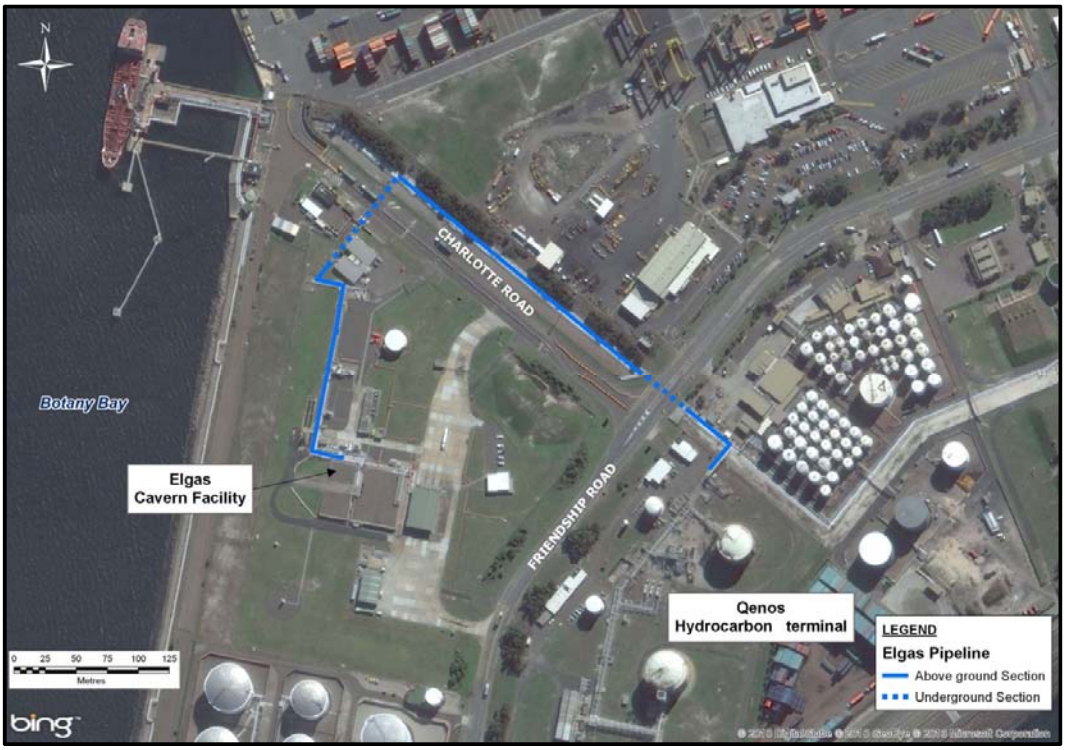
Environmental Assessment

For the ELGAS Liquid Petroleum Gas Storage Cavern Facility Proposed Modification – Liquid Petroleum Gas (LPG) Pipeline (DA No. 463-93 MOD1)



31 January 2014

KBR

ENVIRONMENTAL ASSESSMENT

ELGAS Cavern Facility Proposed Modification - Liquid Petroleum Gas Pipeline (DA No. 463/93 MOD 1)

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Acknowledgments

NSW Ports Corporation

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Revision History

Revision	Date	Comment	Signatures		
			Originated by	Checked by	Approved by
A	22/10/13	Internal Review	C. O'Riordan	T. Burdett	R. Brown
B	29/10/13	Draft for Client Comment	C. O'Riordan	L. Mottee	R. Brown
C	14/01/14	Draft for Comment	L. Mottee	R. Hunt	R. Brown
0	21/01/14	Final for External Comment	L. Mottee	R. Hunt	R. Brown
1	31/01/14	Final Incorporating Comments	L. Mottee	R. Hunt	R. Brown

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APPENDICES

Terms

Acronym	Definition
ADG	Australian Dangerous Goods Code
AHD	Australian Height Datum
AHIMS	Aboriginal Heritage Information Management System
BLB	Bulk Liquids Berth
CEMP	Construction Environmental Management Plan
CHAZOP	Control systems Hazard and Operability Study
CLM Act	*Contaminated Land Management Act 1997*
CO_2e	Carbon dioxide equivalent
DECC	Department of Environment and Climate Change NSW
DGR	Director General's Requirements
EA	Environmental Assessment
EP&A Act	*Environmental Planning and Assessment Act 1979*
EP&A Regulation	*Environmental Planning & Assessment Regulation 2000*
EPA	Environment Protection Authority (NSW)
EPL	Environment Protection Licence
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
Frac-out	A frac-out is caused when excessive drilling pressure results in drilling mud propagating toward the surface
GMZ	Groundwater Management Zone
HAZCON	Hazards in Construction
HAZOP	Hazard Operability Study
HIPAP	Hazardous Industry Planning Advisory Paper
HIRAC	Hazard Identification, Risk Assessment and Control
LEP	Local Environmental Plan
LOPA	Layer of Protection Analysis Study
LPG	Liquefied Petroleum Gas
MAEs	Major Accident Events
M b ToC	Meters below Top of Casing

MHF	Major Hazard Facility
NB	Nominal Bore
NPW Act	*National Parks and Wildlife Act 1974*
OEH	Office of Environment and Heritage
OHS Act	*Occupational Health and Safety Act 2000*
PIRMP	Pollution Incident Response Management Plan
PHA	Preliminary Hazard Analysis
QRA	Quantitative Risk Assessment
RMS	Roads and Maritime Service
SC Act	Soil Conservation Act 1938
SEPP 2013	State Environmental Planning Policy (Port Botany and Port Kembla) 2013
SEPP 33	State Environmental Planning Policy No. 33 Hazardous and Offensive Development
SEPP 55	State Environmental Planning Policy No.55 Remediation of Land
SIS	Species Impact Statement
TSC Act	*Threatened Species Conservation Act 1995*
WM Act	*Water Management Act 2000*

Certification

I, Catherine O'Riordan, am the author of the Environmental Assessment for the *ELGAS Cavern Facility Proposed Modification - Liquid Petroleum Gas Pipeline (DA No. 463/93 MOD 1)* and certify that the information contained within the document is neither false nor misleading.

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Executive Summary

As part of a proposal to supply Qenos Port Botany with Liquefied Petroleum Gas (LPG), ELGAS is proposing to build a new LPG pipeline to connect the ELGAS Cavern Facility to the Qenos Hydrocarbon Terminal at Port Botany. Qenos uses propane as a backup feedstock to supplement the ethane supply to the Qenos Olefines Plant, located in the Port Botany Industrial Park. The new pipeline will reduce the cost of Qenos feedstock and improve plant supply security.

The proposed pipeline alignment runs from the ELGAS site along the existing Charlotte Road NSW Ports Pipeline Corridor and under Friendship Road to the Qenos Terminal via the existing Pipeline Corridor road culvert. In order for the pipeline to reach this corridor from the ELGAS Cavern Facility, the pipeline route will be horizontally bored from behind the administration building to beneath Charlotte Road.

An approval pathway for the works has been agreed with the Department of Planning & Infrastructure; the proposed pipeline will be assessed under the existing consent for the ELGAS Cavern Facility (Randwick Council Application No 463/93). The existing development has a Part 4 development consent that is proposed to be modified under Section 75W of the *Environment Planning & Assessment Act 1979*. The proposed modifications are for the construction and operation of a pipeline to transport LPG from ELGAS's existing Cavern Facility to Qenos Hydrocarbon Terminal at Port Botany and associated infrastructure (DA No. 463/93 MOD 1).

Under Section 75W, a set of requirements to inform an Environmental Assessment (EA) of the proposed modifications has been issued by the Director-General. This included a set of general requirements for the environmental assessment as well as highlighting key issues to be considered in the assessment. Key issues for consideration addressed in the EA include hazards and risk; soil and water; noise and vibration; air quality; traffic and transport; waste management; and greenhouse gas.

Consultation with relevant government and non-government stakeholders was also carried out in line with the Director General's Requirements (DGR's) to address any concerns or issues with the proposed pipeline.

The assessment considered the existing environment, the potential for likely impacts and the significance of any impacts based on consequence and likelihood of those impacts occurring. A Preliminary Hazard Analysis was also completed to address the potential hazards and risks of the proposed modification works. Given the scope of the project, the potential environmental impacts identified are minimal and considered manageable under general best practice for site construction. In line with the DGR's a statement of commitments outlining the proposed environmental management and monitoring measures have been included in the EA.

1 Introduction

1.1 PROJECT BACKGROUND

ELGAS is a leading provider of Liquefied Petroleum Gas (LPG) and operates Australia's largest LPG storage facility at Port Botany, NSW. The ELGAS Sydney LPG Cavern Facility occupies 7.1 hectares and is located on the north-western edge of Molineux Point, Port Botany. The facility, which operates 24 hours per day, 365 days a year, was designed in the 1990's and commissioned in 2000 and operates as a storage and distribution terminal for bulk LPG, and industrial gases in cylinders. Bulk LPG is stored on site in large underground caverns and filled into road tankers for distribution to customers or transferred to LPG ships for redelivery to other sea terminals. Industrial gases are stored on site in cylinders and distributed locally to customers.

As part of a contract arrangement to supply the Qenos Hydrocarbon Terminal (Qenos Port Botany) with LPG a new pipeline from the ELGAS Cavern Facility will be constructed to the Qenos Hydrocarbon Terminal. Through this connection, ELGAS will be able to supply propane from the Cavern Facility to the Qenos Olefines Plant.

Qenos uses propane as a backup feedstock to supplement their ethane supply to the Olefines Plant. The connection of the Cavern to the Olefines Plant will reduce Qenos LPG feedstock cost, improve the Olefines plant supply security and allow closure of the Qenos Hydrocarbon Terminal LPG storage tanks, thus improving utilisation of land in the port area.

An application to modify the existing consent of the ELGAS Cavern Facility will be submitted for the proposed pipelines. This Environmental Assessment (EA) will support the application.

1.2 SCOPE OF ENVIRONMENTAL ASSESSMENT

The scope of this EA is to undertake an assessment of the potential environmental impacts of the construction and operational phases of the project. The assessment is required to meet the Director-General's requirements (DGR's), contained in Appendix A, for an Environmental Assessment which is to be assessed under the Section 75W of the *Environment Planning and Assessment Act 1979* (EP&A Act).

The DGR's for the project required the following key areas to be reviewed as part of the EA:

- Hazards and Risk
- Soil and Water
- Noise and Vibration
- Air Quality

- Traffic and transport
- Waste Management
- Greenhouse Gas.

In completing this assessment, the EA will identify the significance of potential impacts arising from the works and identify the mitigation measures required to avoid or minimise potential impacts.

The key objectives of the EA are to:

- Describe the project and scope of works required to deliver the project.
- Describe the values of the surrounding environment in order to quantify and qualify the predicted impacts.
- Identify the likely impacts to be generated during the construction and operational phases of the proposed modification works and the significance of those impacts to the environmental values.
- Proposed measures to mitigate significant impacts in line with relevant planning policy and legislation.

1.2.1 Assessment methodology

To determine the existing environmental condition of the values identified in the DGRs requirements, a desktop review of existing reports pertaining to the site and other publically available resources on the general environment has been undertaken.

Based on the proposed scope of construction and operational works, potential impacts to the local environment have been identified.

The consequence of each impact was evaluated based on the sensitivity of the environmental value, the magnitude and duration of the impact, and whether the impact will be reversible. Details on consequence ratings is shown in Table 1.1.

A risk matrix to compare consequence against likelihood of the impact occurring was used to determine the significance of the impact (Table 1.2).

Environmental aspects that were not raised in the DGR's but were considered in the assessment, such as impacts on flora and fauna and heritage, have been included for completeness. The outcome of the environmental risk assessment is provided in Appendix E.

A Preliminary Hazard Analysis (PHA) in the form of a Quantitative Risk Assessment (QRA) has been prepared in accordance with the NSW Hazard Industry Planning Advisory Papers (HIPAPs) as per the DGR's which covers potential environmental and safety risks of the project in more detail and is summarised in Section 5 and included in Appendix D.

Table 1.1 Environmental Consequence Categories

Insignificant	Insignificant damage with no discernible impact upon the environment or public amenity value
Minor	Insignificant damage or impact, restoration expected within 1 day.
Moderate	Short-term or controllable damage upon the natural environment or public amenity value, restoration expected within 1 day to 1 month. Tier 3 (PIN) prosecution under POEO or equivalent prosecution under other environmental acts and regulations
Major	Medium term damage or effect upon the natural environment, restoration expected within 1 month to 2 years. Effect on public amenity generates complaints. Tier 2 prosecution under POEO or equivalent prosecution under other environmental acts and regulations.
Catastrophic	Long term damage or effect upon the natural environment, restoration likely to exceed 2 years. Effect on public amenity is long term. Tier 1 prosecution under the POEO Act or equivalent prosecution under other environmental acts and regulations; significant public health effects or death.

Table 1.2 Risk Matrix

	Likelihood Rating				
Consequence Rating	**Rare** Only in exceptional circumstances	**Unlikely** Not likely to occur	**Moderate** Could occur, less than 50% likelihood	**Likely** Is known to occur	**Almost certain** Common or frequent occurrence
Insignificant	Low	Low	Medium	Medium	High
Minor	Low	Low	Medium	Medium	High
Moderate	Low	Medium	Medium	High	High
Major	Medium	Medium	High	High	Critical
Catastrophic	Medium	High	High	Critical	Critical

2 Project Description

2.1 SITE DESCRIPTION

The ELGAS Cavern Facility is located on the north western edge of Molineux Point, which extends into Botany Bay. The facility is bounded to the west by Fishburn Road, to the north by Charlotte Road and the east by Friendship Road. An import/export/distribution facility for Vopak Terminal Sydney bounds the southern boundary of the ELGAS Cavern Facility. A Bulk Liquids Berth (BLB) runs adjacent to Fishburn Road and is a shared facility used by Origin, Terminals, Vopak, Qenos as well as ELGAS.

The Qenos Hydrocarbon Terminal is located directly to the east of the ELGAS site on the eastern side of Friendship Road.

The general setting is highly industrialised, a mixture of hard standings, roads and landscaped green space. Figure 2.1 shows an overview of the site and surrounding uses.

2.2 SURROUNDING LAND USE

Port Botany is located on the north-eastern edge of Botany Bay, approximately 12km south-east from Sydney's Central Business District. The port is the major NSW port for the handling of containers, bulk liquids and petrochemicals with Sydney's international and domestic airports located nearby to the north.

The ELGAS Cavern site is located in an industrial zoned area, with the nearest residential premises being the caretaker's residence at the Botany cemetery, which is located approximately 1.4km away. The closest residential properties to the south-east are located in Yarra Road and Elaroo Avenue, Philip Bay, approximately 1.8 km away from the ELGAS site across Yarra Bay (EMS, 2013).

2.3 NEED FOR THE PROPOSED MODIFICATION

Neighbouring operator at Port Botany, Qenos, are proposing in the near future to demolish two existing aboveground storage tanks at their Hydrocarbon Terminal at Port Botany. The tanks at the Hydrocarbon Terminal are utilised by Qenos to store propane and butane, which is transported by pipeline to the Qenos Olefines plant on the Botany Industrial Park site. The tanks are currently planned to be demolished to provide the land back to NSW Ports as the land manager at the Port who require the land.

Thus, Qenos require a reliable and fast replacement source for LPG. ELGAS have entered into a contract with Qenos to supply LPG to Qenos on demand to ensure their supply requirements for the Olefines plant at the Botany Industrial Park are met.

2.3.1 Alternatives

The alternatives and options considered for the project are described below.

Option 1 - Do Nothing

Qenos requires a reliable on demand supply of LPG to conduct its operations at present. As Australia's sole manufacturer and leading supplier of polyethylene and polymers, ensuring LPG is supplied to their plant is of importance to their organisation as well as the wider economy. Future demands for the supply of LPG by their operations require a greater, faster and more reliable supply so the 'Do Nothing' option is not considered a viable long-term option. Qenos is also under pressure to rationalise operations in the Port Botany area by the land manager, NSW Ports, and the provision of LPG via the new pipeline is the only viable method to secure their demand requirements.

Option 2 - Direct Pipeline

A direct pipeline option was considered from the ELGAS Cavern Facility to the Qenos Hydrocarbon Terminal as the shortest route, directly underneath Friendship road. However, in order to construct the pipeline along this route, there would potentially be a significant impact to the environment, given the depths of underbores required to avoid facilities. Excavation would not be an option given the existing neighbouring facilities and heavily trafficked roadways. Therefore, this option was not considered economically or environmentally viable.

Option 3a - Pipeline using Charlotte Road

The co-location of the pipeline within the Charlotte Road NSW Ports Pipeline corridor was considered the preferred option for the project. Utilising existing pipeline corridor presents the least engineering and environmental constraints and would be the simplest construction methodology. Only one shorter bore would be required. The use of the pipeline corridor would also provide easy access without disrupting traffic at the Port during construction and maintenance.

Option 3b – Pipeline using Charlotte Road with Pumps

An additional option considered for the co-location of the pipeline within the Charlotte Road NSW Ports Pipeline corridor included the use of pumps in the operation. However, engineering investigations determined the process could be simplified by removing the requirement for the pumps. This would reduce the likelihood of potential safety and environmental risks, as well as, reduce the energy required to operate the pipeline. Therefore, Option 3a was selected as it would satisfy the needs of the project and has minimal environmental impacts, whilst maximising design and construction efficiency.

2.4 SCOPE OF WORKS

The proposed ELGAS to Qenos pipeline consists of a 150mm diameter pipeline (schedule 80 low temperature carbon steel) connecting the ELGAS Cavern Facility to the Hydrocarbon Terminal, with tie-in points inside the ELGAS and Qenos Hydrocarbon Terminal site boundaries. The proposed pipeline is to be mostly aboveground and located inside the current Charlotte Road NSW Ports Pipeline corridor located on the eastern side of Charlotte Road.

The pipeline will run parallel and adjacent to the existing pipelines (owned by others) within the Pipeline corridor. The proposed pipeline is shown on Figure 2.2 below. More detailed design drawings of the proposal are provided in Appendix B. Note the design drawings have been annotated following the engineering investigations to remove the pumps. The drawings will be made final once the works have been approved.

The pipeline is to cross underneath Charlotte Road via a horizontally drilled underbore (at an approximate depth of 2.5 to 3 m below grade). The pipeline then crosses below ground under Friendship Road via the existing Pipeline Corridor road culvert. Cathodic protection would be provided to the buried pipeline.

No flanged connections are proposed in the pipeline between the ELGAS and Qenos Hydrocarbon Terminal site boundaries. The pipeline is to be fully welded.

The contract with Qenos requires ELGAS to supply LPG to Qenos at a rate of up to 30 tph, and at a pressure of 1,950 kPa at the Qenos Hydrocarbon Terminal site boundary. The pipeline is to have automated actuated valves at each company site's battery limits. There will be a custody flow meter located at ELGAS. The pipeline will connect into existing pipelines within the boundary of the Qenos Hydrocarbon Terminal, complete with interconnecting pipework, control devices, flowmeter, and emergency isolation valving, so as to deliver the LPG from the ELGAS site.

The entire operation is proposed to be automated and controlled from the ELGAS Control Room at the existing Cavern facility. The current ELGAS Distributed Control System, ESD system, gas system and fire system would be configured for the new pipeline operation. During operation of the pipeline, an ongoing maintenance requirement is proposed for the pipeline, as well as testing of the cathodic protection on the pipeline.

Figure 2.1 Port Botany Overview

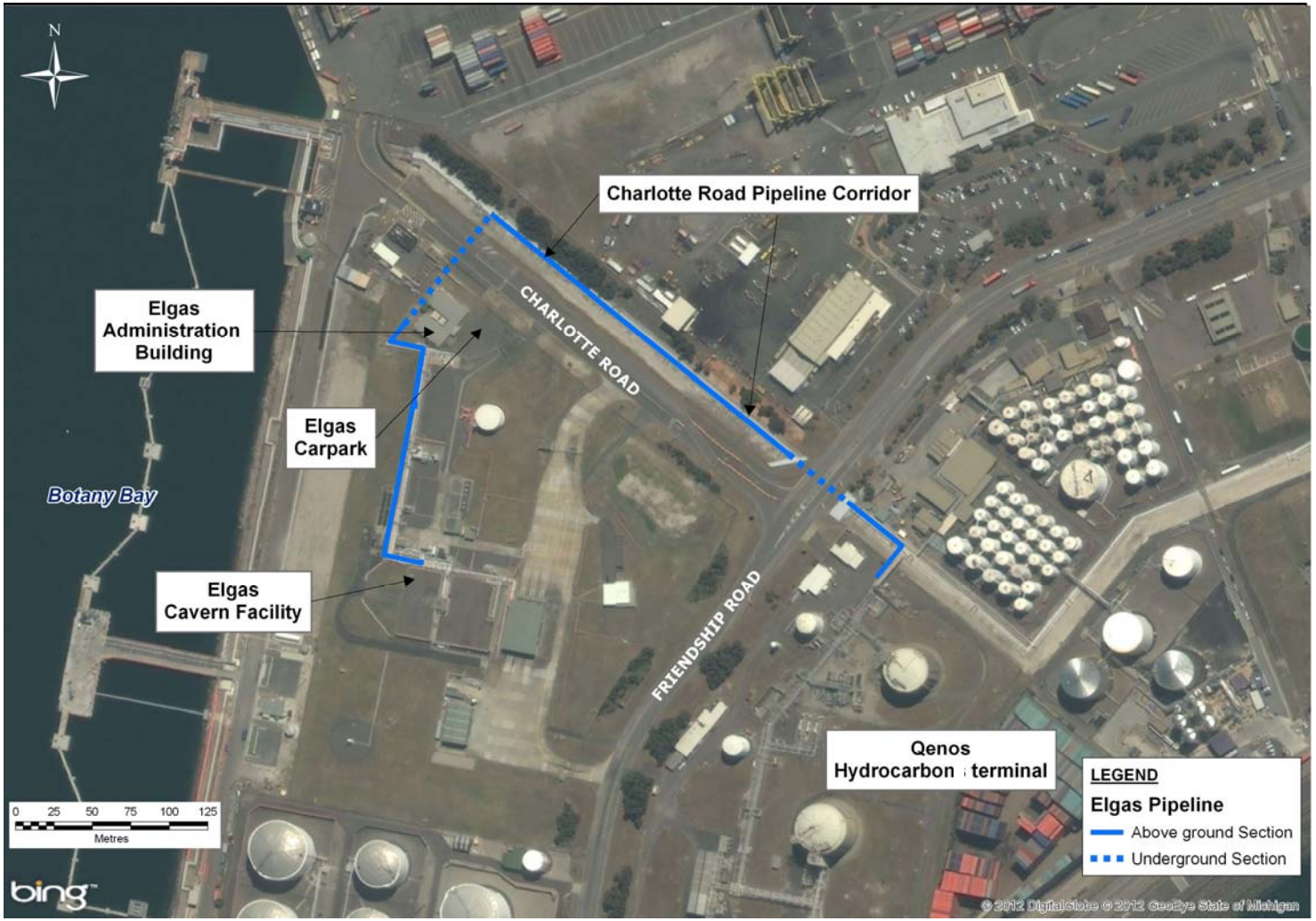

Figure 2.2 Project Overview

2.5 WORK METHOD

2.5.1 Construction Corridor

The majority of the pipeline is to be installed above ground along the Charlotte Road NSW Ports Pipeline corridor, located on the eastern side of Charlotte Road. Preparation work will be undertaken in the NSW Ports Pipeline Corridor prior to the installation of the pipe sections.

2.5.2 Proposed methodology for horizontal drilling

The pipeline is to be horizontally drilled under Charlotte Road to a depth of 2.5m to 3m below grade. An entry trench (11 m x 3 m x 1 m) (referred to as the launch pit) will be excavated on the ELGAS side of the proposed underbore and a receiver pit (3 m x 3 m x 3 m) excavated on the Pipeline Corridor of the proposed underbore. The horizontal boring machine would drill the required hole (350 mm NB x 120 m long) under the roadway from pit to pit. Once the hole is drilled the outer pipe sleeve will be pulled through and then the inner pipeline pulled in through the sleeve.

The excavated soil from the horizontal drilling is to be collected within the launch pit and removed to a nominated stockpile area. All excavated soil is to be tested to determine if it is suitable for backfill once drilling works are complete. If soil is not suitable, it would be removed off-site for disposal.

2.6 EQUIPMENT AND MATERIALS

Construction vehicles on-site during the construction period will include;

- delivery trucks (including semi-trailers);
- cranes, including Franna cranes which have a lifting capacity between 10 to 25 tonnes;
- backhoes and personnel vehicles; and
- horizontal drilling machine to bore the pipeline under Charlotte Road.

Key materials to be used during construction would include pipe materials and fittings.

2.7 CONSTRUCTION PROGRAM

The construction program includes the following elements (estimate of time in brackets):

- Civil construction (2 months)
- Mechanical (5 months)
- Horizontal drilling works (1.5 months)
- Electrical works (3 months)
- Commissioning works (1 month part-time).

All of these activities would occur in parallel with each other. Once the tender is awarded, the timeframes for construction would be confirmed and construction will commence. Works are to be undertaken in the hours from 6:00am to 6:00pm Monday to Friday and Saturday 6:00am to 4:00pm. Noisy works are to be scheduled during standard construction hours as per the EPA *Interim Construction Noise Guideline* (DECC 2009) between 7:00am to 6:00pm Monday to Friday and Saturday 8:00am to 1:00pm to minimise impacts upon the surrounding environment. No works will be undertaken on Sundays or on Public Holidays.

The number of personnel will vary with the different stages of construction, from four (4) to a maximum of 16 personnel.

3 Planning and Legislative Framework

3.1 PLANNING CONTEXT AND LEGISLATIVE CONSIDERATIONS

The following section provides details of the relevant State and Commonwealth legislation and a discussion of the application of these provisions to the proposed Section 75W modifications, being the construction and operation of a pipeline to transport liquid petroleum gas (LPG) from ELGAS's existing LPG Cavern facility at Port Botany to the Qenos Hydrocarbon Terminal at Port Botany and associated infrastructure.

3.2 PLANNING CONTEXT

3.2.1 Environmental Planning and Assessment Act 1979

The *Environmental Planning & Assessment Act 1979* (EP&A Act) is the prevailing planning legislation that applies to all development and environmental assessment within NSW.

Under the EP&A Act, there are two avenues of approval:

- Part 4 – development requiring consent under an environmental planning instrument (typically a local environmental plan but occasionally the Minister for Planning).
- Part 5 – activities that are permissible without development consent under an environmental planning instrument (i.e. that do not fall under Part 4).

The existing development has a Part 4 development consent that is to be modified under Section 75W of the EP&A Act to allow the proposed gas pipeline and storage.

An application will be needed for a proposed modification to an existing development consent under the now repealed Section 75W of the EP&A Act. In this respect, an application can be made to the Minister for Planning for a Modification of Consent to Part 3A approvals under certain transitional arrangements which are discussed below.

Section 75W Modification of Consent

Existing Development Consent

The determination of the original development application was made pursuant to Section 101 of the EP&A Act on 5 May, 1994 by the Minister for Planning. The application was made by Skymill Pty Ltd to Randwick City Council in respect of the following:

- Lot 2, DP 815358, corner of Friendship and Charlotte Roads. Lot 3, DP 815358, corner of Friendship and Simblist Roads, Molineux Point, Port Botany. It was for the development of underground storage caverns for storing and distributing Liquefied Petroleum Gas (LPG) together with associated excavation. (Randwick Council Application No 463/93).

- Approval was granted for the development of two underground storage caverns, however, ELGAS proceeded with the construction of a single underground storage cavern at Lot 2, DP815358 which is the cavern currently in use at Port Botany and the subject of this modification application.

Proposed Section 75W Modifications - Liquid Petroleum Gas Pipeline

The proposed modifications are for the construction and operation of a pipeline to transport liquid petroleum gas (LPG) from ELGAS's existing LPG Cavern facility at Port Botany to Qenos Hydrocarbon Terminal at Port Botany and associated infrastructure. The location of the proposed modifications is at the corner of Friendship Road and Charlotte Road, Port Botany in the Randwick Local Government Area. The modification application number is DA No. 463/93 MOD 1.

As part of the application for modification of consent under Section 75W of the EP&A Act, the Director General has issued Director General's Requirements (DGRs), as provided in Appendix A. The application is to be accompanied by this EA of the proposed modifications.

Schedule 6A Transitional Arrangements

Schedule 6A of the EP&A Act states transitional arrangements for the repeal of Part 3A of the EP&A Act. Clause 12 of Schedule 6A states that Section 75W of Part 3A continues to apply to modifications of the development consents referred to in Clause 8J(8) of the *Environmental Planning and Assessment Regulations 2000* (the Regulations), whether an application for modification is made before or after the commencement of the clause.

Clause 8J(8) Transitional Provisions of the Regulations states:

> *"for the purposes only of modification, the following development consents are taken to be approvals under Part 3A of the Act and section 75W applies to any modification of such a consent:*
>
> *(a) a development consent granted by the Minister under section 100A or 101 of the EP&A Act;"*

Therefore, these transitional arrangements apply to the proposed modifications and an application can be made to modify the existing determination made under Section 101 of the EP&A Act.

In determining whether changes to a project warrant a separate approval process or a modification under Section 75W, consideration must be given to the proposed modifications and any changes to the environmental impacts associated with the changes.

The existing approval is for the development of underground storage caverns for the storage and the distribution of LPG. The proposed storage and distribution pipeline is an extension of the approved activity in that it is for distribution of LPG to the Qenos site using a stored gas pipeline. This pipeline is kept full so that Qenos has immediate access to LPG when required, rather than having to wait for the pipeline to be pressurised each time gas is required. Therefore, from a "use" perspective, the pipe is limited to being a distribution pipeline as envisaged in the original approval. The existing approval needs to be modified to allow this extra distribution pipe to be added to the existing storage and distribution system.

In view of the scope and scale of the proposed modifications, the proposed development is not considered a significant deviation from the currently approved operations and Section 75W is the appropriate pathway for approval.

Ports Lessor/NSW Ports Land

The land on which the proposal is planned is subject to a 99 year lease from the Port Lessor to NSW Ports, who is the land manager and leases the land to ELGAS. The Section 75W planning pathway requires consent from the land owner, the Port Lessor. NSW Ports is responsible for managing this aspect of the approval and prior to lodgement of the EA with DPI, will review the documentation and obtain the signature from the Port Lessor. As part of the assessment preparation, NSW Ports also requires that all development considers the *Port Botany Development Code October 2013* (NSW Ports, 2013) and the Green Port Guidelines (Sydney Ports Corporation, 2006). Further detail on how the proposal has considered these requirements is discussed below.

Port Botany Development Code October 2013

The *Port Botany Development Code October 2013* (the Code) (NSW Ports, 2013) has been developed by NSW Ports to ensure that the Port Botany precinct is developed and managed in line with the NSW Ports strategic vision to 'manage and develop its port land and port-related infrastructure in a safe, secure, efficient and environmentally responsible manner to cater for the import and export demands of the NSW economy'. The purpose of the Code is to (NSW Ports, 2013, p. 2)

- *"articulate NSW Ports' design and operational requirements for all new development in a consolidated document;*
- *set minimum standards for design and operation of new development at Port Botany; and*
- *provide a guide for consent authorities to assess and determine new development at Port Botany."*

A number of key assessment areas for consideration incorporating objectives and criteria are provided in the Code which new development must demonstrate compliance with. A review of the Code undertaken as part of this assessment shows that the majority of key assessment areas do not apply to the proposed modification works due to the minor nature of the works proposed. Three key assessment areas have been identified in consultation with NSW Ports on 24 January 2014, as applicable are as follows:

- Section 10 - Safety and Hazard Management
- Section 15 - Contamination and Acid Sulfate Soils
- Section 16 - Groundwater Management Zone (Elgas Deed)

Detail of how the proposed modification and EA have addressed the above criteria as per the Code is provided in Appendix F.

Nevertheless, wherever possible the EA has also recommended that the CEMP includes the best practice Water Quality and Stormwater, Noise and Vibration and Air Quality management practices which are detailed in Section 11, 12 and 14 of the Code.

Green Port Guidelines

The Green Port Guidelines (Sydney Ports Corporation, 2006) (the Guidelines) have been prepared as guidance in preparing sustainable strategies for port developments and operations. The aim of the Guidelines is to 'encourage port developers and operators to adopt sustainable business approaches and encourage innovation in design and operation'. A checklist has been developed to accompany the Guidelines which provides practices and strategies to demonstrate how developments can be environmentally friendly and commercially viable.

NSW Ports requires that the Green Port Guidelines are consulted 'during the planning and application stages of a new project and operation or activity at the port' and suggestions incorporated into development. Furthermore, it is required that in order to demonstrate compliance with the Guidelines, the Green Port Guidelines Checklist must be completed so that NSW Ports can assess the extent to which the Guidelines have been addressed. In preparing this EA the Green Port Guidelines Checklist has been completed and is provided in Appendix G.

It should be noted that while ELGAS endeavours to incorporate best practice sustainability measures as per the Guidelines in its current operations at the Port, the minor nature of these modification works limits the incorporation of further practices as recommended by the Guidelines. This is discussed further in Appendix G.

3.3 LEGISLATIVE CONSIDERATIONS

3.3.1 Protection of the Environment Operations Act 1997

The *Protection of the Environment Operations Act 1997* (POEO Act) is administered by the Environment Protection Authority (EPA) and is administered by the Environment Minister. It is the main law in NSW regulating water, air and noise pollution. Provisions for waste are also included.

The POEO Act:

- empowers regulatory authorities to issue pollution licenses for scheduled activities, (e.g. Schedule 1 activities require EPLs)
- creates a range of pollution offences and penalties
- allows regulatory authorities to enforce the POEO Act
- allows the public to take legal action to enforce the POEO Act.

The owner or occupier of premises engaged in Schedule 1 activities is required to hold an EPL and comply at all times with the conditions of that licence.

ELGAS currently holds one EPL for the site. It is listed on the NSW EPA's POEO licence website as: - ELGAS Pty Ltd Sydney LPG Cavern EPL 10698, 30 Friendship Road, Port Botany for Petroleum Products Storage and Shipping in Bulk.

The conditions attached to this licence would continue for the proposed modifications and the EPL may require updating to include the new pipeline.

Offence to Pollute Waters

The POEO Act applies a general prohibition to water pollution, i.e. all water pollution is prohibited unless it is authorised in some way.

Air Pollution

Unlike water pollution, there is no general prohibition on causing air pollution. However, the POEO Act contains a number of specific offences which regulate certain activities that result in air pollution.

Air pollution is defined as the emission into the air of any impurity, including dust, smoke, cinders, solid particles, gases, fumes, odours and radioactive substances. The residual risk of any gaseous escape of LPG is negligible due to the sealed nature of the pipeline and planned release is not required during maintenance. However, in the event of an unplanned escape from the proposed storage and distribution pipeline it would qualify as air pollution.

Noise Pollution

Unlike water pollution, there is no general prohibition on causing noise pollution. However, the POEO Act contains a number of specific offences which regulate certain activities that result in noise pollution.

3.3.2 Water Management Act 2000

The *Water Management Act 2000* (WM Act) addresses the management and interference of surface and groundwater in NSW. Under the Act, approvals are required for controlled activities. A controlled activity means:

- the erection of a building or the carrying out of a work (within the meaning of the EP&A Act);
- the removal of material (whether or not extractive material) or vegetation from land, whether by way of excavation or otherwise;
- the deposition of material (whether or not extractive material) on land, whether by way of landfill operations or otherwise; and
- the carrying out of any other activity that affects the quantity or flow of water in a water source.

Due to the low volumes of groundwater that are likely to be intercepted, the proposed pipeline is likely to be defined as a "minimal impact aquifer interference activity" and would not require further assessment as advised by the Department of Primary Industries - Office of Water (Refer to Section 4). However, should it become apparent that the proposed modifications may intercept or extract 3ML or more of water, an aquifer interference licence would be required for the works. This would be required to be monitored during the construction and operational phases and must be included in the environmental management plans for the proposed works. The *NSW Aquifer Interference Policy, 2012* prepared by the Office of Water provides guidelines on the licensing and assessment of aquifer interference activities.

3.3.3 Heritage Act 1977

Under Section 57 of the *Heritage Act 1977* (Heritage Act), an applicant would need an approval if the proposed development involves a place, building, work, relic that has an interim heritage order or listing on the NSW State Heritage Register.

In addition, under Sections 139 and 140 of the Heritage Act, an excavation permit is required for the disturbance or excavation of any relic. Any deposit, object or material evidence relating to the settlement of NSW, not being Aboriginal settlement, that is over 50 years old is classified as a relic under the Act.

There have been no historic or archaeological sites identified in the vicinity of the proposed modifications, and it is unlikely that any items of historic significance will be discovered as the land is reclaimed and previously disturbed by industry.

3.3.4 Threatened Species Conservation Act 1995

The *Threatened Species Conservation Act 1995* (TSC Act) lists threatened species, populations and ecological communities in NSW. If a threatened species, population or ecological community or its habitat is likely to occur in any area which may be affected by a development proposal, then a 'seven-part test' in accordance with Section 5A of the EP&A Act (as amended by the TSC Act) must be conducted to determine whether the proposal would have a significant impact. If it is concluded that there would be a significant impact, then a Species Impact Statement (SIS) must be prepared, and the proposal would then be subject to approval from the Director-General of the Office of Environment and Heritage.

The general pipeline corridor is cleared, heavily modified and runs through an industrial site. There has been no evidence of any listed threatened species, populations or ecological communities at the proposed modifications site.

3.3.5 National Parks and Wildlife Act 1974

The *National Parks and Wildlife Act 1974* (NPW Act) is administered by the Office of Environment and Heritage. The purpose of the Act is the conservation of:

- Nature, including habitat, ecosystems, biological diversity, landscapes and landforms.
- Objects, places or features of cultural value within the landscape including:
  - Places, objects and features of significance to Aboriginal people
  - Places of social value to the people of NSW
  - Places of historic, architectural or scientific significance.

The NPW Act also sets outs the responsibilities for the management of NSW National Parks.

