

## Preliminary SMS Workshop Report

# Northern Growth Area (Lovely Banks) - APA Pipeline SMS

## Lovely Banks Consortium

GPA Document No: 16459-REP-002

Rev	Date	By	Checked	QA	Description
A	15/11/2016	RMcD	SH	IIK	Draft for participant review
0	31/01/2017	RMcD	SH	IIK	Issued

## EXECUTIVE SUMMARY

The Northern Geelong Growth Area forms part of the broader northern and western Geelong growth areas project. The project is being managed by the City of Greater Geelong in conjunction with landowner consortiums, including the Lovely Banks landowner consortium group.

The G21 Regional Growth Plan identified land in the Lovely Banks area as a 'Further Investigation Area' for future urban growth, primarily residential development and associated land uses. In late 2014, land within the further investigation area was rezoned from Farming to Urban Growth (UGZ). This area is now known as the Northern Geelong Growth Area (NGGA) and includes a larger study area than the land rezoned to Urban Growth Zone.

The alignment of the gas transmission pipeline (T92 Lara to Iona Pipeline, owned and operated by APA Group) bisects NGGA. The predominant land use activity that currently surrounds the pipeline easement is agricultural. Given the land use zoning change in late 2014, there is a need to assess the compatibility of the existing transmission pipeline design with the potential future land use activities.

The T92 Lara to Iona Pipeline is licensed under the Victorian *Pipelines Act 2005*, and as such is required to comply with the AS 2885 *Pipelines – gas and liquid petroleum*. AS 2885 requires that a Safety Management Study (SMS) is carried out when there is a proposed change of land use around the pipeline so that actions required to maintain the safety of the pipeline can be identified.

An AS 2885 Safety Management Workshop to review the risks to the T92 Lara to Iona Pipeline resulting from potential land uses for the proposed Northern Geelong Growth Area was carried out on Tuesday 4<sup>th</sup> October 2016. The workshop was conducted at City Hall (Meeting Room 3), 57 Little Malop Street, Geelong. The workshop incorporated a location classification review and safety management study review of the possible risk mitigation measures set out in AS2885.1-2012. .

The land use planning for the NGGA is in its early stages, and there are no firm or detailed plans with regard to the location of actual land uses on the site. For this reason the SMS workshop was restricted to a high level review only with the objective to inform the future land use planning around the gas transmission pipeline.

The review was successfully carried out in accordance with the general requirements of AS 2885.1-2012. The workshops were attended by key pipeline, council and development project personnel so that collectively the participants possessed sufficient knowledge and experience to carry out an effective workshop review.

Given the objective of the workshop is to inform the land use planning for the NGGA, the SMS is based on the threat to pipeline integrity and consequences of a gas release that are associated with the fully developed and occupied site. Management of threats to the pipeline during major construction programs will be addressed under specific approvals and management processes.

Based on the assumptions in this report, it is concluded that the T92 Lara to Iona Pipeline meets the requirements of AS 2885.1-2012 Section 4.7 "Special Provisions for High Consequence Areas" with regard to "no rupture" and maximum energy release rate. Based on this, APA's position on land uses at various distances from the pipeline easement is detailed in Section 6.5. Specific requirements and principles for activities and infrastructure on the pipeline easement are detailed in Section 6.6.

In general, to minimise safety risks:

- High Density or Sensitive land uses should be removed as far as is practicable from the pipeline easement and at least beyond the 4.7 kW/m<sup>2</sup> radiation contour (65m) for the maximum credible hole.
- Activities on the pipeline easement should minimise the threat of pipeline damage due to



excavation, vertical boring and horizontal directional drilling (HDD).

- Creating passive open space with bike tracks and foot paths which also serves as pipeline protection is supported.
- Every effort should be made to minimise pipeline crossings (roads, buried services) to minimise the risk of damage due to future maintenance dig-ups.
- Minimum offsets and separation specified by APA for buried services, footings, and supports for lighting and signage need to be adhered to.
- Council and developers should liaise with APA with regard to design considerations to provide for maximum protection to occupants in the event of an ignited gas release.

It is emphasised that the radiation distances for the a full bore rupture quoted here apply specifically to the T92 Lara to Iona Pipeline only and cannot be used for any other pipeline unless it is shown that the pipeline design and operating regime is the same. Further, the radiation distance quoted for the maximum credible hole size is based on the threat assumptions in Section 6.2 and only applies to the NGGA (i.e. it cannot be applied elsewhere unless it is shown that these assumptions equally apply).

As noted above, this SMS review was necessarily a high level review, consistent with the current status of the project and the objectives of the review. AS 2885 requires that future SMS reviews are required at key stages of the development to confirm that the assumptions made in this review are valid, that the objective and actions identified by this report have been addressed, and also to update the SMS record to include the development details so that APA can continue to manage pipeline safety in accordance with the requirements of the standard.

# CONTENTS

<b>1</b>	<b>INTRODUCTION .....</b>	<b>1</b>
1.1	BACKGROUND .....	1
1.2	OBJECTIVE AND SCOPE .....	1
<b>2</b>	<b>REFERENCE DOCUMENTS .....</b>	<b>2</b>
2.1	PIPELINE DOCUMENTS .....	2
2.2	LIST OF STANDARDS .....	3
2.3	LIST OF ABBREVIATIONS .....	3
<b>3</b>	<b>WORKSHOP PROCESS.....</b>	<b>5</b>
3.1	AS 2885 SMS METHODOLOGY.....	5
3.2	SCOPE.....	5
3.3	WORKSHOP PROCEDURE .....	5
3.4	STUDY TEAM .....	5
<b>4</b>	<b>OVERVIEW OF T92 LARA TO IONA PIPELINE .....</b>	<b>6</b>
<b>5</b>	<b>NORTHERN GEELONG GROWTH OVERVIEW.....</b>	<b>8</b>
<b>6</b>	<b>SUMMARY OF MAJOR ACTIONS AND OUTCOMES.....</b>	<b>9</b>
6.1	LOCATION CLASSIFICATION.....	9
6.2	EXTERNAL INTERFERENCE THREATS AND CONTROLS .....	10
6.2.1	Threats .....	10
6.2.2	Controls.....	11
6.3	TYPICAL NON EIP THREATS – CONTROLLED BY DESIGN AND/OR PROCEDURES.....	13
6.4	SPECIAL PROVISIONS FOR HIGH CONSEQUENCE AREAS.....	13
6.4.1	No Rupture .....	13
6.4.2	Maximum Discharge Rate.....	13
6.5	PREFERRED LAND PLANNING .....	13
6.5.1	Passive Open Space (T1 location class) .....	14
6.5.2	Active Open Space (T1 location class).....	14
6.5.3	Residential (T1 location class).....	14
6.5.4	Industrial / Employment Zone (T1/I location class).....	14
6.5.5	Full line retail / town centre (T2 location class).....	14
6.5.6	Sensitive Use S, (schools, hospitals, aged care, etc).....	15
6.5.7	General Design .....	15
6.5.8	Summary.....	16
6.6	PIPELINE EASEMENT CONSIDERATIONS .....	16
6.6.1	Passive Open Space.....	16
6.6.2	Road Crossings.....	17
6.6.3	Buried Services .....	17



---

6.6.4	Stormwater, drainage and wetlands .....	17
<b>6.7</b>	<b>ACTIONS .....</b>	<b>17</b>
<b>7</b>	<b>SUMMARY, CONCLUSIONS AND RECOMMENDATIONS.....</b>	<b>19</b>
<b>APPENDIX 1 WORKSHOP MATERIALS</b>		
<b>APPENDIX 2 REFERENCE DOCUMENTS</b>		



# 1 INTRODUCTION

## 1.1 BACKGROUND

The Northern Geelong Growth Area forms part of the broader northern and western Geelong growth areas project. The project is being managed by the City of Greater Geelong in conjunction with landowner consortiums, including the Lovely Banks landowner consortium group.

The G21 Regional Growth Plan identified land in the Lovely Banks area as a 'Further Investigation Area' for future urban growth, primarily residential development and associated land uses. In late 2014, land within the further investigation area was rezoned from Farming to Urban Growth (UGZ). This area is now known as the Northern Geelong Growth Area and includes a larger study area than the land rezoned to Urban Growth Zone.

The alignment of the gas transmission pipeline (T92 Lara to Iona Pipeline, owned and operated by APA Group) bisects the study area (refer to map, Appendix 2). It runs north-east/south-west, entering the study area from Bacchus Marsh Road and exiting at Anakie Road. Within the study area, the transmission pipeline easement largely affects land zoned UGZ. At the south-west corner of the study area, the easement travels through Farming Zone land. The predominant land use activity that surrounds the pipeline easement is agricultural.

Given the land use zoning change in late 2014, there is a need to assess the compatibility of the existing transmission pipeline design with the potential future land use activities.

The T92 Lara to Iona Pipeline is licensed under the Victorian *Pipelines Act 2005*, and as such is required to comply with the *AS 2885 Pipelines – gas and liquid petroleum*. AS 2885 requires that a Safety Management Study (SMS) is carried out when there is a proposed change of land use around the pipeline so that actions required to maintain the safety of the pipeline can be identified.

## 1.2 OBJECTIVE AND SCOPE

GPA Engineering was engaged to facilitate an SMS workshop to review the associated risks resulting from the future land use changes that will arise from the framework planning process for the Northern Geelong Growth Area.

The workshop incorporated a location classification review and safety management study review of the possible risk mitigation measures set out in AS2885.1. This workshop report is intended to inform the future land use planning around the gas transmission pipeline.

The workshop was conducted on Tuesday 4<sup>th</sup> October 2016 at City Hall (Meeting Room 3), 57 Little Malop Street, Geelong.

The workshop was attended by key planning, development and pipeline personnel from the following organizations:

- City of Greater Geelong
- Tract Consultants
- Lovely Banks Consortium
- APA Group
- GPA Engineering



## 2 REFERENCE DOCUMENTS

### 2.1 PIPELINE DOCUMENTS

Documentation referenced by the SMS workshop is listed below:

DOC No.	TITLE	DATE
n/a	NGGA Map	No date
n/a	CoGG, Northern Geelong Growth Area, Safety Management Study workshop, Land Use Assumptions	27 September 2016
R-T92-15	500 Lara – Iona Transmission Pipeline Route Plan	03/04/99
R-T92-16 Rev A	500 Lara – Iona Transmission Pipeline Route Plan	03/04/99
530-DWG-L-1001, Rev 0	APA Group, Standard Protection, Concrete Slab Installation – Other Utility Crossing beneath APA Pipeline, High Pressure Pipeline Details	08/04/15
530-DWG-L-1002, Rev 0	APA Group, Standard Protection, Concrete Slab Installation – Other Utility Crossing beneath APA Pipeline, 300-500mm Separation Details	08/04/15
530-DWG-L-1003, Rev 0	APA Group, Standard Protection, Other Utility Crossing above APA Pipeline, >500mm Separation Details	08/04/15
530-DWG-L-1011, Rev 0	APA Group, Standard Protection, Concrete Slab Installation – Other Utility Crossing beneath APA Pipeline, High Pressure Pipeline – Field Recording Details	08/04/15
530-DWG-L-1012, Rev 0	APA Group, Standard Protection, Concrete Slab Installation – Other Utility Crossing beneath APA Pipeline, 300-500mm Separation – Field Recording Details	08/04/15
530-DWG-L-1013, Rev 0	APA Group, Standard Protection, Other Utility Crossing above APA Pipeline, >500mm Separation – Field Recording Details	08/04/15
S13-22-11, Rev D	APA Group, Standard Procedures, Road Crossing, Typical Bored Crossing, G.A.	08/10/09
S13-22-12, Rev D	APA Group, Standard Procedures, Road Crossing, Open Cut Installation, G.A.	28/11/08
n/a	Appendix 1: APA VTS Australia's Guidelines to Planning and Development around High Pressure Gas Transmission Pipelines	No date
n/a	Energy Safe Victoria, Memo "Land Development around Pipelines, Uses"	2 May 2016



## 2.2 LIST OF STANDARDS

REFERENCE	DOCUMENT TITLE
AS 2885.1-2012	Pipelines – Gas and liquid petroleum – Design and construction
AS 2885.3-2012	Pipelines – Gas and liquid petroleum – Operations and Maintenance

## 2.3 LIST OF ABBREVIATIONS

ABBREVIATION	DESCRIPTION
ALARP	As Low As Reasonably Practicable
APA	APA Group
APGA	Australian Pipeline and Gas Association
AS	Australian Standard
CDL	Critical Defect Length
CoGG	City of Greater Geelong
CPU	Cathodic Protection Unit
CST	Common Services Trench
DBYD	Dial Before You Dig
DCVG	Direct Current Voltage Gradient
DN	Nominal Diameter
DOC	Depth of Cover
EIP	External Interference Protection
ESV	Energy Safe Victoria
FBE	Fusion Bonded Epoxy
FJC	Field Joint Coating
FOC	Fibre Optic Cable
GA	General Arrangement
GIS	Geographic Information System
GJ/s	Gigajoules per second (energy release rate)
GP	General Purpose
HAZOP	Hazard and Operability Study
HDD	Horizontal Directional Drill
HV	High Voltage
ILI	In Line Inspection
KP	Kilometre Point



ABBREVIATION	DESCRIPTION
kW/m <sup>2</sup>	Kilowatts per metre squared (heat radiation flux)
LBC	Lovely Banks Consortium
MAOP	Maximum Allowable Operating Pressure
MLV	Main Line Valve
MOP	Maximum Operating Pressure
NGGA	Northern Geelong Growth Area
NLS	Non Location Specific
PIMP	Pipeline Integrity Management Plan
QA	Quality Assurance
R1	Rural location classification
R2	Rural Residential Use location classification
ROW	Right of Way
RTP	Resistance to Penetration
S	Sensitive Use location classification
SCC	Stress Corrosion Cracking
SMS	Safety Management Study
SMYS	Specified Minimum Yield Strength
T1	Residential location classification
T2	High Density location classification
UGZ	Urban Growth Zone
VTS	Victorian Transmission System
WT	Wall Thickness



### 3 WORKSHOP PROCESS

#### 3.1 AS 2885 SMS METHODOLOGY

The AS 2885 Pipeline Safety Management Study process and workshop agenda are detailed in the Participants' Briefing, (GPA Doc 16459-REP-001, Rev 1, 28/09/2016).

#### 3.2 SCOPE

The scope of the workshop was the section of the T92 Lara to Iona Pipeline that traverses the proposed Northern Geelong Growth Area, between Bacchus Marsh Road and Anakie Road (refer map, Appendix 2).

#### 3.3 WORKSHOP PROCEDURE

The workshop procedure is as detailed in the Participants' Briefing. The procedure was generally followed however the High Level Safety Management Study was limited to a general discussion of the threats and controls rather than a more structured and detailed review. The reason for this was that the participants agreed that the objectives of the workshop were achieved by the general discussion.

#### 3.4 STUDY TEAM

The workshop was attended by the following personnel:

NAME	POSITION	ORGANISATION
Daniel Tucci	Senior Concept Engineer	APA Group
Fiona Finlayson	Recreational and Open Space Planner	City of Greater Geelong
Gail Altmann	Engineer	City of Greater Geelong
James Hamilton	Strategic Planner	City of Greater Geelong
Kirsten Kilpatrick	Town Planner	TRACT (Lovely Banks)
Kris Wilson	Project Manager	Lovely Banks Consortium
Lachie Marshall	Land Agent	APA Group
Matthew Wilson	Engineer	City of Greater Geelong
Phil McCutcheon	Planner	APA Group
Richard McDonough	Facilitator	GPA Engineering
Sarah Storen	Strategic Planner	City of Greater Geelong

Attendance sheets are included as Appendix 1.

The study team comprised a broad cross-section of responsibility, knowledge and experience with the Northern Geelong Growth Area and the T92 Lara to Iona Pipeline, and therefore possessed sufficient knowledge and experience to carry out an effective workshop review.



## 4 OVERVIEW OF T92 LARA TO IONA PIPELINE

The details of the pipeline are listed in the Table below.

ITEM	DETAILS
Pipeline Description	T92 Lara to Iona Pipeline
License Number:	PL231
MAOP	10,200 kPag
Pipeline Coating	Fusion Bonded Epoxy (FBE), with heat shrink sleeves at joints
Pipeline Diameter	DN 500
Wall Thickness	9 mm and 10.8 mm
Depth of Burial	1000 mm to 1100 mm (based on construction records)
Measurement Length	~570 m
Pipeline length	144 km
Pipeline length in NGGA	~4,950 m (as per route plans)
Pipeline Design Code	AS2885
Pipeline Product	Gaseous Hydrocarbon (Sales Quality Gas)
Pipeline Classification (current)	T1 and R1 (in parts)
Construction Year	1999
Design Life	80 years

The T92 Lara to Iona Pipeline is a “bi-directional” pipeline which means that gas can flow in either direction. The pipeline supplies ~30% of Victoria’s gas supply. Approximately 25% of the pipeline capacity supplies the Geelong area.

While the MAOP of the T92 Lara to Iona Pipeline is 10,200 kPag, the normal operating pressure is ~9,500 kPag. However, it is likely that compressors will be installed on the pipeline so that it operates at the MAOP.

The “measurement length” of the T92 Lara to Iona Pipeline is ~570m. The “measurement length” of a pipeline is the distance to the 4.7 kW/m<sup>2</sup> radiation contour<sup>1</sup> from an ignited full bore rupture at MAOP. The activities and land use within this distance is used to determine the location classification. The measurement length of the pipeline applies regardless of whether or not rupture is a credible failure mode. As discussed in Section 6.4.1, the T92 Lara to Iona Pipeline meets the criteria for a “no rupture” pipeline (as defined in by Clause 4.7.2 of AS 2885.1-2012). Another important parameter is the radiation distance from the maximum credible hole size (assumed to be a hole with an equivalent diameter of 50mm, which is based on the pilot of a vertical auger). For this pipeline radiation zones for

<sup>1</sup> The significance of these radiation contours are explained in AS2885.1-2012, Appendix B3.1 *NOTE: A thermal radiation level of 4.7 kW/m<sup>2</sup> will cause injury, at least second degree burns, after 30 seconds exposure. A thermal radiation level of 12.6 kW/m<sup>2</sup> represents the threshold of fatality, for normally clothed people, resulting in third degree burns after 30 seconds exposure.*



a 50mm hole for this pipeline at MAOP are ~65m ( $4.7\text{kW/m}^2$ ) and ~40m ( $12.6\text{kW/m}^2$ ). The energy release rate in this case is ~1 GJ/s.

