Delphi Risk Management Consulting

Parwan Employment Precinct
Moorabool Vic

AS 2885.6 Safety Management Study
Workshop & Report

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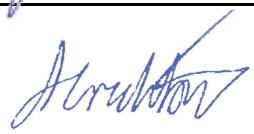
Approved By:	Adam Crichton Team Lead, Risk and Engineering Services Engineering & Planning APA Group	Signature:	
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1. ABBREVIATIONS

ALARP	As Low As Reasonably Practicable
APA	APA Group (Pipeline Licensee)
AS	Australian Standard
CIC	Common Infrastructure Corridor
CDL	Critical Defect Length (mm) is a hole size where a pipeline is likely to rupture
CMP	Construction Management Plan
CTE	Coal Tar Enamel
DET	Department of Education & Training
DRMC	Delphi Risk Management Consulting – SMS Facilitator
DN	Diameter nominal
EPC	Engineering Procurement Construction
FEED	Front end engineering design
FJC	Field Joint Coating
GIS	Geographical Information System
GWW	Greater Western Water
HDD	Horizontal Directional Drill (used for installation of utilities under existing assets)
km	Kilometre(s)
KP	Kilometre Point
LC	Location Class
LOPA	Layers of Protection Analysis
m	Metre(s)
MAOP	Maximum Allowable Operating Pressure
ML	Measurement Length (4.7 kW/m2 radiation contour in the event of a full-bore rupture of the pipeline)
MLV	Main Line Valve
MSC	Moorabool Shire Council
MW	Melbourne Water
OPP	Overpressure Protection
O&M	Operations and Maintenance
PEP	Parwan Employment Precinct
PIMP	Pipeline Integrity Management Plan
PL	Pipeline License
PPC	Primary Pressure Control
ROW	Right of Way
SLC	Secondary Location Class
SMS	Safety Management Study
SMYS	Specified Minimum Yield Stress
SPC	Secondary pressure Control
Standard	Australian Standard AS2885 for Pipelines-Gas & Liquid Petroleum Pipelines
TOR	Terms of Reference
VPA	Victorian Planning Authority
WT	Wall Thickness
YVW	Yarra Valley Water

2. EXECUTIVE SUMMARY

2.1 Background

Delphi Risk Management Consulting (DRMC) is pleased to support the Victorian Planning Authority (VPA) in facilitating a Safety Management Study for the new Parwan Employment Precinct (PEP) in the Moorabool Shire Council (MSC) area, some 60km west of Melbourne.

The proposed PEP is positioned immediately over an existing APA Group Transmission Pressure Gas Pipeline (Brooklyn-Ballan Transmission Pressure (TP) Gas Pipeline (T56, PL78)) which, under the Australian Standard for TP Gas Pipelines (AS2885) requires the risks associated with construction of the PEP and future operation and maintenance of the pipeline be assessed and suitably mitigated before the development proceeds.

To comply with Australian Standard AS/NZS 2885.1:2018, any Development works in the immediate vicinity of a Transmission Pressure Gas Pipeline licensed under AS2885 in Australia must be subjected to a Safety Management Study (SMS) to review all possible threats to the safe operation and maintenance of the pipeline and ensure that any threats that cannot be mitigated by design or procedures are risk assessed and confirmed to be As Low As Reasonably Practical.

Mark Harris from Delphi Risk Management Consulting was engaged by the VPA and their consultants SMEC and Urban Design & Management (collectively the Client) to facilitate an SMS Workshop for this Development.

This SMS Report captures the findings of the “Land Use Change” (AS2885.6 Table 5.1) SMS Workshop held on the 7th of July 2023. The Development provided for review at the SMS Workshop was a DRAFT, sufficient to allow the Workshop to assess all likely risks. The findings from this SMS Report will provide direction to the Client with respect to pipeline licensee approvals and works over and adjacent to the pipeline as the development proceeds.

2.2 Key Findings

The proposed Development land use within the pipeline Measurement Length (ML, 171m) does not include any “Sensitive Use” facilities.

The existing PL78 Brooklyn to Ballan Transmission Pressure Pipeline currently services up to 3000 customers in Ballan with anticipated future growth up to 9000 customers so supply consequences were based on this information when undertaking the risk assessment.

The results of the 42 Threats specifically considered can be summarised as follows: -

Table 1, Risk Assessment Summary

Pipeline	Threats Considered	Threats		Threats Requiring Risk Assessment	Risk Assessment		
		Non-Credible	Credible		Negligible	Low	Intermediate
PL78	42	8	34	8	-	7	1

The workshop results were recorded in the minutes, provided in Appendix H.

2.3 Actions

There were 10 Actions identified during the SMS Workshop and listed in the table below.

Miscellaneous Actions				
No.	**Issue**	**Action**	**By**	**Due Date**
A1	SMS findings not translated into planning docs leading to variations and disruption of construction works	VPA & Council to ensure all requirements from SMS are incorporated into the relevant VPA Documentation and MSC planning scheme.	VPA / Council	Prior to issue of planning permits and planning work within project

A2	Construction of the Development could damage the pipelines	Developer to prepare a Construction Management Plan as per permit condition to the satisfaction of the responsibility authority. Review and comment will be sought by MSC to APA (pipeline licensee) as part of the planning application.	Developer/ APA/ Council	Prior to works starting
A3	Contractors may not be familiar with working around TP Gas Pipelines	Engage in a –Third Party Works - Safety Awareness Session, either as a toolbox or zoom meeting for contractors undertaking building and works nearby the pipeline.	Developer/ APA	Prior to works starting
Threat Specific Actions				
No.	**Issue**	**Action**	**By**	**Due Date**
ID11	Vibration from works damages the coating leading to corrosion and failure of the pipe	Developer to identify in the CMP if piling is required as part of the development. CMP will be reviewed by APA prior to construction commencing. (Note due to CTE coating of pipeline max allowable vibration at pipeline is 10mm/s.)	Developer/ Council	Prior to construction
ID12	Gouge to pipe or holing or rupturing the pipeline.	Developer not to propose any buildings or structures on the pipeline easement. (Identifiable from construction plans). Council as responsibility authority, to implement this and ensure timely referrals are made to APA.	Developer/ Council/ APA	Prior to construction
ID15	Pipe impacted during utility installation resulting in damage or a hole causing loss of containment. Hole is less than critical defect length or max credible hole size (whichever is the smaller) Maximum credible hole size for a 30T excavator 70mm hole leading to a ML 98m.	APA to provide Std crossing designs for Developer reference. Future crossing designs to comply with APA minimum standard crossing requirements Should MW deem a waterway or pipe/relevant infrastructure to affect the pipeline is necessary, they will engage with APA.	APA/ Developer/ Council	Detailed Design
ID18	Over stressing the pipe resulting in pipe deformation (out of round), which could require reducing the MAOP or replacement of a section to allow for future integrity works. Potential loss of supply.	Pipeline to be recoated and slabbed as part of APA's Std Design if any new crossing designs are required	Developer/ Council/ DTP	Detailed Design
ID23	CP is damaged or compromised during works resulting in long term corrosion potential leading to leak only	CMP to include identification of all CP assets and provide appropriate protection during construction	APA/ Developer/ Council	Prior to construction
ID24	CP is damaged or compromised by local electrical currents causing localised long term corrosion potential leading to leak only	Design/utility plans to include identification of proposed Transformers and or HV power supplies near pipeline easement for APA review and approval	APA/ Developer/ Council	Detailed Design
ID33	APA cannot access easement/meter/reg assets due to new development	Access to City Gate must be maintained at all times during the develop construction. Requirement to be included in CMP	Developer/ Council	Prior to construction

2.4 Outcomes

The SMS undertaken is considered to be a Land Use Change SMS. All actions raised at the SMS will need to be closed out to the satisfaction of APA, AusNet and all other authorities prior to any works commencing.

Continued liaison between the Client, Third Party Utilities, APA and AusNet should ensure that construction activities and post construction activities pose no significant increase in the operational and maintenance risk to the transmission pipeline running past the Development.

Upon satisfactory close out of the actions raised from this SMS Workshop, it can be confirmed that the requirements of AS2885.6-2018 are met and that the APA and AusNet assets under review will continue to be in compliance with the SMS requirements of AS2885.6-2018 in the Parwan Employment Precinct.

3. INTRODUCTION

3.1 PARWAN EMPLOYMENT PRECINCT

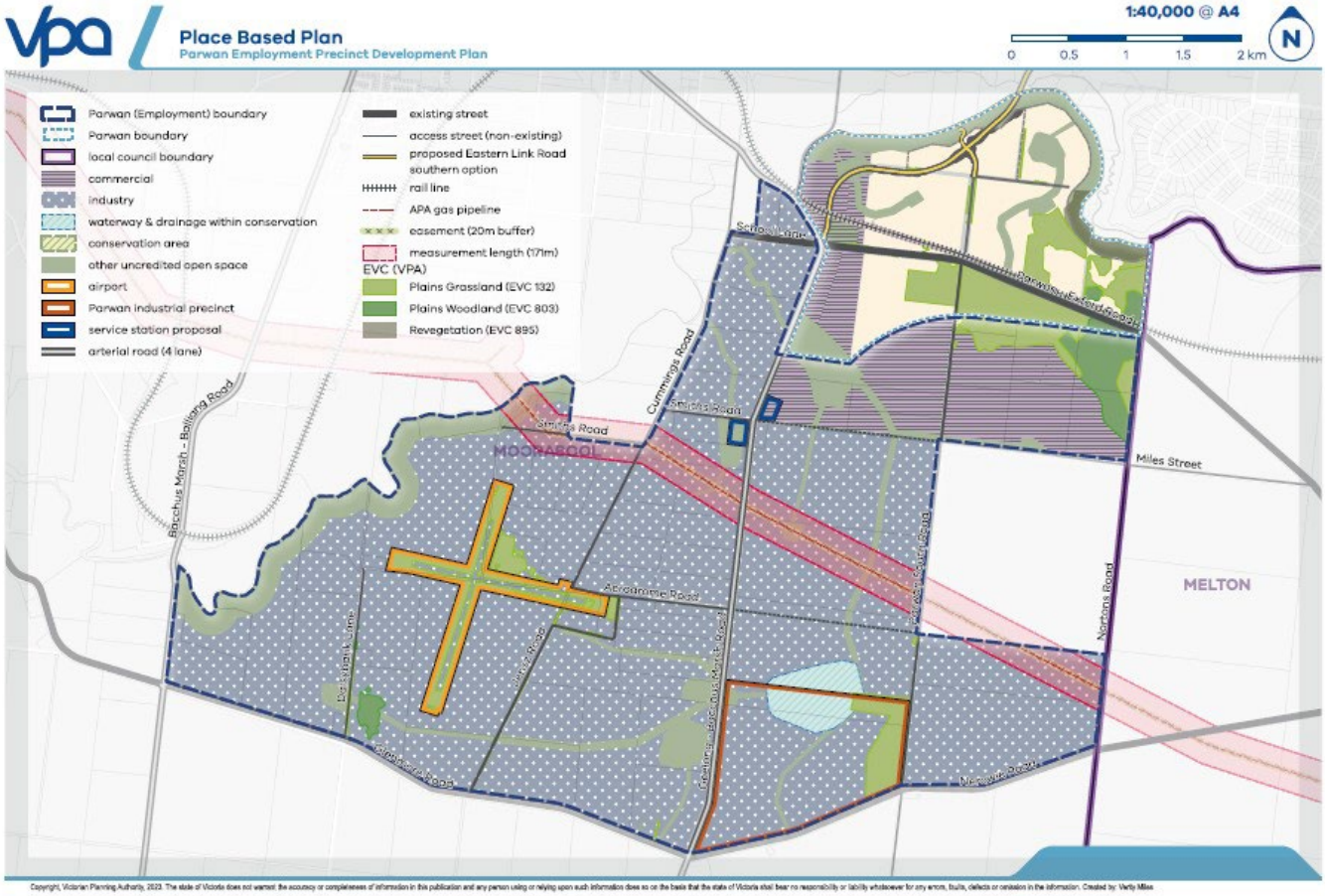
The Victorian Planning Authority (VPA) is currently developing the new Parwan Employment Precinct (PEP) in the Moorabool Shire Council (MSC) area. The proposed PEP is positioned immediately over an existing APA Group Transmission Pressure Gas Pipeline which runs roughly east to west across the middle of the PEP. The VPA provided a PowerPoint presentation at the beginning of the SMS Workshop, refer to Appendix A.

The PEP is an area of approximately 2,480ha, incorporating over 80 separate properties (including the existing Bacchus Marsh aerodrome) and is intended for employment only uses. Much of the land within the precinct is currently used for agriculture and rural residential uses, with a limited range of commercial, recreation and utility use.

The precinct does have Maddingley Brown Coal facilities to the North and Bacchus March Western Water Treatment Facility to the East of the PEP.

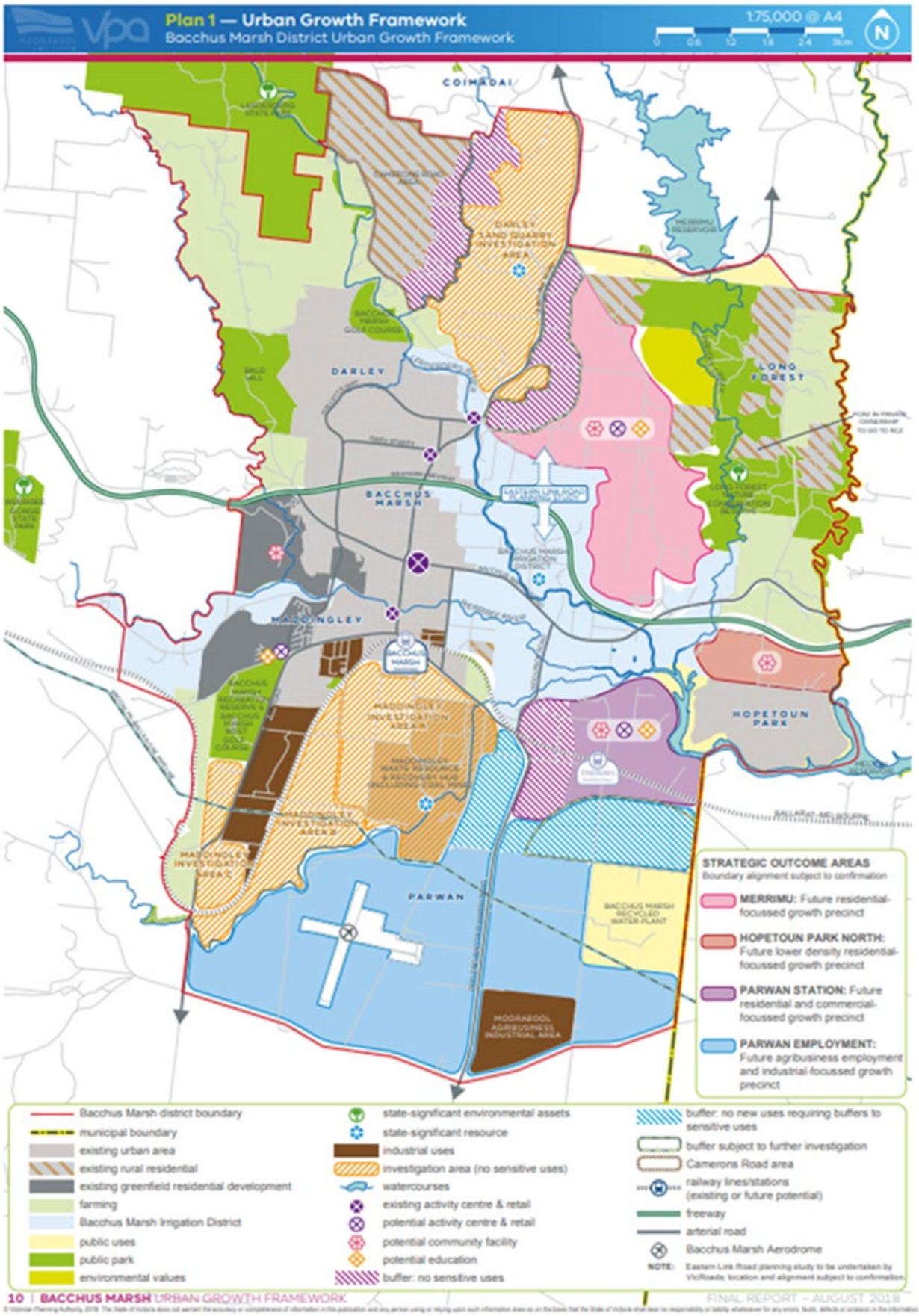
The subject land is encapsulated by the thick blue dashed line on the image below.

Figure 1, Parwan Employment Precinct, APA Pipeline ML "pink" corridor



Note: - Pink corridor is 420m wide representing the pipeline Heat Radiation Contour which recognises a 210m ML either side of the pipeline. (Note: - actual ML is 171m so corridor can be reduced to 342m wide)

Figure 2, Parwan Employment Precinct PEP and location of APA Pipeline



3.2 GAS TRANSMISSION INFRASTRUCTURE

The APA Group has advised that the following asset is impacted by the proposed development:

Table 2, Pipeline Details

Pipeline	Pipeline Licence	Easement Width (m)	Pipeline Easement Location	Diameter (mm)	Measurement Length (m)
Brooklyn-Ballan	T56, PL78	20.1	4.57m from South side	219	171
	Note: Measurement Length is applied to either side of the pipeline				

There are no other known pipeline assets affected by the Development proposed.