If the proposed modifications are to take place in the vicinity of an Aboriginal Place or identified historic site, the potential impacts of the development must be assessed. The proposed modifications are not proposed in the vicinity of an Aboriginal place however, if identified the potential impacts of the development on an Aboriginal Place must be assessed. Under Section 90 of the NPW Act, a development must not destroy, deface or damage, or permit the destruction or defacement of, or damage to a relic or Aboriginal place. As the proposed modification works are proposed on reclaimed land within a disturbed industrial area the potential to discover items of Aboriginal heritage significance is negligible.

3.3.6 Soil Conservation Act 1938

The *Soil Conservation Act 1938* (SC Act) has the main objective of environmental protection of areas of erosion hazard. As part of the geological assessment for the proposed modifications, soil reports have been assessed and management measures have been identified in this EA for inclusion in the Construction Environmental Management Plan (CEMP).

3.3.7 Contaminated Land Management Act 1997

The management of contaminated land is shared by the Environment Protection Authority (EPA), the Department of Planning and Infrastructure and local government authorities.

Under the *Contaminated Land Management Act 1997* (CLM Act), the EPA regulates contaminated sites where the contamination is significant enough to warrant regulation. Contaminated sites that are not regulated by the EPA are managed by local councils through land use planning processes.

The CEMP will include provisions for addressing workplace health and safety and contamination management for any contaminated land that is recorded over the pipeline route, or is found during construction.

3.3.8 Occupational Health and Safety Act 2000

The *Dangerous Goods Act 1975*, has been repealed in NSW and the "Dangerous goods" term is now defined under the *Occupational Health and Safety Act 2000* (OHS Act) as:

"(a) substances or articles subject to a national standard declared by the NOHSC; and

(b) any other substances or articles of risk to public safety".

In addition, section 135A(2) of the OHS Act allows regulations to be made for any substance or article as dangerous goods - irrespective of quantities currently prescribed by the OHS Regulations and regardless of whether they are at a place of work.

There is a new duty of care, whereby the new amendments place specific duties on employers, occupiers of premises, manufacturers, importers and people dealing with self-service fuel dispensing units, fuel dispensing units, liquefied flammable gas, the filling of balloons and other containers, and the decommissioning of LPG tanks.

The duties are to identify, assess and control the risk associated with the storage and handling of dangerous goods. Other duties include retaining records of induction and training, keeping and maintaining registers of dangerous goods, labelling duties and risk identification, assessment and control procedures.

These procedures, management systems and protocols would be outlined in the Construction EMPs for the proposed modification works and the ELGAS Emergency Response Plan for the site.

3.3.9 Roads Act 1993

If the proposed modification works consist of any of the following under the meaning of the *Roads Act 1993* (Roads Act), then consent would be required under Section 138 of the Roads Act from the Roads and Maritime Services (RMS):

- erecting a structure or carrying out work in, on or over a public road;
- dig up, disturb the surface of a public road;
- remove or interfere with a structure, work or tree on a public road;
- pump water into a public road from any land adjoining the road; and
- connect a road (whether private or public) to a classified road.

Consent from RMS is not anticipated at this stage of the proposed works, given the works are not interfering with any public roads, however, they have been consulted with as part of the EA process as noted in Section 4.

3.3.10 Waste Avoidance and Resource Recovery Act 2001

The waste hierarchy, established under the *Waste Avoidance and Resource Recovery Act 2001*, is one that ensures that resource management options are considered against the following priorities:

- Avoidance including action to reduce the amount of waste generated by households, industry and all levels of government.
- Resource recovery including reuse, recycling, reprocessing and energy recovery, consistent with the most efficient use of the recovered resources.
- Disposal including management of all disposal options in the most environmentally responsible manner.

The proposed modifications would need to consider these principles when preparing any waste management plans for inclusion in any environmental management planning and reporting in the construction and operational stages.

3.4 STATE ENVIRONMENTAL PLANNING POLICIES

3.4.1 State Environmental Planning Policy (Port Kembla and Port Botany) 2013

State Environmental Planning Policy (Port Botany and Port Kembla) 2013 (SEPP 2013) would normally apply to any proposed new developments at the Port Botany site. The proposed modifications works (i.e. new pipeline) are located within the SP1 - Special Activities Land Zoning Mapzone of SEPP 2013.

The aims of the SEPP 2013 are to:

- To provide a consistent planning regime for the development and delivery of infrastructure on land in Port Botany and Port Kembla.
- To allow the efficient development, redevelopment and protection of land at Port Botany and Port Kembla for port purposes.
- To identify certain development within the Lease area as exempt development or complying development.

- To specify matters to be considered in determining whether to grant consent to development adjacent to development for port purposes.
- To provide for development at Port Botany that does not, by its nature or scale, constitute an actual or potential obstruction or hazard to aircraft.
- To identify certain development as State significant development or State significant infrastructure.
- To ensure that land around the lease Area is maintained for port-related and industrial uses, including heavy industry on land around Port Kembla.

Under SEPP 2013, the proposed pipeline falls within the SP1 - Special Activities land use zone and the proposed development would be permissible with consent in that zone. In addition, Regulation 25 of SEPP 2013 states that development for the purposes outlined in Schedule 2 of SEPP 2013 is Complying Development. In this respect, Schedule 2, Division 2, Clause 13 includes development for the purposes of bulk liquid storage tanks - modifications to pipelines and flow rates. This type of development would be considered complying development, provided the required studies specified have been prepared by a qualified person approved by the Director General for the purposes of this clause.

Clause 13 (1) (c) includes the installation of a new pipeline to increase the flow rate to or from the bulk liquid storage tank. Clause 13 (2) specifies the studies that are required for such complying development as:

- A hazard analysis study
- A fire safety study
- A hazard and operability study.

Each of these studies must be prepared in accordance with the requirements of Clause 13 (2) of Schedule 2 of the SEPP 2013.

In addition, Part 2 of Schedule 2 sets out complying development certificate conditions. Clause 29 states specific additional conditions for bulk liquid storage tanks (modifications to pipelines and flow rates). These are:

> "(a) a certificate by a qualified engineer must be provided to the principal certifying authority certifying that:
>
> (i) the item has been modified or installed in accordance with the specifications for the design certified by a qualified engineer
>
> (ii) the item is structurally adequate
>
> (b) the commissioning and operation of the tank, as modified or after the installation of the new pipeline or after the modification of an existing pipeline, must comply with the applicable recommendations of the studies referred to in clause 13 (2)
>
> (c) on completion of the building work, the principal certifying authority must be satisfied that the item is structurally adequate for its intended purpose".

In this respect, the proposed ELGAS LPG pipeline from the ELGAS Cavern Facility to the Qenos Hydrocarbon Terminal (Qenos Port Botany) at Port Botany would ordinarily be subject to the provisions of the *State Environmental Planning Policy*

(Port Botany and Port Kembla) 2013 (SEPP 2013). In addition to this, Regulation 25 of SEPP 2013 states that development for the purposes outlined in Schedule 2 of SEPP 2013 is Complying Development. This type of development would be considered complying development, provided the required studies specified have been prepared by a qualified person approved by the Director General for the purposes of this clause.

However, in this particular case, liaison with the Department of Planning and Infrastructure (DPI) indicated at the time that the qualified person or certifier and appropriate board for the abovementioned class of development did not exist as yet and an alternative planning pathway was required to assess the proposed development.

Upon further clarification of the proposed development with DPI as a modification to an existing consent, the proposed pipeline will be assessed via a Section 75W of the EP&A Act Modification of Consent.

3.4.2 State Environmental Planning Policy No.33 - Hazardous and Offensive Development

The *State Environmental Planning Policy No.33 - Hazardous and Offensive Development* (SEPP 33) principles apply to the proposed new ELGAS pipeline development. SEPP 33 applies to the modification of the existing facilities, the construction of new facilities, or the commencement of new uses.

If the proposed use or modifications are considered potentially hazardous or potentially offensive in their own right, then SEPP 33 applies. Any preliminary hazard analysis (PHA) would need to consider hazards from the existing facility.

SEPP 33 would also apply if the proposed modifications are not potentially hazardous in themselves, but interact with the existing facility in such a way that cumulative hazards (or offence) from the existing facility may be significantly increased. This may be subject to the judgement of the consent authority.

SEPP 33 aims to:

- amend the definitions of hazardous and offensive industries where used in environmental planning instruments;
- render ineffective a provision of any environmental planning instrument that prohibits development for the purpose of a storage facility on the ground that the facility is hazardous or offensive if it is not a hazardous or offensive storage establishment as defined in this Policy;
- require development consent for hazardous or offensive development proposed to be carried out in the Western Division;
- ensure that in determining whether a development is a hazardous or offensive industry, any measures proposed to be employed to reduce the impact of the development are taken into account;
- ensure that in considering any application to carry out potentially hazardous or offensive development, the consent authority has sufficient information to assess whether the development is hazardous or offensive and to impose conditions to reduce or minimise any adverse impact; and
- require the advertising of applications to carry out any such development.

Whilst, the proposed new ELGAS pipeline does not fall directly into one of the following definitions, the principles of the SEPP 33 would need to be applied to the proposed modifications.

Hazardous industry means a development for the purposes of an industry which, when the development is in operation and when all measures proposed to reduce or minimise its impact on the locality have been employed (including, for example, measures to isolate the development from existing or likely future development on other land in the locality), would pose a significant risk in relation to the locality:- (a) to human health, life or property, or (b) to the biophysical environment.

Hazardous storage establishment means any establishment where goods, materials or products are stored which, when in operation and when all measures proposed to reduce or minimise its impact on the locality have been employed (including, for example, measures to isolate the establishment from existing or likely future development on the other land in the locality), would pose a significant risk in relation to the locality: (a) to human health, life or property, or (b) to the biophysical environment.

Determination of Potentially Hazardous Development

Appendix 3 of DPI's "*Applying SEPP 33 Hazardous and Offensive Industry Guidelines (January 2011)*" indicates that LPG storage and handling facilities are a source of hazard through potential gas leaks which could in turn have potential impacts of fire and/or explosion.

Flammable gases (LPG) are classified as Class 2.1, in accordance with the Australian Dangerous Goods Code (ADG). Appendix 4 of the guideline shows how to apply the risk screening procedure. The application of the screening procedure to ELGAS activities at the Port shows that the existing Cavern Facility exceeds the risk screening threshold of 40 tonne, which is set for LPG stored underground. However, the pipeline development itself does not and will not change the existing storage capacity.

To assist DPI with making judgement on identifying and assessing the proposal under this SEPP, and as per the DGRs, a Preliminary Hazards Analysis (PHA) in the form of a Quantitative Risk Assessment (QRA) for the proposed pipeline development with reference to the department's *Port Botany Land Use Safety Study Overview Report* has been undertaken and is discussed further in this EA in Section 5.1 and Appendix D.

WorkCover NSW Notification

Where dangerous goods are used or stored in volumes greater than the threshold quantities, WorkCover NSW must be notified, and manifests and emergency plans must be developed. For Class 2.1, the manifest threshold is 5000L.

While the potential capacity of the existing ELGAS cavern meets this threshold, the proposed pipeline is not considered above this manifest threshold. WorkCover have been notified of the proposal through the consultation process as discussed in Section 4.

Risk and Hazard Studies

A Hazard Operability Study (HAZOP) study has been completed for the proposed modifications.

In addition, the following studies are planned for the proposed modifications:

- A four part Construction HAZCON – one for each construction stage.
- Quantitative Risk Analysis (QRA) and workshop to review against AS2885 Pipelines to determine any Major Accident Events (MAEs).
- A Confined Space HIRAC hazard identification, risk identification and controls – for underbore entry/exit pits under Charlotte Road and the Friendship Road culvert.
- Relief Study (to be determined).
- Layer of Protection Analysis Study (LOPA) (to be determined)A Fire Safety Study (to be determined).
- A CHAZOP – A Control systems Hazards and Operability Study.

3.4.3 State Environmental Planning Policy No 55 - Remediation of Land

State Environmental Planning Policy No 55 – Remediation of Land (SEPP 55) applies to any site that is deemed to be contaminated. A consent authority must consider contamination and remediation in any development application where there is potential for contaminated land. In determining a development application the consent authority must not consent to the carrying out of any development unless:

- it has considered whether the land is contaminated;
- if the land is contaminated, it is satisfied that the land is suitable in its contaminated state (or will be suitable, after remediation) for the purpose for which the development is proposed to be carried out; and
- if the land requires remediation to be made suitable for the purpose for which the development is proposed to be carried out, it is satisfied that the land will be remediated before the land is used for that purpose.

While there are no known areas of contamination on the ELGAS site, there is a small risk that contaminated soil may be excavated during the construction program. Management of contaminated soil will be carried out in line with standard good practice construction management as documented in Section 5.

3.5 LOCAL PLANNING INSTRUMENTS

3.5.1 Randwick Council Local Environmental Plan (LEP) 2012

The *Randwick Council Local Environmental Plan (LEP) 2012* is the relevant environmental planning instrument for the Randwick Local Government Area. Under the LEP, the Port Botany area is included in the Major Development (SEPP) 2005 zoning and in this case the Port Botany and Port Kembla SEPP 2013 applies. In any case, the proposed development will not be assessed under the LEP as the State Environmental Planning Policy applies.

3.6 COMMONWEALTH LEGISLATIVE FRAMEWORK

3.6.1 Work Health and Safety Act 2011

The main objective of the *Work Health and Safety Act 2011* is to provide for a balanced and nationally consistent framework to secure the health and safety of workers and workplaces.

Major Hazard Facilities

Major Hazard Facilities (MHF) are facilities including large gas storage depots that have hazardous chemicals in amounts that exceed specified threshold quantities. Operators of MHFs have certain obligations under the *Work Health and Safety Regulation 2011* (WHS Regulation) which aims to reduce the risk of major incidents and minimise consequences in the event of a major incident notification.

Any person conducting a business or undertaking that operates a facility where chemicals in Schedule 15 of the WHS regulation are greater than 10% of the corresponding threshold quantity, must notify WorkCover within 3 months of awareness of the operation. This is in addition to any dangerous goods notification. For example, the MHF threshold for LPG is 200 tonnes, therefore notification is required for greater than 20 tonnes.

It is understood that ELGAS has submitted a Major Hazard Facility (MHF) Safety report toward attaining a MHF Licence for the Cavern Facility through NSW WorkCover.

3.6.2 Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)

Under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), an action will require approval from the Department of the Environment (DoE) if the action has, will have, or is likely to have, a significant impact on a matter of national environmental significance (MNES).

The nine matters of national environmental significance (MNES) are:

- world heritage properties;
- national heritage places;
- wetlands of international importance (often called 'Ramsar' wetlands after the international treaty under which such wetlands are listed);
- nationally threatened species and ecological communities;
- migratory species;
- Commonwealth marine areas;
- the Great Barrier Reef Marine Park;
- nuclear actions (including uranium mining); and
- a water resource, in relation to coal seam gas development and large coal mining development (as of amendments to the EPBC Act on 22 June 2013).

A person who proposes to take an action that will have, or is likely to have, a significant impact on a MNES must refer that action to the Minister for a decision on whether assessment and approval is required under EPBC Act.

A search of the protected matters search tool was conducted on 27 August 2013 of a one km buffer surrounding the proposed Pipeline work site. The search returned one wetland of international importance, Towra Point Reserve, located 10 km away from the works site. A further 50 threatened species and 62 migratory species were returned, with a large portion (85 species) recorded as marine species. No suitable habitat for terrestrial flora or fauna is located within the proposed works area, however, migratory species may overfly the work site. Measures have been recommended in this EA to protect marine habitats which are located close by to the Port. Overall the proposed modification works are considered of low potential impact to the environment.

It is not anticipated that a referral would be required from the initial review of the proposed modifications as the works do not affect any area containing known MNES.

4 Stakeholder Consultation

ELGAS recognises people and safety as one of its core company values. It is committed to ensuring community interests are considered, as well as, the needs of neighbouring operators and NSW Ports with regard to its operations at Port Botany. ELGAS regularly engages the EPA, the community and NSW Ports in regards to its operations as part of its standard practice.

4.1 CONSULTATION APPROACH

The consultation process for this new pipeline project involved consultation with a number of state agencies, the land owner and operators and the neighbourhood community. The purpose of the consultation was broadly to identify opinion and concern regarding social and environmental effects, but also to ascertain any potential operational, safety and technical concerns and issues which may need to be addressed during the engineering process. The following stakeholders and Ports operators were consulted during the Environmental Assessment process:

Government/State Agencies

- Environment Protection Authority (EPA)
- Department of Primary Industries (Office of Water)
- WorkCover NSW
- Randwick City Council
- Roads and Maritime Services (RMS).

Non-government

- NSW Ports (formerly Sydney Ports)
- Terminals Pty Ltd
- Qenos Hydrocarbons
- Vopac
- Origin Energy
- Port Botany Neighbourhood Liaison Group

4.1.1 Director General's Requirements

Requirements of the Director General of the Department of Planning and Infrastructure (DPI) were issued for the project on 6 September 2013. The table below demonstrates how the EA has complied with the DGR's.

Table 4.1 DGR's Consultation Requirement

Consultation Requirement	Compliance
During the preparation of the Environmental Assessment, you should consult with the relevant local, state or commonwealth government authorities, services providers, community groups or affected landowners. In particular you must consult with the: • Sydney Ports Corporation • Randwick City Council • Environment Protection Authority • WorkCover NSW and; • Roads and Maritime Services The consultation process, and the issues raised during this process, must be described in the Environmental Assessment.	The stakeholders and agencies listed, operators and community have been consulted with regard to the project. The outcomes of the consultation have been incorporated into the EA and are summarised in Table 4.2.

4.2 CONSULTATION PROCESS

Community and stakeholder consultation involved a mixture of face-to-face, telephone and written communications during the EA process. Port Botany Pipeline operators of the Charlotte Road corridor pipelines and government stakeholders were invited by telephone and email to attend a consultation meeting at the ELGAS offices to introduce them to the project and provide any feedback or requirements they may have prior to the issuance of the DGR's. Following the receipt of the DGR's, the RMS were also consulted via telephone and provided information about the project.

The Port Botany Neighbourhood Liaison Group is a port-wide consultation and communication forum with the principal objective of sharing information about port activities amongst port lessees, community and special interest group representatives. The community were informed of the project separately, at the Port Botany Neighbourhood Liaison Group Meeting held Tuesday 27 August 2013.

Table 4.2 below summarises the consultation undertaken to date and the outcomes/issues raised at each session and by respective stakeholders. It also details how the issues raised will be addressed. Full records of the meeting minutes and other correspondence are provided in Appendix C.

Table 4.2 Summary of Consultation

Stakeholder/ Attendees	Date	Consultation method/ Description/Outcome	Section in EA addressed (if applicable)
Department of Primary Industries (DPI) (Office of Water)	7 August 2013 & 13 August 2013	The DPI (Office of Water) was invited to comment on the proposal and attend the agencies consultation meeting via email. A formal response was provided on 13 August 2013 indicating that a low volume of groundwater is likely to be intercepted and further assessment and participation by the DPI (Office of Water) was not required (Refer to Appendix C). Furthermore, in the event that groundwater may intercept or extract 3 ML or more of water, DPI (Office of Water) should be consulted.	Section 5.3 Groundwater
Environment Protection Authority	8 August 2013 &12 August 2013	The EPA was invited to comment on the proposal and attend the agencies consultation meeting via telephone and email. A formal response indicating no further information was required other than what is stipulated in the DGRs was provided on 11 September 2013 (refer to Appendix C).	All sections of the impact assessment.
Workcover	8 August 2013	WorkCover was invited to attend both the operators and agencies meetings and provide comment on the project via telephone and email. WorkCover declined to attend both meetings. WorkCover were provided the minutes of the meeting. No formal comments or requirements were provided in response to the correspondence, however, verbal feedback was provided confirming satisfaction with the process undertaken (refer to Appendix C).	N/A
Roads and Maritime Services (RMS) - Sydney Region	17 September 2013	Telephone conversations were conducted and follow up email issued to RMS regarding the proposal and inviting comment. The RMS responded with no comment or issue with the proposal (refer to Appendix C).	Section 5.9 Traffic and Transport.
Randwick Council	8 August 2013	Randwick Council was invited to comment on the proposal and attend the agencies consultation meeting. Council representatives provided the majority of comment during the face-to-face agencies meeting (refer to Appendix C). These issues are noted below.	Refer to Agencies meeting below.

Stakeholder/ Attendees	Date	Consultation method/ Description/Outcome	Section in EA addressed (if applicable)
NSW Ports (Operations) and Pipeline Operators	Early August 2013	Telephone conversions and follow up emails were issued to other operators in Port Botany within the Charlotte Road corridor and NSW Ports inviting them to attend a consultation meeting.	N/A
NSW Ports (Operations) Port Operators (Qenos Hydrocarbons, Vopac, Terminals Pty Ltd and Origin Energy) and WorkCover	15 August 2013	A face-to-face meeting was held with NSW Ports and the other pipeline operators within the Charlotte Road pipeline corridor. The project was introduced and then an open forum conducted to gather issues/concerns. Key concerns raised included: • Timing of works in relation to other construction activities on site • Health and Safety during construction for workers and in undertaking construction activities • Emergency safety measures in the design • Design parameters Minutes were issued following the meeting 16 August 2013 which were accepted by all with no comment (refer to Appendix C for the full record)	A Quantitative Risk Assessment (QRA) has been undertaken to address some issues and has been summarised in Section 5.1. Further issues are to be addressed through design and safety workshops to be undertaken post approval and pre-construction.
Meeting with Port Botany Neighbourhood Liaison Group	27 August 2013	An ELGAS representative introduced the project at the neighbourhood meeting. Comments raised included (full record of minutes not provided due to privacy): • The reasoning behind selecting the route instead of a straight route. Clarified during the meeting that the route selected uses an existing pipeline corridor. Planning approval pathway (Part 4 compared to Complying Development)	Section 2 project description and planning approval Section 3.

5 Environmental Impact Assessment

5.1 HAZARD AND RISK ASSESSMENT

A Preliminary Hazard Analysis (PHA) study in the form of a Quantitative Risk Assessment (QRA) has been carried out by Arriscar Pty Ltd on the proposed LPG pipeline by Elgas Ltd, between the Elgas LPG Cavern site and the Qenos Hydrocarbon Terminal at Port Botany, NSW. The complete study has been provided in Appendix D. A summary of the details, findings and actions arising from the study is provided in this section of the EA. As noted in Section 3, the PHA has been prepared to assist DPI assessing the human health and safety risks of the proposed pipeline.

A risk assessment addressing environmental risks has been provided in Appendix E.

Methodology

The study has been prepared to fulfil a number of requirements under NSW legislation and as required by the DGR's, in particular the requirement for a risk assessment in accordance with the *Hazardous Industry Planning Advisory Paper (HIPAP) No 6, Hazard Analysis* (DPI 2011) and the recommendations of the Port Botany Land Use Safety Study Overview Report (DUAP 1996). The study also addresses the proposed modification works against the applicable risk criteria set out in the *Hazardous Industry Planning Advisory Paper (HIPAP) No 4, Risk Criteria for Land Use Safety Planning*, (DPI 2011), in the form of a Quantitative Risk Assessment (QRA).

The scope of the study covered all above and below ground sections of the proposed LPG pipeline, including sections within the boundary of the ELGAS Cavern Facility and the Charlotte Road NSW Ports Pipeline Corridor. The scope of the analysis undertaken includes a quantitative analysis and assessment of off-site fatality, injury and property damage risk, in accordance with the abovementioned guidelines and included the proposed modifications to both the pipeline and on the ELGAS Cavern site.

The approach to the QRA involved initially undertaking a hazard identification of hazardous scenarios through a number of methods including:

- AS 2885.1 – Pipeline Design Code.
- Incident data related to hydrocarbon pipelines reported in the literature.
- A hazard identification workshop held in September 2013, attended by ELGAS, Qenos and Sydney Ports, and facilitated by Arriscar.

A register of Major Accident Events (MAEs) was also developed to identify events with the potential to cause off-site fatality or injury, property damage or long-term damage to the biophysical environment. A full list of hazards and hazardous events identified can be found in Appendix D.

Following the identification of hazards, the consequence analysis and risk assessment were carried out using the software PhastRisk Version 6.7. The risk criteria applied to identify the tolerability of risk, both Quantitative and Qualitative, were adopted from the HIPAP No. 4 guidelines.

5.1.1 Assessment of Impact

Risk of Fatality

The cumulative individual fatality risk contour for the existing facility was compared with the proposed pipeline risk contour and the cumulative individual facility risk for the proposed pipeline and follows the pipeline route, remaining within the Port Land. The risk of 50 chances in a million per year was not reached at any location, therefore the existing facility and proposed modification works comply with the HIPAP No. 4 fatality risk criteria.

Risk of Injury

The total risk from the pipeline incident was not in excess of 50 changes in million per year, therefore the risk of injury potential (from exposure risks identified during the Hazard Identification process) at 50 chances in a million per year was not generated. The existing facility and proposed modification works comply with the HIPAP No. 4 injury risk criteria.

Risk of Property Damage and Accident Propagation

The total risk from the pipeline incident was not in excess of 50 chances in million per year, therefore the risk of accident propagation at neighbour land use at 50 in a million per year was not generated, complying with HIPAP No. 4 guidelines and presenting no risk to neighbouring facilities.

Port Botany Land Use Safety Review Recommendations

The proposed modifications comply with the recommendations of the Port Botany Land Use Safety Study Overview Report and are of low level risk, provided the recommended mitigation measures listed below are implemented.

5.1.2 Recommendations

The following recommendations arise from the hazard analysis study. Implementation of these recommendations would result in maintaining the risk at the calculated low levels.

- The Emergency Response Plans of ELGAS and Qenos should be reviewed / amended to address additional LPG release scenarios (including response to gas detection in Charlotte /Friendship Roads).
- Specify insulation joint between above and below ground sections to ensure cathodic protection integrity.
- Provide for inspection of cathodic protection facilities in the pipeline design.
- Review providing seals at either end of sleeve to prevent rainwater ingress into the annular space, for the underground section of the pipeline beneath Charlotte and Friendship Roads.

- Include provision for manual pump out of accumulated rainwater in the underground pit.
- Consider soil strength analysis of pipeline route during pipeline design, as required by AS 2885.1.
- The Pressure Safety Valves (PSVs) on pipeline are to be designed for two-phase release.
- Consider restricting hydrostatic test water pump shut-in pressure to maximum allowable pressure for the pipeline.
- Confirm pressure rating of isolation and shutdown valves with respect to Pressure Safety Valves (PSV) set-point.
- Develop start-up and maintenance procedures for the pipeline (depressuring, purging and re-pressurisation after maintenance).
- Review with NSW Ports, impact protection requirements for pipeline in corridor at vulnerable locations (e.g. ARMCO railing).

In addition to the above, the following is recommended:

- Emergency Response Training is to be provided to all staff in relation to the updated Emergency Response Plan and how to response to an emergency situation relating to the new pipeline operation.
- Ensure that the conditions of the existing EPL 10698 are continued to be complied with and the licence is updated if required by the EPA.

5.2 TOPOGRAPHY, GEOLOGY AND SOILS

5.2.1 Existing Environment

Botany Bay itself has a roughly circular shape of 6-7 km in diameter with the entrance to the Bay between the rocky headlands of La Perouse and Inscription Point (Albani & Rickwood, 1998). The topography around bay is generally flat and has a low visual profile. The suburb of Port Botany extends from the northern shore of Botany Bay, with Molineaux Point a key landmark on its southern tip, providing views to La Perouse, and Kurnell on the southern headland of the entrance to the bay.

The pipeline route lies within the Sydney Basin biogeographic region with the local geology of the area being Hawkesbury Sandstone, overlain with unconsolidated sand deposits (Botany Sands). Hawkesbury sandstone is a hard durable rock composed of very fine to coarse quartz sand grains cemented with silica, clay and iron oxides or carbonates to form massive sheet sandstone. Occasional shale bands occur within the sandstone.

Under the ELGAS site, the sand deposit is up to 40 m thick and is comprised of dredged material (sand from Botany Bay) up to 14 m depth, with a variable thickness of Botany Sands (9 to 30 m). The natural deposits of the Botany Sands formation comprise alluvial sands with minor silt, clay and peat layers. The base of the unconsolidated sand sequence is at around -17 m AHD on the southern boundary of the ELGAS cavern site and around -40 m AHD on the northern site boundary (Charlotte Road) (Parsons Brinckerhoff, 2013).

The DIPNR Acid Sulphate Soils Risk Maps indicates the pipeline route is located on disturbed land (DIPNR, 2013) and the area has not been noted as a risk area within the Randwick LEP 2012. The risk of encountering acid sulphate soils has been deemed low given soils along the proposed route are disturbed, laid down as part of the land reclamation works in the 1970's.

A search of the OEH contaminated land register was conducted for Randwick and no sites were identified within the Port Botany area. ELGAS is unaware of any known contamination within the pipeline route. However, given the industrial past of Port Botany, there is a risk that contaminated soil may be excavated during works.

5.2.2 Assessment of Impact

Soil Impacts during Construction

The proposed works are not likely to have a significant permanent impact upon the soils or geology of the area as the pipeline will be mostly aboveground, located inside the current Charlotte Road NSW Ports Pipeline corridor on the eastern side of Charlotte Road. The pipeline alignment crosses beneath two roads via an existing pipeline culvert under Friendship Road and a new horizontally drilled bore beneath Charlotte Road at an approximate depth of 2.5 to 3 m below grade. Impacts to soils will be restricted to the area under Charlotte Road, within soil likely to be characterised as unconsolidated sand deposits. The key risks are likely to be the excavation and exposure of unknown contaminated soils and possible contamination of soil during works from spills (i.e. 'frac-out' during drilling).

The exposure of contaminated soil can potentially lead to further contamination of the environment and indirect impacts on human health and biota. The consequence of this risk is considered to be moderate and but it unlikely that it will occur. Therefore the significance of the impact is considered medium in the absence of mitigation. Standard good practice construction management can mitigate and manage this impact (as described in Section 5.2.3) and reduce the significance of the impact to low.

Horizontal drilling requires the use of a drilling lubricant, usually bentonite slurry, a fine clay material, which is non-toxic. A 'frac-out', the inadvertent return of drilling fluid, could result in release of the lubricant to the surrounding soils. However, this type of lubricant is non-toxic, and as such the consequence is considered insignificant. The likelihood that it would impact a sensitive environment is unlikely, therefore the impact is considered low. However, a contingency plan will be developed to manage any residual risk (see Section 5.2.3)

Soil Impacts during Operation

Potential impacts during operation include leakages from the pipeline to the surrounding soil. However, the pipeline will be encased along its length and therefore will not be in direct contact with the surrounding soils. Additionally, propane and butane, key components of LPG, have a low boiling point (-42C and -0.5C respectively) and tend to volatise rapidly into the air, hence spillages are unlikely to penetrate the soil. The likelihood of a leakage occurring is rare and the consequence is considered low, therefore impact significance is low.

5.2.3 Environmental Mitigation Measures

The following measures should be implemented to minimise the potential for soil impacts:

- A soil management strategy to be prepared that details how excavated spoil will be managed on the site, including contaminated soil. The plan is to include stockpile locations as well as stormwater management measures.
- A contingency plan to provide guidance should either acid sulphate soils or contaminated soils are encountered during works. This should make reference to the following guidelines:
  - Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites (ANZECC & NHMRC)
  - National Environment Protection (Assessment of Site Contamination) Measures 1999 (NEPC)
  - Managing Land Contamination – Planning Guidelines SEPP 55 – Remediation of Land (DOP)
  - Acid Sulphate Soils Assessment Guidelines 1998 (ASSMAC).
- A frac-out contingency plan should be developed for use during the drilling works.

5.3 GROUNDWATER

5.3.1 Existing Environment

Two aquifer systems are thought to be present under the ELGAS site; an unconfined aquifer with the dredged sand/Botany Sands layer and an underlying confined aquifer with the Hawkesbury Sandstone. The shallow aquifer within the dredged sands/Botany Sands layer lies a few meters below ground level, is dominated by saline water and heavily influenced by tidal action. The main recharge for this aquifer is from precipitation and the reinjection of cavern seepage water, which leads to natural discharge to Botany Bay (Parsons Brinckerhoff, 2013).

The Hawkesbury Sands aquifer is divided into an upper and lower aquifer system, divided by a band of shale. The upper aquifer has some connectivity with the shallower Botany Sands aquifer.

The Botany Sands Aquifer, which lies beneath the proposed pipeline route, is a large volume of water present throughout the sandy ground around Botany Bay. Due to the permeability of the sands and generally shallow water table, the aquifer has been impacted by historic contamination and the NSW government strictly monitors use. The pipeline route falls under Zone 4 of the established management zones for the aquifer, which restricts the domestic use of groundwater (DPI, 2013).

A Groundwater Extraction Exclusion Area (Zone 1), known to be contaminated with chlorinated hydrocarbons, lies approximately 2km to the northeast of the site. This is being actively managed by Orica and has not affected the groundwater at the ELGAS Cavern Facility.

Under current groundwater monitoring arrangements for the ELGAS Cavern Facility, the Botany Sand aquifer is monitored annually via one borehole, with the deeper sandstone aquifers monitored quarterly over a number of boreholes throughout the

ELGAS site (Parsons Brinckerhoff, 2013). Data from the recent monitoring period (June 2013 to September 2013) indicated a downward flux of saline groundwater from the Botany Sands aquifer through the upper sandstone aquifer to the lower sandstone aquifer. High ammonia (as N) levels were noted in the Botany Sands aquifer however these were within the historical monitoring range. Water levels for the Botany Sands aquifer were recorded at 0.14 m ADH at a borehole approximately 200 m south of Charlotte Road (Parsons Brinckerhoff, 2013). Water quality was also monitored at the north western end of Charlotte Road as part of an ERM study. Depth to the water table was measured between 2.18 and 2.31 m b TOC (meters below Top of Casing).

In terms of water quality, sampling results from the three ERM monitoring wells on Charlotte Road indicated that levels of arsenic (filtered) exceeded the Ecological Screening Criteria for arsenic (0.0023-0.0045 mg/L) at two of the wells. No other exceedences for heavy metals, chlorinated hydrocarbons, halogenated hydrocarbons or monocylic aromatic hydrocarbons (MAHs) were noted.

A Groundwater Management Zone (GMZ) associated with the ELGAS Cavern Facility is specified under the NSW Ports *Port Botany Development Code October 2013*. Development which is undertaken in this zone is required to comply with the 'Groundwater Management Zone Deed'. As the proposed works are a modification to the ELGAS Cavern Facility, the works fall within this zone.

5.3.2 Assessment of Impact

Groundwater Impacts during Construction

The works will not require extraction of groundwater; however it is likely that the unconfined Botany Sands aquifer will be intercepted during construction works. Penetration of an aquifer can affect the functioning of the aquifer or impact water quality. Drilling into unconfined aquifers does not usually change water levels, and therefore is unlikely to affect its function; however unconfined aquifers are susceptible to contamination from surface land use.

Any impacts would be restricted to the horizontal drilling works beneath Charlotte Road, which will extend to a depth of 2.5 m to 3 m below grade. Data from the nearest borehole location indicates relatively high groundwater levels, indicating potential for intercepting water during works. The Department of Primary Industries (Office of Water) were consulted (refer to Section 4) during the EA preparation and advised that the volumes of groundwater to be low and considered of minimal impact to the local aquifer volumes.

Key potential impacts from the interception of the aquifer include the contamination of the aquifer during works from spills or a frac-out and mismanagement of dewatering potentially resulting in release of contaminated water to the environment.

The likelihood of a spill (i.e. a frac-out) impacting the aquifer is considered to be unlikely and the consequence minor. The significance of the impact is therefore considered low.

It is almost certain that dewatering would need to be carried out during the works. The consequence of mismanaging water extracted from the borehole is dependent on whether or not contaminants are present. Based on a worst case scenario, the release of contaminated water to the surrounding environment would be considered to be of

moderate consequence; therefore the significance of the impact is considered high. Best practice dewatering management would reduce the likelihood of release to the environment to rare which in turn would reduce the significance of any impact to low.

As the proposed works are occurring within the GMZ of the ELGAS Cavern Facility, the Groundwater Management Zone Deed was reviewed for any requirements. Due to the shallow depths of works unlikely to impact the deep aquifer in which the cavern is located, it was concluded that the proposed works would not have any impact upon the ELGAS Cavern Facility.

Groundwater Impacts during Operation

Impacts to groundwater quality during operation could occur as a result of pipeline leakages into the surrounding soil; however the pipeline is to be encased along its length. Additionally LPG is not known to be toxic to flora, fauna or soil organisms and on contact with air is likely to volatise rapidly. It is not known to bioaccumulate and is unlikely to cause long term effects in the aquatic environment (ELGAS Safety Data sheet for LPG). Significance of the impact is considered to be low.

5.3.3 Environmental Mitigation Measures

The following measures should be implemented to minimise the potential for groundwater impacts:

- A groundwater management plan (as part of the CEMP) is to be developed to manage any dewatering works. The plan is to include suitable control measures for the collection, treatment (as necessary) and disposal of contaminated groundwater that may be pumped from excavations during construction.
- The CEMP is to include measures for managing spills or potential release of contaminated materials during the drilling works (e.g. frac-out situations).
- A frac-out contingency plan to be developed for use during the drilling works
- If the works encounter groundwater, it is unlikely to be of a sufficient volume to require an aquifer interference licence (as per the correspondence received from DPI (Office of Water) – Appendix C), however, monitoring during works should be undertaken to ensure this is the case.
    - In the event that groundwater monitoring shows the works would intercept or extract 3 ML or more of water, the Office of Water is to be contacted and a licence must be obtained for the works.

5.4 SURFACE WATER

5.4.1 Existing Environment

Botany Bay is a major estuarine embayment with a catchment area of approximately 1,165km^2. It is fed by two major waterways, Georges River which enters the bay from the southwest and Cooks River which enters the bay from the northwest (SMCMA, 2011). Contaminants enter the bay via several pathways including discharge through the stormwater network, groundwater inflows, surface runoff from foreshore catchments or via the major and minor tributaries that feed the main two watercourses.

Water quality within Botany Bay is heavily influenced by the tidal regime and the flow of freshwater into the bay, especially after large rainfall events.

The pipeline route lies within the Sydney Metropolitan Catchment Management Authority Area.

