Delphi Risk Management Consulting

Victorian Planning Authority
Officer South Employment PSP,

AS 2885.6 Safety Management Study
Workshop & Report

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1. ABBREVIATIONS

ALARP	As Low As Reasonably Practicable
APA	APA Group (Pipeline Licensee)
APA Networks	APT O&M services (APA Networks) operates and manages the natural gas reticulation network within the Precinct on behalf of Australian Gas Networks (AGN)
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
CSC	Cardinia Shire Council
CTE	Coal Tar Enamel
CTMS	Custody Transfer Meter Station
DBYD	Dial Before You Dig
DRMC	Delphi Risk Management Consulting – SMS Reviewer & Facilitator
DN	Diameter nominal
DOC	Depth of Cover
EIP	External Interference Protection
FJC	Field Joint Coating
GIS	Geographical Information System
GJ/s	Gigajoules per Second (energy release rate)
GPT	General Purpose Teeth (used on excavator buckets)
HDD	Horizontal Directional Drill (used for installation of utilities under existing assets)
km	Kilometre(s)
KP	Kilometre Point
kPag	kiloPascals (gauge)
kW/m^2	Kilowatts per metre squared (heat radiation flux)
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, results in 2nd degree burns within 30 sec of exposure at this distance)
MLV	Main Line Valve
MW	Melbourne Water
OPP	Overpressure Protection
O&M	Operations and Maintenance
PE	Polyethylene plastic gas pipe
PIMP	Pipeline Integrity Management Plan
PL	Pipeline License
PPV	Peak Particle Velocity, related to degree of ground movement or vibration
PSP	Precinct Structure Plan
R1	Rural location classification
R2	Rural Residential location classification
ROW	Right of Way/Easement
RTP	Resistance to Penetration
S	Sensitive Use location classification
SAOP	Safety and Operating Plan
SEW	South East Water
SLC	Secondary Location Class
SMS	Safety Management Study
SMYS	Specified Minimum Yield Stress
SWMS	Safe Work Method Statement
T1	Residential location classification
T2	High Density location classification
TOR	Terms of Reference
TP	Transmission Pipeline
w.r.t.	With Respect To
VPA	Victorian Planning Authority
WT	Wall Thickness

2. EXECUTIVE SUMMARY

2.1 Background

The proposed Project under review is the Officer South Employment Precinct Structure Plan (PSP). The proposed PSP is positioned immediately over and around an existing APA Group Transmission Pressure Gas Pipeline and Officer City Gate Gas Regulating Facility.

To comply with Australian Standard AS2885.6-2018, land use changes in the immediate vicinity (i.e. within the Measurement Length, ML) of a transmission pressure gas pipeline must be subjected to a Safety Management Study (SMS) to review all possible threats to the safe operation and maintenance of the pipeline and associated facilities to 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 to facilitate an SMS Workshop for this PSP.

This SMS Report captures the findings of the "Land Use Change" (AS2885.6 Table 5.1) SMS Workshop held on the 27th of April 2022. The PSP provided for review at the SMS Workshop was sufficient to allow the Workshop to assess all likely risks. The findings from this SMS Report will provide direction to the VPA & CSC and future Developers as part of the future Planning Permits(s).

2.2 Key Findings

The workshop found that based on the known and anticipated threats considered, TP Gas Pipeline PL50, would be considered a "no rupture" pipeline. It was found to have a credible consequence distance (4.7kW/m2 radiation contour) from an ignited leak of ~50m.

The proposed Development land use within the pipeline Measurement Length (ML, 240m) includes both industrial and business land use but no proposed "Sensitive" land uses, therefore, under AS2885 a Secondary Location Class of "Industrial" will be added to the existing Location Classes applied to the affected pipeline in the area of the PSP.

Due to the pipeline being "no rupture" and the land use being mostly industrial with some business use, there were no Intermediate risks identified and thus no need for any further ALARP assessments.

The results of the 48 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
PL50	48	10	38	5	3	2	-

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

2.3 Actions

There were seventeen 17 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 PSP Requirements/Tender Docs leading to variations and disruption of construction works	VPA to ensure all relevant SMS findings are incorporated into the either the PSP or the planning ordinances where applicable (including requirements for consultation with APA & APA Networks).	VPA/APA/ APA Networks	Prior to PSP being finalised

No.	Issue	Action	By	Due Date
A2	Construction of the Development could damage the pipelines	VPA will include a requirement in the UGZ schedule to undertake a gas pipeline construction management plan within 50 metres of the boundary of the easement. A future developer is to facilitate preparation of a Construction Management Plan (CMP), under the schedule to the UGZ for review and comment by APA/APA Networks prior to any third party works.	VPA/APA/ APA Networks	Prior to PSP being finalised
A3	The E/W Connector Road appears to clash with the north side of the City Gate	VPA to consider moving E/W Connector Rd further north or to the south of the City Gate to provide appropriate separation in liaison with APA/APA Networks.	VPA/APA/ APA Networks	Prior to PSP being finalised
A4	Industrial use could include storage of flammable/combustible products or other use (e.g. Sensitive Use) which could constitute a multiplying effect to the consequence	SMS confirmed that max consequence distance is ~50m (65mm hole from excavator penetration teeth). Action to include provision in PSP Ordinance for APA/APA Networks notice for land use applications within 50m of the pipeline easement or City Gate. APA/APA Networks to will review and approve the construction management plan.	VPA/APA/ APA Networks	Prior to PSP being finalised
A5	APA Transmission /APA Networks cannot access City Gate during adjacent roadwork or PSP construction	Planning ordinances will include a requirement for the developer to undertake a CMP, which will investigate this miscellaneous action.	VPA/APA/ APA Networks	Prior to PSP being finalised
A6	City Gate is a potential noise source which may impact on adjacent PSP development(s) if it is noise sensitive?	PSP to include a requirement for a future developer to undertake a noise assessment due diligence and confirm for the city gate noise. does not impact their operations. Developer to be responsible for any noise mitigation requirements associated with the City Gate.	VPA/APA/ APA Networks	Prior to PSP being finalised
A7	Current PSP design does not identify all utility crossings of the pipeline easement. Easement crossings should be targeted, kept to a minimum and cross as close to perpendicular as possible	All utility (and road) crossings should be designed as close to perpendicular to the pipeline easement as possible to minimise the length of any easement crossing. Number of utility crossings of the pipeline easement within the PSP should be minimised wherever possible and aligned with proposed or current road crossings. VPA to include a PSP requirement	VPA	Prior to PSP being finalised
A8	Officer City Gate Current Location Class is R1	APA Networks to update their database for the facility to include T1/I Location Classification	APA Networks	1/07/2022 POST MEETING NOTE: Closed 2/5/2022
Threat Specific Actions				
No.	**Issue**	**Action**	**By**	**Due Date**
11	Vibration from works damages the coating leading to corrosion and failure of the pipe	The Planning ordinances will include a requirement for the developer to undertake a CMP, which will investigate threat specific issues including pipeline vibration damage.	VPA/ CSC Developer/ APA	Prior to PSP being finalised
12	Gouge to pipe or holing or rupturing the pipeline.	The Planning ordinances will include a requirement for the developer to undertake a CMP, which will investigate threat specific issues including provision of a traffic management plan.	VPA/ CSC Developer /APA	Prior to PSP being finalised
15	Dent or gouge or damage to coating possible from impact of concrete piping or other load when lowered in under or over the pipeline	The Planning ordinances will include a requirement for the developer to undertake a CMP, which will investigate threat specific issues which will include provisions for protection measures to protect the pipeline and coating from potential damage during works, requirements to be clearly identified in the CMP. APA will undertake DCVG checks before and after works. Repair or replace coating if necessary at the cost of the Developer.	VPA/ CSC Developer /APA	Prior to PSP being finalised
18	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.	The Planning ordinances will include a requirement for the developer to undertake a CMP, which will investigate threat specific issues including reference to APA's std road crossing design. Note:- Pipeline is to be recoated and slabbed at each road easement crossing consistent with APA's Std Design. Council will review all road crossing designs.	VPA/ CSC Developer/ APA	Prior to PSP being finalised

No.	Issue	Action	By	Due Date
19	Over stressing the pipe resulting in pipe coating damage or 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.	The Planning ordinances will include a requirement for the developer to undertake a CMP, which will investigate threat specific issues including reference to APA's std temporary heavy vehicle road crossing design.	VPA/ CSC Developer/ APA	Prior to PSP being finalised
20	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.	The Planning ordinances will include a requirement for the developer to undertake a CMP, which will investigate threat specific issues including a Spoil Management Plan.	VPA/ CSC Developer/ APA	Prior to PSP being finalised
23	CP is damaged or compromised during works resulting in long term corrosion potential leading to leak only	The Planning ordinances will include a requirement for the developer to undertake a CMP, which will investigate threat specific issues including requirement to identify all Cathodic Protection assets and provide appropriate protection during construction.	VPA/ CSC Developer/ APA	Prior to PSP being finalised
25	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	VPA/MW to provide APA & APA Networks the proposed Drainage Service Scheme for Officer South so they can confirm that the flooding risk to their assets is not increased due to the PSP.	VPA/ MW/ CSC/ APA	Prior to PSP being finalised
46	Road intersection within 30m of city gate. Road speeds 60-80 km/hr. Vehicles turning could leave the road and impact the City Gate.	Consider provision of Armco rails at the intersection of Officer South Rd and the E/W Connector Rd to prevent vehicle impact to the City Gate. Consider including additional bollarding within the City Gate	VPA/APA/ CSC/ APA Networks	Prior to PSP being finalised

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/APA Networks prior to any works commencing.

Continued liaison between the VPA, CSC, APA Group and APA Networks should ensure that construction activities and post construction activities pose no significant increase in the operational and maintenance risk to the transmission pipeline and associated facilities effected by the PSP.

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 Officer South Employment PSP area.

3. INTRODUCTION

3.1 OFFICER SOUTH EMPLOYMENT PSP PROJECT

The Victorian Planning Authority (VPA) is developing the Officer South Employment Precinct Structure Plan (PSP). Officer South Employment PSP is located 45km south-east of Melbourne's CBD, in Cardinia Shire Council. It is bounded by Cardinia Creek to the west, Princess Freeway to the north, Lower Gum Scrub Creek to the east and the Urban Growth Boundary to the south.

The Precinct Structure Plan for Officer South includes:

1. A residential sector comprising approximately 1640 dwellings and a population of around 5084 new residents.
2. 164 hectares of commercial land which is forecasted to have 10256 commercial jobs.
3. 560 hectares of industrial land which is forecast to have 11288 industrial jobs.

3.2 GAS TRANSMISSION INFRASTRUCTURE

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

APA Group is responsible for the T1 Morwell-Dandenong high pressure gas pipeline, a 450 mm diameter transmission pipeline that runs west-east through the Precinct. This asset is contained within a 20.1 m wide easement. There is approximately 1.2 m of cover from the top of the pipe to the existing surface level.

