



## Gladstone LNG Project

### Laird Point Placement Facility Concept Description

**GLNG Ref: 3301-HRW-3-3.3-9073-PDF**

**HR Wallingford Ref: EBR4320/108/001**

Release	Date	Reason for Issue	HR Wallingford		GLNG
			Approved	Authorised	Authorised
3-0	14 May 09	Re-Issued for Use	SDU	IG	SS
2-0	05 Mar 09	Issued for Use	SDU	IG	SS
1-0	24 Feb 09	Issued for Review	SDU	IG	SS



**Address and Registered Office:** HR Wallingford Ltd. Howbery Park, Wallingford, OXON OX10 8BA  
Tel: +44 (0) 1491 835381 Fax: +44 (0) 1491 832233

Registered in England No. 2562099. HR Wallingford is a wholly owned subsidiary of HR Wallingford Group Ltd.

## Document Information

<b>Project</b>	Gladstone LNG Project
<b>Technical Subject</b>	Laird Point Placement Facility
<b>Client</b>	GLNG
<b>Client Representative</b>	Steve Schoemaker
<b>Project No.</b>	EBR4320
<b>Document No.</b>	EBR4320/108/001
<b>Project Manager</b>	Iain Gunn
<b>Engineering Manager</b>	Scott Dunn
<b>Document Originator</b>	Scott Dunn

## Document History

Changes since Release 1

Revision	Changed by	Changes made

© HR Wallingford Limited

*HR Wallingford accepts no liability for the use by third parties of results or methods presented in this report.*

*The Company also stresses that various sections of this report rely on data supplied by or drawn from third party sources. HR Wallingford accepts no liability for loss or damage suffered by the client or third parties as a result of errors or inaccuracies in such third party data.*

# Contents

1.	Scope of Document .....	1
2.	Input Data .....	1
3.	Main dredge - Swing basin, berth pocket and channel .....	2
3.1	Placement at Laird Point .....	2
3.2	Creation of bund at Laird Point.....	3
3.3	Programme .....	4
3.4	Further work.....	4

## 1. Scope of Document

Dredging operations are proposed as part of the development of marine facilities for the GLNG Project at a previously undeveloped site at North China Bay on Curtis Island on the north side of Gladstone Harbour, shown in Drawing EBR4320/108/D001. These include a small amount of dredging for the Materials Off-Loading Facility (MOF) and then following on from the establishment of the MOF, access for the main GLNG storage and export facility is required to enable the movement of LNG tankers. This access includes the need for a navigation approach channel, berthing and maneuvering areas. The main dredge comprises a swing basin dredged to -13.5 m LAT linked to the Targinie channel by a 200 m wide channel dredged to -13 m LAT. A total of some 8,000,000 m<sup>3</sup> in situ is anticipated to be dredged. Materials arising from the main dredge are to be placed ashore at Laird Point in a specially constructed containment area. The purpose of this report is to provide an overview of the works at Laird Point.

## 2. Input Data

This document should be read in conjunction with EBR4320/006/002, which contains further information in relation to selection of likely dredge equipment and methods.

It should be noted that this document presents an outline of what is considered to be the likely dredging process but that this process will be subject to design by the dredging contractor who will also develop environmental controls as part of a Dredging Management Plan.

HR Wallingford documents and drawings referenced in this report are listed below.

### HR Wallingford Documents

GLNG Ref	HRW Ref	Title
1603-HRW-2-3.3-9001-PDF	EBR4320/003/001	Marine Site Characteristics
1603-HRW-2-3.3-90017-PDF	EBR4320/006/001	Project Description
1603-HRW-2-3.3-9006-PDF	EBR4320/006/002	Feasibility of disposal of dredge material on Curtis Island

### HR Wallingford Drawings

GLNG Ref	HRW Ref	Title
3301-HRW-3-3.3-9075-PDF	EBR4320/108/D001	Dredging and placement of dredged material, general layout
3301-HRW-3-3.3-9076-PDF	EBR4320/108/D002	Dredged Areas
3301-HRW-3-3.3-9077-PDF	EBR4320/108/D003	Detail of Laird Point placement facility
3301-HRW-3-3.3-9078-PDF	EBR4320/108/D005	Sections of Laird Point placement facility

### 3. Main dredge - Swing basin, berth pocket and channel

The areas to be dredged for the swing basin, berth pocket and berth approach channel are shown in EBR4320/108/D002. The volume of dredging for the main dredge is orders of magnitude greater than the MOF at approximately 8,000,000m<sup>3</sup>

The areas to be dredged are generally in sheltered waters and therefore, they are suited to being dredged by Cutter Suction Dredgers (CSD). In view of the shallow water depths and mix of likely dredge material, it is unlikely to be economical to use Trailer Suction Hopper Dredgers (TSHD).

