

APPENDIX B

TECHNICAL DRAWINGS AND CHEMICAL INVENTORY

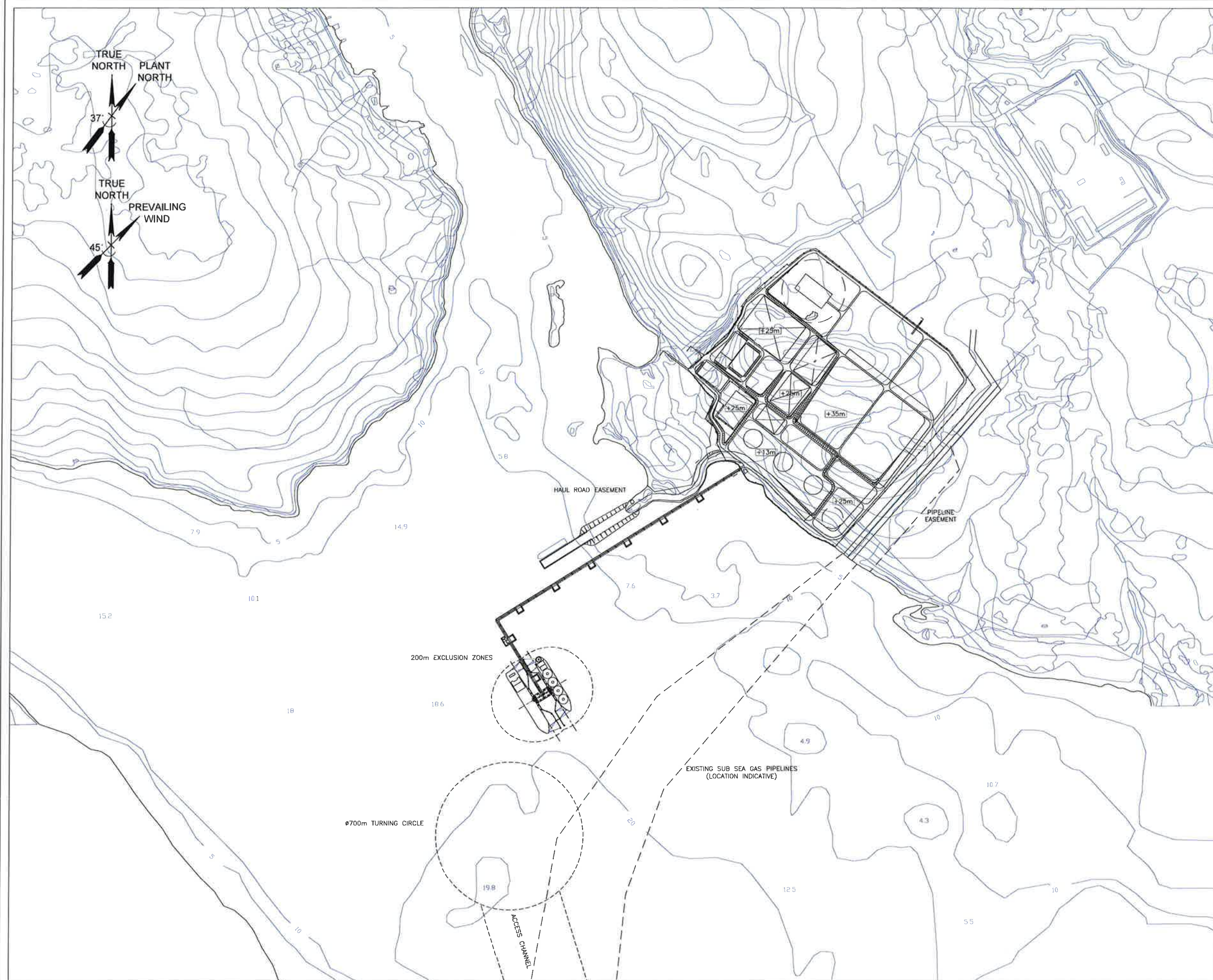


**GOLDBORO
LNG**

Appendix B-1: Goldboro LNG Facility Technical Drawings

List of Drawings:

- Overall Site Plan - LNG
- Overall Plot Plan - LNG
- Overall Plot Plan - Jetty & Berths
- LNG Jetty - Approach Trestle Details
- Overall Block Flow Diagram (2 sheets)
- Generic Liquefaction Schematic



NOTES



1. ALL DIMENSIONS ARE IN METRES
UNLESS OTHERWISE NOTED

HOLDS

1. CAMP LOCATION TO BE CONFIRMED FOLLOWING FURTHER DEVELOPMENT
2. EARTHWORKS AT SITE PERIMETER

REFERENCE DRAWINGS

1. 185352-000-PI-01-000002
2. 185352-000-PI-01-000003
3. 9Y0903/PF/0001
4. 9Y0903/PF/1001

B	25JAN13	ISSUED FOR REVIEW	CJ	PJW	MW	
A	03JAN13	ISSUED FOR REVIEW	CJ	AM	MW	
REV	DATE	DESCRIPTION	DRN	CHK	APP	CL



GOLDBORO LNG PROJECT



TITLE: OVERALL SITE PLAN
LNG

SCALE (A1): SEE SCALE BAR

DOCUMENT ID: -

CONTRACT No: -

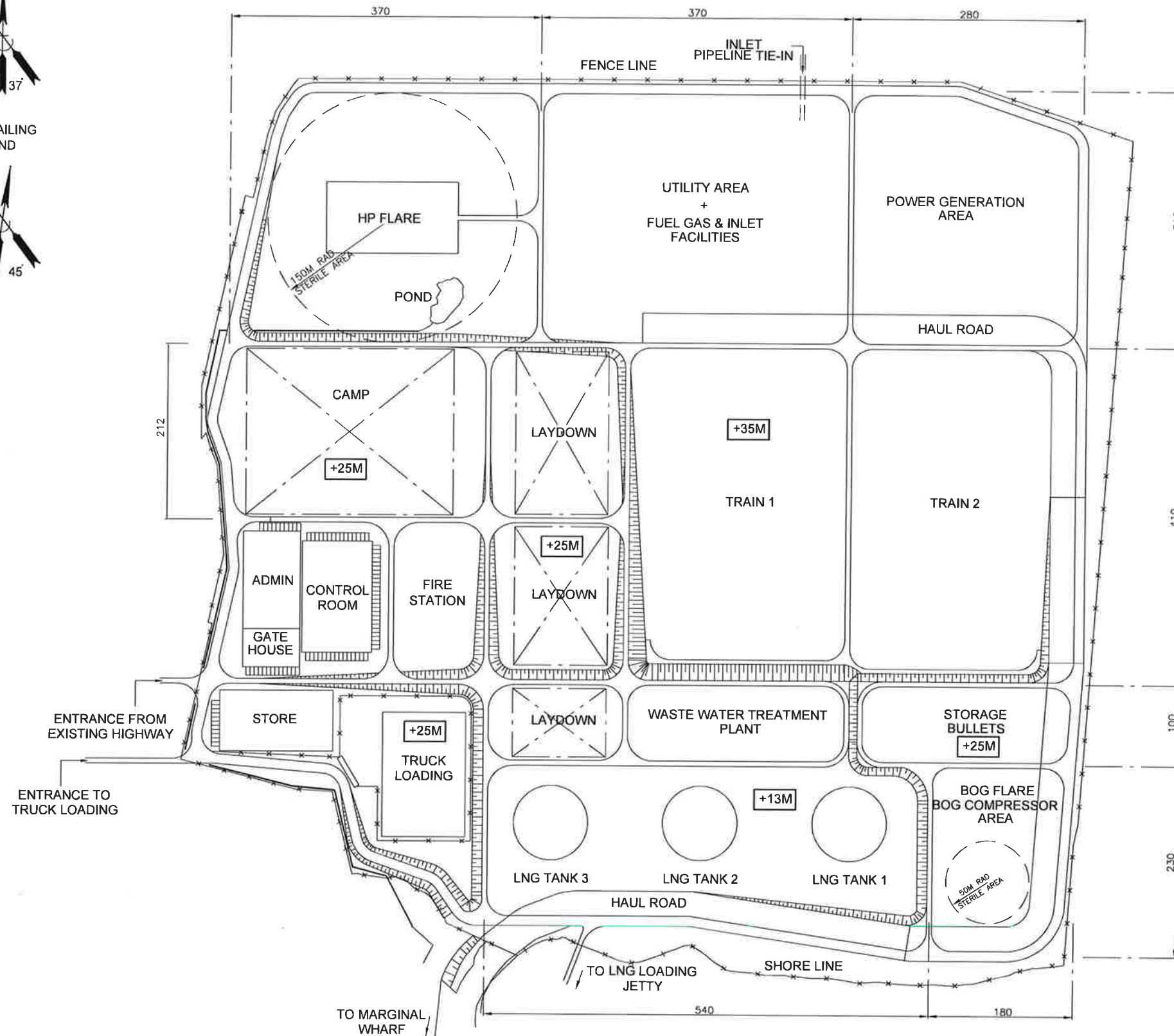
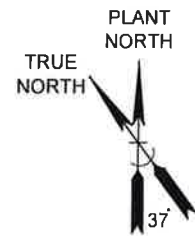
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DRAWING No.