Table 2, Pipeline Details

Pipeline	Pipeline Licence	Easement Width (m)	Pipeline Easement Location	Diameter (mm)	Measurement Length (m)
Morwell–Dandenong	T1, PL50	20	5.5m to North side	450	240
	Note: Measurement Length is applied to either side of the pipeline				

There are no other known transmission pressure gas pipeline assets affected by the PSP.

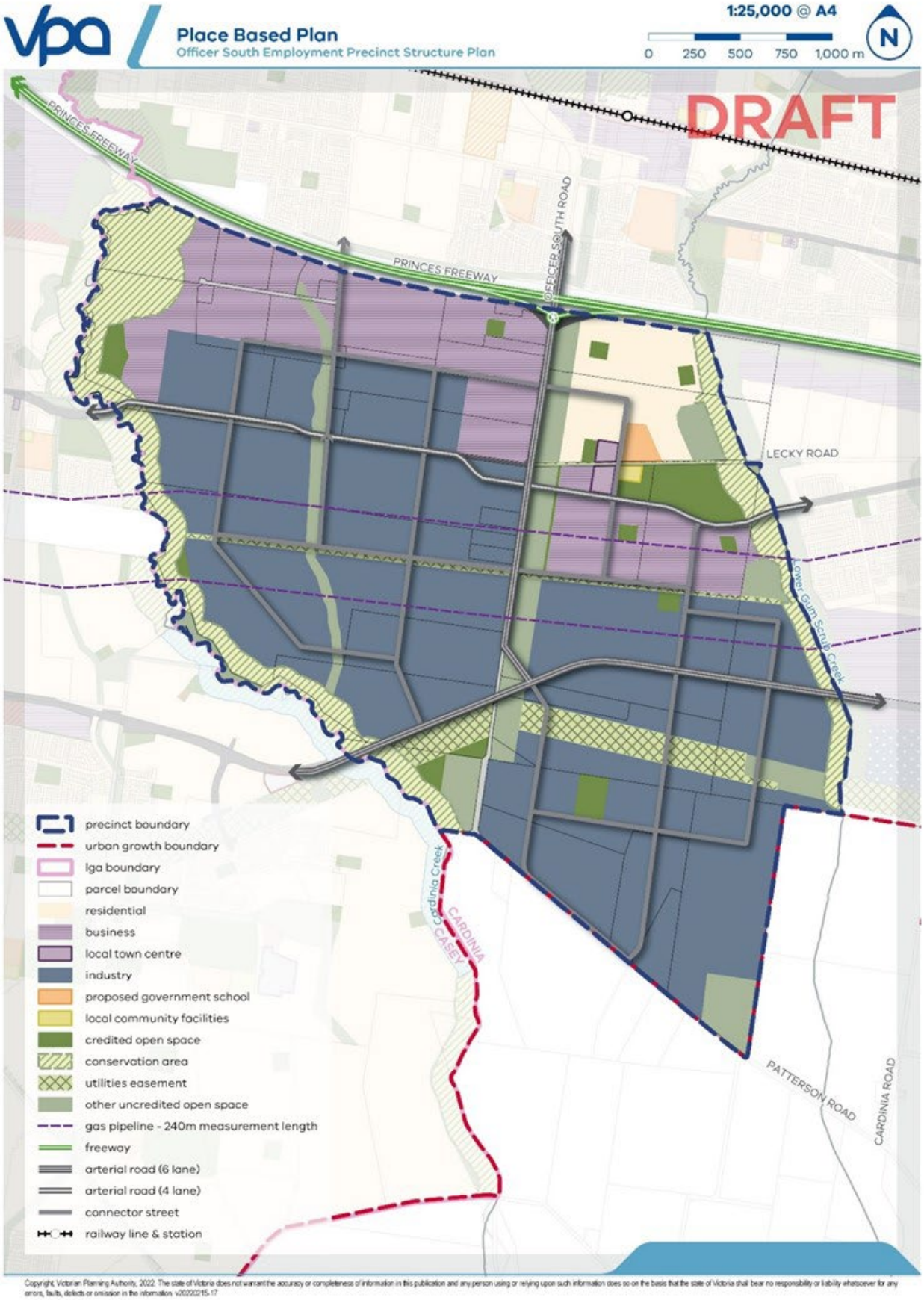
APA Group owns the gas transmission network and APA Networks operates and manages the natural gas reticulation network within the Precinct on behalf of Australian Gas Networks (AGN)

APA Networks controls distribution assets including a 180 mm diameter high pressure gas pipeline in the Lecky Road reserve to the east, and a 150 mm diameter high pressure gas pipeline located in an easement in private property, adjacent to the Officer South Road reserve in the north of the Precinct at an offset of 2.1 m.

An existing "City Gate" gas facility is operated by APA Networks and is located to the west of Officer South Road. These types of facilities may impact upon the amenity of surrounding uses (noise, smell, safety etc.) and are considered when undertaking an SMS for this PSP.

The SMS Workshop assessed the consequences, likelihoods, and overall risks to the pipeline and associated facilities during PSP construction and throughout the remaining life of the pipeline assets. The SMS Workshop sort to confirmed what, if any, new mitigations will be required to ensure the future risks to the pipeline and the population nearby are ALARP.

Figure 1, Subject site and location of APA Pipeline



Note: - Purple Dash Lines represent the TP Gas Pipeline ML, running through middle of the development

Figure 2, GIS Image of Officer South City Gate

Figure 3, GIS Image of Transmission Pipeline Route

4. WORKSHOP PARTICIPANTS

The Safety Management Study Workshop was held on the 27th of April 2022. As the SMS Workshop was undertaken over the internet using Microsoft Teams it was not possible to record a written and signed attendance sheet. (Refer to Appendix A for details of the individual's time in attendance).

The Workshop was attended by a range of qualified people comprising representatives from the Licensees (APA Group), APA Networks, VPA, MW and CSC. 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
Matthew Simmons	Planner	VPA
Maureen Benier	Senior Planner	VPA
Sarah Doring	Strategic Planning Manager – South East	VPA
Monique So	Infrastructure Engineer	VPA
Laurence Newcome	Precinct Structure Planning Coordinator	MW
James Hodges	Senior Catchment Planner	MW
Keira Lee	Coordinator Growth Area Planning	CSC
Daisy So	Risk Engineer	APA Group
Peter Dawson	Lands Officer	APA Group
Alex Chin	Integrity Engineer	APA Networks
Michael Mielczarek	Senior Urban Planner	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

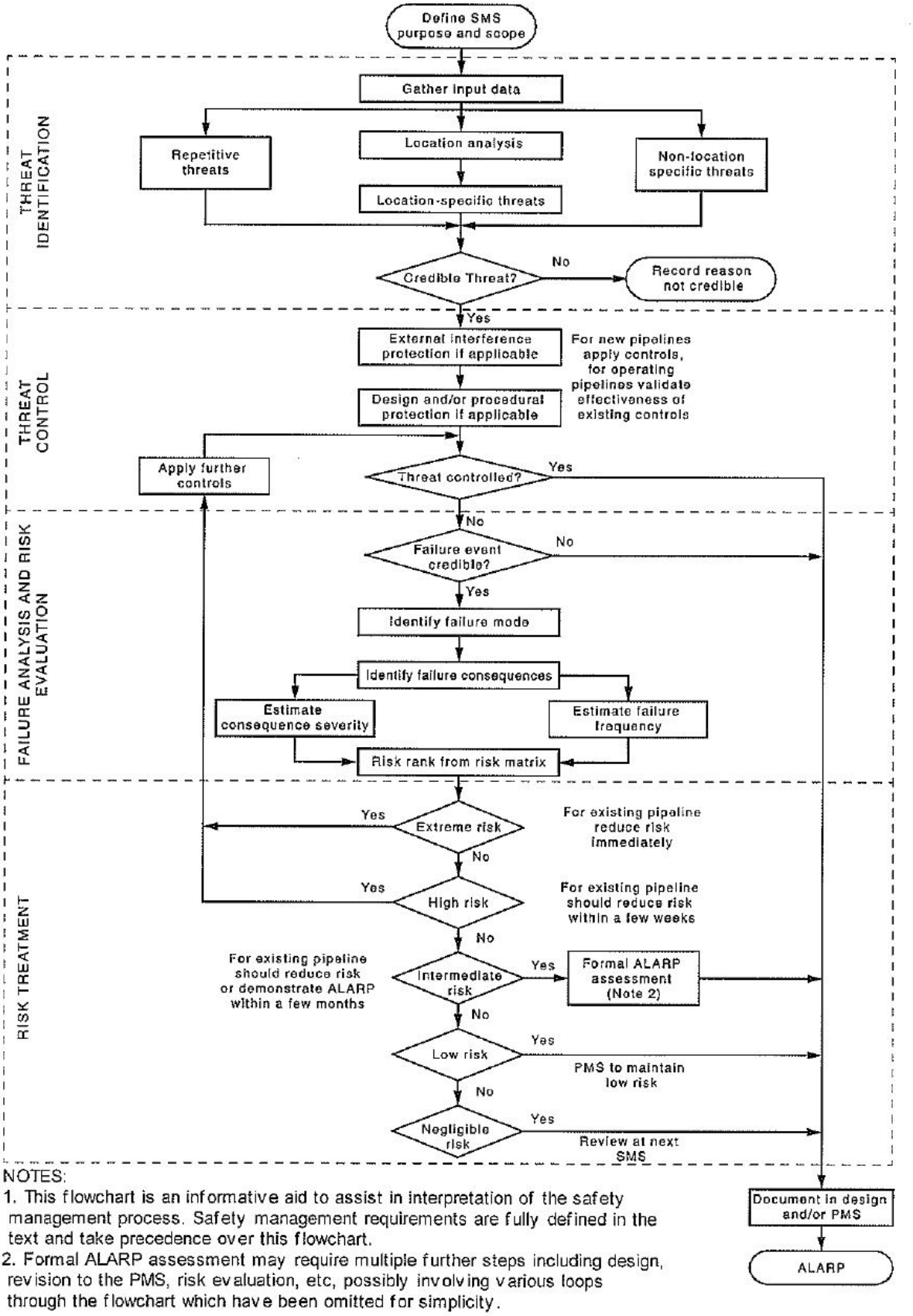
Prior to the SMS workshop being convened, APA Group, APA Networks and VPA teams prepared a range of relevant information to be presented to the workshop.

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 Officer South PSP 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 4 - 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).

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)/SAOP 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 pipelines under consideration during this study all have their 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 pipelines under AS2885 when considering the potential new threats or changes to existing threats resulting from construction of, and long-term presence of, the Officer South Employment PSP 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.

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 Officer South Employment PSP.

The measurement length 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 are 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 3 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 Officer South Employment PSP, 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 assesses the level of existing (and 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 measurement length 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 with any residual risk assessments found to be ALARP.