Due to the configuration of the material to be removed from the site and, in particular, the presence of pockets of hard rock the most technically suitable and cost effective dredging plant is a large or medium CSD.

#### 3.1 PLACEMENT AT LAIRD POINT

In considering the relocation options for the main dredge, it has been assumed that all material will be disposed of to land. Laird Point has been identified as a suitable site for placement of the dredged material with the emphasis being on the containment of fines arising from the works.

It is noted that the relocation of dredge material to Laird Point includes for placement on the inter-tidal foreshore. The intention would therefore be to bund off this site and to lagoon the dredged material on the landward side of the bund.

A pipeline from the dredged area to Laird Point will be required for the works. It is anticipated that at least one booster pumping station will be installed at some point along this pipeline. The path of the pipeline may be on land or near shore. Installation onshore will facilitate maintenance.

Based upon a pumping distance of 6km, the estimated 240,000m<sup>3</sup> of rock in the berth area could be dredged in 5 weeks. It would take a further 52 weeks to complete removal of the remaining 8,000,000 m<sup>3</sup> of silty sand material. Production rates for the silty sand will be in the region of about 150,000m<sup>3</sup>/week.

The dredged materials will be transported hydraulically. The mixture of water and soil (a maximum of 30% solids to water ratio) particles will be pumped directly from the dredger through a pipeline into the confinement area at Laird Point. Thus over the course of a week when dredging silty sand material about 150,000m<sup>3</sup> of material (volume measured in-situ) would be pumped into the bunded area along with at least 500,000m<sup>3</sup> of water. The transport water will run-off from the site along with a proportion of the fines derived from the dredged material.

The volume occupied within the bunded area by the placed material will be greater than that in-situ because the material will initially be less consolidated than in-situ. Thus the capacity of the bunded area, at any time, needs to take into account the total volume (unconsolidated) of the placed material and a proportion of the transport waters so that settlement of fines into the bunded area can occur.

In order to limit suspended solids from the dredged materials passing back into the sea, two measures will be needed.

Firstly, the rate of settlement of the solid materials is determined by the distance between the discharge pipeline, the area and shape of the enclosed area, and the location where the water returns to the marine water body. Therefore it is proposed that the end of the pipeline will be positioned to the northerly ends of the placement area furthest away from the closure bunds as shown in drawing EBR4320/108/D003

The second important factor which determines the rate of settling is the velocity of the mixture as it flows through the site. The lower this velocity, the more the solids will settle out. To achieve this, intermediate bunds would be constructed within the area for land raising (possibly by trenching) - this will have the effect of both enlarging the settlement distance (if the water is caused to flow over an extended course across the site between control points, rather than the shortest direct route) and when coupled with effective use of weir boxes will result in an increased settlement time for the soil particles.

As a contingency, a silt curtain can also be used within the settlement pond prior to discharge from the sea outlet.

The Laird Point site has a large plan area within which settlement and containment of solids should not prove to be an onerous task.

### 3.2 CREATION OF BUND AT LAIRD POINT

The bunds required to contain the volume of placed material at Laird Point will be a significant structures and will be classified as a regulated dam and will require detailed design by an RPEQ based upon appropriate site investigation.

To close off the inter-tidal areas, initially a bund with 1:5 side slopes, crest elevation of approximately +10m AHD, and a 4 m wide access track on top would be constructed, working progressively from one side of the opening. Bund construction would comprise of sand, clay, rock and geotextile lining.

It is assumed that about 0.2Mm<sup>3</sup> of material will be needed to construct the Phase 1 bunds (crest elevation of 10m AHD) and the perimeter haul roads and causeway. It is proposed that all of this material will be won locally.

