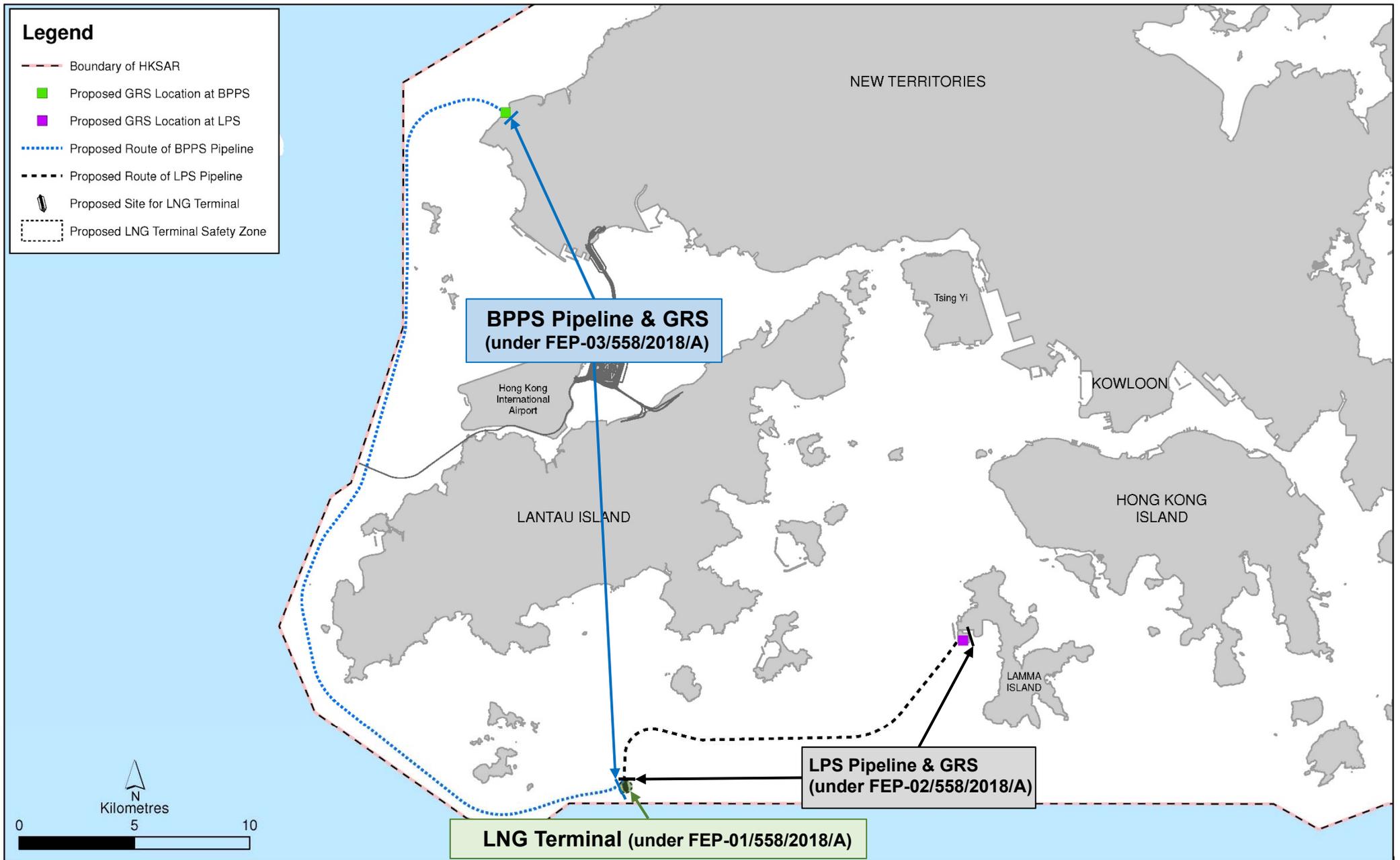


Figure 1.1

Indicative Location of Key Project Components

1.2 Purpose of the Piling Installation Plan

As stated in Condition 2.8 of the FEP of the LNG Terminal (FEP-01/558/2018/A), this Piling Installation Plan presents the detailed design of the jetty, size of the jetty, type, number and diameter of the piles for the jetty, piling methods, type and number of piling plant, pile striking and penetration details, ramp-up piling procedure and environmental mitigation measures to avoid and minimize environmental impacts during construction of the jetty and underwater noise impact during piling works.

1.3 Structure of the Piling Installation Plan

The remainder of this Piling Installation Plan is set out as follows:

- **Section 2** provides the detailed design and size of the jetty;
- **Section 3** details the type, number and diameter of the piles for the jetty;
- **Section 4** details the piling methods, type and number of piling plant, pile striking, penetration details and the ramp-up piling procedure, response to sighting of marine mammals; and
- **Section 5** outlines the environmental mitigation measures during jetty construction.

2. DETAILED DESIGN AND SIZE OF THE JETTY

2.1 Location of the Jetty

The proposed jetty of the Project (“the Jetty”) is located offshore in Hong Kong SAR waters about 4 km east of Tau Lo Chau, near the Soko Islands. The water depth at the Jetty area is at least 15m which is suitable for the safe transit approach and departure of the FSRU Vessel and a visiting LNG Carrier (LNGC), and their safe berthing. The location of the Jetty is near the below key sites as shown in **Figure 2.1**:

- To the north of the Jetty there are recommended traffic separation schemes (TSS), including Adamasta Channel Recommended TSS and South Cheung Chau Recommended TSS;
- To the northwest of the Jetty there is the proposed South Lantau Marine Park (SLMP), and the Jetty is in relatively close proximity to its southeastern corner;
- To the south of the Jetty there is open water for approximately 500m, until the boundary of the HKSAR waters is reached, and thereafter lies the South China Sea;
- To the east of the Jetty there is the Sediment Disposal Area, which is operational and used for the disposal of uncontaminated sediment; and
- To the west of the Jetty there are subsea telecommunications cables that span approximately 4.5 km.

2.2 Size & Detailed Design of the Jetty

The double-berth Jetty is designed to accommodate simultaneous mooring of the FSRU Vessel and a visiting LNGC. The Jetty is designed so that the FSRU Vessel can be moored on either side of the Jetty. The footprint of the Jetty marine structure including its mooring facilities is approximately 400m long and 50m wide.

The Jetty consists of the following key components:

- Jetty substructure, including six numbers of Mooring Dolphins (named MD1 to MD6) and three numbers of Breasting Dolphins (named BD1 to BD3), for mooring of the FSRU Vessel and a visiting LNGC;
- Jetty Topsides, comprising of an integrated unloading deck structure, Mooring Dolphins deck structure and topsides equipment such as pipe racks and firewater pump. The design of the integrated unloading deck features a two-level steel truss structure with dimensions of approximately 110 m x 50 m. The deck is divided into three main modules for ease of installation;
- The substructures of the three Breasting Dolphins will also support the integrated unloading deck;
- Six bridges will connect the Mooring Dolphins and the integrated unloading deck. The bridges will carry walkways and topside piping;
- A vent stack will be installed on top of Mooring Dolphin 5 (MD5);
- A boat landing will be provided at Mooring Dolphin 1 (MD1) and Mooring Dolphin 6 (MD6); and
- Mooring Dolphin 1 (MD1) will accommodate the Fire Boat and Standby Boat Berth.

Details of the Jetty layout can be found in **Annex A**. The Jetty Substructure and integrated unloading deck, walkway bridges etc. is designed to a 50-year design life. It should be noted that the final design of Jetty has to be approved by the Hong Kong Buildings Department.

The sizes of the key Jetty components are shown in **Table 2.1**.