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 sections of pipelines adjacent to the Officer South Employment PSP. The pipeline's technical details and resistance to penetration data in the area can be summarised as follows:

Table 4, APA Group Pipeline PL50 - Technical Details

Substance conveyed	Natural Gas
Pipeline License No.	Lic 50, T1
Measurement Length (ML)	240m (4.7 kW/m2 Heat Radiation Zone)
	146 (12.6 kW/m2 Heat Radiation Zone)
Length of pipeline affected	550 m + 2 x 240m (Total 1030m approx)
Pipeline section under review within PSP	~KP14.45.95 to KP 15.48
Outside Diameter	457 mm
Easement	Permit required within 3m of the pipeline
Wall Thickness	7.95 mm WT, 9.94mm HWT
Depth Of Cover	0.9-1.2m
Pipe specification	API 5L Grade A (with Coal Tar Enamel coating)
Max. Allowable Operating Pressure	2760 kPa (MAOP)
Location Class - Primary	T1
Location Class – Secondary	S/I (refer to Table 4 above for KP distances)
CDL	259mm
Hole size & ML based on 10GJ/s release rate	N/A
Hole size & ML based on 1GJ/s release rate	110mm (Not Credible)
65mm Hole size & ML	53mm
50mm Hole size & ML	41mm

The pipeline excavator risk can be summarised as follows:

Table 5, Excavator Risk PL50

Max equipment sizes without risk of a leak: -	
Excavator with std bucket	N/A (>55T)
Excavator with Single Tiger Tooth	5T (max hole size 65mm)
Excavator with Twin Tiger Tooth	20T
Excavator with Penetration Tooth	5T (max hole size 65mm)
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 PSP proposed and confirmed that the existing T1 Primary Location Class for the APA pipeline is appropriate.

Due to the new land use proposed by the PSP (i.e., Industrial and business land use) a Secondary Location Class (SLC) of Industrial "I" throughout the PSP (including the ML distance to the east and west of the PSP) was agreed in addition to the existing Sensitive "S" SLC within the western end of the PSP resulting from existing sensitive assets to the west and outside of the proposed PSP.

Table 6, 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	PL50 (Route Plan T1)	T1	S	T1	S/I	KP17.36 to KP18.888	No Change to existing "S" NEW "I" Industrial and Business land use
APA	PL50 (Route Plan T1)	T1		T1	I	KP18.888 to KP21.28	NEW "I" Industrial and Business land use

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 PSP. Forty-Eight (48) 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 PSP and not expected to change the frequency of these threats occurring.

The results of the 48 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
PL50	48	10	38	5	3	2	-

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

9.1 Negligible Threats

The NEGLIGIBLE risk assessments were related to three threats. They were originally risk assessed as LOW, however with the introduction of additional concrete footpath the likelihood of failure was subsequently lowered to Hypothetical as described below.

9.1.1 Pipeline Dent or Gouge or Coating Damage

The threats leading to a dent or gouge, or coating damage were: -

- an excavator (Threat ID1),
- an Auger (Threat ID5)
- or an HDD (Threat ID9)

The workshop considered Supply consequences only as it was not considered possible for people to be injured with this threat:

For coating damage or a gouge in the pipeline

- Loss of Supply consideration only: -
  - Consequence - Minor as restriction only with reduced operating pressure.
  - Likelihood - Remote, as pipeline impact is not anticipated because of procedures and highly controlled environment during works.

The risk was deemed NEGLIGIBLE.

9.2 Low Threats

The LOW risk assessments were related to two threats.

9.2.1 Threat ID 2

The threat leading to a hole in the pipeline was an excavator with a hole up to 65mm (50m ML).

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

- Loss of Supply consideration: -
  - Consequence - Major due a week outage to Local area.
- Safety consideration: -
  - Consequence - Severe as potential work crew and onlookers could be injured but could easily remove themselves from the 50m ML area.
- Likelihood of Failure: -
  - Likelihood - Hypothetical as in a highly controlled environment, use of larger excavators less likely in the built up area.

The risk was found to be LOW and will continue to be monitored as a credible threat throughout the construction of the PSP and the life of the pipeline.

9.2.2 Threat ID 6

The threat leading to a hole in the pipeline was an Auger with a hole up to 50mm (41m ML).

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

- Loss of Supply consideration: -
  - Consequence - Major due a week outage to Local area.
- Safety consideration: -
  - Consequence - Severe as potential work crew and onlookers could be injured but could easily remove themselves from the 41m ML area.
- Likelihood of Failure: -
  - Likelihood - Hypothetical as in a highly controlled environment, use of larger excavators less likely in the built up area.

The risk was found to be LOW and will continue to be monitored as a credible threat throughout the construction of the PSP and the life of the pipeline.

9.3 Intermediate Threats

There were no INTERMEDIATE risks identified during the SMS.

10. ALARP ASSESSMENTS

There were no Intermediate risks identified and as such no ALARP assessments were required for this PSP adjacent to the section of transmission pipeline and associated City Gate Facility under review.

11. DISCUSSION

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

1. A key discussion point from the SMS Workshop was the mechanism in place to ensure the outcomes from the SMS will be translated through key documents as the PSP progresses to completion. The VPA and CSC identified that there will be a set of “PSP Requirements” developed which will include the key findings from the SMS Workshop. In addition a “PSP Ordinance” will be developed which will include a notification of land use application to APA and or APA Networks within 50m of the gas pipeline and associated facility. These two documents will be made available as part of any future PSP Construction Tender Documentation to ensure a future Developer and their constructor are fully aware of the requirements identified at this SMS Workshop.
2. Melbourne Water attended the SMS Workshop to discuss their preliminary plans for two major water crossings of the pipeline easement. Work is still underway to identify the depth of the pipeline so the water crossing designs can proceed. It was clear from the discussion that APA will have further engagement with MW to provide their input and ultimate acceptance of the future designs. All potential construction methodologies were reviewed and/or risked assessed as necessary such that the SMS would not need to be reconvened to assess any further construction activities associated with design development.
3. It is expected that as each developer is engaged to construct a section(s) of the PSP in the future, APA/APA Networks will advise them to initiate a Preconstruction SMS Workshop to ensure the initial risks and actions identified at the recent SMS have been properly mitigated and implemented in the final design(s) and any new risks as a result of the detailed design are also mitigated.
4. It was identified at the SMS Workshop that the layout of PSP utility infrastructure (e.g. sewer, water, power, comms etc..) has not yet been finalised. It was discussed that any utility crossings of the pipeline easement should be kept to a minimum and be co-located with proposed road crossings wherever possible.

12. ACTIONS

Seventeen (17) Actions were developed during the SMS workshop including who carried what responsibility for closing out the action. The list of Actions is referenced below.

APA/APA Networks 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 VPA, CSC or a third party is to be provided to APA/APA Network's representative for review and approval/acceptance.

Table 8, Action List

Miscellaneous Actions				
No.	**Issue**	**Action**	**By**	**Due Date**
A1	SMS findings not translated into PSP Requirements/Tender Docs leading to variations and disruption of construction works	VPA to ensure all relevant SMS findings are incorporated into the either the PSP or the planning ordinances where applicable (including consultation with APA & APA Networks).	VPA/APA/ APA Networks	Prior to PSP being finalised
A2	Construction of the PSP could damage the pipelines	VPA will include a requirement in the UGZ schedule to undertake a gas pipeline construction management plan within 50 metres of the boundary of the easement. A future developer is to facilitate preparation of a Construction Management Plan (CMP), under the schedule to the UGZ for review and comment by APA/APA Networks prior to any third party works.	VPA/APA/ APA Networks	Prior to PSP being finalised
A3	The E/W Connector Road appears to clash with the north side of the City Gate	VPA to consider moving E/W Connector Rd further north or to the south of the City Gate to provide appropriate separation in liaison with APA/APA Networks.	VPA/APA/ APA Networks	Prior to PSP being finalised
A4	Industrial use could include storage of flammable/combustible products or other use (e.g. Sensitive Use) which could constitute a multiplying effect to the consequence	SMS confirmed that max consequence distance is ~50m (65mm hole from excavator penetration teeth). Action to include provision in PSP Ordinance for APA/APA Networks notice for land use applications within 50m of the pipeline easement or City Gate. APA/APA Networks to will review and approve the construction management plan.	VPA/APA/ APA Networks	Prior to PSP being finalised
A5	APA Transmission /APA Networks cannot access City Gate during adjacent roadwork or PSP construction	Planning ordinances will include a requirement for the developer to undertake a CMP, which will investigate this miscellaneous action.	VPA/APA/ APA Networks	Prior to PSP being finalised
A6	City Gate is a potential noise source which may impact on adjacent PSP development(s) if it is noise sensitive?	PSP to include a requirement for a future developer to undertake a noise assessment due diligence and confirm for the city gate noise. does not impact their operations. Developer to be responsible for any noise mitigation requirements associated with the City Gate.	VPA/APA/ APA Networks	Prior to PSP being finalised
A7	Current PSP design does not identify all utility crossings of the pipeline easement. Easement crossings should be targeted, kept to a minimum and cross as close to perpendicular as possible	All utility (and road) crossings should be designed as close to perpendicular to the pipeline easement as possible to minimise the length of any easement crossing. Number of utility crossings of the pipeline easement within the PSP should be minimised wherever possible and aligned with proposed or current road crossings. VPA to include a PSP requirement	VPA	Prior to PSP being finalised
A8	Officer City Gate Current Location Class is R1	APA Networks to update their database for the facility to include T1/I Location Classification	APA Networks	1/07/2022 POST MEETING NOTE: Closed 2/5/2022
Threat Specific Actions				
No.	**Issue**	**Action**	**By**	**Due Date**
11	Vibration from works damages the coating leading to corrosion and failure of the pipe	The Planning ordinances will include a requirement for the developer to undertake a CMP, which will investigate threat specific issues including pipeline vibration damage.	VPA/ CSC Developer/ APA	Prior to PSP being finalised
No.	**Issue**	**Action**	**By**	**Due Date**