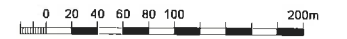
185352-000-PI-01-000001

REV

8



NOTES



- ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE NOTED

HOLDS

- CAMP LOCATION TO BE CONFIRMED FOLLOWING FURTHER DEVELOPMENT
- EARTHWORKS AT SITE PERIMETER

REFERENCE DRAWINGS

- 185352-000-PI-01-000001
- 185352-000-PI-01-000003

REV	DATE	DESCRIPTION	DRN	CHK	APP	CLT
B	25JAN13	ISSUED FOR REVIEW	CJ	PJW	MW	
A	03JAN13	ISSUED FOR REVIEW	CJ	AM	MW	



GOLDBORO LNG PROJECT



TITLE: OVERALL PLOTPLAN LNG

SCALE (A1): SEE SCALE BAR

DOCUMENT ID: -

CONTRACT No: -

CLIENT CONTRACT No: -

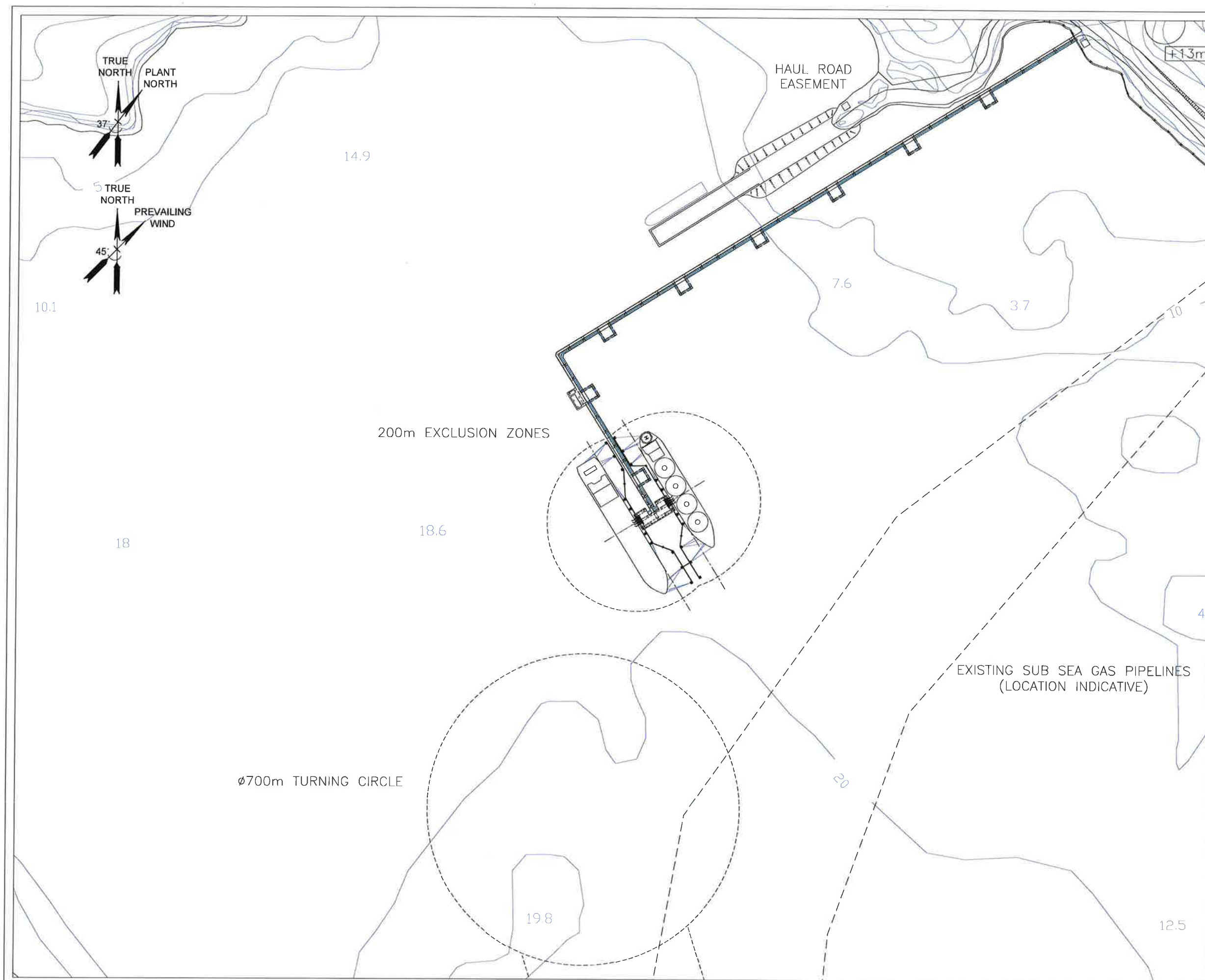
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185352-000-PI-01-000002