There is also a new Gas City Gate immediately south of the Western Water Treatment Plant (see square yellow box in image below).

The APA pipeline was built in 1972 and will continue operating for another 30-40 years so it is important to consider the implications for the safe operation and maintenance of the pipeline during construction and for the remaining life of the pipeline.

The proposed development will be deemed as an Industrial development with several road and utility crossings of the pipeline, but no intended sensitive uses within the Measurement Length of the Pipeline.

There is currently no specific design information about any water, sewer, road, or utility crossings of the pipeline. APA has standard crossing designs which will need to be adhered to unless a separate, bespoke design is required. Any crossing designs should be presented to the SMS Workshop for review if possible, however if not available then it will become an action for APA to review and approve any bespoke crossing designs.

The SMS Workshop assessed the consequences, likelihoods, and overall risks to the pipeline during construction of the development and throughout the remaining life of the pipeline. The SMS Workshop sought to confirm what, if any, new mitigations will be required to ensure the future risks to the pipeline and the population nearby are ALARP.

4. WORKSHOP PARTICIPANTS

The Safety Management Study Workshop was held on the 7th of July 2023. As the SMS Workshop was undertaken over the internet using Microsoft Teams it was not possible to record a written and signed attendance sheet.

The Workshop was attended by a range of qualified people comprising representatives from the Licensees (APA Group), City Gate Licensee (AusNet), and the Client. The group included sufficient disciplines, knowledge, and experience to provide confidence that the output of the workshop is soundly based.

The nominated attendees for the workshop are listed below.

Table 3, Participants

Name	Position	Organisation
Mark Harris	Facilitator	DRMC
Damien Tran	Strategic Planner	VPA
Jeff Tait	Strategic urban and regional planner	VPA
Monique So	Infrastructure Engineer	VPA
Zack Ilic	Engineering Manager	Downer
Arun Premraj	Gas Field Engineer	Ausnet Services
Sam Pitruzzello	Principal Gas Engineer - Network Operations	Ausnet Services
Glenn Ogilvie	Pipeline Risk Engineer	APA Group

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5. APPROACH AND METHODOLOGY

5.1 Approach

The Australian Standard AS 2885.1–2018 & AS2885.6-2018 describes the requirements for pipeline SMS including:

- Threat identification.
- Application of physical, procedural and design controls for each credible threat.
- Review of threat control; and
- Assessment of residual risk from failure threats.

The SMS process focuses on eliminating threats to pipeline integrity from location specific and non-location specific activities, present and future, and conditions foreseeable, including likely land use, during the pipeline operational phase. Where failures are assessed as possible after the application of control measures, risk assessment is undertaken for the relevant threat, and it must be demonstrated that the risks are ‘as low as reasonably practicable’ (ALARP).

5.2 Methodology

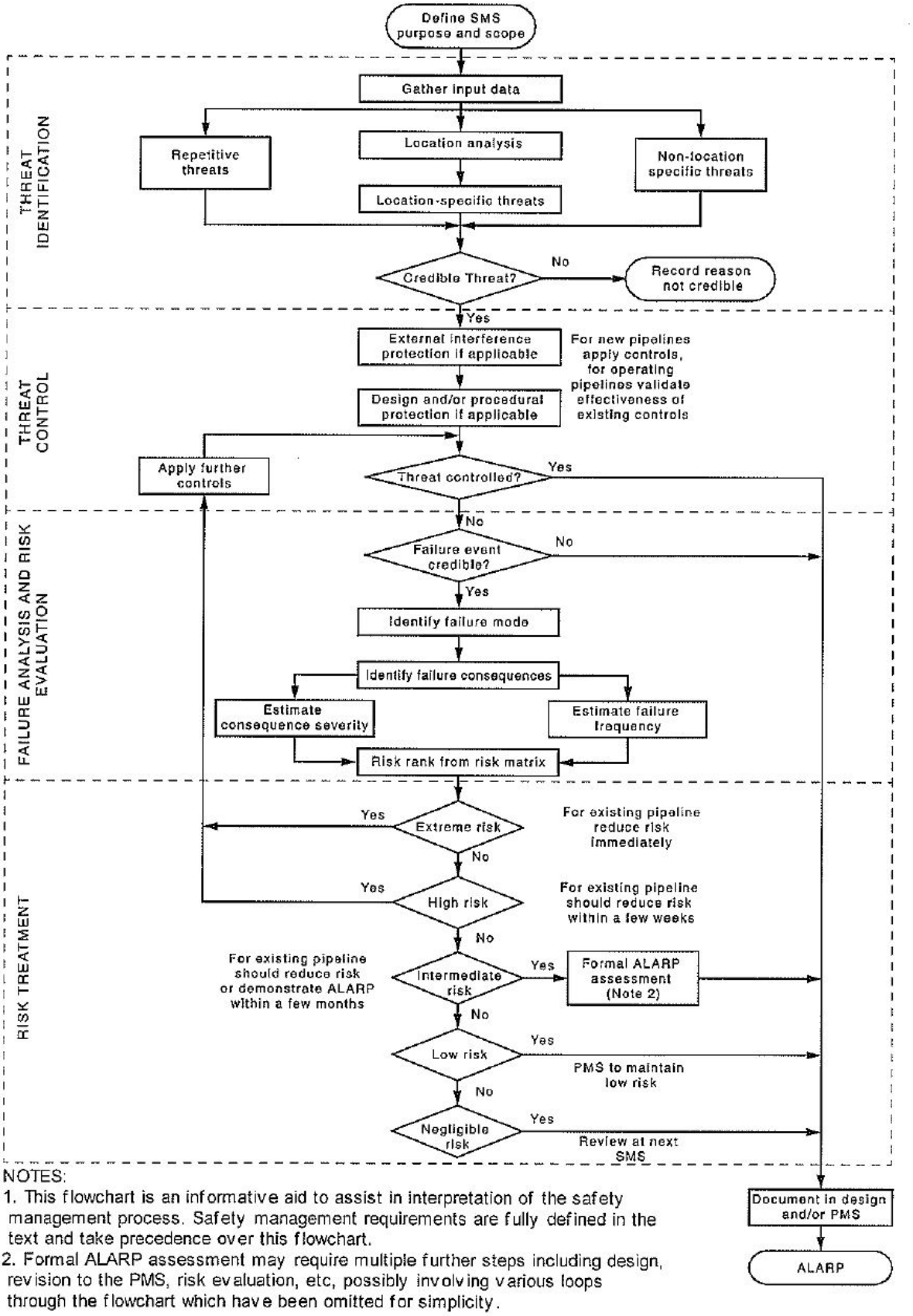
Prior to the SMS workshop being convened, APA, AusNet and the Client teams prepared a range of relevant information to be presented to the workshop.

All threats developed prior to the SMS workshop were documented in a spreadsheet and to the workshop. Changes or additions to the threats and risk mitigations were recorded directly into the spreadsheet. Additional actions not related to particular threats were also recorded.

A copy of the Parwan Employment Precinct was available to the workshop electronically as were all other documents referenced in the TOR Document.

The SMS study is based on the risk assessment process defined in AS 2885.6–2018 and in particular the Flowchart presented in the Standard and referenced below.

Figure 3 - AS2885.6 Risk Assessment Process



5.3 Location Classification

The AS 2885.6 – 2018 definition of Location Class is “The classification of an area according to its general geographic and demographic characteristics, reflecting both the threats to the pipeline from the land usage and the consequences for the population, should the pipeline suffer a loss of containment”. For the selection of location class, the area along the pipeline route and the surrounding land uses are considered.

Classification of locations is defined in AS 2885.6-2018, Section 2.2.

The primary location class reflects the population density of the area. It is defined based on an analysis of the predominant land use in the broad area traversed by the pipeline/s. There are four primary location classes to select from, as described in, Appendix B. One or more secondary location classes, reflecting special uses, may also apply to an area, as described in, Appendix B. Changes in location class occur when there are changes in land use planning along the route of existing pipelines.

Where this occurs a safety assessment (SMS) shall be undertaken, and additional control measures implemented until it is demonstrated that the risk from loss of containment involving a rupture is As Low As Reasonably Practical “ALARP”.

The assessment shall include analysis of at least the alternatives of the following:

a) MAOP reduction.
b) Pipe replacement (with no rupture pipe).
c) Pipeline relocation.
d) Modification of land use; and
e) Implementing physical and procedural protection measures that are effective in controlling threats capable of causing rupture of the pipeline.

5.4 Threat Identification

The threat identification process seeks to list all location specific and non-location specific threats with the potential to:

- Damage any of the pipelines.
- Cause interruption to service for any of the pipelines.
- Cause release of fluid from any of the pipelines; or
- Cause harm to pipeline operators, the public or the environment.

Prompts are used to aid the team, drawn from the Standard, and include the most commonly identified threats for gas and liquid petroleum pipelines. The threat prompts are provided in Appendix C.

Threats determined to be non-credible are documented, along with the reasoning.

5.5 Threat Control

For each credible threat identified in the previous step, effective controls are listed. Controls are considered effective when failure as a result of that threat has been removed for all practical purposes.

For external interference threats, physical and procedural controls are required, and the minimum number of effective controls required for a threat depends on the location class, as shown in, Appendix C. The categories of physical and procedural are also displayed in Appendix C.

For all other threats, design and/or procedures are required.

To assist in the analysis and in determining if controls are effective (e.g., pipeline wall thickness), pipeline calculations can be completed. The pipeline calculations establish:

- The maximum excavator size and teeth that can be used during construction to ensure the pipelines are not compromised; and

- Radiation contours (distances) of interest for full bore rupture incidents

A radiation of 4.7 kW/m2 will cause injury (at least second-degree burns) after 30 seconds exposure. Therefore, for example, it is preferred that there are no sensitive groups located within range of a pipeline's 4.7 kW/m2 measurement length as these population groups may be unable to be evacuated or to seek shelter.

5.6 Residual Threats Risk Assessment

For threats where failure is still possible despite the control measures, and no further threat controls can be applied, an assessment of the residual risk is undertaken. This is completed by:

- Assessment of the severity of the consequence of a failure event
- Analysis of the frequency of occurrence of the failure event and
- Risk ranking

The results of the risk ranking determine the required treatment action for the threat. Refer to the Risk Matrix in Appendix D.

If the risk of a particular threat cannot be considered to be low or negligible according to recognised industry risk matrix then further investigation of the threat will take place to confirm that the risk is "As Low As Reasonably Practical" (ALARP).

At the end of the Workshop, participants will be required to form an opinion on the quality of the SMS presented for review, and to reach a conclusion as to whether the SMS satisfies the requirements of AS 2885.6.

Actions noted in the minutes during the course of the SMS workshop will fall into two general categories, those requiring close out before the change in land use can proceed and those that will form part of the future Pipeline Integrity Management Plan (PIMP) or equivalent.

An SMS Report (this report) is produced following the workshop to capture proceedings of the workshop and highlight key decisions or issues. It will also contain all the threats and their associated mitigations and/or agreed actions.

5.7 Specific Approach for this Study

Under AS2885, the pipeline under consideration for this study has its own existing pipeline SMS database which covers the existing known threats and controls for the pipeline based on the existing land use for the development site.

The focus of this study is to ensure the safe operation and maintenance of the pipeline under AS2885 when considering the potential new threats or changes to existing threats resulting from construction of, and long-term presence of, the Parwan Employment Precinct proposed at this SMS Workshop.

6. AS 2885 LAND USE REQUIREMENTS

6.1 AS 2885.6 – Pipeline Safety Management

AS 2885.6 2018 is the Australian Standard that governs the management of safety & risk around and associated with petroleum pipelines, including transmission pressure (>1050kPag) natural gas pipelines. Within the Standard there are four Primary zones discussed, ranging from R1 – relatively remote, undeveloped land, through R2 (rural residential), and T1 (typical suburban development) to T2, which is intense multi-storey or CBD areas. There are also Secondary zones defined that categorise land use into heavy industrial (HI) or light industrial (I), common infrastructure corridor (CIC), crowds (C), or Sensitive (S) use. A copy of Section 2 of AS2885.6 is included in Appendix B of this document for reference.

Table 4, Pipeline Location Class Details

		Current Location Class		Proposed Location Class			
Pipeline Licensee	**Pipeline Licence**	**Primary Location Class**	**Secondary Location Class**	**Primary Location Class**	**Secondary Location Class**	**KP point (km)**	**Reason for change**
APA	PL78 (Route Plan T56)	R1	-	R1	I	KP33.85 to KP39.70 plus ML each end	Change in land use within ML
AusNet	N/A	R1	-	R1	I	KP34.97	Change in land use within ML

A fundamental principle of AS2885.6 is that pipeline safety management and safe operation are on-going imperatives during the life of the pipeline and must be actively supported and documented by the pipeline licensee. This places on-going obligations on a pipeline licensee to operate and maintain robust systems, plans and procedures during the pipeline's operational phase.

A review of any transmission pressure gas pipeline is undertaken as a minimum every 5 years under AS2885 but is also triggered under the standard if there is a change in the design or operation of the pipeline or a change in land use within the Measurement Length of the pipeline that increases the likelihood or consequences of a FAILURE EVENT.

6.2 Measurement Length

The concept of Measurement Length (ML) is a key parameter in assessments of land use changes such as the Parwan Employment Precinct.

The ML of a pipeline is defined in AS 2885.6 Appendix B1 as the radius of the 4.7 kW/m2 radiation contour for a full-bore rupture. At this distance it is expected that an able bodied and clothed person is likely to sustain 2nd degree burns within 30 seconds if they were to remain in the area. This is derived from calculations of the heat radiation intensity if a full-bore rupture of the pipeline is ignited.

A related parameter is the radiation contour for a heat radiation intensity of 12.6 kW/m2. At this distance it is expected that an able bodied and clothed person would sustain 3rd degree burns and life-threatening injuries within 30 seconds if they were to remain in the area.

These distances are calculated for each pipeline, and used in the assessment of land uses, both existing and planned for new and operational pipelines. AS2885.6 provides that the assessment of an existing pipeline's Location Class is based on land use within the measurement length.

The practical outcomes of the above are that for land use changes around an existing pipeline, such as the Parwan Employment Precinct, the SMS Workshop assesses the population density and proposed activities of the land within the measurement length to determine what risks are present. The SMS Workshop assessed the level of existing (or possible new) protections required to protect against interference and other threats necessary to keep the pipeline and the people around the pipeline safe.

Sensitive use activities such as places where people congregate, and/or have limited means of escaping from a pipeline incident and fire (shopping centres, sports stadiums, schools, childcare, aged care facilities etc) within the ML impose the most stringent protection requirements on the pipeline, to the extent that significant measures are required to ensure that rupture of the pipe is not a credible event.

7. PHYSICAL AND PROCEDURAL PROTECTION MEASURES

7.1 AS 2885 Requirements

For pipeline Location Class T1, T1/S or T2 the design requirements against External Interference Threats within AS2885 seek to have a minimum of two physical protection measures and two procedural measures wherever possible.

7.1.1 Physical Protection

Physical protection measures comprise:

- Separation of external interference activities from the pipeline – exclusion of activities which may damage the pipeline. Typically, these are excavation activities by third parties, but can also include intensive vibration such as might be employed during the construction of roads and other infrastructure. Typical separation measures include burial, exclusion of the public or third parties from the pipeline alignment or barriers.
- Resistance to penetration, such as adequate wall thickness to resist the identified excavation equipment threats, or again a barrier to penetration.
- Concrete slabbing directly above pipelines is one barrier method that is accepted to provide adequate exclusion as a second physical barrier, particularly where a pipeline is at risk of holing or rupture due to the known threats. The concrete slab usually has a minimum width of the nominal pipeline diameter plus 600 mm either side and shall be placed a minimum of 300 mm above the pipeline. This solution is usually paired with marker tape installed above the concrete slab to warn of what is underneath the slab.
- A Concrete footpath or bike path over the pipeline or buried HDPE slabs are acceptable forms of physical protection when a pipeline is within a linear open space.

7.1.2 Procedural Measures

Procedural mitigation measures which are recognised by AS 2885 comprise:

- Pipeline Awareness activities, such as marker signs, dial-before-you dig service (DBYD), third party liaison programs to inform other parties of the presence of the pipeline and consequences of damage, and activity agreements with other entities.
- External interference detection measures such as pipeline patrolling, planning notification zones and remote intrusion detection. The most common for existing pipelines are the first two. Remote intrusion detection is usually only implemented at pipeline facilities such as valve or city gate stations. APA have a nominated patrol frequency of every weekday in this area

8. PIPELINE TECHNICAL DETAILS

The SMS focused on the section of pipeline within and adjacent to the subject land in Parwan. The pipeline's technical details and resistance to penetration data in the area can be summarised as follows:

Table 5, APA Group Pipeline PL78 - Technical Details

Substance conveyed	Natural Gas
Pipeline License No.	Lic 78, T56
Measurement Length (ML)	171m (4.7 kW/m2 Heat Radiation Zone)
	104 (12.6 kW/m2 Heat Radiation Zone)
Length of pipeline affected	5850 m + 2 x 171m (Total 6192m approx)
Pipeline section under review within PSP	~KP33.85 to 39.70 (Plus ML each end)
Outside Diameter	219.1 mm
Easement	Permit required within pipeline easement
Wall Thickness	6.35mm WT & 7.04mm HWT
Depth Of Cover	1.2 – 1.4m
Pipe specification	API 5L Grade B (with CTE & Polyethylene coating)
Max. Allowable Operating Pressure	7390 kPa (MAOP)
Location Class - Primary	T1
Location Class – Secondary	None
CDL	115mm
Hole size & ML based on 10GJ/s release rate	147mm
Hole size & ML based on 1GJ/s release rate	N/A
70mm Hole size & ML	98mm
50mm Hole size & ML	70mm

The pipeline excavator risk can be summarised as follows:

Table 6, Excavator Risk PL78

Max equipment sizes without risk of a leak: -	
Excavator with std bucket	N/A (>55T)
Excavator with Single Tiger Tooth	5T (max hole size 70mm)
Excavator with Twin Tiger Tooth	20T
Excavator with Penetration Tooth	5T (max hole size 70mm)
Max equipment sizes without causing rupture: -	
Excavator with std bucket	N/A (>55T)
Excavator with Single Tiger Tooth	N/A (>55T)
Excavator with Twin Tiger Tooth	N/A (>55T)
Excavator with Penetration Tooth	N/A (>55T)

9. WORKSHOP RESULTS

The workshop team reviewed the Development proposed and confirmed that the existing T1 Primary Location Class for the APA pipeline is appropriate.