Material and plant will be brought to Laird Point on barges that can ground out, or ramp equipped vessels for unloading via a causeway. The causeway will comprise a bund of suitable material placed over the existing salt flat out to the 0m LAT contour. This will provide a firm surface for transport vehicles and equipment up to the dredge material facility. Given the assumed ground conditions at the causeway location it is likely that this material will be placed on a robust geotextile (yet to be designed) and possible that there may be a need to excavate unsuitable material before placement. The causeway will be topped with a suitable wearing course for the traffic and tidal conditions.

Site clearance, construction of the haul route and the bunds will require suitable plant to be available on site. Typically, the equipment required for this exercise would be: 3 x 50 tonne excavators, 6 x 80 tonne dump trucks and 3 x D8 dozers. Working on the basis of 500 m<sup>3</sup> of material movement per hour (loading, placing compaction), it would be necessary to allow three months for construction of the bund assuming that operations are carried out twenty four hours per day and seven days per week.

Assuming a phased approach, construction of the phase 1 bund should be possible utilising both local sourced material but also potentially topped up with import rock from the GLNG plant site. An initial bund height of 10 m AHD would be similar to the existing perimeter bund at Fisherman's Landing. Any subsequent bund raising could be undertaken using materials recovered from the discharged dredgings. (EBR4320/108/D005)

The initial bund constructed to a level of 10m AHD would be suitable for containing about 3 Mm<sup>3</sup>. It will be necessary to raise this bund to contain the full volume of material to be dredged. Bund raising is proposed to be undertaken utilising dredged materials. So in the early stages of pumping ashore there will also be recovery of materials from the placed materials to raise the bund and construct the secondary bunds. A further volume of 0.2Mm<sup>3</sup> of materials will be recovered from the dredge material to raise the bund.

Prior to any construction activity happening at the site there will be a need to clear the site and construct a haul route around the site. Clearance is expected to take about a month to complete.

The area of land at Laird Point within the perimeter of the haul route, including the footprint of the bund and the barge unloading facility is approximately 1.0Mm<sup>2</sup>.

### 3.3 PROGRAMME

The following items are identified as being the main stages in the programme:

- i) Construction of a barge handling facility at Laird Point (2 months)
- ii) Site clearance (1 month)
- iii) Construction of haul route around perimeter of site (1 month)
- iv) First stage of bund construction (5 months)
- v) Main dredge and placement of materials (14 months)
- vi) Second stage of bund construction (3 months)

Items i), ii) and iii) could be undertaken in parallel.

Items v) and vi) would be undertaken in parallel.

Item v) can commence once item iv) is complete.

Extending the time available to complete the first stage of bund construction (Item iv) could provide flexibility in the approach to bund construction.

Extending the time for completion of the main dredge (Item v) could give rise to lower rates of release of fines from the site.

Overall the construction works could be completed within a 18-24 month period.

### 3.4 FURTHER WORK

Ground proofing/geotechnical surveys will be required – to check there are no underground caverns or other potential subsidence issues that may undermine bunds or cause slippage.