12	Gouge to pipe or holing or rupturing the pipeline.	The Planning ordinances will include a requirement for the developer to undertake a CMP, which will investigate threat specific issues including provision of a traffic management plan.	VPA/ CSC Developer/ APA	Prior to PSP being finalised
15	Dent or gouge or damage to coating possible from impact of concrete piping or other load when lowered in under or over the pipeline	The Planning ordinances will include a requirement for the developer to undertake a CMP, which will investigate threat specific issues which will include provisions for protection measures to protect the pipeline and coating from potential damage during works, requirements to be clearly identified in the CMP. APA will undertake DCVG checks before and after works. Repair or replace coating if necessary at the cost of the Developer.	VPA/ CSC Developer/ APA	Prior to PSP being finalised
18	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.	The Planning ordinances will include a requirement for the developer to undertake a CMP, which will investigate threat specific issues including reference to APA's std road crossing design. Note:- Pipeline is to be recoated and slabbed at each road easement crossing consistent with APA's Std Design. Council will review all road crossing designs.	VPA/ CSC Developer/ APA	Prior to PSP being finalised
19	Over stressing the pipe resulting in pipe coating damage or 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.	The Planning ordinances will include a requirement for the developer to undertake a CMP, which will investigate threat specific issues including reference to APA's std temporary heavy vehicle road crossing design.	VPA/ CSC Developer/ APA	Prior to PSP being finalised
20	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.	The Planning ordinances will include a requirement for the developer to undertake a CMP, which will investigate threat specific issues including a Spoil Management Plan.	VPA/ CSC Developer/ APA	Prior to PSP being finalised
23	CP is damaged or compromised during works resulting in long term corrosion potential leading to leak only	The Planning ordinances will include a requirement for the developer to undertake a CMP, which will investigate threat specific issues including requirement to identify all Cathodic Protection assets and provide appropriate protection during construction.	VPA/ CSC Developer/ APA	Prior to PSP being finalised
25	Stormwater scour as a result of the design of the stormwater management as part of the PSP. Leading to loss of DOC and impact on pipe coating leading to corrosion and a leak only	VPA/MW to provide APA & APA Networks the proposed Drainage Service Scheme for Officer South so they can confirm that the flooding risk to their assets is not increased due to the PSP.	VPA/ MW/ CSC/ APA	Prior to PSP being finalised
46	Road intersection within 30m of city gate. Road speeds 60-80 km/hr. Vehicles turning could leave the road and impact the City Gate.	Consider provision of Armco rails at the intersection of Officer South Rd and the E/W Connector Rd to prevent vehicle impact to the City Gate. Consider including additional bollarding within the City Gate	VPA/APA/ CSC/ APA Networks	Prior to PSP being finalised

13. CONCLUSION

A Safety Management Study (SMS) was undertaken to review whether additional protection measures are required to mitigate the risks associated with the Officer South Employment PSP 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 PSP that is located near the pipeline
- Review the Location Classification of the pipeline resulting from the PSP
- 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 PSP 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 PSP 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 “Preliminary” Land Use Change SMS.

Continuing liaison between the CSC, APA and APA Networks should ensure that the construction and post construction activities pose no significant increase in the operational and maintenance risk to the transmission pipeline and associated facilities effected by the PSP.

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 PSP area.

APPENDIX A: Attendance List

Table 9, Participants (including time in meeting)

Name	Position	Organisation	Present at SMS?
Mark Harris	Facilitator	DRMC	Yes - Fulltime
Matthew Simmons	Planner	VPA	Yes - Fulltime
Maureen Benier	Senior Planner	VPA	Yes - Fulltime
Sarah Doring	Strategic Planning Manager – South East	VPA	Yes - Fulltime
Monique So	Infrastructure Engineer	VPA	Yes - Fulltime
Laurence Newcome	Precinct Structure Planning Coordinator	MW	Yes- 1pm-2pm
James Hodges	Senior Catchment Planner	MW	Yes- 1pm-2pm
Keira Lee	Coordinator Growth Area Planning	CSC	Yes - 9am-2:30pm
Daisy So	Risk Engineer	APA Group	Yes - Fulltime
Peter Dawson	Lands Officer	APA Group	Yes - Fulltime
Alex Chin	Integrity Engineer	APA Networks	Yes - 9am-12:30pm
Michael Mielczarek	Senior Urban Planner	APA Group	Yes - 10:30am-2:30pm

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 Tl 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

Table 10, 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
Operations & Maintenance	Exceeding MAOP of pipeline
	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

Table 11, 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

Table 12, 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 13, Documents & References for Workshop

Document Name	Document Number	Included in Pre-SMS Report
RFQ Trim REF D/22/329	Appendix A, B, C Property Location	Reviewed by DRMC
Officer South Employment PSP - Background Report Summary	May 2021	Reviewed by DRMC
Officer South Employment PSP - Situational Analysis Report (GHD)	October 2020	Reviewed by DRMC
Officer South Employment PSP - Land Capability Assessment (Aurecon)	October 2020	Reviewed by DRMC
Officer South Employment PSP - Sodic and Dispersive Soil and Acid Sulphate Soil Investigation (WSP)	September 2021	Reviewed by DRMC
GHD QRA Report	July 2007	Reviewed by DRMC
Origin Officer City Gate Environmental Report (2006)	PR317-001 September 2006	Reviewed by DRMC
Officer City Gate Site Layout	L1-0080-1	Reviewed by DRMC
Pipeline Penetration Calc	Gippsland Penetration Resistance Results	Reviewed by DRMC
Pipeline Radiation Contour Calc	Energy Release Calculation for Gippsland Pipelines (VTS)	Reviewed by DRMC
Pipeline Route Plan & Longitudinal Section	T1-29/30/31	Reviewed by DRMC
SMS Databases	AS 2885 Risk Assessment- 2021 Victorian Transmission System (GIPPSLAND)Facility Threats	Reviewed by DRMC

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

Victorian Planning Authority

Officer South Employment Draft PSP

SMS Workshop Terms of Reference

Client Reference: G2220.3000.6201

Prepared by Delphi Risk Management Consulting Pty Ltd

DRMC Ref Number: 2022-0004-REP-002

Current Revision

Revision:	Reason for Revision:	Revision Date: 11/4/2022	
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
A	8/4/2022	Issued for Review	MAH	
0	11/4/2022	Issued for Use	MAH	MAH

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1 INTRODUCTION

Delphi Risk Management Consulting Pty Ltd (DRMC) is pleased to support the Victorian Planning Authority (VPA) in facilitating a Safety Management Study for the proposed Officer South Employment Precinct Structure Plan (PSP). The proposed development is positioned immediately over an existing APA Group Transmission Pressure Gas Pipeline which, under the Australian Standard for TP Gas Pipelines (AS2885) requires the risks associated with construction of the PSP 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

1.1 Officer South Employment PSP Project

The Victorian Planning Authority (VPA) is developing the Officer South Employment Precinct Structure Plan (PSP). Officer South Employment PSP is located 45km south-east of Melbourne's CBD, in Cardinia Shire Council. It is bounded by Cardinia Creek to the west, Princess Freeway to the north, Lower Gum Scrub Creek to the east and the Urban Growth Boundary to the south.

The Precinct Structure Plan for Officer South includes:

1. A residential sector comprising approximately 2,800 dwellings and a population of around 8,680 new residents.
2. 158 hectares of commercial land which is forecasted to have 12,727 commercial jobs.
3. 560 hectares of industrial land which is forecast to have 13,034 industrial jobs.

1.2 Gas Transmission Infrastructure

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

APA Group is responsible for the T1 Morwell-Dandenong high pressure gas pipeline, a 450 mm diameter transmission pipeline that runs west-east through the Precinct. This asset is contained within a 20.1 m wide easement. There is approximately 1.2 m of cover from the top of the pipe to the existing surface level.

Table 1, Pipeline Details

Pipeline	Pipeline Licence	Easement Width (m)	Pipeline Easement Location	Diameter (mm)	Measurement Length (m)
Morwell–Dandenong	T1, PL50	20	5.5m to North side	450	240
	Note: Measurement Length is applied to either side of the pipeline				

There are no other known transmission pressure gas pipeline assets affected by the PSP.

APA Group owns the gas transmission network and APT O&M services (APT) operates and manages the natural gas reticulation network within the Precinct on behalf of Australian Gas Networks (AGN)

APT controls distribution assets including a 180 mm diameter high pressure gas pipeline in the Lecky Road reserve to the east, and a 150 mm diameter high pressure gas pipeline located in an easement in private property, adjacent to the Officer South Road reserve in the north of the Precinct at an offset of 2.1 m.

An existing "City Gate" gas facility is operated by APT and is located to the west of Officer South Road. These types of facilities may impact upon the amenity of surrounding uses (noise, smell, safety etc.) and should be considered when undertaking an SMS for this PSP.