The pipeline is installed in a 20m wide easement. The pipeline is located ~6m from the southern boundary of the easement (refer route plans). There is provision to install a second pipeline in the easement, and it possible that this will be installed within a 10 year time frame. This pipeline would be installed ~6m from the northern boundary of the easement.

Further information regarding the management of the pipeline is summarized in the workshop presentation Potential Land Use, Pipelines Design, SMS Threats and Controls, which is included in Appendix 1.

## 5 NORTHERN GEELONG GROWTH AREA OVERVIEW

The gas transmission pipeline easement largely bisects land that is zoned Urban Growth (UGZ) within the study area. The purpose of the UGZ is effectively a holding zone for future urban development and seeks to manage the transition of non-urban land into urban land in accordance with future precinct structure plans.

The City of Greater Geelong is planning for this area through the preparation of a Framework Plan. The Framework Plan will set out the overall strategic land use and development vision for the Northern Geelong Growth Area. Future detailed planning processes will build on the Framework Plan through the preparation of Precinct Structure Plans and Planning Permits.

The principal land use that is planned for in an urban growth context is residential, including associated uses such as retail, employment, industrial, education and other social infrastructure, civil infrastructure and open space (active and passive), etc.

Typical land uses include:

- Standard residential density development;
- Medium residential density development;
- Active open space – playing fields and courts and their associated buildings and infrastructure;
- Passive open space – e.g. a linear corridor that can be used for walking and cycling;
- Retail – full line supermarkets, associated speciality stores and car parking, etc;
- Employment – precincts providing a range of commercial services;
- Infrastructure – including road crossings and other civil infrastructure, etc;
- Other potentially compatible land uses (e.g. education).

Examples of each of these developments were prepared for the workshop in the document *Northern Geelong Growth Area, Safety Management Study workshop, Land Use Assumptions*. This document is included in Appendix 2.



## 6 SUMMARY OF MAJOR ACTIONS AND OUTCOMES

### 6.1 LOCATION CLASSIFICATION

Key primary location classification definitions in Section 4.3 of AS 2885.1-2012 which apply to the Northern Geelong Growth Area are:

**Residential (T1):** Land that is developed for community living. Residential applies where multiple dwellings exist in proximity to each other and dwellings are served by common public utilities. Residential includes areas of land with public infrastructure serving the residential use; roads, railways, recreational areas, camping grounds/caravan parks, suburban parks, small strip shopping centres. Residential land use may include isolated higher density areas provided they are not more than 10% of the land use. Land used for other purposes but with similar population density shall be assigned Residential location class

**High Density (T2):** Land that is developed for high density community use. High Density applies where multi storey development predominates or where large numbers of people congregate in the normal use of the area. High density includes areas of public infrastructure serving the high density use; roads, railways, majors porting and cultural facilities and land use areas of major commercial developments; cities, town centres, shopping malls, hotels and motels.

The following secondary location classifications are also relevant.

**Sensitive use (S):** The sensitive use location class identifies land where the consequences of a failure may be increased because it is developed for use by sectors of the community who may be unable to protect themselves from the consequences of a pipeline failure. Sensitive uses are defined in some jurisdictions, but include schools, hospitals, aged care facilities and prisons. Sensitive use location class shall be assigned to any portion of pipeline where there is a sensitive development within a measurement length. It shall also include locations of high environmental sensitivity to pipeline failure. The design requirements for high density shall apply.

**Industrial (I):** The Industrial location class identifies land that poses a different range of threats because it is developed for manufacturing, processing, maintenance, storage or similar activities or is defined in a local land planning instrument as intended for light or general industrial use. Industrial applies where development for factories, warehouses, retail sales of vehicles and plant predominates. Industrial includes areas of land with public infrastructure serving the industrial use. Industrial location class shall be assigned to any portion of pipeline where the immediately adjoining land use is industrial. The design requirements for residential shall apply.

Based on the examples provided in *Northern Geelong Growth Area, Safety Management Study workshop, Land Use Assumptions*, the following land uses are assumed within the NGGA:

- **Standard Residential Development** (e.g. Estuary Estate, Leopold and Warralilly, Armstrong Creek Growth area). These fall under the definition of *Residential T1*.
- **Medium Residential Development** (e.g. Spring Street, Geelong West). The block sizes for these developments is 160m<sup>2</sup>, which equates to >60 dwellings per hectare. In isolation, this is considered to fall under the definition of *High Density T2*. However, where the higher density areas do not exceed 10% of the total land use, then *Residential T1* applies.
- **Active Open Space** (e.g. Estuary Estate, Leopold and Saltwater Reserve, Point Cook), and **Passive Open Space** (linear corridor examples). These fall under the definition of *Residential*



T1.

- **Retail** (e.g. Lara Town Centre (Coles and Woolworths) Waverley Road; Leopold Neighbourhood Activity Centre; and Manor Lakes Shopping Centre, Wyndham Vale). These are all major commercial developments where large numbers of people congregate in the normal use of the area and as such fall under the definition of *High Density T2*.
- **Employment** (e.g. Grubb Road Commercial / Industrial Precinct, Ocean Grove and Industrial/Business Park, Laverton North). For locations which are clearly industrial in nature, then the secondary location classification of *Industrial I* applies. For employment precincts the applicable location classification is dependent on the population density and needs to be considered on a case by case basis.
- **Infrastructure** (including road crossings and other civil infrastructure). In general, infrastructure associated with any given land use does not result in a change to the location classification which is determined by the land use.
- **Other land uses (e.g. schools, aged care facilities)**. These land uses clearly fall under the *Sensitive Use S* definition.

Based on the foregoing, the predominant location classification in the Northern Geelong Growth Area is *Residential T1*. However, locating large retail precincts and schools etc within the pipeline measurement length will result in sections of the pipeline route being classified as *High Density T2*, or *Sensitive Use S*.

## 6.2 EXTERNAL INTERFERENCE THREATS AND CONTROLS

The implications of the requirements of AS 2885 which apply for any given location class are dictated by the activities which occur near the pipeline and which have the potential to damage the pipeline.

### 6.2.1 Threats

Typical “external interference threats” which apply to a residential development include:

- Excavation (excavators, back hoes, trenching machines) for activities such as installation and maintenance of buried utilities, or road maintenance.
- Vertical boring (pendulum or fixed augers) for the activities such as installation of power poles, light poles and signage.
- Horizontal directional drilling (HDD) for the installation of buried utilities.

For “greenfields” developments such as the Northern Geelong Growth Area the activities around the pipeline are dictated by the phase of the development, which can broadly be characterised as:

- “Development phase” – i.e. construction of the development.
- “Operational phase” – i.e. the development is occupied.

Major construction works undertaken during the “development phase” include bulk earthworks, installation of roads, drainage, sewers and services. These activities normally involve the use of large heavy equipment. Equipment used for rocky or difficult ground may be fitted with aggressive teeth or bits that can readily penetrate the pipeline wall. The nature of these activities are such that the pipeline operator is aware of them prior to site works and is normally involved in approvals processes for the works. Construction sites have controlled access and activities are generally conducted in accordance with procedures which control activities around high pressure gas pipelines in accordance with the requirement of the pipeline operator. Members of the general public are excluded or remote from the activities.

The primary focus of this safety management study is the activities that occur during the “operational phase” (i.e. once the development is occupied and members of the community are exposed to the risks



of an ignited gas release). These activities are generally related to the augmentation, maintenance or repair of buried assets, roads or poles (light poles, power poles, signage). These tend to be carried out using lighter equipment by organisations such as councils and utility owners or their contractors. These organisations are generally conducted in accordance with procedures which require identification of other buried services. For excavation in particular, the equipment used tends to be fitted with flat buckets or general purpose teeth to minimise the risk of damage to buried utilities.

Given this, the following assumptions apply to the threats to the T92 Lara to Iona Pipeline during the “operational phase” of the development:

- The pipeline is generally located in passive open space (i.e. linear corridor which includes the pipeline easement), which may include other buried services which are parallel or cross the pipeline. The linear open space may also include signage, light poles, etc.
- The pipeline will be crossed by a number of roads, which are likely to include other buried services which are parallel or cross the pipeline, as well as signage, light poles and power poles.
- Access to the pipeline at these locations is likely to preclude use of large excavation equipment. Typical equipment used for buried utility maintenance will be <10T fitted with flat buckets or general purpose teeth, while larger excavators (up to 20T) are credible.
- Vertical boring activities for pole or signage replacement will utilise relatively light equipment.
- The design of the development will be sufficient so that the services installed during the major construction phase will minimise the requirement for any major service installation using major equipment for the foreseeable future.

## 6.2.2 Controls

### 6.2.2.1 GENERAL

The AS 2885.1-2012 requirement for *Residential T1, Industrial I, High Density T2* and *Sensitive Use S* locations is that at least 2 physical controls and 2 procedural controls are applied to external interference threats.

Physical controls fall are: 1) separation (by burial, horizontal distance, exclusion or barriers); and 2) resistance to penetration (wall thickness, concrete slabs).

- For excavation threats, wall thickness, depth of cover and concrete slabs are the main physical controls.
- For vertical boring threats, depth of cover does not necessarily provide protection as the depth of boring often exceeds the pipeline depth. While wall thickness provides one protection measure in many cases, concrete slabs and horizontal separation (i.e. minimum offsets) are normally also required.
- For HDD threats, wall thickness can often provide good protection but this is not guaranteed. Similarly, depth of cover does not provide protection in all cases, while slabbing does not provide any protection against horizontal threats. The difficulty in providing absolute physical protection for HDD places increased reliance on the procedural controls for this threat.

Procedural controls are: 1) pipeline awareness (e.g. DBYD, signage, liaison and awareness programs); and 2) external interference detection (e.g. pipeline patrols).

Where APA requirements are met for crossings and parallel services then the requirements of AS 2885 are normally achieved. APA requirements include specifying minimum vertical separation and installation of concrete slabs at crossing points, minimum offsets for parallels services or vertical boring, and signage and marker tape requirements.



Further discussion of APA requirements as applied to the NGGA is provided in Section 6.6.

### **6.2.2.2 RESISTANCE TO PENETRATION**

Resistance to penetration is an important physical control and is provided by the wall thickness of the pipeline. For new pipelines, this is specified as part of the design process, which takes into account the expected threat profile. For existing pipelines where change of land use occurs (e.g. the section of the T92 Lara to Iona Pipeline that traverses the NGGA) then the resistance to penetration of the existing pipeline needs to be assessed against the new threat profile imposed by the change of land use.

APA calculations show that an excavator fitted with general purpose teeth cannot penetrate the “standard wall” (9.0mm thick) T92 Lara to Iona Pipeline. A 20T excavator fitted with Tiger Teeth could penetrate the pipeline in extreme circumstances resulting in a hole with an equivalent diameter of 25mm. However, based on the assumptions above, this is not considered to be a credible threat during the “operational phase”.

Similarly, vertical boring using light equipment is not expected to penetrate the pipeline. This is based on the results of experiments of auger damage to pipelines are presented in APIA/CRC-WS Research Project 98-66 *Resistance to Pipelines to External Interference, Phase II – Final Report, March 2002*, and Victorian Gas & Fuel Corporation tests in 1983<sup>2</sup>. The Victorian Gas & Fuel Corporation tests were conducted on pipeline very similar to the Typical Pipeline as they were the operators of the network at that time. Both experiments yielded similar results:

- Fixed augers can penetrate the pipeline if the operator persists for a significant period of time (Gas and Fuel Corporation – 1.5 minutes for 6.4 mm, DN300 pipe) and ignores other warning signs (audible “metal gouging” noises and vibrations).
- The maximum hole size is the diameter of the pilot drill (50mm).
- Pendulum augers are unlikely to penetrate the pipe as they tend to skid off the pipe rather than remain in a fixed position.
- While it is possible that an auger can penetrate the pipeline, it will leak rather than rupture.

Given that the “standard wall” of the T92 Lara to Iona Pipeline is 9.0mm, the likelihood of penetration by an auger assumed to be less than that for the example above.

Notwithstanding this, it is noted that an incident on the PL 167 Dromana to Rye Pipeline (WT = 6.4mm) occurred on 28 September 2016 in which a pendulum mounted auger fitted to a >30T excavator struck the pipeline, resulting in a gas release which did not ignite.

Information on the damage caused by HDD is limited. However, it is understood to be influenced by factors such as soil type (and the amount by which the drill bit is restrained), bit type and angle contact. It is typically assumed that the worst case damage is a hole with an equivalent diameter of 50mm.

To summarise, for the “operational phase” of the development:

- The maximum credible excavator threat (up to 20T fitted with general purpose teeth) cannot penetrate the pipeline (noting that pipeline >55T fitted with general purpose teeth cannot penetrate the pipeline).
- Vertical boring threats are very unlikely to penetrate the pipeline. The worst case damage is a hole with an equivalent diameter of 50mm.
- HDD threats are thought very unlikely to penetrate the pipeline. The worst case damage is a hole with an equivalent diameter of 50mm.

---

<sup>2</sup> Refer <https://pipelinesoz.wordpress.com/2010/12/20/more-on-augers/>



### 6.3 TYPICAL NON EIP THREATS – CONTROLLED BY DESIGN AND/OR PROCEDURES

Threats controlled by design and / or procedures fall under the following broad categories:

- Corrosion
- Natural events
- Operations and maintenance
- Design Defects
- Material defects
- Construction defects
- Intentional damage
- Other

No particularly unusual threats under any of these categories are envisaged as a result of the development of the Northern Geelong Growth Area which are not otherwise managed by APA under normal operating procedures.

The APA Transmission Pipelines are operated and maintained in accordance with the APA National Pipeline Management System (PMS) which has been developed to meet the requirements of a Pipeline Management System in AS 2885.3-2012 *Pipelines – Gas and liquid petroleum – Operations and Maintenance*. The Pipeline Integrity Management Plan governs the maintenance programme so that the structural integrity of the pipelines is maintained.

### 6.4 SPECIAL PROVISIONS FOR HIGH CONSEQUENCE AREAS

#### 6.4.1 No Rupture

Clause 4.7.2 of AS 2885.1 requires that in Residential (T1), High Density (T2), Industrial (I), and Sensitive (S) location classes and in Heavy Industrial (HI) location class, where pipeline failure would create potential for consequence escalation, the pipeline shall meet the requirements for “No Rupture”. This can be achieved by either:

- (a) The hoop stress shall not exceed 30% of SMYS.
- (b) Critical Defect Length is >150% of the maximum credible defect for the identified threats.

Based on the assumptions and information in Section 6.2 it is concluded that the T92 Lara to Iona Pipeline will meet the “No Rupture” requirement on the basis that:

- The maximum credible excavator threat for the “operational phase” of the development cannot penetrate the pipeline.
- The CDL is >150% of the maximum credible hole due to vertical boring or HDD.

#### 6.4.2 Maximum Discharge Rate

Clause 4.7.3 of AS 2885.1 requires that, for pipelines carrying flammable gases, the maximum discharge rate shall not exceed 10 GJ/s in Residential (T1) and Industrial (I) locations or 1 GJ/s in High Density (T2) and Sensitive (S) locations.

As discussed above, the maximum credible hole size for a vertical auger or HDD is considered to be 50 mm. The energy release rate in this case is ~1 GJ/s. Therefore, the requirement for High Density (T2) and Sensitive (S) locations is satisfied.

### 6.5 PREFERRED LAND USE PLANNING

APA’s preferred land uses around the pipeline are structured around radiation distances associated with



this pipeline:

570m	4.7 kW/m <sup>2</sup> radiation contour for an <i>ignited full bore rupture</i> at MAOP (i.e. the measurement length).
350m	12.6 kW/m <sup>2</sup> radiation contour for an <i>ignited full bore rupture</i> at MAOP
65m	4.7 kW/m <sup>2</sup> radiation contour for the maximum credible hole (in this case is 50mm, or ~1 GJ/s energy release rate).

Note that the distance nominated in this case is from the edge of the pipeline easement on the basis that there are future plans to install a second pipeline in the easement.

***It is emphasised that the radiation distances for the a full bore rupture quoted here apply specifically to the T92 Lara to Iona Pipeline only and cannot be used for any other pipeline unless it is shown that the pipeline design and operating regime is the same. Further, the radiation distance quoted for the maximum credible hole size is based on the threat assumptions in Section 6.2 and only applies to the NGGA (i.e. it cannot be applied elsewhere unless it is shown that these assumptions equally apply).***

### 6.5.1 Passive Open Space (T1 location class)

APA supports the use of passive open space on the pipeline easement (and beyond) to minimise external interference activities on the pipeline and increase separation distance between the pipeline and residential areas. Additional comment on issues to be considered is provided in Section 6.6.

### 6.5.2 Active Open Space (T1 location class)

Active open space is generally supported by APA. However, APA's preferred approach in any given case is determined by an assessment of the risk profile, which takes into account factors such as times and frequency of use, and threats when the facility is used. For active open space it is APA's preference that building, clubrooms, playgrounds are located outside of 65m distance.

APA prefers not to co-locate school playing fields with general open space within the 12.6 kw/m<sup>2</sup> zone for full bore rupture (i.e. APA prefers schools beyond 350m).

### 6.5.3 Residential (T1 location class)

APA accepts Residential within 65m of the easement, but it is preferable that the separation between the pipeline and the buildings is maximised in this zone.

It is APA's preference that small retail strips which fall under the *Residential T1* definition are located beyond 65m.

### 6.5.4 Industrial / Employment Zone (T1/I location class)

APA accepts Industrial within 65m of the easement, but it is preferable that the separation between the pipeline and the buildings is maximised in this zone.

Where the population density of the Employment zone includes higher density uses (office, commercial), further consideration is required.

### 6.5.5 Full line retail / town centre (T2 location class)

As a general principle, where full bore rupture is a credible failure mode, APA prefer to locate larger facilities outside of measurement length (i.e. the 4.7 kW/m<sup>2</sup> radiation contour for a full bore rupture, which for the T92 Lara to Iona Pipeline = 570m), although can accept locating these between the 12.6 kW/m<sup>2</sup> and 4.7 kW/m<sup>2</sup> radiation contours for a full bore rupture (which for the T92 pipeline is between



350m – 570m).