REV

B

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NOTES



ALL DIMENSIONS ARE IN METRES
UNLESS OTHERWISE NOTED

HOLDS

1. EARTHWORKS AT SITE PERIMETER

REFERENCE DRAWINGS

1. 185352-000-PI-01-000001
2. 185352-000-PI-01-000002
3. 9Y0903/PF/0001
4. 9Y0903/PF/1001

B	25JAN13	ISSUED FOR REVIEW	CJ	PJW	MW		
A	03JAN13	ISSUED FOR REVIEW	CJ	AM	MW		
REV	DATE	DESCRIPTION	DRN	CHK	APP	C	

PIERIDAE ENERGY

GOLDBORO LNG PROJECT



TITLE: OVERALL PLOTPLAN
JETTY & BERTHS

SCALE (A1): SEE SCALE BAR

DOCUMENT ID: —

CONTRACT No: —

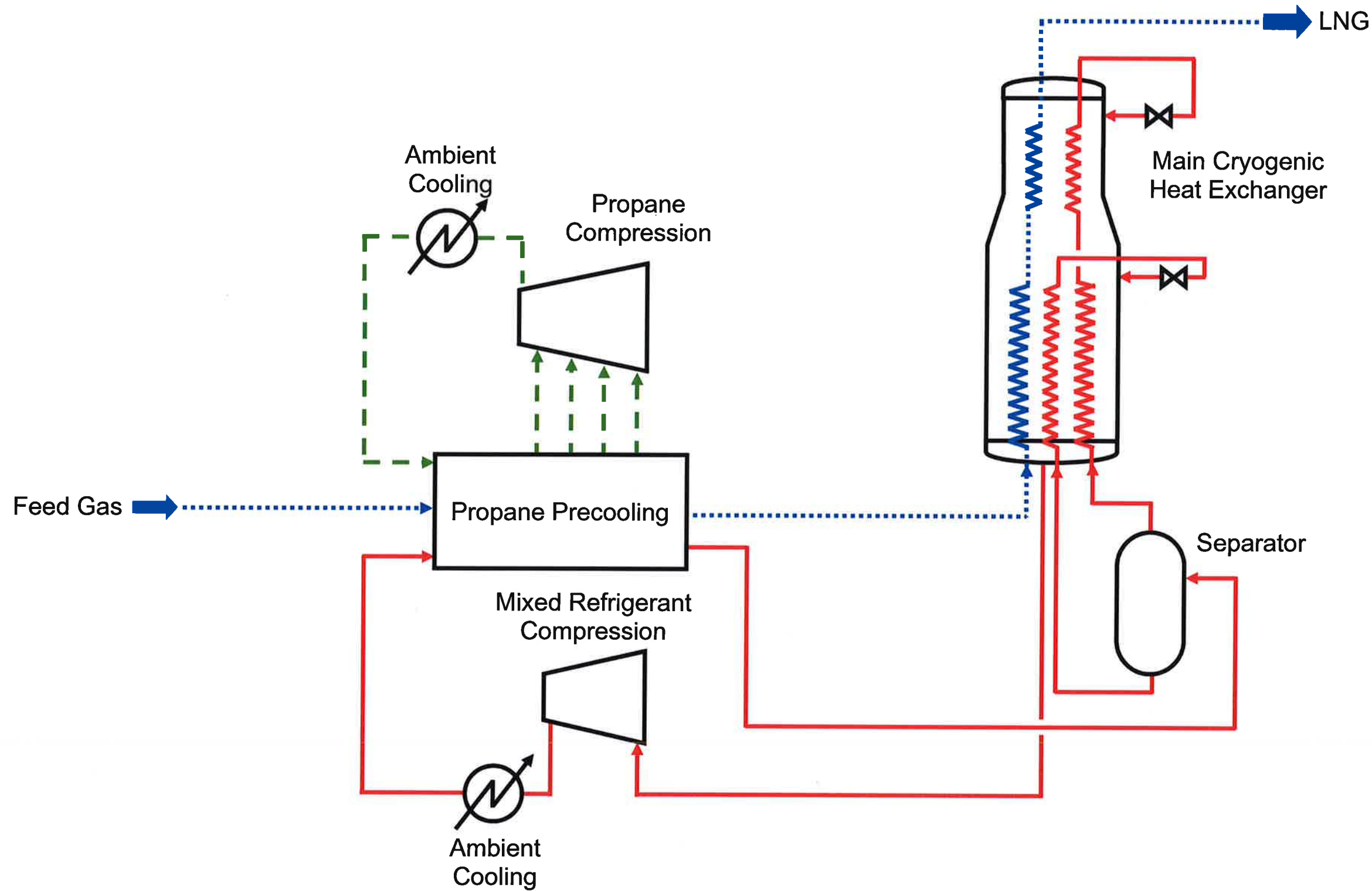
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DRAWING No.

185352-000-PI-01-000003

REV
B

	A	B	C	D	E	F	G	H	I	J					
	NOTES														
1	1. STREAM DATA IS FOR SINGLE TRAIN OPERATING FOR PHASE 1.														
	2. ACID GAS VENT INCLUDES FOR COMBUSTION OF FUEL GAS IN ACID GAS INCINERATOR.														
	3. ANNUAL PRODUCTION RATES ARE BASED ON AN ASSUMED FACILITY AVAILABILITY OF 340 DAYS/YEAR														
	4. LNG PRODUCT STREAM IS A ESTIMATED FREE ON BOARD VALUE ALLOWING FOR EXPECTED STORAGE AND LOADING LOSSES.														
2	5. AGGREGATE RATE BASED ON A TIME WEIGHTED AVERAGE OF ESTIMATED HOLDING AND LOADING MODE OPERATION.														
3															
4															
5															
6															
7															
8															
9															
10															