Figure 1, Subject site and location of APA Pipeline

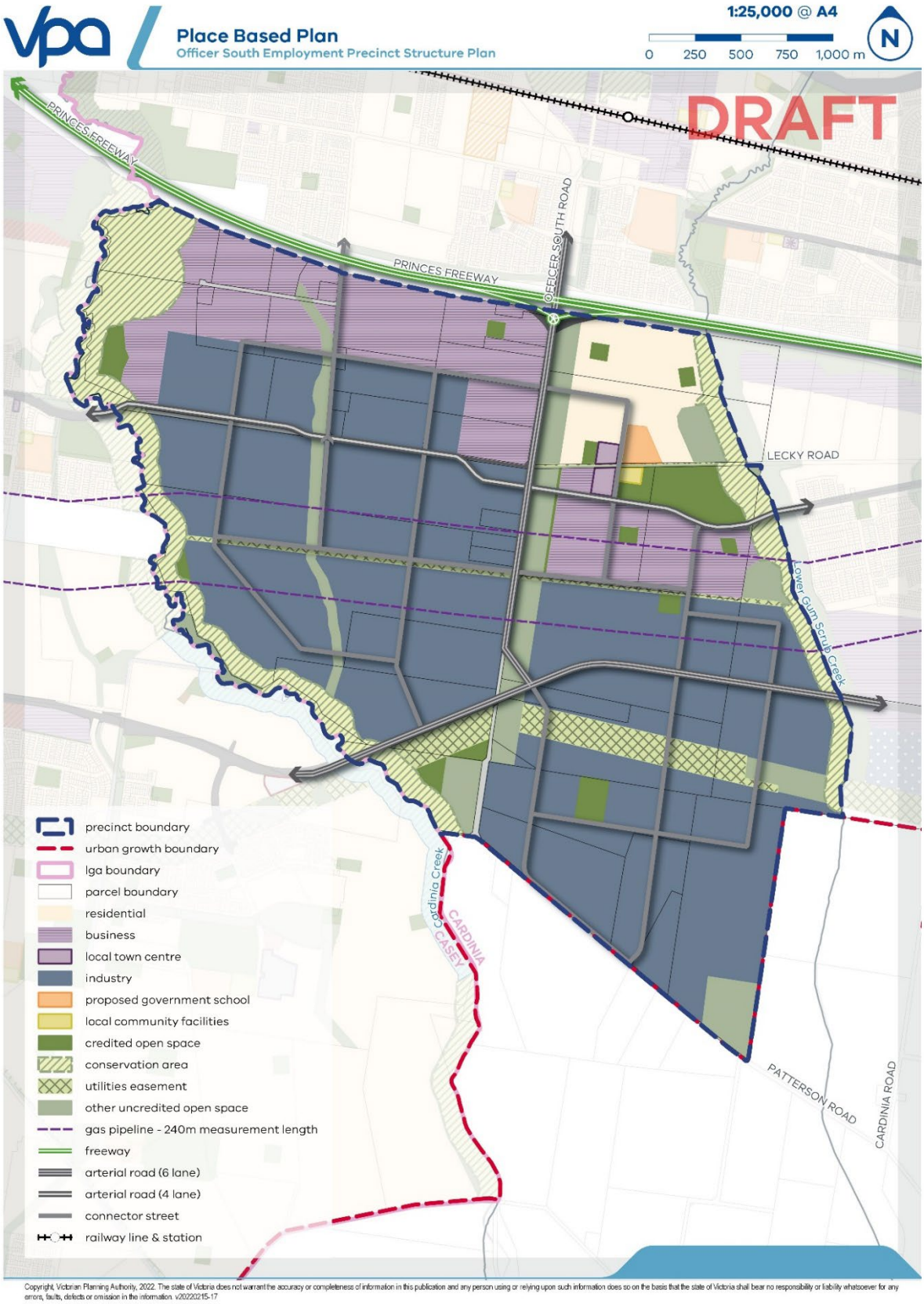


Figure 2, GIS Image of Officer South City Gate

Figure 3, GIS Image of Transmission Pipeline Route

2 ABBREVIATIONS

ALARP	As Low As Reasonably Practicable
APA	APA Group (Pipeline Licensee)
APT	APT O&M services (APA) operates and manages the natural gas reticulation network within the Precinct on behalf of Australian Gas Networks (AGN)
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
CSC	Cardinia Shire Council
CTE	Coal Tar Enamel
DRMC	Delphi Risk Management Consulting – SMS Reviewer & 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
MW	Melbourne Water
OPP	Overpressure Protection
O&M	Operations and Maintenance
PIMP	Pipeline Integrity Management Plan
PL	Pipeline License
PPC	Primary Pressure Control
ROW	Right of Way
SEW	South East Water
SLC	Secondary Location Class
SMS	Safety Management Study
SMYS	Specified Minimum Yield Stress
SPC	Secondary pressure Control
TOR	Terms of Reference
VPA	Victorian Planning Authority

3 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

Pipeline	Pipeline Licence	Previous Primary Location Class	Previous Secondary Location Class	Proposed Primary Location Class	Proposed Secondary Location Class	KP point (km)	Allowable Heat Release Rate from a leak (GJ/s)
Morwell–Dandenong	T1, PL50	T1	-	No Change	I	17.82 to 21.28	10
Morwell–Dandenong	T1, PL50	T1	S	No Change	No Change	17.82 to 18.888	10

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 above ground pipeline facilities (Officer City Gate) within the area being considered during this SMS.

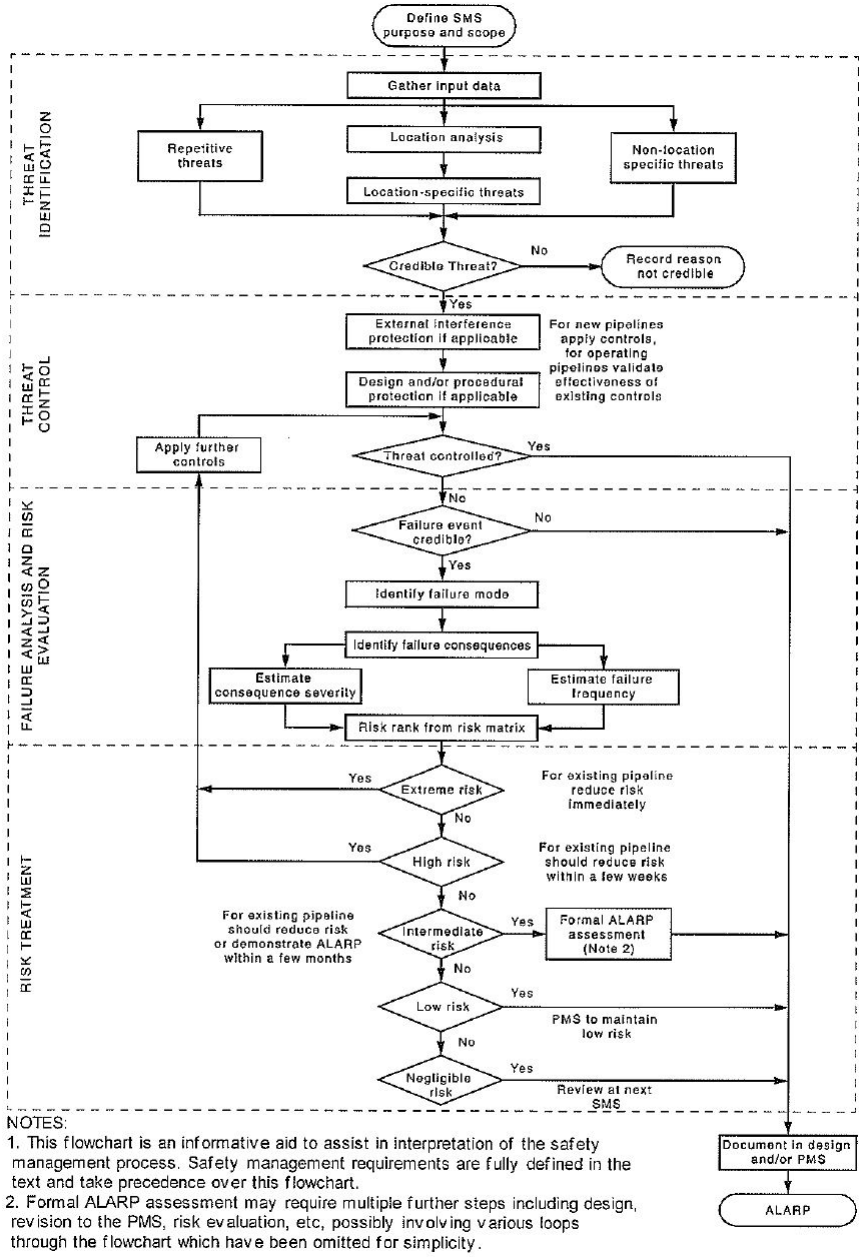
4 OBJECTIVE AND METHODOLOGY

Prior to the SMS workshop being convened APA, APT and the VPA teams have prepared a range of relevant information to be presented to the workshop (refer to Section 5 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 4 – 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 to view during the workshop along with all other documents referenced in the TOR Document.

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.

Specifically for the Officer South Employment PSP Project SMS: -

The SMS workshop will focus on both the above ground facilities and the buried transmission pipeline. Specific focus on the above ground facilities at 10:40am with APT and the review of proposed water crossings will be undertaken at 1pm with the Utility providers.

5 DOCUMENTS AND REFERENCES FOR WORKSHOP

The documents required for the SMS workshop are referenced below.

Table 3, Documents

Document Name	Document Number	Included in Pre-SMS Report
RFQ Trim REF D/22/329	Appendix A, B, C Property Location	Reviewed by DRMC
Officer South Employment PSP - Background Report Summary	May 2021	Reviewed by DRMC
Officer South Employment PSP - Situational Analysis Report (GHD)	October 2020	Reviewed by DRMC
Officer South Employment PSP - Land Capability Assessment (Aurecon)	October 2020	Reviewed by DRMC
Officer South Employment PSP - Sodic and Dispersive Soil and Acid Sulphate Soil Investigation (WSP)	September 2021	Reviewed by DRMC
GHD QRA Report	July 2007	Reviewed by DRMC
Origin Officer City Gate Environmental Report (2006)	PR317-001 September 2006	Reviewed by DRMC
Officer City Gate Site Layout	L1-0080-1	Reviewed by DRMC
Pipeline Penetration Calc	Gippsland Penetration Resistance Results	Reviewed by DRMC
Pipeline Radiation Contour Calc	Energy Release Calculation for Gippsland Pipelines (VTS)	Reviewed by DRMC
Pipeline Route Plan & Longitudinal Section	T1-29/30/31	Reviewed by DRMC
SMS Databases	AS 2885 Risk Assessment- 2021 Victorian Transmission System (GIPPSLAND)Facility Threats	Reviewed by DRMC

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

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.

6 WORKSHOP PARTICIPANTS

The Workshop will comprise representatives from APA Group, APT, VPA and CSC.

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 5-7 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
Matthew Simmons	Planner	VPA
Maureen Benier	Senior Planner	VPA
Sarah Doring	Strategic Planning Manager – South East	VPA
Chris Braddock	Water & Engineering Manager	VPA
Monique So	Infrastructure Engineer	VPA
Laurence Newcome	Precinct Structure Planning Coordinator	MW
James Hodges	Senior Catchment Planner	MW
Nino Polon	Area Manager, Development Services	MW
Matthew Snell	Group Manager Growth	SEW
Conrad Dabrowski	Senior Engineer	SEW
Marcelle Bell	Principal Growth Area Strategic Planner	CSC
Keira Lee	Coordinator Growth Area Planning	CSC
Daisy So	Risk Engineer	APA Group
Peter Dawson	Lands Officer	APA Group
Alex Chin	Project Development Engineer	APT Networks
Michael Mielczarek	Senior Urban Planner	APA Group

7 WORKSHOP RULES

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

- The Owner of the pipeline (APA Group & APT) along with VPA & CSC 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 if necessary.

8 SMS WORKSHOP LOGISTICS

The Safety Management Study (SMS) Workshop will be held on TEAMS on the 27th of April 2022. 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 3:30pm.

(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 3:00 and 5:00pm 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 20 minutes.
- Afternoon tea break will be around 3pm depending on how we are progressing.

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.

9 PROPOSED AGENDA

Table 5, SMS agenda

	Agenda Items	Presenter	Time
1	**Welcome/Introduction**	**All**	**9am**
2	**Workshop Overview and Objectives**	**Facilitator**	**9:05am**
3	**Pipeline Design Review/ Operating Approach** · Wall Thicknesses · Rupture and puncture · Radiation contours · Location Classes · Interface agreements with corridor users · Other relevant items	**Facilitator/ APA/APT**	**9:10am**
4	**Development Review**	**VPA**	**9:45am**
5	**Morning Tea**	**(10mins)**	**10:30am**
6	**Facility Threats** · Review identified location specific threats relating to the above ground facilities · Review identified non-location specific threats relating to the network piping · Review external interference controls applied and assess adequacy. · Review design controls applied and assess adequacy · Risk Assess threat if necessary · Identify the consequence if the City Gate was shutdown or the local network piping was to fail? (sensitive users and residential user consequence as per AS4645 Risk Matrix)	**All/APT**	**10:40am**
7	**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 necessary · Identify the consequence if the Transmission Pipeline was shutdown (sensitive users and residential user consequence as per AS2885 Risk Matrix)	**All**	**11:15am**
8	**Lunch**	**(30mins)**	**12:30pm**
9	**Location Specific WATER UTILITIES**	**All/MW/SEW**	**1:00pm**
10	**Non-Location Specific Threats Review** · Continued	**All**	**1:30pm**
11	**Location Specific Threats for each Crossing Design Proposed** · Review location specific threats · Review Standard designs	**All**	**2:30pm**
12	**Review Actions for Workshop** · Review the Actions found during the Workshop for completeness.	**All**	**3:00pm**
13	**Workshop Close**		**3:30pm**