The workshop facilitator pre-populated an SMS Risk Register prior to the workshop using the threats listed in Appendix C as a guide when considering the Development. Forty-One (41) Threats were specifically considered for comments on the day of the Workshop. The other Threats listed in Appendix C were either unaffected or irrelevant to the Development and not expected to change the frequency of these threats occurring.

The results of the 41 Threats specifically considered can be summarised as follows: -

Table 7, Risk Assessment Summary

Pipeline	Threats Considered	Threats		Threats Requiring Risk Assessment	Risk Assessment		
		Non-Credible	Credible		Negligible	Low	Intermediate
PL78	42	8	34	8	-	7	1

The workshop results were recorded in the minutes, provided in Appendix H.

9.1 Intermediate Threats

The INTERMEDIATE risk assessment was related to 1 threat.

9.1.1 Threat ID 17

The threat leading to a hole in the pipeline was a Bored Crossing of the easement leading to a hole greater than 2/3rds CDL >~70mm leading to a rupture of the pipeline.

The workshop considered the Safety considerations when making the assessment on the following basis:

- Safety consideration: -
  - Consequence - Catastrophic as the Workshop considered the potential for work crew and onlookers along with people in the sensitive use areas could be seriously injured or killed resulting in multiple fatalities.
- Likelihood of Failure: -
  - Likelihood - Hypothetical as to cause multiple fatalities would only occur under extraordinary circumstances.

Whilst the consequences of this Threat are significant, it was acknowledged at the workshop that in order for a boring rig to continue to cut through the pipeline to a hole size of >70mm an enormous amount of gas would have already been released, even when the hole was relatively small and it is impossible to believe a work crew would continue boring under such circumstances. Furthermore, the act of setting up for a bore takes days and would be picked up by APA through DBYD and patrolling before any actual works could take place. It was agreed that the threat is ALARP, and no further action was required. (refer ALARP Report 320-RP-AM-0251)

10. DISCUSSION

The issues raised below are for consideration in support of the Threats and Actions raised at the SMS Workshop.

1. Where there is a crossing of the pipeline (e.g. any permanent road, water or utility crossings) the pipeline coating will need to be replaced under the direction and supervision of APA.
2. The key crossing of the pipeline will be any proposed water crossings. Design drawings will need to be finalised by Melbourne Water and formally submitted to APA for review and acceptance.

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11. ACTIONS

There were Ten (10) Actions identified during the SMS Workshop and listed in the table below. The list of Actions is referenced below.

APA and AusNet will require all actions to be documented as they are closed out with a description of what actions were taken and any documented supporting evidence being a Plan, Calculation, Updated Drawing etc. All close out material provided by the Client or a third party is to be provided to APA's representative (and AusNet representative as necessary) for review and approval/ acceptance.

Table 8, Action List

Miscellaneous Actions				
No.	**Issue**	**Action**	**By**	**Due Date**
A1	SMS findings not translated into planning docs leading to variations and disruption of construction works	VPA & Council to ensure all requirements from SMS are incorporated into the relevant VPA Documentation and MSC planning scheme.	VPA / Council	Prior to issue of planning permits and planning work within project
A2	Construction of the Development could damage the pipelines	Developer to prepare a Construction Management Plan as per permit condition to the satisfaction of the responsibility authority. Review and comment will be sought by MSC to APA (pipeline licensee) as part of the planning application.	Developer/ APA/ Council	Prior to works starting
A3	Contractors may not be familiar with working around TP Gas Pipelines	Engage in a –Third Party Works - Safety Awareness Session, either as a toolbox or zoom meeting for contractors undertaking building and works nearby the pipeline.	Developer/ APA	Prior to works starting
Threat Specific Actions				
No.	**Issue**	**Action**	**By**	**Due Date**
ID11	Vibration from works damages the coating leading to corrosion and failure of the pipe	Developer to identify in the CMP if piling is required as part of the development. CMP will be reviewed by APA prior to construction commencing. (Note due to CTE coating of pipeline max allowable vibration at pipeline is 10mm/s.)	Developer/ Council	Prior to construction
ID12	Gouge to pipe or holing or rupturing the pipeline.	Developer not to propose any buildings or structures on the pipeline easement. (Identifiable from construction plans). Council as responsibility authority, to implement this and ensure timely referrals are made to APA.	Developer/ Council/ APA	Prior to construction
ID15	Pipe impacted during utility installation resulting in damage or a hole causing loss of containment. Hole is less than critical defect length or max credible hole size (whichever is the smaller) Maximum credible hole size for a 30T excavator 70mm hole leading to a ML 98m.	APA to provide Std crossing designs for Developer reference. Future crossing designs to comply with APA minimum standard crossing requirements Should MW deem a waterway or pipe/relevant infrastructure to affect the pipeline is necessary, they will engage with APA.	APA/ Developer/ Council	Detailed Design
ID18	Over stressing the pipe resulting in pipe deformation (out of round), which could require reducing the MAOP or replacement of a section to allow for future integrity works. Potential loss of supply.	Pipeline to be recoated and slabbed as part of APA's Std Design if any new crossing designs are required	Developer/ Council/ DTP	Detailed Design
ID23	CP is damaged or compromised during works resulting in long term corrosion potential leading to leak only	CMP to include identification of all CP assets and provide appropriate protection during construction	APA/ Developer/ Council	Prior to construction
ID24	CP is damaged or compromised by local electrical currents causing localised long term corrosion potential leading to leak only	Design/utility plans to include identification of proposed Transformers and or HV power supplies near pipeline easement for APA review and approval	APA/ Developer/ Council	Detailed Design
ID33	APA cannot access easement/meter/reg assets due to new development	Access to City Gate must be maintained at all times during the develop construction. Requirement to be included in CMP	Developer/ Council	Prior to construction

12. CONCLUSION

A Safety Management Study (SMS) was undertaken to review whether additional protection measures are required to mitigate the risks associated with the Parwan Employment Precinct as per the requirements of the Australian Standard AS2885 for Transmission Pressure Gas Pipelines.

This report summarises the following aspects considered at the SMS:

- The nature of the pipeline in question
- The key land uses proposed by the Development that is located near the pipeline
- Review the Location Classification of the pipeline resulting from the Development
- Review AS2885 requirements for the agreed Location Classification
- Threats requiring a Risk Assessment and the findings of those Assessments
- Actions required to ensure the ongoing safe operation and maintenance of the pipelines in compliance with AS2885
- Implications for preparing the Development for final design and tender.

The review was successfully carried out in accordance with the requirements of AS 2885.6 -2018. The workshop was attended by key operations, maintenance, and engineering personnel. The study team comprised a broad cross-section of responsibility, knowledge and experience with the proposed Development and the affected Pipeline, and therefore possessed sufficient knowledge and experience to carry out an effective workshop review.

The SMS undertaken is considered to be a Land Use Change SMS.

Continuing liaison between the Client, Third Party Utilities, APA and AusNet should ensure that construction and post construction activities pose no significant increase in the operational and maintenance risk to the transmission pipeline running past the Development.

Upon satisfactory close out of the actions raised from this SMS Workshop and completion of the relevant Project Lifecycle SMS studies required under AS2885.6-5.6, it can be confirmed that the requirements of AS2885.6-2018 are met and that the APA assets under review will continue to be in compliance with the SMS requirements of AS2885.6-2018 in the Development area.

APPENDIX A: VPA Parwan Employment Precinct SMS Presentation

SMS Workshop

Parwan Employment Precinct

July 2023

Victorian Planning Authority

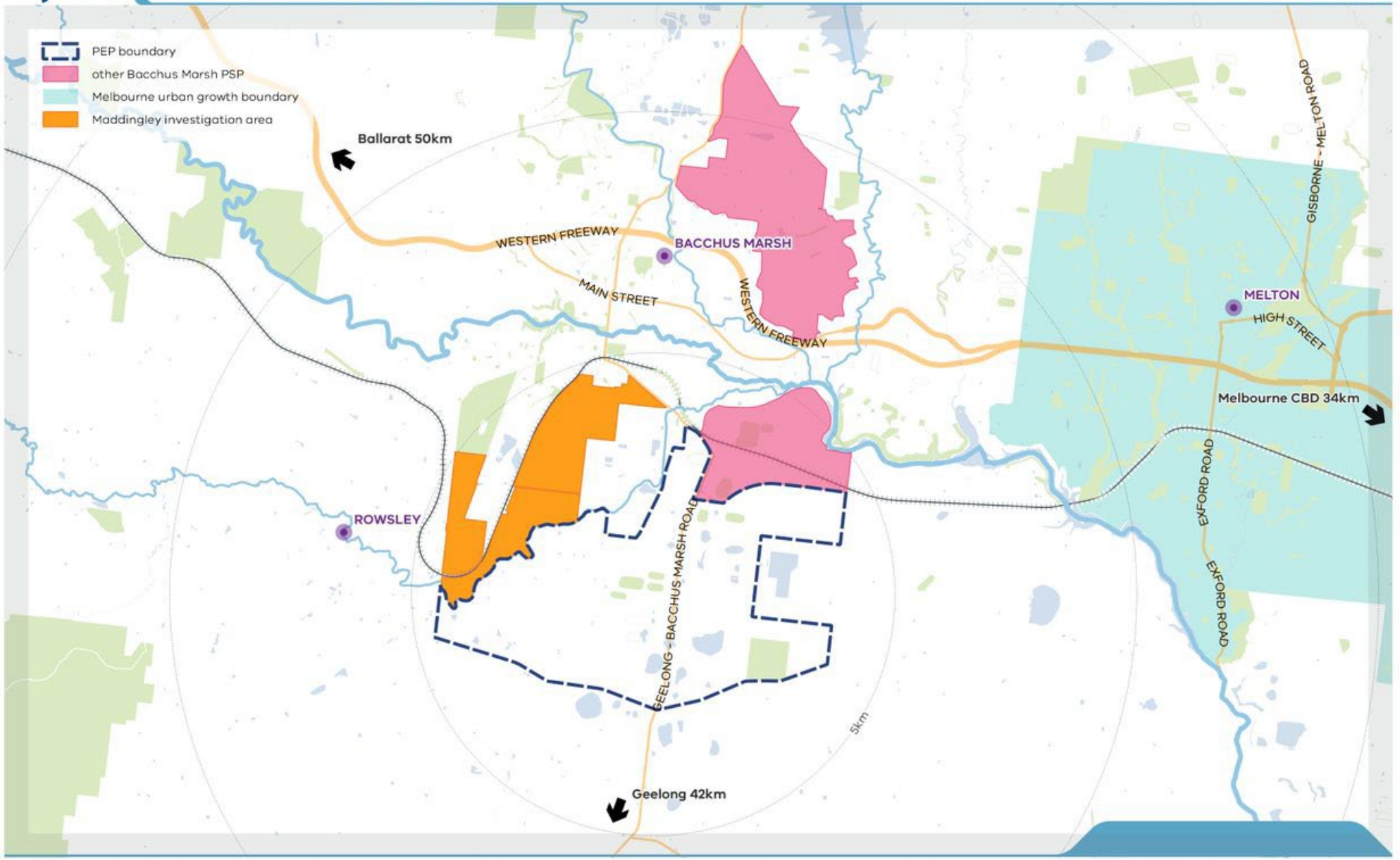
VICTORIA State Government

Plan 3
Regional Context
Parwan Employment Precinct Development Plan

1:100,000 @ A4

0 1 2 3 4 5 km

N



VICTORIA State Government

Plan 15
Transport and Accessibility
Parwan Employment Precinct Development Plan

1:40,000 @ A4

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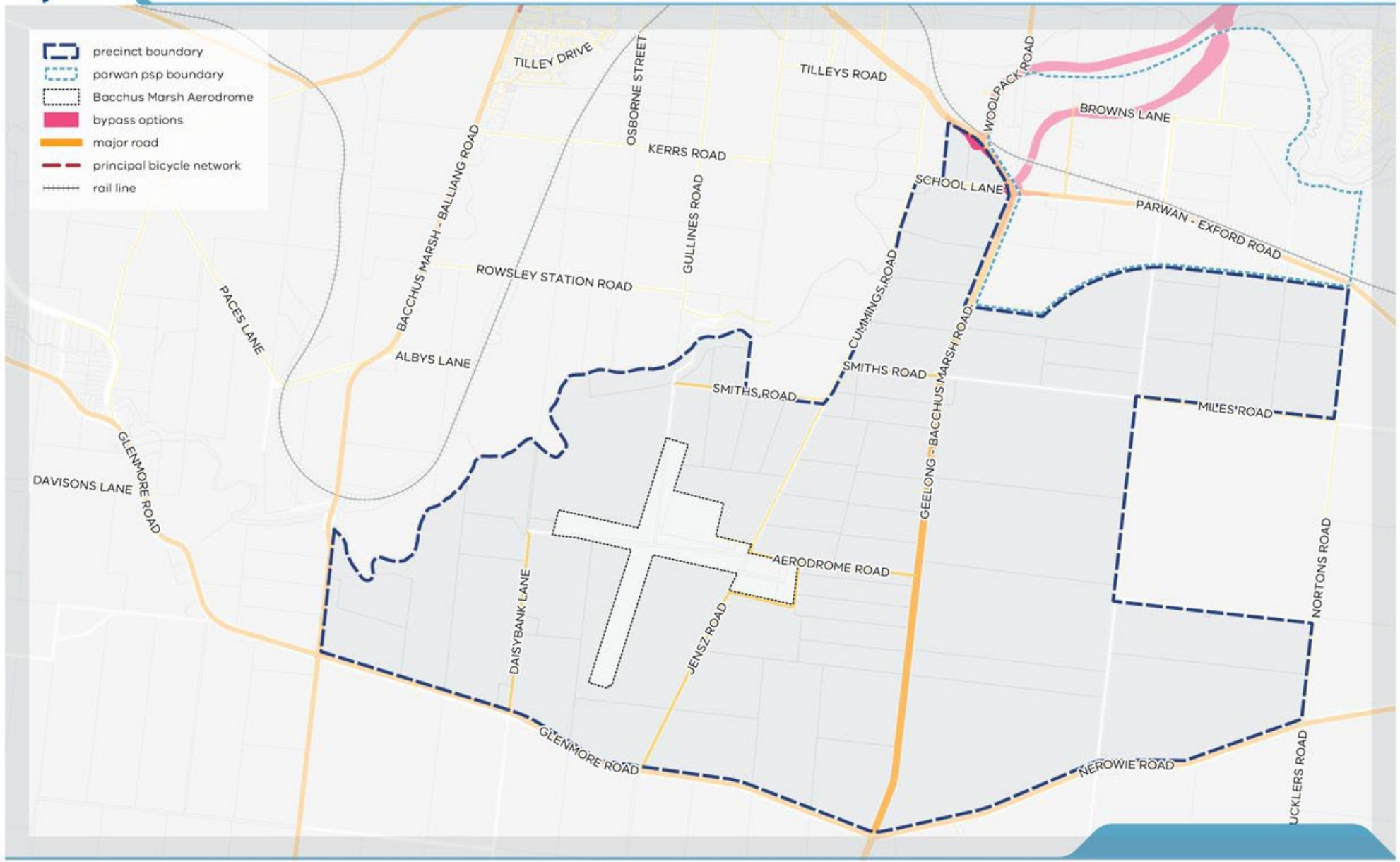