5.4.2 Assessment of Impact

Surface Water Impacts during Construction

The proposed works will not directly impact surface waters but there is potential for sediment or contaminated run-off to enter the adjacent Brotherson Dock. These impacts are likely be localised and it is not anticipated they would have a significant impact on sensitive habitats/communities within Botany Bay (see Section 4.7). Potential avenues for contamination of surface waters include:

- Stormwater run-off from stockpiles (including contaminated spoil) entering the waterway.
- Uncontained diesel/fuel spills entering the waterway.
- Frac-outs resulting in release of bentonite slurry to the environment which is non-toxic but can impact aquatic environments, smothering benthic invertebrates, aquatic plant and fish, if discharged to a waterway.

The consequence of releasing sediment-laden or contaminated run-off into the local environment is considered to be minor and the likelihood possible. In the absence of mitigation, the significant of the impact is considered to be medium. Best practice site management to reduce the likelihood off run-off from the construction site entering Brotherson Dock would reduce the significance of any impact to low.

Surface Water Impacts during Operation

The operation or future maintenance requirements of the pipeline are not anticipated to result in an impact to surface water quality in Botany Bay. However, ELGAS has a Pollution Incident Response Management Plan (PIRMP) to minimise and control the risk of a pollution incident on the site. This would be utilised in the event of any spill that may pose a potential pollution hazard.

5.4.3 Environmental Mitigation Measures

Best practice measures for the management of run-off from the site should be put in place as part of standard site management as follows:

- The contractor is to ensure systems are in place to prevent pollution of waters from handling, transport and storage of liquids and to ensure that activities are undertaken in accordance with the *Contaminated Land Management Act 1997* (CLM Act), EPA guidelines and the POEO Act. Creating site specific tailored actions for staged construction activities would be the responsibility of the contractor and be portrayed in the CEMP.
- Development of a frac-out contingency plan to protect nearby aquatic habitats.
- Use of the Botany Bay Precinct Emergency Sub Plan 2011 (Major Hazard Facility – Port Botany South).

- Appropriate stockpile locations to be notified in the CEMP and development of stormwater management plan following relevant guidelines:
  - *Managing Urban Stormwater: Soils & Construction (Landcom)*
  - *Managing Urban Stormwater: Treatment Techniques (DECC)*
  - *Managing Urban Stormwater: Source Control (DECC).*
- Development of contingency plan for spill management:
  - *Technical Guidelines: Bunding and Spill Management (DECC).*
- All machinery and equipment to be checked daily and maintained to ensure there are no oil, fuel or other liquids leaking.
- A spill kit to be kept on site to manage any unexpected spills.
- Update the PIRMP to include the LPG pipeline as part of the ELGAS Port Botany facilities.

5.5 NOISE AND VIBRATION

5.5.1 Existing Environment

The ELGAS site is zoned SP1 (Special Activities Land Zoning Mapzone) under the *SEPP (Port Botany and Port Kembla)* 2013 (as noted in Section 3 of this EA) with container loading docks to the north, and bulk liquid storage tank areas to the east of the site. The site is surrounded by industries and separated from residential areas or commercial operations by over 1 km. The nearest sensitive noise receivers are the caretaker's residence at the Botany cemetery, approximately 1.4 km away and to the south-east residential properties in Yarra Road and Elaroo Avenue, Philip Bay, approximately 1.8 km away (EMS, 2013).

A noise impact assessment completed by EMS Pty in May 2013 identified the key equipment contributing to noise generation at the ELGAS site (see Table 5.1)

Table 5.1 Hand-held Measurement of Site Machinery (EMS, 2013)

Equipment Item	Measurement distance (m)	Noise Level dB(A)
Supply Ship Unloading	80	62.1
Single Road Tanker Loading (Rotor Gauge audible)	7	68.1
3 Road Tankers Loading	7	66.5
Booster Pump – P201A	7	77
Kaldair Heater	7	75.3
Compressor House (electrical supply)	7	64.2
Main Supply Pipe	7	63.3

The assessment found that the current noise levels emitted from the ELGAS site are minimal given the distance to sensitive receivers and comply with the noise criteria established in accordance with Industrial Noise Policy NSW (EMS, 2013).

5.5.2 Assessment of Impact

Noise and vibration impacts during construction

The construction phase of the proposed works may generate additional noise and vibration sources due to the following activities:

- Movement and operation of work trucks, supply vehicles and workers vehicles to and from the site.
- Use of generators, pumps and compressors.
- Horizontal and directional drilling equipment.
- Excavation works (including the use of excavators and hand digging machinery e.g. jack hammers).

Of these, the horizontal drilling works are likely to be the most significant source of noise and/or vibration impacts. Adverse impacts from additional noise and/or vibration during construction may cause disturbance to sensitive receivers, such as residential properties. However, given the temporary and short-term nature of the works, and the distance to sensitive receivers, noise and vibration impacts associated with construction are likely to be of low significance and management will be guided by the Environment Protection Authority (EPA) (formerly DECC) *Interim Construction Noise Guideline* (DECC, 2009).

Noise and vibration impacts during operation

No proposed mitigation measures are proposed as the operation of the pipeline is likely to comply with the noise criteria in accordance with the Industrial Noise Policy Criteria.

5.5.3 Environmental Mitigation Measures

The following measures should be implemented to minimise the potential for noise and vibration impacts:

- The NSW EPA *Interim Construction Noise Guideline* (DECC, 2009) to be used to inform CEMP and management of construction noise.
- Construction to take place between 6:00am and 6.00pm (Monday to Friday) and 6:00am to 4:00pm on Saturday, with the noisiest activities to be scheduled during recommended standard hours (DECC, 2009) of 7:00am to 6:00pm Monday to Friday and 8:00am to 1:00pm on Saturday.
- Nearby commercial and industrial properties to be notified of works.
- Noise generated by work equipment to comply with noise control standard AS 1055.
- Works involving noise-generating machinery should be undertaken within the shortest possible timeframe, with minimum delays. All efforts should be made to schedule noisier work activities during the daytime on week days.

5.6 GREENHOUSE GAS/AIR QUALITY

5.6.1 Existing Environment

The air quality in the Port Botany area is influenced by the industry in the area and includes emissions from ship activities, local road traffic, aircraft and local industrial emissions. A study completed by SKM (2008) for the BLB2 expansion works found that higher concentration of particulate matter are generally experience during summer months and the mean monthly NO2 and ozone concentration vary on a seasonal basis, with higher concentration recorded during the warmer months of the year.

The nearest air quality monitoring site is Randwick, part of OEH's air quality monitoring network, located approximately 4.5km north of Port Botany. A review of air quality data between October 2012 and October 2013 did not record any exceedences in the air pollutants measured.

Sensitive receivers are likely to be nearby residential areas, schools or hospitals. The caretaker's residence at the Botany cemetery is approximately 1.4 km away and to the southeast residential properties in Yarra Road and Elaroo Avenue, Philip Bay are approximately 1.8 km away.

The latest data from NSW (2010) calculated NSW greenhouse gas (GHG) emissions as 157 million tonnes CO_2e.

5.6.2 Assessment of Impact

GHG emissions are considered based on three "scopes" – scope one (direct emissions), scope two (indirect emissions from the consumption of purchased energy) and scope three (other indirect emissions).

In general, the different scopes can be defined, in accordance with the GHG Protocol (WRI/WBCSD, 2007) and ISO 14064-1 (ISO, 2006) as:

Scope 1 Emissions

Scope 1 emissions are greenhouse gas emissions produced from sources within the boundary of the project and as a result of that project's activities.

Scope 1 emissions arising from the construction and operation of the project include those from vehicles and machinery used for materials delivery and handling, excavation, rehabilitation works, waste transport and general construction activities. The major contributor would be the consumption of diesel fuel by transport vehicles.

Scope 2 Emissions

Scope 2 emissions are greenhouse gas emissions generated from the production of electricity, heat or steam that a project consumes, but which is physically produced by another facility. It is unlikely that the works will generate Scope 2 emissions during the construction phase.

Scope 3 Emissions

Scope 3 emissions are greenhouse gas emissions generated in the wider economy that are related to a project, which are physically produced by another facility. Scope 3 emissions from the project would be present in the form of embedded emissions associated with construction material such as steel and concrete

In the context of greenhouse gas emissions in terms of scope 1, 2 and 3 emissions, the proposed scope of works would result in an insignificant increase to greenhouse gas emissions.

Air Quality Impacts during Construction

Diesel fuel is likely to be the primary fuel used in construction equipment and greenhouse gas emissions during construction are likely to be produced from the direct combustion of diesel fuel in vehicles during the transportation of materials and personnel to the site and from machinery used during works.

An increase in airborne particulate matter from either dust or vehicle emissions has been identified as an impact likely to arise during the construction stage. Dust generation is likely to be restricted given that access to and from the site is along bitumen roads and the only areas that will expose soil will be the entrance and exit pits for the horizontal drilling works. One potential source of dust that will require management is the spoil stockpiles that will be used to store excavated soil. An increase in construction traffic and plant in the general area will contribute to a localised increase in diesel emissions but is unlikely to significantly impact any nearby sensitive receivers. Given the distance to sensitive receivers the consequence of any impact is considered minor. As such its significance is considered medium in the absence of mitigation.

Odour is not considered to be an issue and has not been discussed further.

Air Quality Impacts during Operation

The maintenance and operation of the pipeline is unlikely to generate any air quality impacts during operation. The components of LPG are volatile, with any spills/leakage likely to evaporate to air almost immediately and unlikely to cause long term adverse effects in the environment.

5.6.3 Environmental Mitigation Measures

The following measures should be implemented to minimise the potential for greenhouse gas and air quality impacts:

- Best practice dust management practices to be included in the CEMP. These should include procedures for stockpile management, particularly during dry and windy weather conditions.
- Vehicles to be maintained and operated efficiently, be serviced according to the manufacturer's specifications and be fitted with emission control devices complying with Australian Design Standards so as to minimise air emissions (including greenhouse gases).
- Work machinery to be turned off when not in use and not left running or idling.

5.7 FLORA AND FAUNA

5.7.1 Existing Environment

The pipeline alignment falls within a heavily industrialised area which has undergone significant land development, including land reclamation works, and there is no

natural terrestrial habitat remaining in the immediate vicinity of the pipeline alignment. A study for the second Bulk Liquids Berth (BLB2) at Port Botany (2007) found that while there are a few remaining patches of the natural vegetation in the suburb of Port Botany they are degraded and of low ecological and conservation significance (SKM 2007). A search of the OEH Atlas of NSW Wildlife (2013) and the Department of the Environment (DoE) Protected Matters Reporting Tool (2013) did not return any records for threatened or protected species within the general ELGAS site. The Randwick LEP does not identify any areas of biodiversity value within the Port Botany peninsula.

The site however does lie adjacent to Botany Bay, which contains marine and estuarine habitats of importance, including Penrhyn Estuary. The estuary lies 1.5km to the north of the site and comprises saltmarsh, intertidal sand and mudflats and mangroves providing important habitat for migratory bird species and shorebirds. Seagrass beds are also known from Philip Bay, approximately 1.5km to the east of Port Botany. The Towra Point Nature Reserve Ramsar adjoins Kurnell Peninsula and forms the southern and eastern boundaries of Botany Bay, approximately 3km to the south west of the site.

5.7.2 Assessment of Impact

Flora and Fauna Impacts during Construction

Impacts affecting local biodiversity values are likely to be associated with instances where run-off from the site, or changes in groundwater quality, impact marine water quality in the bay and cause indirect impacts on flora and fauna such as:

- Smothering of benthic flora and fauna as sediment load drops out of the water column.
- Toxicity effects from contaminated water, either short-term or long term cumulative effects, on sensitive flora or fauna.

The works are adjacent to Brotherson Dock, which has been dredged to allow ships access to the BLB, and as such is unlikely to support sensitive marine habitat, such as seagrass communities (SKM, 2007). Therefore these impacts, should they occur, are likely to be temporary and localised and are unlikely to result in a significant impact on sensitive receivers.

Flora and Fauna Impacts during Operation

No impacts to local biodiversity values during operation have been identified.

5.7.3 Environmental Mitigation Measures

Potential impacts from the works centre on the potential for run-off from the site, or contaminated groundwater to affect water quality in the adjacent Botany Bay. Therefore mitigation measures focus on managing storm-water run-off as well as reducing the potential for works to contaminate groundwater. Whilst it is unlikely that there would be a significant impact, management of site run-off and protection of groundwater will be subject to standard mitigation measures as detailed in Sections 5.3.3 and 5.4.3.

5.8 HERITAGE VALUES

5.8.1 Existing Environment

A search of the Heritage schedule of the Randwick LEP, the Aboriginal Heritage Information Management System (AHIMS) and the Australian heritage database was undertaken as part of this assessment. There are no known Aboriginal cultural heritage sites or declared places within 200m of the proposed pipeline route (AHIMS, 2013).

There are also no known European heritage sites along the route of the proposed pipeline. The nearest conservation area is located to east of the pipeline route associated with Philip Bay (Randwick City Council, 2013).

5.8.2 Assessment of Impact

Given the relatively recent history of land reclamation to develop the Port Botany area and the small area of ground to be disturbed, the presence of unknown Aboriginal or European artefacts that could be disturbed during works is considered negligible. However, measures to manage unexpected discovery of artefacts will be incorporated in the CEMP for the project.

5.8.3 Environmental Mitigation Measures

In the event that Aboriginal or European artefacts are discovered during works, all works should cease and the Contractor should notify ELGAS for further advice.

5.9 TRAFFIC AND TRANSPORT

5.9.1 Existing Environment

The proposed works site is located within the Port Botany precinct, which is subject to a significant amount of heavy vehicle traffic on a daily basis. There are a number of main roads in the surrounding network including Foreshore Road, Botany Road, Beauchamp Road, Southern Cross Drive, Bunnerong Road and General Holmes Drive, which are heavy vehicle routes and heavily trafficked roads connecting the area to the Sydney CBD in the north, Cronulla and Kurnell in the south, the airport precinct and other surrounding industrial areas, such as the Botany Industrial Park.

The two roads within the immediate area of the proposed pipeline, Friendship Road and Charlotte Road are roads both managed by NSW Ports. The main entry into the Port is from Botany Road, via the publically accessible road, Bumborah Point Road as shown in Figure 2.1.

Traffic is directed into the Port via Simblist road, which then connects in a one-way system to the right at the intersection of Friendship Road and two-way towards the left. To exit the Port, traffic must continue in the same direction out via Friendship road onto Bumborah Point Road. Friendship Road is a one way single-lane road up to the point where it reaches Charlotte Road, with a slip lane often frequented by trucks waiting to access other areas of the port. Beyond this point the road becomes wider, however, remains one way directing traffic outside of the Port. This section of Friendship Road is separated by a median with two lanes, each with a slip lane.

Charlotte Road is a narrower road without parking, accessed via Friendship Road and is shared with the Charlotte Road pipeline corridor. There is approximately 2-3 m width of vacant unpaved pipeline corridor. This unoccupied area also passes under Friendship Road.

The ELGAS main administration office is accessed via Charlotte Road and consists of parking space for a number of vehicles. Access to the pipeline corridor is via Charlotte Road and from Qenos land.

The traffic counts undertaken in 2005 at the nearest RMS monitoring stations to the Port are shown in Table 5.1.

Table 5.1 AADT Volumes on Adjacent Roads to the Port

Road	Location	Average Annual Daily Traffic (AADT) Volumes (RMS 2005)
Botany Road	West of Beauchamp Road	39342
Botany Road	East of Beauchamp Road	24266
Foreshore Drive	2.1 km east of General Holmes Drive	33454
Beauchamp Road	North of Botany Road	20848
Southern Cross Drive	East of Botany Road, Mascot	103616
Southern Cross Drive	North of General Holmes Drive, Mascot	78383

5.9.2 Assessment of Impact

Traffic and Transport Impacts during Construction

A small number of vehicles and larger construction vehicles will be required during construction, including cranes (frannas), delivery trucks (semi-trailers), back hoe (for excavating drilling pits) and personnel vehicles.

The number of vehicles and daily traffic movements will vary during the construction stages. The estimated traffic volume is an average of up to four heavy vehicle movements (cranes and semi-trailer delivery trucks) per week and up to 15 light vehicle movements (cars, utilities, delivery trucks) per day. Large construction vehicles are unlikely to require daily traffic movements in the local road network once work has commenced in the corridor. The proposed increase in traffic in the road network during construction is considered very minor.

The works are anticipated to be undertaken entirely within the Charlotte Road pipeline corridor, ELGAS land and minor tie-in works on Qenos land. The pipeline corridor runs along Charlotte road and shares a property boundary with the Qenos property boundary to the east of the ELGAS Cavern Facility and Friendship Road. During the pipeline lifting works into the corridor near Friendship Road, there may be a requirement to partially obstruct the footpath/grassed area or part of one lane Friendship Road to ensure that the appropriate safe working distances are maintained around the crane. If this is required, it will be discussed prior with NSW Ports and a Traffic Management Control Plan would be implemented.

All vehicles will be parked off road to avoid any impacts to traffic, within the ELGAS property or within the pipeline corridor.

Overall the proposed construction works would have negligible impact upon the local traffic within the Port throughout the duration of works. Where potential disruption to Friendship Road is identified, this could be mitigated through the measures proposed in Section 5.9.3.

Traffic and Transport Impacts during Operation

During operation there are no anticipated impacts upon traffic in the local area as the pipeline will not generate any traffic movements or require any road obstructions during maintenance. A reduction in traffic may be a positive impact as a result of less ships delivering LPG into the Port once the pipeline is in operation.

5.9.3 Environmental Mitigation Measures

The following measures should be implemented to minimise the potential for traffic and transport impacts:

- Consultation should be undertaken with NSW Ports in regards to the Traffic management requirements prior to the commencement of construction. Any requirements should be implemented into the CEMP or a Traffic Management Control Plan, if deemed required by NSW Ports.
- Where possible, roads and pedestrian paths should not be obstructed during the construction works. The appropriate alternative access pathways and Traffic Controls should be enforced prior to the commencement of construction if obstructions cannot be avoided.
- Signage should be placed on Friendship Road and Charlotte Road indicating the presence of construction works as per Australian Standards.
- All vehicles should be parked off Charlotte Road and Friendship Road within the ELGAS property as far as practicable.
- All work sites and any compound established should be secured when not in use to ensure the safety of landholders and the public and maintain security of materials and equipment.

5.10 WASTE MANAGEMENT

5.10.1 Assessment of Impact

The major resource and waste generating aspects of the works are likely to include:

- Material for construction of the pipeline (primarily steel)
- Construction material packaging.
- Resources used during construction (e.g. water, temporary fencing).
- Energy (e.g. fuel).
- Spoil from horizontal drilling works, which may include contaminated spoil (approximately 120 tonnes of soil will be excavated).
- Used drilling lubricant (bentonite slurry).

- Groundwater / Surface water collected during dewatering activities.

Key risks with regards to waste management include inadequate onsite waste management resulting in waste becoming dispersed into the environment and incorrect waste disposal.

Given the close proximity of the site to Botany Bay, there is a risk of waste (particularly plastics) being easily dispersed into the water and impacting marine biota. The significance of this impact is considered to be low however it could be considered an offence under the POEO Act.

With respect to the disposal of waste, the most significant impact is likely to stem from the incorrect disposal of materials such as contaminated soil, groundwater / surface water, chemicals or fuels. Given the scope of the works, the generation of waste during the construction period is unlikely to be significant. The key risk centres around the management of any potentially contaminated spoil generated during works and excess water from dewatering activities, as well as any specific chemicals used during works. Mitigation for this is dealt in Section 5.2.3 and 5.3.3.

5.10.2 Environmental Mitigation Measures

The following measures should be implemented to manage waste generated by the works:

- The *Protection of the Environment Operations Act 1997* (POEO Act) defines waste for regulatory purposes and established management and licensing requirements. The *Protection of the Environment Operations (Waste) Regulation 2005* sets out the provisions covering the way waste is managed in terms of storage and transportation.
- Waste management should consider the hierarchy of resource management in the *Waste Avoidance and Resource Recovery Act 2001* (WARR Act).
- Contractor waste management arrangements to include waste minimisation, containment, segregation and appropriate reuse, recycling, treatment and disposal.
- Classification of waste as per the Environment Protection Authority (EPA) (DECC 2009a) guidelines.
- In the event of spillage of hazardous or non-hazardous material, spill kits to be utilised and disposal of material undertaken in line with EPA guidelines (DECC 2009a).

6 Statement of Commitments

As per the DGR's Table 6.1 below is a statement of commitments for implementation during the construction and operation phases of the project. The commitments made are the environmental management and monitoring measures proposed for mitigating the impacts of the ELGAS LPG Pipeline project.

The measures proposed would be developed further once the construction tender is issued and incorporated into a CEMP prior to construction.

Measures which have been developed as part of the PHA would be incorporated into the Safety Management Plan and design documents as applicable and as such have not been included in Table 6.1.

Where required by this EA, measures would also be incorporated into the Operational procedures for the ELGAS Cavern Facility.

Table 6.1 Statement of Commitments

Objective	Action	Timing

Minimise Impacts to Soil	• A soil management strategy to be prepared that details how excavated spoil will be managed on the site, including contaminated soil. The plan is to include stockpile locations as well as stormwater management measures.
	• A contingency plan to provide guidance should either acid sulphate soils or contaminated soils are encountered during works. This should make reference to the following guidelines:
	  • Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites (ANZECC & NHMRC)
	  • National Environment Protection (Assessment of Site Contamination) Measures 1999 (NEPC)
	  • Managing Land Contamination – Planning Guidelines SEPP 55 – Remediation of Land (DOP)
	  • Acid Sulphate Soils Assessment Guidelines 1998 (ASSMAC).
	• A frac-out contingency plan should be developed for use during the drilling works.
		Prior to and During Construction

Objective	Action	Timing
Avoid and minimise impacts to Groundwater	• A groundwater management plan (as part of the CEMP) is to be developed to manage any dewatering works. The plan is to include suitable control measures for the collection, treatment (as necessary) and disposal of contaminated groundwater that may be pumped from excavations during construction. • The CEMP is to include measures for managing spills or potential release of contaminated materials during the drilling works (e.g. frac-out situations). • A frac-out contingency plan to be developed for use during the drilling works • If the works encounter groundwater, it is unlikely to be of a sufficient volume to require an aquifer interference licence (as per the correspondence received from DPI (Office of Water) – Appendix C), however, monitoring during works should be undertaken to ensure this is the case. • In the event that groundwater monitoring shows the works would intercept or extract 3 ML or more of water, the Office of Water is to be contacted and a licence must be obtained for the works.	Prior to and During Construction

Minimise impacts to Surface Water	• The contractor is to ensure systems are in place to prevent pollution of waters from handling, transport and storage of liquids and to ensure that activities are undertaken in accordance with the *Contaminated Land Management Act 1997* (CLM Act), EPA guidelines and the POEO Act. Creating site specific tailored actions for staged construction activities would be the responsibility of the contractor and be portrayed in the CEMP.
	• Development of a frac-out contingency plan to protect nearby aquatic habitats
	• Use of the *Botany Bay Precinct Emergency Sub Plan 2011 (Major Hazard Facility – Port Botany South)*
	• Appropriate stockpile locations to be notified in the CEMP and development of stormwater management plan following relevant guidelines:
	  • *Managing Urban Stormwater: Soils & Construction (Landcom)*
	  • *Managing Urban Stormwater: Treatment Techniques (DECC)*
	  • *Managing Urban Stormwater: Source Control (DECC).*
	• Development of contingency plan for spill management:
	• *Technical Guidelines: Bunding and Spill Management (DECC).*
		During Construction and Operation

Objective	Action	Timing
	• All machinery and equipment to be checked daily and maintained to ensure there are no oil, fuel or other liquids leaking. • A spill kit to be kept on site to manage any unexpected spills. • Update the PIRMP to include the LPG pipeline as part of the ELGAS Port Botany facilities.	
Minimise impacts of noise and vibration	• The NSW EPA *Interim Construction Noise Guideline* (DECC, 2009) to be used to inform CEMP and management of construction noise. • Construction to take place between 6:00am and 6.00pm (Monday to Friday) and 6:00am to 4:00pm on Saturday, with the noisiest activities to be scheduled during recommended standard hours (DECC, 2009) of 7:00am to 6:00pm Monday to Friday and 8:00am to 1:00pm on Saturday. • Nearby commercial and industrial properties to be notified of works. • Noise generated by work equipment to comply with noise control standard AS 1055. • Works involving noise-generating machinery should be undertaken within the shortest possible timeframe, with minimum delays. All efforts should be made to schedule noisier work activities during the daytime on week days.	During Construction
Minimise air quality impacts through dust and Greenhouse gas emissions	• Best practice dust management practices to be included in the CEMP. These should include procedures for stockpile management, particularly during dry and windy weather conditions. • Vehicles to be maintained and operated efficiently, be serviced according to the manufacturer's specifications and be fitted with emission control devices complying with Australian Design Standards so as to minimise air emissions (including greenhouse gases). • Work machinery to be turned off when not in use and not left running or idling	During Construction
Minimise impacts to flora and fauna	• Potential impacts from the works centre on the potential for run-off from the site, or contaminated groundwater to affect water quality in the adjacent Botany Bay. Therefore mitigation measures focus on managing storm-water run-off as well as reducing the potential for works to contaminate groundwater. Whilst it is unlikely that there would be a significant impact, management of site run-off and protection of groundwater will be subject to standard mitigation measures as detailed in Sections 5.3.3 and 5.4.3.	During Construction

Objective	Action	Timing
Minimise impacts to unidentified items of heritage significance	• In the event that Aboriginal or European artefacts are discovered during works, all works should cease and the Contractor should notify ELGAS for further advice.	During Construction and Operation
Minimise impacts to traffic and access within Port and the surrounding road network.	• Consultation should be undertaken with NSW Ports in regards to the Traffic management requirements prior to the commencement of construction. Any requirements should be implemented into the CEMP or a Traffic Management Control Plan, if deemed required by NSW Ports. • Where possible, roads and pedestrian paths should not be obstructed during the construction works. The appropriate alternative access pathways and Traffic Controls should be enforced prior to the commencement of construction if obstructions cannot be avoided. • Signage should be placed on Friendship Road and Charlotte Road indicating the presence of construction works as per Australian Standards. • All vehicles should be parked off Charlotte Road and Friendship Road within the ELGAS property as far as practicable. • All work sites and any compound established should be secured when not in use to ensure the safety of landholders and the public and maintain security of materials and equipment.	During Construction
Encourage waste minimisation and management in accordance with the WARR Act	• The *Protection of the Environment Operations Act 1997* (POEO Act) defines waste for regulatory purposes and established management and licensing requirements. The *Protection of the Environment Operations (Waste) Regulation 2005* sets out the provisions covering the way waste is managed in terms of storage and transportation. • Waste management should consider the hierarchy of resource management in the *Waste Avoidance and Resource Recovery Act 2001* (WARR Act). • Contractor waste management arrangements to include waste minimisation, containment, segregation and appropriate reuse, recycling, treatment and disposal. • Classification of waste as per the Environment Protection Authority (EPA) (DECC 2009a) guidelines.	During Construction, Post-Construction and Operation.

7 Conclusions

The overall environmental impact of the proposed LPG Pipeline is low and can be managed with best practice construction site management, as well as, the site specific measures proposed in Section 6 of this EA. Furthermore, the proposed modifications to Qenos operations would have a positive influence in a wider context, as Australia's sole manufacturer and leading supplier of polyethylene and polymers. The proposed modifications would reduce its feedstock cost and improve plant supply security which would have economic and social benefit in terms of continuing to maintain supply of its products to the Australian economy.

The proposed pipeline would also have a positive cumulative impact, to reduce the frequency of ships into the Port due to the more efficient discharge operation from ship to terminal provided by the ELGAS pipeline.

As required by the DGR's issued, consideration has been given to the consistency of the project with the objects of the EP&A Act below:

(a) to encourage:

i the proper management, development and conservation of natural and artificial resources, including agricultural land, natural areas, forests, minerals, water, cities, towns and villages for the purpose of promoting the social and economic welfare of the community and a better environment,

The proposed modifications would facilitate a reduction in feedstock costs for Qenos and improve supply security. If the Qenos Olefines plant were taken off-line due to supply issues, this would have a knock-on effect on other end users at the Botany Industrial Park.

ii the promotion and co-ordination of the orderly and economic use and development of land,

The proposed modifications meet the requirements of the SEPP 2013 and are permissible with consent in the Special Activities land use zone identified in the SEPP.

iii the protection, provision and co-ordination of communication and utility services,

The proposed modifications would not directly impact on the provision and co-ordination of communication and utility services.

iv the provision of land for public purposes,

The proposed modification would not directly impact on the provision of land for public purposes

v the provision and co-ordination of community services and facilities, and

The proposed modification would not directly impact on the provision and co-ordination of community services and facilities

vi the protection of the environment, including the protection and conservation of native animals and plants, including threatened species, populations and ecological communities, and their habitats, and

The proposed modifications would not directly or indirectly impact any threatened species, populations, ecological communities and their habitats.

vii ecologically sustainable development, and

Where possible, ecologically sustainable principles will be employed and mitigation measures proposed in this EA would ensure that the project is consistent with the definition of ecologically sustainable development under NSW legislation.

viii the provision and maintenance of affordable housing, and

Not applicable

(b) to promote the sharing of the responsibility for environmental planning between the different levels of government in the State, and

Section 3 of this EA demonstrates that the project is consistent with relevant local and state planning legislation. All levels of government have been involved during the consultation process.

(c) to provide increased opportunity for public involvement and participation in environmental planning and assessment.

ELGAS has undertaken consultation activities with the Port Botany Neighbourhood Liaison Group Meeting during the environmental assessment process as noted in Section 4.

The project is consistent with the objects of the EP&A Act as illustrates how proper management of natural resources can promote social and economic supports a key Australian manufacturer and would be constructed with the aim of ensuring minimal environmental impact.

8 References

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Appendix A

DIRECTOR GENERAL REQUIREMENTS

NSW GOVERNMENT | Planning & Infrastructure

Contact: Andrew Hartcher
Phone: (02) 9228 6503
Fax: (02) 9228 6466
Email: andrew.hartcher@planning.nsw.gov.au

Our ref: DA No. 463/93 MOD 1

M/s Lara Mottee
Environmental Scientist
Kellogg Brown & Root Pty Ltd
Level 13, 201 Kent Street
SYDNEY NSW 2000

Dear M/s Mottee

Director-General's Requirements
Elgas Liquid Petroleum Gas Storage Caverns Facility
Proposed Modification - Liquid Petroleum Gas Pipeline (DA No. 463/93 MOD 1)

I refer to your request to modify the development consent (DA No. 463/93) issued by the then Minister for Planning on 15 May 1994 for the development of underground storage caverns for storage and distribution of liquid petroleum gas (LPG) at Port Botany.

The proposed modification will be assessed under Section 75W of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

I have attached a copy of the Director-General's requirements for the project. Please note that the Director-General may alter these requirements at any time.

I would appreciate it if you would contact the Department at least two weeks before you propose to submit your Environmental Assessment (EA) for the project. This will enable the Department to determine the:

- applicable fee;
- determine consultation requirements; and
- number of copies (hard-copy or CD-ROM) of the Environmental Assessment that will be required for exhibition purposes.

The Department is required to make all the relevant information associated with the project publicly available on its website. Consequently, I would appreciate it if you would ensure that all the documents you subsequently submit to the Department are in a suitable format for the web, and arrange for an electronic version of the EA to be hosted on a suitable website during the assessment process

If you have any enquiries about these requirements, please contact Andrew Hartcher on 9228 6503 or andrew.hartcher@planning.nsw.gov.au

Yours sincerely

for 6·9·2013

Chris Ritchie
Manager – Industry
Major Projects Assessment
as the Director-General's nominee

Director-General's Requirements

Section 75W of the *Environmental Planning and Assessment Act 1979*

Application Number	DA No. 463/93 MOD 1
Project	The proposal is for the construction and operation of a pipeline to transport liquid petroleum gas (LPG) from Elgas's existing LPG Cavern facility at Port Botany to the Qenos Hydrocarbon Terminal at Port Botany and associated infrastructure.
Location	Corner of Friendship Road and Charlotte Road, Port Botany in the Randwick local government area.
Proponent	Elgas Ltd
Date of Issue	September 2013
General Requirements	The Environmental Assessment of the proposed modification must include: • an executive summary • a detailed description of the following within the site and any associated areas: - historical operations/activities - existing and approved operations/facilities, including any statutory approvals that apply to these operations and facilities; - a description of the proposed modifications in relation to any existing environmental management plans that may need to be updated; • a detailed description of the project, including: - need for the modification - proposed modifications or upgrades to activities or infrastructure - alternatives considered - various components and stages of the proposal - likely interactions between existing and proposed operations; - likely interactions between the approval being sought and the existing approvals/consents that apply to site; - plans of any proposed building works; and - flow-diagrams that show how the modifications work. • a detailed assessment of the following, and any other significant issues identified in the Environmental Risk Assessment (see 'Key Issues'): - a description of the existing environment, using baseline data; - a detailed description of the process and equipment modifications involved (to determine whether any additional impacts are likely (e.g. noise, odour, wastewater and traffic); - an assessment of the potential impacts of the project, including any cumulative impacts, taking into consideration any relevant guidelines, policies, plans and statutory provisions - a description of the measures that would be implemented to avoid, minimise, mitigate, rehabilitate/remediate, monitor and/or offset the potential impacts of the project, including detailed contingency plans for managing any significant risks to the environment. • a statement of commitments, outlining all the proposed environmental management and monitoring measures • a conclusion justifying the project on economic, social and environmental grounds, taking into consideration whether the project is consistent with the objects of the *Environmental Planning & Assessment Act 1979*; and • a signed statement from the author of the Environmental Assessment, certifying that the information contained within the document is neither false nor misleading.
Key Issues	• **Hazards and Risk** – including: - updating the risk assessment for the subject site to include the proposed modification. The risk assessment should be updated in accordance with *Hazardous Industry Planning Advisory Paper No. 6 – Hazards Analysis*; and

	- address all recommendations of the Department's *Port Botany Land Use Safety Study Overview Report* relevant to the modification. • **Soil and Water** – including: - an assessment of the potential impacts of the proposal on soil and water (including surface and groundwater resources) during construction and operation; and - consideration of the potential for contaminated soil and water to be encountered during construction and its management in accordance with the relevant guidelines. • **Noise and Vibration** – including an assessment of construction, operation and traffic noise generated by the project in accordance with the relevant EPA guidelines. This assessment should focus on potential impacts on nearby sensitive receivers; • **Air Quality** – including: - an assessment of the air quality (including odour) impacts of the development in accordance with the relevant EPA guidelines. This assessment should focus on potential impacts on nearby sensitive receivers; and - details of any air quality control and management measures for the modification. • **Traffic and Transport** – including: - accurate predictions of the traffic volumes likely to be generated during construction and operation; and - a detailed traffic impact study of the project. • **Waste Management** – including: - identification of the volume, type and classification of all waste/s generated during the construction of the project; and - details of all waste treatment (e.g. contaminated soil) and disposal measures undertaken in accordance with the relevant guidelines. • **Greenhouse Gas** – including an assessment of the potential greenhouse gas emissions of the project.
References	While not exhaustive, the following attachment contains a list of the guidelines, policies, and plans that may be relevant to the project.
Consultation	During the preparation of the Environmental Assessment, you should consult with the relevant local, State or Commonwealth Government authorities, service providers, community groups or affected landowners. In particular you must consult with the: • Sydney Ports Corporation; • Randwick City Council; • Environment Protection Authority; • WorkCover NSW; and • Roads and Maritime Service. The consultation process, and the issues raised during this process, must be described in the Environmental Assessment.