NOTES

HOLDS

A	05/02/2013	ISSUED FOR INFORMATION	RAD	DEC	MW
REV	DATE	DESCRIPTION	DRN	CHK	APP

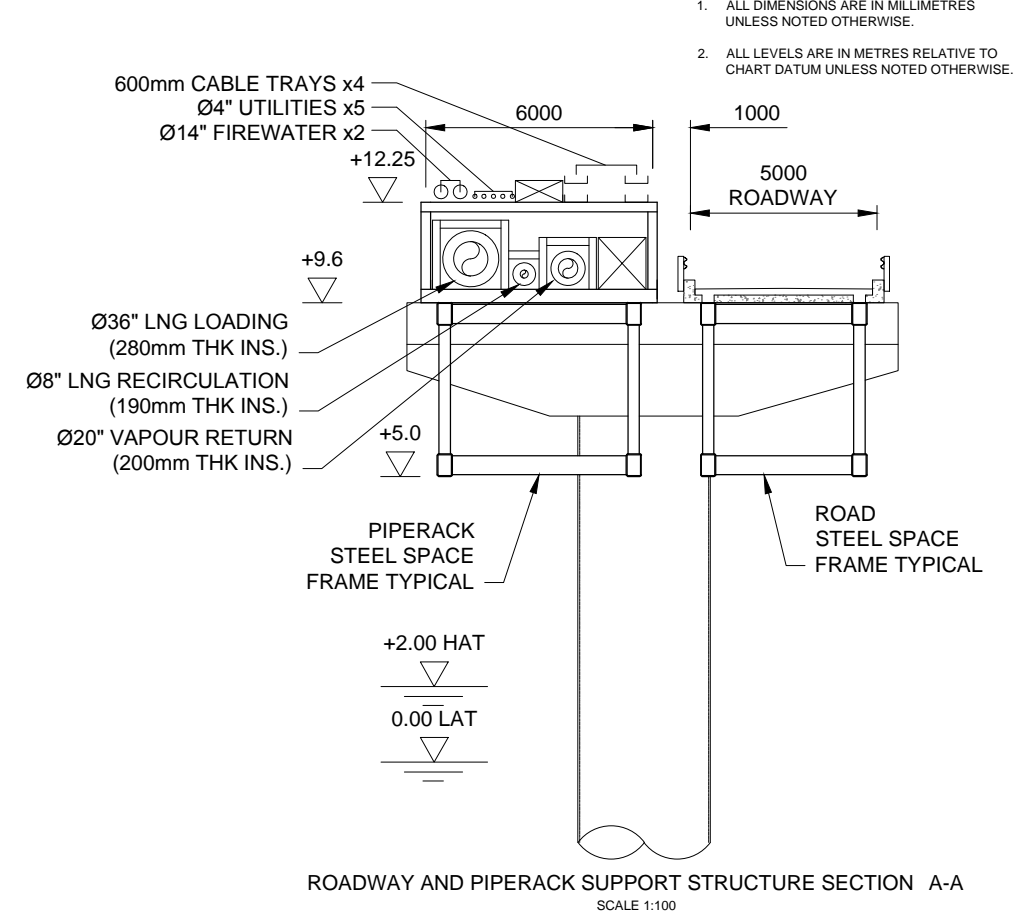
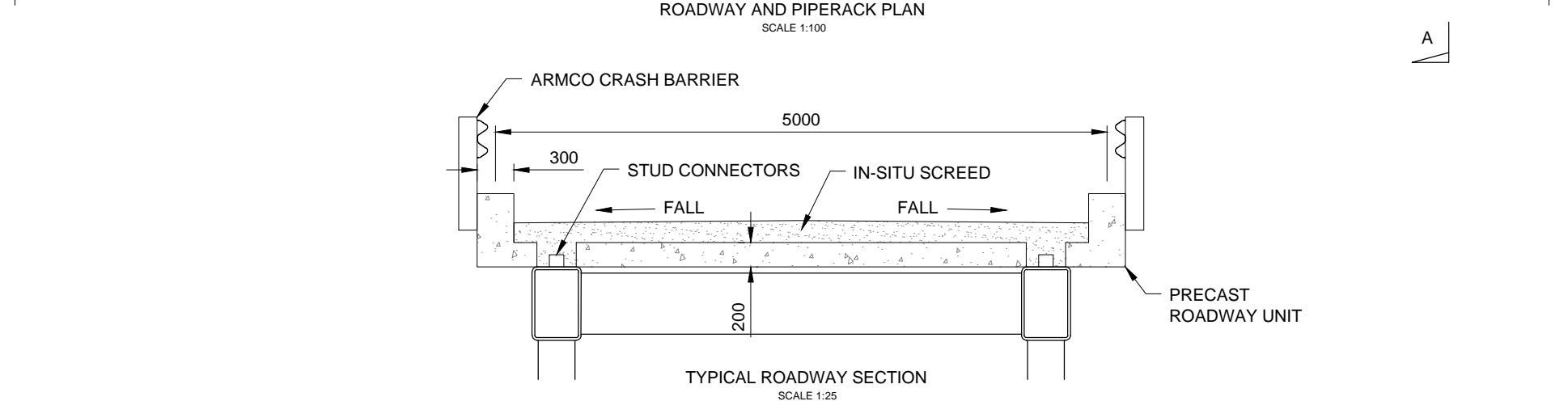
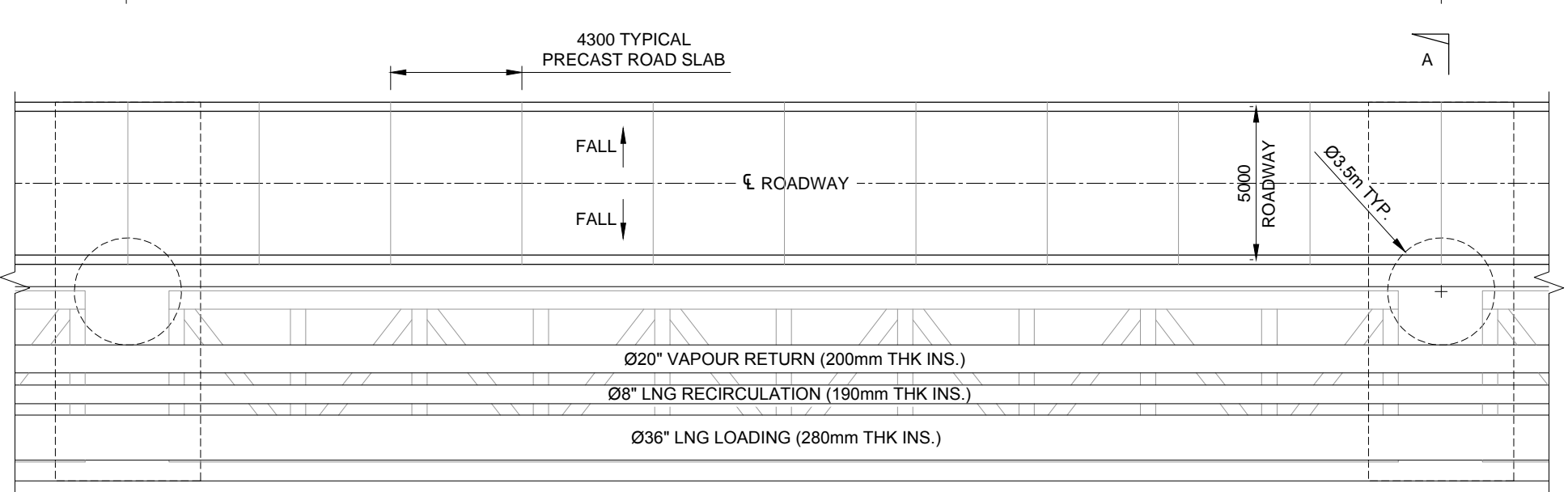
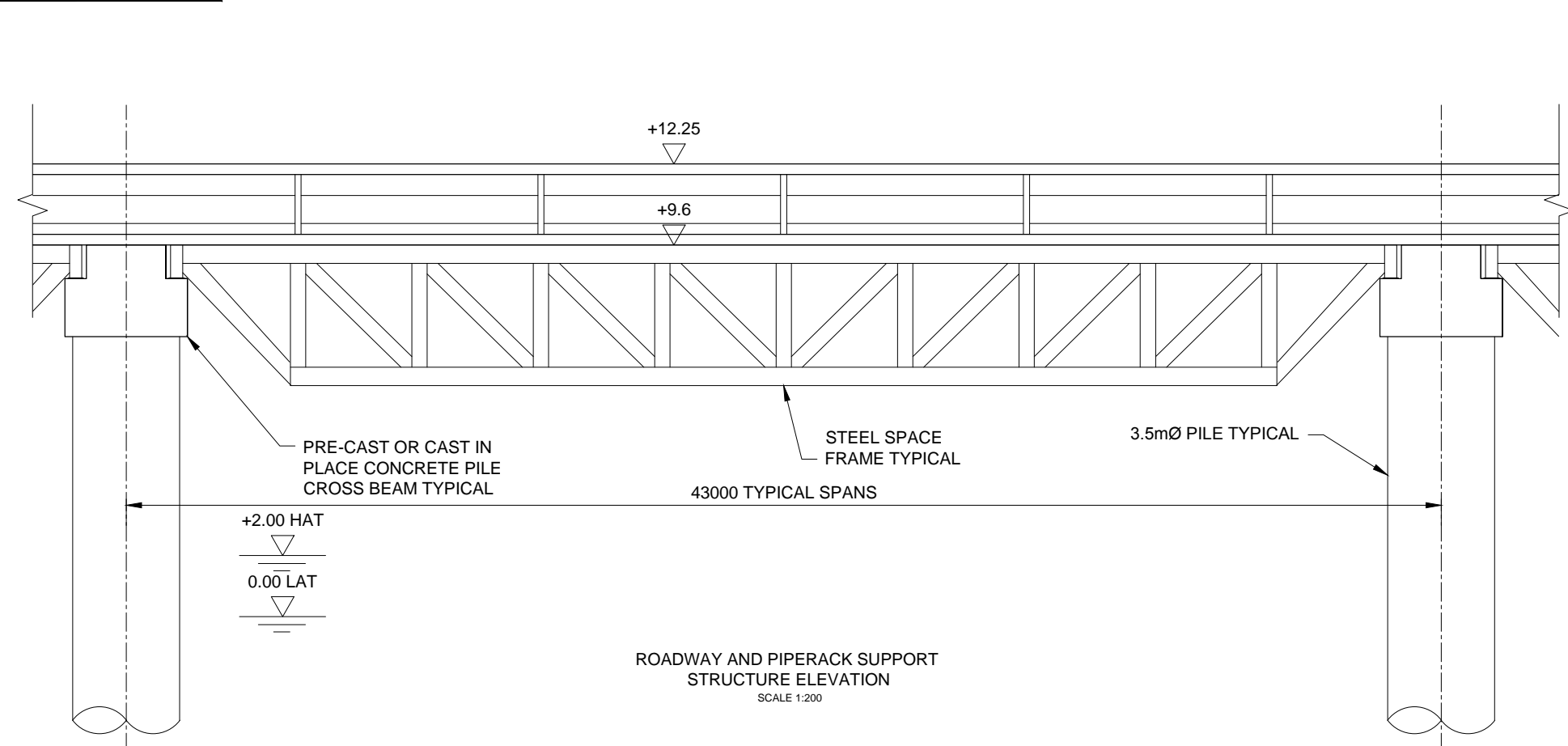