In this case, given that the T92 Pipeline meets the “no rupture criteria”, and that maximum energy release rate from the maximum credible hole size meets T2 / S criteria of 1 GJ/s (i.e. 4.7 kW/m<sup>2</sup> radiation contour is 65m) then location of the these facilities in the 65m – 350m zone is a consideration, but is least preferred.

#### **6.5.6 Sensitive Use (S), (schools, hospitals, aged care, etc)**

As a general principle, APA prefer to locate sensitive use outside of measurement length, although can accept locating these in the 350m – 570m zone. This is consistent with ESV’s approach which does not prohibit sensitive use developments inside the measurement length. Notwithstanding this, it is preferable the distance to the sensitive use development is maximised as a matter of principle.

In this case, given that the T92 Lara to Iona Pipeline meets the “no rupture criteria”, and that maximum energy release rate from the maximum credible hole size meets T2 / S criteria of 1 GJ/s (i.e. 4.7 kW/m<sup>2</sup> radiation contour is 65m) then location of the these facilities in the 65m – 350m zone is a consideration, but is least preferred.

#### **6.5.7 General Design**

Where facilities such as schools, shopping centres and sporting complexes are located within the measurement length, layouts need to be considered which provide for maximum protection to occupants in the event of an ignited gas release. This includes maximising the separation between the pipeline and the buildings, orienting buildings so that people are protected from radiant heat in the event of an ignited gas release, and that escape routes direct people to shelter away from the pipeline. An action has been raised for all parties to liaise on these issues.

### 6.5.8 Summary

The foregoing (which is specific to the T92 Lara to Iona Pipeline) is summarised in the table below:

LAND USE	DISTANCE TO EASEMENT				COMMENT
	0m – 65m	65m – 350m	350m – 570m	>570m	
Passive open space	Green	Green	Green	Green	
Active Open Space (no facilities)	Green	Green	Green	Green	
Active Open Space (facilities)	Yellow	Green	Green	Green	
Residential	Green	Green	Green	Green	Maximise distance to buildings.
Minor retail (small shopping strips)	Yellow	Green	Green	Green	
Industrial / Employment	Green	Green	Green	Green	Maximise distance to buildings.
Employment (office / commercial)	Yellow	Green	Green	Green	Population density needs to be considered.
Full Line Retail	Red	Orange	Yellow	Green	Only for “no rupture” pipeline (i.e. T92 pipeline at this location). Maximise distance to facility.
Sensitive Use	Red	Orange	Yellow	Green	Only for “no rupture” pipeline (i.e. T92 pipeline at this location). Maximise distance to facility.
General	Layouts should provide for maximum protection to occupants in the event of an ignited gas release (e.g. maximising the separation between the pipeline and the buildings, orienting buildings so that people are protected from radiant heat in the event of an ignited gas release, and that escape routes direct people to shelter away from the pipeline).				
<b>Legend</b>					
Preferred	Green				
Acceptable	Yellow				
Least preferred	Orange				
Not supported	Red				

## 6.6 PIPELINE EASEMENT CONSIDERATIONS

### 6.6.1 General Liaison Requirements

Plans for any works proposed on the APA pipeline easement need to be provided to APA for design approval prior to any works on the easement. Early liaison with APA will facilitate this process.

### 6.6.2 Passive Open Space

APA supports utilising the easement as passive open space:

- 1) **Bike Path:** APA supports the use of bike path over the pipeline, to act as protective slab over the pipeline. While the pipeline is straight, APA is willing to work with the designer to make the path meander, so long as protection is maintained above the pipeline.
- 2) **Light poles:** light poles used for the bike path must be installed so that the edge of foundation



formwork exceeds 3m from edge of the pipe.

- 3) **Access:** There is a preference to install lockable bollards at road access points to control access by excavation machinery.
- 4) **Landscaping:** APA will put limits on vegetation that can be planted on easement - one concern is root damage on to the coating. APA does not have formal guidelines but will work with the developer, who will need to take into account:
  - APA needs to maintain line of site for signage.
  - APA may need to undertake maintenance digs on the pipeline.
  - APA has plans to construct a second pipeline in the easement.

### 6.6.3 Road Crossings

APA's standard crossing drawings are included in Appendix 2.

Road crossings must be designed to API RP1102, and meet the requirements of AS2885.1-2012 Clause 5.8.8 and Figure 5.8.8(B).

Further requirements are included in APA's *VTS Australia's Guidelines to Planning and Development around High Pressure Gas Transmission Pipelines* (included in Appendix 2).

### 6.6.4 Buried Services

APA's standard crossing drawings are included in Appendix 2.

As a general principle crossings should be minimised to reduced the risk of pipeline damage due to installation or maintenance dig-ups (e.g. by use of Common Services Trench and avoiding providing services across pipe to every dwelling)

In the past APA has allowed services in "dead side of easement" or 1m from the edge. However, the future installation of second pipeline in the easement will severely restrict the availability of the space on the easement. In any case, it is CoGG policy that new services are installed in a new easement.

The use of pre-installed crossing points for future buried services was discussed, but it was noted that there needs to be assurance that these will be used in future. Mechanisms need to be included so that future crossings will use pre-installed crossing if installed.

### 6.6.5 Stormwater, drainage and wetlands

The development will require the installation of deep stormwater pipelines which cross below gas pipeline. APA has no issue with this in principle but the Lovely Banks Consortium needs to liaise with APA re: design and construction methodology so that the pipeline is protected during construction. Methods used include open cut or HDD or micro-tunnelling.

Similarly, open drainage channels (above the gas pipeline) may be required. Again, APA has no issue in principle but the Lovely Banks Consortium needs to liaise with APA re: design and construction methodology so that the pipeline is protected during construction and operation.

APA prohibits the construction of wetlands on the easement.

## 6.7 ACTIONS

The consolidated actions list is as follows:



ACTION	DETAILS	RESP.
1	<b>Inline Inspection (ILI) results:</b> An ILI is planned the gas pipeline later this year. Once results are available (up to 6 months), APA to provide summary results of NGGA section if any significant anomalies are identified.	APA
2	<b>Design and Layout:</b> Where facilities such as schools, shopping centres and sporting complexes are located within the measurement length, layouts need to be considered which provide for maximum protection to occupants in the event of an ignited gas release. This includes maximising the separation between the pipeline and the buildings, orienting buildings so that people are protected from radiant heat in the event of an ignited gas release, and that escape route direct people to shelter away from the pipeline. All parties to liaise on these issues	CoGG / LBC / APA
3	<b>Stormwater Design:</b> Lovely Banks Consortium to liaise with APA re: design and construction methodology so that the pipeline is protected during construction. Methods used include open cut or HDD or micro-tunnelling.	LBC / APA
4	<b>Drainage Design:</b> Lovely Banks Consortium to liaise with APA re: design and construction methodology so that the pipeline is protected during construction and operation. Issues to be considered include erosion, flow rate, cover etc.	LBC / APA
5	<b>Geotech Report:</b> Lovely Banks Consortium to provide Geotech report to APA. APA to review and confirm whether there are any issues relating to ground movement and presence of rocks which may need to be taken into account.	LBC / APA
6	<b>Road crossings, buried service crossings and infrastructure planned on APA easements:</b> Where road crossings, buried service crossings or any other infrastructure is planned to be installed on the APA pipeline easement, the relevant party is required to liaise with APA for design approval prior to any works on the easement.	CoGG / LBC / APA



## 7 SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

An AS 2885 Safety Management Workshop to review the risks to the T92 Lara to Iona Pipeline resulting from potential land uses for the proposed Northern Geelong Growth Area (NGGA) was carried out on Tuesday 4<sup>th</sup> October 2016. The workshop was conducted at City Hall (Meeting Room 3), 57 Little Malop Street, Geelong. The workshop incorporated a location classification review and safety management study review of the possible risk mitigation measures set out in AS2885.1-2012. .

The land use planning for the NGGA is in its early stages, and there are no firm or detailed plans with regard to the location of actual land uses on the site. For this reason the SMS workshop was restricted to a high level review only with the objective to inform the future land use planning around the gas transmission pipeline.

The review was successfully carried out in accordance with the general requirements of AS 2885.1-2012. The workshops were attended by key pipeline, council and development project personnel so that collectively the participants possessed sufficient knowledge and experience to carry out an effective workshop review.

Given the objective of the workshop is to inform the land use planning for the NGGA, the SMS is based on the threat to pipeline integrity and consequences of a gas release that are associated with the fully developed and occupied site. Management of threats to the pipeline during major construction programs will be addressed under specific approvals and management processes.

Based on the assumptions in this report, it is concluded that the T92 Lara to Iona Pipeline meets the requirements of AS 2885.1-2012 Section 4.7 "Special Provisions for High Consequence Areas" with regard to "no rupture" and maximum energy release rate. Based on this, APA's position on land uses at various distances from the pipeline easement is detailed in Section 6.5. Specific requirements and principles for activities and infrastructure on the pipeline easement are detailed in Section 6.6.

In general, to minimise safety risks:

- High Density or Sensitive land uses should be removed as far as is practicable from the pipeline easement and at least beyond the 4.7 kW/m<sup>2</sup> radiation contour (65m) for the maximum credible hole.
- Activities on the pipeline easement should minimise the threat of pipeline damage due to excavation, vertical boring and HDD:
  - Creating passive open space with bike tracks and foot paths which also serves as pipeline protection is supported.
  - Every effort should be made to minimise pipeline crossings (roads, buried services) to minimise the risk of damage due to future maintenance dig-ups.
  - Minimum offsets and separation specified by APA for buried services, footings, and supports for lighting and signage need to be adhered to.
- Council and developers should liaise with APA with regard to design considerations to provide for maximum protection to occupants in the event of an ignited gas release.

It is emphasised that the radiation distances for the a full bore rupture quoted here apply specifically to the T92 Lara to Iona Pipeline only and cannot be used for any other pipeline unless it is shown that the pipeline design and operating regime is the same. Further, the radiation distance quoted for the maximum credible hole size is based on the threat assumptions in Section 6.2 and only applies to the NGGA (i.e. it cannot be applied elsewhere unless it is shown that these assumptions equally apply).

As noted above, this SMS review was necessarily a high level review, consistent with the current status



of the project and the objectives of the review. AS 2885 requires that future SMS reviews are required at key stages of the development to confirm that the assumptions made in this review are valid, that the objective and actions identified by this report have been addressed, and also to update the SMS record to include the development details so that APA can continue to manage pipeline safety in accordance with the requirements of the standard.



## APPENDIX 1      WORKSHOP MATERIALS

TITLE
1. Introduction and SMS Process Overview Presentation
2. Potential Land Use, Pipelines Design, SMS Threats and Controls Presentation
3. Attendance List



**Wilcon Projects / City of Greater  
Geelong  
NORTHERN GEELONG GROWTH AREA  
T92 LARA TO IONA GAS PIPELINE (PL231)  
SMS Review Workshop**

4 October 2016

**INTRODUCTION AND SMS PROCESS  
OVERVIEW**

GPA Project 16459



## Introductions

- Name
- Role
- Have you been to an SMS workshop before?



## Why Are We Doing This?

- Pipeline is designed to AS 2885 – Pipelines: gas and liquid petroleum
- Safety Management Study is a mandatory requirement of AS 2885
- Compliance with AS 2885 is a mandatory statutory requirement



## Background

- Northern Geelong Growth Area
- Rezoned from Farming to Urban Growth (2014)
- Planning requirements and future precinct structure plans are in development
- APA Group's T92 Lara to Iona Sales Gas Pipeline (PL231) traverses the area



## Workshop Purpose

- Initial review of risks associated with future development around the gas pipeline
  - Understand zoning and planning process
  - Understand potential land uses
  - Understand pipeline design, operations and AS2885 requirements
  - What issues need to be addressed so that the development and pipeline can coexist to maintain pipeline safety and security of supply
- Inform land use planning process



## AS 2885 SMS Process (1)

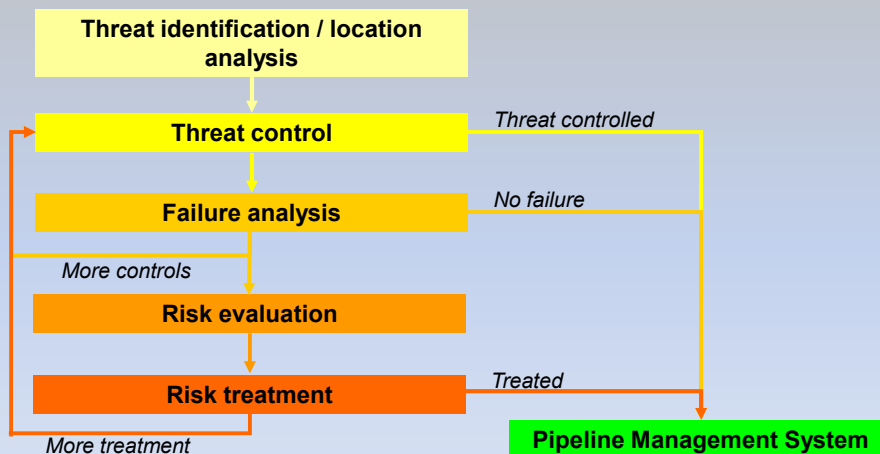
- Shall be undertaken rigorously, shall apply controls to identified threats and shall reduce residual risk to an acceptable level through a safety management study, and a risk assessment of threats that are not controlled.
- All threats to the integrity of the pipeline shall be identified and multiple independent controls shall be applied to each identified threat.



## AS 2885 SMS Process (2)

- Mandatory requirements are specified for control of external interference threats.
- SMS to be carried out by suitably qualified, trained and experienced personnel.
- The safety management process and its outcomes shall be documented and approved.
- Pipeline safety management shall be an ongoing process over the life of the pipeline.

## Safety Management Process Overview



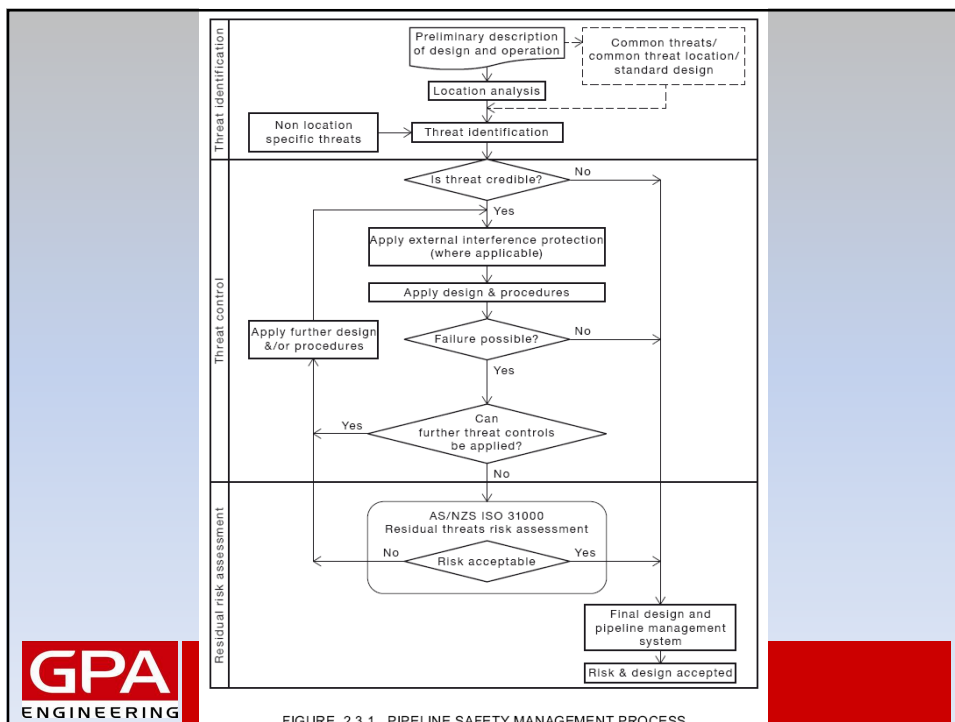
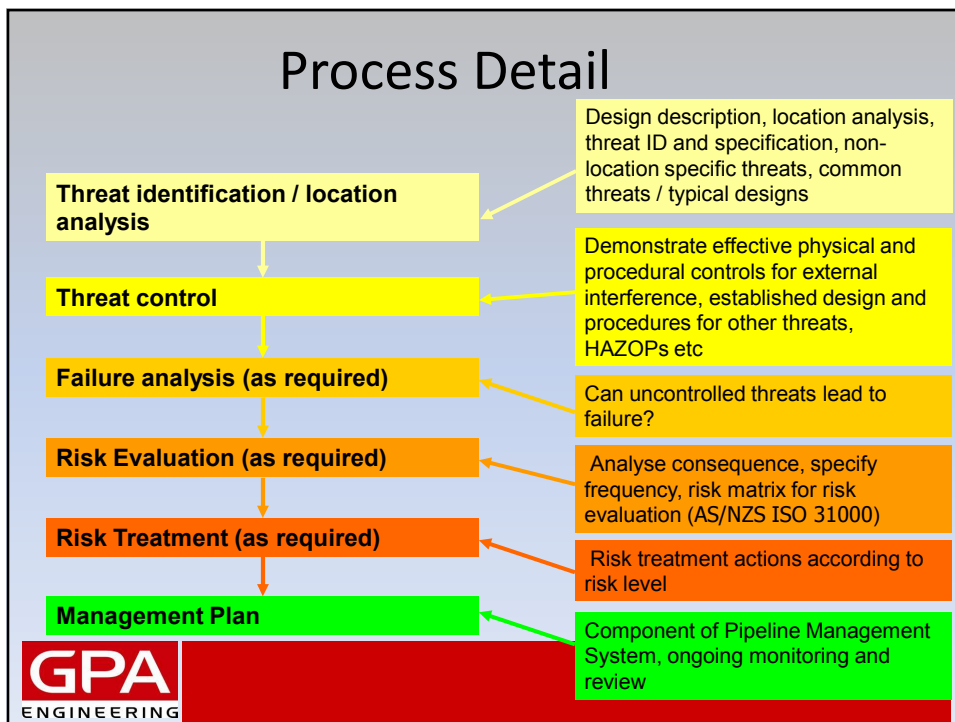


FIGURE 2.3.1 PIPELINE SAFETY MANAGEMENT PROCESS

## Primary Location Class Summary

- **Rural (R1)** – broad acre agricultural, sparse population
- **Rural Residential (R2)** – small farm allotments, increased population
- **Residential (T1) Land** – community living / suburban areas
- **High Density (T2) Land** – high rise development, town and city centre, high population areas, high people concentration
- Location class is determined by development and activities within the “measurement length”, which is the distance to the 4.7 kW/m<sup>2</sup> contour from a full bore rupture at MAOP.