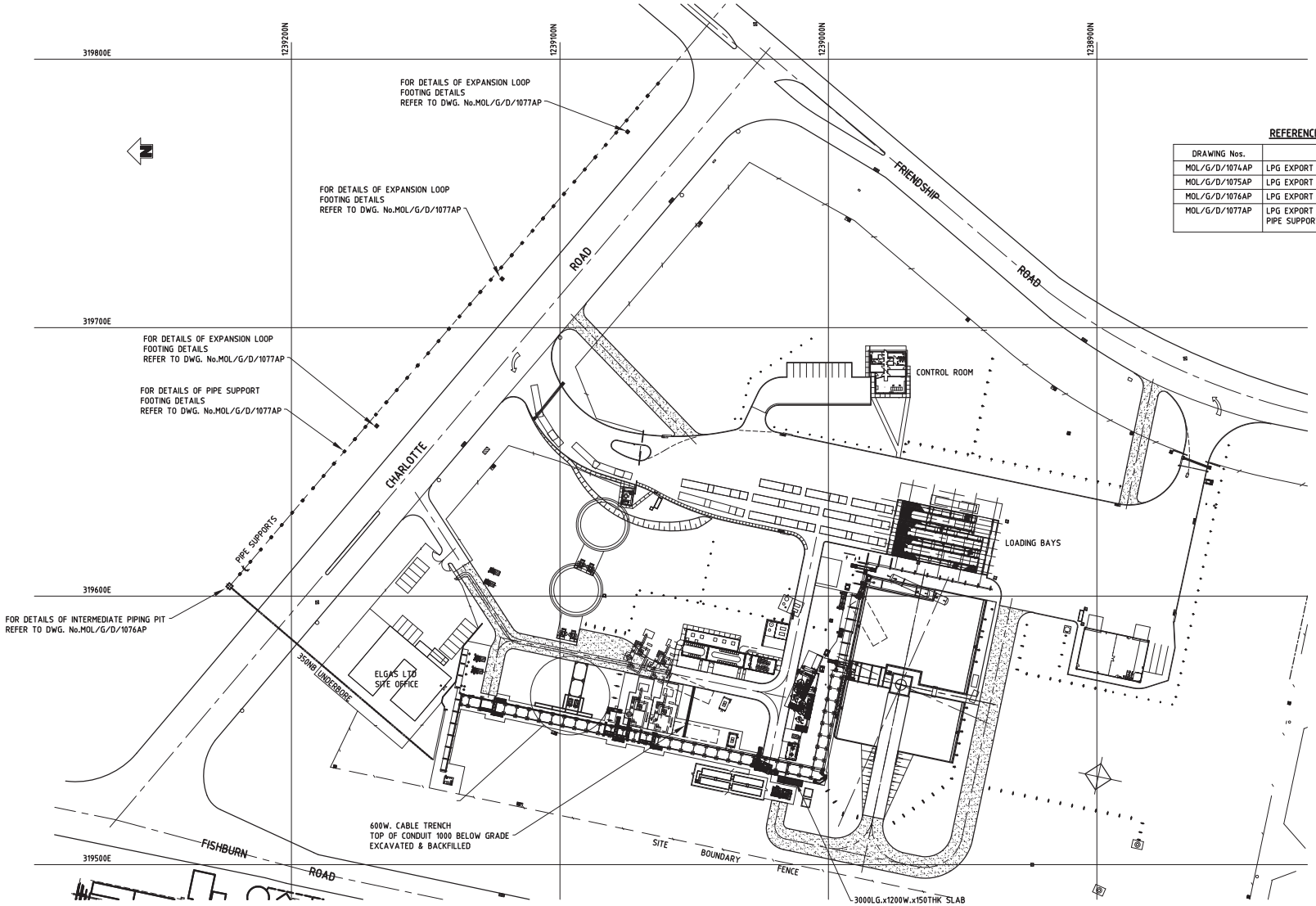
Technical and Policy Guidelines

Aspect	Policy /Methodology
Risk Assessment	
	AS/NZS 4360:2004 Risk Management (Standards Australia)
	HB 203: 203:2006 Environmental Risk Management – Principles & Process (Standards Australia)
Hazards	
	State Environmental Planning Policy No. 33 – Hazardous and Offensive Development
	Applying SEPP 33 – Hazardous and Offensive Development Application Guidelines (DUAP)
	Hazardous Industry Planning Advisory Paper No. 6 – Guidelines for Hazard Analysis
Noise	
	NSW Industrial Noise Policy (DECC)
	NSW Road Noise Policy (NSW EPA)
	Interim Construction Noise Guideline (NSW EPA)
Soil and Water	
Soil	Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites (ANZECC & NHMRC)
	National Environment Protection (Assessment of Site Contamination) Measure 1999 (NEPC)
	Draft Guidelines for the Assessment & Management if Groundwater Contamination (DECC)
	State Environmental Planning Policy No. 55 – Remediation of Land
	Managing Land Contamination – Planning Guidelines SEPP 55 – Remediation of Land (DOP)
	Acid Sulphate Soils Assessment Guidelines 1998 (ASSMAC)
Surface Water	National Water Quality Management Strategy: Water quality management - an outline of the policies (ANZECC/ARMCANZ)
	National Water Quality Management Strategy: Policies and principles - a reference document (ANZECC/ARMCANZ)
	National Water Quality Management Strategy: Implementation guidelines (ANZECC/ARMCANZ)
	National Water Quality Management Strategy: Australian Guidelines for Fresh and Marine Water Quality (ANZECC/ARMCANZ)
	National Water Quality Management Strategy: Australian Guidelines for Water Quality Monitoring and Reporting (ANZECC/ARMCANZ)
	Using the ANZECC Guideline and Water Quality Objectives in NSW (DEC)
	State Water Management Outcomes Plan
	NSW Government Water Quality and River Flow Environmental Objectives (DECC)
	Approved Methods for the Sampling and Analysis of Water Pollutants in NSW (DEC)
	Greater Metropolitan Regional Environmental Plan No. 2 – Georges River Catchment
	Managing Urban Stormwater: Soils & Construction (Landcom)
	Managing Urban Stormwater: Treatment Techniques (DECC)
	Managing Urban Stormwater: Source Control (DECC)
	Technical Guidelines: Bunding & Spill Management (DECC)
	Environmental Guidelines: Use of Effluent by Irrigation (DECC)

Groundwater	National Water Quality Management Strategy Guidelines for Groundwater Protection in Australia (ARMCANZ/ANZECC)
	NSW State Groundwater Policy Framework Document (DLWC)
	NSW State Groundwater Quality Protection Policy (DLWC)
	NSW State Groundwater Quantity Management Policy (DLWC) Draft
	Guidelines for the Assessment and Management of Groundwater Contamination (DECC)
Air Quality	
	Protection of the Environment Operations (Clean Air) Regulation 2002
	Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (DEC)
	Approved Methods for the Sampling and Analysis of Air Pollutants in NSW (DEC)
Odour	
	Technical Framework: Assessment and Management of Odour from Stationary Sources in NSW (DEC)
	Technical Notes: Assessment and Management of Odour from Stationary Sources in NSW (DEC)
Transport	
	Guide to Traffic Generating Development (RTA)
	Road Design Guide (RTA)
Waste	
	Waste Classification Guidelines (DECC)
	Environmental Guidelines: Assessment, Classification, and Management of Liquid and Non-Liquid Wastes (EPA)
Visual	
	Control of Obtrusive Effects of Outdoor Lighting (Standards Australia, AS 4282)
	State Environmental Planning Policy No 64 - Advertising and Signage
Greenhouse Gas	
	AGO Factors and Methods Workbook (AGO)
	Guidelines for Energy Savings Action Plans (DEUS, 2005)

Appendix B

DESIGN DRAWINGS



SITE PLAN
1:1000

REFERENCE DRAWINGS

DRAWING Nos.	DESCRIPTION
MOL/G/D/1074AP	LPG EXPORT TO QENOS TIE-IN - CIVIL PUMP/SLAB AREA
MOL/G/D/1075AP	LPG EXPORT TO QENOS TIE-IN - SECTIONS - PUMP SLAB
MOL/G/D/1076AP	LPG EXPORT TO QENOS TIE-IN - DETAILS - UNDERBORE PIT
MOL/G/D/1077AP	LPG EXPORT TO QENOS TIE-IN - DETAILS - PIT COVER & PIPE SUPPORT PLINTHS

NOTE
FOR ALL CIVIL NOTES REFER TO DWG. No.MOL/G/D/1074AP

A1 FRAME 801x554

BAR SCALES

REFERENCE DRAWINGS

DRG No.	TITLE

REVISIONS AND APPROVALS

CODE	DATE	DESCRIPTION	DRAFT	DES	P.S.

REVISIONS AND APPROVALS

CODE	DATE	DESCRIPTION	DRAFT	DES	P.S.
A	14.05.13	INFORMATION ONLY	L.P.	H.R.	R.A.

DESIGNED	DATE	SCALES	
L.PORTELLI	14.05.13	NONE	
DESIGN CHECK		CAD FILE	MOLGD1073AP
-	- . - . -	PLOT SCALE	1:1000
DRAWN		TECHNICAL APPROVAL	DATE
L.PORTELLI	14.05.13	-	-
DRAFTING CHECK		PROJECT APPROVAL	
H.ROBINSON	14.05.13	R. ANDERSON	14.05.13
PROJECT DRAFTER		CLIENT APPROVAL	
-	- . - . -	-	-

Kellogg Brown & Root Pty Ltd
KBR
Kellogg Brown & Root Pty Ltd ABN 91 007 660 317

AS PROPOSED

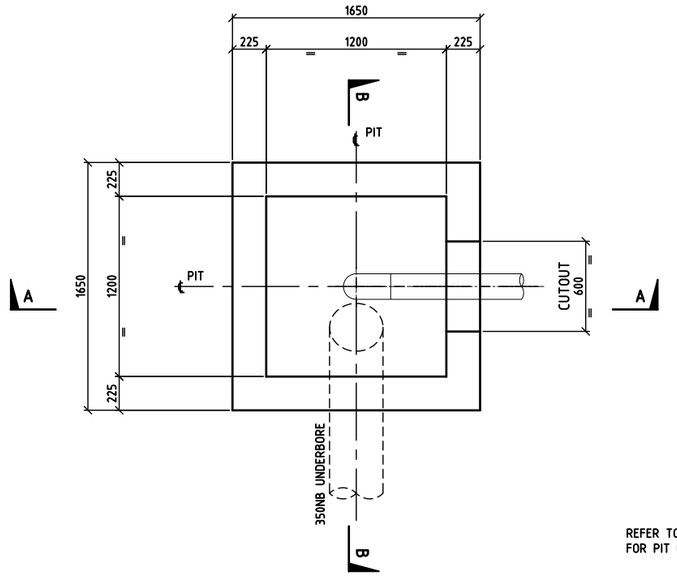
ELGAS LIMITED

SYDNEY LPG CAVERN

LPG EXPORT TO QENOS TIE-IN
SITE LAYOUT
CIVIL G.A.

ELG130-DW-CV-GAR-0001 REV CODE:A

DRAWING NUMBER	REVISION CODE
MOL/G/D/1073AP	A



PLAN - INTERMEDIATE UNDERBORE PIT

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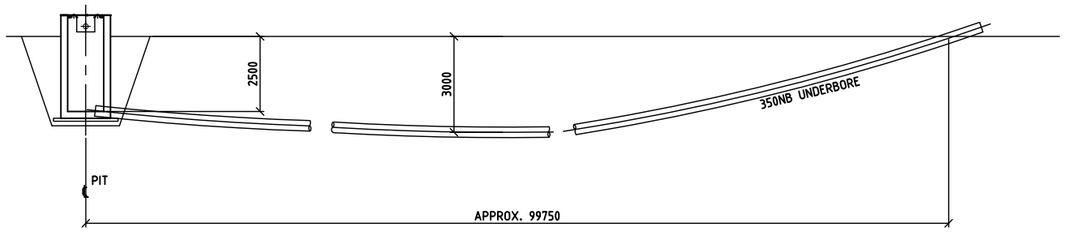
REFER TO DRAWING No.
FOR PIT COVER DETAILS



SECTIONAL ELEVATION - UNDERGROUND BORE

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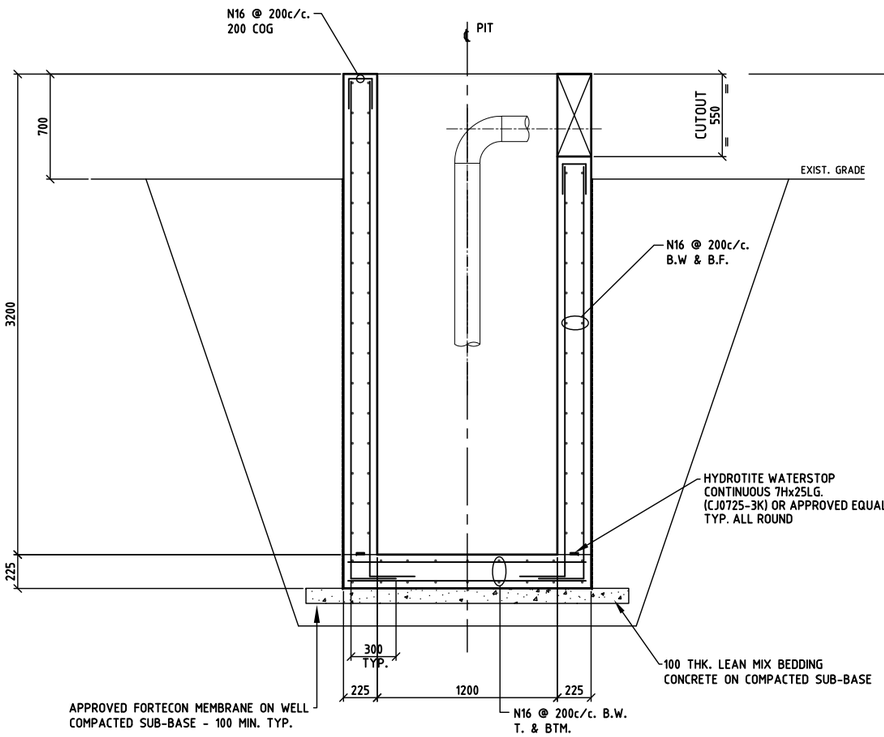

SECTION A-A

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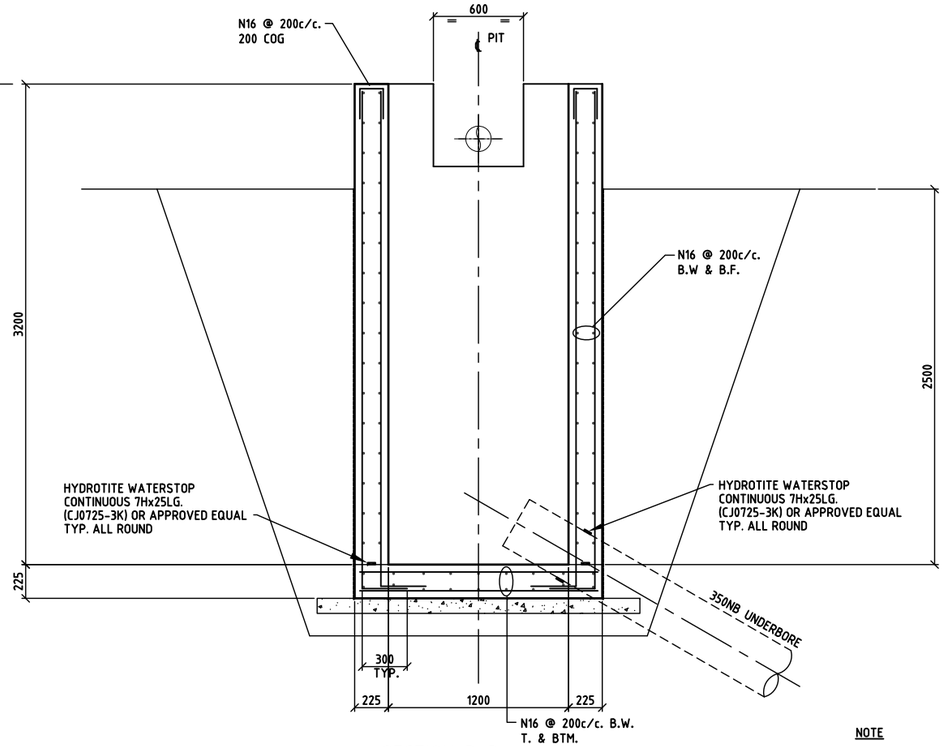

SECTION B-B

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NOTE

FOR ALL CIVIL NOTES REFER TO DWG. No.MOL/G/D/1074AP

A1 FRAME 801x554

BAR SCALES	REFERENCE DRAWINGS		REVISIONS AND APPROVALS					REVISIONS AND APPROVALS					
	1073AP	SITE PLAN - CIVIL G.A.	CODE	DATE	DESCRIPTION	DRAFT	DES	P.S.	A	14.05.13	INFORMATION ONLY	L.P.	H.R.	R.A.
	DRG No.	TITLE							CODE	DATE	DESCRIPTION	DRAFT	DES	P.S.

DESIGNED L.PORTELLI	DATE 14.05.13	SCALES NONE	
DESIGN CHECK -	- . - . -	CAD FILE MOLGD1076AP PLOT SCALE 1:1000	
DRAWN L.PORTELLI	14.05.13	TECHNICAL APPROVAL -	DATE -
DRAFTING CHECK H.ROBINSON	14.05.13	PROJECT APPROVAL R. ANDERSON	14.05.13
PROJECT DRAFTER -	- . - . -	CLIENT APPROVAL -	-

Kellogg Brown & Root Pty Ltd

KBR

Kellogg Brown & Root Pty Ltd ABN 91 007 660 317

AS PROPOSED

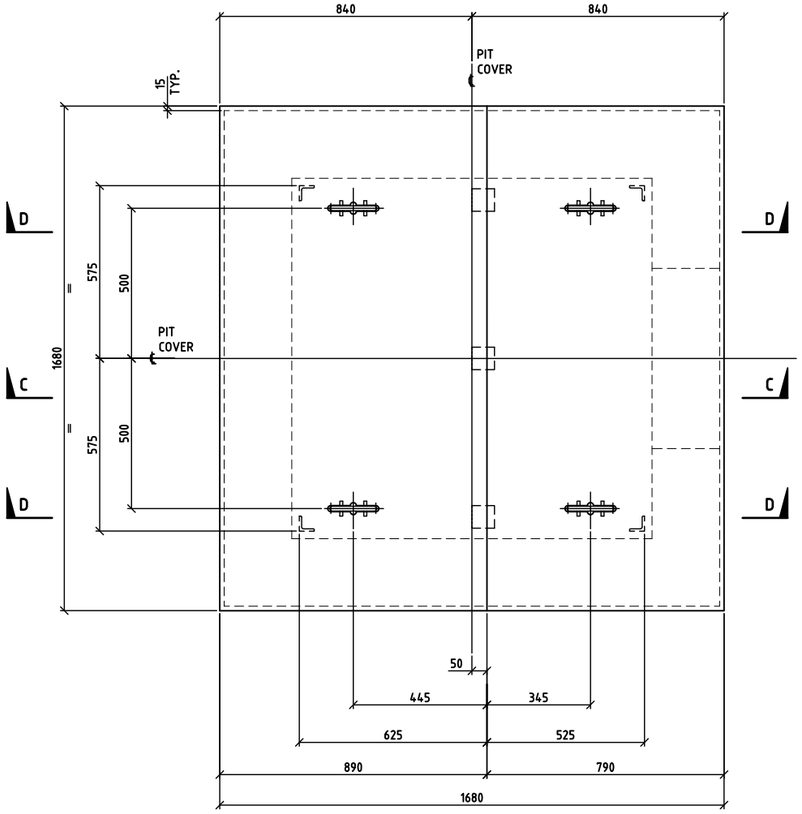
ELGAS LIMITED

SYDNEY LPG CAVERN

LPG EXPORT TO QENOS TIE-IN
CIVIL
DETAILS - UNDERBORE PIT

ELG130-DW-CV-DTL-0004 REV CODE:-A

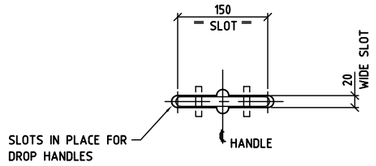
DRAWING NUMBER	REVISION CODE
MOL/G/D/1076AP	A



PLAN - INTERMEDIATE PIT COVER DETAIL

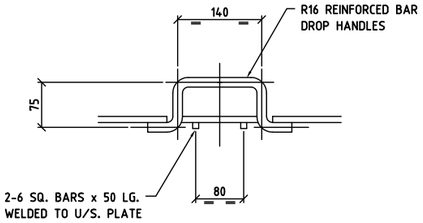
1:5

REFER TO DRAWING No. MOL/G/D/1073AP FOR INTERMEDIATE PIT DETAILS



PLAN

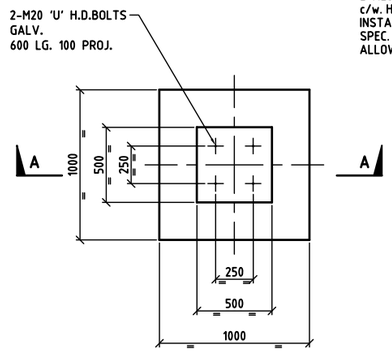
1:5



TYP. COVER HANDLE DETAIL

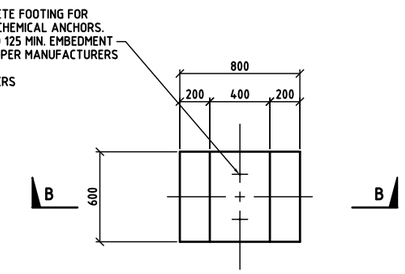
1:5

4 REQUIRED



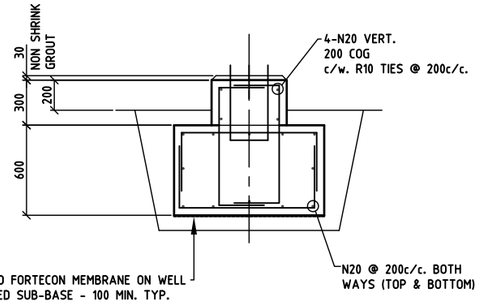
PLAN

1:20



PLAN

1:20

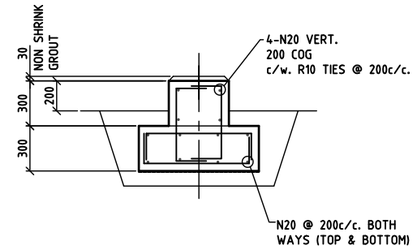


SECTION A-A

1:20

EXPANSION LOOP FOOTING 3 REQUIRED

MOL/G/D/1073AP

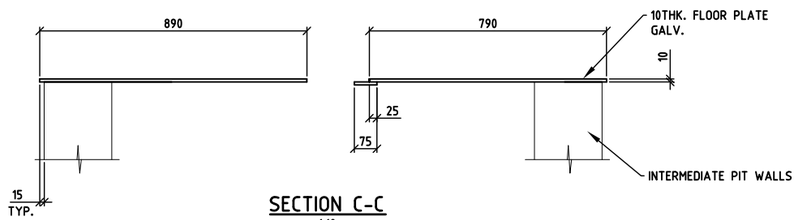


SECTION B-B

1:20

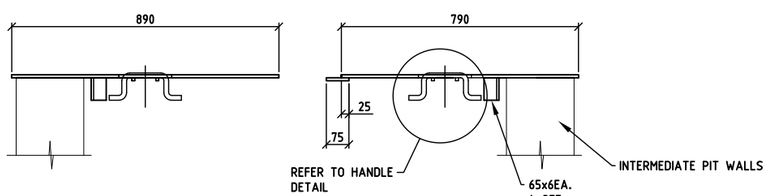
TYP. PIPE SUPPORT FOOTING 41 REQUIRED

MOL/G/D/1073AP



SECTION C-C

1:10



SECTION D-D

1:10

NOTE

FOR ALL CIVIL NOTES REFER TO DWG. No.MOL/G/D/1074AP

A1 FRAME 801x554

BAR SCALES	REFERENCE DRAWINGS			REVISIONS AND APPROVALS					REVISIONS AND APPROVALS					
	DRG No.	TITLE	CODE	DATE	DESCRIPTION	DRAFT	DES	P.S.	CODE	DATE	DESCRIPTION	DRAFT	DES	P.S.
	1073AP	SITE PLAN - CIVIL G.A.							A	14.05.13	INFORMATION ONLY	L.P.	H.R.	R.A.

DESIGNED L.PORTELLI	DATE 14.05.13	SCALES NONE	
DESIGN CHECK -	- . - . -	CAD FILE MOLGD1077AP PLOT SCALE 1:10	
DRAWN L.PORTELLI	14.05.13	TECHNICAL APPROVAL -	DATE -
DRAFTING CHECK H.ROBINSON	14.05.13	PROJECT APPROVAL R. ANDERSON	14.05.13
PROJECT DRAFTER -	- . - . -	CLIENT APPROVAL -	-

Kellogg Brown & Root Pty Ltd

KBR

Kellogg Brown & Root Pty Ltd ABN 91 007 660 317

AS PROPOSED

ELGAS LIMITED

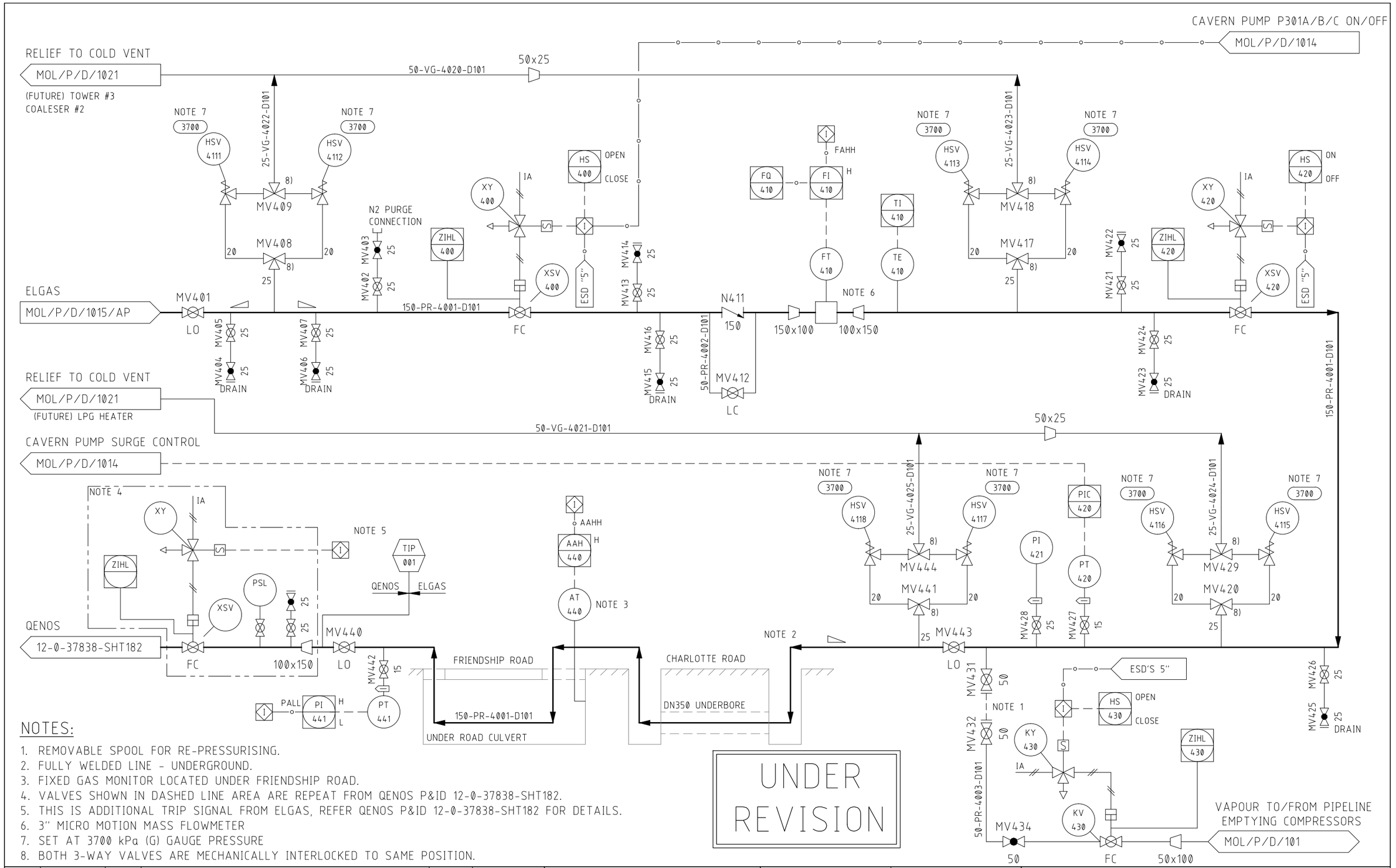
SYDNEY LPG CAVERN

LPG EXPORT TO QENOS TIE-IN
CIVIL DETAILS
PIT COVER & PIPE SUPPORT PLINTHS

ELG130-DW-CV-DTL-0005 REV CODE: A

DRAWING NUMBER MOL/G/D/1077AP

REVISION CODE A



NOTES:

1. REMOVABLE SPOOL FOR RE-PRESSURISING.
2. FULLY WELDED LINE - UNDERGROUND.
3. FIXED GAS MONITOR LOCATED UNDER FRIENDSHIP ROAD.
4. VALVES SHOWN IN DASHED LINE AREA ARE REPEAT FROM QENOS P&ID 12-0-37838-SHT182.
5. THIS IS ADDITIONAL TRIP SIGNAL FROM ELGAS, REFER QENOS P&ID 12-0-37838-SHT182 FOR DETAILS.
6. 3" MICRO MOTION MASS FLOWMETER
7. SET AT 3700 kPa (G) GAUGE PRESSURE
8. BOTH 3-WAY VALVES ARE MECHANICALLY INTERLOCKED TO SAME POSITION.

UNDER REVISION

REV.	DATE	DRAWN	REVISIONS	PASSED	APPROVED	REFERENCE DRAWINGS
1.G	16-1-14	JAM	UNDER REVISION.			
1.F	20-12-13	JAM	UNDER REVISION.			
1.E	20-11-13	MD	PSVS 403, 404, 421 & 422 ADDED.			
1.D	20-11-13	MD	CLIENTS COMMENTS INCORPORATED			
1.C	13-11-13	MD	UNDER REVISION		SW	

PROJECT

SCALE NTS

BOC

A Member of The Linde Group

10 JULIUS AVENUE, NORTH RYDE, NSW 2113

DIAGRAM – P&I

ELGAS LPG TO QENOS

A3 FORM Nº DEP-002-F07/4

DRAWING Nº MOL/P/D/1064/AP

SHEET

REVISION 1

MATCHLINE C.O.D.MOL/T/D/1023

REFER PLAN E

REFER TO DWG. No. MOL/T/D/1139 FOR DETAILS

P-401B

P-401A

REFER PLAN B

A-204

FUTURE

MATCHLINE C.O.D.MOL/T/D/1025

PLAN
1:250

REFER PLAN F
MOL/T/D/1027

FOR HYDRANT DETAILS SEE MOL/T/D/1047

CL.RL.6.000

150-FW-2413-B300
CL.RL.5.384

END VIEW

VIEW D
1:50

SCALE OF MILLIMETRES 0 5000 10000 15000 20000 SCALE 1:250

SCALE OF MILLIMETRES 0 1000 2000 3000 4000 SCALE 1:50

A1 FRAME 801x554

MATCHLINE C.O.D.
MOL/T/D/1139

150-PR-4001-D100
50-PR-4006-D101
UNDER PIPERACK

50-VG-4020-B101

150-PR-4005-D100
UNDER PIPERACK

FE 423

GATE VALVE DN50

GAS DISPOSAL CONNECTION

250-FW-2413-B300

PS 1221

FIRE HYDRANT

HSV 2117 N2 PURGE HV 220

T.O.G.RL.7.210

100-PR-2039-D101
80-PR-2016-D101

JUNCTION BOXES UJB-200-1 UJB-200-4

T.O.G.RL.6.700

PS 1222

100-PR-2038-D101

XSV 221

T.O.G.RL.6.700

400-PR-2027-D101

25-PR-2013-D101

HSV 2206

50-VG-2041-B101

PS 1223

N2 PURGE CONN.

PSV 2201

50-VG-4020-B101

150-PR-4005-D100
UNDER PIPERACK

150-PR-4001-D100

50-PR-4006-D101
UNDER PIPERACK

PS 1224

DN50 N2 HEADER

400-PR-2026-D101

80-PW-2503-B500

80-VG-7001-B101

250-FW-2413-B300

50-1A-2501-B500

40-PA-2502-B500

JUNCTION BOXES UJB-200-5 UJB-200-6 UJB-200-1

A-204
LPG HEATER

UTILITY STATION
DN20 PW
DN20 PA
DN25 N2

DN300 BLIND FLANGE

TT 220 UNDER

80-PR-3103-B100

50-VG-7003-B100

100-PR-1002-D101

100-TW-3204-B300

50-PR-2016-D101

50-PR-1003-D100

25-A-B500

MOL/T/D/1027

MATCHLINE C.O.D.MOL/T/D/1027

PART PLAN B
1:50

150-FW-2411-B300
400-PR-2026-D101

25-PR-2010-D101
40-PA-2502-B500
50-1A-2501-B500
80-PW-2503-B500

PT 217
PS 1211

80-PR-2051-D101
CL.RL.7.228

PSV 2115

50-PR-1003-D100
100-PR-1002-D101
50-VG-7003-B100

B

MATCHLINE C.O.D.
MOL/T/D/1023

T.O.G.RL.7.210

DN50 N2 HEADER

CL.RL.6.928

PART PLAN E
1:50

MATCHLINE C.O.D.
MOL/T/D/1139

THIS DRAWING

KEYPLAN

ABOVEGROUND UNDERGROUND

B.O.P.RL.5.300

80-PA-2502-B500
40-PW-2503-B500
100-TW-3204-B300

250-FW-2413-B300

CL.RL.3.848
CL.RL.3.847
B.O.P.RL.3.723

MATCHLINE C.O.D.MOL/T/D/1046

150-WW-2507-B300

TP 1
TP 2
TP 6
TP 5
TP 3
TP 4

CL.RL.6.646

STRAINER

50-PW-2503-B500

NOTES

FOR PIPE SPEC. D101 DIMENSIONS SHOWN RELATE TO 1.6mm THICK GASKETS WHICH WERE CHANGED TO 4.5mm SPIRAL WOUND DURING CONSTRUCTION

REFERENCE DRAWINGS		
MOL/T/D/1023	PIPING G.A. - BOOSTER PUMPS	
MOL/T/D/1027	PIPING G.A. - N/S PIPE RACK & PROPANE HTR. SHT.2	
MOL/P/D/1011	P&ID - LPG HEATING MANIFOLD	
DRG No.	TITLE	

REVISIONS AND APPROVALS					
10B	11.07.13	ELGAS LPG EXPORT TO QENOS - AS PROPOSED AMENDED TO CONFORM WITH PROJECT P&ID'S	RPC	RA	-
10A	16.05.13	ELGAS LPG EXPORT TO QENOS - AS PROPOSED	BR	RA	-
CODE	DATE	DESCRIPTION	DRAFT	DES	P.S.

REVISIONS AND APPROVALS					
10	20/2/01	AS BUILT HSV 2117	E.L.	A.C.	J.W.
9	24/10/00	ISSUED FOR CONSTRUCTION	RM		
8	9/10/00	ISSUED FOR TENDER	RM		
7	17/07/98	AS-BUILT	RM		
6	5/6/98	80-PR-20651-D101 WAS DN50,CL.EL.6.928 WAS 7.228,HOLDS REMOVED, 80-VG-7001-B101 MODIFIED	J.A.F.		
5	16/09/97	REVISED AS SHOWN	R.M.		
4	15/07/97	ISSUED FOR CONSTRUCTION	J.A.F.		
		THE KINHILL REVISION CODE WAS RAISED TO 4 FOR 'APPROVED FOR CONSTRUCTION' STATUS.			
CODE	DATE	DESCRIPTION	DRAFT	DES	P.S.

	DATE	SCALES
DESIGNED J.A.J.F	25.09.96	1.50 & 1:250
DESIGN CHECK A.C/S.N.J	.5.97	CAD FILE MOLTD1024AP
DRAWN J.A.F.	25.09.96	PLOT SCALE 1:1
DRAFTING CHECK P.L.	.5.97	TECHNICAL APPROVAL R.S. DATE
PROJECT DRAFTER T.A.	.5.97	PROJECT APPROVAL C.E.
		CLIENT APPROVAL

Kellogg Brown & Root Pty Ltd
KBR
Kellogg Brown & Root Pty Ltd ABN 91 007 660 317

AS PROPOSED

ELGAS LIMITED

SYDNEY LPG CAVERN

PIPING GENERAL ARRANGEMENT NORTH/SOUTH PIPE RACK & PROPANE HEATER SHT.1.

ELG130-DW-PI-GAR-0002 REV CODE:10B

DRAWING NUMBER MOL/T/D/1024AP

REVISION CODE 10B

MATCHLINE CONTD MOL/T/D/1027

MATCHLINE CONTD FROM BELOW LEFT

MATCHLINE CONTD ABOVE RIGHT

MATCHLINE CONTD ON DWG.MOL/T/D/1060

DRAWING AREA

KEYPLAN

SECTION 1:50

SECTION 1:50

SECTION 1:50

SECTION 1:50

AERATION TANK No.1

A-301

PROVIDE REMOVABLE SPOOL FOR FUTURE ACTUATED VALVE

(FUTURE)

DN40 N2 HEADER

DN25 BURNER FUEL GAS VENT

DN80 CONN.

UTILITY STATION

FIREWATER MONITOR FM.904

FIREWATER HYDRANT

FIRE BOX

JUNCTION BOX UJB-300-17

DN25 GAS DISPOSAL CONN.

T.O.STACK RL.19.047

FROM AERATION TANK No.3

DN65 Cu. PIPE UNDER PATHWAY

B/F VALVE

BURNER FUEL GAS VENT TO ATMOS.

REFER MOL/T/D/1047 FOR HYDRANT DETAILS

CABLE TRAYS

APPROX GRADE RL.4.800

US.CABLE LADDER RL.5.896

US.CABLE LADDER RL.5.596

US'BASE RL.5.385

DN20 DRAIN

DN50 FNPT THD CONN'

NOTES

FOR PIPE SPEC. D101 DIMENSIONS SHOWN RELATE TO 1.6mm THICK GASKETS WHICH WERE CHANGED TO 4.5mm SPIRAL WOUND DURING CONSTRUCTION

0 1000 2000 3000 4000

SCALE OF MILLIMETRES SCALE 1:50

A1 FRAME 801x554

REVISIONS AND APPROVALS						
CODE	DATE	DESCRIPTION	DRAFT	DES	P.S.
7B	11.06.13	ELGAS LPG EXPORT TO QENOS - AS PROPOSED AMENDED TO CONFORM WITH PROJECT P&ID'S	RPC	RA	-
7A	16.05.13	ELGAS LPG EXPORT TO QENOS - AS PROPOSED	BR	RA	-
7	19/7/00	AS-BUILT	R.M.		
6	3/6/98	50-PR-5030-B100 ADDED,PSV 2203 SIZE CHANGE, HOLDS REMOVED AERATION TANK & DISCH. PIPE ADDED	I.A.H.		
5	4/09/97	REVISED AS SHOWN	R.M.		
4	15/07/97	ISSUED FOR CONSTRUCTION	J.A.F.		
		THE KINHALL REVISION CODE WAS RAISED TO 4 FOR 'APPROVED FOR CONSTRUCTION' STATUS.			