GOLDBORO LNG



TITLE:
GENERIC LIQUEFACTION SCHEMATIC

SCALE (A1): NTS	
DOCUMENT ID:	
CONTRACT No: 185352	
CLIENT CONTRACT No:	
DRAWING No: 185352-000-PR-SK-000001	REV A



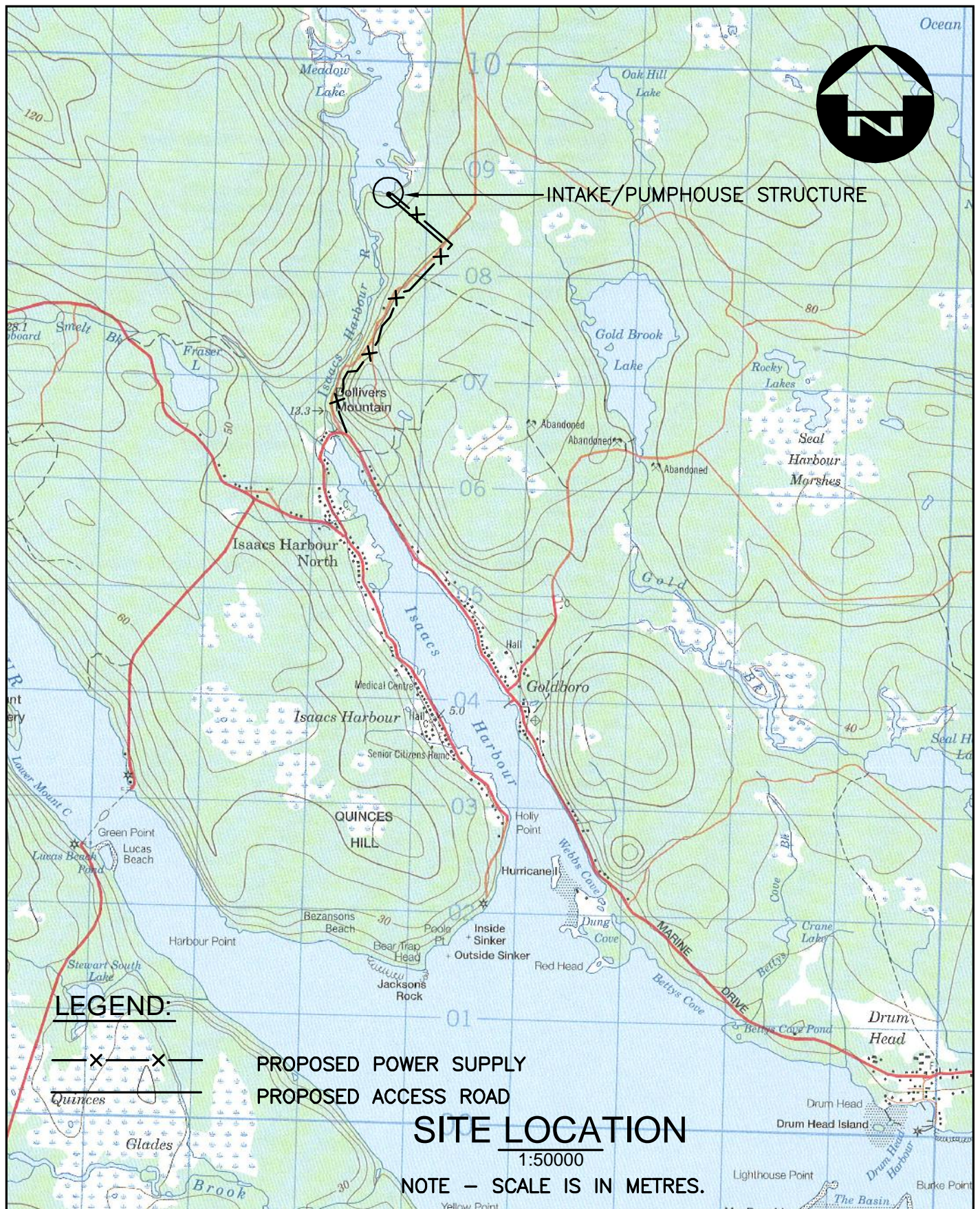
PRE FEED
DESIGN STAGE
ONLY


REV	DATE	DESCRIPTION	BY	CHK	APP
REVISIONS					
CLIENT					
PROJECT					
GOLDBORO LNG PRE-FEED STUDY					
TITLE					
LNG JETTY APPROACH TRESTLE DETAILS					
<div><div></div><div><small>4 Desario Yard, Westminster London, SW1P 3NL Tel +44(0)207 222 2115 Email info.london@rhdhv.com Website www.royalhaskoning.com</small></div></div>					
DRAWN	TF	CHECKED	GM	APPROVED	SH
DATE	01/13	SCALE	AT A1 AS SHOWN	REF.	
DRAWING No. 9Y0903/ PF/1021					REVISION 0

Appendix B-2: Water Intake Figures

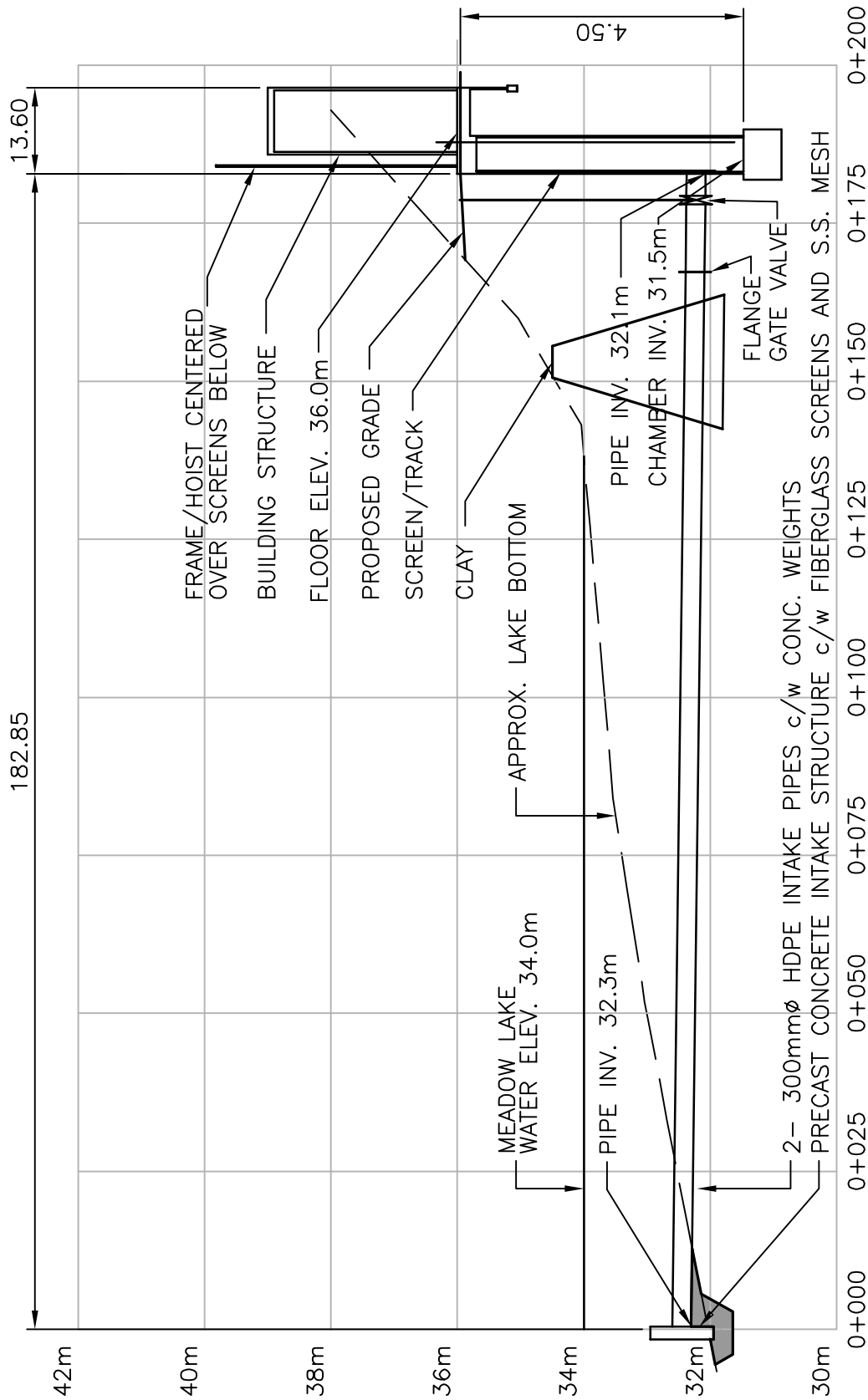
List of Figures:

- Figure 1 Site Location
 - Figure 2 Water Intake Structure Profile
 - Figure 3 Water Intake Structure Plan
 - Figure 4 Pump House Floor Plan
 - Figure 5 Site Plan
-



 DILLON CONSULTING	PROJECT GOLDBORO LNG WATER SUPPLY CONCEPT DESIGN	PROJECT NO. 13-7407
	TITLE SITE LOCATION	FIGURE NO. 1

DATE June 2013



Profile

1:1000 (horiz) 1:100 (vert)

NOTE - DIMENSIONS AND SCALES ARE IN METRES.