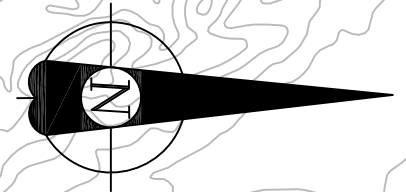
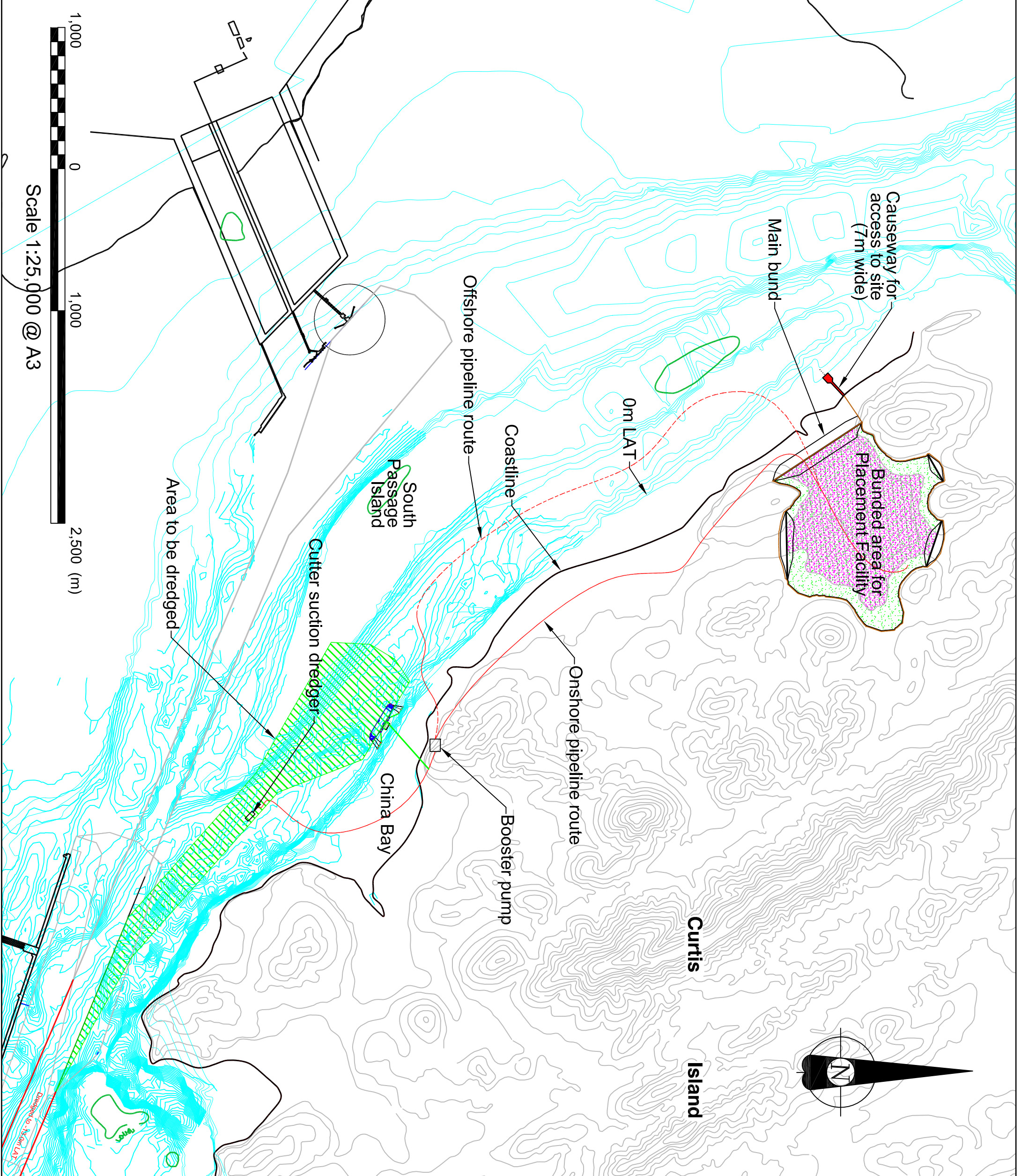
Additionally, this will be necessary to confirm drainage management for the area during construction, placement and post placement of the dredged materials. It is currently envisaged

that during construction the internal bunds will be maintained at a level lower than an emergency spillway on the main bund. In the event of an extreme storm event the internal bunds will become inundated and not relied on or detrimentally influence drainage management.

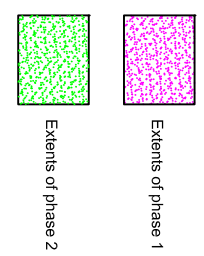
Given the need to manage the discharge of fines and other species back into the marine environment it will be important to establish a good understanding of background levels of suspended sediment in the waters adjacent to Laird Point. Monitoring of the discharge water will be required as part of the dredge management plan with appropriate actions in place in the event of exceedence of concentration limits of species that are identified as having potential to exceed limits (see the EIS document for further discussion).

If the pipeline route is to be across land a suitable route and permissions for access will be required.