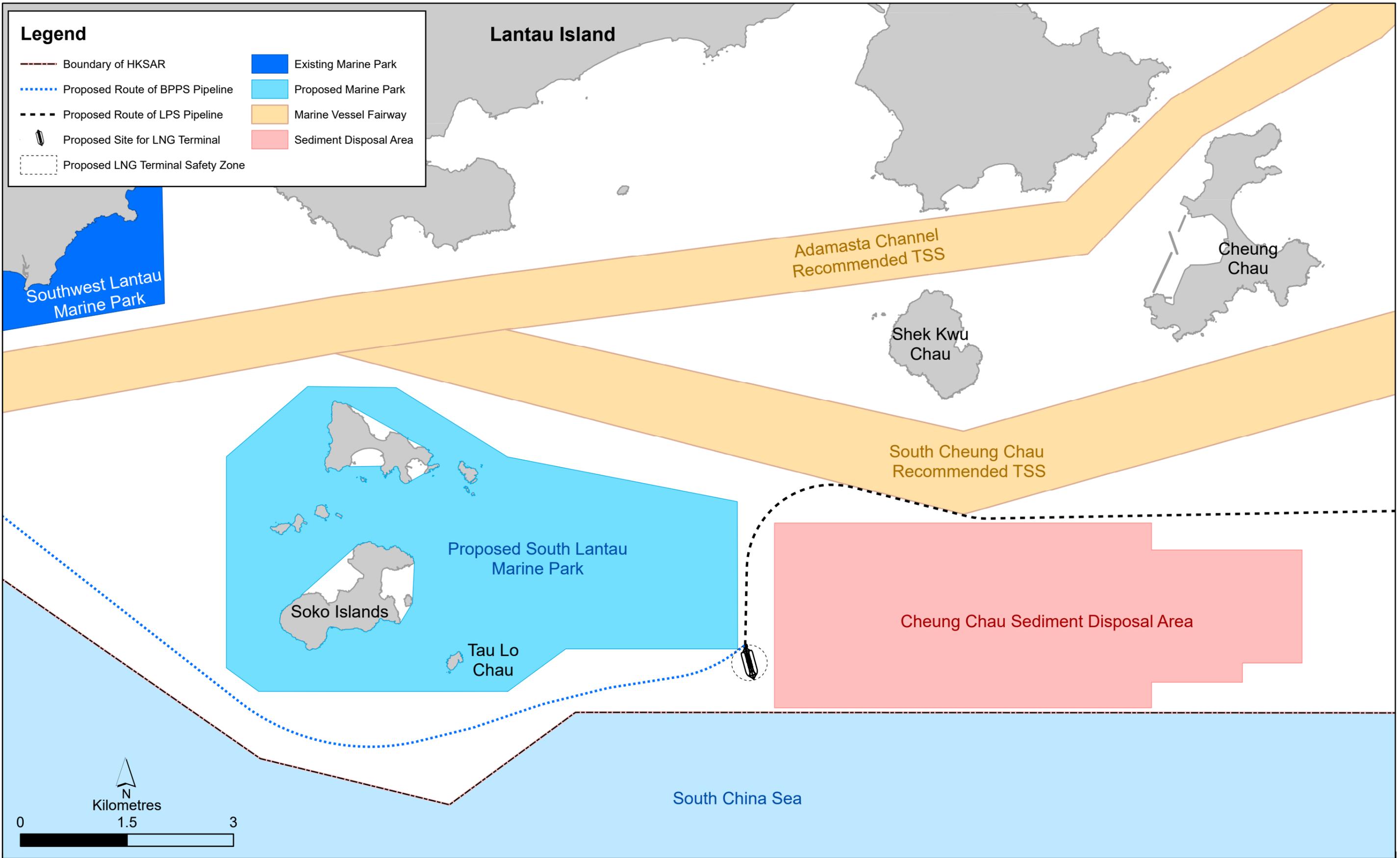


Figure 2.1

Location of the Proposed Jetty

Table 2.1 Indicative Size of Key Jetty Components

Structure	Size (Length × Width × Height)
Breasting Dolphin	
BD1, BD2 & BD3 Jackets	50m × 30m × 25m
BD1 & BD3 Modules	50m × 35m × 8m
BD2 Module	50m × 40m × 8m
Mooring Dolphin	
MD1, MD2 & MD3 Jackets	18m × 14m × 23m
MD4, MD5 & MD6 Jackets	18m × 14m × 22m
MD1, MD2 & MD3 Decks	12m × 11m × 8m
MD4, MD5 & MD6 Decks	12m × 9m × 8m
Others	
Walkways 1 & 2	24.5m × 4.3m × 3.4m
Walkway 3	59.0m × 4.3m × 4.0m
Walkway 4	51.0m × 3.5m × 3.5m
Walkways 5 & 6	24.5m × 3.5m × 3.5m
MD5 Vent Stack	6.0m × 5.2m × 33.0m

3. TYPE, NUMBER AND DIAMETER OF THE PILES FOR THE JETTY

3.1 Piles of Breasting Dolphins

A typical Breasting Dolphin pile consists of a steel tube in two segments. Thickness of the pile varies from ~45 mm to ~70 mm. Each breasting dolphin has eight numbers of about 1830 mm diameter steel open end tubular driven piles to be installed through jacket legs.

3.2 Piles of Mooring Dolphins

A typical Mooring Dolphin pile consists of a steel tube in two segments. Thickness of the pile varies from ~45 mm to ~50 mm. For each Mooring Dolphin four steel open end tubular driven piles of about 1830 mm diameter will be installed through jacket legs.

The type, number and diameters of the piles for the Jetty are summarized in **Table 3.1**. A total of approximately 54 piles of about 1830 mm diameter are expected to be installed at the Jetty.

Table 3.1 Summary of the Type, Number and Diameter of the Piles for the Jetty

Total Number of Piles	Type of Piles
Mooring Dolphins	
<ul style="list-style-type: none"> ▪ Four piles per Mooring Dolphin x Six Mooring Dolphins = 24 piles ▪ Additional six piles for Fire Boat/Standby Boat Berthing at MD1 (subject to Fire Services Department and Buildings Department approval) 	<ul style="list-style-type: none"> ▪ Thickness: ~45mm to ~50mm ▪ Diameter: ~1830 mm ▪ Type: Steel open end tubular driven piles
Breasting Dolphins	
<ul style="list-style-type: none"> ▪ Eight piles per Breasting Dolphin x three Breasting Dolphins = 24 piles 	<ul style="list-style-type: none"> ▪ Thickness: ~45mm to ~70mm ▪ Diameter: ~1830 mm ▪ Type: Steel open end tubular driven piles

4. DETAILS OF PILING METHODS

4.1 Types and Numbers of Piling Plants

4.1.1 Hammers for Piling of Breasting and Mooring Dolphins

Three types of hydraulic hammers have been selected for piling at the Jetty, namely MENCK MHU-800, MENCK MHU-1200 and the MENCK MHU-1900:

- For the piles of the Breasting Dolphins, MENCK MHU-1200 will be used for pile driving while MENCK MHU-1900 will be the backup equipment in case higher driving power is required; and
- For the piles of the Mooring Dolphins, MENCK MHU-800 will be used for pile driving while MENCK MHU-1200 will be the backup equipment in case higher driving power is required.

The specifications of these hydraulic hammers are provided in **Annex B**.

Jetty piles will be installed one at a time. During the piling process, only one of the abovementioned hydraulic hammers will be used.