DATE

June 2013

PROJECT

GOLDBORO LNG WATER SUPPLY
CONCEPT DESIGN

TITLE

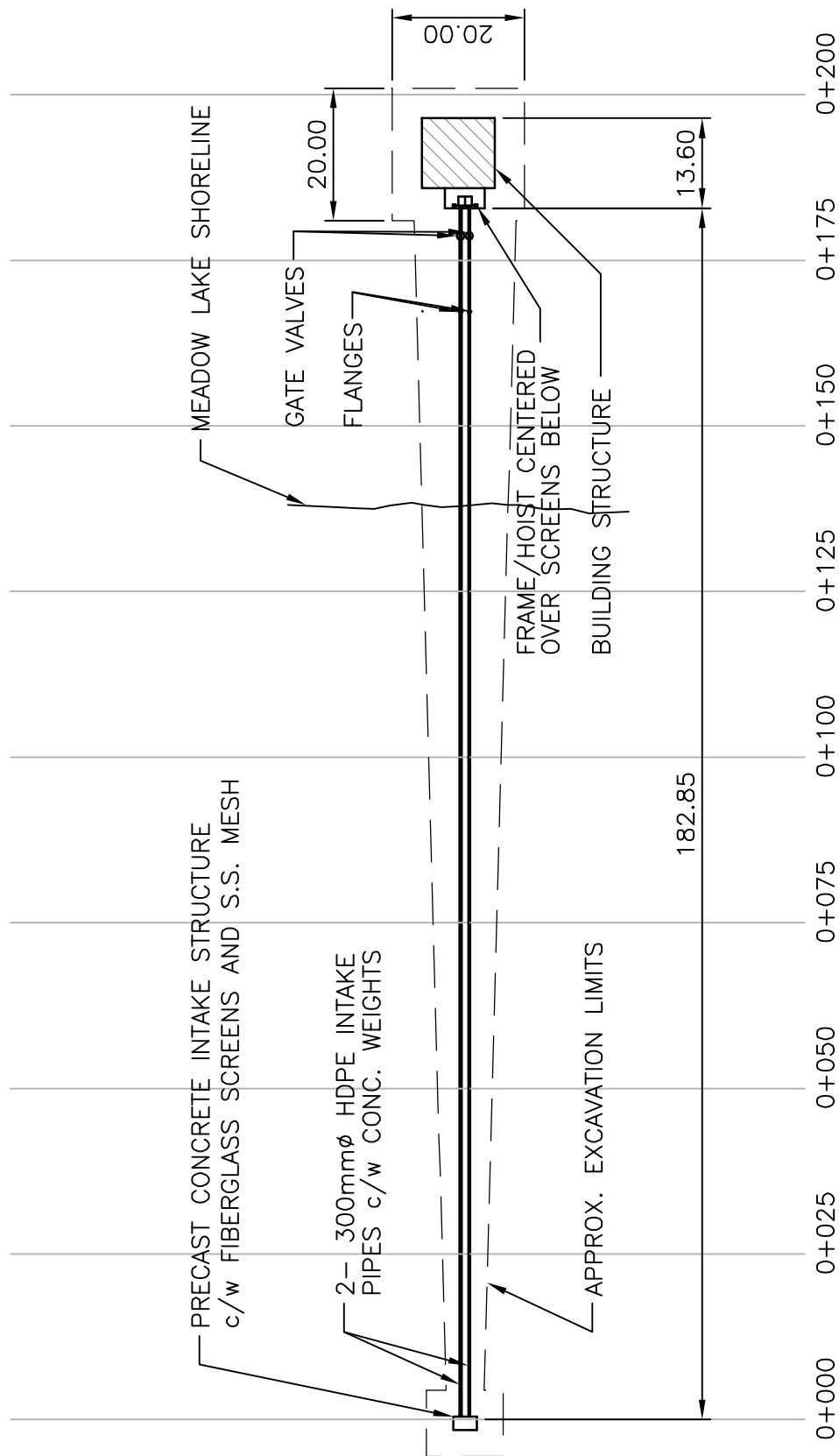
WATER INTAKE STRUCTURE
PROFILE

PROJECT NO.

13-7407

FIGURE NO.

2



PLAN 1:1000

NOTE - DIMENSIONS AND SCALE ARE IN METRES.



DATE

June 2013

PROJECT

GOLDBORO LNG WATER SUPPLY
CONCEPT DESIGN

TITLE

WATER INTAKE STRUCTURE
PLAN

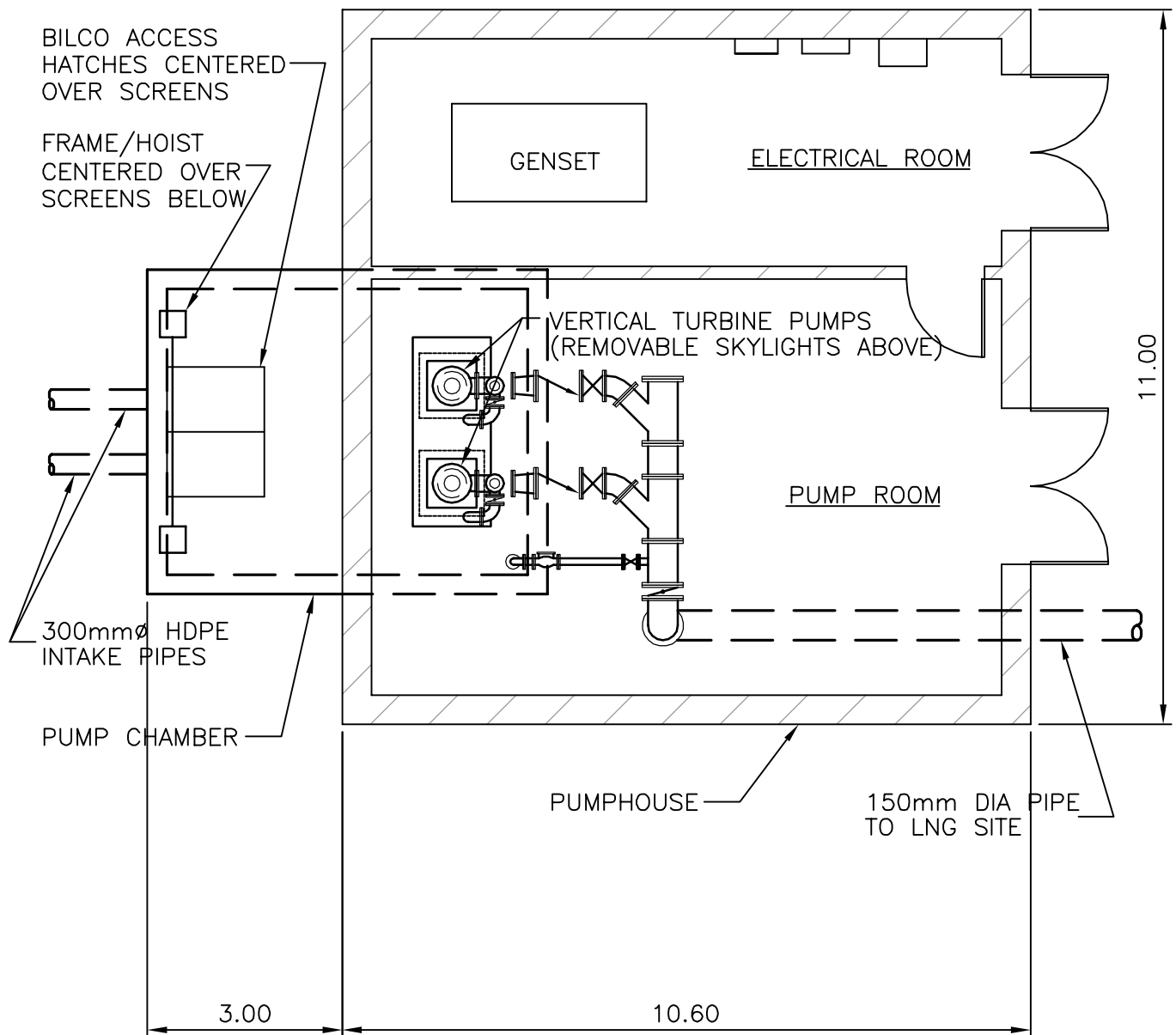
PROJECT NO.