**NOTES:**  
 Depths are in metres relative to LAT  
 Land contours are in metres relative to AHD  
 All dimensions in metres  
 All co-ordinates in MGA Zone 56, Datum GDA94  
 Bathymetry supplied by GFC in drawing no. 906-0014, dated 26/05/08.  
 Layout of dredged areas is provisional and indicative



REVISION	DESCRIPTION	DATE
B	Issued for use	14/05/09

**CLIENT:**  
**ISSUED FOR USE**

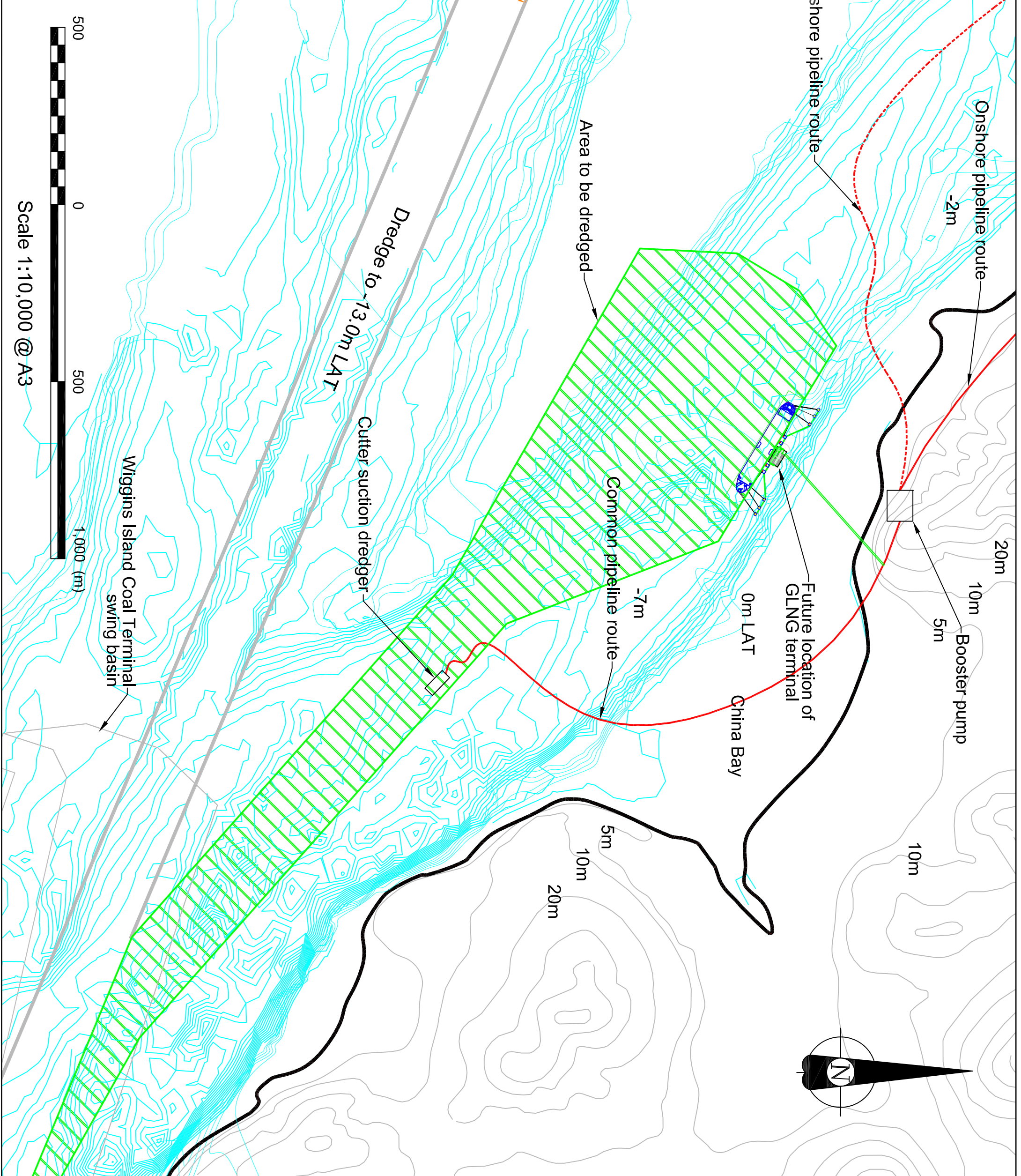


**HR Wallingford**  
 HR Wallingford Ltd, Howbery Park, Wallingford,  
 Oxon, OX10 8BA, UK.  
 Tel: +44 (0) 1491 835381 Fax: +44 (0) 1491 832233  
<http://www.hrwallingford.co.uk>