4.1.2 Installation Vessel

One installation vessel, Derrick and Pipelay Barge HiLong 106 (see **Figure 4.1**) (or equivalent) will be used for the piling installation works. Acoustic decoupling of noisy equipment (e.g. generators, winch generators, air compressors, etc) will be undertaken. The specification of the HiLong 106 is provided in **Annex C**.

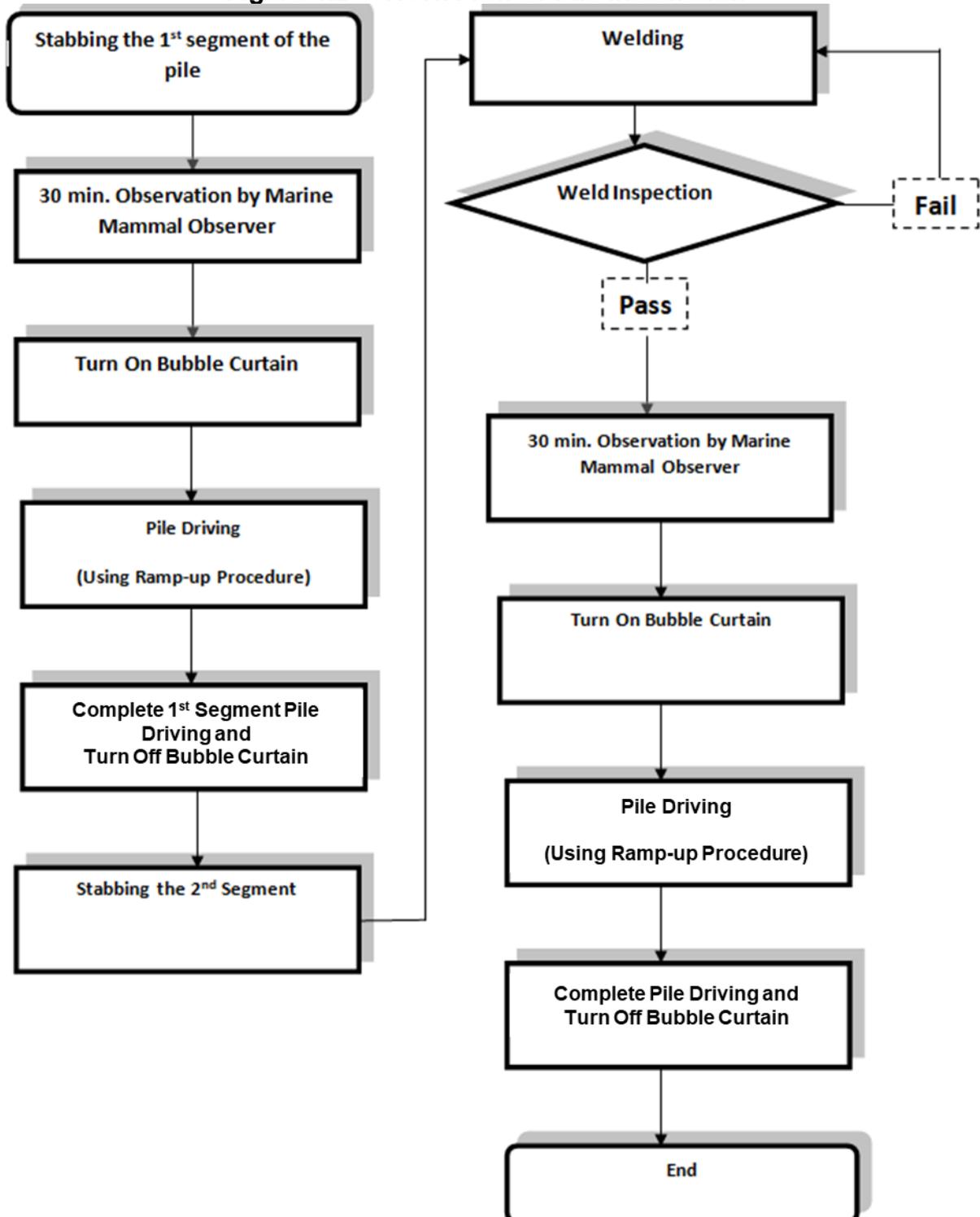
Figure 4.1 Derrick and Pipelay Barge HiLong 106



4.2 Piling Work Flow

The work flow for installing a pile (total two segments for each pile) installation is shown in **Figure 4.2**. It should be highlighted that no piling works for construction of the Jetty will be carried out from 1900 hours to 0700 hours of the following day as per Condition 3.4 of the FEP, and no piling works for construction of the Jetty will be carried out from January to June (both months inclusive), which has been ascertained to be the peak occurrence season of Finless Porpoise in the Review Report on Finless Porpoise Peak Occurrence Season as stated in Condition 3.3 of the FEP.

Figure 4.2 Work Flow of Pile Installation



4.3 Pile Striking and Penetration Details

4.3.1 Preparation for Pile Driving Operation

Prior to picking up the first pile the following checks will be made:

- 1) Obtain the initial datum of jacket level survey to determine the sequence of pile stabbing.
- 2) Ensure Lifting grommets and shackles and Internal Lifting Tools (ILT) are in good conditions and ready for operation.
- 3) Confirm that all sea fastening of the specified pile has been removed.
- 4) Ensure that the foreman is aware of the lifted pile to be stabbed into the designated leg of the jacket as marked at the top of the pile.
- 5) Ensure the hammer system has been tested and be ready for operation.
- 6) Ensure the bubble curtain system which encloses the piling works has been properly tested, all the workers are in place and ready for operating.
- 7) Marine mammal observer from the Environmental Team (ET) to ensure no marine mammals for 30 minutes continuously in sight, within the 500 m marine mammal exclusion zone from the piling installation works.

4.3.2 1st Pile Segment (P1) Lifting, Stabbing and Self Penetration

Once the jacket is checked and ready to receive the pile, the first segment of the pile (P1) is lifted up and stabbed into the jacket leg. The 1st segment of the pile will self-penetrate under its own weight into the seabed. The self-penetration is estimated to be between about 15m to 20m below seabed level based on the latest soil information and analysis.

4.3.3 Hydraulic Hammer Placement onto Pile and further Self Penetration

Once the pile will self-penetrate no further, the hammer is lifted and placed onto the pile. This will cause the pile to further self-penetrate. The additional self-penetration is estimated to be about 5m and the total self penetration depth is estimated to be between approximately 20m to 25m).

4.3.4 Driving of the 1st Pile Segment (P1)

Upon receiving the confirmation from the marine mammal observer that the exclusion zone is clear of marine mammals after the 30-minutes of continuous monitoring, the bubble curtain operation would be initiated. The hydraulic hammer would then be activated. The pile driving would follow a ramp-up procedure to commence driving operation and once the 1st segment is driven to depth (about 33 m below seabed level), the pile driving would stop and the bubble curtain would be turned off. **The above sequences are repeated for the other P1 segments of all piles.**

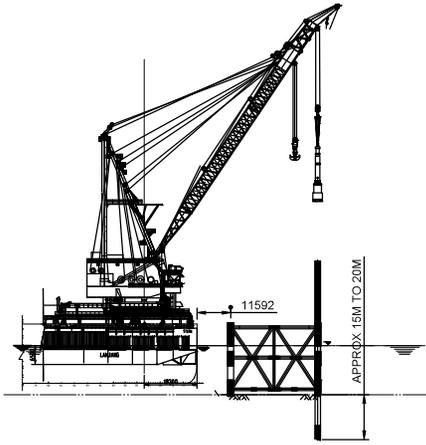
4.3.5 2nd Pile (P2) Segment Lifting, Stabbing, Welding and Driving

Once the 1st pile segment is checked and ready to receive the 2nd segment of the pile, the 2nd segment of the pile (P2) is lifted up and stabbed onto the 1st segment. Once stabbed and secured, the 2nd segment is welded onto the 1st segment. Upon completion of welding, the hammer is placed onto the combined 1st and 2nd segment. Pile driving will then be commenced following the sequence detailed in the above. The combined 1st and 2nd segment will be driven to the designed final penetration depth, at about 68 m below seabed level.