13-7407

FIGURE NO.

3

FileName: g:\cad\137407-3000002-civil\03-reports\137407-02-site-fig.dwg



PLAN

1:100

NOTE - DIMENSIONS AND SCALE ARE IN METRES.



DILLON
CONSULTING

DATE

June 2013

PROJECT

GOLDBORO LNG WATER SUPPLY
CONCEPT DESIGN

TITLE

PUMPHOUSE
FLOOR PLAN

PROJECT NO.

13-7407

FIGURE NO.

4

MEADOW LAKE

INTAKE STRUCTURE

HDPE INTAKE PIPES

MEADOW LAKE SHORELINE

182.85

31.00

42.00

CHAINLINK FENCE

PUMPHOUSE

ACCESS ROAD

WATER SUPPLY
TO LNG SITE

PLAN

1:2000

NOTE — DIMENSIONS AND SCALE ARE IN METRES.



PROJECT GOLDBORO LNG WATER SUPPLY
CONCEPT DESIGN

PROJECT NO.
13-7407

TITLE
SITE
PLAN

FIGURE NO.
5

DATE June 2013

Appendix B-3: Preliminary Chemical Inventory

Appendix B-3: Preliminary Chemical Inventory

EC category	Substance	CAS	UN number	Concentration (%)	Threshold amount (tonnes)	Properties	Acute	Human toxicity Chronic	aquatic toxicity	amount stored at Site
likely to explode	acetylene	74-86-2	1001	0.01	4.5	Physical state: gas, colour: colourless, odour: ether/garlic, critical temperature: 35.3 deg C, specific garvity 0.9 (air), stability: unstable and reactive ¹	Acts as an asphyxiant, expansion may cause burns ¹	May cause damage to the following organs: lungs, upper respiratory tract, central nervous system (CNS) ¹	NA	less than threshold
	liquefied natural gas	8006-14-2	1972	0.01	4.5	Physical state: liquid, colour: colourless, odour: none, critical temperature: 537 deg C, specific garvity 0.4 (water), stability: stable ²	Liquid or cold gas contact with skin or eyes could cause freezing or severe cryogenic burns. After vapourization, contact with burning gas may cause burns.Inhalation produces weak depressant effects on the CNS at high gaseous concentrations approaching the lower flammability limit. ² Occupational limit 1000 ppm	NA	NA	less than threshold
	propane	74-98-6	1978	0.01	4.5	Physical state: gas, colour: colourless, odour: gasoline, critical temperature: 96.6 deg C, specific garvity 1.6 (air), stability: stable ³	Inhalation of this product may cause dizziness, an irregular heartbeat, narcosis, nausea or asphyxiation. Occupational limit 1000 ppm ³	NA	NA	less than threshold
	gasoline (motor fuel)	86290-81-5	1203	0.01	150	Physical state: liquid, colour: colourless, odour: gasoline, critical temperature: 257 deg C, specific garvity 3-4 (air), stability: stable ⁴	Inhalation of this product may cause respiratory tract irritation. Inhalation of this product may cause respiratory tract irritation and Central Nervous System (CNS) Depression, symptoms of which may include; weakness, dizziness, slurred speech, drowsiness, unconsciousness and in cases of severe overexposure; coma and death. Occupational limit 300 ppm. ⁴	This product contains an ingredient or ingredients, which have been shown to cause chronic toxic effects. Repeated or prolonged exposure to the substance can produce blood disorders. ⁴	NA	less than threshold
	benzene	71-43-2	1114	0.01	10	Physical state: liquid, colour: colourless, odour: sweetish aromatic, critical temperature: 498 deg C, specific garvity 2.8 (air), stability: stable ⁵	Acute exposure to high levels of benzene affects the central nervous system, causing dizziness, nausea, vomiting, headache, and drowsiness. HC limit -1300 ug/m ³ ⁶	In mammals, the major chronic effect is manifested on cells from the blood system. Chronic low-level exposure in humans results in blood disorders, such as pancytopenia, a reduction in the three types of formed elements in blood (erythrocytes, leucocytes, and platelets). Benzene is a known carcinogen, specifically causing acute myelogenous leukemia. In mammalian tests (e.g., rats and mice), the carcinogenicity of benzene shows a wide range of tissue and species sensitivity, with the most common effect being tumorigenicity. HClimit- 3 ug/m ³ ⁷	NA	less than threshold
	methane	74-82-8	1971 & 1972	0.01	4.5	Physical state: gas, colour: colourless, odour: sweet, critical temperature: -82.4 deg C, specific garvity 0.422 (air), stability: stable and reactive with oxidizing agents	Inhalation of this product may cause dizziness, an irregular heartbeat, narcosis, nausea or asphyxiation. Contact with rapidly expanding gas may cause burns or frostbite. Occupational limit of 1000 ppm ⁸	NA	NA	less than threshold
	ethane	74-84-0	1035 & 1961	0.01	4.5	Physical state: gas, colour: colourless, odour: sweet, critical temperature: 32.4 deg C, specific garvity 1.1 (air), stability: stable and reactive with oxidizing agents ⁹	Inhalation of this product may cause dizziness, an irregular heartbeat, narcosis, nausea or asphyxiation. Contact with rapidly expanding gas may cause burns or frostbite. Occupational limit of 1000 ppm ⁹	NA	NA	less than threshold
	ethylene	74-85-1	1038 & 1962	0.01	4.5	Physical state: gas, colour: colourless, odour: waxy, critical temperature: 10.0 deg C, specific garvity 0.61 (air), stability: stable and reactive with oxidizing agents ¹⁰	Inhalation of this product may cause dizziness, an irregular heartbeat, narcosis, nausea or asphyxiation. Contact with rapidly expanding gas may cause burns or frostbite. Occupational limit of 1000 ppm ¹⁰	Not carcinogenic, possibly mutagenic, causes long term damage to the heart and kidney. ¹⁰	NA	less than threshold