Plan 13
Sensitive Use Buffers
Parwan Employment Precinct Development Plan

1:40,000 @ A4

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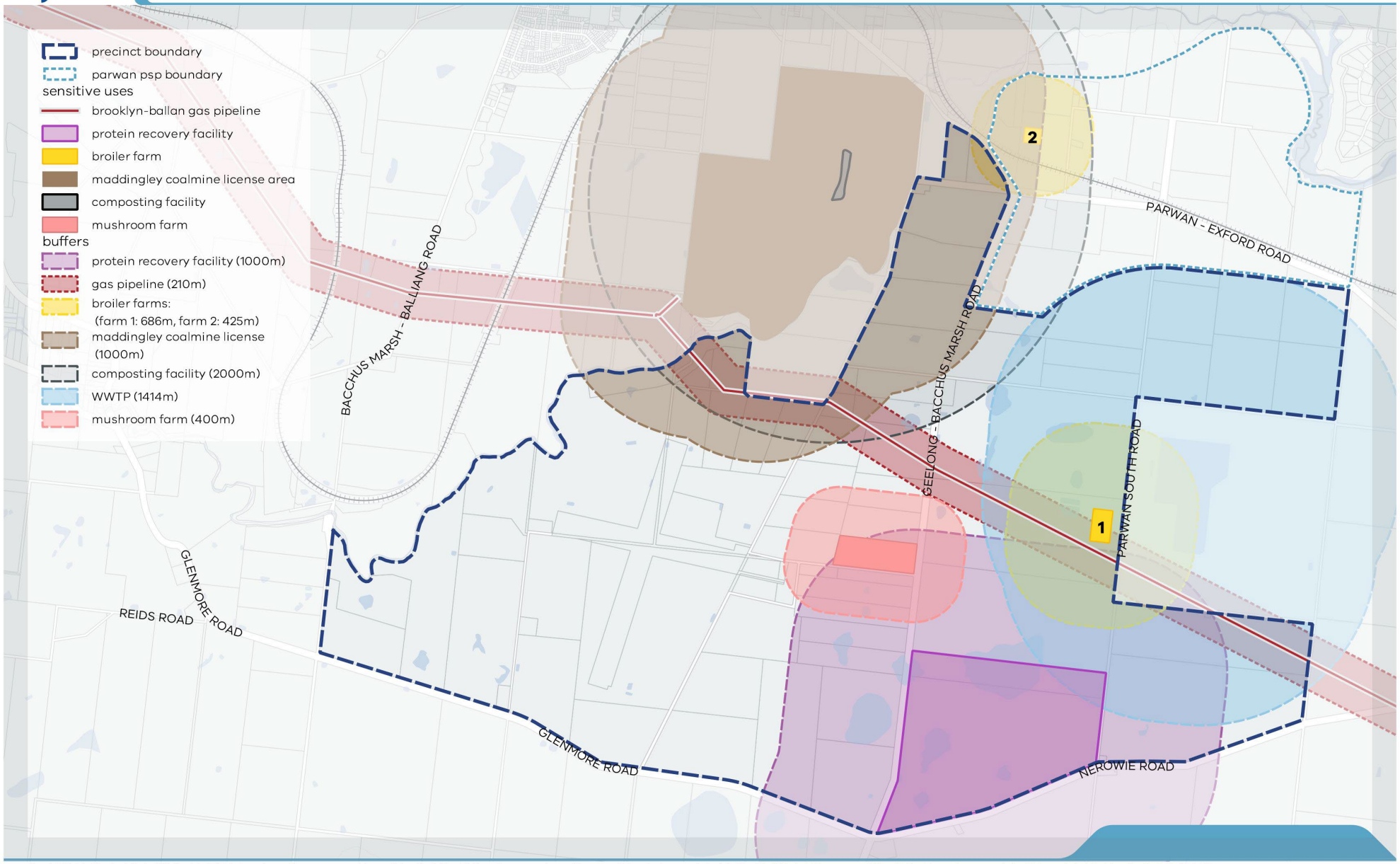

Planning Zones

Parwan Employment Precinct Development Plan

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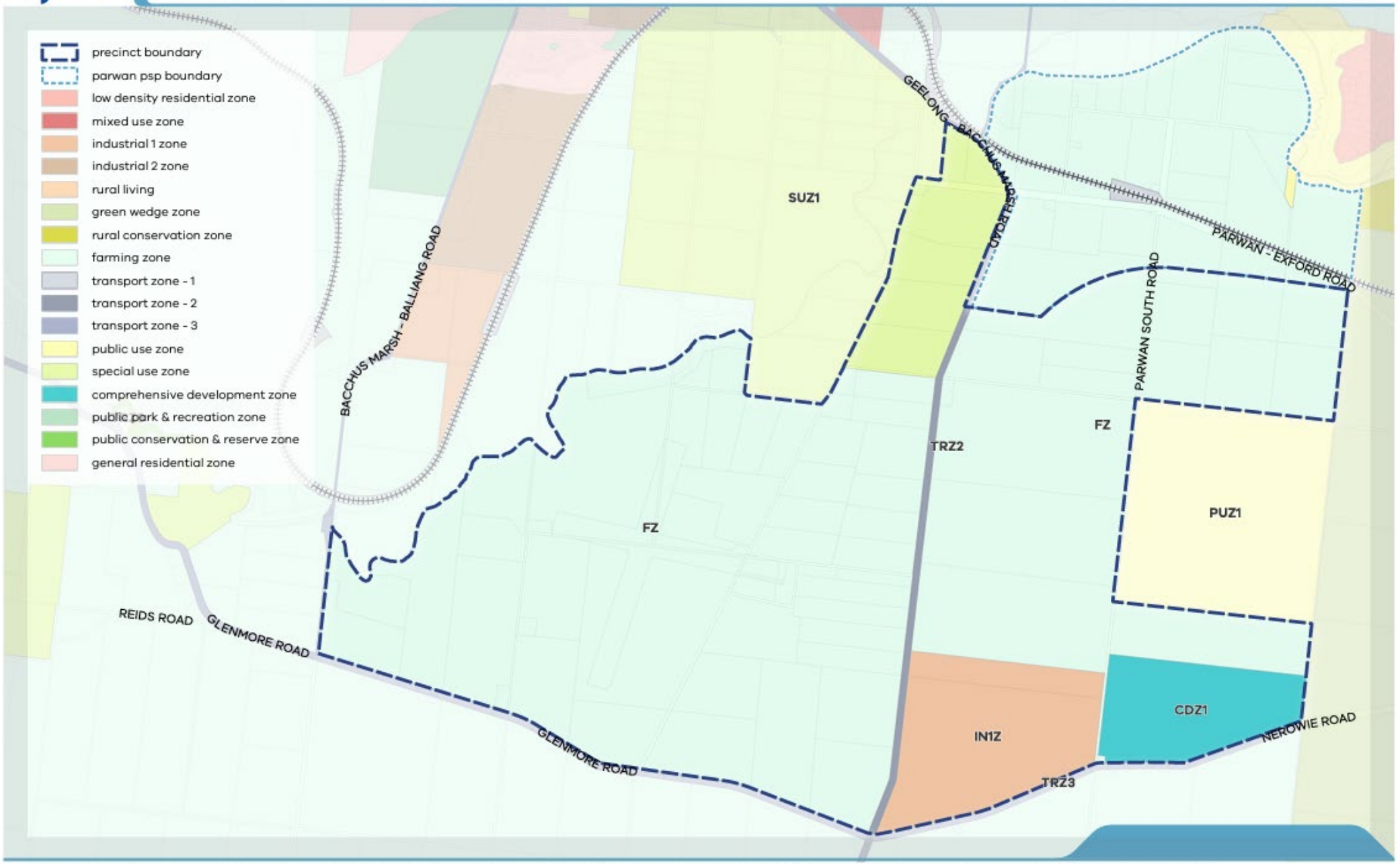

Planning Overlays

Parwan Employment Precinct Development Plan

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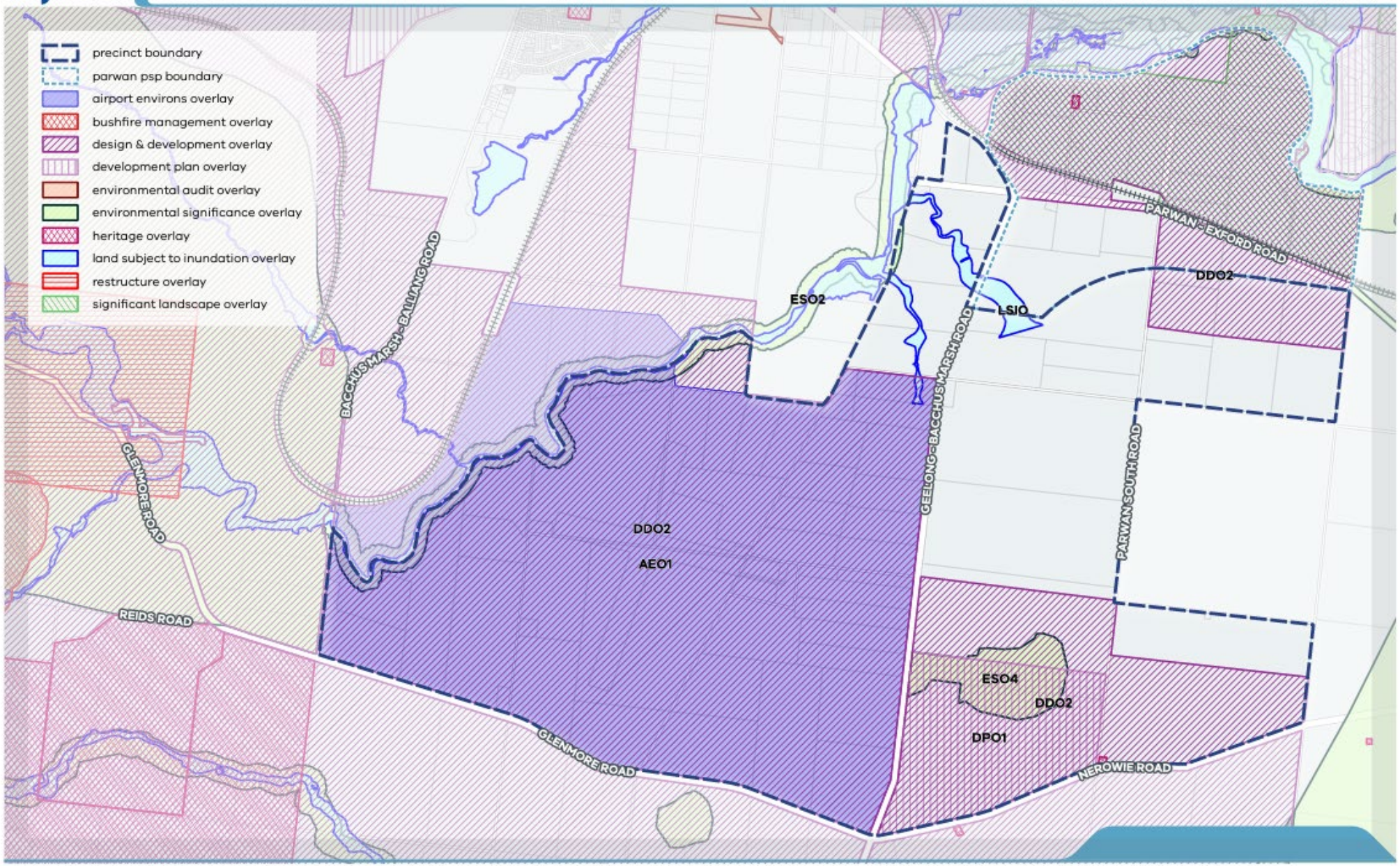

VICTORIA State Government

Place Based Plan

Parwan Employment Precinct Development Plan

DRAFT

1:40,000 @ A4

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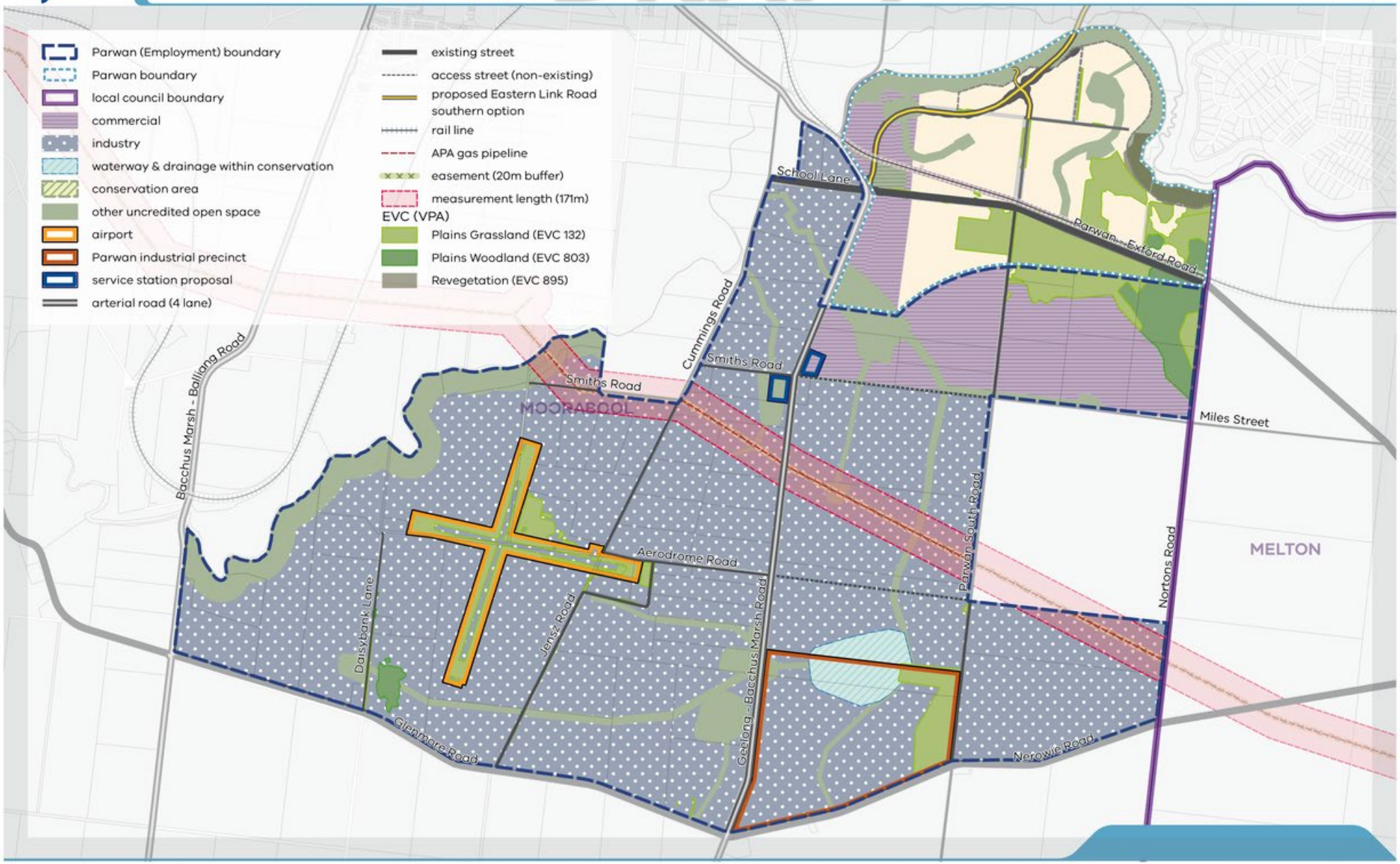

VICTORIA State Government

APPENDIX B: Classification of Locations

In order to determine the location class, the Standard AS2885 requires that the population, activities, and environment be assessed within a distance described as the “measurement length (ML)” from the centre of the pipeline. For gas pipelines in particular, where the most serious outcome is either injury or fatality due to radiation from an ignited gas leak, the measurement length is deliberately and conservatively defined in AS 2885.1, Cls 4.3.2 as the radius of the 4.7 kW/m2 radiation contour for an ignited full-bore rupture calculated in accordance with Clause 4.10. Clause 4.10 states that the calculation is to assume that the pipeline is at Maximum Allowable Operating Pressure (MAOP) at the time of release. A full-bore rupture is a hole which is equivalent to the diameter of the pipeline.

It is important to understand that the measurement length is used to define the corridor around the pipeline that must be considered to determine location classification, regardless of whether a full-bore rupture at MAOP is credible or not.

As is required by the Standard, consideration has been given to future development along the pipeline route both within and outside the pipeline measurement length when assessing the pipeline classification.

For any given location classification, AS 2885 defines minimum compliance requirements. As the consequence of a pipeline failure increases and location classification changes, the requirements of AS 2885 become more stringent. The various Location Classes under the Standard are outlined below.

AS2885.6-2018 gives four primary location classes:

R1 - Rural - Land that is unused, undeveloped or is used for rural activities such as grazing, agriculture and horticulture. Rural applies where the population is distributed in isolated dwellings. Rural includes areas of land with public infrastructure serving the rural use (e.g. roads, railways, canals, utility easements)..

R2 - Rural Residential - Land that meets any of the following criteria:

(i) Defined in a local land planning instrument as rural residential or its equivalent. (ii) Occupied by single residence blocks typically in the range 1 ha to 5 ha. (iii) Rural or semi-rural areas for which the number of dwellings within the MEASUREMENT LENGTH radius from any point on the pipeline does not exceed approximately 50.

Land used for other purposes but with similar population density shall be assigned rural residential LOCATION CLASS. Rural Residential includes areas of land with public infrastructure serving the rural residential use (e.g. roads, railways, canals, utility easements).

T1 - Residential - Land that is developed for community living or is defined in a local planning instrument as residential or its equivalent. 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, e.g. 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 within a radius of one MEASUREMENT LENGTH at any point on the pipeline. Land used for other purposes but with similar population density shall be assigned Residential LOCATION CLASS**.**

T2 - High Density - Land that is developed for high density community use or is defined in a local planning instrument as high density or its equivalent. 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 major sporting and cultural facilities, major retail and business centres (e.g. town centres, shopping malls, hotels and motels) and areas of public infrastructure serving the high-density use (e.g. roads, railways). To assist in determining the LOCATION CLASS boundary between TI and T2, the T2 LOCATION CLASS contains more than approximately 50 dwellings per hectare.