## Secondary Location Class Summary

- **Sensitive Use (S)** – High population where people unable to escape (e.g. schools, hospitals, aged care facilities, prisons). Includes high environmental sensitivity areas. Treat as T2.
- **Industrial (I)** – light or general industrial areas (e.g. factories, warehouses). Treat as T1.
- **Heavy Industrial (HI)** – heavy industry / toxic industrial use with unusual threats or considerable escalation consequences. Treat as R2, T1, or T2 depending on circumstances.
- **Common Infrastructure Corridor (CIC)** – multiple infrastructure within a common reserve. Location class is a per surrounding area, but special threats to be considered.
- **Submerged (W)** – land which is inundated (lakes, estuaries, harbours, marshes, flood plains and navigable waterways, etc).



## External Interference Protection

- Minimum physical and procedural controls to be applied, depending on location class.
- Controls must be demonstrably effective for the specified threat.
- Threats need to be defined with sufficient information to determine effective controls.



## Physical and Procedural Controls

Controls	Control Methods
<b>PHYSICAL CONTROLS</b>	
1. Separation	<ul style="list-style-type: none"> <li>• Burial</li> <li>• Exclusion</li> <li>• Barrier</li> </ul>
2. Resistance to Penetration	<ul style="list-style-type: none"> <li>• Wall thickness</li> <li>• Barrier to penetration</li> </ul>
<b>PROCEDURAL CONTROLS</b>	
1. Pipeline Awareness	<ul style="list-style-type: none"> <li>• Landowner liaison</li> <li>• Third party liaison</li> <li>• Community awareness program</li> <li>• One call service</li> <li>• Marking</li> <li>• Activity agreements with other entities</li> </ul>
2. External Interference Detection	<ul style="list-style-type: none"> <li>• Planning notification zones</li> <li>• Patrolling</li> <li>• Remote intrusion monitoring</li> </ul>

## Minimum Control Requirements

Location Class	Physical	Procedural	Notes
R1, R2	1	2	
T1, T2	2	2	No rupture and limiting energy release rate applies
S	2	2	As for T2
I	2	2	As for T1
HI	1 or 2	2	Physical controls from primary location class.
CIC	1 or 2	2	Physical controls from primary location class.
W	1 or 2	2	Physical controls from primary location class.

For each control, all reasonably practicable methods shall be adopted.

Physical controls for protection against high powered boring equipment or cable installation rippers shall not be considered absolute.

In CIC location class, agreements to control the activities of each user shall be implemented with other users of the CIC wherever possible.

The adoption of minimum requirements for pressure design wall thickness, depth of cover and marking shall not be assumed to constitute design for protection.

The effectiveness of each external interference protection design shall be reviewed by a safety management study validation workshop.

## Threats controlled by design and/or procedures

- Corrosion
- Natural events
- Operations and maintenance
- Design Defects
- Material defects
- Construction defects
- Intentional damage
- Other

## Facilities

- Process safety to be addressed by HAZOP, etc
- External interference and other threats to be addressed by SMS workshop

## Special Provisions for High Consequence Areas

- No rupture
  - Hoop stress <30% SMYS, or
  - CDL = 1.5 times maximum credible defect
- Energy Release Rate
  - T1 = 10 GJ/s
  - T2 = 1 GJ/s

## Change of Location Class

- Where there are changes in land use planning (or land use) along the route of existing pipelines to permit *Residential, High Density, Industrial, or Sensitive* development or *Heavy Industrial* development in areas where these uses were previously prohibited, a safety assessment shall be undertaken and additional control measures implemented until it is demonstrated that the risk from a loss of containment involving rupture is ALARP..
- This assessment shall include analysis of at least the alternatives of the following:
  - a) MAOP reduction (to a level where rupture is non-credible).
  - b) Pipe replacement (with no rupture pipe).
  - c) Pipeline relocation (to a location where the consequence is eliminated).
  - d) Modification of land use (to separate the people from the pipeline).
  - e) Implementing physical and procedural protection measures that are effective in controlling threats capable of causing rupture of the pipeline.

## KEY LOCATION CLASS DEFINITIONS

## Residential (T1)

- Land that is developed for community living.
- Residential applies where multiple dwellings exist in proximity to each other and dwellings are served by common public utilities.
- Residential includes areas of land with public infrastructure serving the residential use; roads, railways, recreational areas, camping grounds/caravan parks, suburban parks, small strip shopping centres.
- Residential land use may include isolated higher density areas provided they are not more than 10% of the land use.
- Land used for other purposes but with similar population density shall be assigned Residential location class.

*NOTE: In residential (T1) and high density (T2) areas the societal risk associated with loss of containment is a dominant consideration*



## High Density (T2)

- Land that is developed for high density community use.
- High Density applies where multi storey development predominates or where large numbers of people congregate in the normal use of the area.
- High density includes areas of public infrastructure serving the high density use; roads, railways, major sporting and cultural facilities and land use areas of major commercial developments; cities, town centres, shopping malls, hotels and motels.

*NOTE: In residential (T1) and high density (T2) areas the societal risk associated with loss of containment is a dominant consideration*



## Sensitive Use (S)

- The sensitive use location class identifies land where the consequences of a failure may be increased because it is developed for use by sectors of the community who may be unable to protect themselves from the consequences of a pipeline failure.
- Sensitive uses are defined in some jurisdictions, but include schools, hospitals, aged care facilities and prisons.
- Sensitive use location class shall be assigned to any portion of pipeline where there is a sensitive development within a measurement length.
- It shall also include locations of high environmental sensitivity to pipeline failure.
- The design requirements for high density shall apply.

*NOTE: In sensitive use areas, the societal risk associated with loss of containment is a dominant consideration*

## Industrial (I)

- The Industrial location class identifies land that poses a different range of threats because it is developed for manufacturing, processing, maintenance, storage or similar activities or is defined in a local land planning instrument as intended for light or general industrial use.
- Industrial applies where development for factories, warehouses, retail sales of vehicles and plant predominates. Industrial includes areas of land with public infrastructure serving the industrial use.
- Industrial location class shall be assigned to any portion of pipeline where the immediately adjoining land use is industrial.
- The design requirements for residential shall apply.

*NOTE: In industrial use areas the dominant consideration may be the threats associated with the land use or the societal risk associated with the loss of containment*

# NORTHERN GEELONG GROWTH AREA T92 LARA TO IONA GAS PIPELINE (PL231)

## SMS Review Workshop

4 October 2016

### POTENTIAL LAND USE, PIPELINES DESIGN, SMS THREATS AND CONTROLS

GPA project 16459 – post workshop update



## Northern Geelong Growth Area



## PIPELINE SUMMARY

ID	Name	OD (mm)	L (km)	MAOP (MPa)	Fluid	Grade	WT (mm)	4.7kW/m <sup>2</sup> (m)	12.6kW/m <sup>2</sup> (m)
1	T92 Iona to Lara gas pipeline	508	n/a	10.2 <sup>1</sup>	Sales Gas	API 5L X70	9.0 / 10.8	~570	~350

Note 1 –Operating Pressure is close to MAOP



## Resistance to Penetration – Tiger Teeth

ID	Grade	WT (mm)	CDL (mm)	B-factor	No penetration	Leak Only	Rupture	“No Rupture Criterion”
“Standard Wall”	API 5L X70	9.0	142	1.3	≤15T	20T – 40T	>40T	≤15T
				1.0	≤25T	30T-40T	>40T	≤25T
				0.75	>55T	>55T	>55T	>55T
“Heavy Wall”	API 5L X70	10.8	199	1.3	≤25T	30T – 55T	>55T	≤35T
				1.0	≤40T	>40T	>55T	≤40T
				0.75	>55T	>55T	>55T	>55T

1. Pipeline has resistance to penetration for all excavators fitted with General Purpose (GP) teeth
2. Calculation based on penetration by single point to tiger tooth
3. Rupture where “Max Tooth Length” exceeds CDL
4. “No Rupture Criterion” where “Max Tooth Length” < 2/3 CDL



## Energy Release Rate / Contours

Hole diameter (mm)	Energy Release Rate (GJ/s)	4.7kW/m <sup>2</sup> (m)	12.6kW/m <sup>2</sup> (m)	Excavator – single point TT
10	~0.04	~15	~8	<5T
15	~0.08	~20	~12	5T
20	~0.1	~25	~15	10T, 15T
25	~0.2	~30	~19	20T, 25T
30	~0.3	~40	~23	30T, 35T
35	~0.5	~45	~27	40T, 55T
40	~0.6	~50	~30	
45	~0.8	~60	~35	
50	~1.0	~65	~40	

## Typical Designs / Drawings

TYPE	DESCRIPTION	DRAWING No.	FEATURES
<b>GENERAL TRENCH</b>	General Trench Details	TBA	Depth of Cover > 1000mm Signage as per AS 2885 Marker tape installed
<b>FOREIGN CROSSING</b>	Foreign Crossing Detail	S91-7-6 Rev C	Depth of Cover = 1200mm, Minimum separation = 300mm (pipe below utility) Signage at crossings Marker tape installed above slab Concrete Slab – 150mm thick and 600mm beyond pipeline wall <i>NOTE – Telstra crossings are not slabbed</i>
<b>ROAD CROSSING</b>	Road Crossing Detail	TBA	Depth of Cover = 1200mm Signage at crossings Marker tape installed above slab Concrete Slab – 150mm thick, installed for full distance of the road reserve
<b>WATER CROSSING</b>	Water Crossing Detail	N/A for this pipeline	N/A

## EIP Physical Controls

### PENETRATION RESISTANCE

### SEPARATION

- Depth of burial = 1000mm - 1100mm
- Horizontal/vertical separation to parallel infrastructure (roads, pipelines, fences)
- Concrete slabbing at utility and road crossings

## EIP Procedural Controls

- Pipeline Surveillance Patrols – Frequency to be confirmed
- Dial-before-you-dig
- Marker Signs (as per AS 2885)
- Marker Tape in general trench and crossings
- Community awareness
- Landowner and emergency service liaison
- Liaison with council, developer and their contractors
- APA Excavation Procedures
- APA procedures for work on pipelines (permit to work, JSA, approved policies and working procedures)
- Inspection or supervision of third-party activities for proposed activities
- Gas is odorised

*Targeted program with council and utilities, annual landowner visits, DBYD users receive APA/ESV information pack. There is a general high awareness of the pipeline in the community.*

*APA attend all excavations on the pipeline easement to locate the pipe and supervise activities. Activities are subject to APA procedures, including Permit to Work and restrictions on mechanical digging near the pipeline.*

## Corrosion Mitigation Design

- External corrosion protection
  - External coatings (FBE, heat shrink sleeves at joints)
  - Cathodic Protection (CP)
- Internal corrosion protection
  - Internal coatings – N/A
  - Pigging facilities – N/A
  - Biocide / Corrosion inhibitor – N/A

## Integrity Management

- Condition Monitoring Activities
  - Right Of Way (ROW) Surveys
  - Cathodic protection systems routine surveys
  - Cathodic protection interference testing
  - External coating defect surveys
  - Corrosion probes surveys
- Inspection Activities
  - In-Line Inspection
  - Direct Assessment Inspection (dig-ups) – as required
  - Pig barrel inspections
- Refurbishment Activities (inc CP, coatings)
  - Pipeline, CP, coating refurbishment
  - ROW/Easement reinstatement

## NORTH GEELONG GROWTH AREA

- Potential Land Use Zoning
  - General Residential and Commercial
  - Potential for Sensitive Uses
- Potential Land Uses in Measurement Length
  - Passive Open Space / Linear Park
  - Standard Residential
  - Medium Residential
  - Active Open Space
  - Retail
  - Employment
  - Infrastructure and services (road, comms, electricity, water, sewers, drainage)
- Other compatible land uses



## HIGH LEVEL SMS (DATABASE)

- Location Classification
- External Interference Threats, Locations and Controls
  - Excavators
  - Vertical Boring
  - Horizontal Directional Drills
  - Trenchers and Rock Saws
  - Other threats
- Corrosion Threats and Controls
- Geohazards Threats and Controls
- Other Threats (including loads)



## Special Provisions for High Consequence Areas

- No rupture
  - Hoop stress <30% SMYS, or
  - CDL = 1.5 times maximum credible defect
- Energy Release Rate
  - T1 = 10 GJ/s
  - T2 = 1 GJ/s

## Change of Location Class

- Where there are changes in land use planning (or land use) along the route of existing pipelines to permit *Residential, High Density, Industrial, or Sensitive* development or *Heavy Industrial* development in areas where these uses were previously prohibited, a safety assessment shall be undertaken and additional control measures implemented until it is demonstrated that the risk from a loss of containment involving rupture is ALARP..
- This assessment shall include analysis of at least the alternatives of the following:
  - a) MAOP reduction (to a level where rupture is non-credible).
  - b) Pipe replacement (with no rupture pipe).
  - c) Pipeline relocation (to a location where the consequence is eliminated).
  - d) Modification of land use (to separate the people from the pipeline).
  - e) Implementing physical and procedural protection measures that are effective in controlling threats capable of causing rupture of the pipeline.

## Actions for Land Use Planning and PSP

- Workshop discussion

## SMS WORKSHOP ATTENDANCE RECORD

### NORTHERN GEELONG GROWTH AREA / T92 LARA TO IONA GAS PIPELINE SMS 4th October 2016

GPA 16439

Name	Position in Relation to Project	Company / Organization
Richard McDonough	Facilitator	GPA
JAMES HAMILTON	STRATEGIC PLANNER	COGG
GRILL ALTMANN	ENGINEER	COGG
SARAH STOREN	STRATEGIC PLANNER	COGG
MATTHEW WILSON	ENGINEER	COGG
FIONA FINLAYSON	REC 2 OPEN SPACE PLANNER	COGG
KIRSTEN KILPATRICK	<del>TRACT</del> TOWN PLANNER	TRACT (LOVELY BANKS)
DANIEL TUCCI	SENIOR CONCEPT ENGINEER	APA GROUP
Simon Harding	Senior Planning Engineer	COGG
KRIS WILSON	PROJECT MANAGER	LOVELY BANKS CONSORTIUM
LACHIE MARSHALL	LAND AGENT	APA GROUP
Phil McCutcheon	Planner	APA Group

## APPENDIX 2 REFERENCE DOCUMENTS

DOC No.	TITLE	DATE
n/a	NGGA Map	No date
n/a	CoGG, Northern Geelong Growth Area, Safety Management Study workshop, Land Use Assumptions	27 September 2016
n/a	Appendix 1: APA VTS Australia's Guidelines to Planning and Development around High Pressure Gas Transmission Pipelines	No date
n/a	Energy Safe Victoria, Memo "Land Development around Pipelines, Uses"	2 May 2016
530-DWG-L-1001, Rev 0	APA Group, Standard Protection, Concrete Slab Installation – Other Utility Crossing beneath APA Pipeline, High Pressure Pipeline Details	08/04/15
530-DWG-L-1002, Rev 0	APA Group, Standard Protection, Concrete Slab Installation – Other Utility Crossing beneath APA Pipeline, 300-500mm Separation Details	08/04/15
530-DWG-L-1003, Rev 0	APA Group, Standard Protection, Other Utility Crossing above APA Pipeline, >500mm Separation Details	08/04/15
530-DWG-L-1011, Rev 0	APA Group, Standard Protection, Concrete Slab Installation – Other Utility Crossing beneath APA Pipeline, High Pressure Pipeline – Field Recording Details	08/04/15
530-DWG-L-1012, Rev 0	APA Group, Standard Protection, Concrete Slab Installation – Other Utility Crossing beneath APA Pipeline, 300-500mm Separation – Field Recording Details	08/04/15
530-DWG-L-1013, Rev 0	APA Group, Standard Protection, Other Utility Crossing above APA Pipeline, >500mm Separation – Field Recording Details	08/04/15
S13-22-11, Rev D	APA Group, Standard Procedures, Road Crossing, Typical Bored Crossing, G.A.	08/10/09
S13-22-12, Rev D	APA Group, Standard Procedures, Road Crossing, Open Cut Installation, G.A.	28/11/08
T92-15	Lara – Iona Transmission Pipeline Route Plan	3/4/99
T92-16, Rev A	Lara – Iona Transmission Pipeline Route Plan	3/4/99