REFERENCE DRAWINGS	
DRG No.	TITLE
MOL/T/D/1027	PIPING G.A. N/S PIPE RACK & PROPANE HEATER SHT.2.
MOL/T/D/1060	PIPING G.A. N/S PIPE RACK & PROPANE STRIPPING

BAR SCALES

DESIGNED	J.A.F	DATE	05.11.96
DESIGN CHECK	A.C./S.J.N.		.11.96
DRAWN	J.A.F.		05.11.96
DRAFTING CHECK	P.L.		.6.97
PROJECT DRAFTER	T.A.		.6.97

SCALES 1:50

CAD FILE MOLTD1025AP

PLOT SCALE 1:1

TECHNICAL APPROVAL	DATE
R.S.	
PROJECT APPROVAL	
C.E.	
CLIENT APPROVAL	

Kellogg Brown & Root Pty Ltd

KBR

Kellogg Brown & Root Pty Ltd ABN 91 007 661 317

AS PROPOSED

ELGAS LIMITED

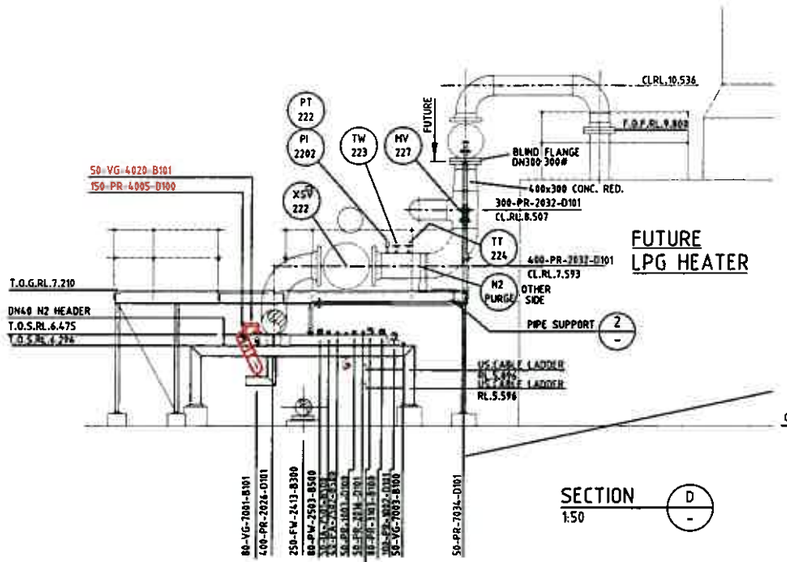
SYDNEY LPG CAVERN

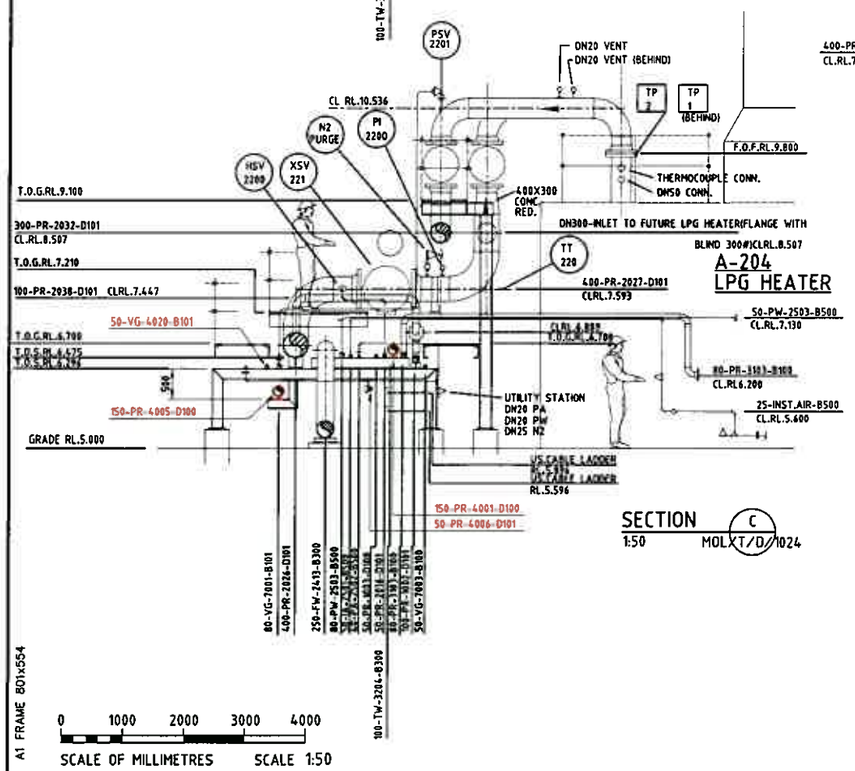
PIPING GENERAL ARRANGEMENT NORTH/SOUTH PIPERACK, REGEN HEATER

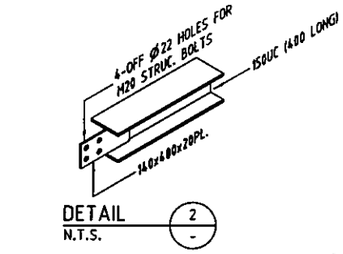
ELG130-DW-PI-GAR-0003 REV CODE:7B

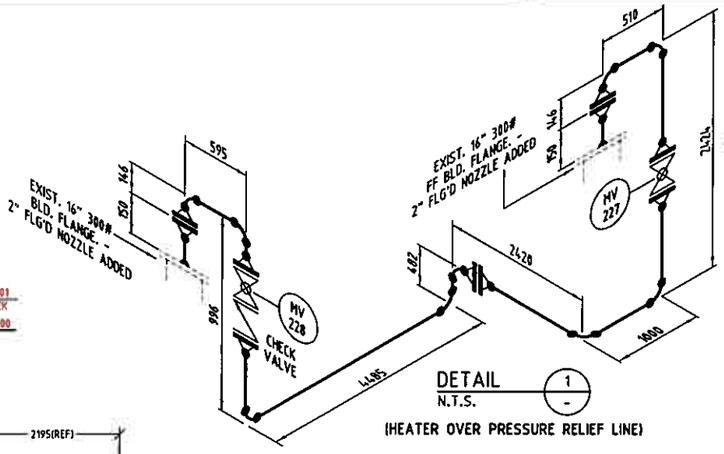
DRAWING NUMBER MOL/T/D/1025AP

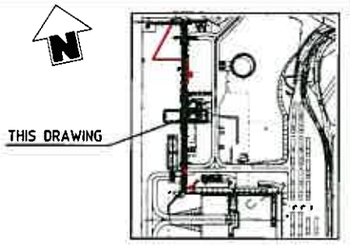
REVISION CODE 7B

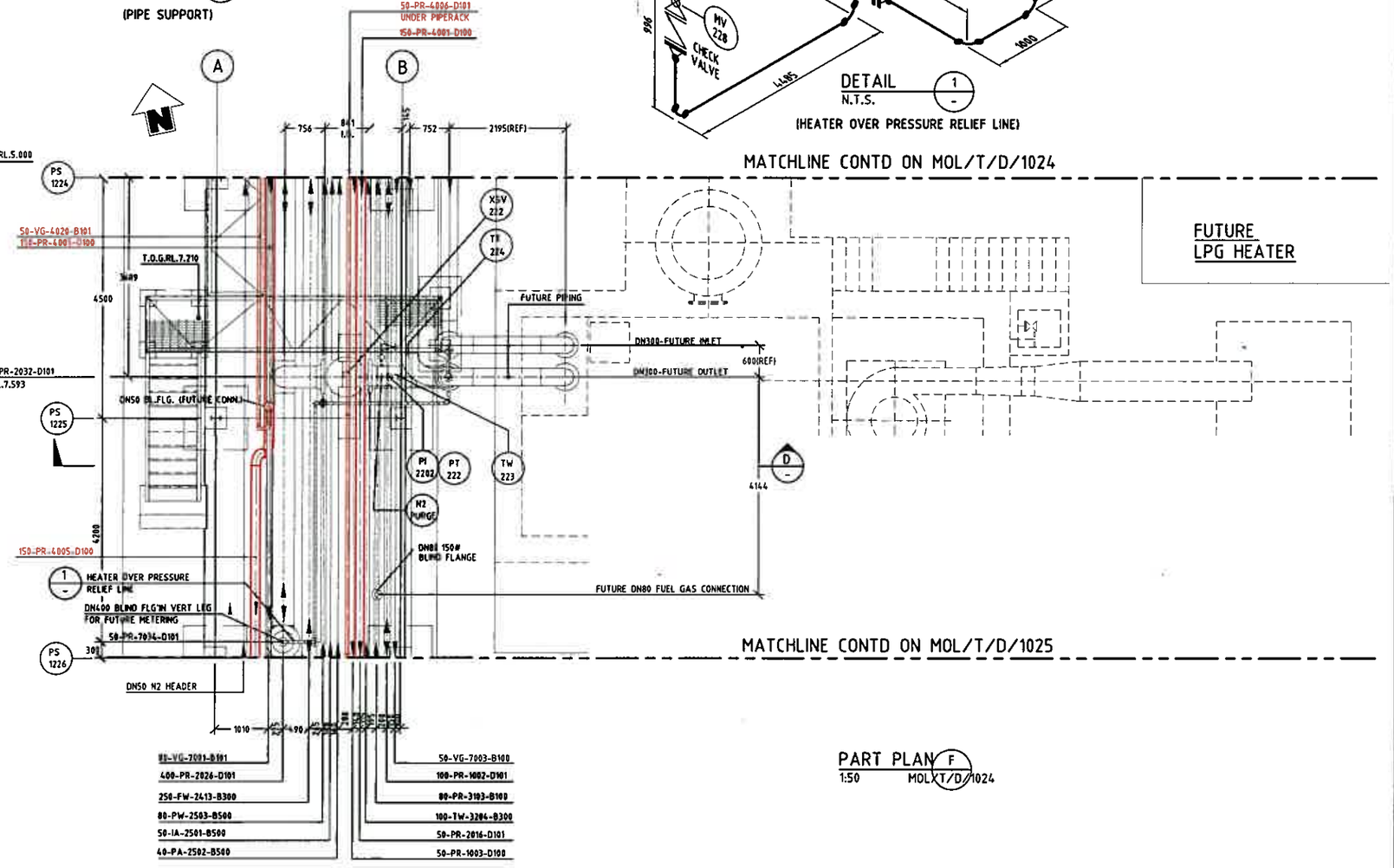












NOTES

FOR PIPE SPEC. D101 DIMENSIONS SHOWN RELATE TO 1.6mm THICK GASKETS WHICH WERE CHANGED TO 4.5mm SPIRAL WOUND DURING CONSTRUCTION

A1 FRAME 801x554

0 1000 2000 3000 4000
SCALE OF MILLIMETRES SCALE 1:50

DRG No.	TITLE
MOL/P/D/1011	P&ID - LPG HEATING MANIFOLD
MOL/T/D/1025	PIPING G.A.NORTH/SOUTH PIPERACK,REGEN HEATER
MOL/T/D/1024	PIPING G.A.NORTH/SOUTH PIPERACK & PROPANE HEATER SHT.1.

REFERENCE DRAWINGS

CODE	DATE	DESCRIPTION	DRAFT	DES	P.S.

REVISIONS AND APPROVALS

CODE	DATE	DESCRIPTION	DRAFT	DES	P.S.
7B	10.06.13	ELGAS LPG EXPORT TO QEMOS - AS PROPOSED AMENDED TO CONFORM WITH PROJECT P&ID'S	RPC	RA	-
7A	16.05.13	ELGAS LPG EXPORT TO QEMOS - AS PROPOSED	BR	RA	-
7	16/02/11	AS-BUILT - HEAT OVERPRESSURE RELIEF LINE ADDED	B.R.	H.R.	A.Hen
6	19/1/00	AS-BUILT	RM		
5	5/6/98	REVISED AS SHOWN	JAJF		
4	16/01/97	REVISED AS SHOWN	R.M.		
3	15/01/97	ISSUED FOR CONSTRUCTION	J.A.F.		
		THE KINHILL REVISION CODE WAS RAISED TO 3 FOR 'APPROVED FOR CONSTRUCTION' STATUS.			

REVISIONS AND APPROVALS

DESIGNED	J.A..F.	DATE	25. 9 .96
DESIGN CHECK	A.C./S.J.N.		. 5 .97
DRAWN	J.A.F.		25.09.96
DRAFTING CHECK	P.L.		. 5 .97
PROJECT DRAFTER	T.A.		. 5 .97

SCALES 1:50
CAD FILE MOLTD1027AP
PLOT SCALE 1:1

TECHNICAL APPROVAL	DATE
R.S.	
PROJECT APPROVAL	
C.E.	
CLIENT APPROVAL	

Kellogg Brown & Root Pty Ltd
KBR
Kellogg Brown & Root Pty Ltd ABN 99 007 660 317

AS PROPOSED

ELGAS LIMITED

SYDNEY LPG CAVERN

PIPING GENERAL ARRANGEMENT NORTH/SOUTH PIPE RACK & PROPANE HEATER SHT. 2

ELG130-DW-PI-GAR-0005 REV CODE:7B

DRAWING NUMBER MOL/T/D/1027AP

REVISION CODE 7B

MATCHLINE C.O.D. MOL/T/D/1061

MATCHLINE C.O.D. MOL/T/D/1032

MATCHLINE C.O.D. MOL/T/D/1029

MATCHLINE C.O.D. MOL/T/D/1029

J-301
FULL-LINE EJECTOR

V-306
FUEL GAS K.O. POT

PLATFORM TOG.RL.6.478

EDGE OF MOUND

EXTENDED WALKWAY

DN50 BRANCH WITH BLIND FLANGE

DN300 CAVERN WATER DRAINAGE CONN.

2x600 WIDE CABLE LADDERS

1500 WIDE CHANNEL FOR U/GROUND CONDUITS

F.W. DELUGE VALVE ARRGMT.

DN50 FROM K-303A/B DISCH. PSV's

DN25 FROM K-303A/B SUCT. PSV's

300x200 ECC. RED. FOB

250x200 ECC. RED. FOB

300 WIDE CABLE LADDER

2x300 WIDE CABLE LADDERS

SECTION A 1:25

SECTION B 1:25

SECTION C 1:25

SECTION D 1:25

SECTION M 1:50

NOTES

1. TO BE READ IN CONJUNCTION WITH SECTIONAL VIEWS ON MOL/T/D/1030

KEY PLAN

THIS DRAWING

SCALE OF MILLIMETRES SCALE 1:25

SCALE OF MILLIMETRES SCALE 1:50

MATCHLINE C.O.D. SYD/T/P/0013
5000 FROM SHAFT/SHELTER C

A1 FRAME 801x554

BAR SCALES	REFERENCE DRAWINGS			REVISIONS AND APPROVALS					REVISIONS AND APPROVALS				
	DRG No.	TITLE	CODE	DATE	DESCRIPTION	DRAFT	DES	P.S.	CODE	DATE	DESCRIPTION	DRAFT	DES	P.S.
	MOL M/D/1016	PLOT/KEYPLAN							6	9/10/01	ISSUED FOR TENDER	RM		
	MOL M/D/1009	SITE PLAN							5A	25/9/96	SHIP LOADOUT PIPING ADDED - ISSUED FOR CLIENT REVIEW	RM		
	MOL T/D/1030	PIPING DETAILS-CAVERN SHELTER & E/W PIPERACK							5	20/9/96	AS-BUILT	RM		
	SYD T/P/0013	PIPEWORK IN SHELTER							4	5/8/98	HOLDS 7.3.7.13 REMOVED PV 313 SIZE CHANGED HOLD REMOVED PV 323,FV 302,FV 312 HOLDS REMOVED FO 3006 ADDED,FO-3000 BYPASS REMOVED	L.A.J.F	RM	C.E.
	MOL T/D/1029	PIPING G.A. - PROPANE DRYER PACKAGE												
	MOL T/D/1031	PIPING G.A. - VAPOUR RECOVERY												
	MOL T/D/1061	PIPING G.A. - NORTH/SOUTH PIPERACK												
	MOL G/D/1036	WELLHEAD/SHELTER - STRUCT. LAYOUT & DETAILS	8B	10.05.13	ELGAS LPG EXPORT TO QENOS - AS PROPOSED AMENDED TO CONFORM WITH PROJECT P&ID'S	RPC	RA	-	3	12/8/97	REVISED AS INDICATED	RM	RM	C.E.
	MOL P/D/1015	P.& I.D - COALESCING, DRYING & DISTRIBUTION									THE KINNELL REVISION CODE WAS RAISED TO 2 FOR 'APPROVED FOR CONSTRUCTION' STATUS.			
	MOL P/D/1014	P.& I.D - WELLHEAD AREA - LIQUID LPG	8A	16.05.13	ELGAS LPG EXPORT TO QENOS - AS PROPOSED	BR	RA	-						
	MOL P/D/1013	P.& I.D - WELLHEAD AREA - LPG VAPOUR, ETC.	8	06.03.01	SHIP LOADOUT - AS BUILT	KF	AC	JW						
	SYD P/S/0007	P.& I.D - WELLHEAD AREA - LPG VAPOUR, ETC.	7	23.10.00	ISSUED FOR CONSTRUCTION	RM	AC	JW	2	15/7/97	ISSUED FOR CONSTRUCTION	L.A.J.F		

DESIGNED R.M.	DATE 1.10.96	SCALES 1:50 & 1:25	
DESIGN CHECK A.C./S.N.J.	21.08.97	CAD FILE MOLTD1028AP	
DRAWN R.MITCHELL	1.10.96	PLOT SCALE 1:1	
DRAFTING CHECK P.LYELL	.06.97	TECHNICAL APPROVAL R.S.	DATE 21/8/97
PROJECT DRAFTER T.ANDREWS	21.08.97	PROJECT APPROVAL C.E.	21/8/97
		CLIENT APPROVAL	

Kellogg Brown & Root Pty Ltd
KBR
Kellogg Brown & Root Pty Ltd ABN 91 007 660 317

AS PROPOSED

ELGAS LIMITED

SYDNEY LPG CAVERN

PIPING GENERAL ARRANGEMENT CAVERN SHELTER & EAST-WEST PIPERACK

ELG130-DW-PI-GAR-0006 REV CODE 8B

DRAWING NUMBER MOL/T/D/1028AP

REVISION CODE 8B

A-301

LPG COALESCER & DRYER PACKAGE

ODOURANT INJECTION BUILDING

PIPE RACK SUPPORT STEEL

MATCHLINE C.O.D. MOL/T/D/1028

MATCHLINE CONT. BELOW

MATCHLINE CONT. ABOVE

MATCHLINE CONT.ON MOL/T/D/1028

DN1S SOCKOLET FOR ODORANT INJECT. QUILL

DN50 BALL VALVE IN VERT.

DN2S N2 INST. SUPPLY

A-304 COMPRESSOR PACKAGE

V-306 FUEL GAS K.O. DRUM

SECTION A 1:25

SECTION B 1:50

SECTION D 1:50

SECTION E 1:50

SECTION F 1:50

SECTION G 1:50

SECTION H 1028 1:50

KEY PLAN

THIS DRAWING

SCALE OF MILLIMETRES SCALE 1:50

SCALE OF MILLIMETRES SCALE 1:25

A1 FRAME 801x554

HOLDS

1. DIMS. OF PV-357 ON DRG. MOL/T/D/11028

DRG No.	TITLE
MOL/M/D/1028	PLOT/KEYPLAN
MOL/M/D/1005	SITE PLAN
MOL/T/D/1029	PIPING G.A. - EAST/WEST PIPERACK
MOL/P/D/1001	P.& I.D. - COALESCING, DRYING & DISTRIBUTION
MOL/P/D/1002	P.& I.D. - WELLHEAD AREA - LPG VAPOUR, ETC.
MOL/P/S/1001	P.& I.D. - WELLHEAD AREA - LPG VAPOUR, ETC.

REFERENCE DRAWINGS

CODE	DATE	DESCRIPTION	DRAFT	DES	P.S.
8B	10.07.13	ELGAS LPG EXPORT TO QENOS - AS PROPOSED AMENDED TO CONFORM WITH PROJECT P&ID'S	RPC	RA	-
8A	16.05.13	ELGAS LPG EXPORT TO QENOS - AS PROPOSED	BR	RA	-
8	06.03.01	SHIP LOADOUT - AS BUILT	KF	AC	JW

REVISIONS AND APPROVALS

CODE	DATE	DESCRIPTION	DRAFT	DES	P.S.
7	13/10/00	ISSUED FOR CONSTRUCTION	RM	AC	JW
6	9/10/00	ISSUED FOR TENDER	RM		
5A	25/9/00	SHIP LOADOUT PIPING ADDED - ISSUED FOR CLIENT REVIEW	RM		
5	4/8/00	AS-BUILT	RM		
4	5/6/98	REVISED AS INDICATED	J.A.J.F		
3	13/8/97	REVISED AS INDICATED	RM		
2	15/7/97	ISSUED FOR CONSTRUCTION	J.A.J.F		
		THE KINHILL REVISION CODE WAS RAISED TO '2' FOR 'APPROVED FOR CONSTRUCTION' STATUS.			

REVISIONS AND APPROVALS

DESIGNED	R.M.	DATE	14.03.97
DESIGN CHECK	A.C./S.N.J.		21.08.97
DRAWN	R.MITCHELL		14. 3 .97
DRAFTING CHECK	P.LYELL		.06.97
PROJECT DRAFTER	T.ANDREWS		21.08.97

SCALES	1:50 & 1:25		
CAD FILE	MOLTD1029AP		
PLOT SCALE	1:1		
TECHNICAL APPROVAL	R.S.	DATE	21/8/97
PROJECT APPROVAL	C.E.		21/8/97
CLIENT APPROVAL			

Kellogg Brown & Root Pty Ltd

KBR

Kellogg Brown & Root Pty Ltd ABN 91 007 660 317

AS PROPOSED

ELGAS LIMITED

SYDNEY LPG CAVERN

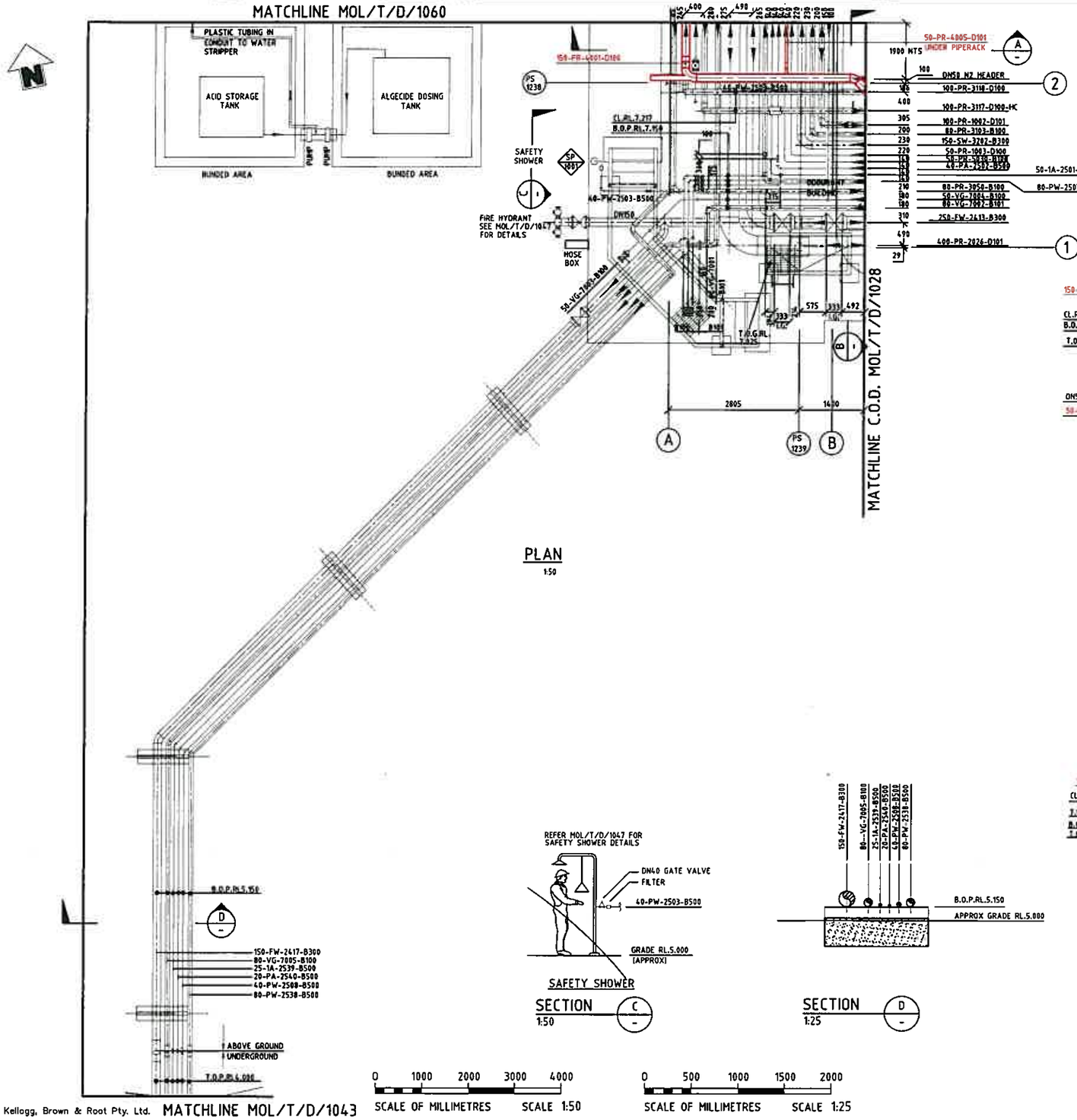
PIPING GENERAL ARRANGEMENT PROPANE DRYER & COMPRESSOR PACKAGES

ELG130-DW-PI-GAR-0007 REV. CODE:8B

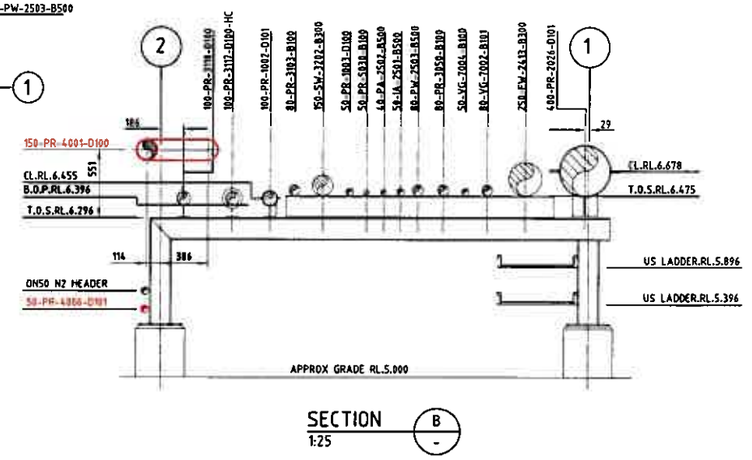
DRAWING NUMBER MOL/T/D/1029AP

REVISION CODE 8B

MATCHLINE MOL/T/D/1060

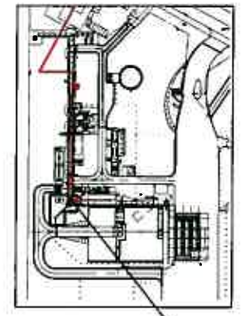


PLAN
1:50



SECTION B
1:25

KEYPLAN

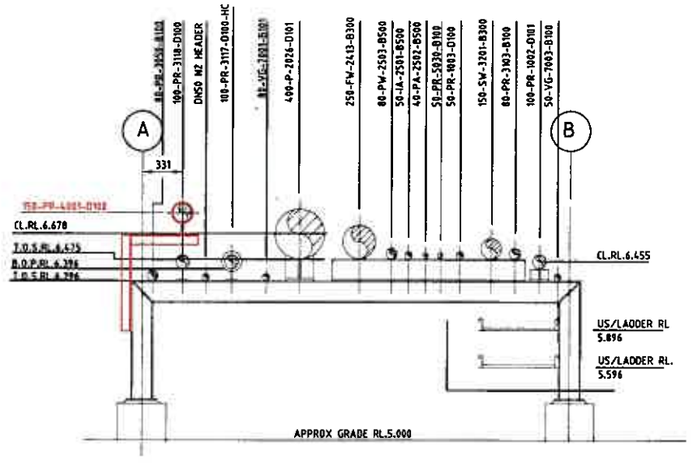


DRAWING AREA

SAFETY SHOWER

SECTION C
1:50

SECTION D
1:25



SECTION A
1:25

NOTES

FOR PIPE SPEC. D101 DIMENSIONS SHOWN RELATE TO 1.6mm THICK GASKETS WHICH WERE CHANGED TO 4.5mm SPIRAL WOUND DURING CONSTRUCTION

A1 FRAME 801x554

MATCHLINE MOL/T/D/1043

0 1000 2000 3000 4000
SCALE OF MILLIMETRES SCALE 1:50

0 500 1000 1500 2000
SCALE OF MILLIMETRES SCALE 1:25

BAR SCALES

REFERENCE DRAWINGS

DRG No.	TITLE
MOL/T/D/1028	P&ID - GAS DISPOSAL UNIT & COLD VENT
MOL/T/D/1060	PIPING G.A CAVERN SHELTER & E/W PIPERACK
MOL/T/D/1043	PIPING G.A FW & GEN'SITE PIPING
MOL/T/D/1060	PIPING G.A N/S PIPERACK & PROPANE STRIPPING

REVISIONS AND APPROVALS

CODE	DATE	DESCRIPTION	DRAFT	DES	P.S.

REVISIONS AND APPROVALS

CODE	DATE	DESCRIPTION	DRAFT	DES	P.S.
5B	10.05.13	ELGAS LPG EXPORT TO QENOS - AS PROPOSED AMENDED TO CONFORM WITH PROJECT P&ID'S	RPC	RA	-
5A	16.05.13	ELGAS LPG EXPORT TO QENOS - AS PROPOSED	BR	RA	-
5	18/7/08	AS-BUILT	RM		
4	5/6/98	HOLDS 2,4,6,7 & 9 REMOVED	J.A.F.	J.A.F.	C.E
3	4/09/97	REVISED AS SHOWN	R.M.		
2	15/07/97	ISSUED FOR CONSTRUCTION	J.A.F.		
		THE SMALL REVISION CODE WAS RAISED TO 2 FOR 'APPROVED FOR CONSTRUCTION' STATUS.			

DESIGNED	J.A.F	02.04.97
DESIGN CHECK	A.C./S.J.N.	02.04.97
DRAWN	J.A.F.	02.04.97
DRAFTING CHECK	P.L.	.6.97
PROJECT DRAFTER	T.A.	.04.97

SCALES: 1:50 & 1:25
CAD FILE: MOLTD1061AP
PLOT SCALE: 1:1
TECHNICAL APPROVAL: R.S. — DATE:
PROJECT APPROVAL: C.E.
CLIENT APPROVAL:

Kellogg Brown & Root Pty Ltd
KBR
Kellogg Brown & Root Pty Ltd ABN 91 007 660 317

AS PROPOSED

ELGAS LIMITED

SYDNEY LPG CAVERN

PIPING GENERAL ARRANGEMENT NORTH/SOUTH - EAST/WEST PIPERACK & COLD VENT K.O.DRUM

ELG130-DW-PI-GAR-0010 REV CODE:5B

DRAWING NUMBER: MOL/T/D/1061AP

REVISION CODE: 5B

MATCHLINE CONTD ON MOL/T/D/1025

DE-AERATION TANK No.4

DE-AERATION TANK No.2

B/F VALVE

B/F VALVE

150-TW-3206-B300

BOP RL 5.150
50-DRAIN-B300

TP 01 CL.RL.5.560

TP 02 CL.RL.5.500

TP 03 CL.RL.6.166

TP 04 CL.RL.5.504

150x100 CONC. RED.

UTILITY STATION

150-SW-3202-B300
80-PR-3054-B100

PS 1234

PS 1235

PS 1236

PS 1237

DN25 H2
20-PW-2503-B500
25-IA-2501-B500
20-PA-2502-B500

BOP RL 5.504 TYP.

40-PW-2503-B500
25-IA-2501-B500

150-PR-4001-D100

50-PR-4006-D101
UNDER PIPERACK

A-303

A-501

SAFETY SHOWER

SP 1001

ODOURANT BUILDING

50NB BYPASS & VALVE

150NB CHECK

150NB BALL

XSV 400

FT 400

200-PR-3083-D100(REF ONLY)
C.L.RL.5.798

FOR DETAILS OF LINE NUMBER 200-PR-3083-D100 REFER PIPING G.A.MOL/T/D/1029

B.O.P.RL.7.237

PLASTIC TUBING IN CONDUIT FROM CHEMICAL DOSING PUMPS

MATCHLINE CONTD ON MOL/T/D/1061

80-PR-3050-B100
100-PR-3118-D100
100-PR-3117-D100-HC
80-VG-7001-B101
400-PR-2026-D101
250-FW-2413-B300
80-PW-2503-B500
50-VG-7003-B100
100-PR-1002-D101
80-PR-3103-B100
150-SW-3202-B300
50-PR-1003-D100
50-PR-5030-B100
40-PA-2502-B500
50-IA-2501-B500

0 1000 2000 3000 4000
SCALE OF MILLIMETRES SCALE 1:50

A1 FRAME 801x554

KEYPLAN

DRAWING AREA

REFER MOL/T/D/1047 FOR SAFETY SHOWER DETAILS

40-PW-2503-B500

ODOURANT BUILDING

GRADE RL.5.000 (APPROX)

SAFETY SHOWER

SECTION A - 1:50

80-PR-3050-B100
100-PR-3118-D100
100-PR-3117-D100-HC
80-VG-7001-B101
400-PR-2026-D101
250-FW-2413-B300
80-PW-2503-B500
50-IA-2501-B500
40-PA-2502-B500
50-PR-5030-B100
50-PR-1003-D100

150-PR-4001-D100
T.O.S. RL.6.475
B.O.P. RL.6.396
T.O.S. RL.6.296
50-PR-4006-D101

100-SW-3201-B300
80-PR-3103-B100
100-PR-1002-D101
CL. RL.6.455
50-VG-7003-B100
U.S.CABLE LADDER RL.5.896
U.S.CABLE LADDER RL.5.596
APPROX GRADE RL.5.000

SECTION B - 1:50

BAR SCALES	DRG No.	TITLE
	MOL/T/D/1060	P&ID - SEEPAGE WATER STRIPPER
	MOL/T/D/1025	PIPING G.A. N/S PIPERACK & REGEN HEATER
	MOL/T/D/1061	PIPING G.A. N/S-E/W PIPERACK & COLD VENT K.O DRUM

REFERENCE DRAWINGS

CODE	DATE	DESCRIPTION	DRAFT	DES	P.S.

REVISIONS AND APPROVALS

CODE	DATE	DESCRIPTION	DRAFT	DES	P.S.
5B	10.05.13	ELGAS LPG EXPORT TO QENOS - AS PROPOSED AMENDED TO CONFORM WITH PROJECT PLANTS	RPC	RA	-
5A	16.05.13	ELGAS LPG EXPORT TO QENOS - AS PROPOSED	BR	RA	-
5	18/7/98	AS-BUILT	RH		
4	5/6/98	HOLD REMOVED A-303 TAP 01.02.03.04 ADDED NAMES 2 & 4 & SUPPLY PIPE ADDED DISCHARGE PIPE REMOVED 50-PR-5030-B100 ADDED	J.A.F. R.M.		
3	16/09/97	REVISED AS SHOWN	R.M.		
2	15/07/97	FOR CONSTRUCTION	J.A.F.		
		THE KINHILL REVISION CODE WAS RAISED TO '2' FOR 'APPROVED FOR CONSTRUCTION' STATUS.			

REVISIONS AND APPROVALS

DESIGNED	J.A.F.	DATE	02.04.97
DESIGN CHECK	A.C./S.J.N		.4.97
DRAWN	J.FitzGerald		02.04.97
DRAFTING CHECK	P.L.		.6.97
PROJECT DRAFTER	T.A.		.6.97

SCALES 1:50

CAD FILE MOLTD1060AP

PLOT SCALE 1:1

TECHNICAL APPROVAL R.S. DATE

PROJECT APPROVAL C.E.