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 B – SMS Technical Presentation

APPENDIX G: SMS Technical Presentation

AS 2885.6 SMS Workshop
Officer South Employment PSP

Technical Information

April 2022

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

APA Morwell–Dandenong Pipeline T1 Licence No. PL50 (1956)
Design Information

Substance conveyed		Natural Gas
Length of pipeline affected		3460 m + 2 x 240m (Total 3940 approx)
Pipeline section under review within PSP		~KP17.820 to KP21.280 (plus ML each end)
Outside diameter		457 mm
Wall Thickness		7.94mm & 9.94mm
Depth Of Cover		0.9-1.2m
Pipe specification		SAA A 33 Class D (with Bitumen with Fibreglass & Asbestos coating)
Max. Allowable Operating Pressure		2760 kPa (MAOP)
Location Class - Primary		T1
Location Class – Secondary	KP17.360 to KP18.888	S
	KP17.360 to KP21.280	I
CDL		259mm (@ 7.94mm WT)
Credible Excavator Size in the area		25T with General Purpose Teeth
Credible Hole Size from Excavator		65mm (but only for penetration teeth not used during normal works)
Credible Hole Size from Auger		50mm
Measurement Length (ML)		240m (4.7 kW/m^2 Heat Radiation Zone, Q 14GJ/s)
		146m (12.6 kW/m^2 Heat Radiation Zone)
Hole size based on 1GJ/s release rate		110mm
50mm hole ML		41m (<50m)
65mm hole ML		53m (~50m)

APA Morwell-Dandenong Pipeline T1 Licence No. PL50 (1956) Design Information

Credible Excavator Size	25T typically with Std General Purpose Teeth (i.e. without Penetration or Tiger Teeth)
Max equipment sizes without risk of a leak(B Factor 1.3, 7.94mm 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, 7.94mm 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)

APA Morwell-Dandenong Pipeline T1 Licence No. PL50 (1956) Pipeline Route

Generic Protections – By APA

Patrolling :
Ground patrol – Week Days
Aerial patrol – Monthly

Liaison with land users – annually

Marker signs, max. spacing
T1 100m, T1,S 50m, T2 50m

Buried Marker Tape (300mm above pipe) – No

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

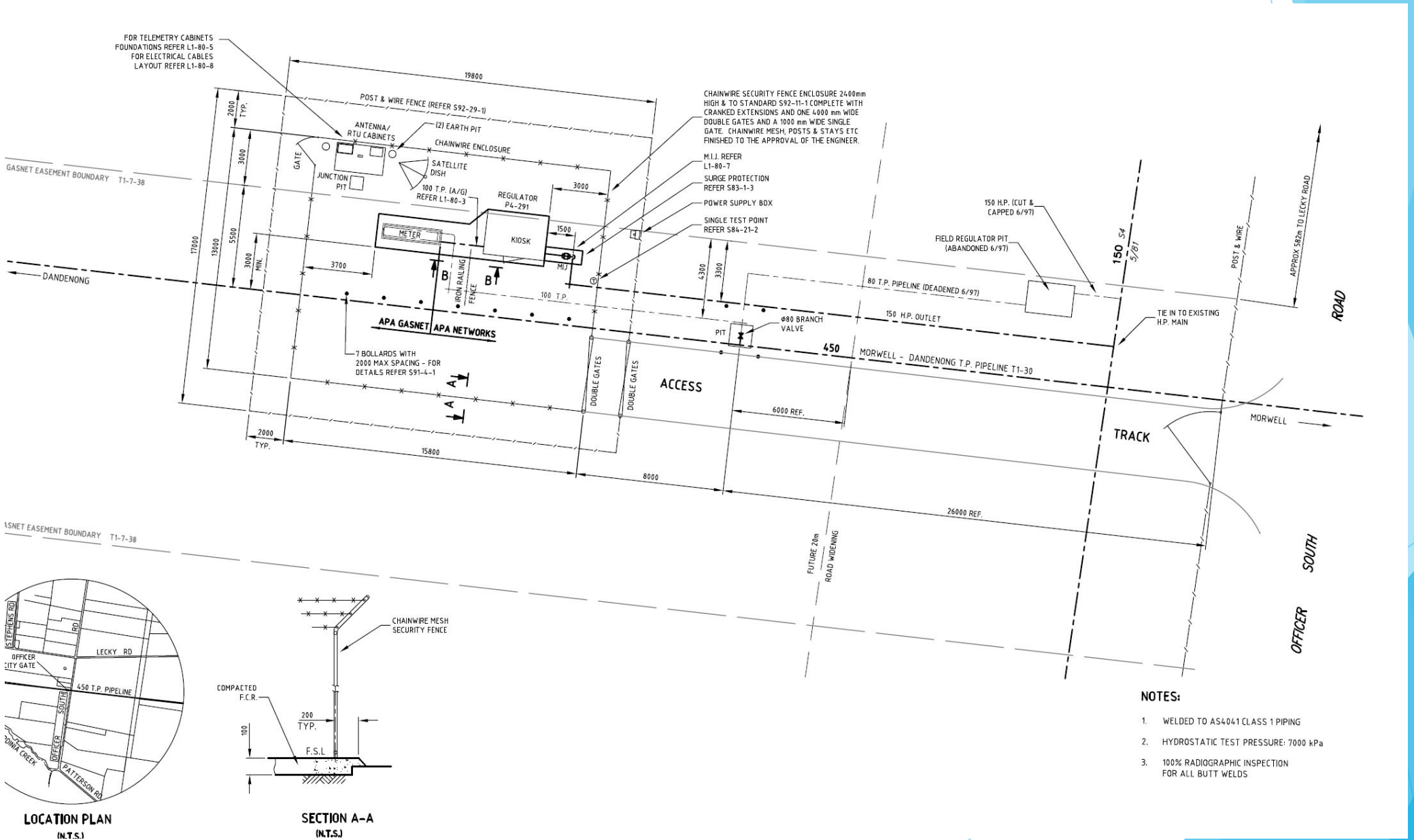
Depth Of Cover :
1.2 to 4m at roads, railways & creeks etc

Bollards and Fencing for above ground facilities

APT Officer South City Gate - Design Information

Noise Contour	No current data available, may need to undertake a noise study to confirm potential localise noise impact?
Flammable Plume Contour	GHD QRA (July 2007) confirms a conservative 50%LFL could extend 19m from the City Gate pipework. And an ignited gas release would generate a 4.7kW/m2 contour of up to 23m from a 15mm hole. QRA recommendation is that any building must be able to withstand thermal radiation of 4.7 kW/m2 and provide protection for people inside and would apply up to a radius of 23m at ground level due to thermal radiation impacts
Odour Contour	No current data available, facility does not release gas (odourised) under normal operating conditions. Only potential release is during maintenance activities which are very infrequent and would only release a small amount of gas.

Officer South City Gate Plot Plan



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

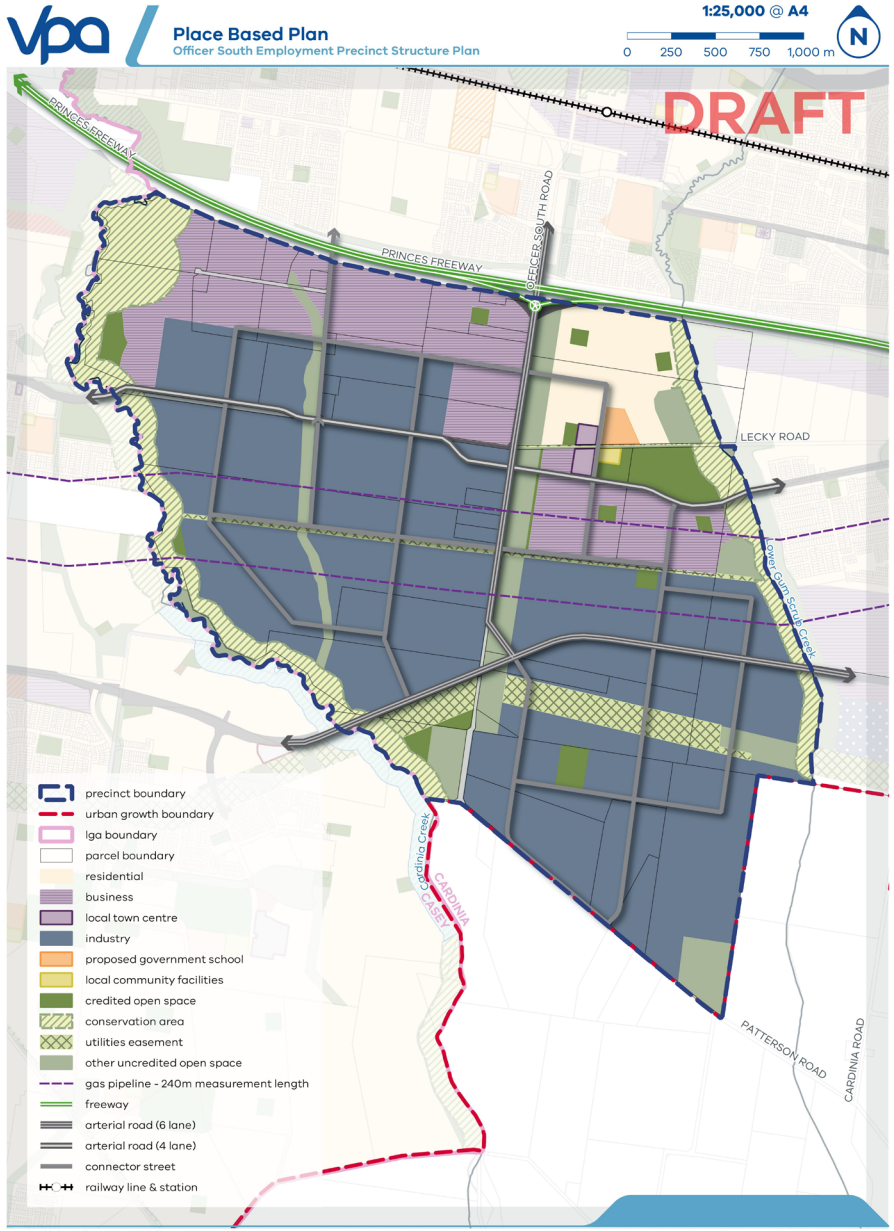
Nominate in general the types of activities expected from land users over the length of the pipeline. (e.g. Farmers, Council, Constructors etc.)