NOTE: In Residential and High Density areas, the societal risk associated with loss of containment is a dominant consideration..

In addition, AS2885.6-2018 gives six secondary location classes:

S – Sensitive Use: The sensitive use LOCATION CLASS identifies land where the consequences of a FAILURE EVENT 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 EVENT. Sensitive uses are specifically defined in some jurisdictions, but include schools, hospitals, aged care facilities and prisons. Sensitive use LOCATION CLASS shall be assigned to any section of the PIPELINE SYSTEM where there is a sensitive development within a MEASUREMENT LENGTH. The design requirements for High Density (T2) shall apply.

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

E – Environmental: The Environmental LOCATION CLASS identifies locations of high environmental sensitivity to pipeline failure, including particularly areas where pipeline failure may impact on threatened ecological communities or species or where rectification of environmental damage may be difficult. Areas of high environmental sensitivity may be identified by analysis of government environmental mapping within the pipeline MEASUREMENT LENGTH and, where required, may be validated by field surveys conducted by COMPETENT persons. A consequence assessment shall be undertaken, and depending on the assessed environmental severity the requirements of R2, TI or T2 shall be applied..

I – Industrial: 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.

The design requirements for Residential (TI) 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..

HI – Heavy Industrial: Sites developed or zoned for use by heavy industry or for toxic industrial use shall be classified as Heavy Industrial. They shall be assessed individually to assess whether the industry or the surroundings include features that-

(i) contain unusual THREATS to the PIPELINE SYSTEM; or

(ii) contain features that may cause a pipeline FAILURE EVENT to escalate either in terms of fire, or for the potential release of toxic or flammable materials. A consequence assessment shall be undertaken, and depending on the assessed severity, the requirements of R2, TI or T2 shall be applied.

NOTE: In heavy industrial use areas, the dominant consideration may be the THREATS associated with the land use or a range of location specific risks associated with the loss of containment..

CIC – Common Infrastructure Corridor: Land which, because of its function, results in multiple (more than one) parallel infrastructure development within a common easement or reserve, or in easements which partially or fully overlay the pipeline easement. CIC classification includes pipelines within reserves or easements for roads, railways, powerlines, buried cables, or other pipelines. It does not include crossings, roads or tracks which are not gazetted, or where the pipeline is adjacent to but outside a road reserve.

AS/NZS 2885.1 addresses PROCEDURAL CONTROLS for CIC LOCATION CLASS.

NOTE: In CIC areas, the dominant consideration may be the THREATS associated with the land use by other infrastructure operators or the higher consequences of loss of containment associated with increased transient population (e.g. roads) or other parallel infrastructure.

C – Crowd: The crowd LOCATION CLASS shall be applied to locations where there may be crowds or congestion leading to concentrations of population that are both intermittent and much higher than typical for the prevailing primary LOCATION CLASS. Examples include sports fields, roads subject to serious traffic congestion, and rural community halls.

Where C LOCATION CLASS is assigned, the SMS shall examine risk to the concentration of people with consideration of the number of people, the frequency and duration of assembly, the time of day or week that people are present, and the likelihood that THREATS and the population concentration will occur at the same time. Controls appropriate to the level of risk shall be applied.

NOTE: In crowd areas, the societal risk associated with loss of containment is a dominant consideration. The risk level may vary considerably. For example, the SMS may conclude that a country playing field, which is only used on occasional Sundays, presents a much lower risk than a motorway that becomes highly congested twice every weekday, because of both the frequency of congestion and the likelihood (or otherwise) of concurrent THREATS.

APPENDIX C Threats & Controls

THREAT IDENTIFICATION PROMPTS

CATEGORY	THREAT
External Interference	Excavation - related to construction
	Excavation - without consent
	Excavation - private landowners post construction (e.g., ploughing, ripping, or trenching)
	Power augers and drilling
	Cable installation ripping & ploughing
	Pipeline access for maintenance activities
	Installation of posts or poles
	Land use development - pavement works, road surfacing &/or grading
	Land use development - landscaping
	Deep ploughing or drilling around pipeline (horizontal)
	Vehicle or vessel impact - during construction
	Vehicle or vessel impact - during ongoing use of the road
	Vehicle or vessel impact - rail
	Vehicle or vessel impact - aircraft crash
	Damage from bogged vehicles or plant
	External loads from backfill or traffic
	Blasting
	Blasting - seismic survey for mining using explosives
	Anchor dropping & dragging
	Other - soil testing with penetrometer
	Other - methane from contaminated land ignited by site works (e.g., welding)
	Other - creeping movement of slope (geotechnical risk)
	Other - loading from the buildings
	Other - Vibration due to piling
Corrosion	External corrosion or erosion due to environmental factors
	Internal corrosion due to contaminants
	Internal erosion
	Environmentally assisted cracking / stress corrosion cracking
	Bacterial corrosion
	Other - stray current corrosion
	Other - CP testing performed incorrectly and potential for corrosion.
	Other - low frequency induction from parallel HV power lines or earthing bed
Natural Events	Earthquake
	Ground movement - land subsidence, soil expansion / contraction
	Ground movement - land subsidence causing breakage of water
	pipelines in region of gas pipe
	Wind and cyclone
	Bushfires
	Lightning
	Flooding or inundation
	Erosion of cover or support
	Other – tsunami or volcanic eruption
CATEGORY	**THREAT**
	Exceeding MAOP of pipeline

Operations & Maintenance	Incorrect operation of pigging
	Incorrect valve operating sequence
	Incorrect operation of control & protective equipment
	Bypass of logic, control or protection equipment followed by incorrect manual operation
	Fatigue from pressure cycling
	Inadequate or incomplete maintenance procedures
	Maintenance actions contrary to procedures
	Incident due to inadequate, incorrect, or out of date operating or maintenance procedures
	Inadequate servicing of equipment
	Other - inaccurate test equipment, leading to incorrect settings
	Other - overpressure control system failure
	Other - pipe vibration (e.g., underground due to road works)
	Other - failure to adequately manage and implement changes to assets
	Other - incident caused due to project records, as built records and installed material records being lost, ignored, or not maintained
	Other - inaccurate measurement equipment or equipment not calibrated
	Other - inadequate emergency management
	Other - live welding
Design Defects	Incorrect material, component, and equipment characteristics
	Incorrect design or engineering analysis
	Failure to define correct range of operating conditions
	Failure of design configuration and equipment features to allow for safe operations & maintenance
	Other - design for corrosion
	Other - stresses in places that are not earth anchored areas
Material Defects	Incorrectly identified components
	Incorrect specification, supply, handling, storage, installation, or testing
	Under-strength pipe
	Manufacturing defect
	Lack of adequate inspection & test procedures
Construction Defects	Undetected of unreported damage to the pipe, coating, or equipment
	Undetected or unreported critical weld defects
	Failure to install the specified materials or equipment
	Failure to install equipment using the correct procedures or materials
	Failure to install equipment in accordance with the design
	Failure to install the pipeline in the specified location or manner
	Inadequate testing of materials for defects prior to handover
Intentional Damage	Sabotage / Terrorism / Malicious Damage / Vandalism
Other - environmental	Soil excavation
	Ground water and soil contamination from fuel and other chemicals used on site during construction
	Escape of liquid fuel to ground water and soil contamination

EXTERNAL INTERFERENCE PROTECTION – PHYSICAL CONTROLS

CONTROL	METHODS	EXAMPLES

SEPARATION	BURIAL	
	EXCLUSION	FENCING
	BARRIER	BRIDGE CRASH BARRIERS
RESISTANCE TO PENETRATION	WALL THICKNESS -	
	BARRIER TO PENETRATION	CONCRETE SLABS CONCRETE ENCASEMENT CONCRETE COATING

EXTERNAL INTERFERENCE PROTECTION – PROCEDURAL CONTROLS

CONTROL	METHODS	EXAMPLES
PIPELINE AWARENESS -	LANDOWNER	
	THIRD PARTY LIAISON	LIAISON PROGRAM INCLUDING ALL RELEVANT PARTIES
	COMMUNITY AWARENESS PROGRAM	
	ONE-CALL SERVICE	
	MARKING	SIGNAGE
		BURIED MARKER TAPE
	ACTIVITY AGREEMENTS WITH OTHER ENTITIES	
EXTERNAL INTERFERENCE DETECTION	PLANNING NOTIFICATION ZONES	PLANNING NOTIFICATION REQUIRE BY LAW
	PATROLLING	SYSTEMATIC PATROLLING OF THE PIPELINE
	REMOTE INTRUSION MONITORING	DETECTION AND ALARM BEFORE THE PIPELINE IS DAMAGED

APPENDIX D AS2885 Part6 Risk Assessment

The AS2885 Risk Assessment we used to undertake any risk assessments is provided below

TABLE 3.1

SEVERITY CLASSES

Dimension	Severity class				
	Catastrophic	Major	Severe	Minor	Trivial
	Measures of severity				
People	Multiple fatalities result	One or two fatalities; or several people with life-threatening injuries	Injury or illness requiring hospital treatment	Injuries requiring first aid treatment	Minimal impact on health and safety
Supply (see Note)	Widespread or significant societal impact, such as complete loss of supply to a major city for an extended time (more than a few days)	Widespread societal impact such as loss of supply to a major city for a short time (hours to days) or to a localized area for a longer time	Localized societal impact or short-term supply interruption (hours)	Interruption or restriction of supply but shortfall met from other sources	No loss or restriction of pipeline supply
Environment	Impact widespread; viability of ecosystems or species affected; or permanent major changes	Major impact well outside PIPELINE CORRIDOR or site; or long-term severe effects; or rectification difficult	Localized impact, substantially rectified within a year or so	Impact very localized and very short-term (weeks), minimal rectification	No effect; or minor impact rectified rapidly (days) with negligible residual effect

NOTE: Appendix G provides guidance on assessment of consequence severities.

3.5.3 Frequency analysis

A frequency class shall be assigned to each FAILURE SCENARIO. The frequency class shall be selected from Table 3.2.

The contribution of existing controls to the prevention of failure shall be considered in assigning the frequency class.

NOTE: Appendix F provides guidance on estimating frequencies.

TABLE 3.2

FREQUENCY CLASSES

Frequency class	Frequency description
Frequent	Expected to occur once per year or more
Occasional	May occur occasionally in the life of the pipeline
Unlikely	Unlikely to occur within the life of the pipeline, but possible
Remote	Not anticipated for this pipeline at this location
Hypothetical	Theoretically possible but would only occur under extraordinary circumstances

3.5.4 Risk ranking

Table 3.3 shall be used to combine the results of the consequence analysis and the frequency analysis to determine the risk rank.

Use of the risk matrix in Table 3.3 is mandatory for SAFETY MANAGEMENT STUDIES in accordance with this Standard. Other methods such as a corporate risk matrix may be used only in parallel with Table 3.3 or as part of a separate corporate RISK ASSESSMENT.

TABLE 3.3

RISK MATRIX

	Catastrophic	Major	Severe	Minor	Trivial
Frequent	Extreme	Extreme	High	Intermediate	Low
Occasional	Extreme	High	Intermediate	Low	Low
Unlikely	High	High	Intermediate	Low	Negligible
Remote	High	Intermediate	Low	Negligible	Negligible
Hypothetical	Intermediate	Low	Negligible	Negligible	Negligible

NOTE: Comparative studies sponsored by the Energy Pipelines Cooperative Research Centre have shown that for risks ranked as Intermediate, Table 3.3 produces results consistent with both reliability-based analysis (in accordance with Annex O of CSA Z662-07) and quantitative risk assessment. Use of a different risk matrix or method that has not been similarly calibrated may produce invalid results.

3.6 RISK TREATMENT

3.6.1 General

Action to reduce risk shall be taken in accordance with Table 3.4, based on the risk rank determined from Table 3.3.

The action(s) taken and the planned effect on risk shall be documented.

3.6.2 Risk treatment during design

Risk treatment actions at design stage may include the following:

(a) Relocation of the pipeline route.

(b) Modification of the design for any one or more of the following:

  (i) PIPELINE SYSTEM isolation.

  (ii) PHYSICAL CONTROLS for prevention of external interference.

  (iii) PROCEDURAL CONTROLS for prevention of external interference.

  (iv) Corrosion prevention.

  (v) Operational controls.

TABLE 3.4

RISK TREATMENT ACTIONS

Risk rank	Required action
Extreme	Modify the THREAT, the frequency or the consequences so that the risk rank is reduced to Intermediate or lower. For an in-service pipeline, the risk shall be reduced immediately.
High	Modify the THREAT, the frequency or the consequences so that the risk rank is reduced to Intermediate or lower. For an in-service pipeline, the risk shall be reduced as soon as possible. Risk reduction should be completed within a timescale of not more than a few weeks.
Intermediate	Repeat THREAT identification and risk evaluation processes to verify the risk estimation; determine the accuracy and uncertainty of the estimation. Where the risk rank is confirmed to be "intermediate", where reasonably practicable modify the THREAT, the frequency or the consequence to reduce the risk rank to "low" or "negligible". Where it is not reasonably practicable to reduce the risk rank to "low" or "negligible", action shall be taken to— (a) remove THREATS, reduce frequencies and/or reduce severity of consequences to the extent practicable; and (b) formally demonstrate ALARP (see Section 4). For an in-service pipeline, the reduction to "low" or "negligible" or demonstration of ALARP shall be completed as soon as possible. Risk reduction or demonstration of ALARP should be completed within a few months.
Low	Determine the management plan for the THREAT to prevent occurrence and to monitor changes that could affect the classification.
Negligible	Review at the next relevant SMS (for periodic operational review, LAND USE CHANGE, ENCROACHMENT, or change of operating conditions).

3.6.3 Risk treatment during operation and maintenance

Risk treatment actions at operating pipeline stage may include one or more of the following:

(a) Installation of additional or modified PHYSICAL CONTROLS.

(b) Additional or modified PROCEDURAL CONTROLS.

(c) Specific actions in relation to identified activities (e.g. presence of operating personnel during activities on the easement).

(d) Modification to pipeline marking.

(e) Changes to the isolation plan.

(f) Changes to the PIPELINE SYSTEM design or operation to satisfy the requirements of this Standard when there is a change to the LOCATION CLASS of the pipeline.

(g) Specific operational or maintenance procedures.

(h) Repair, remediation or removal of a condition or DEFECT that presents a THREAT.

THREAT treatment for operating PIPELINE SYSTEMS should consider interim control measures (e.g. reduction in operating pressure, access restrictions) to allow time for the implementation of permanent control measures (e.g. repair).

APPENDIX E: Documents and References for Workshop

The documents referenced at the SMS workshop are listed below.

Table 9, Documents & References for Workshop

Document Name	Document Number
REQUEST FOR QUOTATION—NON PANEL (RFQ Trim REF D/22/6770)	RFQ – Gas SMS - PEP
PEP Context Plan	Appendix 1: RFQ – Gas SMS - PEP
Fracture Control Plan	320-PL-AM-0063_1 (Frac Control Plan)
Pipeline Radiation Contour Calc	Heat Radiation Release Calculation T56
Pipeline Route Plan & Longitudinal Section	T56-24 / BBP.2373-DWG-L-0001.01
SMS Report VTS	SMS Report VTS 2021 Rev1.0 320-RP-AM-0237 Rev1.0

The legislative references for this Workshop are listed below: -
Victoria

- Pipelines Act 2005
- Pipelines Regulations 2017

The Industry Standards referenced for this Workshop are listed below: -

- AS 2885.0 :2018 Gas and liquid petroleum General requirements
- AS/NZS 2885.1:2018 Gas and liquid petroleum Design & Construction
- AS2885.3 :2012 Gas and liquid petroleum Operations and Maintenance
- AS/NZS 2885.6:2018 Pipelines - Gas and liquid petroleum - Pipeline safety management

APA Pipeline Management System - Volume 1 Introduction – dated 3/11/16 Section 2 Coverage states that when conflict exists between the various applicable documents, the following order shall apply, in decreasing order of precedence. Where APA requirements are more stringent, they shall take precedence.

- Acts of law or other legislation
- Government licenses and permits
- APA Engineering Standards. This will be covered by documented practices and any specific inputs from APA risk assessments
- Local engineering standards

APPENDIX F: SMS Terms Of Reference

Delphi Risk Management Consulting

Parwan Employment Precinct
Moorabool Vic

SMS Workshop Terms of Reference

DRMC Ref Number: 2023-0005-REP-002

Current Revision

Revision:	Reason for Revision:	Revision Date: 28/06/2023	
Rev No.0	Issued for SMS workshop		
Prepared By:	Mark Harris	Signature:	
Approved By:	Mark Harris	Signature:	

Revision History

Rev	Revision Date	Reason for Revision	Prepared By	Approved By
0	28/06/2023	Issued for Use	MAH	MAH

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ABBREVIATIONS

ALARP	As Low As Reasonably Practicable
APA	APA Group (Pipeline Licensee)
AS	Australian Standard
CIC	Common Infrastructure Corridor
CDL	Critical Defect Length (mm) is a hole size where a pipeline is likely to rupture
CMP	Construction Management Plan
CTE	Coal Tar Enamel
DET	Department of Education & Training
DRMC	Delphi Risk Management Consulting – SMS Facilitator
DN	Diameter nominal
EPC	Engineering Procurement Construction
FEED	Front end engineering design
FJC	Field Joint Coating
GIS	Geographical Information System
HDD	Horizontal Directional Drill (used for installation of utilities under existing assets)
km	Kilometre(s)
KP	Kilometre Point
LC	Location Class
LOPA	Layers of Protection Analysis
m	Metre(s)
MAOP	Maximum Allowable Operating Pressure
ML	Measurement Length (4.7 kW/m2 radiation contour in the event of a full-bore rupture of the pipeline)
MLV	Main Line Valve
MSC	Moorabool Shire Council
MW	Melbourne Water
OPP	Overpressure Protection
O&M	Operations and Maintenance
PEP	Parwan Employment Precinct
PIMP	Pipeline Integrity Management Plan
PL	Pipeline License
PPC	Primary Pressure Control
ROW	Right of Way
SLC	Secondary Location Class
SMS	Safety Management Study
SMYS	Specified Minimum Yield Stress
SPC	Secondary pressure Control
Standard	Australian Standard AS2885 for Pipelines-Gas & Liquid Petroleum Pipelines
TOR	Terms of Reference
VPA	Victorian Planning Authority
WT	Wall Thickness
YVW	Yarra Valley Water

1 INTRODUCTION

Delphi Risk Management Consulting (DRMC) is pleased to support the Victorian Planning Authority (VPA) in facilitating a Safety Management Study for the new Parwan Employment Precinct (PEP) in the Moorabool Shire Council (MSC) area, some 60km west of Melbourne.