LEMMP 1km  
Industry Buffer

Staceys Road

Bacchus Marsh Road

Electricity  
Powerline &  
Easement

SW Gas Pipeline  
Easement & 500m  
Buffer

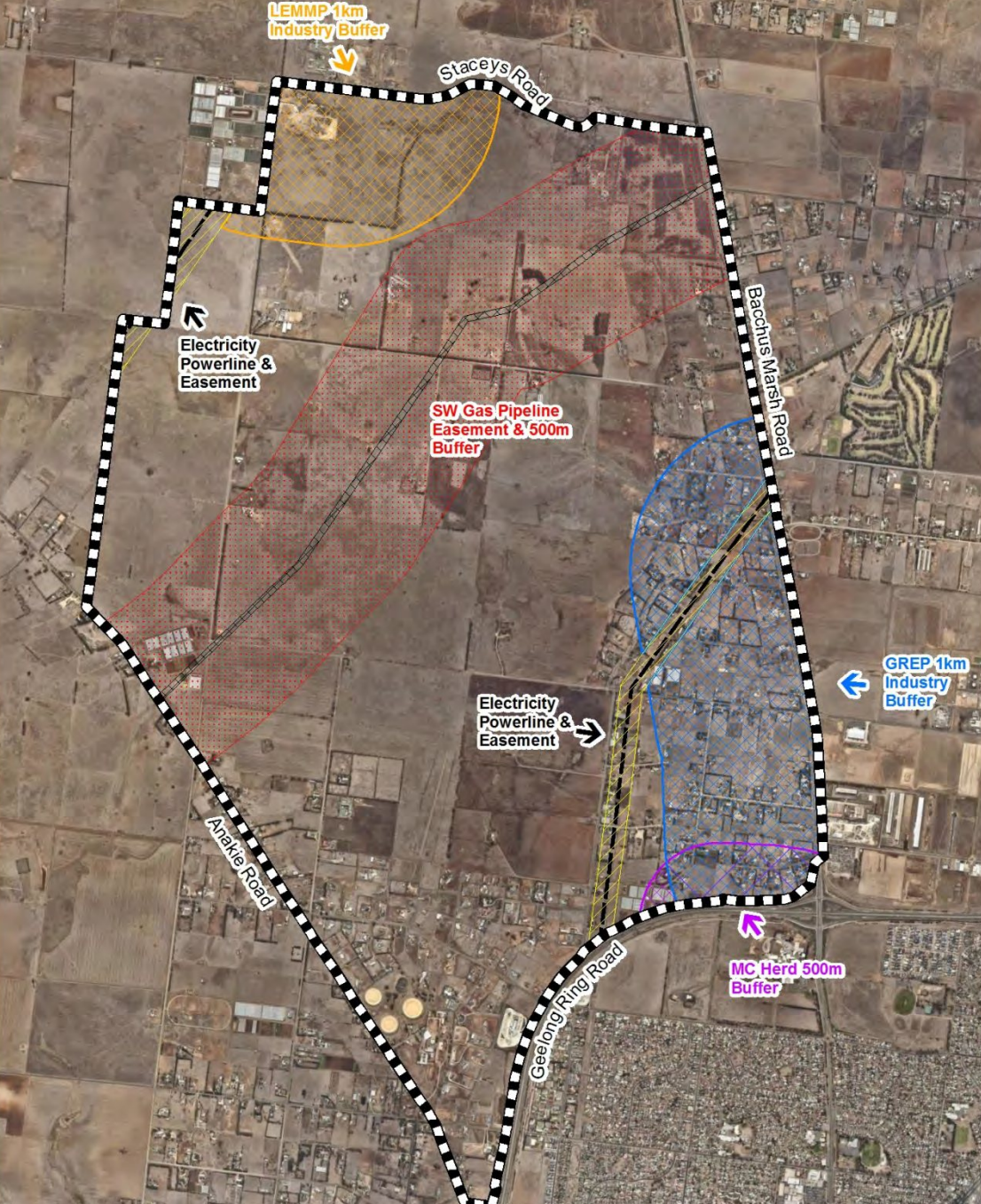
GREP 1km  
Industry Buffer

Electricity  
Powerline &  
Easement

Anakie Road

Geelong Ring Road

MC Herd 500m  
Buffer





# Northern Geelong growth area

## Safety Management Study Workshop

### Land Use assumptions

LAND USE	GPA ENGINEERING CLARIFICATION	COGG RESPONSE
<b>Standard residential density development</b>	Density in terms of dwellings per hectare, and occupants per dwelling  Examples of similar developments will be useful in the workshop (photos, plans, GIS images)	<ul style="list-style-type: none"> <li>• 15 dwellings per hectare</li> <li>• 2.8 people per household</li> </ul>
<b>Medium residential density development</b>	Density in terms of dwellings per hectare, and occupants per dwelling, number of levels  Examples of similar developments will be useful in the workshop (photos, plans, GIS images)	<ul style="list-style-type: none"> <li>• 20 + dwellings per hectare</li> <li>• 2.8 people per household</li> </ul>
<b>Active open space</b> - playing fields and courts and their associated buildings and infrastructure;	Noted	
<b>Passive open space</b> - (within the pipeline easement would comprise open space, being passive open space and associated low scale landscaping, where population density/activity is low. An example of passive open space is a linear corridor that can be used for walking and cycling)	An issue for discussion in the workshop will be how access to this space might be controlled with regard to activities that could damage the pipeline (primarily excavation for installation and maintenance of other buried services; use of auger / vertical bores to install signs, fences, etc; Horizontal Directional Drills (HDD) across the corridor)	<ul style="list-style-type: none"> <li>• Noted</li> </ul>
<b>Retail</b> - full line supermarkets, associated speciality stores and car parking et al;	Examples of similar developments will be useful in the workshop (photos, plans, GIS images)	<ul style="list-style-type: none"> <li>• Noted</li> </ul>
<b>Employment</b> - precincts providing a range of commercial services;	Examples of similar developments will be useful in the workshop (photos, plans, GIS images)	<ul style="list-style-type: none"> <li>• Industrial/Business parks et al</li> </ul>
<b>Infrastructure</b> - including road crossings and other civil infrastructure et al.	Key issues will be:  1) What other buried services will be located in the pipeline corridor (parallel to the pipeline)?	<ul style="list-style-type: none"> <li>• Noted</li> </ul>

	<ol style="list-style-type: none"> <li>2) What other buried services will cross the pipeline?</li> <li>3) What services will be buried above the pipeline and what services will be buried deeper than the pipeline?</li> <li>4) How will the design be future-proofed to minimise the requirement to install new buried services in future (e.g. install sufficient capacity, pre-install crossing points for future services).</li> <li>5) How can crossings of the pipeline be minimised?</li> <li>6) What maintenance will be required for buried services over the life of the development?</li> <li>7) Maximising offsets between the pipeline and potential vertical bores (signs, light poles etc).</li> <li>8) Designs that don't required boring when signs / poles are replaced.</li> <li>9) Are there any plans for train stations of major bus interchanges?</li> </ol>	
<p><b>Other potentially compatible land uses</b> may need to be tested at the workshop, subject to agreement by all parties involved.</p>	<p>Will need to flag what these might be prior to the workshop.</p>	<ul style="list-style-type: none"> <li>• It is likely that most land uses have been considered as above.</li> </ul>
<p><b>Sensitive uses-</b> It is assumed that sensitive uses such as schools (both primary and secondary), community centres and aged care accommodation would not be compatible land uses within the measurement length. Other sensitive land uses may arise as a consequence of the workshop process.</p>	<p>Noted – it will be APA's preference to locate these outside of the measurement length.</p>	<ul style="list-style-type: none"> <li>• This is a key land use issue to be discussed at the workshop.</li> </ul>

Estuary Estate, Leopold (*standard residential development*)



Warralily, Armstrong Creek Growth Area (Standard residential development)





Spring St, Geelong West cntd...



Estuary Blvd active open space, Leopold



Saltwater Reserve active open space precinct, Point Cook



Passive open space- linear corridor examples



Lara Town Centre (Coles and Woolworths) Waverley Road (Full line supermarkets, associated speciality retail and car parking)



**Leopold Neighbourhood Activity Centre** (Full line supermarket, associated speciality retail and car parking)



Manor Lakes Shopping Centre, Manor Lakes Blvd, Wyndham Vale



Grubb Road Commercial/Industrial precinct, Ocean Grove



Industrial/Business Park, Boundary Rd, Laverton North





## **Appendix 1: APA VTS Australia's Guidelines to Planning and Development around High Pressure Gas Transmission Pipelines.**

### **1. Planning Controls**

Operations of gas transmission pipelines carry a level of risk, which must be assessed when considering development proposals in the vicinity of high pressure transmission pipelines, to ensure that risk to people, property and the environment is within acceptable levels.

Whilst Australian gas pipelines industry has an excellent safety record, in case of a pipeline failure an area of several hundred metres can be significantly impacted. The most frequent cause of pipeline failure worldwide is damage caused by external interference resulting from multiple activities such as construction or maintenance activities on or near gas pipelines.

Whilst the land that is required to control access to the pipeline itself is set aside in an **easement** in most situations, a much larger buffer should be considered when planning or developing land in the vicinity of any high pressure gas infrastructure.

The "**measurement length**" clearly defines the region that could be affected by the worst case scenario pipeline failure and identifies the distance where development proposals should be referred to the pipeline owners by the planning authority.

If there is any change in land use/zoning, in pipeline location classification or a construction activity is proposed within the measurement length, AS2885 requires a detailed **Safety Management Study** to be undertaken, which incorporates performing a risk assessment. For example, as a location classification changes from rural to residential (Appendix 2 and 3), the level of pipeline protection required normally increases to ensure protection of the pipeline and to manage the risk to the community and the environment.

### **2. All proposed development needs to be restricted in the pipeline's easements and/or within close proximity to the pipeline**

APA owns and operates multiple natural gas transmission pipelines of various wall thickness and pressures throughout Victoria.

APA would oppose road construction (including water courses or structures) within or on the transmission pipeline easements parallel to or over the pipeline as it seeks to minimise construction works in the easements to reduce the likelihood of excavations potentially causing damage to the pipelines.

We advise that APA's position is supported by Government legislation and Australian Safety Standards:

- Pipelines Act (2005) - there is restrictions on works within close proximity to APA's pipelines.
- APA has restrictive covenants that control development within its easements, for example, restrictions on structures and excavation.
- AS2885.1 - APA has a duty to review and comment on changes in land uses in close proximity to the pipeline.

Each easement could be incorporated into a proposed development subject to early consultation with APA as periodic access is required to our pipelines.

Most transmission pipelines are protected by a registered easement which varies in width from 6.5 to 35m; however there is high pressure transmission pipelines located in various road reserves or

Government land without a registered easement. In such cases, a "Permit to Work", issued by APA, is required for any proving and/or construction activity deeper than 300mm within 3m of a transmission pipeline.

**3. Multi-lot Subdivision of an APA VTS Australia high pressure transmission pipeline or easement**

Subdividing an APA VTS pipeline easement into multiple allotments is not supported by APA due to the increase in the threat of external interference and the substantial maintenance and management issues associated with a pipeline asset being split into numerous individual allotments under separate ownership. Issues such as access, structures, additional infrastructure being constructed all contribute to increased costs and threats to the pipeline and must be avoided. The pipeline easement was acquired by APA first and foremost for the transmission of high pressure gas. APA's ability to utilise its asset for this purpose must not be jeopardised in anyway.

**4. Crossing of an APA VTS Australia high pressure transmission pipeline or easement**

Crossing high pressure transmission pipelines and/or any related easements by roads, rails and other services, would be permitted in principle with prior approval of APA (at a 90 degree angle) as the pipelines might need to be re-engineered for the proposed crossing.

Further assessments of road crossings, other services and potential impact on the pipeline will need to be assessed and conditions issued on a case by case basis upon consideration of a number of factors such as: the depth of pipeline cover, pipeline recoating, relocation of the pipeline and future pipeline accessibility, to the applicant's cost.

Each pipeline easement could be incorporated into a reserve or open space, that is, in other Structure Plans the easements have served as cycle links or linear paths connecting areas of open space.

The easement must be left grassed with no large trees or bushes planted that may cause damage to the pipeline coating. Any flora deemed a danger to the integrity of the pipeline will be removed. Plant species placed within the easement must be approved by APA.

Due to periodic access required to our pipelines for maintenance, significant disturbance to the easement may occur due to excavation around the pipeline.

**5. Developments within the "measurement length" – urban encroachment issues**

High pressure gas transmission pipelines have the potential to cause major damage if the gas ignites in case of a rupture. APA constantly monitors and maintains these pipelines to ensure their integrity; therefore the likelihood of a major incident is highly unlikely, however, under the safety obligations of AS2885, APA is required to ensure that adequate measures are taken to minimise the risk to public safety in close proximity of its pipelines.

The 'measurement length' relevant to APA pipelines in the area vary and proximity is determined by the diameter of the pipeline and its operating pressures.

For proposals within the 'measurement length' a pipeline risk management plan will be required to demonstrate that the risk from the pipeline is within acceptable levels. The risk management plan may require a safety assessment and must be undertaken in consultation with the pipeline owner/operator.

The safety assessment is conducted in the form of a Safety Management Study (SMS). The SMS is defined as the process that identifies threats to the pipeline system and applies controls to them, and (if necessary) undertakes assessment and treatment of any risks to ensure that residual risk is reduced to an acceptable level.

AS 2885.1 explicitly addresses the urban encroachment problem in **Clause 4.7.4** (Appendix 2); Change of Location Class. It addresses situations where higher population densities occur in areas where they were previously not permitted. In that situation the standard requires that:

"...a safety assessment shall be undertaken and additional control measures implemented until it is demonstrated that the risk from a loss of containment involving rupture is As Low As Reasonably Possible (ALARP)."**AND**

"...the assessment shall demonstrate that the cost of the risk reduction measures provided by alternative solutions is grossly disproportionate to the benefit gained from the reduced risk that could result from implementing any of the alternatives"

The assessment must include consideration of alternative risk reduction measures including Maximum Allowable Operating Pressure (MAOP) reduction, pipe replacement, pipeline relocation, modification of land use and additional physical and procedural protection. All measures to be further discussed and considered on specific developments upon early consultation with APA.

The additional physical and procedural external interference protection measures are:

- Physical controls: separation (burial, exclusion & barrier) and resistance to penetration (wall thickness and barrier to penetration).
- Procedural controls: pipeline awareness (landowner, third party liaison, community awareness program, one call service, marking, activity agreements with other entities) and external interference detection (planning notification zones, patrolling & remote intrusion monitoring).

AS2885 requires a metre by metre qualitative analysis to identify each threat to pipeline integrity followed by a defined process to manage each threat either by eliminating it through external interference or design processes, or by development of management procedures to reduce the risk from hazardous events to negligible, low or in unresolved cases, to ALARP.

APA will also conduct preliminary calculations and assessments of existing pipeline's credible threats to either rupture or create a hole. In addition APA would seek assistance from local Council in preventing the use of rippers and horizontal directional drills (HDDs) working in the vicinity of the pipeline.

Based on the above, APA recommends that "'T2" high density and "Sensitive"' land uses are preferably located the corresponding measurement length (see Table 1) from the pipeline away from either edge of the pipeline's easements.

**"'T2" high density and "Sensitive"' land uses are defined in AS2885 as:**

**"T2" High density** - Applies where multi-storey development predominates or where large numbers of people congregate in the normal use of the area. High density includes areas of public infrastructure serving the high density use; roads, railways, major sporting and cultural facilities and land use areas of major commercial developments; cities, town centres, shopping malls, hotels and motels." (Section 4.3.4[d] of AS2885).

**"Sensitive"** – The sensitive use location class identifies land where the consequences of a failure may be increased because it is developed for use by sectors of the community who may be unable to protect themselves from the consequences of a pipeline failure. Sensitive uses are defined in some jurisdictions but include schools, hospitals, aged care facilities and prisons. Sensitive use location class shall be assigned to any portion of pipeline where there is a sensitive

*development within a measurement length. It shall also include locations of high environmental sensitivity to pipeline failure. The design requirement for high density shall apply."* (Section 4.3.5[a] of AS2885).



We understand that the predominant land use within the measurement length of the gas pipeline in the Planning Scheme amendments as currently presented is residential land. Residential is defined in AS2885 as:

*“**Residential** applies where multiple dwellings exist in proximity to each other and dwellings are served by common public utilities. Residential includes areas of land with public infrastructure serving the residential use; roads, railways, recreational areas, camping grounds/caravan parks, suburban parks, small strip shopping centres. Residential land use may include isolated higher density areas provided they are not more than 10% of the land use. Land used for other purposes but with similar population density shall be assigned Residential location class.”* (Section 4.3.4[c] of Australian Standard AS2885).

However, there could be possible conflicts if the location or isolated high density area land uses within the measurement length were to change and therefore APA would in that case request that “T2” high density and “Sensitive” is relocated preferably to a position located at least the measurement length from the pipelines away from either edge of the pipeline's easements.

**Memo**

---

**To** Major Hazard Facilities Advisory Committee  
**From** Energy Safe Victoria  
**Date** 2 May 2016  
**Project Name** Land Development around Pipelines  
**Subject** Uses

At the Advisory Committee hearing on 23 March the Committee invited Energy Safe Victoria (ESV) to give further consideration to the uses that may trigger a requirement for a permit pursuant to the Overlay approach recommended in our primary submission.

ESV has since given this matter further consideration and we provide the following information.

*Comparison of Sensitive Uses as defined in Planning and Pipeline Legislation*

<b>Sensitive Use</b>	<b>Planning *</b>	<b>AS2885</b>	<b>APA Submission to Advisory Committee</b>
Child Care Centre	✓	✓	✓
Residential	✓		✓
Preschool	✓	✓	✓
Primary School	✓	✓	✓
Hospital		✓	✓
Aged Care Facility		✓	✓
Prison		✓	✓
Education			✓
Service Station			✓
Cinema			✓
Accommodation (other than 1 dwelling on a lot)			✓
Uses where the likely population density will increase considerably as a result of the development including a retail premises, industry, leisure and recreation transport terminal, warehouse, sale yard, office, places of assembly			✓

\*These are the uses commonly accepted as 'sensitive', although they are not formally defined

ESV suggest the following uses trigger a permit requirement via an Overlay. These uses capture both sensitive uses and uses where large numbers of people will congregate. Further discussion with stakeholders, including State Government, is required to determine the threshold triggers that would apply to each of the two Overlay Schedules ESV has advocated.