Existing Excavator Use: Credible Excavator Size 25T with Penetration teeth (for Development Areas)

During Construction: (VPA to Advise)

Water Crossing Design	TBC
Boring and Open Cut	TBC
Blade Ploughing	TBC / Road Crossing Construction
Ripping	TBC
Excavators	Size TBC (Tonnes)
Bulldozers (use of Rippers)	Yes
Boring rigs (pole augers/piling or HDD)	Yes - Street Lighting & Signage
Heavy Vehicles	Yes - Non road legal

Officer South Employment- Draft PSP



APPENDIX H: SMS Workshop Minutes

Officer South - Safety Management Study

Wednesday, 27 April 2022

Morwell–Dandenong Pipeline T1 Licence No. PL50 (1956)
~KP17.820 to KP21.280 (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?
	PIPELINE SPECIFIC THREATS															
1	**Excavator use over easement (up to 25T)**	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	**N**		**Remote**	**Minor**	**Neg**	Consequence - **Supply** Minor restriction only with reduced operating pressure **Likelihood** - Remote, as pipeline impact is not anticipated because of procedures and highly controlled environment during works				
2	**Excavator use over easement (up to 25T)**	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) 65mm leading to a 50m radiation contour	**Y**		Depth of Cover, WT	DBYD, Patrolling, PTW, signage	**N**		**Hypothetical**	**Major**	**Low**	Consequence - **People** Severe as potential work crew and onlookers could be injured but could easily remove themselves from the 50m ML area **Supply** consequence considered Major due a week outage to Local area; Likelihood - Hypothetical as in a highly controlled environment, use of larger excavators less likely in the built up area.				
3	**Excavator use over easement (up to 25T) - During Development**	Pipe Damage resulting in a hole causing loss of containment. Hole is greater than critical defect length leading to **rupture**	**N**	Pipeline cannot be ruptured by an excavator up to 55 T												
4	**Excavator use over easement (up to 25T) - Post Development**	Pipe Damage resulting in a hole causing loss of containment. Hole is greater than critical defect length leading to **rupture**.	**N**	Pipeline cannot be ruptured by an excavator up to 55 T												
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,	**N**		**Remote**	**Minor**	**Neg**	Consequence - **Supply** Minor restriction only with reduced operating pressure **Likelihood** - Remote, as pipeline impact is not anticipated because of procedures and highly controlled environment during works				
6	**Augering of Piles for street light pole footings or fences**	Auger impacts pipeline causing a hole in the pipe (~50mm leading to a 41m 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	**N**		**Hypothetical**	**Major**	**Low**	Consequence - **People** Severe as potential work crew and onlookers could be injured but could easily remove themselves from the 41m ML area **Supply** consequence considered Major due a week outage to Local area; Likelihood - Hypothetical as in a highly controlled environment, use of larger excavators less likely in the built up area.				
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. (Sewer installation likely using HDD, 2 crossings)	**Y**		WT	DBYD, Patrolling, PTW, signage + APA procedure for monitoring of HDD crossing including use of slit trenches to positively identify horizontal trenching	**N**		**Remote**	**Minor**	**Neg**	Consequence - **Supply** Minor restriction only with reduced operating pressure **Likelihood** - Remote, as pipeline impact is not anticipated because of procedures and highly controlled environment during works				
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	**Y**	Extensive Lab Testing from Future Fuel CRC Research Project RP3.4-03B (April 2022)has determined that using a variety of HDD drill bits and soil loads, it was not possible to put a hole in a pipeline (most likely equipment for HDD Drill Rigs installing 50mm to 300mm holes. Torque 5400-6700 Nm, Thrust 110-160kN)							
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, as per FFCRC findings (Refer ID9 Comments) identifying that any hole is extremely unlikely and achieving a hole 2/3rd CDL is considered impossible for this												
11	**Boring and Driving of Piles for building footings**	Vibration from works damages the coating leading to corrosion and failure of the pipe	**Y**		Separation (buildings off easement)	DBYD, Patrolling, PTW, signage	**Y**						See Threat Specific Actions List			**Y**
12	**Boring and Driving of Piles for building footings**	Gouge to pipe or holing or rupturing the pipeline.	**Y**		WT	DBYD, Patrolling, PTW, signage	**Y**						See Threat Specific Actions List			**Y**
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**													
14	**Rail/Tram Crossing**	High voltage power associated with Tram may influence the CP of the pipeline.	**N**													
15	**Open cut Utilities installation (Water/Power/Comms) over or under the pipeline**	Dent or gouge or damage to coating possible from impact of concrete piping or other load when lowered in under or over the pipeline	**Y**		WT	DBYD, Patrolling, PTW, signage	**Y**	The PTW and DBYD are critical at installation as there is no additional slabbing protection.					See Threat Specific Actions List			**Y**

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 25T excavator 65mm hole leading to a ML 50m.	Y		Depth of Cover, WT, (possible Concrete Slabbing)	DBYD, Patrolling, PTW, signage, marker tape		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/Water 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	Y	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 protection of the pipeline was required								
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	Y	Pipeline is designed to resist road legal vehicle movements.					See Threat Specific Actions List			Y
19	**Heavy vehicle access track to works (non road legal vehicles).**	Over stressing the pipe resulting in pipe coating damage or 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	Patrolling, PTW + APA approval of design and the final Construction Management Plan	Y	Refer APA Temp road crossing design.					See Threat Specific Actions List			Y
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	Y						See Threat Specific Actions List			Y
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	Y									
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	Y	Steel plate over 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 from adjacent, parallel infrastructure or 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.	Y						See Threat Specific Actions List			Y
24	**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	Y	Steel plate or fencing and possible wool blankets to prevent damage required as part of PTW								
25	**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.	Y						See Threat Specific Actions List			Y
26	**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 (580-POL-L-0001)	Y									
27	**Threat - Excavation next to edge of easement**	Retarding basin construction could undermine the edge of the easement causing easement profile to diminish reducing DOC.	Y		Depth of Cover, WT.	Patrolling, PTW + APA approval of the Construction Management Plan.	Y	Note, any excavation next to the pipeline easement must not lead to reduction in DOC across the easement								
28	**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	Y									
29	**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												
30	**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 potholing procedure as part of TPWG.	Y									
31	**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.	N	No significant trees of consequence to the pipeline in the area of the Development.												
32	**Maintenance - Inadequate servicing of equipment**	APA cannot access easement/meter/reg assets due to new development	Y		Separation (fencing maintains access for APA)	Patrolling, PTW		Easement is generally accessible .								

33	**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**		Depth of Cover, WT	Patrolling, PTW, APA notification within 50m of easement for an identified list of land uses	**Y**									
34	**Intentional Damage Transmission - Sabotage, Terrorism or Malicious Damage**	coating damage or loss of containment leading to corrosion and a leak only	**Y**		Depth of Cover, WT	Patrolling + additional population provides passive surveillance	**Y**	No significant change from current risk level as a result of the Development.								
35	**Threat - Deep ripping activities impacts the pipe and causes a loss of containment - leak but not rupture**	Possible installation of cable utilities. Pipeline damage, leak or rupture	**Y**	Soft soils, no need for ripping in the area normally but maybe used for utility installation	Depth of Cover, WT	Patrolling, DBYD, PTW + APA approval of the Construction Management Plan. Highly controlled activity.	**Y**	Soft soils, no need for ripping in the area normally but maybe used for utility installation								
36	**HV power installed parallel to pipeline**	Electrical currents set up in steel pipeline disrupting the CP and causing pipeline corrosion	**N**	No parallel HV required by PSP												
37	**Rock Saw/Hammer used in Development construction**	Causes pipeline to rupture	**N**	No rock in area, soft soils												
38	**Inappropriate choice of vegetation within pipeline easement**	Blocking line of site between marker signs or roots damaging pipeline coating.	**Y**		Depth of Cover, WT	Patrolling, PTW, APA Landscaping Guidelines	**Y**									
39	**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.	**Y**									
40	**Flooding of Easement due to change in land topography**	loss of DOC and damage to coating	**Y**		Depth of Cover, WT	PSP Stormwater design, Patrolling	**Y**									
	FACILITY SPECIFIC THREATS															
41	**Noise from the City Gate Reg causes complaints to APA and potential impact to normal operation**	Cannot operate the facility, non compliance with EPA noise requirements	**Y**		Separation , concrete barriers around regs	Operation and maintenance procedures	**Ref Note(1)**	**Note (1)** Risk to Facility is not considered to be increased as a result of this Threat provided all actions are satisfactorily closed out for the Officer South PSP Encroachment SMS								
42	**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	**Ref Note(1)**									
43	**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	**Ref Note(1)**	GHD Report confirmed a 23m ML from the largest credible hole size. ML does not have a significant impact on the nearest assets. Likelihood of individual risk (1x10 million likelihood).								
44	**Inappropriate choice of vegetation adjacent to City Gate**	Blocking line of site between marker signs or damaging above ground pipe coating or equipment.	**Y**		WT	Patrolling, PTW, APA Landscaping Guidelines	**Ref Note(1)**	No chance of bushfire in the area								
45	**Threat - Vehicle collision with above ground infrastructure (City Gate) during construction activities resulting in pipeline dent or gouge.**	Pipe coating damaged if site left exposed during works	**Y**		WT	Patrolling, PTW + APA approval of the Construction Management Plan. (Use of fencing etc.. To protect equipment egress)	**Ref Note(1)**									
46	**Threat - Vehicle collision with above ground infrastructure (City Gate) post construction activities resulting in pipeline dent or gouge.**	Pipe coating damaged if site left exposed by design of facilities or location relative to public roads or access.	**Y**		WT, Armco railing or equivalent		**Ref Note(1)**					Road intersection within 30m of city gate. Road speeds 60-80 km/hr. Vehicles turning could leave the road and impact the City Gate.	See Threat Specific Actions List			**Ref Note(1)**
47	**Intentional Damage Facility - Sabotage, Terrorism or Malicious Damage for City Gate**	coating damage or loss of containment leading to corrosion and a leak only	**Y**		Depth of Cover, WT	Patrolling + additional population provides passive surveillance	**Ref Note(1)**	No significant change from current risk level as a result of the Development.								
48	**Flooding of City Gate due to change in land topography**	Damage to equipment	**Y**		WT/ Fencing protects from significant debris	PSP Stormwater design, Patrolling	**Ref Note(1)**									

Officer South - Safety Management Study
Wednesday, 27 April 2022
Miscellaneous Actions