The proposed PEP is positioned immediately over an existing APA Group Transmission Pressure Gas Pipeline (Brooklyn-Ballan Transmission Pressure (TP) Gas Pipeline (T56, PL78)) which, under the Australian Standard for TP Gas Pipelines (AS2885) requires the risks associated with construction of the PEP and future operation and maintenance of the pipeline be assessed and suitably mitigated before the development proceeds.

To comply with Australian Standard AS/NZS 2885.1:2018, any Development works in the immediate vicinity of a Transmission Pressure Gas Pipeline licensed under AS2885 in Australia must be subjected to a Safety Management Study (SMS) to review all possible threats to the safe operation and maintenance of the pipeline and ensure that any threats that cannot be mitigated by design or procedures are risk assessed and confirmed to be As Low As Reasonably Practical.

This document outlines the Terms of Reference for the SMS Workshop

Parwan Employment Plan

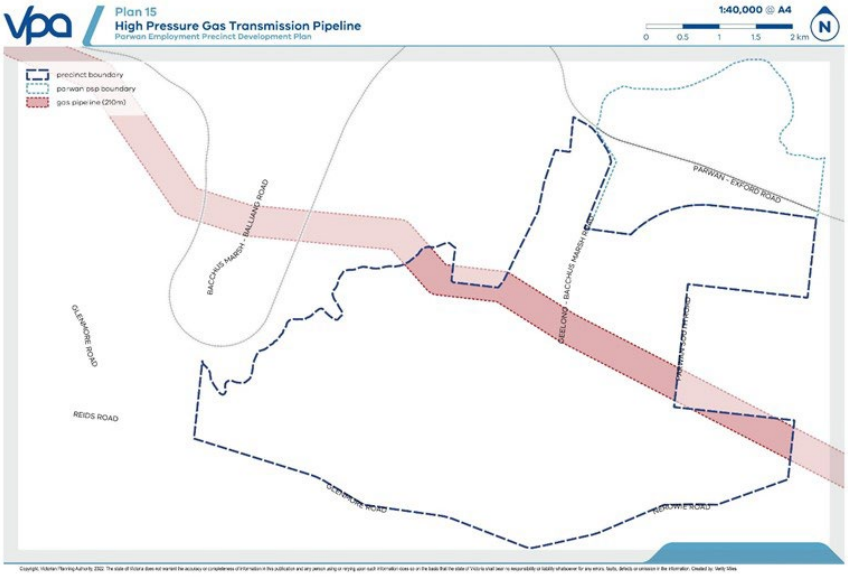
The Victorian Planning Authority (VPA) is currently developing the new Parwan Employment Precinct (PEP) in the Moorabool Shire Council (MSC) area. The proposed PEP is positioned immediately over an existing APA Group Transmission Pressure Gas Pipeline which runs roughly east to west across the middle of the PEP.

The PEP is an area of approximately 2,480ha, incorporating over 80 separate properties (including the existing Bacchus Marsh aerodrome) and is intended for employment only uses. Much of the land within the precinct is currently used for agriculture and rural residential uses, with a limited range of commercial, recreation and utility use.

The precinct does have Maddingley Brown Coal facilities to the North and Bacchus March Western Water Treatment Facility to the East of the PEP.

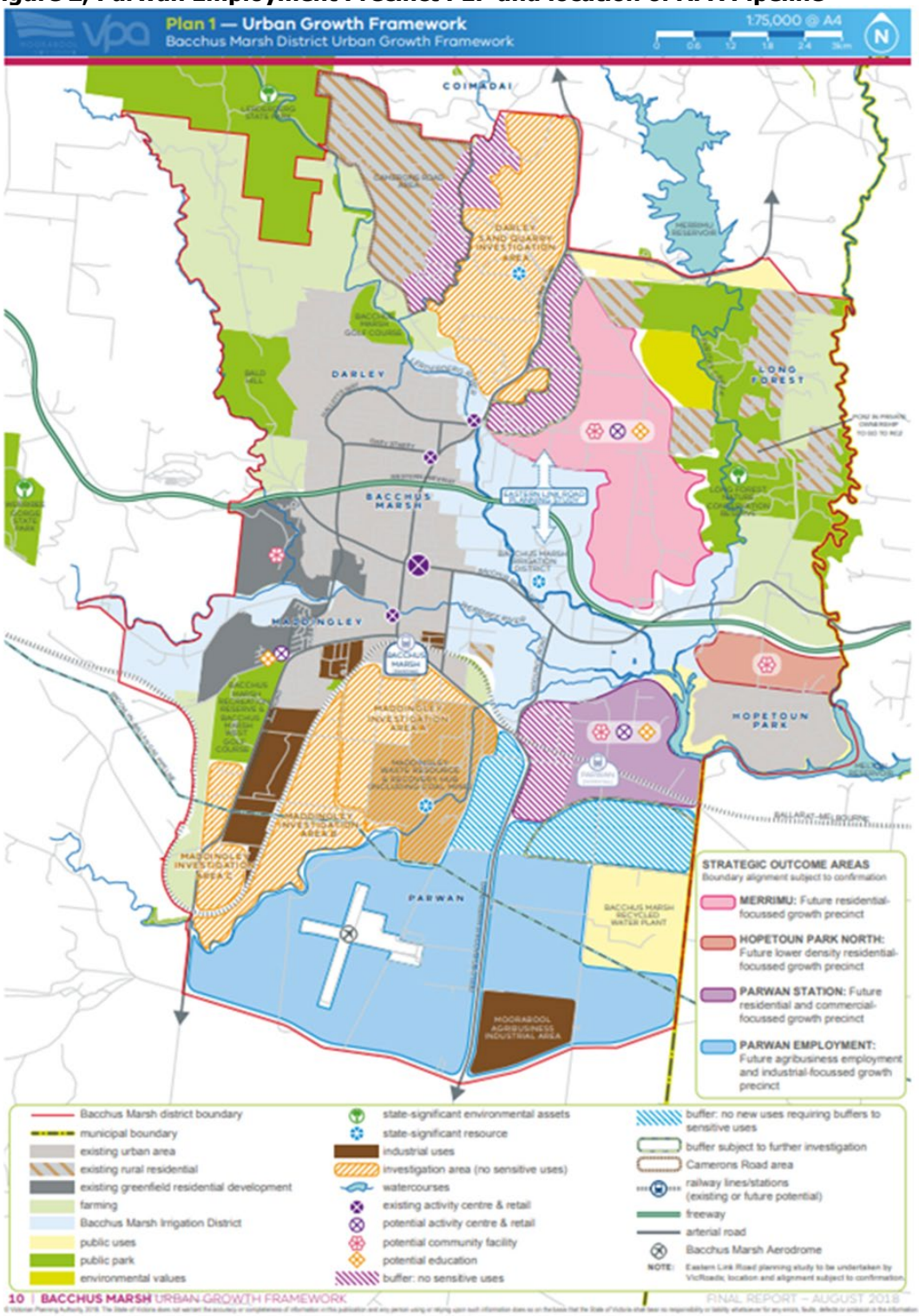
The subject land is encapsulated by the thick blue dashed line on the image below.

Figure 1, Parwan Employment Precinct, APA Pipeline ML "pink" corridor



Note: - Pink corridor is 420m wide representing the pipeline Heat Radiation Contour which recognises a 210m ML either side of the pipeline. (Note: - actual ML is 171m so corridor can be reduced to 342m wide)

Figure 2, Parwan Employment Precinct PEP and location of APA Pipeline



Gas Transmission Infrastructure

The APA Group has advised that the following asset is impacted by the proposed development:

Table 1, Pipeline Details

Pipeline	Pipeline Licence	Easement Width (m)	Pipeline Easement Location	Diameter (mm)	Measurement Length (m)
Brooklyn-Ballan	T56, PL78	20.1	4.57m from South side	219	171
	Note: Measurement Length is applied to either side of the pipeline				

There is also a new Gas City Gate immediately south of the Western Water Treatment Plant (see square yellow box in image below).

The APA pipeline was built in 1972 and will continue operating for another 30-40 years so it is important to consider the implications for the safe operation and maintenance of the pipeline during construction and for the remaining life of the pipeline.

The proposed development will be deemed as an Industrial development with several road and utility crossings of the pipeline, but no intended sensitive uses within the Measurement Length of the Pipeline.

There is currently no specific design information about any water, sewer, road, or utility crossings of the pipeline. APA has standard crossing designs which will need to be adhered to unless a separate, bespoke design is required. Any crossing designs should be presented to the SMS Workshop for review if possible, however if not available then it will become an action for APA to review and approve any bespoke crossing designs.

The SMS Workshop will assess the consequences, likelihoods, and overall risks to the pipeline during construction and throughout the remaining life of the pipeline. The SMS Workshop will confirm what if any new mitigations will be required to ensure the future risks to the pipeline and the population nearby are (ALARP).

2 SCOPE OF SMS

The SMS will focus on the section of pipeline immediately adjacent to the Development. The pipeline has been divided into the following sections:

Table 2, Pipeline sections

Section ID	Distance	Current Land Use	Description	Measurement Length	Proposed Location Class	Secondary Location - Class	SMS Section
1	~5850m (plus 2 x 171m (ML)	T1	6.35mm & 7.04mm Wall Thickness 200mm DN diameter 7390 kPa CTE/Yellow Jacket coating 900-1200mm+ DOC	171m from pipeline	R1	I	**N/A**

In addition to the sections identified in the table above, the SMS will focus on the following aspects of the design:

- Non-Location Specific Threats (e.g., corrosion, coating damage).
- Standard Crossing Designs (e.g., minor roads).
- Location Specific Crossing Designs will be considered as they appear during the meter-by-meter pipeline risk assessment.
- Slabbing requirements to mitigate risks to the development from third party strikes
- Review of the design calculations or reports which form the basis of the design presented (e.g., wall thickness calculation, fracture control plan etc.).
- There are no above ground pipeline facilities within the area being considered during this SMS.

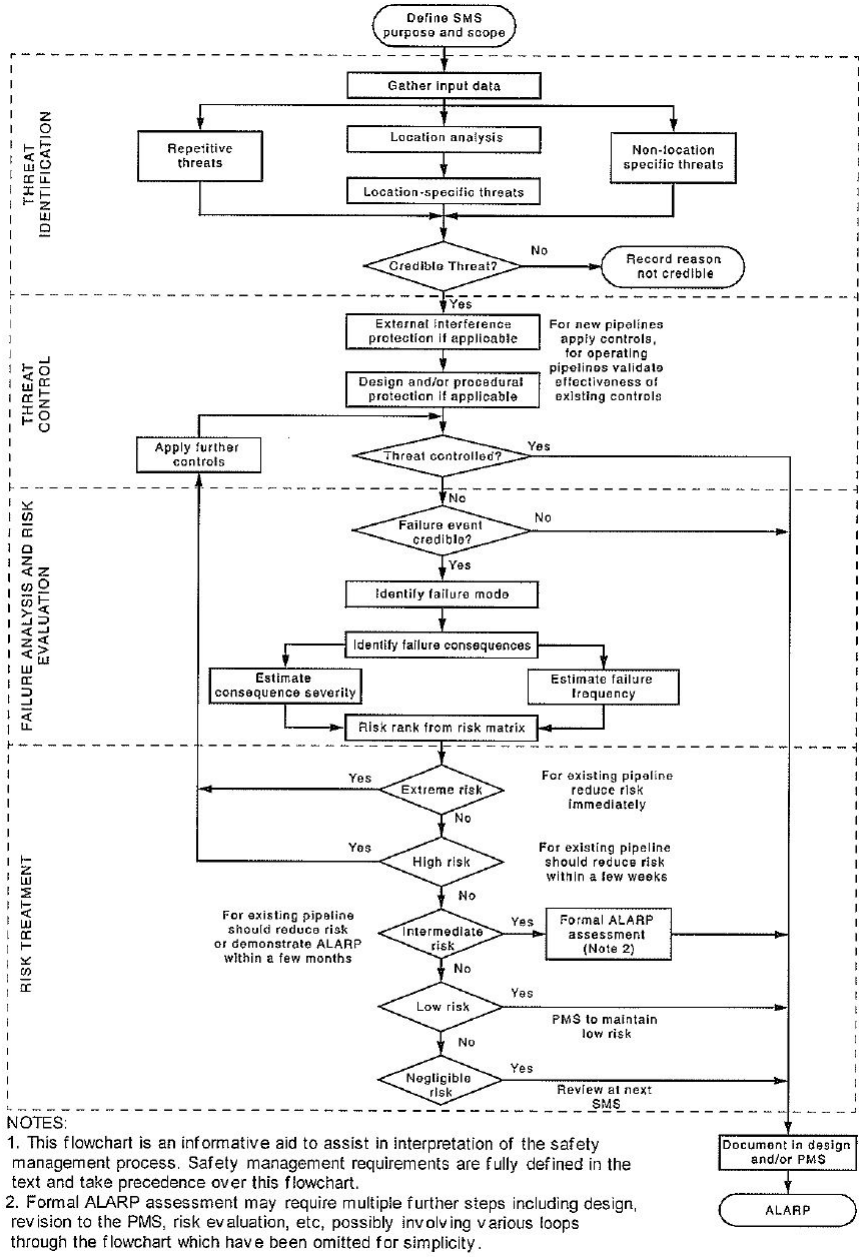
3 OBJECTIVE AND METHODOLOGY

Prior to the SMS workshop being convened APA and the Client teams have prepared a range of relevant information to be presented to the workshop (refer to Section 4 below for the list of Documents). The information available includes the results from previous SMS workshops held for the existing pipelines.

The SMS workshop objective is to re-validate the APA pipeline design under AS/NZS 2885.6:2018 against the proposed new land use plans.

The risk assessment process is broadly described in the Figure below.

Figure 3 – AS/NZS 2885.6:2018 Risk Assessment Process



The focus of the SMS workshop is on the safe operation and maintenance of the pipeline including consideration of the risks of the construction of the development and on the safe operation and maintenance of the pipeline into the future.

Where the SMS workshop considers that a design proposed is inadequate to reduce a particular identified threat to a level of accepted risk, it will identify additional controls which if implemented, would achieve that objective.

If further controls cannot fully mitigate the threat, then the SMS workshop will risk assess the residual threat against a recognised industry risk matrix to determine the residual level of risk. If the risk of a particular threat cannot be considered to be low or negligible according to recognised industry risk matrix then further investigation of the threat will take place to confirm that the risk is "As Low As Reasonably Practical" (ALARP).

At the end of the Workshop, participants will be required to form an opinion on whether there are any other threats not already considered prior to closing the Workshop.

Actions minuted during the course of the SMS workshop will fall into two general categories, those requiring close out before the change in land use can proceed and those that will form part of the future Pipeline Integrity Management Plan (PIMP).

All threats developed prior to the SMS workshop have been documented in a spreadsheet that will be projected on a screen and referred to in the workshop. Changes or additions to the threats and risk mitigations will be recorded directly into the spreadsheet. Additional actions not related to particular threats will also be recorded.

A copy of the Development Plan will be available on a wall of the workshop with additional smaller copies for reference on the table. All other documents referenced in the TOR Document will be made available in either electronic or hard copy at the SMS Workshop.

An SMS Report will be produced following the workshop to capture proceedings of the workshop and highlight key decisions or issues. It will also contain all the threats and their associated mitigations and/or agreed actions.

4 DOCUMENTS AND REFERENCES FOR WORKSHOP

The documents required for the SMS workshop are referenced below.

Table 3, Documents

Document Name	Document Number
REQUEST FOR QUOTATION—NON PANEL (RFQ Trim REF D/22/6770)	RFQ – Gas SMS - PEP
PEP Context Plan	Appendix 1: RFQ – Gas SMS - PEP
Fracture Control Plan	320-PL-AM-0063_1 (Frac Control Plan)
Pipeline Radiation Contour Calc	Heat Radiation Release Calculation T56
Pipeline Route Plan & Longitudinal Section	T56-24 / BBP.2373-DWG-L-0001.01
SMS Report VTS	SMS Report VTS 2021 Rev1.0 320-RP-AM-0237 Rev1.0

The Industry Standards referenced for this Workshop are listed below: -

- AS 2885.0 – 2018 Gas and liquid petroleum General requirements
- AS/NZS 2885.1 – 2018 Gas and liquid petroleum Design & Construction
- AS2 885.3 – 2012 Gas and liquid petroleum Operations and Maintenance
- AS/NZS 2885.6:2018 Pipelines - Gas and liquid petroleum - Pipeline safety management

APA Pipeline Management System - Volume 1 Introduction – dated 3/11/16 Section 2 Coverage states that when conflict exists between the various applicable documents, the following order shall apply, in decreasing order of precedence. Where APA requirements are more stringent, they shall take precedence.