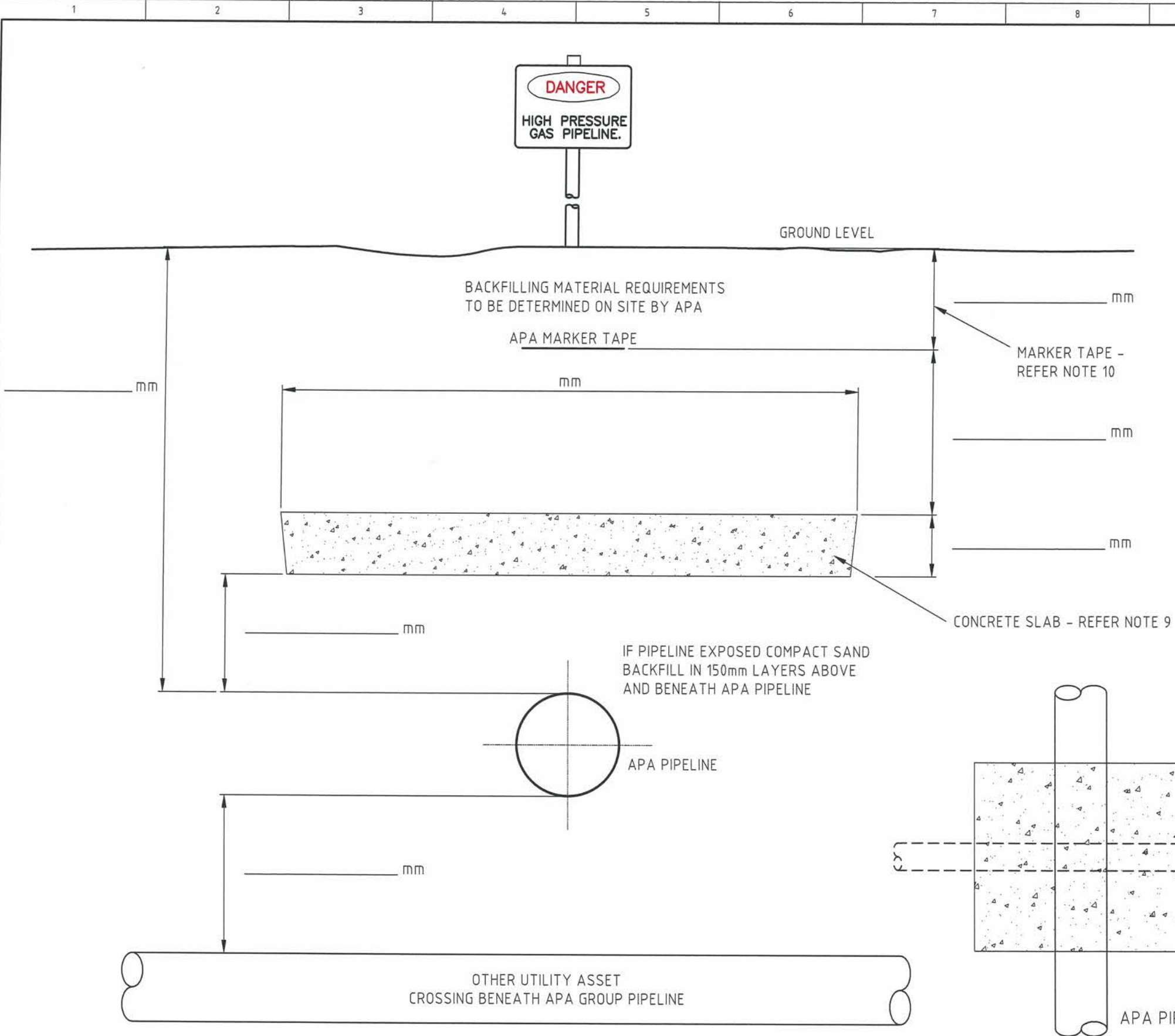
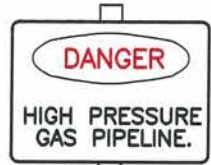
A permit is required to use land for a:

- Dwelling (other than the construction or extension of a building of three stories or less)
- Accommodation (other than dwelling)
- Child care centre
- Education centre
- Industry
- Leisure and recreation
- Office
- Place of assembly
- Retail premises
- Transport terminal
- Cinema based entertainment facility
- Hospital
- Emergency services facility
- Funeral parlour
- Research centre
- Saleyard
- Service station
- Freeway services centre
- Warehouse









**GENERAL NOTES**

- ALL WORKS ON THE PIPELINE ARE TO ADHERE TO THE REQUIREMENTS OF:
1. APA'S PERMIT TO WORK INSTRUCTIONS AND DRAWING REQUIREMENTS
  2. AN APA REPRESENTATIVE (PIO) MUST BE ONSITE TO SUPERVISE ALL WORKS ON THE PIPELINE EASEMENT/CORRIDOR UNLESS OTHERWISE SPECIFIED BY APA.
  3. NO MECHANICAL DIGGING WITHIN 1 METER OF THE PIPELINE. HAND DIGGING ONLY.
  4. THE PIO WILL:
    - 4.1. CONDUCT AN ONSITE COMPULSORY INDUCTION FOR ALL PERSONNEL WORKING WITHIN THE PIPELINE EASEMENT / CORRIDOR
    - 4.2. MARK OUT THE PIPELINE CENTERLINE
    - 4.3. MARK OUT THE BOUNDARY OF THE PIPELINE EASEMENT/CORRIDOR
    - 4.4. ESTABLISH DEPTH OF COVER OVER PIPELINE AND VISUALLY LOCATE THE PIPE AT CROSSING POINT.
  5. COMMUNICATION/POWER CABLES MUST BE INSTALLED IN A CONDUIT AND THE CONDUIT EXTEND TO FULL WIDTH OF THE EASEMENT. IF NO EASEMENT 3m EITHER SIDE OF PIPELINE WHERE PRACTICABLE.
  6. WHERE PRACTICABLE ALL SERVICES TO BE 90° TO THE APA PIPELINE AND HAVE A MARKER POST INSTALLED DIRECTLY OVER CROSSING POINT.
  7. METHOD STATEMENT FOR ALL COMPACTION OF BACKFILL IN THE VICINITY OF THE PIPELINE MUST BE APPROVED BY APA PRIOR TO COMMENCEMENT.
  8. ANY WORKS NOT IN ACCORDANCE WITH THESE GENERAL NOTES MUST BE APPROVED BY APA.
  9. CONCRETE SLAB TO BE CAST IN SITU OR PRECAST WHERE CAST IN SITU IS NOT PRACTICAL & LOCATED CENTRALLY OVER THE PIPELINE. CONCRETE TO COMPLY TO A.S. 3600-2009. MINIMUM COMPRESSIVE STRENGTH SHALL BE 25 MPa AT 28 DAYS.
  10. MARKER TAPE TO BE LOCATED APPROXIMATELY 300-500mm BENEATH GROUND LEVEL.

PIPE NAME	
PROJECT/CROSSING NAME	
APA REFERENCE	
DATE COMPLETED:	

AS BUILT INSTALLATION DETAILS	
PIPELINE KP	
GAS PIPE COVER	
GAS PIPE DIAMETER	
GPS COORDINATES	
TYPE OF SERVICE	
CONDUIT OR SERVICE DIAMETER	
SERVICE REQUIRED DOC	
ADDITIONAL	

**ELEVATION**

**PLAN**

B:\Production\513\dwg\513-DWG-L-1011.dwg Layer: Misc - Mon 01/04/2015 3:46:48 PM

0	ISSUED FOR USE	08/04/15	NL	CB	AJ	CB	MARKER TAPE	S13-8-4
1	REVISION	DATE	DRW	DES	CHK	APP	REFERENCE DRGs	DRG No

**APA Group**

THIS DRAWING, AND THE INFORMATION AND DETAILS CONTAINED IN IT ARE CONFIDENTIAL AND ARE THE PROPERTY OF APA GROUP. ANY USE MUST BE AUTHORIZED BY APA GROUP.

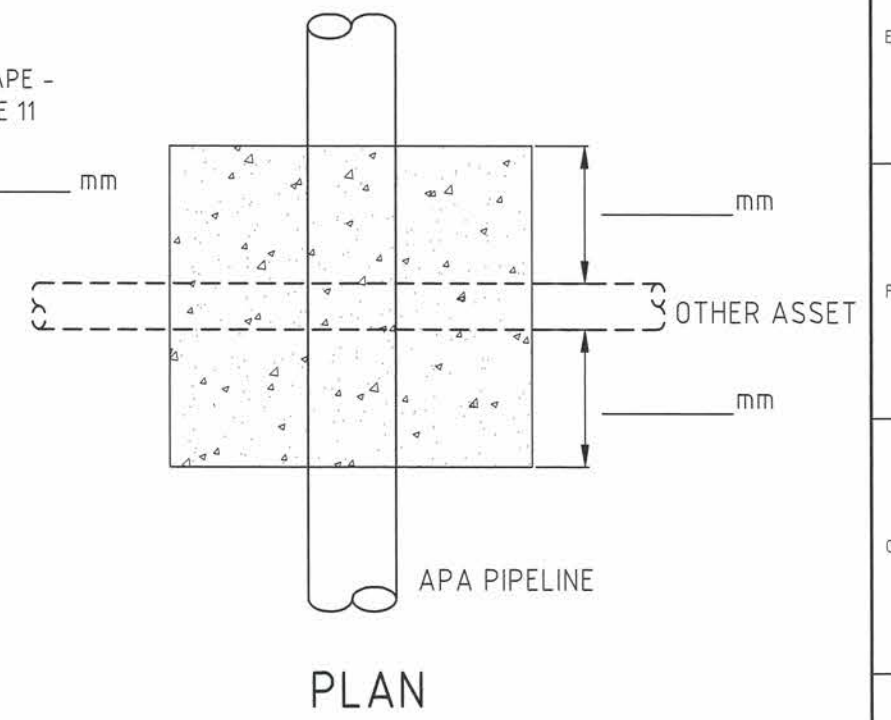
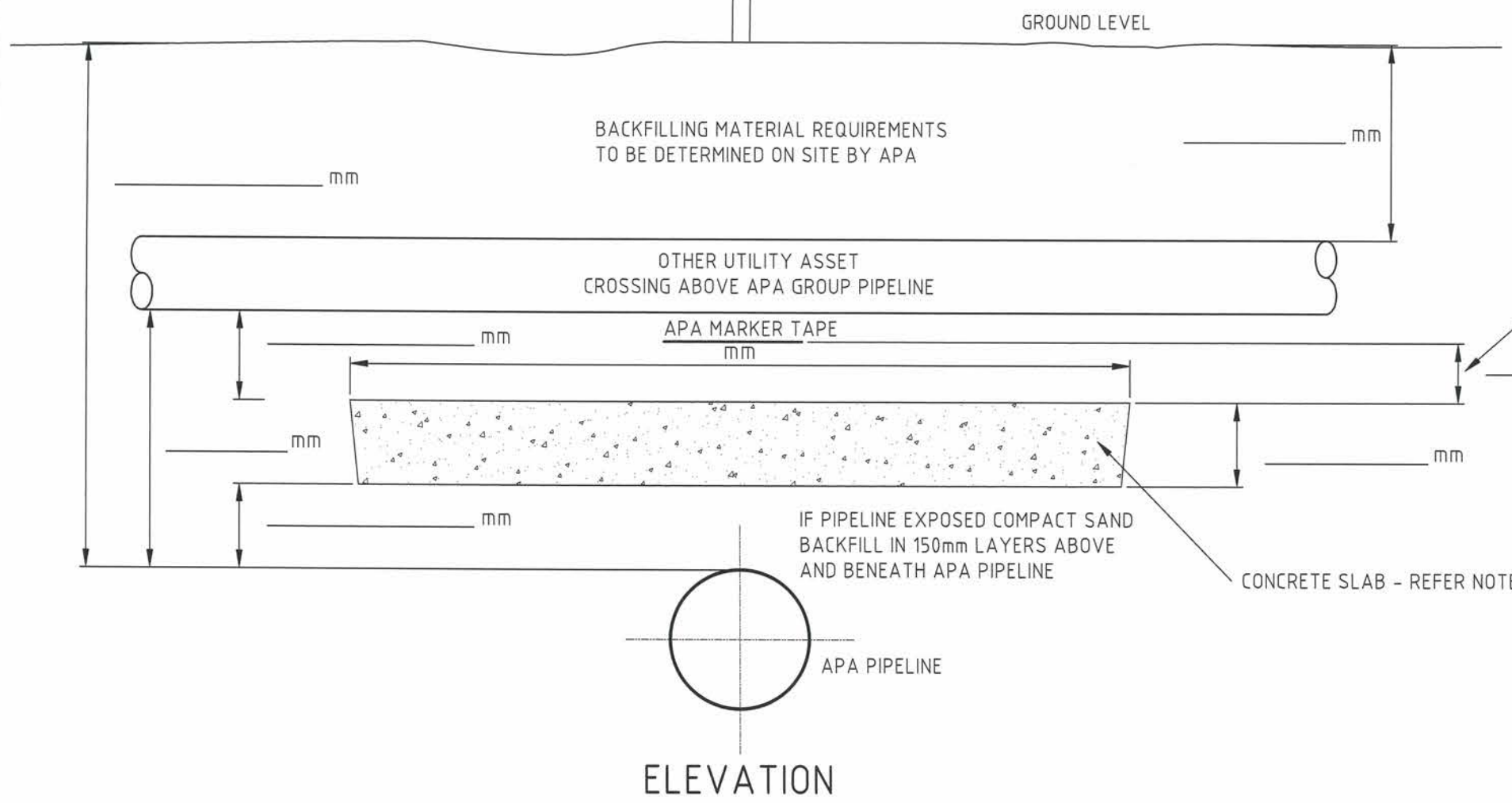
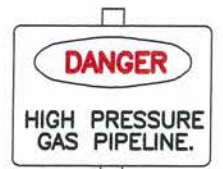
DRAWN	N. LOW	30/01/15	<b>STANDARD PROTECTION</b> <b>CONCRETE SLAB INSTALLATION - OTHER UTILITY CROSSING BENEATH APA PIPELINE</b> <b>HIGH PRESSURE PIPELINES - FIELD RECORDING DETAILS</b>
DESIGNED	C. BONAR	08/04/15	
VALIDATED	A. JONES	08/04/15	
ACCEPTED	C. BONAR	08/04/15	
SCALE	N.T.S.		PROJECT No
			DRG No
			530-DWG-L-1011
			REV
			0

PIPE NAME	
PROJECT/CROSSING NAME	
APA REFERENCE	
DATE COMPLETED:	

AS BUILT INSTALLATION DETAILS	
PIPELINE KP	
GAS PIPE COVER	
GAS PIPE DIAMETER	
GPS COORDINATES	
TYPE OF SERVICE	
CONDUIT OR SERVICE DIAMETER	
SERVICE REQUIRED DOC	
ADDITIONAL	

**GENERAL NOTES**

- ALL WORKS ON THE PIPELINE ARE TO ADHERE TO THE REQUIREMENTS OF:
1. APA'S PERMIT TO WORK INSTRUCTIONS AND DRAWING REQUIREMENTS
  2. AN APA REPRESENTATIVE (PIO) MUST BE ONSITE TO SUPERVISE ALL WORKS ON THE PIPELINE EASEMENT/CORRIDOR UNLESS OTHERWISE SPECIFIED BY APA.
  3. NO MECHANICAL DIGGING WITHIN 1 METER OF THE PIPELINE. HAND DIGGING ONLY.
  4. THE PIO WILL:
    - 4.1. CONDUCT AN ONSITE COMPULSORY INDUCTION FOR ALL PERSONNEL WORKING WITHIN THE PIPELINE EASEMENT / CORRIDOR
    - 4.2. MARK OUT THE PIPELINE CENTERLINE
    - 4.3. MARK OUT THE BOUNDARY OF THE PIPELINE EASEMENT/CORRIDOR
    - 4.4. ESTABLISH DEPTH OF COVER OVER PIPELINE AND VISUALLY LOCATE THE PIPE AT CROSSING POINT.
  5. SLABBING MUST BE INSTALLED ABOVE POWER CABLES FOR 3m EITHER SIDE OF PIPELINE WHERE PRACTICABLE, UNLESS ARMoured SHIELDED CABLE IS INSTALLED.
  6. CONCRETE SLAB TO BE CAST IN SITU OR PRECAST WHERE CAST IN SITU IS NOT PRACTICAL & LOCATED CENTRALLY OVER THE PIPELINE. CONCRETE TO COMPLY TO A.S. 3600-2009. MINIMUM COMPRESSIVE STRENGTH SHALL BE 25 MPa AT 28 DAYS.
  7. COMMUNICATION/POWER CABLES MUST BE INSTALLED IN A CONDUIT AND THE CONDUIT EXTEND TO FULL WIDTH OF THE EASEMENT. IF NO EASEMENT 3m EITHER SIDE OF PIPELINE WHERE PRACTICABLE.
  8. WHERE PRACTICABLE ALL SERVICES TO BE 90° TO THE APA PIPELINE AND HAVE A MARKER POST INSTALLED DIRECTLY OVER CROSSING POINT.
  9. METHOD STATEMENT FOR ALL COMPACTION OF BACKFILL IN THE VICINITY OF THE PIPELINE MUST BE APPROVED BY APA PRIOR TO COMMENCEMENT.
  10. ANY WORKS NOT IN ACCORDANCE WITH THESE GENERAL NOTES MUST BE APPROVED BY APA.
  11. WHERE PRACTICABLE, LOCATE MARKER TAPE APPROXIMATELY MIDWAY BETWEEN TOP OF CONCRETE SLAB AND UNDERSIDE OF OTHER UTILITY ASSET.



B:\Production\Engineering\3D\DWG\1-UTL\Asa\Level1\Main\_APA\_Group.dwg: 08/04/15 10:54:41 PM

REV	PROJ No	REVISION	DATE	DRW	DES	CHK	APP	REFERENCE DRG#	DRG No
0		ISSUED FOR USE	08/04/15	NL	CB	AJ	CB		
		WARNING PLATE						S90-12-3	
		INSTALLATION ASSEMBLY						S90-11-3	
		POST ASSEMBLY						S90-8-4	
		MARKER TAPE						S13-8-4	

**APA Group**

THIS DRAWING, AND THE INFORMATION AND DETAILS CONTAINED IN IT ARE CONFIDENTIAL AND ARE THE PROPERTY OF APA GROUP. ANY USE MUST BE AUTHORISED BY APA GROUP.

NAME	DATE
DRAWN: N. LDW	30/01/15
DESIGNED: C. BONAR	08/04/15
VALIDATED: A. JONES	08/04/15
ACCEPTED: C. BONAR	08/04/15

SCALE: N.T.S.