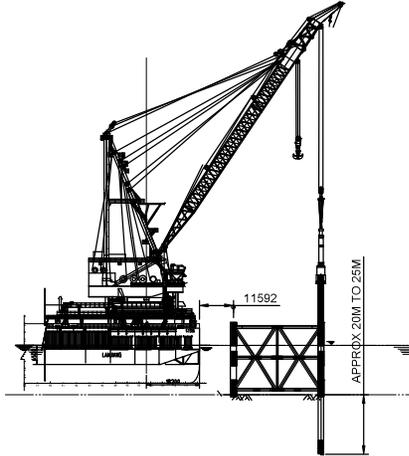
The above sequences are repeated for the remaining P2 segments.

The illustration of pile striking and penetration details is provided in **Figure 4.3**.

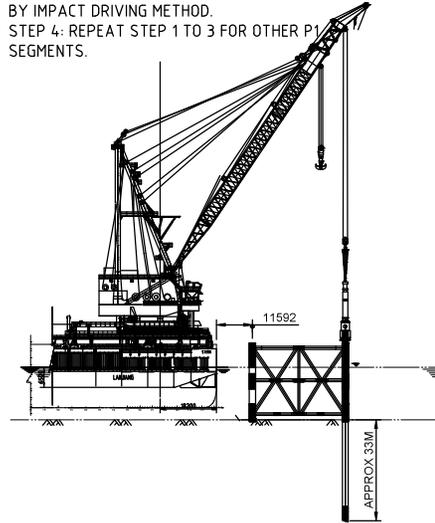
STEP 1: RIGUP THE FIRST SECTION OF PILE(P1) AND STAB INTO JACKET TILL PENETRATION BY SELF-WEIGHT OF PILE.



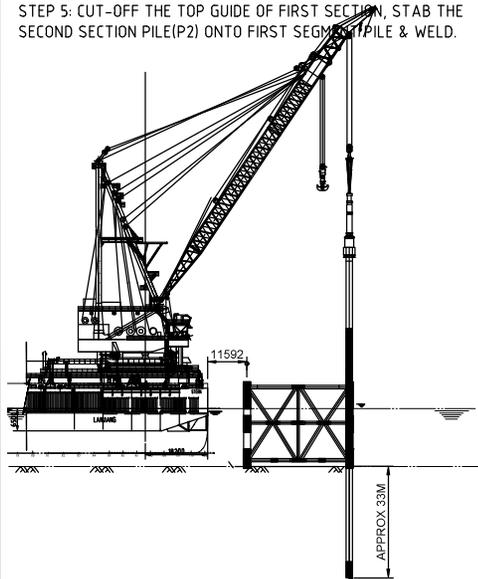
STEP 2: STAB THE MHU (800 or 1200 AND 1900) HAMMER ON THE TOP OF P1 TO SELF PENETRATION.



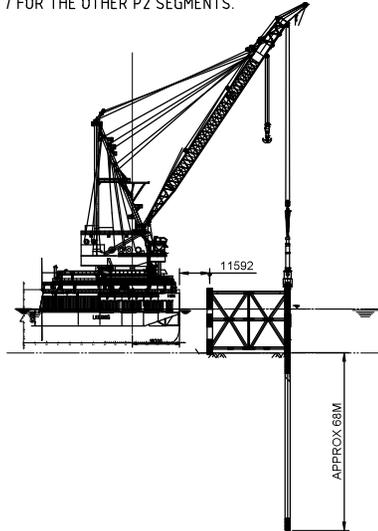
STEP 3: DRIVING THE P1 WITH MHU HAMMER BY IMPACT DRIVING METHOD.
STEP 4: REPEAT STEP 1 TO 3 FOR OTHER P1 SEGMENTS.



STEP 5: CUT-OFF THE TOP GUIDE OF FIRST SECTION, STAB THE SECOND SECTION PILE(P2) ONTO FIRST SEGMENT PILE & WELD.



STEP 6: STAB MHU HAMMER AND DRIVE THE PILE TO DESIGN PENETRATION.
STEP 7: UPON DRIVING P2+P1 TO DESIGN PENETRATION, REPEAT STEP 5 TO 7 FOR THE OTHER P2 SEGMENTS.



GENERAL NOTES:

1. ALL DIMENSION ARE IN MILLIMETERS.
2. PILE DRIVING INTENSITY WILL BE DONE VIA A "RAMP-UP" METHODOLOGY.

DWG. NO.		DRAWING TITLE					
REFERENCE DOCUMENTS							
REVISIONS							
No.	DATE	DESCRIPTION	BY	CHK'D	APP'D	CLP	HKE
CLIENT		PROJECT		JOB No.		CERTIF. No.	
SIGNATURE		DATE		HONG KONG OFFSHORE LNG TERMINAL PROJECT PACKAGE A		2020-0602	
DRAWN		DESIGNED		DRAWING TITLE:		A112002816	
CHECKED		REVIEWED		Figure 4.3		PILE INSTALLATION SEQUENCE FOR BD JACKET	
EXAMINED		APPROVED		DWG No.		REV. 0	

4.4 Noise Reduction System for Hydraulic Hammering

Use of Noise Reduction System for hydraulic hammering has been recommended as mitigation measure to be implemented during piling works. Specific envelope made of noise absorption/isolation material enclosing hammer sleeve will be utilized during piling works to minimise noise impact. Noise isolation pad such as rubber or cotton mat enclosing the hammer will be adopted in order to reduce noise transmission to the sea. An example of Noise Reduction System for hydraulic hammering is shown in **Figure 4.4**.

Figure 4.4 Example of Noise Reduction System for Hydraulic Hammering



4.5 Structural Jacket and Bubble Curtain

Each structural jacket has four jacket legs with diameter of ~2m for inserting piles at the Jetty. Three independent bubble-generating tubes with diameter of ~2.5m will be mounted to each of the jacket legs at ~5 m depth intervals along the water column as bubble curtains. The indicative arrangement of structural jacket and bubble curtain is illustrated in **Figure 4.5**.

Compressed air will be produced from the compressed air distribution and delivery unit placed on the installation vessel, and transmitted through the non-porous hoses to the bubble-generating tubes. Circular single-layer bubble curtains will be formed around the jacket legs when the valves of the bubble-generating tubes are forced to open by the compressed air for the piling works. The indicative setup of the bubble curtain is illustrated in **Figure 4.6**.