CLIENT APPROVAL

Kellogg Brown & Root Pty Ltd

KBR

Kellogg Brown & Root Pty Ltd ABN 91 007 660 317

AS PROPOSED

ELGAS LIMITED

SYDNEY LPG CAVERN

PIPING GENERAL ARRANGEMENT NORTH/SOUTH PIPERACK, & PROPANE STRIPPING

ELG130-DW-PI-GAR-0009 REV CODE:5B

DRAWING NUMBER MOL/T/D/1060AP

REVISION CODE 5B

MATCHLINE CONTINUED BELOW RIGHT

MATCHLINE C.O.D.MOL/T/D/1024

FOR CONTINUATION REFER TO DWG. MOL/T/D/1040

"THIS DRAWING STILL SHOWS THE PUMPS AND PUMP PIPING ASSOCIATED WITH THE ORIGINAL DESIGN OPTION - THESE ARE TO BE DISREGARDED WHEN READING THE EA PROPOSAL"

MATCHLINE C.O.D. MOL/T/D/1024

MATCHLINE CONTINUED ABOVE LEFT

THIS DRAWING

KEYPLAN

A1 FRAME 801x554

SCALE 1: 25 — SCALE IN mm

REFERENCE DRAWINGS	
MOL/T/D/1026	PIPING G.A. - NORTH/SOUTH RACK
MOL/T/D/1021	PIPING G.A. - BOOSTER PUMPS
MOL/T/D/1027	PIPING G.A. - N/S PIPE RACK & PROPANE HTR. SHT.2
MOL/P/D/1011	P&ID - LPG HEATING MANIFOLD
DRG No.	TITLE

REVISIONS AND APPROVALS					
CODE	DATE	DESCRIPTION	DRAFT	DES	P.S.
B	11.07.13	ELGAS LPG EXPORT TO QENOS - AS PROPOSED AMENDED TO CONFORM WITH PROJECT P&ID'S	RPC	RA	-
A	16.05.13	ELGAS LPG EXPORT TO QENOS - AS PROPOSED	BR	RA	-

DESIGNED	-	DATE -. .	SCALES 1:25
DESIGN CHECK	-	-. .	CAD FILE MOLTD1139AP
DRAWN	B.R.	10.05.13	PLOT SCALE 1:1
DRAFTING CHECK	H.R.	15.05.13	TECHNICAL APPROVAL — DATE —
PROJECT DRAFTER	-	-. .	PROJECT APPROVAL R. ANDERSON 16.05.13
			CLIENT APPROVAL -

Kellogg Brown & Root Pty Ltd

KBR

Kellogg Brown & Root Pty Ltd ABN 91 007 660 317

AS PROPOSED

ELGAS LIMITED

SYDNEY LPG CAVERN

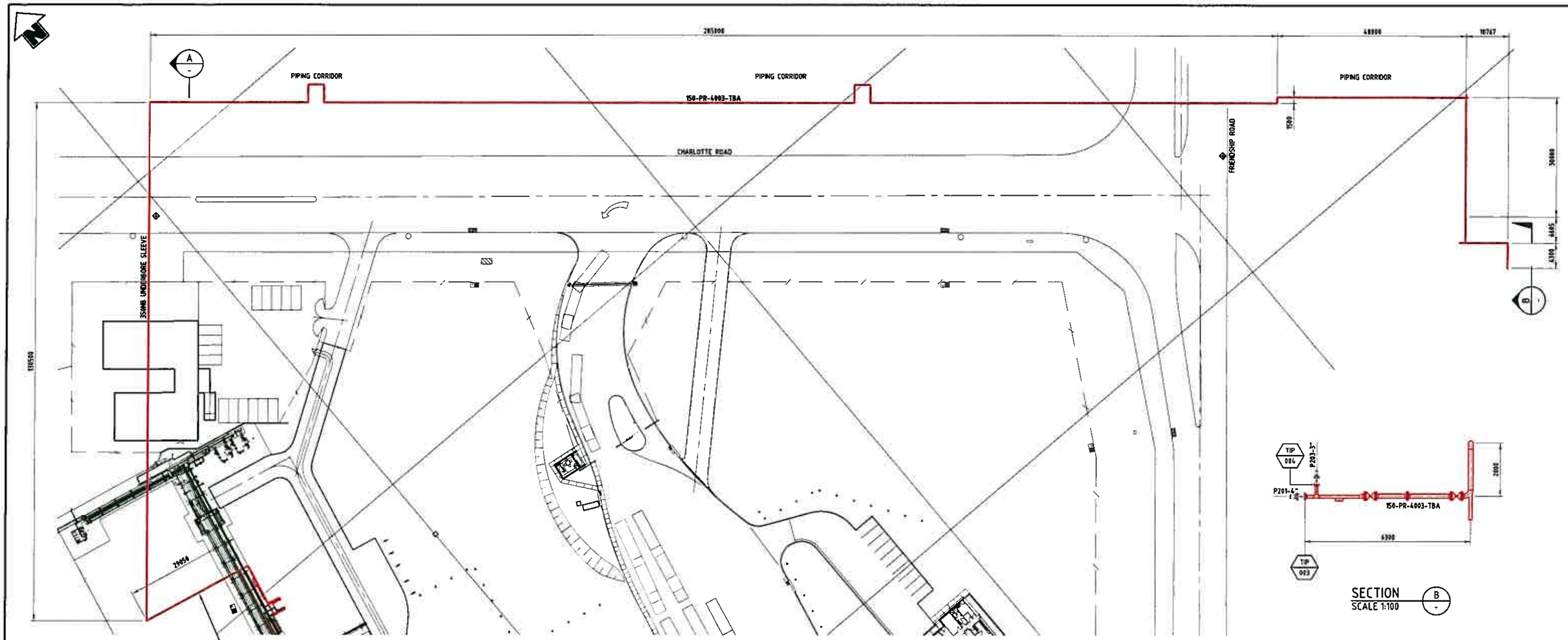
PIPING GENERAL ARRANGEMENT
NORTH/SOUTH PIPE RACK
EXPORT LPG BOOSTING PUMPS

ELG130-DW-PI-GAR-0011 REV CODE:B

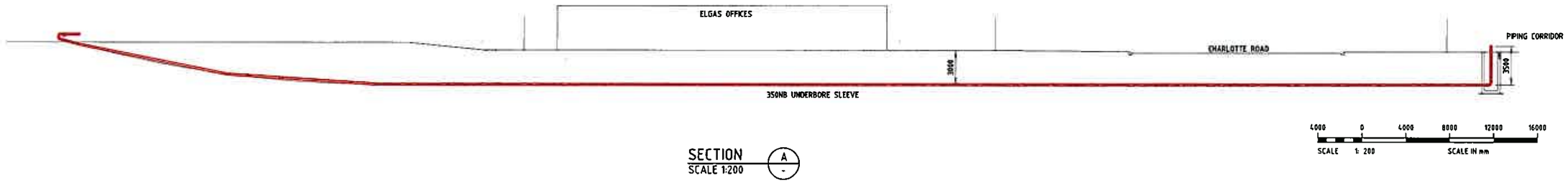
DRAWING NUMBER MOL/T/D/1139AP

REVISION CODE B

BAR SCALES



PLAN - UNDERBORE TO QENOS TIP
SCALE 1:500



A1 FRAME 801x554

REVISIONS AND APPROVALS							
CODE	DATE	DESCRIPTION	DRAFT	DES	P.S.		
B	11.07.13	ELGAS LPG EXPORT TO QENOS - AS PROPOSED AMENDED TO CONFORM WITH PROJECT PAID'S	RPC	RA	-		
A	16.05.13	ELGAS LPG EXPORT TO QENOS - AS PROPOSED	BR	RA	-		

REFERENCE DRAWINGS							
DRG No.	TITLE	CODE	DATE	DESCRIPTION	DRAFT	DES	P.S.

BAR SCALES

DESIGNED -	DATE -. .	SCALES	1:500; 1:150
DESIGN CHECK -	-. .	CAD FILE	MOLTD1140AP
		PLOT SCALE	1:1
DRAWN B.R.	10.05.13	TECHNICAL APPROVAL -	DATE
DRAFTING CHECK H.R.	15.05.13	PROJECT APPROVAL R. ANDERSON	16.05.13
PROJECT DRAFTER -	-. .	CLIENT APPROVAL -	

Kellogg Brown & Root Pty Ltd
KBR
Kellogg Brown & Root Pty Ltd ABN 91 007 660 317

AS PROPOSED

ELGAS LIMITED

SYDNEY LPG CAVERN
LPG EXPORT TO QENOS
PIPING GENERAL ARRANGEMENT
UNDERBORE AND PIPING CORRIDOR
LPG EXPORT TO QENOS TIE-IN

ELG130-DW-PI-GAR-0012 REV CODE:B

DRAWING NUMBER MOL/T/D/1140AP

REVISION CODE B

Appendix C

CONSULTATION CORRESPONDENCE AND MINUTES

Appendix D

PRELIMINARY HAZARD ANALYSIS

Proposed LPG Pipeline from Elgas Cavern to Qenos Hydrocarbons Terminal, Port Botany

Hazard Analysis

For Elgas Ltd

13 January 2013

Doc. No.: J-000049-REP-01

Revision: 0

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DISTRIBUTION LIST

Name	Organisation	From (Issue)	To (Issue)
Aldo Costabile	Elgas Ltd	A	0

Prepared by: Philip Skinner Date: 17 November 2013

Reviewed by: Dr Raghu Raman Date: 28 November 2013

Approved by: Dr Raghu Raman Date: 13 January 2014

DOCUMENT HISTORY AND AUTHORISATION

Issue	Date	Changes
A	05 December 2013	Draft for client review.
B	16 December 2013	Updated after draft review by Elgas
0	13 January 2014	Final issue after Elgas review and feedback

Summary

A Hazard Analysis study has been carried out by Arriscar Pty Ltd on the proposed LPG pipeline by Elgas Ltd, between the Elgas LPG Cavern site and the Qenos hydrocarbon storage facility at Port Botany, NSW. The study has been based on the requirements of Hazardous Industry Planning Advisory paper (HIPAP) No.6, "Hazard Analysis Guidelines".

Elgas Ltd (Elgas) operates an LPG storage and bulk road tanker loadout facility at its LPG Cavern, at the corner of Charlotte Road and Friendship Road, Port Botany in NSW. Elgas is proposing to install a new LPG pipeline to transfer LPG (liquid) from the Cavern storage to the neighbouring Qenos facility on Friendship Road, Port Botany. The majority of the proposed pipeline will be located above ground in the existing common Pipeline Corridor located adjacent to the northern side of Charlotte Road. A short section of the pipeline will be located below ground between the Elgas facility and the Pipeline Corridor.

The pipeline will be 150mm NB, designed to carry pressurised liquid propane, and is constructed out of low temperature carbon steel, to allow for depressuring for inspection and maintenance. Most part of the pipeline will be welded. There will be three (3) emergency isolation valves in the pipeline, one at the pipeline take off point at the Cavern, one at Qenos boundary, one at the Elgas site boundary. The pipeline will be designed and operated to the requirements of AS 2885.1.

A Hazard Identification workshop was conducted with the stakeholders present, and the loss of containment scenarios and safeguards to prevent and mitigate the event were identified.

The loss of containment scenarios and likelihood have been based on the UK Health & Safety Executive guidelines referring to generic databases on liquid pipeline failures. The risk contours were evaluated using the software PhastRisk. The risk contours were superimposed on the pipeline route. The risk contours for the existing Cavern facility, prepared for the Safety Report for MHF Regulation, is also reproduced for comparison.

It was found that the $1x10^{-6}$ p.a. fatality risk contour was contained within the Pipeline Corridor. The contour for $50x10^{-6}$ p.a. was not generated. The proposed development satisfies the risk criteria specified in HIPAP No.4.

A set of recommendations, developed in the HAZID workshop are summarised in this report for action by Elgas and Qenos.

Contents

List of Tables

List of Figures

Notation

Abbreviation	Description
BLB	Bulk Liquids Berth
DCS	Distributed Control System
DP&I	Department of Planning and Infrastructure
EA	Environmental Assessment
EIV	Emergency Isolation Valve
ERP	Emergency Response Plan
ESD	Emergency Shut Down
HAZAN	Hazard Analysis
HAZID	Hazard Identification
HIPAP	Hazardous Industry Planning Advisory Paper
HIWD	Hazard Identification Word Diagram
kPa	Kilo-Pascals
kV	Kilo-Volts
kW/m^2	Kilo-Watts per square metre
LFL	Lower Flammability Limit
LPG	Liquefied Petroleum Gas
LSIR	Location-Specific Individual Risk
m	Metres
MAE	Major Accident Event
MHF	Major Hazards Facility
MLA	Marine Loading Arm
mm	Millimetres
NB	Nominal Bore
PAL	Pressure Alarm Low
PALL	Pressure Alarm Low Low
PSV	Pressure Safety Valve
QRA	Quantitative Risk Assessment
V	Volts
VCE	Vapour Cloud Explosion

1 INTRODUCTION

1.1 Background

Elgas Ltd (Elgas) operates an LPG storage and bulk road tanker loadout facility at its LPG Cavern, at the corner of Charlotte Road and Friendship Road, Port Botany in NSW. It is classified as a Major Hazards Facility (MHF) by WorkCover NSW. As such, a Safety Report in compliance with the MHF Regulation has been submitted by Elgas to NSW WorkCover.

Elgas is proposing to install a new LPG pipeline to transfer LPG (liquid) from the Cavern storage to the neighbouring Qenos facility on Friendship Road, Port Botany. The majority of the proposed pipeline will be located above ground in the existing common Pipeline Corridor located adjacent to the northern side of Charlotte Road. A short section of the pipeline will be located below ground between the Elgas facility and the Pipeline Corridor.

A site location map is shown in Figure 1.

According to the State Environmental Planning Policy (SEPP) (Port Botany) 2013, the installation of a new LPG pipeline in Port Botany must address the following requirements for Hazards and Risks [1]:

A hazard analysis that:

(i) is prepared in accordance with the *Hazardous Industry Planning Advisory Paper No 6, Hazard Analysis*, dated January 2011 and published by the Department of Planning and Infrastructure (Ref.2), and

(ii) demonstrates that the proposed development meets the applicable risk criteria set out in the *Hazardous Industry Planning Advisory Paper No 4, Risk Criteria for Land Use Safety Planning*, dated January 2011 (Ref.3) and published by the Department of Planning and Infrastructure, and

(iii) demonstrates that the proposed development will not cause any increase in the individual risk levels shown on Figure 2 of the *Port Botany Land Use Safety Study Overview Report*, published by Planning NSW in 1996 (Ref.4).

Arriscar Pty Ltd (Arriscar) was engaged by Elgas Ltd (Elgas) to undertake the Hazard Analysis (HAZAN) of the proposed LPG pipeline. This report contains details of the study, findings and actions arising from the study.

This study has been undertaken in accordance with the guidance provided by the NSW Department of Planning and Infrastructure (DP&I) in Hazardous Industry Planning Advisory Paper (HIPAP) No. 6 [2]. A quantitative assessment of the risk has been undertaken in accordance with the criteria published by the DP&I in HIPAP No. 4 [3].

1.2 Objectives of the study

The principal objective of the study was to perform a Hazard Analysis for the proposed development, covering the scope outlined in Section 1.2 and in accordance with the NSW HIPAP guidelines. This included:

- Identification of the hazards for all hazardous substances proposed to be stored and handled on site;
- Identification of all 'Major Accident Events' (MAEs) resulting in loss of containment, fire, explosion and/or toxic releases from proposed site operations, and the appropriate and relevant representative scenarios for each MAE;

- Quantification of the consequences of potential harmful effects for each representative scenario, including the potential for impact on surrounding land uses;
- Quantification of the likelihood of occurrence of each representative scenario;
- Using assumptions that are appropriate and justified, with a focus on minimising uncertainty and obtaining the 'cautious best estimate';

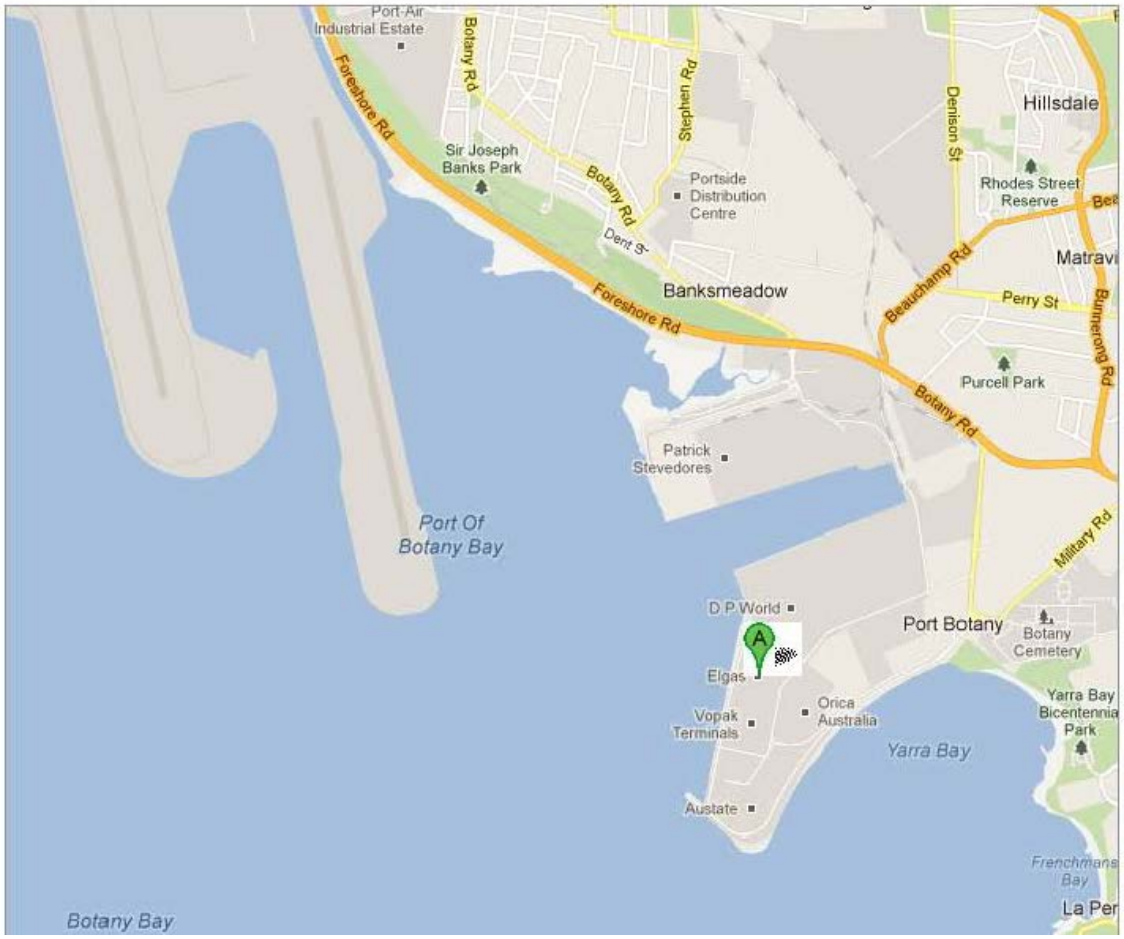

Figure 1: Site Location Map for Elgas Port Botany Cavern

- Development of Location-Specific Individual Risk (LSIR) contours for off-site risks, superimposed on facility plot plans, for comparison with the DP&I's criteria for risk acceptability (viz. as per HIPAP No. 4, Ref.3);
- Estimation of societal risk for residential populations, for comparison with the DP&I's indicative criteria for risk acceptability (viz. as per HIPAP No. 10, Ref.6);
- A review of the recommendations from the DP&I's *Port Botany Land Use Safety Study Overview Report (Ref.4)*, where relevant to the proposed development.

1.3 Scope

1.3.1 Scope of Facilities Covered

The proposed facilities containing hazardous materials included in the scope of the hazard analysis include the following three sections of the LPG pipeline:

- Above-ground section located within the boundary of the Elgas Cavern facility;
- Below-ground section between the Elgas Cavern facility and the Pipeline Corridor (passing under Charlotte Road); and
- Above-ground section in the existing common Pipeline Corridor located adjacent to the northern side of Charlotte Road to the Qenos facility on Friendship Road.

The existing equipment and operations include:

- LPG (propane) Cavern storage at the Cavern;
- Piping manifold;
- Bulk road tanker loading and unloading;
- Pipework on-site to / from the tanks, Cavern, vapour recovery system and road tanker loading area;
- Ancillary equipment (including LPG heater, dryer, odorant dosing, compressor, etc.);
- Vapour recovery system;
- Cold vent system; and
- Pipework to / from the first on-shore valve at the existing Bulk Liquids Berth (BLB) Marine Loading Arm (MLA) and the Elgas Cavern facility.

1.3.2 Scope of Analysis

The study scope includes a quantitative analysis and assessment of off-site fatality, injury and property damage risk, in accordance with the NSW Hazardous Industry Planning Advisory Paper (HIPAP) guidelines. The quantitative risk assessment (QRA) does not include an assessment of the following risks:

- Environmental risks on-site;
- Risk of property damage on-site and
- Fatality or injury risks for personnel on-site. This will be covered in the MHF Safety Report next update.

The hazard analysis scope includes proposed modifications both to the pipeline and associated modifications on the Elgas Cavern site.

2 LOCATION OF SITE AND PROPOSED PIPELINE

2.1 Site Location and Surrounding Land Uses

The Elgas site is located at Molineux Point, at the corner of Friendship and Charlotte Roads, Port Botany, NSW (Location "D" on Figure 2 below [4]). This area is part of the Port Botany reclamation area, which is owned by NSW Ports and is zoned for industrial uses (port and associated activities).

Port Botany Tenants

A	ACFS	H	Gube Logistics	O	PB Towage
B	Vopak Terminals	I	DP World	P	Truck Marshalling Area
C	Qenos Pty Ltd	J	Patrick Stevedores	Q	ACFS/Tyne
D	Elgas	K	Caltex Australia	R	Sydney Ports Corporation – Operations Centre
E	Terminals	L	Svitzer	S	Sydney International Container Terminals Pty Ltd
F	Origin Energy	M	Australian Customs Service	1	Berth Numbers
G	Patrick Port Logistics	N	Warehouse Solutions International	1	Bulk Liquids Berth Numbers

Figure 2: Site Location Map

Facilities located adjacent to the Elgas facilities include:

- Vopak Terminals Pty Ltd (Refer to Figure 2, Location B) – Storage and distribution of refined petroleum products.
- Qenos Pty Ltd (Refer to Figure 2, Location C) – Storage and pipeline transfer of propane, butane and ethylene.
- Terminals Australia Pty Ltd (Refer to Figure 2, Location E) – Storage and distribution of liquid chemicals and vegetable oils.
- DP World (Refer to Figure 2, Location I) – Storage and distribution of containerised goods.

The nearest residential areas are located at Phillip Bay (c. 1500 m to the east, across Yarra Bay), Banksmeadow (c. 1500 m to the north-east) and the suburb of Botany (c. 1500 m to the north-west).

2.2 Location of Proposed LPG Pipeline

The majority of the proposed pipeline will be located above ground in the existing common Pipeline Corridor located adjacent to the northern side of Charlotte Road. Only one section of the pipeline will be located below ground (under Charlotte Road) from the Elgas Cavern facility to the Pipeline Corridor, as shown on Figure 3 (Dashed Line). The pipeline will also pass through the existing culvert under Friendship Road to the Qenos hydrocarbons terminal, as shown in Figure 3 (Dashed Line).

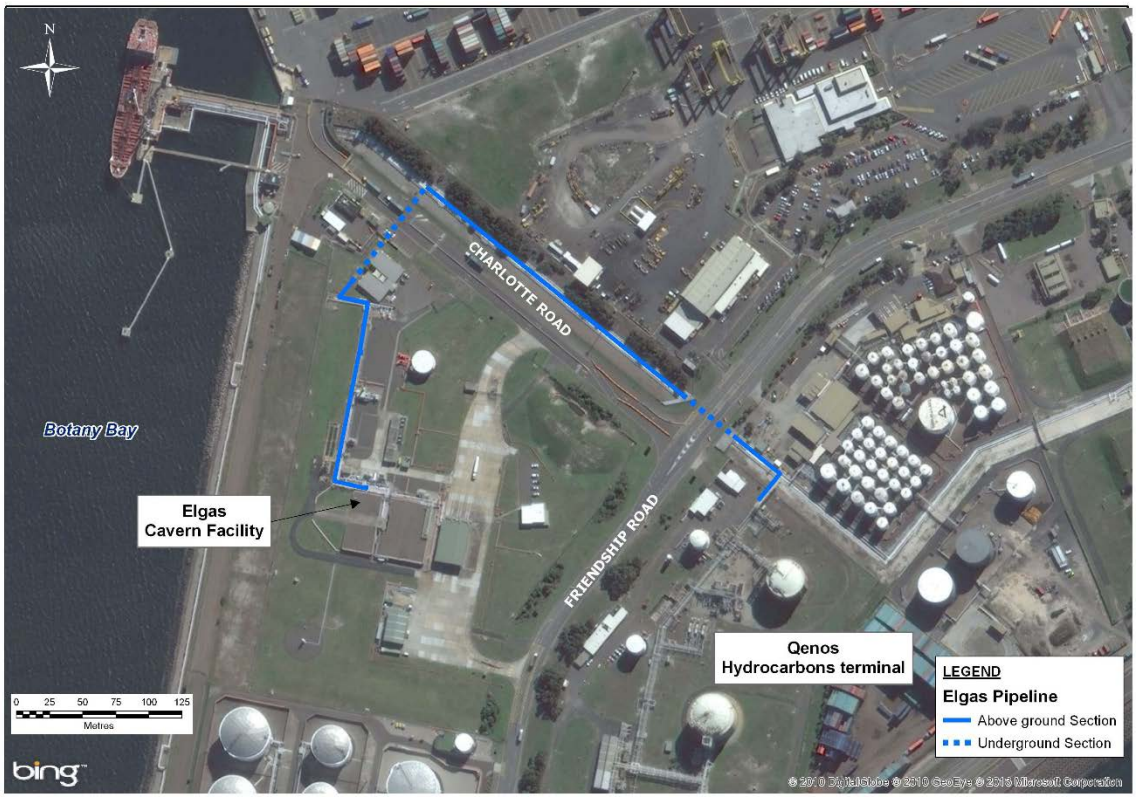

Figure 3: Location of Proposed LPG Pipeline

The total length of the proposed pipeline is approximately 650 m, with about 85 m running below ground.

2.3 Meteorology

The meteorological data for the study obtained from the Bureau of Meteorology for Sydney Airport was processed into representative wind speed/ weather stability classes.

It was found that there was no 'prevailing wind direction', and no wind direction dominated the wind rose. Northerly and Southerly wind were approximately equally distributed (33% each). Wind towards Charlotte Road and Friendship Road amounted to approximately 25% of the time.

The predominant Pasquil stability classes were E and F (stable conditions), prevailing 44% of the time. Unstable conditions would occur (Stability Classes B and C) for 30% of the time, and Neutral conditions (Stability Class D), 25% of the time. This means that for nearly half the time, vertical dispersion of any LPG release would be poor, and the cloud would tend to hug the ground, until sufficiently diluted to become neutrally buoyant.

The wind/ weather data is listed in Appendix A.

2.4 Local Ambient Conditions

The average local ambient conditions (air temperature, barometric pressure, relative humidity) are as follows:

Ambient Air Temperature (°C)	18.1
Barometric Pressure (kPa)	101.3
Relative Humidity (%)	57

3 DESCRIPTION OF PROPOSED FACILITIES AND OPERATIONS

3.1 LPG Pipeline

The pipeline is constructed to carry liquid propane, and is constructed out of low temperature carbon steel, to allow for depressuring for inspection and maintenance.

The pipeline specifications are listed in Table 1.

Table 1: Proposed LPG Pipeline Specification

Parameter	Value
Material	Low Temperature Carbon Steel (LTCS), Schedule 80
Pipeline design Pressure, kPag	5,100
Pipeline design temperature	- 48^{O}C
Thickness of pipeline	11 mm
Diameter of pipeline	6" (NB) 168.4mm (external) 146.3mm (internal)
Pipeline length	650m Below ground section length (85m)
Below ground section construction	Directional drilling through a casing of plastic or concrete in which pipeline will be laid without backfilling
Corrosion protection	Cathodic protection (sacrificial anodes)
Road crossing (Friendship Road)	Laid in an existing pipeline culvert across Friendship Road
Operating conditions	Flow on demand from Qenos. Expected to operate most of the time, and left pressurised under no flow conditions
Construction feature	Fully welded outside the site boundaries of Elgas and Qenos. Shutdown valves located inside the respective site boundaries.

Management of the pipeline is by Elgas, under the Elgas Safety Management System.

3.2 Proposed Control Measures

3.2.1 Isolation Valves

The following emergency isolation valves (EIVs) are provided in the design. These are pneumatically actuated valves that can be remotely operated to shutdown the pipeline system.

At the Cavern:

- At the start of the pipeline (branch from existing distribution piping manifold)
- Inside the Cavern boundary, before the commencement of the below ground section

At Qenos:

- At the site boundary, inside the fence

All valves can be activated from Elgas Cavern Control Room. The boundary isolation valves at the Qenos end can also be operated from Qenos Control Room.

An emergency shutdown (ESD), when activated manually or automatically, shuts all the three EIVs.

3.2.2 Pressure Safety Valves

Pressure safety valves (PSVs), also referred to as pressure relief valves, are provided within Elgas battery limit. There are no PSVs at Qenos end.

PSVs at Elgas site will be piped to the existing Cold Vent header. The PSVs are set at 2900 kPag (to be confirmed during detailed design)

3.2.3 Gas Detection and Alarm

Gas detectors are proposed to be installed in the following locations:

- In the pit on Charlotte Rd (Under Review).
- In the culvert under Friendship Rd

The gas detectors will alarm at the control rooms of both Elgas and Qenos. Alarm will be investigated and the pipeline would be shutdown, if required.

In addition, there are existing gas detectors in the Cavern site which can also detect a gas release from the pipeline, depending on the wind direction.

3.2.4 Leak detection system

The leak detection system consists of the following:

- One pressure transmitter at the Cavern end of the pipeline
- One pressure transmitter at the Qenos end of the pipeline
- Either of the pressure transmitters will alarm on low pressure (PAL) at both control rooms. Alarm will be immediately investigated and pipeline shutdown, if required.
- On low low pressure detection (PALL) by either of the pressure transmitters, the pipeline ESD would be automatically initiated, shutting all the three EIVs.

4 DESCRIPTION OF EXISTING FACILITIES AND OPERATIONS

A layout diagram of the Elgas Cavern and facilities is shown in Figure 4. The site comprises the following main components:

- Propane booster pumps in ship import line;
- Kaldair heater;
- LPG Cavern;
- Vapour recovery system and storage;
- LPG road tanker loading bay;
- LPG odorant injection system;
- Seepage water treatment plant;
- Firewater storage tank and supply system;
- Liquid nitrogen storage vessel and supply system;
- Compressed air supply system;
- Cold vent; and
- Administration block, control room, electrical switches room, workshop and offices.

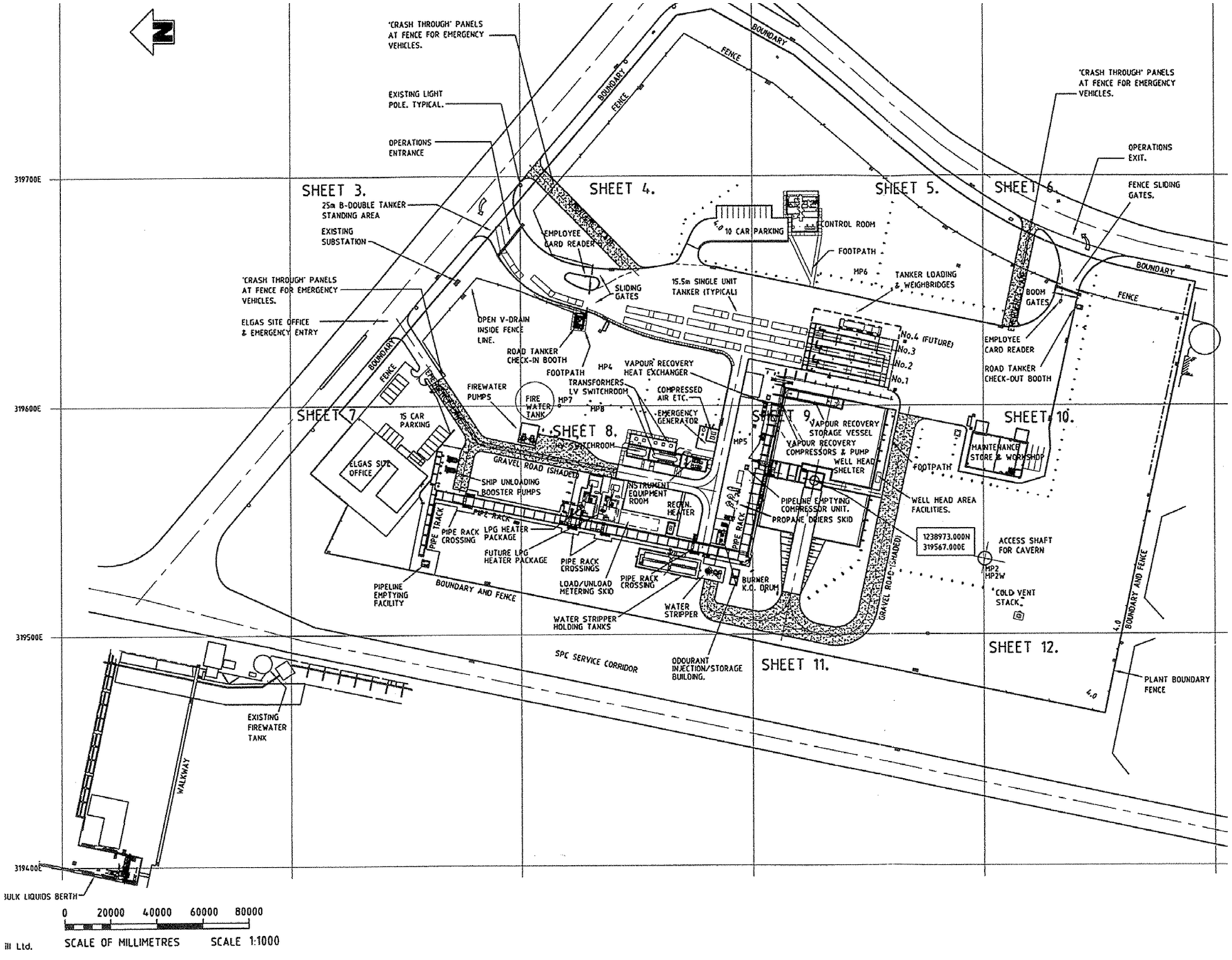

Figure 4: Layout of Existing Facilities

4.1 Process

Ship/ Shore Transfer

Refrigerated LPG (propane) is received from ship into the Cavern via the Marine Loading Arm (MLA), at approximately 1000 m^3/ hour. The cargo on board the ship is stored at -42^{O}C, and is heated on site before being sent to the Cavern for storage.

The MLA is also used for LPG transfers from the Cavern into ships. The MLA is equipped with limit switches for detecting excessive range or slew, and interlocked to initiate emergency shutdown (ESD) of the transfer if the limits are exceeded.

Once the loading arm is connected, a leak test is completed, an ESD test is completed and all issues are addressed, the representative from NSW Ports Authority will allow the transfer to commence.

Booster pumps are located inside the boundary of the terminal to boost the pressure of propane received from the ship to the required pressure, before discharging into the Cavern.

The incoming propane is heated in the gas-fired Kaldair heater to a temperature of approximately 6^{O}C.

The facility can also reload product from the Cavern to ships. During ship loading operation, product (at about 18^{O}C) is transferred to the ship using the Cavern pumps. The product is passed through the dryers to remove any traces of moisture and directed to the wharf pipeline before being loaded onto the ship using Elgas' MLA at the wharf.

A shore watch (Elgas operations controller or an Elgas contractor trained to an adequate level), and a deck watch (on the ship) are present at all times during the transfer from/to ships.

Export via Road Tankers

LPG is mostly exported via road tankers. Product from the Cavern, which is stored at approximately 18^{O}C, is pumped into road tankers for distribution. The LPG is pumped from the Cavern and passed through a coalescer and dryer to remove water, and loaded into bulk road tankers for distribution to customers.

Three submerged 11-stage centrifugal pumps are installed in the Cavern to pump the LPG into bulk road tankers and/ or a ship.

There are three loading bays for loading propane into bulk road tankers. Bays 1 and 2 are capable of accommodating a B-double tanker. Bay 3 can load only a single tanker. The system is fully automated, and is controlled by the Honeywell distributed control system (DCS).

The system is designed for driver loading, but an Operations Controller may be present. Each loading bay is provided with a weighbridge on which the tanker is parked. Details of the prime mover and the tanker are input into the loadout computer, which has their tare weights pre-programmed.

The driver connects the liquid filling line and the vapour recovery line. The driver is present at the loading bay throughout the operation and can initiate an ESD in case of an incident at the loading bay which stops the flow and initiates deluge in the loading bays.

When the desired weight is loaded into the tanker, the transfer is automatically stopped by the computer.

Most road tanker loading is done with odourised material but un-odourised product can also be exported via road tankers.

Emergency Shutdown (ESD)

A comprehensive emergency shutdown system (ESD) has been designed into the facility, using hardwire logic and corresponding alarm through the DCS.

4.2 Control Room

The control room is located within the terminal fenced area. The Operations Controller has views of the terminal including the road tanker loading bays through the glass windows of the control room. In addition, there are nine remotely controlled cameras located around the site (including at the wharf, entry gates and loading bays) allowing the Operations Controller to view specific areas/equipment of concern.

The control system is a Honeywell Distributed Control System (DCS). There are a number of display monitors and special keyboards. The control room is manned at all times by the shift Operations Controller.

Audible and visual alarms are generated by the DCS in the control room, to warn the operator of high or low process parameter values, so corrective actions can be taken. Valve open/ close positions are also indicated on the screen.

4.3 Staffing

The Cavern facility operates 24 hours per day, round the year. The plant process operator in charge for the shift is referred to as the Rosted Operations Controller, and is generally a more experienced operator. Operators are employed on a 12 hour, rotating shift roster. During day shift, there is one Operations Controller in the control room, one Operations Coordinator and maintenance staff working in the maintenance workshop or in the process area. All planned maintenance activity is carried out only during the day shift. Night shift has only a single Operations Controller on the site, and routine road tanker loading by the driver is the only activity.

During ship discharge or loading, there are three operators, one for the control room (Operations Controller), one at the wharf (Shore Watch) and one field operator.

4.4 Pumps and Compressors

The following pumps and compressors are installed at the facility:

- Ship unloading booster pumps (P-201A/B) boosting the pressure in front of the heater package
- Pipeline drawdown pump (P-204)
- Propane pumps in Cavern (P-301A/B/C) transfer the stored product from the Cavern to tanker loading or to the ship for ship loading. The same pumps will be used for the proposed product transfer to Qenos.
- Vapour recovery pump (P-504) transfers the liquid outlet from the Vapour Recovery Vessel to the tanker loading
- Vapour recovery compressor
- Stripped propane recovery compressor.

4.5 Heater and Dryer Packages

A Kaldair heater is installed in the import pipeline. It is a gas fired system, which raises the temperature from about -42^{o}C (refrigerated product on ships) to about 6^{o}C.

The dryer package is installed on the outlet of the transfer line from the Cavern. Product to the road tanker bays is passed through the dryer. Similarly, when product is exported via ships, the product is passed through the dryer before entering the ship-to-terminal liquid line.

In addition, heat exchangers are in place for the vapour recovery process.

4.6 Vapour Recovery System

During road tanker filling operations, the vapour from the tanks flow to the Vapour Recovery Vessel (V-503). The vapour is liquefied and pumped back to the road tanker filling points.

In the event of a road tanker arriving at the site with small quantity of butane left in the tank, this liquid must be removed before filling of propane. The butane can be pumped (using the road tanker pump) to the vapour recovery vessel where it is mixed with the remaining propane liquid in the vessel. This mixture can be pumped back to the road tanker filling point, resulting in small amounts of butane being included in the filling of designated road tankers (loaded at Bay 3 only).

A vapour take-off from the recovery system is used as fuel for the Broach heater.

4.7 Water Stripper

Groundwater continuously seeps into the Cavern. Water can also be added as required, via the water curtain system. Any water pumped out of the Cavern is passed through a water stripper. Ground seepage water is sent to the water soakaway area while any recovered gas is fed back into the Cavern vapour line.

4.8 Cold Vent

A cold vent is installed at the site to release small quantities of product during preparation for maintenance. The cold vent is located away from the process equipment and buildings and the released gas is monitored on the DCS.