PROJECT No: 530-DWG-L-1012

DRG No: 530-DWG-L-1012

REV: 0

**STANDARD PROTECTION CONCRETE SLAB INSTALLATION - OTHER UTILITY CROSSING ABOVE APA PIPELINE 300-500mm SEPARATION - FIELD RECORDING DETAILS**

PIPE NAME	
PROJECT/CROSSING NAME	
APA REFERENCE	
DATE COMPLETED:	

AS BUILT INSTALLATION DETAILS	
PIPELINE KP	
GAS PIPE COVER	
GAS PIPE DIAMETER	
GPS COORDINATES	
TYPE OF SERVICE	
CONDUIT OR SERVICE DIAMETER	
SERVICE REQUIRED DOC	
ADDITIONAL	

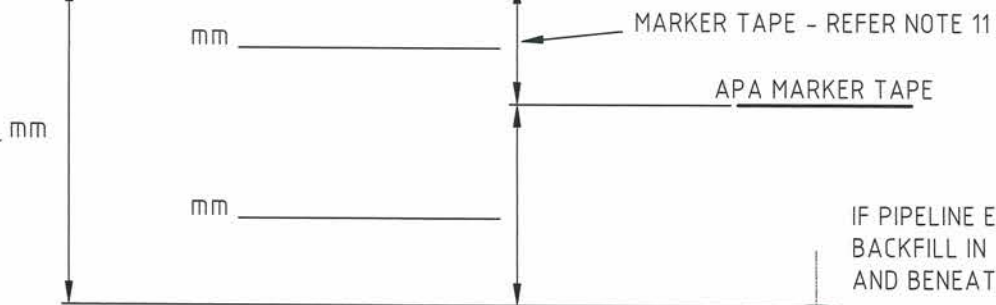
**GENERAL NOTES**

- ALL WORKS ON THE PIPELINE ARE TO ADHERE TO THE REQUIREMENTS OF:
1. APA'S PERMIT TO WORK INSTRUCTIONS AND DRAWING REQUIREMENTS
  2. AN APA REPRESENTATIVE (PIO) MUST BE ONSITE TO SUPERVISE ALL WORKS ON THE PIPELINE EASEMENT/CORRIDOR UNLESS OTHERWISE SPECIFIED BY APA.
  3. NO MECHANICAL DIGGING WITHIN 1 METER OF THE PIPELINE. HAND DIGGING ONLY.
  4. THE PIO WILL:
    - 4.1. CONDUCT AN ONSITE COMPULSORY INDUCTION FOR ALL PERSONNEL WORKING WITHIN THE PIPELINE EASEMENT / CORRIDOR
    - 4.2. MARK OUT THE PIPELINE CENTERLINE
    - 4.3. MARK OUT THE BOUNDARY OF THE PIPELINE EASEMENT/CORRIDOR
    - 4.4. ESTABLISH DEPTH OF COVER OVER PIPELINE AND VISUALLY LOCATE THE PIPE AT CROSSING POINT.
  5. SLABBING MUST BE INSTALLED ABOVE POWER CABLES FOR 3m EITHER SIDE OF PIPELINE WHERE PRACTICABLE, UNLESS ARMoured SHIELDED CABLE IS INSTALLED.
  6. CONCRETE SLAB TO BE CAST IN SITU OR PRECAST WHERE CAST IN SITU IS NOT PRACTICAL & LOCATED CENTRALLY OVER THE PIPELINE. CONCRETE TO COMPLY TO A.S. 3600-2009. MINIMUM COMPRESSIVE STRENGTH SHALL BE 25 MPa AT 28 DAYS.
  7. COMMUNICATION/POWER CABLES MUST BE INSTALLED IN A CONDUIT AND THE CONDUIT EXTEND TO FULL WIDTH OF THE EASEMENT. IF NO EASEMENT 3m EITHER SIDE OF PIPELINE WHERE PRACTICABLE.
  8. WHERE PRACTICABLE ALL SERVICES TO BE 90° TO THE APA PIPELINE AND HAVE A MARKER POST INSTALLED DIRECTLY OVER CROSSING POINT.
  9. METHOD STATEMENT FOR ALL COMPACTION OF BACKFILL IN THE VICINITY OF THE PIPELINE MUST BE APPROVED BY APA PRIOR TO COMMENCEMENT.
  10. ANY WORKS NOT IN ACCORDANCE WITH THESE GENERAL NOTES MUST BE APPROVED BY APA.
  11. WHERE PRACTICABLE, LOCATE MARKER TAPE APPROXIMATELY MIDWAY BETWEEN APA PIPELINE AND OTHER UTILITY ASSET.

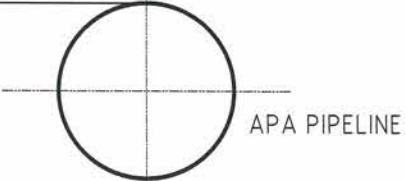


GROUND LEVEL

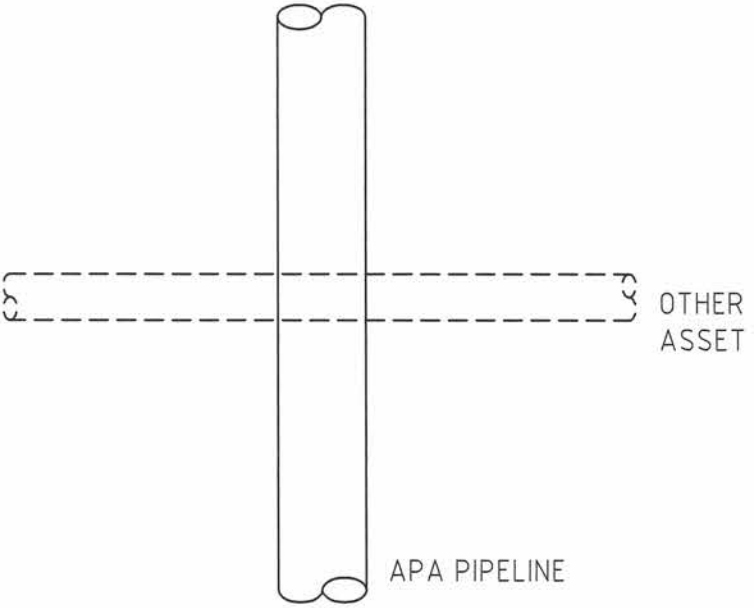
BACKFILLING MATERIAL REQUIREMENTS TO BE DETERMINED ON SITE BY APA



IF PIPELINE EXPOSED COMPACT SAND BACKFILL IN 150mm LAYERS ABOVE AND BENEATH APA PIPELINE



**ELEVATION**



**PLAN**

E:\Production\54\6338-DWG-L-1013-Asst-Locate-111011.dwg - Max: 0.00/2708 3:07:01 PM

REV	PROJ No	REVISION	DATE	DRW	DES	CHK	APP	REFERENCE DRGs	DRG No
0		ISSUED FOR USE	08/04/15	NL	CB	AJ	CB	MARKER TAPE	S13-8-4
								POST ASSEMBLY	S99-8-4
								INSTALLATION ASSEMBLY	S90-11-3
								WARNING PLATE	S90-12-3

**APA Group**

THIS DRAWING, AND THE INFORMATION AND DETAILS CONTAINED IN IT ARE CONFIDENTIAL AND ARE THE PROPERTY OF APA GROUP. ANY USE MUST BE AUTHORIZED BY APA GROUP.

NAME	DATE
DRAWN: N. LOW	30/01/15
DESIGNED: C. BONAR	08/04/15
VALIDATED: A. JONES	08/04/15
ACCEPTED: C. BONAR	08/04/15

SCALE: N.T.S.

PROJECT No: 530-DWG-L-1013

DRG No: 530-DWG-L-1013

REV: 0

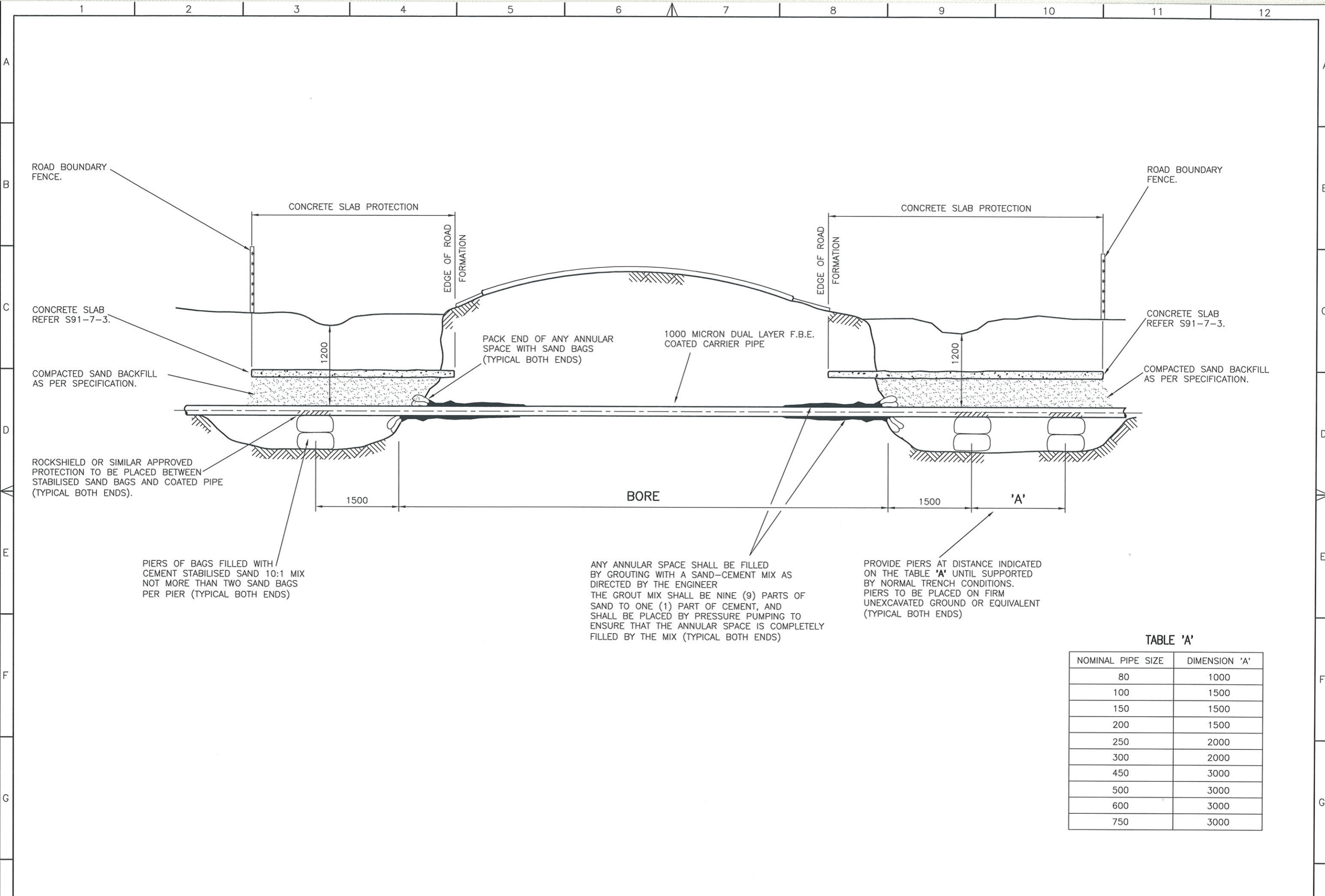


TABLE 'A'

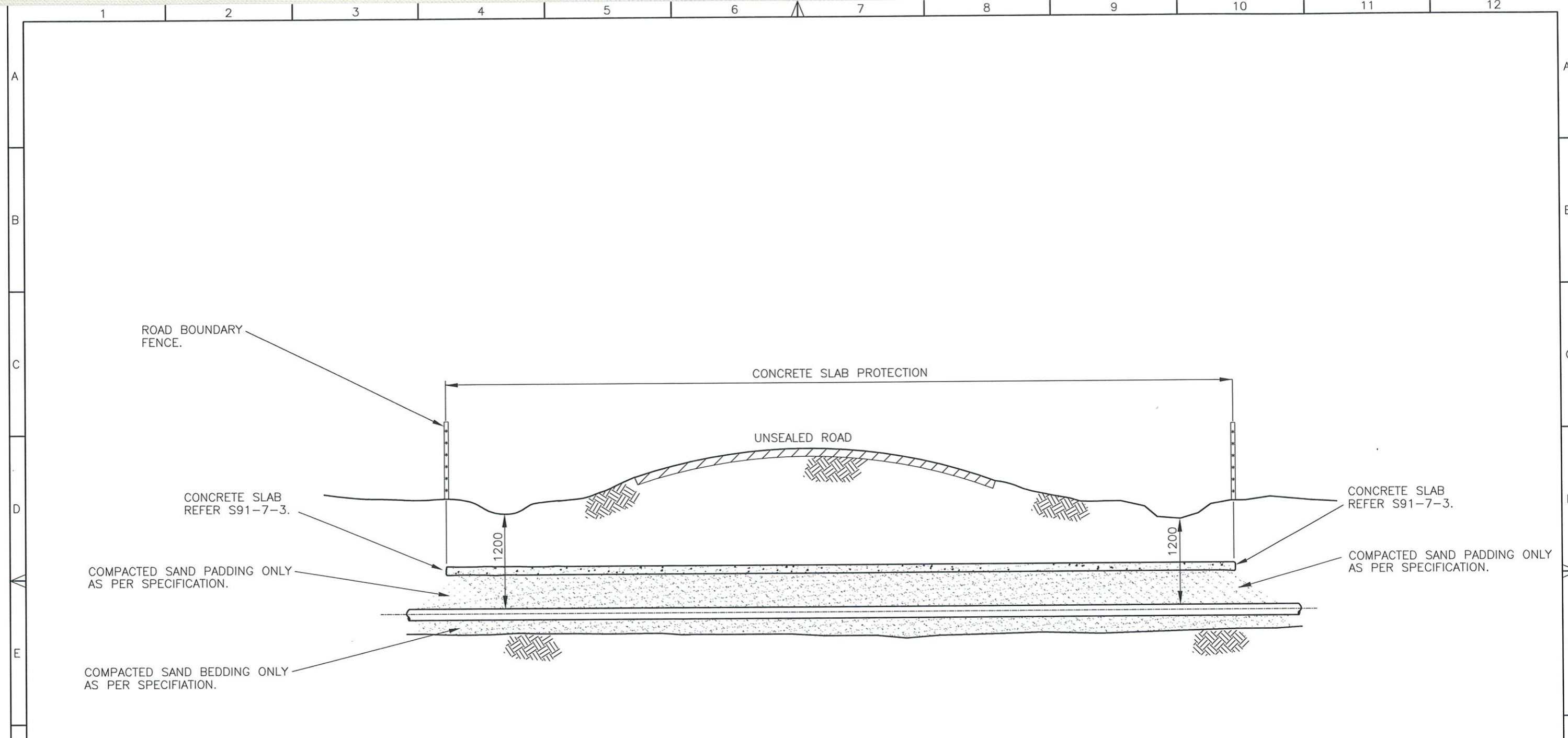
NOMINAL PIPE SIZE	DIMENSION 'A'
80	1000
100	1500
150	1500
200	1500
250	2000
300	2000
450	3000
500	3000
600	3000
750	3000

REV	REVISION	DATE	DRN.	CKD.	APP.	REFERENCE DRAWINGS	DRG.NO.
H	UPDATED TO APA TITLE BLOCK. CARRIER PIPE COATING	08/10/09	NL				
	AMENDED					CONCRETE SLAB	S91-7-3

**APA Group**

This drawing is confidential and the information and details contained in it are and remain the property of APA Group. ©Copyright in this drawing is owned by APA Group.

SHEET NO.	SCALE	N.T.S	PROJECT
LEVEL DATUM	FILENAME	S13-22-11	TITLE STANDARD ROAD CROSSING PROCEDURES
FIELD BOOK	DATE	OCT 96	DRAWN P.STEVIC
	CHECKED	D.V.	APPROVING ENGINEER C. BONAR
DESIGN ENGINEER	PROJECT NO.	DRAWING NO. S13-22-11	REV H



**BACKFILL REQUIREMENTS**  
 BACKFILL WITHIN ROAD RESERVE TO BE IN ACCORDANCE WITH THE RELEVANT CO ORDINATING ROAD AUTHORITIES CONSENT REQUIREMENTS. (REFER: ROAD MANAGEMENT ACT 2004)

REV	REVISION	DATE	DRN.	CKD.	APP.	REFERENCE DRAWINGS	DRG.NO.
D	UPDATED TO APA TITLE BLOCK	28/11/08	N.L.				
C	BACKFILL REQUIREMENTS NOTE AMENDED	2/11/06	R.C.	M.H.	C.B.		
B	GASNET LOGO INSERTED	9/11/01	RJA	R.C.	T.C.		
A	NOTE RE COMPACTED SAND PADDING & BEDDING AMENDED	6/11/98	J.W.	R.C.	T.C.	CONCRETE SLAB	S91-7-3

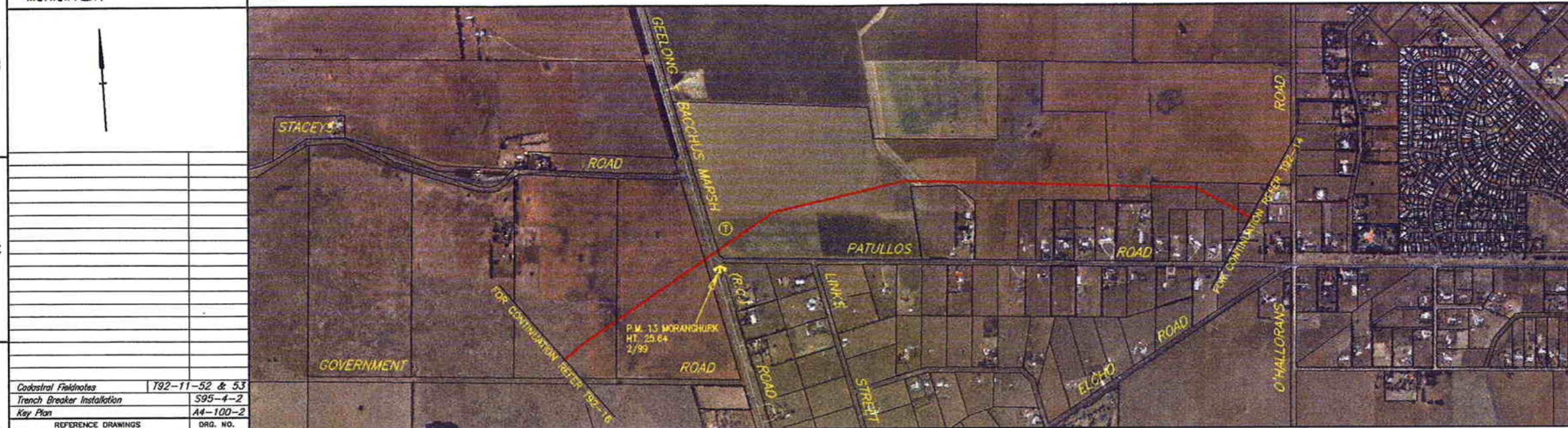
**APA Group**

This drawing is confidential and the information and details contained in it are and remain the property of APA Group. ©Copyright in this drawing is owned by APA Group.