Figure 4.5 Indicative Arrangement of Structural Jacket and Bubble Curtain

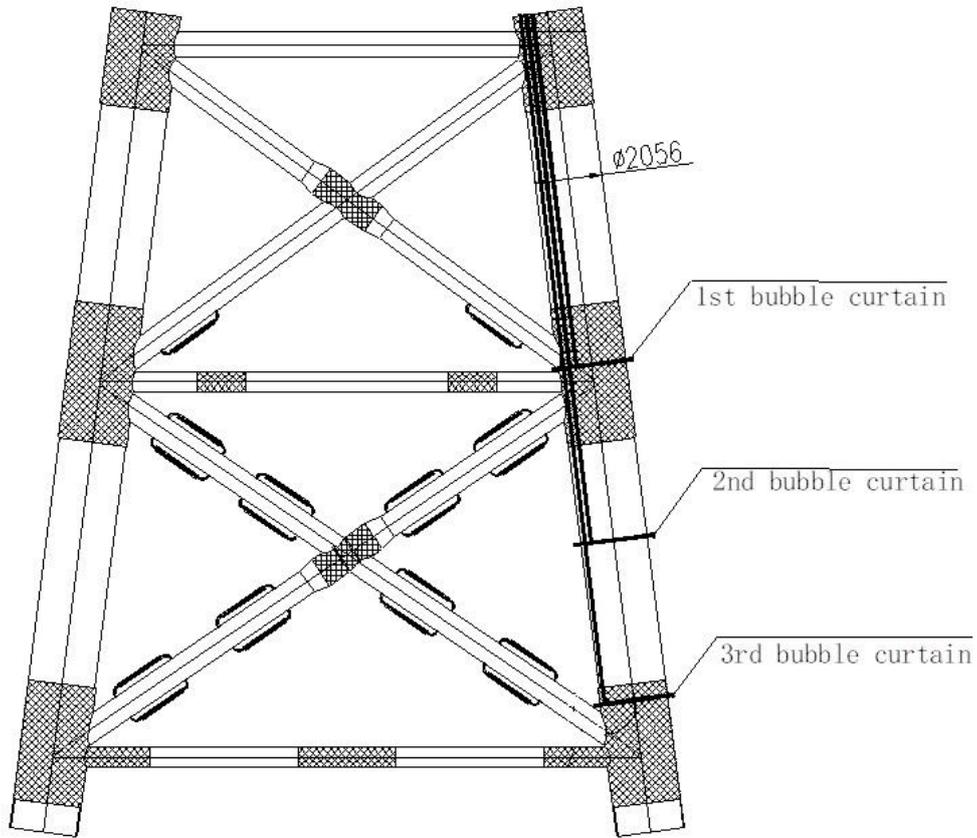
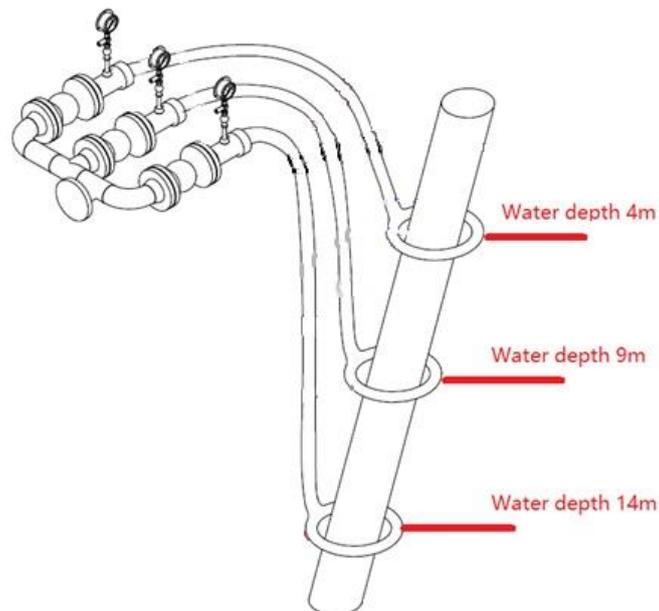


Figure 4.6 Indicative Setup of the Bubble Curtain



4.6 Ramp-up Piling Procedure

To avoid and minimize the impact on marine mammals due to underwater sound from Jetty pile installation works, pile driving activities using hydraulic hammers will begin with a “ramp-up” to promote avoidance of the works area by marine mammals. During ramp-up, lower hammer energy levels with a blow frequency of ~30 blows per minute will be used to start the pile driving process, and then the force of pile driving will be increased gradually.

The ramp-up piling procedure is listed below:

- 1) After the 500 m marine mammal exclusion zone is clear of marine mammals for 30 minutes continuously, hammer operator will turn on hydraulic hammer with a low energy level, of about 15% energy for 15 minutes.
- 2) Marine mammal observer continues to implement marine mammal exclusion zone monitoring and confirms that the zone is clear of marine mammals.
- 3) Increase the hammer energy slowly, in steps of 15% energy increase every 5 minutes until hammer energy is at 75% or design value.
- 4) Hammer energy to step up gradually from 75% to 95% ⁽⁴⁾ by ~50-100kJ intervals.

4.7 Response to Sighting of Marine Mammals

4.7.1 Marine Mammal within 500 m Marine Mammal Exclusion Zone

If marine mammal is observed within the 500 m marine mammal exclusion zone (MMEZ) during the piling works, the marine mammal observer (MMO) shall inform the relevant personnel of Contractor who is on site in charge of the piling works of such observation, and the piling works within the 500 m MMEZ shall be stopped immediately. Monitoring of location and movement of the marine mammal observed shall be continuously implemented by the MMO.

Ramp-up piling procedures shall be taken upon clearance of the presence of marine mammal within the 500 m MMEZ for a period of 30 minutes continuously prior to the resumption of the piling works.

4.7.2 Marine Mammal outside 500 m Marine Mammal Exclusion Zone

If marine mammal being outside the 500 m MMEZ with potential to get into the zone during piling works is observed, the MMO shall remain in position to monitor the location and movement of the marine mammal observed continuously, and inform the relevant personnel of Contractor who is on site in charge of the piling works of such observation for attention.

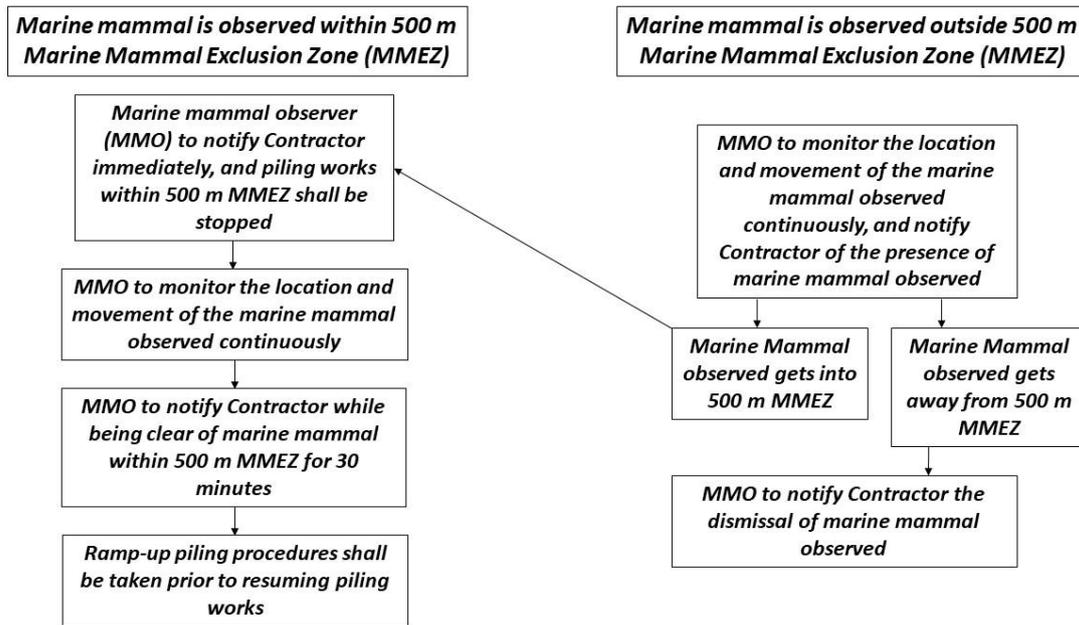
If the marine mammal observed gets into the 500 m MMEZ subsequently, the same procedures as presented in **Section 4.7.1** shall be taken.