Appendix B-3: Preliminary Chemical Inventory										
EC category	Substance	CAS	UN number	Concentration (%)	Threshold amount (tonnes)	Properties	Acute	Human toxicity Chronic	aquatic toxicity	amount stored at Site
inhalation	mercury	7439-97-6	2809	N/A	1	Mercury is a dense silver-white metal that is liquid at room temperature and is characterized by low electrical resistivity, high surface tension, and high thermal conductivity. The two properties that largely determine the environmental behaviour of mercury are the high vapour pressure of liquid mercury, yielding hazardous vapour concentrations, and the relative insolubility of ionic and organic forms. The vapour pressure of mercury is highly dependent on temperature, and the tendency of liquid mercury to form small droplets increases its rate of evaporation. ¹¹	Mercury, in its elemental form, is a liquid metal that can form a vapour at room temperature. Inhaling mercury vapours or ingesting mercury can cause serious injury or death. The body is able to excrete mercury slowly; if the level of exposure is not too high, recovery can take place following accidental or short-term exposure. High levels of exposure may cause birth defects, permanent brain or kidney damage, and death. 14 ug/m ^{3 11}	The health effects of low-level exposure include neurological damage, reproductive system damage, behavioural problems and learning disabilities. TDI = 0.003 mg/kg/day; TC = 0.00006 mg/m ^{3 11}		less than threshold
	hydrogen sulphide	7783-06	1053	0.1	4.5	Pure hydrogen sulphide is slightly heavier than air and may collect in low spots under certain conditions. H ₂ S is soluble in water and hydrocarbons. Any H ₂ S gas that comes out of solution will collect in the head spaces of tanks, pipes and vessels containing sour liquids, liquid sulfur and solid sulfur. When H ₂ S is mixed with some light hydrocarbons such as methane, the mixture can be lighter than air. When mixed with heavier hydrocarbons, such as NGL, the mixture is much heavier than air. Pure hydrogen sulphide is flammable in air at 40,000 ppm (4 per cent) or higher. ¹²	Hydrogen sulphide is extremely toxic at very low concentrations. More than 100 parts of H ₂ S per million parts of air (100 ppm) is Immediately Dangerous to Life and Health (IDLH) for exposures of 30 minutes or more. Exposure to more than 10 ppm for eight hours, or more than 15 ppm for 15 minutes, may irritate the eyes, nose and throat. The Occupational limit is set at 10 ppm.	NA	NA	less than threshold
	methyl mercaptan	74-93-1	1064	0.1	4.5	Physical state: gas, colour: colourless, odour: rotten cabbage, critical temperature: 196.9 deg C, specific garvity 1.6 (air), stability: stable and reactive with oxidizing agents ¹³	May be fatal if inhaled, occupational limit of 0.5 ppm ¹³	NA	NA	less than threshold
	sulphur dioxide	2025884	1079	0.1	2.27	Sulphur dioxide (SO ₂) is a colorless gas that smells like burnt matches. It can be chemically transformed into acidic pollutants such as sulphuric acid and sulfates (sulphates are a major component of fine particles). SO ₂ is generally a byproduct of industrial processes and burning of fossil fuels. ¹⁴	Inhaling sulfur dioxide is associated with increased respiratory symptoms and disease, difficulty in breathing, and premature death. 8-hour limit of 300 ug/m ^{3 15}	Inhaling sulfur dioxide is associated with increased respiratory symptoms and disease, difficulty in breathing, and premature death. Annual limit of 60 ug/m ^{3 15}	NA	less than threshold
	nitric oxide (nitrogen monoxide)	10102-43-9	1660	0.1	4.5	Physical state: gas, colour: colourless, odour: irritating odour, critical temperature: -93.15 deg C, specific garvity 1.04 (air), stability: stable and reactive with oxidizing agents ¹⁶	Severely irritating to eyes. Risk of serious damage to eyes. Contact with rapidly expanding gas may cause burns or frostbite. Irritating to skin. Contact with rapidly expanding gas may cause burns or frostbite. Very toxic by inhalation. Occupational limit of 25 ppm. ¹⁶	May cause damage to the following organs: blood, lungs, mucous membranes, upper respiratory tract, skin, eyes, central nervous system (CNS), nose/sinuses, throat. ¹⁶	NA	less than threshold
	nitrogen dioxide	10102-44-0	1067	0.1	1.13	Nitrogen dioxide (NO ₂) and nitric oxide (NO), collectively referred to as nitrogen oxides (NO _x), are emitted to the atmosphere from high-temperature combustion processes (car engines, power plants, industrial processes). Although primarily emitted as NO, NO ₂ is rapidly formed when NO reacts with ozone (O ₃) and volatile organic compounds (VOC). The major sources of NO ₂ in Canada are on-road and off-road vehicles, the oil and gas industry and the use of fuel for electricity generation and heating. ¹⁷	NO2 has adverse health effects. It can irritate the lungs, decrease lung function and increase susceptibility to allergens for people with asthma. 1-hour limit 400 ug/m ^{3 15}	NO2 has adverse health effects. It can irritate the lungs, decrease lung function and increase susceptibility to allergens for people with asthma. Annual limit 100ug/m ^{3 15}	NA	less than threshold

Appendix B-3: Preliminary Chemical Inventory

EC category	Substance	CAS	UN number	Concentration (%)	Threshold amount (tonnes)	Properties	Acute	Human toxicity Chronic	aquatic toxicity	amount stored at Site
non-scheduled substances	methyl diethanolamine (MDEA)	105-59-9	NA	NA	NA	Physical state: liquid, colour: colourless, odour: irritating odour, critical temperature: 138 deg C, specific garvity 4.01 (air), stability: stable and reactive with halogenated solvents ¹⁸	May cause severe irritation with corneal injury which may result in permanent impairment of vision, even blindness. Chemical burns may occur. Prolonged contact may cause moderate skin irritation with local redness. Repeated contact may cause skin burns. Symptoms may include pain, severe local redness, swelling, and tissue damage. May cause more severe response if skin is abraded (scratched or cut). May cause more severe response on covered skin (under clothing, gloves). ¹⁸	NA	Bioconcentration potential is low (BCF less than 100 or log Pow less than 3). Potential formobility in soil is very high (Koc between 0 and 50). Material is slightly toxic to aquatic organisms on an acute basis (LC50/EC50 between 10 and 100 mg/L in the most sensitive species tested). ¹⁸	150 m ³
	petroleum oil lubricants		NA	NA	NA	Physical state: viscous liquid, colour: black, odour: petroleum odour, specific garvity 0.8 (water), stability: stable ¹⁹	No known significant effects or critical hazards ¹⁹	No known significant effects or critical hazards	NA	600 m ³
	Glycol	107-21-1	NA	NA	NA	Physical state: liquid, colour: black, odour: odourless, specific garvity 1.118 (water), vapour density 3.65 (air), stability: stable ²⁰	No known significant effects or critical hazards ²⁰	In humans, effects have been reported on the following organs: Kidney. Gastrointestinal tract. In humans, symptoms may include: Headache. Nausea and/or vomiting. Abdominal discomfort ²⁰	NA	to be determined
	Diesel oil	64742-81-0	NA	NA	NA	Physical state: bright oily liquid, colour: clear to yellow, odour: mild petroleum, specific garvity 0.8 (water), vapour density 4.5 (air), stability: stable, reacts with oxidizing agents and acids ²¹	Inhalation of this product may cause respiratory tract irritation and Central Nervous System (CNS) Depression, symptoms of which may include; weakness, dizziness, slurred speech, drowsiness, unconsciousness and in cases of severe overexposure; coma and death. ²¹	Diesel engine exhaust particulate is probably carcinogenic to humans (IARC Group 2A) ²¹	NA	200 m ³
	tri-sodim phosphate	10101-89-0	NA	NA	NA	Physical state: soilid, colour: white powder, odour: NA, stability: stable, reacts with acids and magnesium ²¹	Inhalation of product may aggravate existing chronic respiratory problems such as asthma, emphysema or bronchitis. Skin contact may aggravate existing skin disease.	Inhalation of product may aggravate existing chronic respiratory problems such as asthma, emphysema or bronchitis. Skin contact may aggravate existing skin disease.	NA	10 tonnes

NA - Not available in literature search

¹ Air Liquide MSDS sheet 2011

² Fortis BC MSDS sheet 2011

³ Air Liquide MSDS sheet 2011

⁴ Petro-Canada MSDS sheet 2012

⁵ Petro-Canada MSDS sheet 2012

⁶ Health Canada. 2009. Guidelines for Drinking Water Quality Guideline Technical Document

⁷ Canadian soil quality guidelines for the protection of human and environmental health. 2004. Benzene.

⁸ AirLiquide MSDS sheet 2011

⁹ Air Liquide MSDS 2011

¹⁰ Air Liquide MSDS 2011

¹¹ Canadian soil quality guidelines for the protection of human and environmental health. 1999. Mercury.

¹² CAPP Occupational Health and Safety of H₂S. 2003.

¹³ Air Liquide MSDS sheet 2011

¹⁴ <http://www.ec.gc.ca/toxiques-toxics/default.asp?lang=En&n=22B1EA72-1>

¹⁵ <http://novascotia.ca/just/regulations/regs/envairqt.htm>

¹⁶ Airgas MSDS 2013

¹⁷ <http://www.ec.gc.ca/indicateurs-indicators/default.asp?lang=en&n=C8BFC3F2-1>

¹⁸ Dow Chemical MSDS sheet 2007

¹⁹ Petro-Canada MSDS sheet 2010

²⁰ MEGlobal MSDS sheet 2013

²¹ Petro-Canada MSDS 2013

²² cleartech MSDS 2011