**PROJECT:**  
 GLNG

**DRAWING TITLE:**  
 Dredging and placement of dredged  
 material, general layout

<b>DRAWN BY:</b>	RER	<b>CHECKED BY:</b>	SDU
<b>SCALE:</b>	1:25,000 @ A3	<b>DATE:</b>	14-May-09
<b>GLNG DRAWING No:</b>	3301-HRW-3-3.3-9075-PDF	<b>REV:</b>	B
<b>DRAWING No:</b>	EBR4320\1081D001	<b>REV:</b>	B



**NOTES:**  
 Depths are in metres relative to LAT  
 Land contours are in metres relative to AHD  
 All dimensions in metres  
 All co-ordinates in MGA Zone 56, Datum GDA94  
 Bathymetry supplied by GPC in drawing no. 906-0014, dated 28/05/08.  
 Layout of dredged areas is provisional and indicative

REVISION	DESCRIPTION	DATE
B	Issued for use	14/05/09

**CLIENT:**  


**HR Wallingford**  
 HR Wallingford Ltd, Howbery Park, Wallingford,  
 Oxon, OX10 8BA, UK.  
 Tel: +44 (0) 1491 835381 Fax: +44 (0) 1491 832233  
<http://www.hrwallingford.co.uk>

**PROJECT:**  
 GLNG

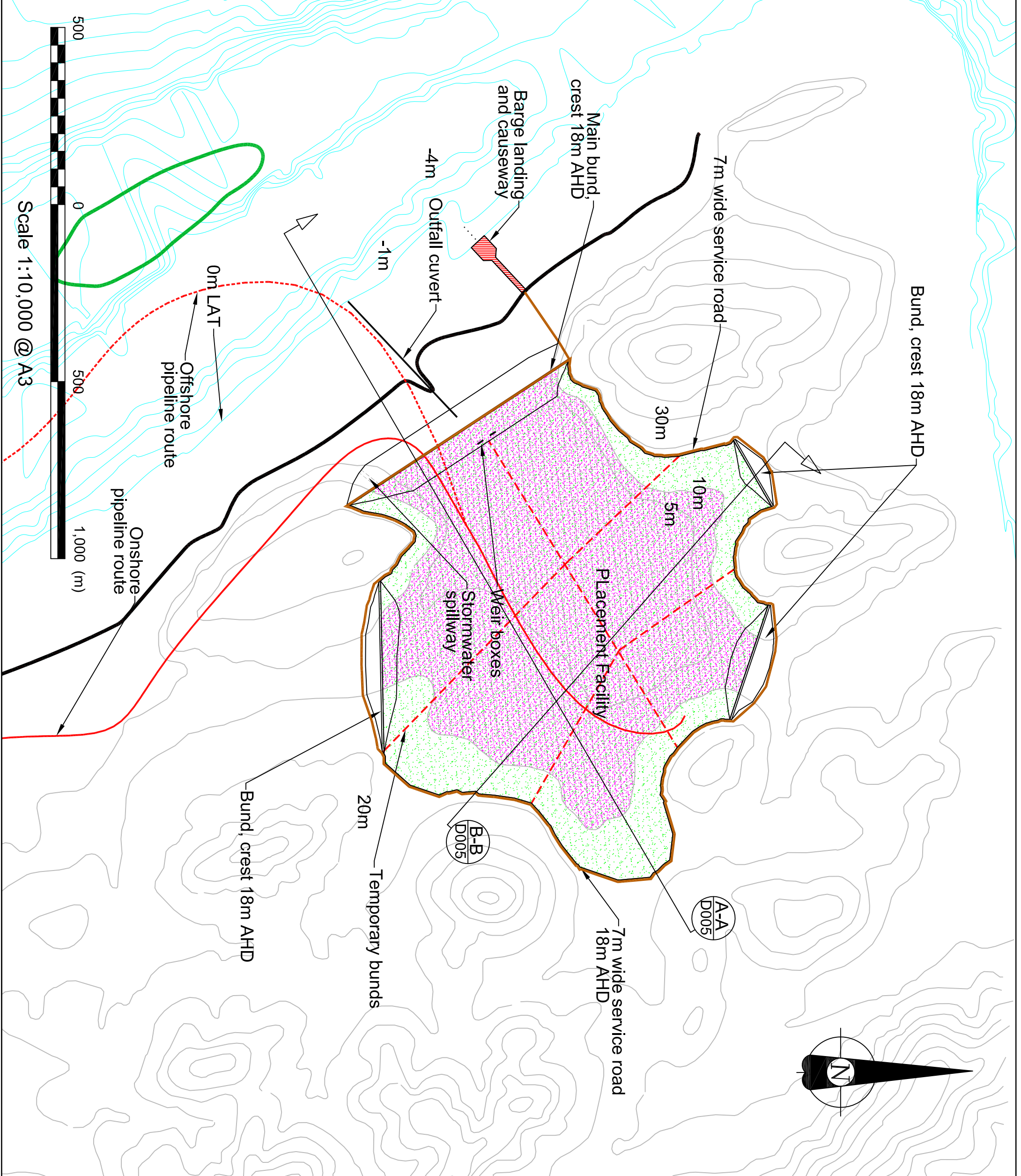
**DRAWING TITLE:**  
 Dredged areas

**DRAWN BY:** RER **CHECKED BY:** SDU

**SCALE:** 1:10,000 @ A3 **DATE:** 14-May-09

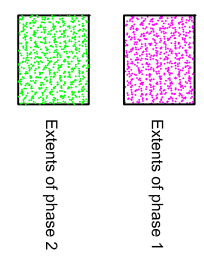
**GLNG DRAWING No:** 3301-HRW-3-3-3-9076-PDF

**DRAWING No:** EBR43201081D002 **REV:** B



**NOTES:**

- Depths are in metres relative to LAT
- Land contours are in metres relative to AHD
- All dimensions in metres
- All co-ordinates in MGA Zone 56, Datum GDA94
- Bathymetry supplied by GFC in drawing no. 906-0014, dated 26/05/08.
- Layout of dredged areas is provisional and indicative



REVISION	DESCRIPTION	DATE
B	Issued for use	14/05/09

**CLIENT:** 

**HR Wallingford**  
 HR Wallingford Ltd, Howbery Park, Wallingford,  
 Oxon, OX10 8BA, UK.  
 Tel: +44 (0) 1491 835381 Fax: +44 (0) 1491 832233  
<http://www.hrwallingford.co.uk>