4.9 Auxiliary Systems

4.9.1 Utilities

The main utilities and services in the terminal are:

- Compressed air system which also provides instrument air (dried) for pneumatically actuated valves.
- The site power is supplied by Energy Australia at 11 kV. There are four transformers on site, two providing 3.3 kV output and two supplying 415V.
- There is an emergency diesel-driven generator set, providing 350kVA, 415V output. The emergency generator starts automatically on loss of main power supply.
- Utilities water is supplied from Sydney Water supply main.
- Independent line supplying water for make-up water to the on-site firewater storage.
- A workshop is provided for minor maintenance work. Major maintenance such as relief valve inspection and testing is carried out offsite.
- Uninterruptible power supply (UPS) for up to 1 hour at full load (12kVA) for the DCS and ESDS to enable safe shutdown of the operations in the event of power failure.
- A cold vent is provided in the southwest corner of the site for venting of LPG vapour.

- A liquid nitrogen vessel of 5-tonnes capacity has been installed and maintained by BOC Gases.

4.9.2 Communications

Communication on the plant is achieved primarily by use of intrinsically safe two-way radios, carried by all Operations Controllers, managers and coordinator. Sufficient redundancy exists to provide backup radios in the event of a fault. A multi battery charger in the control room allows for charging of radio batteries.

There is also an intrinsically safe (Stentofon) telephone communication system. This system has units fixed in places around the plant and in the control room.

An intrinsically safe mobile phone is available for use by the Operations Controllers. If he is required to carry out activities outside the control room, in-coming calls can be redirected to the mobile. If it is necessary to call from the field in an emergency, then the mobile phone can be used.

A 5-minute alarm button is provided at the road tanker loading bay (for use when the driver is loading by himself) in order to assure the operations controller in the control room that the operation is progressing smoothly. The driver presses it every 5 minutes. In the event of an incident or driver medical condition, if the button is not pressed at the end of 5 minutes, an emergency alarm is raised in the control room and loading is stopped automatically. The operations controller will then investigate and initiate emergency response if required.

4.10 Security

The site is enclosed by a chain wire fence approximately 2 m high, with barbed wire at the top.

There are two vehicle access points to the site:

1. the main vehicle entry/ exit from Charlotte Road; and
2. road tanker exit gate on Friendship Road.

Access point is controlled by automatic sliding security gate, operated by an Operations Controller from the control room and the road tanker exit gate is opened by the tanker drivers by use of their swipe card. The exit gate can also be opened from the control room. Both access points are also opened in the event of a manually activated fire alarm in the control room or an automatic fire alarm triggered by fire/gas detection on the site (e.g. start of deluge system in the road tanker bays).

Visitors to the site must contact the control room via the intercom allowing personnel in the control room to identify anyone at this point before granting entry.

There is also an access point (person entry only) leading to Elgas' administration building which is located outside the security fence. This gate is opened by swiping an Elgas id card at the gate. Only Elgas staff has been given access to this gate.

There are also three access gates leading to Fishburn Road. These are padlocked and only used by operators. In addition, two "crash gates" are located close to vehicle access points on Charlotte and Friendship roads, with a third crash gate adjacent to the pumps and water storage tank. The site is well lit at night.

In addition to 9 manually operated cameras (operated remotely in the control room), 13 closed-circuit television cameras (CCTV) monitor the site perimeter. These cameras have an infra-red illuminator for night time operation. In addition, motion detectors are installed along the site's perimeter, with an alarm at the control room.

4.11 Storage of Flammable Materials

4.11.1 Cavern

The Cavern facility is excavated from sandstone rock and consists of four large galleries in parallel (each 230m x 14m x 11m), interconnected by small galleries. An operating shaft connects the Caverns to the wellhead shelter at ground level. The Cavern has a capacity to store approximately 130,000 m^3 of liquid propane.

There is continual water seepage into the Cavern from the surrounding groundwater table. A sump is provided in the Cavern floor, just below the operating shaft, to collect seepage water. The seepage water is pumped to the water stripper on the surface. A constant level is maintained in the sump.

4.11.2 Road Tankers

In general, road tankers arriving at the site are empty. They are weighted upon arrival before commencing to the loading bays. Once the set quantity is reached, the road tanker is again weighted before leaving the site. Road tankers are only a transient storage at the site and full road tankers are not parked on site over-night.

4.11.3 Process Vessels and Equipment with Stored Product

No vessels or other equipment contain any significant quantities of product at the site. The main vessels and equipment are listed below. The containing quantities are part of the isolatable inventories considered in the Major Accident Events (MAEs).

- Propane heater package (A-204)
- Propane dryer package (A-301)
- Vapour recovery vessel (V-503)
- Stripper flash drum (V-302)

4.11.4 Odorant

Two 2,000 Litre odorant (ethyl mercaptan) drums are connected to the odorant injection point and is injected into the process steam for some of the road tanker filling operations. This takes place in the odorant building, located close to the propane dryers (south-east of the instrument equipment room). Ethyl Mercaptan is a flammable material and will form a liquid pool if released and will vaporise rapidly.

5 HAZARD ANALYSIS METHODOLOGY

5.1 Overview

This hazard analysis involves the quantitative estimation of the consequences and likelihood of accidents (viz. a Quantitative Risk Assessment or QRA). For consequences to people, the most common risk measure is 'individual fatality risk' (viz. The likelihood of fatality per year).

In developing the estimates for use in a HAZAN, it is important to ensure that any estimates fall on the side of conservatism, particularly where there is uncertainty in the underlying data and assumptions. This precautionary approach uses 'cautious best estimate' values, which, whilst conservative, are still realistic. This approach is consistent with the DP&I's guidelines for undertaking this type of assessment [3].

Diagrammatically, the QRA process is shown in Figure 5.

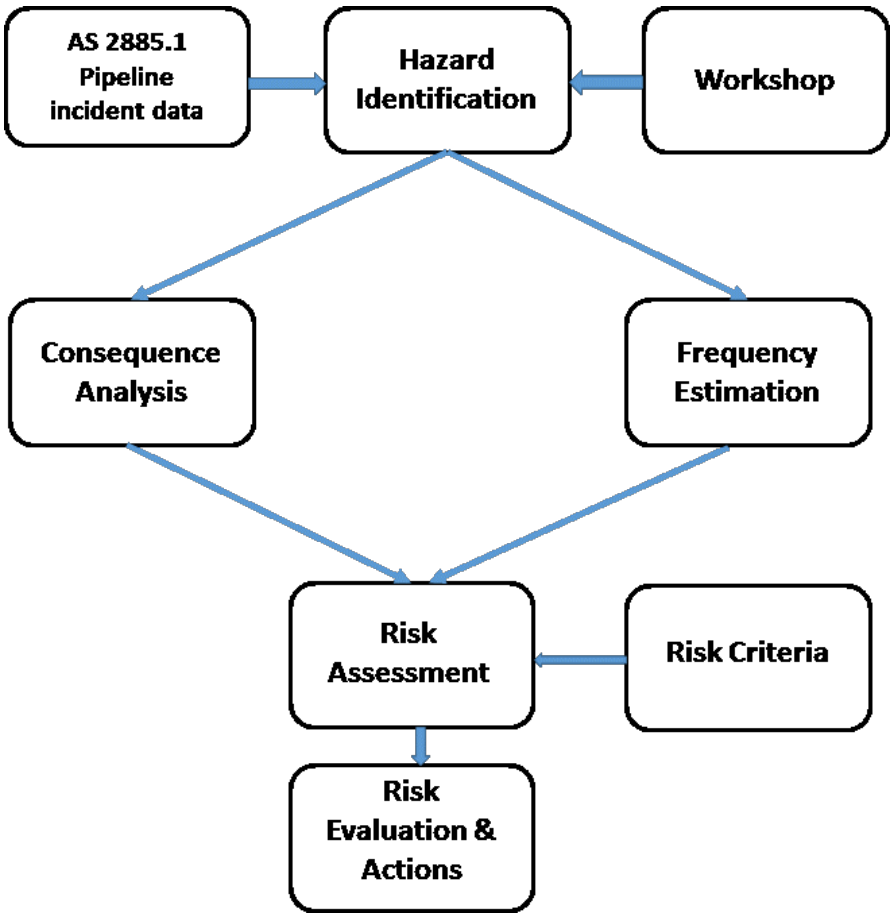

Figure 5: Overview of QRA process

5.2 Hazard Identification and Register of Major Accident Events

The basis for the risk analysis is the identification of hazardous scenarios. Hazard identification (or HAZID) is crucial, as a hazard that is not identified will not be modelled and assessed.

A hazard is a source of harm (e.g. thermal radiation from a fire, physical impact from a moving vehicle or dropped object, or exposure to stored energy etc.). As well as identifying the hazards that exist, it is also important to identify how these hazards could be realised. These representative hazardous events are commonly described as 'Major Accident Events' (or MAEs). In the context of the HAZAN, an MAE is an event with the potential to cause off-site fatality or injury, off-site property damage, or, long-term damage to the biophysical environment (i.e. any outcome for which DP&I has defined an acceptable risk criterion – Refer to Section 5.5).

There is no single definitive method for hazard identification (HAZID); however, it should be comprehensive and systematic to ensure no critical hazards are excluded from further analysis. For this HAZAN the following methods were used for identification of hazardous scenarios:

(i) AS 2885.1 – Pipeline Design Code [6]

(ii) Incident data related to hydrocarbon pipelines reported in the literature

(iii) A hazard identification workshop, attended by Elgas, Qenos and Sydney Ports, and facilitated by Arriscar.

The hazard consequence analysis and risk assessment were carried out using the software PhastRisk Version 6.7. Incident frequencies and ignition probabilities were input to the program, besides meteorological data.

5.3 Impairment Criteria

Based on the assessment of the inherent hazards of LPG in the pipeline, the final events of the MAEs include:

- Fires (jet fire, flashfire); and
- Vapour Cloud Explosion.

5.3.1 Fires

The level of harm caused by a fire is determined by the intensity of the heat radiation emitted during the fire and by the exposure duration of the receptors to the fire.

The impact of thermal radiation on humans is given in Table 2 [7].

Table 2: Effects of Thermal Radiation on Humans

Thermal Radiation Intensity, kW/m2	Impact on Humans
1.2	Received from sun in summer at noon
1.6	Minimum necessary to be felt as pain
4.7	Pain in 15 to 20 seconds, 1st degree burns in 30 seconds
12.6	30% chance of fatality for continuous exposure
23.0	Fatality on continuous exposure. 10% chance of fatality on instantaneous exposure
35.0	25% chance of fatality on instantaneous exposure
60.0	Fatality on instantaneous exposure

The dominant effect in a flash fire is direct engulfment by flame within the combusting cloud. To estimate the magnitude of the flammable gas cloud, the furthest distance from the release location with a concentration equal or above the lower flammability limit (LFL) has to be assessed using a dispersion model. Fatality is assumed for a person caught inside a combusting flammable cloud.

5.3.2 Vapour Cloud explosions

During a flash fire, acceleration of the flame front can occur due to the turbulence generated by obstacles within in the combusting vapour cloud. When this occurs, an overpressure ('shock') wave is generated which has the potential to damage equipment and/or injure personnel.

The impact of explosion overpressure on humans takes two forms:

- For a person in the open, there could be organ damage (e.g. ear drum rupture or lung rupture), that may be considered to constitute serious harm.
- The person could be hit a flying missile, caused by the explosion, and this can lead to serious injury or even fatality.

Table 3 summarises the impact of various levels of peak overpressure from explosions. [8,9,10, 11].

Table 3: Effects of Explosion Overpressure on Humans

Overpressure, kPa	Impact on Humans
0.3	Loud noise
1.0	Threshold for breakage of glass.
4.0	Minimal effect in the open. Minor injury from window breakage in building.
7.0	Glass fragments fly with enough force to injure. Minor injury in the open.
14.0	1% chance of ear drum rupture
21.0	10% chance of ear drum rupture
35.0	Fatal for person within or outside building (building collapse on person or struck by flying debris)
70.0	Fatal for a person outside or within building

5.4 Risk Criteria

Both qualitative and quantitative criteria need to be considered in assessing the tolerability of risk. The criteria adopted for this study are outlined in HIPAP 4 [3].

Quantitative Criteria

HIPAP No. 4 includes quantitative risk criteria for: (i) individual fatality risk (Refer to Section 5.4.1); (ii) injury risk due to exposure to heat radiation, explosion overpressure or toxic gas/smoke/dusts (Refer to Section 5.4.2); and, (iii) damage to property and accident propagation (Refer to Section 5.4.3).

Qualitative Criteria

Irrespective of the numerical value of any risk criteria level for risk assessment purposes, it is essential that certain qualitative principles be adopted concerning the land use safety acceptability

of a proposed development or existing activity. The qualitative risk criteria outlined in Section 3 of HIPAP No. 4 encompass the following general principles:

- Avoidance of all 'avoidable' risks;
- Reduction, wherever practicable, of the risk from a major hazard, even where the likelihood of exposure is low;
- Containment, wherever possible, within the site boundary of the effects (consequences) of the more likely hazardous events; and,
- Recognition that if the risk from an existing installation is already high, further development should not be permitted if it significantly increases that existing risk.

5.4.1 Individual Fatality Risk

The individual fatality risk imposed by a proposed (or existing) industrial activity should be low relative to the background risk. This forms the basis for the following individual fatality risk criteria adopted by the NSW Department of Planning and Infrastructure.

Table 4: Individual Fatality Risk Criteria

Land Use	Risk Criterion [per million per year]
Hospitals, schools, child care facilities and old age housing developments	0.5
Residential developments and places of continuous occupancy, such as hotels and tourist resorts	1
Commercial developments, including offices, retail centres, warehouses with showrooms, restaurants and entertainment centres	5
Sporting complexes and active open space areas	10
Industrial sites	50 *

* HIPAP 4 allows flexibility in the interpretation of this criterion. For example, 'where an industrial site involves only the occasional presence of people, such as in the case of a tank farm, a higher level of risk may be acceptable'.

5.4.2 Injury Risk

Heat Radiation or Explosion Overpressure

The risk of exposure to heat radiation exceeding 4.7 kW/m^2, or an explosion overpressure exceeding 7 kPa, should not exceed fifty chances in a million (50 x 10^{-6}) per year at residential areas.

5.4.3 Risk of Property Damage and Accident Propagation

Heat radiation exceeding 23 kW/m^2 may cause unprotected steel to suffer thermal stress that may cause structural damage and an explosion overpressure of 14 kPa can cause damage to piping and low-pressure equipment. The risk of exposure to heat radiation exceeding 23 kW/m^2, or an explosion overpressure exceeding 14 kPa, should not exceed 50 in a million (50 x 10^{-6}) per year at the boundary with neighbouring industrial facilities.

6 HAZARD IDENTIFICATION

6.1 HAZID Workshop

The hazard identification workshop was held at the Cavern site office on 30 September, 2013.

In the workshop, a "what-if" analysis was undertaken to assist with identification of the potential MAEs. The minutes of this workshop are included in B.

The following people were in attendance:

Table 5: Workshop Participants List

Name	Organisation	Position
Aldo Costabile	Elgas	Cavern Terminal Manager
Paul Edwards	Elgas	Operations Coordinator
Neil Tarin	Elgas	Reliability Manager
Mark walker	Qenos	Terminal Manager
Jim Pullin	NSW Ports	BLB Manager
Raghu Raman	Arriscar	Facilitator
Philip Skinner	Arriscar	Scribe

The minutes of the workshop are listed in Appendix B of this report.

6.2 Pipeline Failure Modes

6.2.1 Corrosion

LPG is a clean liquid and is non-corrosive. Therefore, the chance of internal corrosion is negligible. The pipeline will be cathodically protected with sacrificial anodes, and the cathodic protection will be monitored on a regular basis.

The pipeline will be painted with a corrosion resistant paint, and inspected externally on a regular basis.

The chance of a major failure of LPG pipeline due to corrosion is considered negligible.

6.2.2 Mechanical Damage

The site is protected by a security gate, and normally there is no vehicular access to the pipeline route.

There is normally no vehicle access to Pipeline Corridor. Any access by authorised personnel is through a permit to work system. NSW Ports will review additional impact protection that may be required. This applies to all existing pipelines in the corridor and not exclusively to the proposed LPG pipeline.

6.2.3 External Interference

External interference is considered the most significant cause of failure of 'cross-country' pipelines. However, in this instance, this potential is low because of the following factors:

- The pipeline is located entirely within Port controlled land with no public access

- Any work carried out on the land is by an authorised contractor under an appropriate permit to work system
- Any excavation by public utilities on Friendship road has to be under a 'permit to work' system by the Ports and only after it is ascertained that no excavation over pipeline would occur.
- Gas detection and alarm at the pit in Charlotte Road and in the culvert in Friendship Road, alarming in the Cavern and Qenos control rooms.

Therefore, the risk from external interference, in this case, is low.

6.2.4 Failures of Gaskets/ Flanges

A gasket failure would vary from a weeping leak to a small section of gasket being blown away (typically the section between two adjacent bolts). However, the latter failure is not possible for spiral wound gaskets. The maximum possible hole size for such failures was postulated as 5 mm.

6.2.5 External Leaks from Valves

The type of failures that could be encountered include a gland leak to atmosphere (weep), a body/ bonnet gasket leak to atmosphere (weep), and a significant body/bonnet gasket leak to atmosphere [12].

Most of the leaks would be small. The maximum possible hole size for a significant leak was taken as 20 mm.

6.3 Operational Failures

The only operational failure identified was overpressure due to valve closure to Qenos Cavern pump is running. PSVs are installed upstream of the pump that vent to the cold vent. Thus, overpressure of pipeline is prevented. Further, the excess flow from the Cavern pump is reticulated back to the cavern.

6.4 Rule Set for Failure Scenarios

The following rule sets were developed for LPG release scenarios:

- Short duration release at initial leak rate and depressuring of isolatable inventory, for the case of detection through gas detection/ process alarms and operator initiated ESD. The time to isolation is taken as 3 minutes.
- Uncontrolled release if alarm fails or ESD fails until manual isolation is effected.

6.5 Isolatable Inventories

In order to model releases from loss of containment, it is first necessary to divide the proposal into isolatable inventories. This enables the grouping of different equipment (e.g. equipment, pipework, fittings, etc.) where similar dangerous goods and conditions are present, and ultimately simplifies the modelling of potential consequences.

The following isolatable sections were defined, based on the EIV locations:

1. Pipeline from Cavern tie-in point to Elgas site boundary (with in Cavern site)
2. Pipeline from Elgas site boundary to Qenos site boundary (pipeline corridor)
3. Pipeline from Qenos boundary to Qenos tie-in point (within Qenos site)

Table 6: Isolatable Inventories

Isolatable Section	Approx. Section Length [m]	Contents	Phase	Inventory [kg]	Temp. [°C]	Pressure [barg]	Transfer Rate [kg/s]
Above-Ground - from Cavern ti-in point to start of below ground section (inside Elgas site)	200	LPG	Liquid	1681	20	25	8.3
From Elgas battery isolation to Qenos boundary – Below ground section*	85	LPG	Liquid	3782	20	25	8.3
From Elgas battery isolation to Qenos boundary – Above ground section*	365	LPG	Liquid	3782	20	25	8.3
Qenos boundary to tie-in point**	Not included in QRA	LPG	Liquid	3782	20	25	8.3

* Elgas battery isolation point to Qenos boundary isolation point is one isolatable inventory, but part of it underground as identified in the table.

** Pipeline within Qenos boundary is not included in this risk assessment.

6.6 Hazardous Scenarios

A release from each of the isolatable section becomes a new MAE. After the isolatable sections were identified, representative hole sizes were defined to model fabric failure releases.

The selected representative hole sizes are presented in Table 7.

Table 7: Representative Hole Sizes for LPG Releases

Hole Size	Representative Hole Size Selected	Description
Pinhole	5 mm	Covers spiral wound gaskets gaskets
Small	20 mm	Covers small bore pipe work (instrument nozzles, and small holes in pipeline).
Medium	75 mm	Covers small pipeline rupture (approx. 25% cross sectional area)
Large	110 mm	Covers major rupture (approx. 50% cross sectional area)
Catastrophic	150 mm	Hole size equivalent to full bore of pipeline

A full list of failures, together with applicable process conditions and hole sizes is provided in Appendices C and D.

6.7 List of Major Accident Events

Table 8 contains a summary of the identified Major Accident Events (MAE).

Table 8: List of Major Accident Events

No	MAE	Representative Release Scenario	Reference Number	Hole or Orifice Diameter [mm]
1	Release of LPG from Above-Ground pipeline from Cavern to battery limit	Full bore rupture	S1-110	150
		Large hole	S1-110	110
		Small hole	S1-75	75
		Pin hole	S1-20	20
2	Release of LPG from Below-Ground pipeline from Battery Limits to Qenos boundary	Full bore rupture	S2-150	150
		Large hole	S2-110	110
		Small hole	S2-75	75
		Pin hole	S2-20	20

7 CONSEQUENCE ANALYSIS

7.1 Release Rates

When a release from the pipeline occurs, depending on the hole size, two kinds of phenomena may occur:

1. When the hole size is large, the initial release rate exceeds the transfer flow rate. The pumping head is to the atmosphere, and hence up to 60 kg/s leak can occur, until isolated. If the calculated leak rate to atmosphere is > 60 kg/s, the flow is restricted to the pumping capacity of 60 kg/s. The pump capacity was obtained from the manufacturer supplied pump curves.
2. For small hole sizes, the leak rate is less than the transfer rate, and hence only partial depressuring would occur. The leak would continue at the calculated leak rate until isolated.
3. In either case, the low pressure alarm would be activated, followed by operator investigation and shutdown. For larger releases (20mm or greater), the pressure transmitters would automatically initiate an ESD on low low pressure. In this case, after ESD activation, the isolated inventory is depressured and the leak rate reduces as the line pressure decays.

The following leak rates were estimated:

Table 9: Release Rates Summary

Equivalent hole dia, mm	Release rate, kg/s
150	60*
110	60*
75	60*
50	60*
20	8.9
5	0.6

*Restricted to the maximum capacity of the Cavern pump to atmospheric head.

7.2 Duration of Release

Two cases were considered:

(a) ESD functions successfully when activated by the low low pressure sensor. The time from leak commencement to pipeline isolation was taken as 3 minutes (time to detect, time to activate ESD and time for valve closure).

(b) ESD fails to operate on demand, or leak rate is low enough not to activate the low pressure sensor initiated shutdown. In this case, the leak will continue for longer duration, until isolated manually.

7.3 Dispersion of Flammable Vapour

The distances to lower flammability limit (LFL) for the various wind speeds/ weather stability categories are summarised in Table 10.

Table 10: Distances to LFL

Release rate, kg/s	Wind/weather category	Distance to LFL, m
8.9	B2.4	16
	C3.7	14
	D7.2	12
	D3.5	15
	E4	14
	F1.9	18
60	B2.4	40
	C3.7	37
	D7.2	31
	D3.5	39
	E4	37
	F1.9	44

A flash fire is the result of ignition of a well mixed air-LPG cloud in a relatively unconfined location. A liquid/two-phase leak of LPG would evaporate and disperse into atmosphere forming a flammable air-vapour mixture on ignition, depending on the degree of congestion and confinement in the flame front, and the delay in ignition, a vapour cloud explosion may result. In its absence, a flash fire would be the result.

7.4 LPG Fires

A jet fire could occur if a gas leak or a 2-phase leak from pump/ pipeline/ valve is ignited. A pool fire is highly unlikely with pressurised propane because of the low boiling point of propane (-42ºC) and very high evaporation rates.

The distances to various thermal radiation levels are listed in Table 11.

Table 11: Distances to thermal radiation levels

No	Release rate, kg/s	4 kW/m^2	12.5 kW/m^2	23 kW/m^2	35 kW/m^2
1	8.9	57	36	29	24
2	60	139	86	68	54

7.5 Vapour Cloud Explosion (VCE)

If a liquefied flammable gas is released to atmosphere, there is a possibility that the ignition of the flammable cloud may result in an explosion, and it is referred to as a Vapour Cloud Explosion (VCE). For a VCE to occur the cloud must have sufficient mass and confinement.

The partial confinement for LPG dispersion are located throughout the facility particularly at the Tanker loading/unloading bay. The confinement is not significant.

A blast strength curve number of 5 and a congestion fraction of 0.3 was selected for the explosion calculations using the TNO multi-energy model.

No significant overpressures resulted for a release oriented 45 degrees to the horizontal.

8 FREQUENCY AND LIKELIHOOD ANALYSIS

8.1 LPG Release Events

Incident frequencies were estimated using generic failure rates of pipelines from statistical data, as applicable to the oil and gas industry [13,14].

The failure rates for gaskets and valves were taken from Blything and Reeves [11], as these values applied to LPG installations. Details are given in Appendix C.

A summary of release scenarios with corresponding release frequencies are listed in Appendix C, Table C2.

8.2 Event Tree Analysis

The likelihood of each potentially hazardous outcome (i.e. jet fire, flash fire, etc.) was estimated using event tree analysis.

Each branch in the event tree was assigned a probability to determine the probability of a specific outcome. The total probability for each branch must add up to 1.0 (e.g. if the probability of early ignition = 0.1, then the probability that there is not early ignition = 1.0 – 0.1 = 0.9).

The outcome probability is the product of each probability for each branch leading to that event. Therefore, this was multiplied by the likelihood (per year) of the representative release scenario to determine the likelihood (per year) of each potentially hazardous outcome.

The two principal factors that dictate the potentially hazardous outcome/s for a release are:

- Whether there is early or delayed ignition; and
- The time taken for detection and shutdown to occur.

Examples of event trees used for the QRA are shown in Appendix C.

8.3 Probability of Ignition

The probability of ignition was based on the OGP generic database [15].

For MAE 1 (release upstream of Cavern site boundary EIV) and for smaller releases, the flammable cloud did not reach outside the Cavern site boundary, and hence, for a smaller release to ignite, a source of ignition has to be found inside the site boundary.

The electrical equipment on Elgas site are of the flame proof type, designed for Zone 1 hazardous area classification and earthed. The one possible source of ignition is static electricity, and this chance is low.

The table of probabilities of ignition is given in Appendix C.

9 RISK ANALYSIS AND ASSESSMENT

9.1 Risk for Existing Facilities and Operations

The risk contour for existing facilities at the LPG Cavern is reproduced from the MHF Safety report in Figure 6. This is mainly for comparison with the pipeline risk contour in Figure 6.

Figure 6: Cumulative Individual Fatality Risk for Existing Facilities

9.2 Risk for Proposed LPG Pipeline

9.2.1 Risk of Fatality

The risk contour for the proposed pipeline is shown in Figure 7.

Figure 7: Cumulative Individual Fatality Risk for Proposed Pipeline

The risk contour closely follows the pipeline route, as can be expected. The 1x 10^{-6} per annum risk contour lies entirely within the Port land.

The 50x 10^{-6} per annum contour was not reached at any location.

9.2.2 Risk of Injury

The total risk from a pipeline incident did not exceed 50 in a million per year. Therefore the risk of injury potential (viz. heat radiation > 4.7 kW/m^2, explosion overpressure > 7 kPa, or injury / irritation due to exposure to toxic gas / vapour) at 50 in a million per year was not generated.

The existing facility and proposed LPG pipeline fully comply with the NSW DP&I individual injury risk criteria.

9.2.3 Risk of Property Damage and Accident Propagation (Exceeding 14 kPa)

The total risk from a pipeline incident did not exceed 50 in a million per year. Therefore the risk of accident propagation at neighbouring land uses (viz. heat radiation > 23 kW/m^2, explosion overpressure > 14 kPa, or injury / irritation due to exposure to toxic gas / vapour) at 50 in a million per year was not generated.

9.3 Port Botany Land Use Safety Review Recommendations

The SEPP for Port Botany (Ref.1) requires that the recommendations of the Port Botany Land Use Safety Study Overview Report (Ref.2) recommendations are complied with.

This section summarises the relevant recommendations and compliance.

Recommendation 1: *"Future developments in the Port area should undergo early risk assessment and comprehensive environmental impact process to conclusively demonstrate that they will not contribute to any increase in cumulative risk as shown in Figure 2 (of Ref.2). Developments should also conclusively demonstrate that, consistent with the Department of Urban Affairs and Planning risk criteria, there will not be any propagation of risks to neighbouring facilities"*.

Compliance: The risks from the proposed pipeline lies entirely within the existing Pipeline Corridor. Further, there is no risk propagation to neighbouring facilities of Elgas or Qenos.

Recommendation 2: "*Development controls should be put in place to ensure there is no significant increase in the number of people exposed to risk inside the residential risk contour shown in figure 2."*

Compliance: The proposed development does not impose any risk to residential areas and hence does not affect the existing residential risk contour in Ref.2

Recommendation 3: *"Risk reduction and safety management measures, identified in the individual site studies, should be implemented in accordance with an agreed program."*

Compliance: The pipeline will be managed under the existing Elgas Safety Management System. Relevant procedures will be updated to include the pipeline surveillance, monitoring and maintenance, together with the emergency response plan.

Recommendation 4: *"Emergency plans and procedures and fire prevention and protection systems should be kept up to date. Security arrangements for the Port area should be strengthened."*

Compliance: The existing emergency plans for the Cavern facility will be updated to cover the proposed LPG pipeline. The pipeline is fully welded and hence requires little maintenance. The existing Pipeline Corridor is a restricted area and access is given only to authorised personnel. Security arrangements for the Cavern site is covered by the Site Security Plan, developed for the MHF.

10 CONCLUSIONS AND RECOMMENDATIONS

10.1 Conclusions

The following conclusions were reached from the hazard analysis:

- The $1x10^{-6}$ p.a. fatality risk contour was contained within the Pipeline Corridor, and does not extend outside the Port area.
- The risk contour for $50x10^{-6}$ p.a. was not generated. Thus, there is no risk propagation potential to neighbouring facilities.
- The proposed LPG pipeline development satisfies the risk criteria specified in HIPAP No.4.
- The proposed development complies with the recommendations of the Port Botany Land Use Safety Study Overview Report, as required by the SEPP for Port Botany.

10.2 Recommendations

The following recommendations are made to Elgas arising from the hazard analysis study. Implementation of these recommendations would result in maintaining the risk at the calculated low levels.

1. The Emergency Response Plans of Elgas and Qenos should be reviewed / amended to address additional LPG release scenarios (including response to gas detection in Charlotte /Friendship Roads)
2. Specify insulation joint between above and below ground sections to ensure cathodic protection integrity.
3. Provide for inspection of cathodic protection facilities in the pipeline design.
4. Review providing seals at either end of sleeve to prevent rainwater ingress into the annular space, for the underground section of the pipeline beneath Charlotte and Friendship Roads.
5. Include provision for manual pump out of accumulated rainwater in the underground pit.
6. Consider soil strength analysis of pipeline route during pipeline design, as required by AS 2885.1.
7. The PSVs on pipeline are to be designed for two-phase release.
8. Consider restricting hydrostatic test water pump shut-in pressure to maximum allowable pressure for the pipeline.
9. Confirm pressure rating of isolation and shutdown valves with respect to PSV set-point.
10. Develop start-up and maintenance procedures for the pipeline (depressuring, purging and re-pressurisation after maintenance).
11. Review with NSW Ports, impact protection requirements for pipeline in corridor at vulnerable locations (e.g. ARMCO railing).

11 REFERENCES

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Appendices

Appendix A Meteorological Data

Meteorological conditions, such as wind speed, wind direction and stability class have an impact on the downwind and crosswind dispersion of a released gas. Site-specific meteorological data is therefore required to undertake a QRA study.

The representative wind directions, wind speeds and wind stability classes are normally determined from annual average of weather data available from the local meteorological department.

Wind Direction

The risk model uses data for 16 wind directions.

Wind Speed

Typical wind speeds for the Botany area range from 1.9 m/s to 7.2 m/s. The average wind speed is 3.4 m/s.

Weather Stability Class

In addition to wind speed, the Pasquil stability class has a significant impact on the vertical and crosswind dispersion of a released gas. There are six wind stability classes (A to F). Class A refers to more turbulent unstable conditions and Class F refers to more stable (inversion) conditions. Although the probability distribution of Pasquil stability classes is site-specific, it is a generally observed that Class F conditions are more likely to occur during the night-time while Class D (neutral) conditions occur during the daytime.

The following wind direction, wind speed and stability class distribution was used for the QRA:

Stability Class	Wind Speed (m/s)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Total
B	2.40	0.03	0.05	0.13	0.13	0.08	0.09	0.08	0.05	0.07	0.03	0.02	0.03	0.05	0.07	0.07	0.03	0.14
C	3.70	0.03	0.09	0.11	0.09	0.05	0.04	0.07	0.06	0.12	0.06	0.03	0.05	0.07	0.06	0.05	0.03	0.18
D	7.20	0.01	0.06	0.08	0.03	0.00	0.01	0.04	0.08	0.22	0.10	0.05	0.12	0.11	0.05	0.03	0.01	0.13
D	3.50	0.02	0.06	0.08	0.07	0.05	0.07	0.11	0.13	0.14	0.06	0.02	0.04	0.05	0.05	0.04	0.03	0.13
E	4.00	0.05	0.11	0.07	0.03	0.02	0.03	0.06	0.05	0.09	0.06	0.04	0.11	0.13	0.10	0.04	0.03	0.13
F	1.90	0.07	0.08	0.06	0.04	0.04	0.05	0.04	0.03	0.05	0.05	0.06	0.08	0.09	0.10	0.11	0.07	0.29
Total		0.21	0.45	0.53	0.39	0.24	0.29	0.40	0.40	0.69	0.36	0.22	0.43	0.50	0.43	0.34	0.20	1.00

Appendix B Hazard Identification Word Diagram

Attendees Aldo Costabile (Elgas); Paul Edwards (Elgas); Neil Tarin (Elgas); Mark Walker (Qenos); Jim Pullin (NSW Ports)
Facilitator Raghu Raman (Arriscar)
Scribe Philip Skinner (Arriscar)

No.	Guideword	Scenario	Causes	Consequences	Safeguards - Prevention	Safeguards - Mitigation	Actions
1	External Interference	Pipeline rupture from 3rd party interference	* Digging for underground services by utility company * Road maintenance upgrades	* LPG release, ignition and flash fire / VCE.	* The services for which digging is carried out are buried at depths of 1.6m. The pipeline is buried to a depth of 3m and hence digging would not reach that depth. * Pipeline location to be registered with "dial before you dig". * Signage for pipeline across roadways. * Permit to Work for work in the Pipeline Corridor (Issued by NSW Ports).	* PT with PAL, which will alarm on drop in pressure. * Gas detector in pit on Charlotte Rd, and in culvert on Friendship Rd. * Emergency isolation from both ends of pipeline. * Emergency response plans for site and area (Port Botany Emergency Alarm Radio, PBEAR).	* ERPs should be reviewed / amended to address additional LPG release scenarios (including response to gas detection in Charlotte / Friendship Rds).
2	Corrosion	Pipeline leak	Corrosion of the above-ground section	* LPG release, ignition and flash fire.	* Surface coating on above-ground section. * External inspections (walk the pipeline).		
3			Corrosion of the below-ground section	* LPG release within the sleeve (Gas will be released to atmosphere at the pits at either end)	* Sleeve (plastic) on under-ground section. * Cathodic Protection (Sacrificial anode).	* Gas detector in pit on Charlotte Rd (Under Review). * Gas detector in culvert on Friendship Rd.	* Specify insulation joint between above and below ground sections. * Provide CP inspection facilities in design.

No.	Guideword	Scenario	Causes	Consequences	Safeguards - Prevention	Safeguards - Mitigation	Actions
4	Natural events	Failure of below-ground pipeline due to natural events	* Soil erosion / scouring / inundation.	* LPG release with ignition. Flash fire/VCE. * Rainwater ingress into the sleeve and potential for increased corrosion.	* Directional drilling and depth of cover (3m).		* Review providing seals at either end of sleeve to prevent rainwater ingress into the annular space. * Include provision to manually pump out pit after heavy rain.
5	Subsidence	Pipeline failure due to soil subsidence	* Heavy vehicle movement on roads. * Burst underground water main.		* Depth of cover (3m). * Water main is located c.1.5 m above the underground LPG pipeline.		* Consider soil strength analysis during design (As per AS 2885).
6	Overpressure	Pipeline failure due to exceeding design pressure	* Sudden valve closure at Qenos end.	Pressure surge in pipeline may exceed design pressure. Most likely outcome is leak at valve or flange.	* EIVs do not slam shut (Designed to close over a time period to prevent pressure surge). * Independent PT on the pipeline and PAHH initiating ESD (trips pumps and shuts EIVs). * PSVs.		* PSVs to be designed for two-phase release.
7		Pipeline overpressurised during pre-commissioning	* Hydrostatic testing.	* Potential for pipeline failure during operation due to overstressing during hydrotest.	* Hydrotesting procedures.		* Consider restricting hydrostatic test water pump shut-in pressure to maximum acceptable for the pipeline.
8		Pipeline failure due to exceeding design pressure	* Thermal expansion while line is liquid full and isolated.	* No consequence (Line and equipment is rated for pressure higher than VP of LPG for worst case ambient conditions).			* Confirm pressure rating of valves with respect to PSV set-point.

No.	Guideword	Scenario	Causes	Consequences	Safeguards - Prevention	Safeguards - Mitigation	Actions
9	Brittle failure	Cryogenic conditions and pressurisation	* Depressuring. * Repressuring after maintenance. *Initial fill and pressurisation.	* Potential for brittle failure of pipeline	* Low temperature carbon steel pipeline (Rated for -48 deg.C).		* Develop start-up and maintenance procedures (depressuring and pressurisation after maintenance).
10	Electrical effects	Stray currents impact on pipeline	HV underground cables near pipeline	* Potential for increased corrosion	* CP and inspection of CP. * Separation (depth of cover) between HV cable and pipeline.		
11	External Threat	Incident in Pipeline Corridor from other pipelines impacting on proposed LPG pipeline	LOC of flammable hydrocarbons from other pipeline in corridor and ignition	* Escalation to LPG pipeline, with potential for LPG release	* All pipelines in corridor are fully welded, some with local PSVs. * Majority of pipelines in corridor are empty in between shipments.	* Emergency isolation of pipelines in corridor by respective Operator. * Emergency response plans for site and area (Port Botany Emergency Alarm Radio, PBEAR).	
12		Vehicle impact on pipeline in corridor (Note: Vehicles commonly access corridor to undertake work)		* LPG release, ignition and flash fire / VCE	* Permit to Work for vehicle access to the Pipeline Corridor (Issued by NSW Ports or facility Operator).	* Emergency isolation of pipelines in corridor by respective Operator. * Emergency response plans for site and area (Port Botany Emergency Alarm Radio, PBEAR).	* NSW Ports to review impact protection requirements for pipeline in corridor at vulnerable locations (e.g. ARMCO railing).
13		Vehicle impact on pipeline on-site		* LPG release, ignition and flash fire / VCE	* Site access restricted. * Pipeline located outside of normal traffic flow. * On-site vehicle speed limit.		
14	Material defects	Pipeline failure during operation due	Incorrect / defective material	* LPG release, ignition and flash fire / VCE	* Positive materials identification (PMI).		