SHEET NO.	SCALE	N.T.S
LEVEL DATUM	FILENAME	S13-22-12
FIELD BOOK	DATE	OCT. 96
	DRAWN	P. STEVIC
	CHECKED	
DESIGN ENGINEER	APPROVING ENGINEER	
	C. BONAR	

PROJECT		STANDARD PROCEDURES	
TITLE		ROAD CROSSING	
OPEN CUT INSTALLATION		G.A.	
PROJECT NO.	DRAWING NO.	REV	
	S13-22-12	D	

EASEMENT NUMBER	T92-7-109	T92-7-108	GOVT. ROAD	T92-7-107	T92-7-106	T92-7-105	T92-7-104	T92-7-103
PROPERTY OWNER	J. S. & A. TAINSH	JAMANLEA PTY. LTD.		S. J. L. SPALDING	C. W. WILKS	G. J. SPICE	K. P. & L. M. FITZPATRICK	R. SIWICKI
SUBDIVISION PLAN								
CROWN ALLOTMENT NO.	Pt. 157	156	GEELONG - BACCHUS MARSH (P.C.) ROAD	Lot 2 LP 339864X	Lot 1 LP 339864X	Lot 1 LP 206441M	Lot 5 LP 206441M	Lot 2 LP 210402Y
PARISH	MORANGHURK							MORANGHURK



Cadastral Fieldnotes	T92-11-52 & 53
Trench Breaker Installation	S95-4-2
Key Plan	A4-100-2
REFERENCE DRAWINGS	DRG. NO.

SPECIAL INSTALLATIONS	
PROGRESSIVE HORIZONTAL DISTANCE	
HORIZONTAL BENDS	
PIPE CENTRELINE NO. (peg)	
PIPE O.D. & W.T.	
DATE PIPELINE LAID	
LONGITUDINAL SECTION SHEET	

SPECIAL INSTALLATIONS	
PROGRESSIVE HORIZONTAL DISTANCE	
HORIZONTAL BENDS	
PIPE CENTRELINE NO. (peg)	
PIPE O.D. & W.T.	508.0mm O.D. 9.0mm W.T. 508.0mm O.D. 10.8mm W.T.
DATE PIPELINE LAID	FEBRUARY 1999 FEBRUARY 1999
LONGITUDINAL SECTION SHEET	T92-16-1 T92-15-1

NOTES:

- Weld numbers are prefixed with the letter C
- Test points are installed directly over the pipeline.

**SPECIFICATION FOR 500 NB STEEL PIPELINE**

**PIPE:** 508.0mm O.D. x 9.0mm and 10.8mm W.T. MANUFACTURED TO API STANDARD 5L GRADE X70 CONTRACT No. 98/0034

**COATING:** FUSION BONDED EPOXY CONTRACT No. 98/0041 WITH HEAT SHRINK SLEEVES APPLIED AT JOINTS TO T.P.A. STANDARD

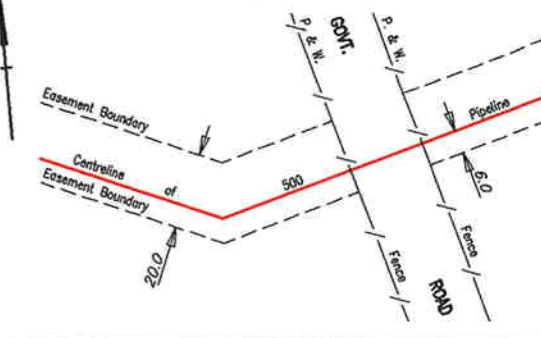
**FIELD WELDING AND BENDS:** AS 2885.2 - 1995 AND CONTRACT No. 98/0031

**HYDROSTATIC TESTING:**

TEST SECTION 1 (PHD 00 - 7365)  
AS 2885.1 - 1997 AND AS 1978 - 1987  
MAXIMUM STRENGTH TEST PRESSURE 23545 kPa.  
MINIMUM STRENGTH TEST PRESSURE 23253 kPa.  
MINIMUM LEAK TEST PRESSURE 14588 kPa.  
REFER CONTRACT No. 98/0031

TEST SECTION 2 (PHD 7365 - 17295)  
AS 2885.1 - 1997 AND AS 1978 - 1987  
MAXIMUM STRENGTH TEST PRESSURE 19600 kPa.  
MINIMUM STRENGTH TEST PRESSURE 18817 kPa.  
MINIMUM LEAK TEST PRESSURE 13414 kPa.  
REFER CONTRACT No. 98/0031

**PLACEMENT OF PIPELINE WITHIN EASEMENT**  
N.T.S.



**LEGEND**

- 2'31'L LEFT HAND HORIZONTAL BEND IN DIRECTION OF PROGRESSIVE HORIZONTAL DISTANCE
- 2'31'R RIGHT HAND HORIZONTAL BEND IN DIRECTION OF PROGRESSIVE HORIZONTAL DISTANCE
- M.B. MANUFACTURED BEND 8 DIA. RAD.
- ⊕ ENCASING ONLY TEST POINT
- Ⓢ ELECTROLYSIS TEST POINT (TYPE AS SPECIFIED)
- Ⓢ CURRENT MEASURING ELECTROLYSIS TEST POINT
- Ⓢ ANODE BED
- Ⓢ EARTHING BED
- ANCHOR CONCRETE
- VALVE
- Ⓢ TEMPORARY BENCH MARK (T.B.M.)
- Ⓢ PERMANENT MARK (P.M.)
- CONCRETE COATING
- CONCRETE SLABBING
- ..... DOUBLE COATED PIPE
- FENCE / CADASTRAL BOUNDARY

REV	REVISION	DATE	DRN.	CKD.	APP.

SHEET NO.	SCALE	AS SHOWN	PROJECT
LEVEL DATUM	A.H.D.	FILENAME	T92-15
FIELD BOOK	DATE	3/4/99	TITLE
576 p26-33	DRAWN	M.H.	500 LARA - IONA TRANSMISSION PIPELINE ROUTE PLAN
DESIGN ENGINEER	CHECKED	RC	PROJECT NO.
	APPROVING ENGINEER	<i>[Signature]</i>	R

DRAWING NO.	REV
T92-15	



EASEMENT NUMBER	T92-7-118	T92-7-117	T92-7-116	T92-7-115	T92-7-114	T92-7-113	T92-7-112	T92-7-111	T92-7-110	T92-7-109
PROPERTY OWNER	P. G. W. J. & J. A. BAKER	G. A. & J. L. BAKER	R. R. & J. F. EVANS & S. M. BROWN	N. J. SPITTY	APRIGO PTY LTD	M. G. SARGEANT	C. SARGEANT	P. R. & M. D. JAMES	BANMAN PTY LTD	J. S. & A. TAINSH
SUBDIVISION PLAN										
CROWN ALLOTMENT NO.	Lot 2 LP 129037	Lot 1 LP 81454	10	CP. 106	Lot 2 LP 344243D	Lot 7 LP 52192	Lot 6 LP 52192	142	Lot 1 LP 93256	Pt. 157 MORANGHURK
PARISH	YOWANG	YOWANG	MORANGHURK	MORANGHURK						MORANGHURK
MUNICIPALITY	CITY OF GREATER GEELONG									

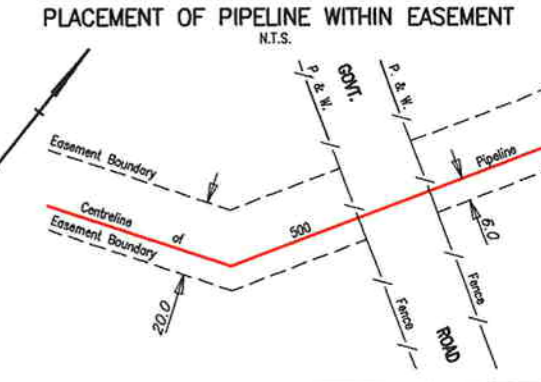
**SPECIFICATION FOR 500 NB STEEL PIPELINE**

- PIPE:** 508.0mm O.D. x 9.0mm and 10.8mm W.T. MANUFACTURED TO API STANDARD 5L GRADE X70 CONTRACT No. 98/0034
- COATING:** FUSION BONDED EPOXY CONTRACT No. 98/0041 WITH HEAT SHRINK SLEEVES APPLIED AT JOINTS TO T.P.A. STANDARD
- FIELD WELDING AND BENDS:** AS 2885.2 - 1995 AND CONTRACT No. 98/0031
- HYDROSTATIC TESTING:** TEST SECTION 2 (PHD 7365 - 17295) AS 2885.1 - 1997 AND AS 1978 - 1987 MAXIMUM STRENGTH TEST PRESSURE 19600 kPa. MINIMUM STRENGTH TEST PRESSURE 18817 kPa. MINIMUM LEAK TEST PRESSURE 13414 kPa. REFER CONTRACT No. 98/0031



Cadastral Fieldnotes	T92-11-53, 54 & 55
Trench Breaker Installation	S95-4-2
Key Plan	A4-100-2
REFERENCE DRAWINGS	DRG. NO.

SPECIAL INSTALLATIONS	
PROGRESSIVE HORIZONTAL DISTANCE	
HORIZONTAL BENDS	
PIPE CENTRELINE NO. (peg)	
PIPE O.D. & W.T.	
DATE PIPELINE LAID	
LONGITUDINAL SECTION SHEET	

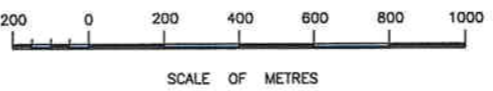


SPECIAL INSTALLATIONS	
PROGRESSIVE HORIZONTAL DISTANCE	14/2 Fence 12466.4 14/1 Fence 12401.7 14/0 Fence 12356.6 13/10 Fence 12205.1 13/8 Fence 12184.1 13/7 Fence 12178.1 13/5 Fence 11789.3 13/4 Fence 11756.3 13/3 Fence 11688.0 13/2 Fence 11661.8 13/0 Fence 10968.7 11/47R Fence 10963.0 Fence 10683.3 Fence 10599.2 Fence 10192.7 Fence 10039.7 12/3 Fence 9389.1 12/2 Fence 9376.7 12/1 Fence 9364.7 Fence 9088.2 4508.2 M.B. 11/0 Fence 8816.7 22/07R 8764.4 Fence 8737.6 8728.5 10/3 Fence 8154.1 Road Bdy. 8123.8
HORIZONTAL BENDS	
PIPE CENTRELINE NO. (peg)	
PIPE O.D. & W.T.	508.0mm O.D. [10.8] 10.8 9.0mm W.T. [10.8] 508.0mm O.D. [10.8] 9.0mm W.T. [10.8]
DATE PIPELINE LAID	FEBRUARY 1999 FEBRUARY 1999
LONGITUDINAL SECTION SHEET	T92-17-1 T92-16-3 T92-16-2 T92-16-1

**LEGEND**

- 2'31'L LEFT HAND HORIZONTAL BEND IN DIRECTION OF PROGRESSIVE HORIZONTAL DISTANCE
- 2'31'R RIGHT HAND HORIZONTAL BEND IN DIRECTION OF PROGRESSIVE HORIZONTAL DISTANCE
- M.B. MANUFACTURED BEND B DIA. RAD.
- (T) ENCASING ONLY TEST POINT
- (T) ELECTROLYSIS TEST POINT (TYPE AS SPECIFIED)
- (C) CURRENT MEASURING ELECTROLYSIS TEST POINT
- (A) ANODE BED
- (E) EARTHING BED
- ANCHOR CONCRETE
- VALVE
- TEMPORARY BENCH MARK (T.B.M.)
- PERMANENT MARK (P.M.)
- CONCRETE COATING
- CONCRETE SLABBING
- DOUBLE COATED PIPE
- FENCE / CADASTRAL BOUNDARY
- ARCHAEOLOGICALLY SENSITIVE ABORIGINAL AREA NOTICE MUST BE GIVEN TO THE WATHAURONG ABORIGINAL PEOPLE PRIOR TO EXCAVATION IN THIS VICINITY

- NOTES:**
- Weld numbers are prefixed with the letter D
  - Test points are installed directly over the pipeline.

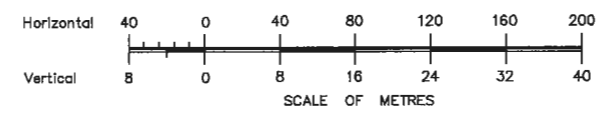
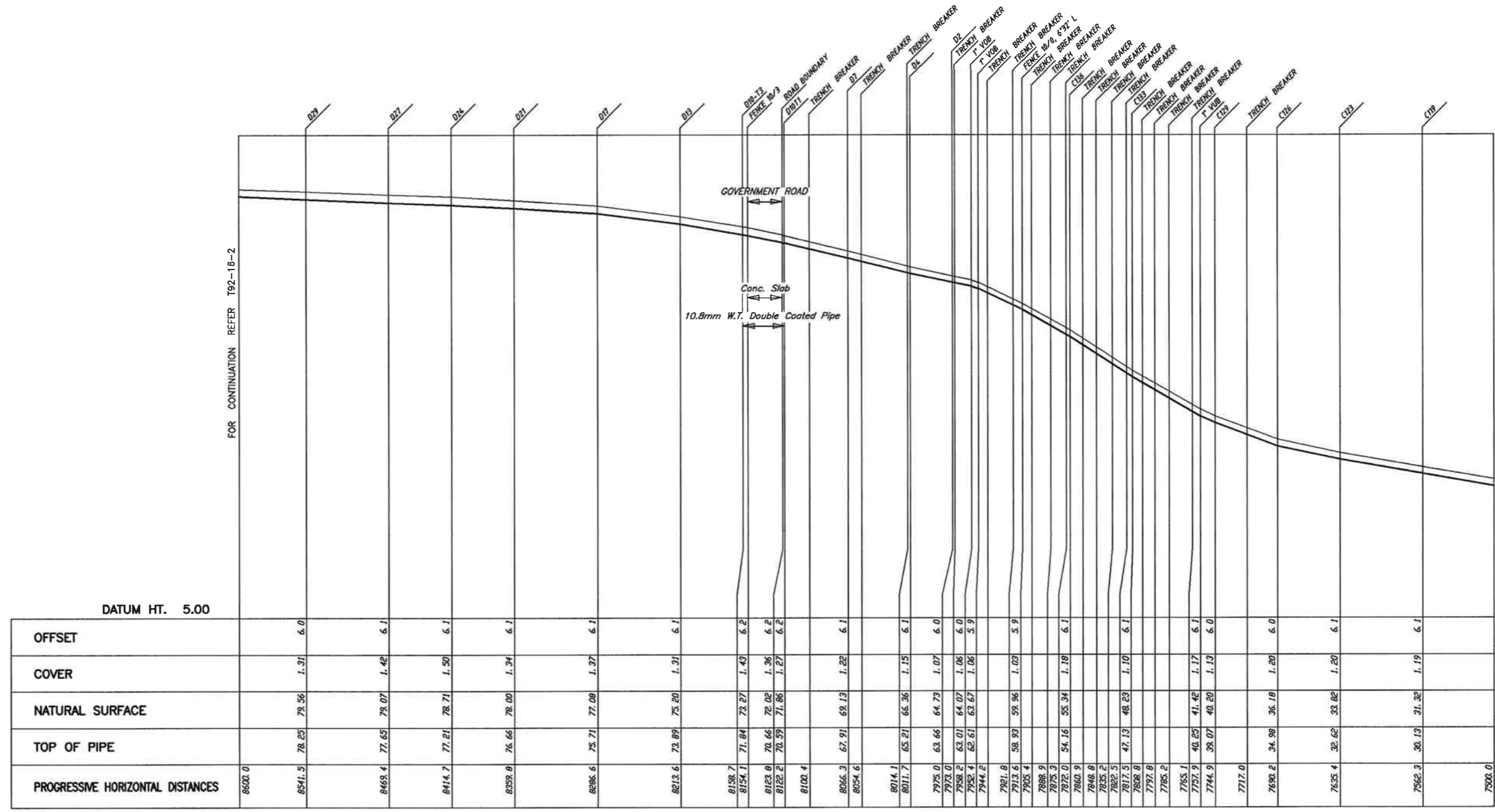


REV	DESCRIPTION	DATE	DRN.	CKD.	APP.
A	ARCHAEOLOGICALLY SENSITIVE AREA ADDED	2/5/00	R.C.	RF	76

GPU GasNet Pty Ltd ACN 083 009 278

SHEET NO.	SCALE AS SHOWN	PROJECT	SOUTH WEST PIPELINE		
LEVEL DATUM A.H.D.	FILENAME T92-16	TITLE	500 LARA - IONA TRANSMISSION PIPELINE ROUTE PLAN		
FIELD BOOK 576 p33-53	DATE 3/4/99	PROJECT NO.	R	DRAWING NO. T92-16	REV A
DESIGN ENGINEER	CHECKED R.C.	APPROVING ENGINEER TOM CARROLL			

A  
B  
C  
D  
E  
F  
G  
H



REV	REVISION	DATE	DRN.	CKD.	APP.	REFERENCE DRAWINGS	DRG.NO.
						Trench Breaker Installation	S95-4-2
						Route Plans	T92-15 & 16



SHEET NO.	SCALE AS SHOWN	PROJECT	SOUTH WEST PIPELINE	
LEVEL DATUM	A.H.D.	FILENAME	T92-16-1	
FIELD BOOK	DATE	DRAWN	14/5/99	
576 p32-35	CHECKED	APPROVING ENGINEER	M.H.	
	DESIGN ENGINEER		R	
		PROJECT NO.	DRAWING NO. T92-16-1	
			REV	