If the marine mammal observed gets away from the 500 m MMEZ eventually, the MMO shall inform the relevant personnel of Contractor who is on site in charge of the piling works of such dismissal.

The flow chart for the response to sighting of marine mammals is shown in **Figure 4.7**.

(4) A maximum of 95% energy efficiency is designed for pile driving operation according to the engineering study on pile drivability.

Figure 4.7 Flow Chart for Response to Sighting of Marine Mammals



5. ENVIRONMENTAL MITIGATION MEASURES

5.1 Mitigation Measures for Jetty Construction

Potential environmental impacts during the construction of the Jetty and associated piling works have been identified and evaluated as documented in the approved EIA Report. The mitigation and precautionary measures during jetty construction as stated in the EIA Report and the FEP are summarised in **Table 5.1** and would be properly implemented during the Jetty construction. Other mitigation measures relevant to general marine construction works will also be implemented in accordance with the Implementation Schedule detailed in Annex A of the Updated EM&A Manual.

Table 5.1 Summary of Relevant Mitigation / Precautionary Measures during Jetty Construction

Impact	Mitigation / Precautionary Measures
Underwater sound from Jetty pile installation works	<p>Use of vibratory/ hydraulic pushing method to vibrate / push the open-ended steel tubular pile for the upper layer of the seabed and only use hydraulic hammer (if needed) to install the remainder of the pile length through the lower layer of the seabed. During piling works:</p> <ul style="list-style-type: none"> ▪ Quieter hydraulic hammers should be used instead of the noisier diesel hammers; ▪ Use of Noise Reduction System for hydraulic hammering, which fully encloses the hammer and pile during driving. Details have been discussed in Section 4.4; ▪ Acoustic decoupling of noisy equipment on work barges should be undertaken; ▪ Use of structural jacket and bubble curtain to enclose the pile installation works. Details have been discussed in Section 4.5; ▪ Using ramp-up piling procedures. Details have been discussed in Section 4.6; ▪ Underwater piling should be conducted inside a bubble curtain so as to ameliorate underwater sound level transmission; ▪ The pile driving will be conducted during the daytime (0700 – 1900) for a maximum of 12 hours, avoiding generation of underwater sounds at night time; ▪ Underwater piling works for the Jetty construction will avoid the peak occurrence season of Finless Porpoise (FP) as stated in Condition 3.3 of the FEP; and ▪ Implementation of a marine mammal exclusion zone of not less than 500 m radius from the piling works during the piling works for construction of the jetty. No piling works shall be carried out until the marine mammal exclusion zone is confirmed by an experienced marine mammal observer as clear of marine mammals for 30 minutes continuously. Use of passive acoustic monitoring device shall be explored to assist the marine mammal observer to monitor and detect the marine mammals. (Note 1)

Impact	Mitigation / Precautionary Measures
Increased marine traffic from marine construction activities	<ul style="list-style-type: none"> <li data-bbox="475 241 1394 510">■ The vessel operators of this Project will be required to use predefined and regular routes (that do not encroach into existing and proposed marine parks), make use of designated fairways to access the works areas, and would avoid traversing sensitive habitats such as existing and proposed marine parks. Predefined and regular routes will become known to FP and Chinese White Dolphin (CWD) using these waters. This measure will further serve to minimise disturbance to marine mammals due to vessel movements; <li data-bbox="475 517 1342 651">■ No working vessels for construction of the Project shall enter into, transit through, stop over or anchor within the existing marine parks including Southwest Lantau Marine Park and the proposed SLMP; <li data-bbox="475 658 1401 860">■ The working vessels for construction of the Project shall not be operated at a speed higher than 10 knots when moving within the areas frequented by Chinese White Dolphin or Finless Porpoise, including the waters near Sha Chau and Lung Kwu Chau Marine Park, the waters at the west of Lantau Island and the waters between Soko Islands and Shek Kwu Chau; <li data-bbox="475 866 1401 1032">■ The working vessels shall be equipped with tracking devices to record their operating speeds and marine travel routes during construction of the Project. The records shall be submitted weekly to the ET Leader and IEC for review of the acceptability of operating speeds and marine travel routes; <li data-bbox="475 1039 1401 1106">■ Any anchoring/ anchor spread requirements during Project construction will avoid encroachment into the existing and proposed marine parks; and <li data-bbox="475 1113 1353 1202">■ No stopping over or anchoring activity of vessels related to the Project should be conducted within existing and proposed marine parks even before, during and after typhoon.

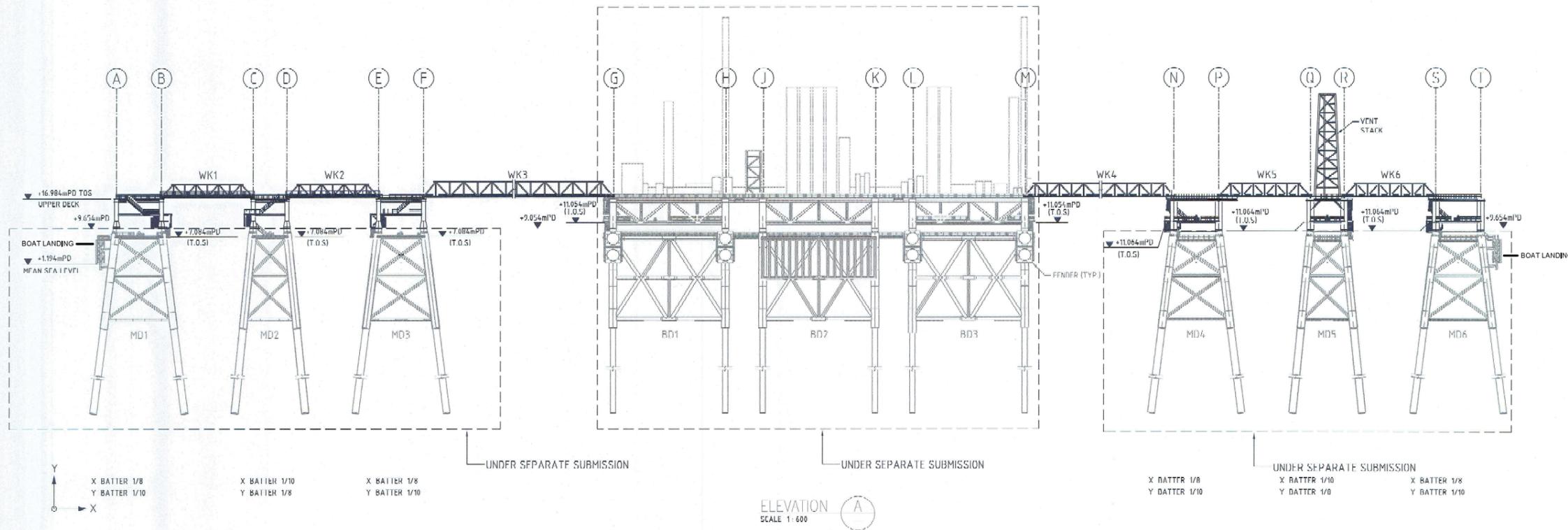
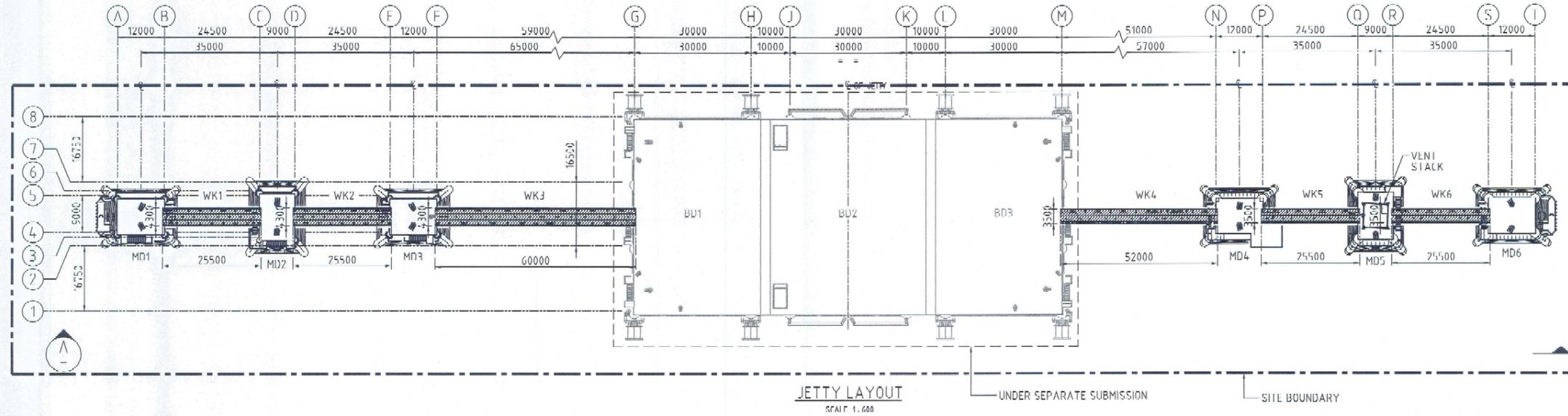
Note 1: A trial is planned to be conducted during early stage of the piling works to test if passive acoustic monitoring device will be useful in assisting the marine mammal observer to monitor and detect the marine mammals.