- Acts of law or other legislation
- Government licenses and permits.
- APA Engineering Standards. This will be covered by documented practices and any specific inputs from APA risk assessments.
- Local engineering standards

Note the following advice from the APA SMS Technical Guide for Localised Urban Developments: -

- There is no requirement to redo-calculations if the calculations provided by APA have already been completed.
- If there are threats that are new i.e., not captured by the existing Pipeline SMS and it needs supporting calculations, then the Facilitator can raise this with APA where it can

leave it to APA to perform the calculations or have an external provider produce the calculations that will be issued to APA for review and approval.

- The facilitator can identify any aspects of the calculations that need to be updated but it is not their responsibility to perform any peer reviews on the existing APA calculations.
- The facilitator is to conduct a threat assessment pertaining to the development in question before the commencement of the SMS Workshop (unlike a HAZOP which requires the risk assessment to be done during the workshop). That is revisit the existing threat controls even if they have already been captured in the existing SMS Database.
- The workshop is to validate the location class and all the threats have been captured and the necessary control measures are documented covering construction activities and future threats.

5 WORKSHOP PARTICIPANTS

The Workshop will comprise representatives from the Licensee (APA Group) and Client.

Workshop participants will have appropriate experience and authority to present the opinion of the segment that he/she represents.

The integrity of the SMS Workshop is based not only on a detailed assessment of all the relevant data but also the continuous attendance of the various experts during the Workshop.

The 5-6 hours allocated will require fulltime attendance or nomination of an appropriately experienced replacement. The nominated attendees for the workshop are listed below.

Table 4, Participants

Name	Position	Organisation
Mark Harris	Facilitator	DRMC
Damien Tran	Strategic Planner	VPA
Jeff Tait	Strategic urban and regional planner	VPA
Chris Braddock	Water & Engineering Manager	VPA
Monique So	Environmental Engineer	VPA
Paul Bezemar	Senior Strategic Planner	Moorabool Shire Council
John Rudakov	Gas Services Engineer	Downer
Zack Ilic	Project Engineer	Downer
Ajun Premraj	TBC	Ausnet Services
Sam Pitruzzello	Gas Engineering Services Manager	Ausnet Services
Glenn Ogilvie	Risk Engineer	APA Group
Michael Mielczarek	Senior Urban Planner	APA Group

6 WORKSHOP RULES

The workshop will be governed by the following rules as a minimum:

- The Owner of the pipeline (APA Group) along with the Client will, to the extent practicable, present the pipeline design and Development Plan respectively in a manner that provides participants with sufficient understanding for them to reach an informed opinion as to whether the threats are properly identified, whether the controls applied adequately control the threats, and where risk assessment is required, to reach a conclusion on the risk.
- The opinion of each participant is equally important and relevant and must be heard and assessed.
- Each participant will conduct themselves in a manner that contributes to the best outcome from the workshop and active participation is compulsory.
- The facilitator will manage the workshop to allow all relevant opinions to be presented, discussed and that each discussion reaches a conclusion.
- Please be prompt at the start of each day and when returning from breaks.
- Mobile phones are to be switched off or on silent, any important calls may be taken outside the workshop room.

7 SMS WORKSHOP LOGISTICS

The Safety Management Assessment Workshop will be held on TEAMS on the 7th of July 2023. A separate TEAMS Meeting Request will be issued.

The SMS agenda proposed in Section 9 is indicative only. It should be noted that the integrity of the SMS process will take priority over meeting particular time commitments.

The workshop will commence at 9:00am sharp (AEST) and will end at approximately 2:30pm.

(Note: - it is far more important to properly consider all the risks rather than try and rush to meet a deadline and so I ask all participants to be flexible as the workshop will finish anywhere between 2:00 and 3:00pm on the day).

Breaks during the day will typically be taken at the following times:

- Morning tea will be taken at ~10:30am for 10 minutes.
- Lunch will be taken at ~12:30pm for 30 minutes.

Copies of the documents will be shared at the Workshop. Electronic copies of the relevant documents can be printed by participants prior to the meeting.

8 PROPOSED AGENDA

Table 5, SMS agenda

	Agenda Items	Time (AEDT)	Presenter
1	**Welcome/Introductions**	9am	Facilitator/All
2	**Workshop Overview and Objectives**	9:05am	Facilitator
3	**Pipeline Design Review/ Operating Approach** · Wall Thicknesses · Rupture and puncture · Radiation contours · Location Classes · Interface agreements with corridor users · Other relevant items	9:10am	Facilitator/APA
4	**Development Review**	9:40am	Client
5	**Non-Location Specific Threats Review** · Review identified non-location specific threats not covered during crossing design review (both during Construction and Post Construction) · Review external interference controls applied and assess adequacy. · Review design controls applied and assess adequacy · Risk assess Threat if found not to be fully mitigated	10:40am	All
6	**Morning Tea Break**	10:30am	All
7	**Non-Location Specific Threats Review - Continued**	10:40am	All
8	**Lunch Break**	12:30pm	All
9	**Complete any other outstanding Non-Location Specific Threats** · Review identified non-location specific threats not covered during crossing design review (both during Construction and Post Construction) · Review external interference controls applied and assess adequacy. · Review design controls applied and assess adequacy · Risk assess Threat if found not to be fully mitigated	1:00pm	All
10	**Review All Actions Raised for Consistency and Responsibility** · Review the threats found not to be mitigated during the threat review process and undertake a risk assessment to determine the level of residual risk. Proposed Risk Matrix is included in Appendix A.	2:00pm	All
11	**Workshop Close**	2:30pm	

Note: if any Risks are found to be Intermediate and require an ALARP or LOPA Assessment then these assessments may require specific information which may not be available at the SMS Workshop and as such will need to be assessed post the workshop and presented to the relevant Parties for acceptance at a later date.

APPENDIX A - AS2885 Risk Matrix

The AS2885.6.2108 Risk Matrix we will use to undertake any risk assessments.
Please refer to Tables 3.1/3.2/3.3 in the Standard. Excerpt of the Risk Matrix from the Standard is below.

AS2885.6 Section 3.5

3.5 QUALITATIVE RISK ASSESSMENT

3.5.1 General

RISK ASSESSMENT of FAILURE SCENARIOS shall be undertaken in accordance with the qualitative method described in this Clause 3.5.

NOTE: This qualitative risk evaluation method is consistent with the process defined within AS/NZS ISO 31000.

There are circumstances where risk estimation using quantitative (numerical) methods may be useful to enable comparison of alternative mitigation measures as a basis for demonstration of ALARP, and in some jurisdictions, to satisfy planning criteria. Purely quantitative methods are not permitted as a substitute for the qualitative assessment required by this Standard, although quantitative estimates may be used to assist with estimating frequency and consequences as part of the qualitative method required by this Standard.

NOTE: Quantitative RISK ASSESSMENT methods need to be used with great care. Classical quantitative RISK ASSESSMENT using historical. failure rates is not valid for determining the absolute risk level of Australian and New Zealand pipelines due to the lack of relevant statistical data. The failure rate of Australian pipelines has been assessed to be at least an order of magnitude lower than pipelines in other parts of the world so use of historical :failure rates from overseas will generate unrealistically conservative results. Reliability-based analysis such as permitted by Canadian Standard CSA Z662 may have more validity.

3.5.2 Severity analysis

The consequences of each FAILURE SCENARIO shall be described, assessed and documented.

A severity class shall be assigned to each FAILURE SCENARIO based on the consequences at the location of the failure. The severity class shall be selected from Table 3.1.

NOTE: Appendix G provides guidance on estimating consequences.

TABLE 3.1

SEVERITY CLASSES

Dimension	Severity class				
	Catastrophic	Major	Severe	Minor	Trivial
	Measures of severity				
People	Multiple fatalitiesresult	One or two fatalities; or severalpeople with life-threatening injuries	Injury or illness requiring hospital treatment	Injuries requiring first aid treatment	Minimal impact on health and safety
Supply (see Note)	Widespread or significant societalimpact, such as complete loss of supply to a major city for an extended time (more than a fewdays)	Widespread societal impact such as loss of supply to a major city for a short time(hours to days) or toa localized area for a longer time	Localized societal impactor short-term supply interruption (hours)	Interruption or restriction of supply but shortfall met from other sources	No loss or restriction of pipeline supply
Environment	Impact widespread; viability of ecosystems or species affected;or permanent major changes	Major impact well outside PIPELINE CORRIDOR or site; or long-term severe effects; or rectification difficult	Localized impact, substantially rectified within a year or so	Impact very localized and very short-term (weeks), minimal rectification	No effect: or minor impact rectified rapidly (days) with negligible residual effect

NOTE: Appendix G provides guidance on assessment of consequence severities.

3.5.3 Frequency analysis

A frequency class shall be assigned to each FAILURE SCENARIO. The frequency class shall be selected from Table 3.2.

The contribution of existing controls to the prevention of failure shall be considered in assigning_ the frequency class.

NOTE: Appendix F provides guidance on estimating frequencies.

TABLE 3.2

FREQUENCY CLASSES

Frequency class	Frequency description
Frequent	Expected to occur once per year or more
Occasional	May occur occasionally in the life of the pipeline
Unlikely	Unlikely to occur within the life of the pipeline, but possible
Remote	Not anticipated for this pipeline at this location
Hypothetical	Theoretically possible but would only occur under extraordinary circumstances

3.5.4 Risk ranking

Table 3.3 shall be used to combine the results of the consequence analysis and the frequency analysis to determine the risk rank.

Use of the risk matrix in Table 3.3 is mandatory for SAFETY MANAGEMENT STUDIES in accordance with this Standard. Other methods such as a corporate risk matrix may be used only in parallel with Table 3.3 or as part of a separate corporate RISK ASSESSMENT.

TABLE 3.3
RISK MATRIX

	Catastrophic	Major	Severe	Minor	Trivial
Frequent	Extreme	Extreme	High	Intermediate	Low
Occasional	Extreme	High	Intermediate	Low	Low
Unlikely	High	High	Intermediate	Low	Negligible
Remote	High	Intermediate	Low	. Negligible	Negligible
Hypothetical	Intermediate	Low	Negligible	Negligible	Negligible

NOTE: Comparative studies sponsored by the Energy Pipelines Cooperative Research Centre have shown that for risks ranked as Intermediate, Table 3.3 produces results consistent with both reliability-based analysis (in accordance with Annex O of CSA Z662-07) and quantitative risk assessment. Use of a different risk matrix or method that has not been similarly calibrated may produce invalid results.

APPENDIX G: SMS Technical Presentation

AS 2885.6 SMS Workshop
Parwan Employment Precinct Development

Technical Information

July 2023

Facilitator:- Mark Harris
Delphi Risk Management Consulting
Ph 0438890968
markharris@delphirisk.com.au

APA Brooklyn-Ballan Pipeline T56 Licence No. PL78 (1972)
Design Information

Substance conveyed	Natural Gas
Length of pipeline affected	5850 m + 2 x 171m (Total 6192m approx)
Pipeline section under review within PSP	~KP33.85 to 39.70 (Plus ML each end)
Outside diameter	219.1 mm
Wall Thickness	6.35mm & 7.04mm
Depth Of Cover	1.2 -1.4m
Pipe specification	API 5L Grade B (with Coal Tar Enamel or Polyethylene coating)
Max. Allowable Operating Pressure	7390 kPa (MAOP)
Current Location Class - Primary	R1
Current Location Class – Secondary	None
New Location Class - Primary	R1
New Location Class – Secondary	I
CDL	115mm (@ 6.35mm WT)
Credible Excavator Size in the area	30T with Penetration Teeth (VTSP SMS Report)
Credible Hole Size from Excavator	70mm (for penetration teeth)
Credible Hole Size from Auger	50mm
Measurement Length (ML)	171m (4.7 kW/m^2 Heat Radiation Zone, Q 14GJ/s)
	104m (12.6 kW/m^2 Heat Radiation Zone)
Hole size based on 10 GJ/s release rate	147mm
50mm hole ML	70m
70mm hole ML	98m

APA Brooklyn-Ballan Pipeline T56 Licence No. PL78 (1972) Design Information

Credible Excavator Size	30T with Penetration Teeth
Max equipment sizes without risk of a leak(B Factor 1.3, 6.35mm WT)	
• Excavator with General Purpose Teeth	N/A (>55T)
• Excavator with Tiger Teeth (Single Point Penetration)	5T
• Excavator with Twin Tiger Teeth (both Points Penetration)	20T
• Excavator with Penetration Teeth	5T
•	
Max equipment sizes without causing risk of Rupture(B Factor 1.3, 6.35mm WT)	
• Excavator with General Purpose Teeth	N/A (>55T)
• Excavator with Tiger Teeth (Single Point Penetration)	N/A (>55T)
• Excavator with Twin Tiger Teeth (both Points Penetration)	N/A (>55T)
• Excavator with Penetration Teeth	N/A (>55T)

Generic Protections – By APA

Patrolling :
Ground patrol – Quarterly(R1), Weekdays (I)
Aerial patrol – Monthly

Liaison with land users – annually

Marker signs, max. spacing
I 100m, R1 500m

Buried Marker Tape (300mm above pipe) – No

Pipeline Awareness Programs, D.B.Y.D, Landholder Liaison - Yes

Depth Of Cover :
1.2 to 1.4m

Bollards and Fencing for above ground facilities – High Security Fencing / Buffer Zone Fence / Bollards
CP Test Point & Anode Bed - Parwan South Rd (WWTP side) / BMG Rd (east side) / 200 Smith Rd (north side)

Land Use (both during Construction & Existing land use?)

Nominate in general the types of activities expected from land users over the length of the pipeline. (e.g. Farmers, Council, Constructors etc.)

Existing Excavator Use: Credible Excavator Size 30T with Penetration teeth (SMS Report VTS2021)

During Construction: (Developer to Advise)

Water Crossing Design	Yes
Boring and Open Cut	Yes
Blade Ploughing	Yes - Road Crossing Construction
Ripping	No
Excavators	Size up to 30T (TBC)
Bulldozers (no Rippers)	Yes
Rock hammer	Yes
Boring rigs (pole augers/piling or HDD)	Yes - Street Lighting & Signage
Heavy Vehicles	Yes - Non road legal

APPENDIX H: SMS Workshop Minutes

Parwan - Safety Management Study

Friday, 7 July 2023

Brooklyn-Ballan Pipeline T56 Licence No. PL78 (1972)
~KP33.85 to 39.70 (Plus ML each end)