**PROJECT:** GLNG

**DRAWING TITLE:**  
 Detail of Laird Point  
 Placement Facility

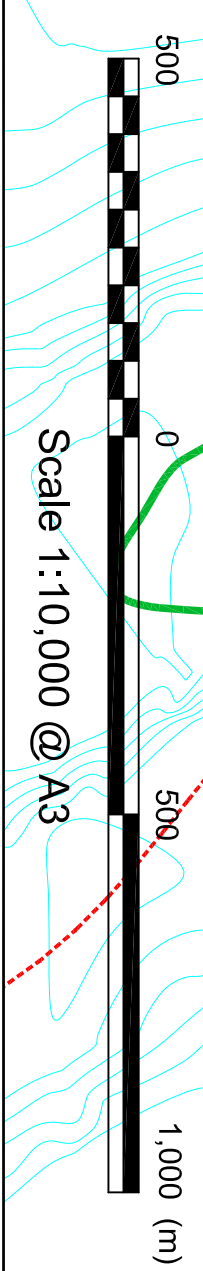
**DRAWN BY:** RER **CHECKED BY:** SDU

**SCALE:** 1:10,000 @ A3 **DATE:** 14-May-09

**GLNG DRAWING No:** 3301-HRW-3-3.3-9077-PDF

**DRAWING No:** EBR4320108ID003 **REV:** B

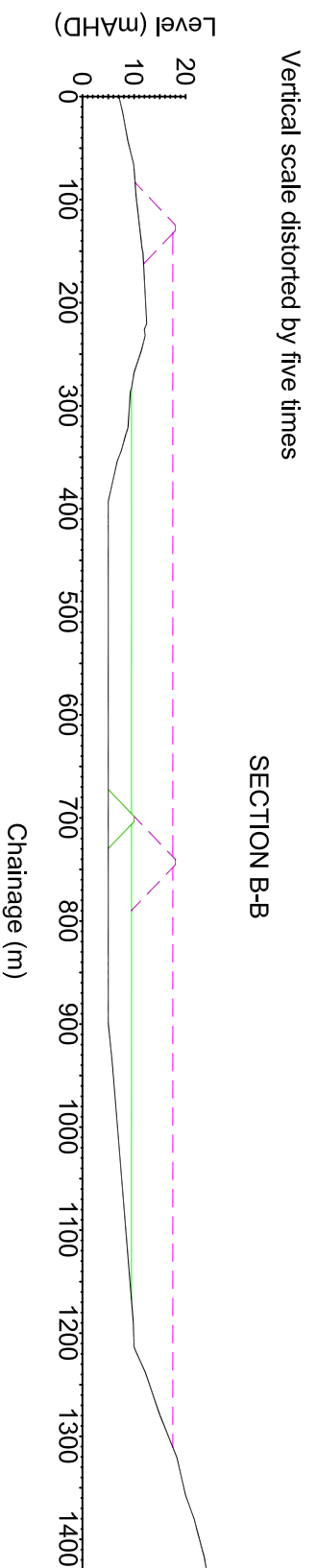
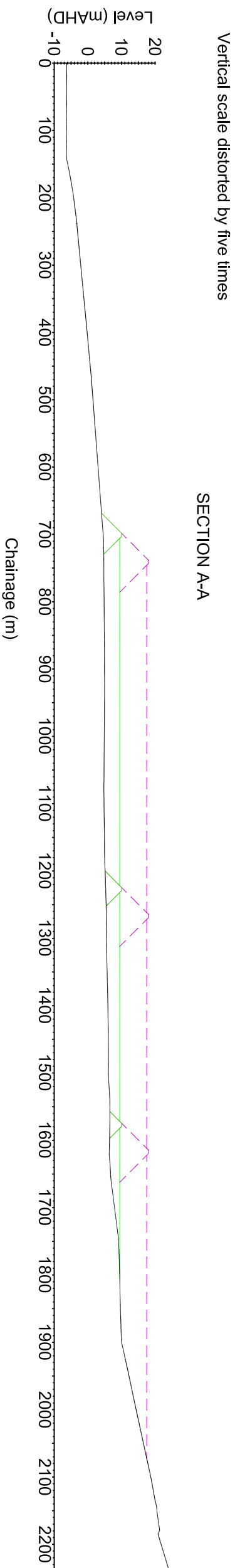
© HR Wallingford Ltd. 2009.



**NOTES:**

All levels are in metres relative to AHD  
 All dimensions in metres  
 All co-ordinates in MGA Zone 56, Datum GDA94  
 Bathymetry supplied by GPC in drawing no. 906-0014, dated 26/05/08.  
 Layout of dredged areas is provisional and indicative

- Phase 1 (10m)
- Phase 2 (18m)
- Phase 1 bunds
- Phase 2 bunds



REVISION	DESCRIPTION	DATE
B	Issued for use	14/05/09

Drawing Status

ISSUED FOR USE

**CLIENT:**



**HR Wallingford**  
 HR Wallingford Ltd, Howbery Park, Wallingford,  
 Oxon, OX10 8BA, UK.  
 Tel: +44 (0) 1491 835381 Fax: +44 (0) 1491 832233  
<http://www.hrwallingford.co.uk>

**PROJECT:**

GLNG

**DRAWING TITLE:**

Sections of Laird Point  
 Placement Facility

**DRAWN BY:** RER **CHECKED BY:** SDU

**SCALE:** n1s **DATE:** 14-May-09

**GLNG DRAWING No:** 3301-HRW-3-3.3-9078-PDF

**DRAWING No:** EBR4320\108\005 **REV:** B