ANNEX A

GENERAL JETTY LAYOUT

A1

DO NOT SCALE DRAWING. CHECK ALL DIMENSIONS ON SIF.
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Notes:

BD: Breasting Dolphin
MD: Mooring Dolphin
WK: Walkway

H.I.D. REF NO. BD/3/9019/19
E.S.D. REF NO.

Signature
LEE CHI CHUN
Site Area Engineering Manager
REGISTERED STRUCTURAL ENGINEER

Rev	Date	By	Description
04/20	VS	BD	SUBMISSION

Client:
 香港電業有限公司
 香港電氣有限公司

EPC Contractor:
 中海石油(中国)有限公司
 海洋石油工程股份有限公司

Consultant:
ARUP

Project Title:
HONG KONG OFFSHORE LIQUEFIED NATURAL GAS (LNG) TERMINAL PROJECT

Drawing title:
GENERAL JETTY LAYOUT

Job no.	Drawing no.	Rev.
271490	8059/122/H-P/20101A	-
Drawn	Date	Checked
SL	20/02/2020	VS
Scale	1:100(A1), 1:200(A3)	Status
		BD SUBMISSION

ANNEX B

HAMMER SPECIFICATIONS

Hydraulic piling hammer 打桩锤



Hammer

Manufacturer: MENCK, GERMANY

Model: MHU-800

Production Date: 2001.7

Quantity: 1

Rang of Piling Dia.: 60~84"

Operation Water Depth: 400m

Total Weight In Air: 139t

Total Weight Submerged: 112t

Dimensions: 17x4m

Max. Impact Energy: 800kN • m

Min. Impact Energy: 80kN • m

Blow Frequency 38~45blow/min

Average Operation Pressure: 250bar

Max. Oil Blow Rate: 1600L/min

Raking Pile: 11°

Power Pack

Dimension: 12.2x2.5x2.6m

Weight: 34t

Diesel Engine

Manufacturer: VOLVO

Model: TWD1630G

Quantity: 2

Power: 2*406kw



Air Compressor

Manufacturer: SPERRE

Model: HV2/200-210-219

Quantity: 1

Flow Rate: 3.2m³/min

Pressure: 300bar

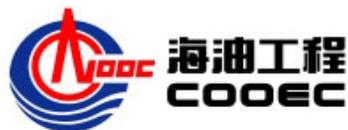
Hydraulic Pump

Model: A11VL0260EP2D

Flow Rate: 1600L/min

Pressure: 350bar

Hydraulic piling hammer 打桩锤



Hammer

Manufacturer: MENCK, GERMANY

Model: MHU-1200

Production Date: 2004. 6.

Quantity: 1

Production ID: 63509

Rang of Piling Dia. : 48~96"

Operation Water Depth: 400m

Total Weight (Include Underwater Ballast)

In Air: 203t

Underwater: 169.3t

Underwater Ballast Weight: 37t

Length of Hammer: 18.9m

Max. Impact Energy: 1200kN · m

Min. Impact Energy: 120kN · m

Blow Frequency 10~120blow/min

Hyd. Oil Operation Pressure: 255bar

Max. Oil Blow Rate: 2000L/min

Power Pack

Dimension: 12. 2x2. 44x2. 6m

Weight: 30t

Diesel Engine

Manufacturer: CATERPILLAR

Model: MARINE 3406E

Quantity: 2

Serial NO. : 9WR03646、9WR03643

Power: 2x597kW



Air Compressor

Manufacturer: SPERRE

Model: HV2/210

Quantity: 1

Serial NO. : 210664

Power: 36.5kW

Flow Rate: 195m³/h

Pressure: 30bar

Hydraulic Pump

Manufacturer: MANNESMAN REXROTH

Model: A11V0

Quantity: 4

Flow Rate: 580 L/min

Pressure: 350bar

Hydraulic piling hammer 打桩锤



Hammer

Manufacturer: MENCK, GERMANY

Model: MHU-1900

Production Date: 2006. 3. 1

Quantity: 1

Production ID: 63811

Rang of Piling Dia. : 60~102"

Operation Water Depth: 400m

Total Weight (Include Underwater Ballast)