No.	Guideword	Scenario	Causes	Consequences	Safeguards - Prevention	Safeguards - Mitigation	Actions
		to material defects			* Welding material and procedures.		

Appendix C Likelihood Analysis - Data and Results

C.1 Leak Frequency for Below-Ground Pipeline

For buried LPG pipelines, the UK HSE [12] recommends the EGIG data for leaks due to mechanical failure or corrosion; CONCAWE data for failures due to natural hazards; and HSE's in-house PIPIN model be used for third party damage. However, it does not specify the data set to use for other failure modes (e.g. human error) and the PIPIN model is not available to the public.

HSE CRR 372/2001 [13] includes some of the data used the PIPIN model. This report lists some of the factors that can be applied to the baseline third party activity leak frequencies to take account of increased depth of cover, increased wall thickness, location factors, and prevention measures (such as signage). However, there is insufficient information to apply these factors directly.

Therefore, the leak frequencies due to third party activity for the proposed 150 mm diameter buried LPG pipeline were factored down based on the data in the 8th EGIG report (Specifically, Section 3.3.3.1).

Table 12: Leak Frequency Data for Below Ground Section of LPG Pipeline

Hole Size Category (as per UK HSE, 2012)	Equivalent Hole Diameter (mm) #	Leak Frequency (per m per year)						%
		Mechanical failure	Operational / Hot Tap Error	Corrosion	Natural Hazard / Ground Movement	Third party activity	Total	
Rupture (>110 mm diameter)	150	4.0E-09	7.9E-09	2.9E-10	4.0E-09	1.1E-08	2.7E-08	13.4
Large Hole (>75 mm to <=110 mm diameter)	110	4.3E-09	5.9E-09	2.0E-10	4.0E-09	9.9E-09	2.4E-08	12.1
Small Hole (>25 mm to <= 75 mm diameter)	75	8.7E-09	2.0E-09	4.0E-10	0.0E+00	2.0E-08	3.1E-08	15.3
Pin Hole (≤25 mm diameter)	20	4.1E-08	2.0E-09	5.5E-08	5.9E-09	1.5E-08	1.2E-07	59.1
	Total =	5.8E-08	1.8E-08	5.6E-08	1.4E-08	5.5E-08	2.0E-07	100.0
	% Contribution =	28.9	8.9	27.8	6.9	27.6	100.0	
	Data Source =	EGIG (1971-2010)	CONCAWE (1971 - 2011)	EGIG (1971-2010)	CONCAWE (1971 - 2011)	EGIG * (1971-2010)		

Each data source reports different hole size ranges. Therefore, for the proposed 150 mm diameter LPG pipeline, the data has been distributed to match the equivalent hole size categories specified by the UK HSE [12].

* Reduced by a factor of 0.33, based on proposed depth of cover (c. 3 m), wall thickness (10.9 mm) and pipe diameter (150 mm).

Table 13: Factors affecting pipeline failure frequency

	Factor	Notes
A. Pipe Diameter	1	The most common pipe diameter class in the EGIG data is 5" <= D < 11" (Ref: 8th EGIG Report, Fig. 2, [14].
B. Depth of Cover	0.66	This is the same factor reported in CRR 372/2001.
C. Wall Thickness	0.5	The most common pipe wall thickness in the EGIG data is 5 mm < wt < 10 mm (Ref: 8th EGIG Report, Fig. 6). Failure rates for pipes with a wall thickness in the range 10 mm < wt <= 15 mm are less than one-sixth of the failure rates for pipes with a wt in the range 5 mm < wt < 10 mm (Ref: 8th EGIG Report, Fig. 6). However, the wt for the proposed pipeline is 10.97 mm and just falls into the 10 mm < wt <= 15 mm range. Therefore, only a factor of 0.5 was applied.
Total Factor (A x B x C) =	0.33	

C.2 Leak Frequency for Above-Ground Pipeline

Table 14: Above Ground LPG Pipelines within a Secure Compound [12]

Hole Size Category	Equivalent Hole Diameter (mm) #	Leak Frequency (per m per yr)	% Contribution
Rupture (>110 mm diameter)	150 mm	6.5E-09	2.4
Large Hole (>75 mm to <=110 mm diameter)	110 mm	3.3E-08	12.4
Small Hole (>25 mm to <= 75 mm diameter)	75 mm	6.7E-08	25.1
Pin Hole (≤25 mm diameter)	20 mm	1.6E-07	60.0
Total =		2.7E-07	100.0

For 150 mm diameter pipe

C.3 Ignition Probability

Table 15: Ignition Probabilities for Pipe-Gas-LPG-Industrial (Gas or LPG release from onshore pipeline in an industrial area)

Release Rate (kg/s)	Total Ignition Probability	Note
0.1	0.0010	
0.2	0.0017	
0.5	0.0033	
0.6	0.0038	Interpolated
1	0.0056	
2	0.0095	
5	0.0188	
8.9	0.0288	Interpolated
10	0.0316	
20	0.0532	
50	0.106	
60	0.12	Interpolated
100	0.178	
200	0.299	
500	0.595	
1000	1.000	

C.4 Event Tree - Release of Liquid LPG from Below-Ground Pipeline

INPUT DATA

Hole Size Category	Equivalent Hole Diameter (mm)	Leak Frequency (per m per year)	Probability of Hole Size Category	Release Rate (kg/s)	Total Ignition Probability (OGP Data)	Immediate Ignition Probability #	Delayed Ignition Probability	Probability of VCE (Rather than Flash Fire)
Rupture	150	2.7E-08	0.13	60*	0.12	0.053	0.067	0.40
Large Hole	110	2.4E-08	0.12	60*	0.12	0.053	0.067	0.40
Small Hole	75	3.1E-08	0.15	60*	0.12	0.053	0.067	0.40
Pin Hole	20	1.2E-07	0.59	8.9	0.03	0.004	0.026	0.00
	Total =	2.0E-07	1.00					

Assumes that hot tap error or TPA will only result in immediate ignition and other causes will only result in delayed ignition.

- Leak rate limited to maximum pumping rate of 60 kg/s.

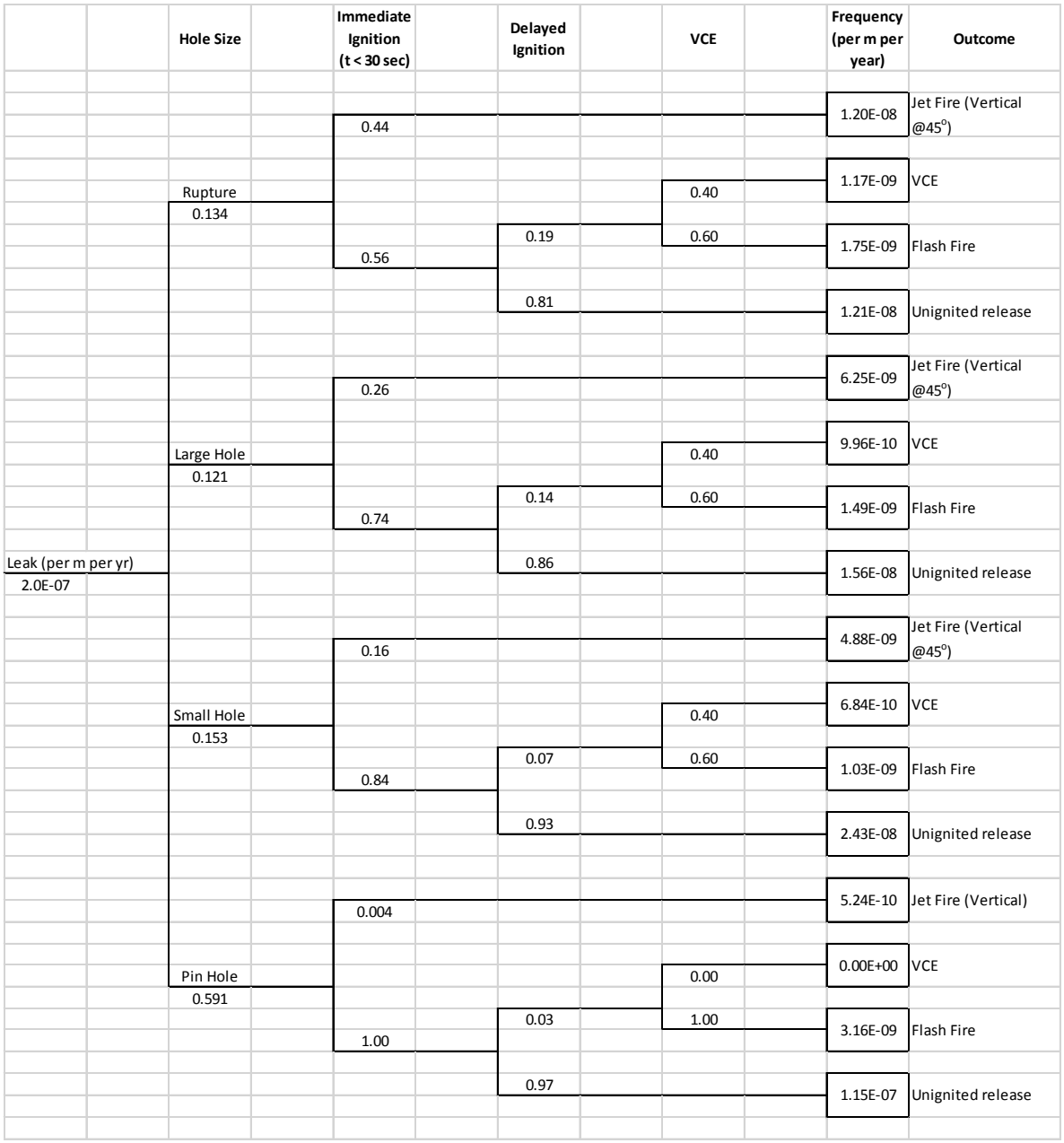

Figure 8: Event Tree for LPG Release from Below-Ground Section

C.5 Event Tree - Release of Liquid LPG from Above-Ground Pipeline

Hole Size Category	Equivalent Hole Diameter (mm)	Leak Frequency (per m per year)	Probability of Hole Size Category	Release Rate (kg/s)	Total Ignition Probability (OGP Data)	Immediate Ignition Probability #	Delayed Ignition Probability	Probability of VCE given ignition
Rupture	150	6.5E-09	0.02	80	0.12	0.053	0.067	0.40
Large Hole	110	3.3E-08	0.12	80	0.12	0.053	0.067	0.40
Small Hole	75	6.7E-08	0.25	80	0.12	0.053	0.067	0.40
Pin Hole	20	1.6E-07	0.60	8.9	0.03	0.004	0.027	0.00
	Total =	2.7E-07	1.00					

Assumes that the ratio of immediate ignition to delayed ignition probabilities are the same as for a below ground pipeline release to atmosphere.

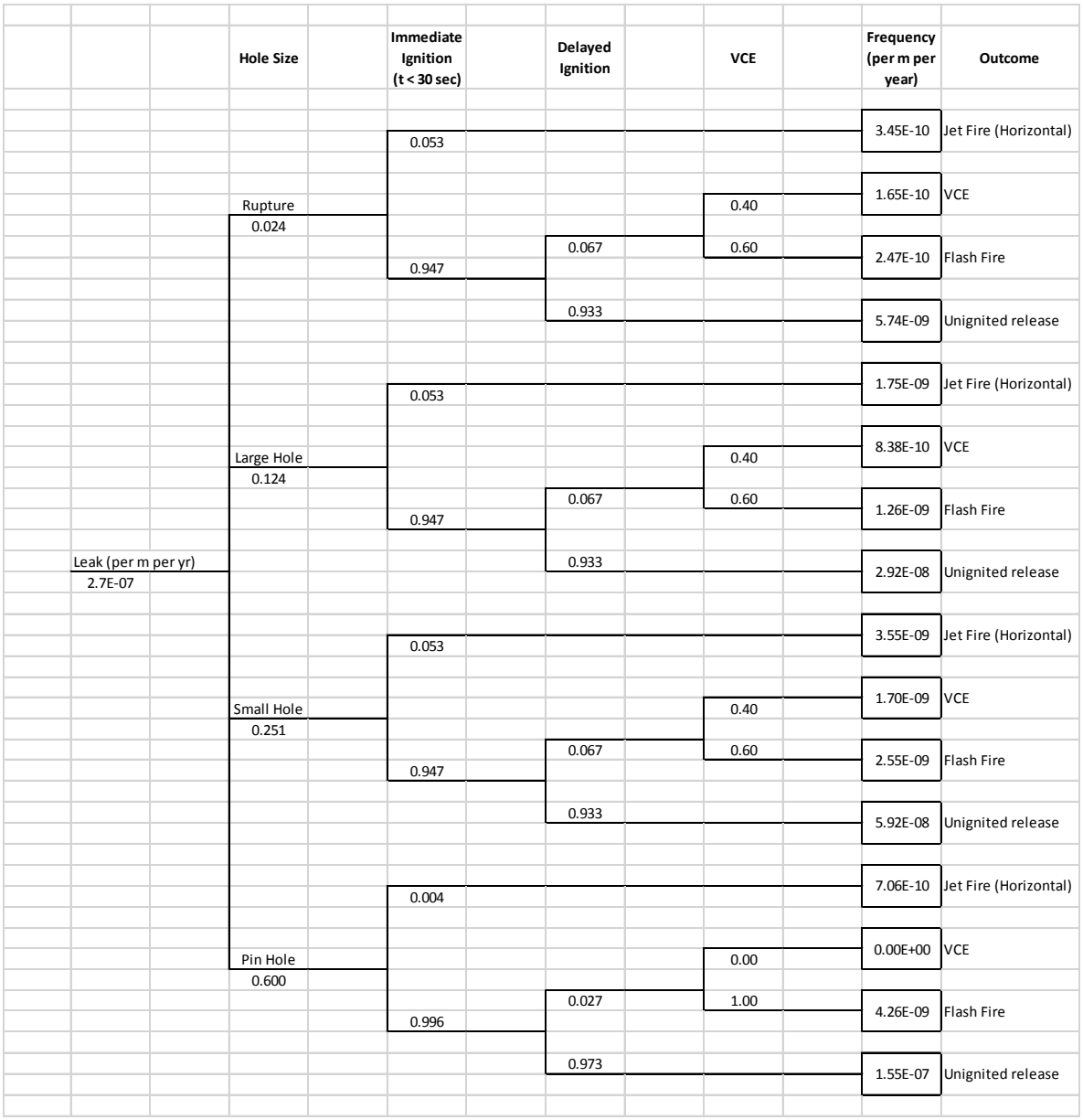

Figure 9: Event Tree for LPG Release from Above-Ground Section

Appendix E

ENVIRONMENTAL RISK ASSESSMENT

STEP	ISSUE	RISK LEVEL PRIOR TO MITIGATION	CONTROLS	RISK LEVEL FOLLOWING MITIGATION
CONSTRUCTION	Traffic	Medium	• Implement traffic management measures following consultation with NSW Ports in regards to the Traffic management requirements. • Implement traffic management measures in the CEMP or a Traffic Management Control Plan, as appropriate. • Vehicle access routes to and within the site will be clearly defined	Low
	Air quality	Medium	• Implementation of best practice dust management practices. • Vehicles or equipment not to be left idling • Maintain vehicles and equipment according to manufacturer's recommendation to reduce greenhouse gas emissions	Medium
	Noise	Medium	• Schedule noisy works in normal work hours Monday – Friday, 0700 – 1800 h; Saturday, 0800 – 1300 h. • Noise generated by work equipment to comply with noise control standard AS 1055. • Works involving noise-generating machinery should be undertaken within the shortest possible timeframe, with minimum delays. All efforts should be made to schedule noisier work activities during the daytime on week days	Low
	Waste	High	• All staff and contractors will be made aware of waste management procedures as well as materials to be recycled, reused or approved for landfill disposal, during site induction • Appropriate waste containers shall be provided on the site • The storage, handling, disposal and transport of Dangerous Goods / Hazardous Materials shall comply with legislation and Australian standards, including but not limited to containment, placarding and segregation from incompatible materials • All vehicles and equipment shall be adequately maintained	Low

STEP	ISSUE	RISK LEVEL PRIOR TO MITIGATION	CONTROLS	RISK LEVEL FOLLOWING MITIGATION
			so as to minimise leaks of Dangerous Goods / Hazardous Materials • All storage and handling equipment (including transfer hoses) shall be kept in a well maintained condition • Where it is necessary to refuel heavy equipment onsite, adequate spill prevention and containment measures shall be implemented (refueling within bunded area)	
	Spills	High	• Spill clean-up kits available and maintained onsite at all times • Vehicles and machinery will be well maintained to reduce the risk of leaks • Install stormwater sediment controls • Development of a contingency plan for spill management in accordance with the *Technical Guidelines: Bunding and Spill Management (DECC)*.	Low
	Surface water	Medium	• Sediment and erosion control measures to be installed and maintained according to NSW Government's 'Blue Book' (4th Edition 2004) • All necessary sediment and erosion control measures will be in place prior to any construction and soil disturbance works commencing • Sediment and erosion control measures will be routinely inspected and maintained to ensure they remain effective • Ensure systems are in place to prevent pollution of waters from handling, transport and storage of liquids and to ensure that activities are undertaken in accordance with the *Contaminated Land Management Act 1997* (CLM Act), EPA guidelines and the POEO Act.	Low
	Groundwater, potential for intercepting the water	High	• Implement a groundwater management plan to manage any dewatering activities. • Consult with NSW DPI (Office of Water) regarding the	Low

STEP	ISSUE	RISK LEVEL PRIOR TO MITIGATION	CONTROLS	RISK LEVEL FOLLOWING MITIGATION
	table during drilling and excavation works, given the existing groundwater levels.		likelihood of intercepting large volumes of water.	
	Carrying materials, contamination and spoil offsite following excavation	Low	• Ensure wheels are clean and free of dirt prior leaving to leaving site. • Cover loads of material being removed	Very Low
	Soils - Exposure of contaminated soils or Acid Sulphate Soils (ASS).	Moderate	• Implement a soil management strategy in line with standard construction good practice environmental management measures to be implemented. • Implement a contingency plan during construction with reference to NSW and Australian guidelines in the event contaminated soil or ASS are encountered.	Low
	Soils - Pollution through drilling 'frac out' and lubricant entering soils, surface water or ground water on site	Moderate	• Works are to be undertaken using a non-toxic bentonite slurry. • A frac-out contingency plan to be developed for use during the drilling works • Refer to controls for spills	Low
	Flora/ fauna impacts through changes in groundwater quality or surface water run-off entering the marine environment.	Low	• Implement best practice surface water and groundwater management measures. • Implement best practice spill management techniques and storage of chemicals and hazardous materials.	Very Low

STEP	ISSUE	RISK LEVEL PRIOR TO MITIGATION	CONTROLS	RISK LEVEL FOLLOWING MITIGATION
DEMOBILISATION	Rehabilitation of site to as previous condition as per NSW Ports requirements.	Medium	• Remove all equipment and amenities • Rehabilitate areas of ground disturbance to pre-construction condition	Low
OPERATION	Uncontrolled pollution release to air, soil or water.	Medium	• Implementation and updating of the Pollution Incident Response Management Plan (PIRMP) to include the LPG pipeline. • Continued monitoring and compliance with EPL conditions and update of EPL 10698 as deemed required by the EPA. • Regular periodic maintenance and checking of the LPG pipeline by ELGAS operations staff. • Emergency Response Plans to be updated and training provided.	Low

Appendix F

PORT BOTANY DEVELOPMENT CODE OCTOBER 2013 CHECKLIST

Section 10	Land Use Safety and Hazard Management	Compliance / Comments
General Criteria	**Including non-hazardous facilities**	
Criteria 1	All new development in Port Botany is required to undergo a risk assessment to demonstrate the development: - will not contribute to any increase in cumulative risk as shown in Figure 2 of the *Port Botany Land Use Safety Study Overview Report 1996 (Overview Report)*; - will not result in any propagation of risks to neighbouring facilities; - will not result in a significant increase in the number of people (including both construction and operational staff) exposed to risk inside the residential contour as shown in Figure 2 of the *Overview Report;* and - will identify and implement risk reduction and safety management measures as required. This risk assessment is to be submitted as part of the application for development.	**Compliant.** This Criteria has been addressed in Appendix D of the EA. A Preliminary Hazard Analysis (PHA) inclusive of a Quantitative Risk Assessment (QRA) and assessment against the *Port Botany Land Use Safety Study Overview Report 1996* has been prepared and is included in Appendix D. The outcome of the assessment concluded there would be no increase in cumulative risk to the Port or neighbours nor would any people be exposed to risk inside the residential contour. Risk reduction and safety management measures have been incorporated into the recommendations of this EA (refer to Section 5.1) which will be submitted to DPI.
Specific Criteria	**Hazardous Facilities**	

Criteria 2	All proposals for new or expanded potentially hazardous developments are required to undergo a Risk Assessment. The Risk Assessment is to be submitted as part of the application for development and is to include the implementation, operation and maintenance phases. The assessment is to demonstrate: - that all foreseeable hazards that may arise from a development, that have a potential to harm the health and safety of any person, the environment, or impact the safety of buildings, equipment, plant and facilities have been clearly identified; - that potential for propagation of hazardous incidents to the neighbouring facilities is identified and is, in accordance with the "As Low As Reasonably Practicable" (ALARP) principle; - that the risks associated with the identified hazards at the development have been appropriately analysed and assessed; - that the proposed development will not contribute to any increase in the cumulative risk (individual and societal risk) beyond the levels shown in Figures 2 and 9 of the *Port Botany Land Use Safety Study Overview Report 1996*; - that the assessed risks comply with the relevant risk criteria published by the regulatory authorities; - that all identified risks will be controlled and minimised by protection and mitigation; and - that incidents at hazardous facilities will not impact on the use or operation of adjacent land, including NSW Ports' common areas (e.g. roadways and pipeline corridors). The Risk Assessment for the proposed development is to include the quantitative analysis of incident impacts relating to consequence severity and risk and include risk contours. The impacts are not to exceed acceptable published risk criteria.	**Compliant (note also refer above).** A PHA inclusive of a QRA and assessment against the HIPAP guidelines published by the DPI has been prepared which identifies all health and safety hazards and risks associated with the project. The assessment concluded that the proposed works do not exceed acceptable published risk criteria. An Environmental Risk Assessment has also been prepared to address the environmental risks associated with the hazards of the proposed works and is included in Appendix E of this EA. The overall risk to the environment of the proposed works is low.

Criteria 3	Minimum separation distances required to 'protected places' under the relevant Australian Standard must be complied with.	**Compliant.** This Criteria has been considered in the design siting investigations. The proposed design drawings are shown in Appendix B of the EA.
Criteria 4	The industrial premises risk contour for the development (including existing site development) must remain within the lease boundary.	This Criteria has been addressed in Appendix D of the EA. A Preliminary Hazard Analysis (PHA) inclusive of a Quantitative Risk Assessment (QRA) has been prepared which has considered the industrial premises risk contour and determined that the risk for the development remains within the lease boundary.
Specific Criteria	**Bulk Liquid Storage Facilities**	*Note Criteria 5 through 7 in this category are not applicable to the proposed works.*
Specific Criteria	**Pipelines**	
Criteria 8	All pipelines proposed within the Port Botany Port precinct are to be located in the following manner: - Pipelines required to be installed external to the leased area are to be located within a Port Botany pipeline corridor (**Figure 15**); - Exposed above ground level or in an open culvert lined with impermeable material so as to prevent the percolation of any spilled materials through the paving into the underlying sand. The paving and any jointing materials to be used shall be resistant both to heat and the corrosive effects of the range of the products to be transported in the pipeline; - Underground pipelines are to be avoided unless absolutely necessary; - Where underground pipelines are used they are to be installed with a leak detection system (e.g. differential flow device, inventory measurement, etc.); - Underground pipelines are to be suitably protected against corrosion,	**Compliant.** This Criteria is addressed in Section 2 of the EA and contained within detail of Appendix D. The proposed LPG pipeline is to be located within the Charlotte Road NSW Ports Pipeline Corridor and will be suitably protected against leaks and corrosion. A small section of the pipeline will be located underground from the Cavern Facility to the pipeline corridor and through the existing pipeline culvert under Friendship Road. An overview of the leak detection system and corrosion protection methods is provided as part of Appendix D. Further detail will be developed as per the Criteria requirements as the proposed design is progressed.

	considering (but not limited to) the following: - expected lifetime of the pipeline; - soil conditions; - potential acid sulfate soils; and - water table level. Details of the leak detection system and corrosion protection are to be provided in the risk assessment documentation.	
Criteria 9	Any new valves at the Bulk Liquids Berth must include remote operated emergency shutdown valves with such valves to be located at the shore manifold. The locations of activation points for the remote operated valves must, as a minimum, be able to be activated from the operator's emergency shutdown system during ship discharges as well as from the Bulk Liquids Berth office.	**Not applicable.** Works are not proposed at the Bulk Liquids Berth.
Criteria 10	All above ground bolted flanged joints, associated with the pipeline outside the main storage bund area, are to be provided with the following: - A bunded pit to retain any product leaks; - Protection to prevent leaks from flanges and joints spraying beyond the confines of the pit; and - Leak detection within the pit and an alarm system to notify of potential flange/joint leaks. It is noted that the pit may require a cover to prevent the ingress of rain water causing false leak detection alarms.	**Not applicable.** This Criteria is not applicable to LPG pipeline proposals.

Section 15	Soil Contamination	Compliance / Comments
Criteria 1	For all development an assessment of potential and likelihood of soil and groundwater contamination is to be undertaken as part of the application for development. Where a contamination hazard is deemed possible, approved mitigation / remediation measures are to be undertaken. This is to be generally in accordance with the Environment Protection Authority guidelines made or approval under the *Contaminated Land Management Act 1997*.	**Compliant.** This Criteria has been addressed in Section 5.2 of the EA. Following a review of information regarding the soil and groundwater conditions in the works area, a contamination hazard was deemed unlikely. In the event that contaminated soil is encountered during the works, contingency mitigation measures have been recommended for incorporation into the CEMP.
Criteria 2	For all development an assessment of potential acid sulfate soils present on site is to be undertaken as part of the application for development. Where acid sulfate soils could be encountered, mitigation measures are to be undertaken.	**Compliant.** This Criteria has been addressed in Section 5.2 of the EA. The proposed works site is not located in an area containing mapped Potential Acid Sulfate Soils and is classified as disturbed land. In the event that Acid Sulfate Soils are encountered during the works, contingency mitigation measures have been recommended for incorporation into the CEMP.
Section 16	**Groundwater Management Zone (Elgas Deed)**	**Compliance / Comments**
Criteria 1	The Groundwater Management Zone (GMZ) associated with the Elgas LPG Storage Cavern(GMZ(A)) is illustrated at **Figure 17**. Any development within the area marked '(GMZ(A)' or 'GMZ(B)' is required to comply with the '*Groundwater Management Zone Deed*' between the Water Administration Ministerial Corporation, Sydney Port Corporation (vested to Port Botany Operations Pty Limited), Elgas Limited and the Marine Ministerial Holding Corporation (NSW Roads and Maritime Services). A copy of the Deed is available on request from NSW Ports. Specifically, any development proposed in the 'GMZ' is required to specify the proposed construction methods; assess the likely impact on the water table; and assess the likely impact on the Elgas LPG Storage Development.	**Compliant.** This Criteria has been addressed in Section 5.3 of the EA. The proposed works fall within the GMZ of the ELGAS Cavern Facility. Due to the shallow depths of works which will not impact the deep aquifer in which the cavern is located, it was concluded that the proposed works would not have any impact upon the ELGAS underground cavern.

Appendix G

NSW PORTS GREEN PORT GUIDELINES CHECKLIST

Applicant details

Name	Aldo Costabile	**Company**	ELGAS Limited		
Address	30 FRIENDSHIP ROAD				
City/Town	PORT BOTANY	**State**	NSW	**Postcode**	2036
Telephone	(02) 8336 4315	**Mobile**		**Email**	ALDO.COSTABILE@ELGAS.COM.AU

Project details

Location of proposed development
The proposed development is predominately located in the Charlotte Road NSW Ports Pipeline corridor, with tie-in points and connections at the ELGAS Cavern Facility and the Qenos Hydrocarbon Terminal.
Description of proposed development
A full description of the proposed development is provided in Section 2 of the EA (ELG130-MD-SAT-REP-0001 REV 1).
The details on this form are the provisions and intentions for maximising the environmental sustainability of this development.

Name	Aldo Costabile		
Signature		**Date**	30.1.2014

	Item No	Purpose/criteria	Has this been addressed? (Yes, No, N/A)	How has it been addressed? Or, why has it not been addressed?	Provide details of supporting documentation/ reference material
Materials selection	R1	Reduce the quantity of new materials being used by reusing materials or by utilising recycled materials.	N/A	Items R1 to R4 are considered not applicable to a LPG pipeline proposal of this scale.	
	R2	Encourage environmentally friendly production of materials.	N/A		
	R3	Specify materials that have minimal embodied energy and environmental impact.	N/A		
	R4	Consider the end of life of materials and the whole building, design for deconstruction.	N/A		

	Item No	Purpose/criteria	Has this been addressed? (Yes, No, N/A)	How has it been addressed? Or, why has it not been addressed?	Provide details of supporting documentation/ reference material
Waste management	W1	Minimise the generation of wastes.	Yes	Mitigation measures with reference to NSW guidelines have been incorporated into the EA for minimising the generation waste.	Section 5.10 of the EA
	W2	Facilitate recycling to reduce the amount of waste going to landfill.	Yes	The nature of the proposed works will generate a minor amount of waste, nevertheless mitigation measures have been incorporated which reference NSW guidelines for reducing waste to landfill.	Section 5.10 of the EA
	W3	Ensure the safe storage and handling of hazardous wastes.	Yes	Although it is unlikely that hazardous wastes will be encountered during the proposed works, mitigation measures have been incorporated into the EA for managing hazardous waste.	Section 5.10 of the EA

	Item No	Purpose/criteria	Has this been addressed? (Yes, No, N/A)	How has it been addressed? Or, why has it not been addressed?	Provide details of supporting documentation/ reference material
Water consumption	H1	Reduce consumption of potable water internally.	N/A	The proposed works are unlikely to utilise a significant amount of water during construction and no water will be required during the operation of the pipeline.	
	H2	Manage and monitor water usage and any leaks.	N/A	Items H2 to H4 are considered not applicable to a LPG pipeline proposal.	
	H3	Reduce the quantity of potable water used for landscape irrigation.	N/A		
	H4	Treat water on-site and reuse the treated water to reduce demand on the local potable water supply and the demand on the local infrastructure.	N/A		

	Item No	Purpose/criteria	Has this been addressed? (Yes, No, N/A)	How has it been addressed? Or, why has it not been addressed?	Provide details of supporting documentation/ reference material
Energy use	E1	Reduce energy consumption and hence greenhouse gas emissions.	Yes	The proposed works are unlikely to generate a significant demand for energy consumption leading to the generation of greenhouse gas emissions. Nevertheless, the emissions of the project have been considered and assessed.	Section 5.6 of the EA
	E2	Manage the use of energy to minimise consumption.	Yes	Mitigation measures have been incorporated into the EA to manage the use of energy to minimise consumption.	Section 5.6 of the EA
	E3	Source energy from renewable sources.	No	This item is not feasible for a project of this size which is unlikely to create a significant energy demand during construction or operation.	Section 5.6 of the EA
	E4	Source energy from alternate energy sources and use less greenhouse intensive fuels (in particular limit diesel use).	N/A	Refer above.	

	Item No	Purpose/criteria	Has this been addressed? (Yes, No, N/A)	How has it been addressed? Or, why has it not been addressed?	Provide details of supporting documentation/ reference material
Transportation	T1	Encourage the use of alternative modes of transport by employees, in order to reduce the amount of inefficient/individual car travel and therefore greenhouse gas emissions.	No	A very small workforce is required to undertake the proposed works and no additional staff would be required during operation.	Section 2 of the EA.
	T2	Reduce greenhouse gas emissions from operational vehicles and equipment.	Yes	The operation of the proposed pipeline is unlikely to generate significant emissions from operational vehicles and equipment. The maintenance required on the pipeline is minimal and would be covered by ELGAS' preventative maintenance system and with patrols conducted on foot. Additionally, the design has been optimised to remove the requirement for pumps, which would have been the only new source of potential greenhouse gas emissions during operation as a result of the modifications.	Section 2.3 and Appendix B of the EA.

	Item No	Purpose/criteria	Has this been addressed? (Yes, No, N/A)	How has it been addressed? Or, why has it not been addressed?	Provide details of supporting documentation/ reference material
Indoor environment	IE1	Improve the quality of indoor air to protect the health of employees and enhance productivity.	N/A	Items IE1 to IE3 are not applicable to a LPG Pipeline proposal.	
	IE2	Optimise daylighting and make best use of artificial lighting to assist eye health and productivity.	N/A		
	IE3	Provide optimum acoustical environment for productivity and to prevent ear damage.	N/A		

	Item No	Purpose/criteria	Has this been addressed? (Yes, No, N/A)	How has it been addressed? Or, why has it not been addressed?	Provide details of supporting documentation/ reference material
Emissions	EM1	Protect the ozone layer and reduce the potential for global warming.	N/A	This item is not applicable to a LPG Pipeline proposal of this size.	
	EM2	Limit the generation of air pollutants and ensure that they are emitted away from sensitive receptors.	Yes	Mitigation measures have been incorporated into the EA to limit the generation of air pollutants. Note there are no sensitive receptors within close proximity to the proposed works.	Section 5.6 of the EA.
	EM3	Minimise odours.	Yes	Mitigation measures have been incorporated into the EA to minimise the generation of odours.	Section 5.6 of the EA.
	EM4	Minimise noise nuisance.	Yes	Mitigation measures have been incorporated into the EA to minimise the generation of noise.	Section 5.5 of the EA.
	EM5	Avoid light spill into night sky or neighbouring properties/areas.	N/A	Works are not anticipated to be undertaken during night-time hours.	
	EM6	Avoid accidental contact with hazardous or poisonous goods.	Yes	Mitigation measures have been incorporated into the EA to handle the storage of hazardous or poisonous goods.	Section 5.4 and Section 5.10 of the EA.

	Item No	Purpose/criteria	Has this been addressed? (Yes, No, N/A)	How has it been addressed? Or, why has it not been addressed?	Provide details of supporting documentation/ reference material
Water quality	HQ1	Manage stormwater to reduce peak stormwater flows and protect water quality.	N/A	No permanent stormwater management measures are required as the pipeline will be in an existing culvert or underground. Mitigation measures have been incorporated into the EA to manage stormwater run-off during construction.	Section 5.4 of the EA.
	HQ2	Manage water quality to protect the harbour and other water bodies.	Yes	Refer to EM6. Mitigation measures have been incorporated into the EA to prevent water quality impacts to the Port Botany area.	Section 5.4 and 5.10 of the EA.
	HQ3	Prevent damage from potential flood events and water table changes.	Yes	Significant weather events were considered at the design stage for stormwater drainage system of the ELGAS Cavern Facility (the existing facility). Changes in the water table and inclement weather during construction will be addressed through contingency measures for Groundwater proposed in the EA and in the CEMP.	Section 5.3 of the EA.

	Item No	Purpose/criteria	Has this been addressed? (Yes, No, N/A)	How has it been addressed? Or, why has it not been addressed?	Provide details of supporting documentation/ reference material
Land use	L1	Encourage the redevelopment of sites that have previously been developed and remediate contaminated land.	Yes	The EA has addressed the potential for contamination and acid sulphate soils and incorporates the required mitigation measures to ensure potential environmental impacts are managed.	Section 5.2 of the EA
	L2	Use landscaping to enhance biodiversity and conserve and create habitat for flora and fauna.	N/A	No landscaping is required as part of the proposal. Where ground is disturbed site, the land will be restored to as previous condition.	
	L3	Enhance visual amenity.	N/A	This item is not applicable to a LPG Pipeline proposal of this size.	
	L4	Avoid impact on identified heritage items.	Yes	A search of the relevant NSW heritage registers were undertaken as part of the EA. No items of heritage significance have been identified in or nearby to the proposed works footprint.	Section 5.8 of the EA.

	Item No	Purpose/criteria	Has this been addressed? (Yes, No, N/A)	How has it been addressed? Or, why has it not been addressed?	Provide details of supporting documentation/ reference material
Environmental management	M1	Maintain good relationships with stakeholders and respond to any complaints.	Yes	As part of the EA process, stakeholders were consulted with regarding environmental issues and the project in general. ELGAS' current public complaints procedure and Traffic Management Plan will continue to be enacted during the construction and operation of the pipeline. Additional mitigation measures for traffic and access management during construction have been included in the EA. The pipeline will not have any impact upon traffic in the Port during operation.	Section 4 and 5.9 of the EA.
	M2	Provide a framework for identifying, managing and minimising environmental impacts, and maximising environmental benefits.	Yes	A Construction Environmental Management Plan (CEMP) will be prepared by the construction contractor to be implemented throughout the construction phase of the project. The CEMP will include the statement of commitments as documented in the EA. In addition, the existing ELGAS' procedures for pollution and emergency response management will be updated prior to the commencement of pipeline operation to ensure potential impacts to the environment are managed. ELGAS' will also continue to abide by the conditions of the EPL 10698 and any new requirements which may be deemed required by the EPA following the approval.	Section 6 of the EA.
	M3	Educate developers, tenants and employees about ESD and how	Yes	Employees will be provided training in Emergency Response management, including pollution incident response management following the updating of the plans and prior to commencement of pipeline	Section 5.1 and Section 5.4 of the EA.

		to improve sustainability.		operation.	