Threat ID	Threats	Consequence	Credible Risk (Y/N)	Reasons this threat is not a credible risk?	Physical Protection Measures	Procedural Protection Measures	Is Risk Mitigated as per AS2885? (If No then Risk Assess)	Comments	Frequency (AS2885.1 Model)	Consequences (AS2885.1 Model)	Pipeline Risk	Considerations which lead to assessment of Risk	Actions	Responsibility	Due Date	Is Risk Mitigated as per AS2885?
1	**Excavator use over easement (up to 30T)**	Damage to coating & or gouge to pipe requiring dig up and repair and temporary loss of supply.	**Y**		Depth of Cover,	DBYD, Patrolling, PTW, signage	**No**		**Remote**	**Severe**	**Low**	Consequence - **Supply** Severe as loss of supply can have a significant impact on supply pressure in the network until repaired, localised societal impact only; Likelihood - Remote, as pipeline impact is not anticipated because of procedures and highly controlled environment during works				**Yes**
2	**Excavator use over easement (up to 30T)**	Pipe Damage resulting in a hole causing loss of containment. Hole is less than critical defect length or max credible hole size (whichever is the smaller) 70mm leading to a 98m radiation contour	**Y**		Depth of Cover, WT	DBYD, Patrolling, PTW, signage	**No**	Post development it is highly unlikely that Penetration or Tiger teeth would every be needed for excavation	**Hypothetical**	**Major**	**Low**	Consequence - **People** Major as potential work crew and onlookers could be seriously injured or killed (1-2 fatalities) **Supply** consequence considered Major due a week outage to Ballan; Likelihood - Hypothetical as in a highly controlled environment				**Yes**
3	**Excavator use over easement (up to 30T) - During Development**	Pipe Damage resulting in a hole causing loss of containment. Hole is greater than critical defect length leading to **rupture**	**N**	This pipeline has been tested and found not to be at risk of rupture (refer to APA Report 18035-RP-L-0007_1)												
4	**Excavator use over easement (up to 30T) - Post Development**	Pipe Damage resulting in a hole causing loss of containment. Hole is greater than critical defect length leading to **rupture**. Up to 100-200 people impacted within ML	**N**	This pipeline has been tested and found not to be at risk of rupture (refer to APA Report 18035-RP-L-0007_1)												**Yes**
5	**Augering of Piles for street light pole footings or fences**	Auger impacts pipeline damaging the coating and denting or gouging the pipeline which could require reducing the MAOP or replacement of a section. Potential loss of supply.	**Y**		Depth of Cover, WT	DBYD, Patrolling, PTW, signage	**No**		**Remote**	**Severe**	**Low**	Consequence - **Supply** Severe as loss of supply can have a significant impact on supply pressure in the network until repaired, localised societal impact only; Likelihood - Remote, as pipeline impact is not anticipated because of procedures and highly controlled environment during works				**Yes**
6	**Augering of Piles for street light pole footings or fences**	Auger impacts pipeline causing a hole in the pipe (~50mm leading to a 70m ML) which would require replacement of a section. Potential loss of supply and serious injury to auger operator if gas ignited (2% chance for a gas leak)	**Y**		Depth of Cover, WT	DBYD, Patrolling, PTW, signage	**No**		**Hypothetical**	**Major**	**Low**	Consequence - **People** Major as potential work crew and onlookers could be seriously injured or killed (1-2 fatalities) **Supply** consequence considered Major due a week outage to Ballan; Likelihood - Hypothetical as in a highly controlled environment				**Yes**
7	**Augering of Piles for street light pole footings or fences**	Pipe Damage resulting in a hole causing loss of containment. Hole is greater than critical defect length leading to rupture	**N**	Augers have a 50mm drill bit on the tip and so the likely hole size from an auger is up to 50mm which is well below the CDL and so the pipeline cannot rupture from this threat												
8	**Use of HDD to install Utilities across pipeline easement**	Damage to coating & or gouge to pipe requiring dig up and repair and temporary loss of supply.	**Y**		WT	DBYD, Patrolling, PTW, signage + APA procedure for monitoring of HDD crossing including use of slit trenches to positively identify horizontal trenching	**No**		**Remote**	**Severe**	**Low**	Consequence - **Supply** Severe as loss of supply can have a significant impact on supply pressure in the network until repaired, localised societal impact only; Likelihood - Remote, as pipeline impact is not anticipated because of procedures and highly controlled environment during works				**Yes**
9	**Use of HDD to install Utilities across pipeline easement**	Pipe Damage resulting in a hole causing loss of containment. Hole is max credible hole size of 50mm, any more and an operator would know this issue and stop drilling.	**Y**		WT	DBYD, Patrolling, PTW, signage+ APA procedure for monitoring of HDD crossing including use of slit trenches to positively identify horizontal trenching	**No**		**Hypothetical**	**Major**	**Low**	Consequence - **People** Major as potential work crew and onlookers could be seriously injured or killed (1-2 fatalities) **Supply** consequence considered Major due a week outage to Ballan; Likelihood - Hypothetical as in a highly controlled environment				**Yes**
10	**Use of HDD to install Utilities across pipeline easement**	Pipe Damage resulting in a hole causing loss of containment. Hole is greater than critical defect length leading to rupture	**N**	HDD cannot cause the pipeline to rupture, assume the HDD pilot might cause a 50mm hole only but not rupture unless the HDD was left uncontrolled for an extended period of time?												
11	**Boring and Driving of Piles for building footings**	Vibration from works damages the coating leading to corrosion and failure of the pipe	**Y**		WT	DBYD, Patrolling, PTW, signage	**Yes**						Developer to identify in the CMP if piling is required as part of the development. CMP will be reviewed by APA prior to construction commencing. (Note due to CTE coating of pipeline max allowable vibration at pipeline is 10mm/s.)	Developer Council APA	Prior to construction	**Yes**
12	**Boring and Driving of Piles for building footings**	Gouge to pipe or holing or rupturing the pipeline.	**Y**		WT	DBYD, Patrolling, PTW, signage	**Yes**						Developer must ensure no buildings or structures are placed on the easement. (Identifiable from construction plans). Council as responsibility authority, to implement this and ensure timely referrals are made to APA	Developer Council APA	Prior to construction	**Yes**
13	**Rail/Tram Crossing**	Over stressing the pipe resulting in pipe deformation (out of round), which could require reducing the MAOP or replacement of a section to allow for future integrity works. Potential loss of supply. Coating cracks leading to corrosion	**N**	No Rail/Trams proposed												
14	**Rail/Tram Crossing**	High voltage power associated with Tram may influence the CP of the pipeline.	**N**	No Rail/Trams proposed												
15	**Open cut Utilities installation (Water/Power/Comms) over or under the pipeline**	Pipe impacted during utility installation resulting in damage or a hole causing loss of containment. Hole is less than critical defect length or max credible hole size (whichever is the smaller) Maximum credible hole size for a 30T excavator 70mm hole leading to a ML 98m.	**Y**		Depth of Cover, WT	DBYD, Patrolling, PTW, signage	**No**	The PTW and DBYD are critical at installation as there is no additional slabbing protection.	**Hypothetical**	**Major**	**Low**	Consequence - **People** Major as potential work crew and onlookers could be seriously injured or killed (1-2 fatalities) **Supply** consequence considered Major due a week outage to Ballan; Likelihood - Hypothetical as in a highly controlled environment	APA to provide Std crossing designs for Developer reference. Future crossing designs to comply with APA minimum standard crossing requirements Should MW deem a waterway or pipe/relevant infrastructure to affect the pipeline is necessary, they will engage with APA	Developer Council APA MW/GWW	Detailed Design	**Yes**
16	**Open cut maintenance of Utilities (Water/Power/Comms) over pipeline**	Pipe impacted during utility maintenance resulting in damage or a hole causing loss of containment. Hole is less than critical defect length or max credible hole size (whichever is the smaller) Maximum credible hole size for a 30T excavator 70mm hole leading to a ML 98m.	**Y**		Depth of Cover, WT, (possible Concrete Slabbing)	DBYD, Patrolling, PTW, signage, marker tape	**Yes**	Standard design has a concrete slab and marker tape under the utility but over the pipeline stopping utility operator from impacting the pipeline whilst digging down to reach the utility								

17	**Use of Bored or Jacked crossing to install Utilities under pipeline easement (e.g. Sewer pipe)**	Damage to coating, or gouge or a hole or **rupture** of the pipeline requiring dig up and repair and significant loss of supply.	**Y**		WT	DBYD, Patrolling, PTW, signage + APA procedure for monitoring of Bored or Jack crossing including use of slit trenches to positively identify horizontal trenching	**No**	Setup for a Bored Crossing takes days by a highly experience contractor who will engage with APA. It was agreed that no changes in the design or further protect of the pipeline was required	**Hypothetical**	**Catastrophic**	**Intermediate**	Consequence - Catastrophic as potential work crew and multiple onlookers could be killed (Supply consequence considered Major); Likelihood - Hypothetical as would only occur under extraordinary circumstances. Known threat considered ALARP with no further mitigations required. (Refer ALARP Report 320-RP-AM-0251)				**Yes**
18	**Road Crossing (road legal vehicles).**	Over stressing the pipe resulting in pipe deformation (out of round), which could require reducing the MAOP or replacement of a section to allow for future integrity works. Potential loss of supply.	**Y**		Depth of Cover, WT	Properly considered road design/Patrolling	**Yes**	Pipeline is designed to resist road legal vehicle movements. No planned road crossings on the pipeline for this development				Refer to APA's std road crossing design.	Pipeline to be recoated and slabbed as part of APA's Std Design if any new crossing designs are required	Developer/Council/ DTP	Detailed Design	**Yes**
19	**Heavy vehicle access track to works (non road legal vehicles).**	Over stressing the pipe resulting in pipe deformation (out of round), which could require reducing the MAOP or replacement of a section to allow for future integrity works. Potential loss of supply.	**Y**		Depth of Cover, WT, Fencing (temp & Permanent)	Patrolling, PTW + APA approval of design and the final Construction Management Plan	**Yes**	Refer APA Temp road crossing design.								
20	**Increased DOC due to landscaping or pavement build-up or placement of Spoil?**	Over stressing the pipe resulting in pipe deformation (out of round), which could require reducing the MAOP or replacement of a section to allow for future integrity works. Potential loss of supply.	**Y**		Depth of Cover, WT, Fencing (temp & Permanent)	Patrolling, PTW + APA approval of design and the final Construction Management Plan	**Yes**									
21	**Heavy lift cranes straddling pipeline. Use of excavator only near or over pipeline**	Over stressing the pipe resulting in pipe deformation (out of round), which could require replacement of a section to allow for future integrity works. Coating could also be damaged. Potential loss of supply for perhaps up to a month.	**Y**		Depth of Cover, WT,	Patrolling, PTW + APA approval of the Construction Management Plan and Lifting Plan	**Yes**									
22	**Excavator heavy lift over easement/ gas pipeline to install third party pipe crossing**	Heavy components falls on the gas pipeline resulting in localised overstressing or damage of coating or gouging pipeline leading to corrosion and a leak only. Potential for lifting of piping over/near gas pipe while installing third party utility crossing	**Y**		Depth of Cover, WT, Fencing (temp & Permanent)	Patrolling, PTW + APA approval of the Construction Management Plan and Lifting Plan	**Yes**	Steel plate over pipe or timber/sandbags strapped to pipe to prevent damage required as part of PTW. Third party pipe positioned to minimise or eliminate need to lift over gas pipe.								
23	**CP interference construction works.**	CP is damaged or compromised during works resulting in long term corrosion potential leading to leak only	**Y**			CPU inspected monthly, CP test points checked 6 monthly.	**Yes**						CMP to include identification of all CP assets and provide appropriate protection during construction	Developer/ APA	Prior to construction	**Yes**
24	**CP interference from adjacent, parallel infrastructure.**	CP is damaged or compromised by local electrical currents causing localised long term corrosion potential leading to leak only	**Y**			CPU inspected monthly, CP test points checked 6 monthly.	**Yes**						Design/utility plans to include identification of proposed Transformers and or HV power supplies near pipeline easement for APA review and approval	Developer/ APA	Detailed Design	**Yes**
25	**Pipeline equipment exposed during crossing works potentially being inundated with stormwater compromising its operation.**	Pipe coating damaged if pipe trench left open during open cut crossing works. Leading to corrosion and a leak only	**Y**		WT	DBYD, Patrolling, PTW	**Yes**	Steel plate or fencing and possible wool blankets to prevent damage required as part of PTW								
26	**Natural Events - Floods (Erosion, impact damage) Scouring of pipe trench, change in watercourse conditions during or after works.**	Stormwater scour as a result of the design of the stormwater management as part of the Development. Leading to loss of DOC and impact on pipe coating leading to corrosion and a leak only	**Y**		Depth of Cover, WT	Patrolling, APA review of Development Stormwater design, easement inspection post major rain event.	**Yes**	MW will engage with APA when stormwater design has been developed								
27	**Threat - Vibration due to compaction**	Pipe coating damaged due to vibration could lead to corrosion and leak if uncontrolled	**Y**		Depth of Cover, WT	Patrolling, PTW + APA approval of the Construction Management Plan. CMP to comply with APA Standard conditions for working around pipelines (580-POL-L-0001)	**Yes**									
28	**Threat - Excavation next to edge of easement**	Causing easement profile to diminish reducing DOC.	**Y**		Depth of Cover, WT. Min 4.5m separation between pipeline and edge of easement	Patrolling, PTW + APA approval of the Construction Management Plan.	**Yes**	Note, any excavation next to the pipeline easement must not lead to reduction in DOC across the easement								
29	**Threat - Vehicle collision with exposed pipeline during construction activities resulting in pipeline dent or gouge.**	Pipe coating damaged if pipe trench left open during open cut crossing works	**Y**		WT	Patrolling, PTW + APA approval of the Construction Management Plan. (Use of steel plate or fencing etc.. To protect open trench from equipment egress)	**Yes**									
30	**Blasting.**	Uncontrolled blasting creates damage to coating and potential over stressing of the pipeline. Leading to loss of containment	**N**	No Blasting required for Project												
31	**Potholing to locate pipe.**	Damage to pipe coating in process of locating pipe resulting in coating failure and possible corrosion to pipe.	**Y**		WT	APA's approved contractors and potholing procedure as part of PTW.	**Yes**									
32	**Tree removal adjacent to the pipeline.**	Ripping of trees where roots are in contact with pipe could damage coating, leading to corrosion damage and requiring repair.	**Y**		WT	Patrolling, PTW	**Yes**									
33	**Maintenance - Inadequate servicing of equipment**	APA cannot access easement/meter/reg assets due to new development	**Y**	No facilities impacted	Separation (fencing maintains access for APA)	Patrolling, PTW	**Yes**	Easement is generally accessible .					Access to City Gate must be maintained at all times during the develop construction. Requirement to be included in CMP	Developer	Prior to construction	**Yes**
34	**Threat - New building footings located on edge of easement**	New building footing may present an additional stress to the pipeline, resulting in coating damage and eventual corrosion, leading to a leak.	**Y**		WT	APA to review Design drawings and CMP to identify if risk existing and agree controls	**Yes**									
35	**Intentional Damage - Sabotage, Terrorism or Malicious Damage**	coating damage or loss of containment leading to corrosion and a leak only	**Y**		Depth of Cover, WT Fencing of City Gate, Reg Stn in locked Kiosk inside locked compound	Patrolling + additional population provides passive surveillance	**Yes**	No significant change from current risk level as a result of the Development								
36	**Threat - Deep ripping activities impacts the pipe and causes a loss of containment - leak but not rupture**	Pipeline damage, leak or rupture	**N**	If ripping is required then APA will review as part of the CMP review												
37	**Rock Saw/Hammer used in Development construction**	Causes pipeline to rupture	**Y**		WT	Patrolling, PTW + APA approval of the Construction Management Plan. Highly controlled activity. Easement delineation	**Yes**									
38	**Noise from the City Gate Reg causes complains to APA and potential impact to normal operation**	Cannot operate the facility, non compliance with EPA noise requirements	**Y**		Separation & Concrete Kiosk	Operation and maintenance procedures	**Yes**									

39	**Odour from City Gate Reg causes complaints to APA and potential impact to normal operation**	Cannot operate the facility	**Y**		Separation	Operation and maintenance procedures	**Yes**	No continuous venting from city gate								
40	**Flammable gas plume from City Gate Reg impinges nearest residents or nearest ignition source.**	Prevents normal venting operations from the field reg	**Y**		Separation	Operation and maintenance procedures	**Yes**	No continuous venting from city gate								
41	**Inappropriate choice of vegetation within easement**	Blocking line of site between marker signs or roots damaging pipeline coating.	**Y**		DOC, WT	Patrolling, PTW	**Yes**	VPA does not intend to redevelop the pipeline easement as passive open space so existing landscaping is expected to be maintained. If this approach changes then please refer to APA Landscaping Guidelines availabble on APA Website.								
42	**Pipeline CTE coating contains asbestos**	Impacting coating could release asbestos fibres putting health at risk.	**Y**		Depth of Cover	DBYD, Patrolling, PTW, Removal of CTE coating to be done by a qualified contractor to avoid breathing in asbestos.	**Yes**									

Parwan - Safety Management Study
Friday, 7 July 2023
Miscellaneous Actions

No.	Issue	Action	Responsibility	Due Date	Close Out Comments	Close Out Date
A1	SMS findings not translated into planning docs leading to variations and disruption of construction works	VPA & Council to ensure all requirements from SMS are incorporated into the relevant VPA Documentation and MSC planning scheme.	VPA / Council	Prior to issue of planning permits and planning work within project		
A2	Construction of the Development could damage the pipelines	Developer to prepare a Construction Management Plan as per permit condition to the satisfaction of the responsibility authority. Review and comment will be sought by MSC to APA (pipeline licensee) as part of the planning application.	Developer/ Council/ APA	Prior to works starting		
A3	Contractors may no be familiar with working around TP Gas Pipelines	Engage in a –Third Party Works - Safety Awareness Session, either as a toolbox or zoom meeting for contractors undertaking building and works nearby the pipeline.	Developer/APA	Prior to works starting		
A4						
Threat Specific Actions						
11	Vibration from works damages the coating leading to corrosion and failure of the pipe	Developer to identify in the CMP if piling is required as part of the development. CMP will be reviewed by APA prior to construction commencing. (Note due to CTE coating of pipeline max allowable vibration at pipeline is 10mm/s.)	Developer/ Council/ APA	Prior to construction		
12	Gouge to pipe or holing or rupturing the pipeline.	Developer not to propose any buildings or structures on the pipeline easement. (Identifiable from construction plans). Council as responsibility authority, to implement this and ensure timely referrals are made to APA.	Developer/ Council/ APA	Prior to construction		
15	Pipe impacted during utility installation resulting in damage or a hole causing loss of containment. Hole is less than critical defect length or max credible hole size (whichever is the smaller) Maximum credible hole size for a 30T excavator 70mm hole leading to a ML 98m.	APA to provide Std crossing designs for Developer reference. Future crossing designs to comply with APA minimum standard crossing requirements Should MW deem a waterway or pipe/relevant infrastructure to affect the pipeline is necessary, they will engage with APA.	Developer Council APA MW/GWW	Detailed Design		
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23	CP is damaged or compromised during works resulting in long term corrosion potential leading to leak only	CMP to include identification of all CP assets and provide appropriate protection during construction	Developer/ APA	Prior to construction		
24	CP is damaged or compromised by local electrical currents causing localised long term corrosion potential leading to leak only	Design/utility plans to include identification of proposed Transformers and or HV power supplies near pipeline easement for APA review and approval	Developer/ APA	Detailed Design		
33	APA cannot access easement/meter/reg assets due to new development	Access to City Gate must be maintained at all times during the develop construction. Requirement to be included in CMP	Developer	Prior to construction		