In air: 231. 1t

Underwater: 187. 7t

Length of Hammer: 22. 5x3. 39m

Max. Impact Energy: 1900kN • m

Min. Impact Energy: 190kN • m

Blow Frequency 32

Hydrau. Oil Operation
Pressure: 250bar

Max. Oil Blow Rate: 3200L/min

Raker Piles: 11°

Power Pack

Dimension: 12. 19x2. 44x2. 9m

Weight: 40t

Quantity: 2

Diesel Engine

Manufacturer: Caterpillar

Model: C18

Quantity: 4

Power: 522kw

Hydraulic Pump

Manufacturer: REXROTH

Model: A11VL0260EP2D/IIR-N2D12K67H

Quantity: 8

Flow Rate: 1600L/min

Pressure: 350bar



Air Compressor

Manufacturer: SPERRE

Model: HV2/210

Quantity: 2

Power: 36. 5kw

Flow Rate: 195m³ /h

Pressure: 35bar

Hose Winch

Dimension of Hydr. Line: 8. 81x3. 53x4. 26m

Net Weight of Hydr. Line: 66t

Dimension of control cable: 2. 44x1. 82x2m

Net Weight of control cable: 42t

ANNEX C

INSTALLATION VESSEL SPECIFICATION

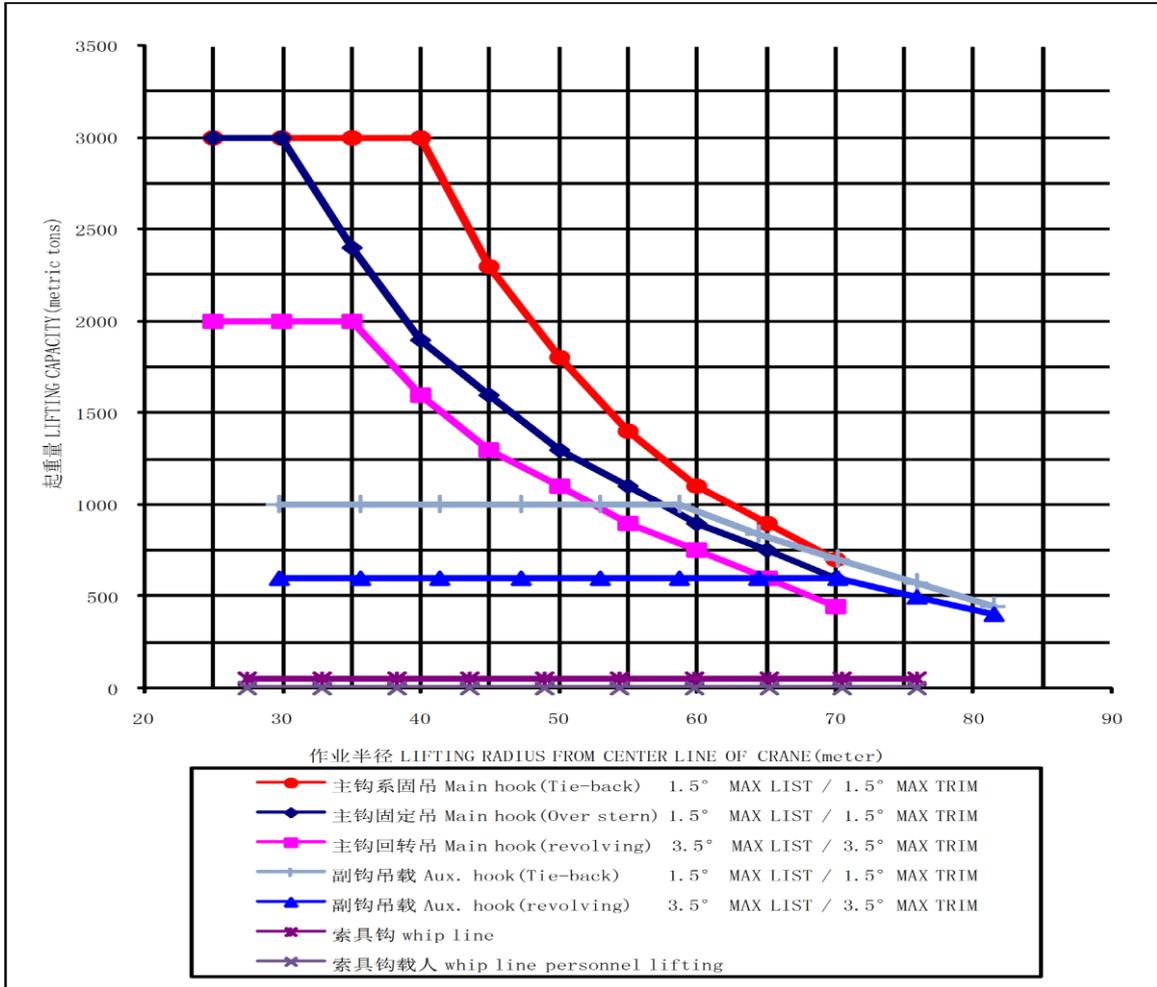
“海隆 106”铺管起重船技术规格书

编号	类目	数量	描述
1.0	总体介绍		
1.1	船旗		HONGKONG
1.2	船籍港		HONGKONG
1.3	船级社		ABS
1.4	建造年份		2012 年 2 月
1.5	船厂		ZPMC
1.6	船体总长		169m
1.7	船体型宽		46m
1.8	船体型深		13.5m
1.9	结构吃水		9.0m
1.10	作业吃水		7.0-8.7m
1.11	铺管水深		300m
1.12	总吨		40612t
1.13	干重		12183t
1.14	满载排水量		62000t
1.15	储管能力		5000t
1.16	储管面积		1200m ² (75m×16m)
1.17	甲板载荷		10t/m ²
1.18	燃油舱容		4038m ³
1.19	淡水舱容		2632m ³
1.20	压载水舱容		34673m ³
1.21	住员		302P
1.22	直升机甲板		直径 22.2m,适用于 Sikorsky S61-N 型直升机
2.0	主电站		
2.1	主发电机组	4	4×2640kW
2.1.1	原动机		STX-MAN-B&W 8L27/38, 2640kW, 720rpm
2.1.2	发电机		2500kW/440V/60Hz/720rpm
2.2	应急发电机	1	1×345kW
2.2.1	原动机		CAT3406 345kW/1800rpm
2.2.2	发电机		315kW/440V/60Hz/1800rpm
3.0	空气压缩机		
3.1	启动空压机	2	WP60, 3.0Mpa, 68m ³ /h
3.2	工作空压机	4	LGD-10/10-C, 10-.0Mpa, 600 m ³ /h
4.0	消防和救生系统		
4.1	救生圈	18	
4.2	救生衣	325	
4.3	气胀式救生筏	14	14×25P
4.4	密闭式救生筏	4	4×70P
4.5	消防泵	2	RSV125-220A, 150 m ³ /h@8.8bar, 3500rpm, 75kw
4.6	直升机甲板泡沫消防泵	1	RSV125-270A, 180 m ³ /h@11bar, 3500rpm,90kw

“海隆 106”铺管起重船技术规格书

5.0	3000 吨主起重机(ZPMC)		
5.1	设计作业风速		<16m/s
5.2	主钩（背拉系固模式）	1	3000t@40m (舷外跨距 24.6m)
5.3	主钩（固定模式）	1	3000t@30m (舷外跨距 14.6m)
5.4	主钩（旋转模式）	1	2000t@35m (舷外跨距 12.0m)
5.5	副钩	1	1000t@58.7m (舷外跨距 43.3m)
5.6	索具钩	2	50t
5.7	索具钩(吊人模式)	1	2t
6.0	铺管设备		
6.1	铺设管径		4-60 英寸（包括涂敷配重层）
6.2	张紧器	2	Remacut 100t, 30m/min
6.3	A/R 绞车	1	Remacut 200t
6.4	舷吊	6	ZPMC,50t,入水 300m
6.5	理管吊	1	40t@35m
6.6	铺管线工作站	12	包括焊接、NDT、返修、节点防腐
6.7	全自动焊机	5	SATURNAX 05, SERIMAX FRANCE
7.0	托管架		
7.1	适用管径		4-60 英寸（包括涂敷配重层）
7.2	托管架总长（两节）		76.6m
7.3	托管架总重（两节）		347t
7.4	A 字架重量		178t
7.5	托管架撑杆重量		50t
7.6	钢丝绳直径		44mm
7.7	钢丝绳长度		700m
7.8	托管架绞车	2	45t
7.8.1	绞车滚筒容绳量		700m
7.8.2	电机		90kW,1500rpm,440v/60Hz
8.0	锚泊系统		
8.1	航行锚绞车	2	≥360kN
8.1.1	航行锚	2	12.9T,Speke Anchor
8.1.2	锚链	2	AM3, φ 87mm, 715m
8.2	工作锚绞车	12	
8.2.1	主要参数		110t(middle layer), 24m/min @110t
8.2.2	锚重及型号	12	12000kg, STEVPRIS
8.2.3	工作锚钢丝绳	12	φ 76mm×2500m
9.0	生活楼设施		HVAC, Boilers, Refrigerators, Fresh Water Makers, Oily Water Separators, etc.
10.0	导航设备		Radar, Gyro Compass, Echo Counder, Weather Facsimiler, GPS, Anemometer, VDR, etc.
11.0	通讯设备		VSAT,INMARSAT-F&C, VHF Air Band Transceiver, VHF, etc.

“海隆 106”起重/铺管船吊重曲线





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