Action Wording updated 22/6/2022

No.	Issue	Action	Responsibility	Due Date	Close Out Comments	Close Out Date
A1	SMS findings not translated into PSP Requirements/Tender Docs leading to variations and disruption of construction works	VPA to ensure all relevant SMS findings are incorporated into the either the PSP or the planning ordinances where applicable (including requirements for consultation with APA & APA Networks).	VPA/APA/APA Networks	Prior to PSP being finalised		
A2	Construction of the Development could damage the pipelines	VPA will include a requirement in the UGZ schedule to undertake a gas pipeline construction management plan within 50 metres of the boundary of the easement. A future developer is to facilitate preparation of a Construction Management Plan (CMP), under the schedule to the UGZ for review and comment by APA/APA Networks prior to any third party works.	VPA/APA/APA Networks	Prior to PSP being finalised		
A3	The E/W Connector Road appears to clash with the north side of the City Gate	VPA to consider moving E/W Connector Rd further north or to the south of the City Gate to provide appropriate separation in liaison with APA/APA Networks.	VPA/APA/APA Networks	Prior to PSP being finalised		
A4	Industrial use could include storage of flammable/combustible products or other use (e.g. Sensitive Use) which could constitute a multiplying effect to the consequence	SMS confirmed that max consequence distance is ~50m (65mm hole from excavator penetration teeth). Action to include provision in PSP Ordinance for APA/APA Networks notice for land use applications within 50m of the pipeline easement or City Gate. APA/APA Networks to will review and approve the construction management plan.	VPA/APA/APA Networks	Prior to PSP being finalised		
A5	APA Transmission /APA Networks cannot access City Gate during adjacent roadwork or PSP construction	Planning ordinances will include a requirement for the developer to undertake a CMP, which will investigate this miscellaneous action.	VPA/APA/APA Networks	Prior to PSP being finalised		
A6	City Gate is a potential noise source which may impact on adjacent PSP development(s) if it is noise sensitive?	PSP to include a requirement for a future developer to undertake a noise assessment due diligence and confirm for the city gate noise. does not impact their operations. Developer to be responsible for any noise mitigation requirements associated with the City Gate.	VPA/APA/APA Networks	Prior to PSP being finalised		
A7	Current PSP design does not identify all utility crossings of the pipeline easement. Easement crossings should be targeted, kept to a minimum and cross as close to perpendicular as possible	All utility (and road) crossings should be designed as close to perpendicular to the pipeline easement as possible to minimise the length of any easement crossing. Number of utility crossings of the pipeline easement within the PSP should be minimised wherever possible and aligned with proposed or current road crossings. VPA to include a PSP requirement	VPA	Prior to PSP being finalised		
A8	Officer City Gate Current Location Class is R1	APA Networks to update their database for the facility to include T1/I Location Classification	APA Networks	1/07/2022	Updated in APA Networks Asset Register	2/05/2022
Threat Specific Actions						
11	Vibration from works damages the coating leading to corrosion and failure of the pipe	The Planning ordinances will include a requirement for the developer to undertake a CMP, which will investigate threat specific issues including pipeline vibration damage.	VPA/ CSC Developer/ APA	Prior to PSP being finalised		
12	Gouge to pipe or holing or rupturing the pipeline.	The Planning ordinances will include a requirement for the developer to undertake a CMP, which will investigate threat specific issues including provision of a traffic management plan.	VPA/ CSC Developer/ APA	Prior to PSP being finalised		
15	Dent or gouge or damage to coating possible from impact of concrete piping or other load when lowered in under or over the pipeline	The Planning ordinances will include a requirement for the developer to undertake a CMP, which will investigate threat specific issues which will include provisions for protection measures to protect the pipeline and coating from potential damage during works, requirements to be clearly identified in the CMP. APA will undertake DCVG checks before and after works. Repair or replace coating if necessary at the cost of the Developer.	VPA/ CSC Developer/ APA	Prior to PSP being finalised		
18	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.	The Planning ordinances will include a requirement for the developer to undertake a CMP, which will investigate threat specific issues including reference to APA's std road crossing design. Note:- Pipeline is to be recoated and slabbed at each road easement crossing consistent with APA's Std Design. Council will review all road crossing designs.	VPA/ CSC Developer/ APA	Prior to PSP being finalised		
19	Over stressing the pipe resulting in pipe coating damage or 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.	The Planning ordinances will include a requirement for the developer to undertake a CMP, which will investigate threat specific issues including reference to APA's std temporary heavy vehicle road crossing design.	VPA/ CSC Developer/ APA	Prior to PSP being finalised		
20	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.	The Planning ordinances will include a requirement for the developer to undertake a CMP, which will investigate threat specific issues including a Spoil Management Plan.	VPA/ CSC Developer/ APA	Prior to PSP being finalised		
23	CP is damaged or compromised during works resulting in long term corrosion potential leading to leak only	The Planning ordinances will include a requirement for the developer to undertake a CMP, which will investigate threat specific issues including requirement to identify all Cathodic Protection assets and provide appropriate protection during construction.	VPA/ CSC Developer/ APA	Prior to PSP being finalised		
25	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	VPA/MW to provide APA & APA Networks the proposed Drainage Service Scheme for Officer South so they can confirm that the flooding risk to their assets is not increased due to the PSP.	VPA/ MW/ CSC/ APA	Prior to PSP being finalised		
46	Road intersection within 30m of city gate. Road speeds 60-80 km/hr. Vehicles turning could leave the road and impact the City Gate.	Consider provision of Armco rails at the intersection of Officer South Rd and the E/W Connector Rd to prevent vehicle impact to the City Gate. Consider including additional bollarding within the City Gate	VPA/APA/ CSC/ APA Networks	Prior to PSP being finalised		

AS2885.6 Risk Matrix

	Severity Class				
	Catastrophic	**Major**	**Severe**	**Minor**	**Trivial**
Dimension	***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	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	Localised societal impact or short-term supply interruption (hours)	Interruption or restriction of supply but shortfall met from other sources	No impact 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	localised impact substantially rectified within a year or so	Impact very localized and very short-term (weeks), minimal rectification	No effect; minor impact rectified rapidly (days) with negligible residual effect
	Catastrophic	**Major**	**Severe**	**Minor**	**Trivial**
Frequent Expected to occur typically once per year or more. Event > 1 year	**Extreme**	**Extreme**	**High**	**Intermediate**	**Low**
Occasional May occur occasionally in the life of the pipeline. 1 Year > Event> 1/10 Years	**Extreme**	**High**	**Intermediate**	**Low**	**Low**
Unlikely Unlikely to occur within the life of the pipeline, but possible. 1/10 years > Event > 1/1000 years	**High**	**High**	**Intermediate**	**Low**	**Negligible**
Remote Not anticipated for this pipeline at this location. 1/1000 years > Event > 1/100,000 years	**High**	**Intermediate**	**Low**	**Negligible**	**Negligible**
Hypothetical Theoretically possible, but would only occur under extraordinary circumstances 1/100,000 year > Event	**Intermediate**	**Low**	**Negligible**	**Negligible**	**Negligible**

Officer South - Safety Management Study
Wednesday, 27 April 2022
9am to 4pm AEST

Name	Position	Organisation	Present at SMS?
Mark Harris	Facilitator	DRMC	Yes - Fulltime
Matthew Simmons	Planner	VPA	Yes - Fulltime
Maureen Benier	Senior Planner	VPA	Yes - Fulltime
Sarah Doring	Strategic Planning Manager – South East	VPA	Yes - Fulltime
Chris Braddock	Water & Engineering Manager	VPA	No
Monique So	Infrastructure Engineer	VPA	Yes - Fulltime
Laurence Newcome	Precinct Structure Planning Coordinator	MW	Yes- 1pm-2pm
James Hodges	Senior Catchment Planner	MW	Yes- 1pm-2pm
Nino Polon	Area Manager, Development Services	MW	No
Matthew Snell	Group Manager Growth	SEW	No
Conrad Dabrowski	Senior Engineer	SEW	No
Marcelle Bell	Principal Growth Area Strategic Planner	CSC	No
Keira Lee	Coordinator Growth Area Planning	CSC	Yes - 9am-2:30pm
Daisy So	Risk Engineer	APA Group	Yes - Fulltime
Peter Dawson	Lands Officer	APA Group	Yes - Fulltime
Alex Chin	Integrity Engineer	APA Networks	Yes - 9am-12:30pm
Michael Mielczarek	Senior Urban Planner	APA Group	Yes - 10:30am-2:30pm

Meeting Summary

Total Number of Participants	12
Meeting Title	Officer South - Safety Management Study Workshop
Meeting Start Time	4/27/2022, 9:01:06 AM
Meeting End Time	4/27/2022, 4:07:39 PM
Meeting Id	63b0300d-f1da-4b9e-b4b1-df0ca83a7b66

Full Name	Join Time	Leave Tim	Duration	Email	Role	Participant ID (UPN)
Sarah Doring (VPA)	4/27/2022,	4/27/2022,	6h 30m	Sarah.Doring@vpa.vic.gov.au	Presenter	Sarah.Doring@vpa.vic.gov.au
Matthew Simmons (VPA)	4/27/2022,	4/27/2022,	7h 6m	matthew.simmons@vpa.vic.gov.au	Organizer	Matthew.Simmons@vpa.vic.gov.au
Mark Harris	4/27/2022,	4/27/2022,	7h 5m	admin@DelphiRiskManagementConsult.onmicros	Presenter	admin@DelphiRiskManagementConsult.onm
Dawson, Peter	4/27/2022,	4/27/2022,	3m 33s	Peter.Dawson@apa.com.au	Presenter	Peter.Dawson@apa.com.au
Dawson, Peter	4/27/2022,	4/27/2022,	6h 58m	Peter.Dawson@apa.com.au	Presenter	Peter.Dawson@apa.com.au
Monique So (VPA)	4/27/2022,	4/27/2022,	3h 32m	Monique.So@vpa.vic.gov.au	Presenter	Monique.So@vpa.vic.gov.au
Monique So (VPA)	4/27/2022,	4/27/2022,	3h 5m	Monique.So@vpa.vic.gov.au	Presenter	Monique.So@vpa.vic.gov.au
Chin, Alex	4/27/2022,	4/27/2022,	3h 43m	Alex.Chin@apa.com.au	Presenter	alex.chin@apa.com.au
So, Daisy	4/27/2022,	4/27/2022,	3h 33m	Daisy.So@apa.com.au	Presenter	daisy.so@apa.com.au
So, Daisy	4/27/2022,	4/27/2022,	2h 27m	Daisy.So@apa.com.au	Presenter	daisy.so@apa.com.au
Maureen Benier (VPA)	4/27/2022,	4/27/2022,	7h 1m	Maureen.Benier@vpa.vic.gov.au	Presenter	Maureen.Benier@vpa.vic.gov.au
Keira Lee	4/27/2022,	4/27/2022,	5h 29m	K.Lee@cardinia.vic.gov.au	Presenter	K.Lee@cardinia.vic.gov.au
Mielczarek, Michael	4/27/2022,	4/27/2022,	1h 38m	Michael.Mielczarek@apa.com.au	Presenter	Michael.Mielczarek@apa.com.au
Mielczarek, Michael	4/27/2022,	4/27/2022,	4m 19s	Michael.Mielczarek@apa.com.au	Presenter	Michael.Mielczarek@apa.com.au
Mielczarek, Michael	4/27/2022,	4/27/2022,	37m 8s	Michael.Mielczarek@apa.com.au	Presenter	Michael.Mielczarek@apa.com.au
Mielczarek, Michael	4/27/2022,	4/27/2022,	56m 50s	Michael.Mielczarek@apa.com.au	Presenter	Michael.Mielczarek@apa.com.au
Laurence Newcome	4/27/2022,	4/27/2022,	1h 15m	Laurence.Newcome@melbournewater.com.au	Presenter	Laurence.Newcome@melbournewater.com.a
James Hodgens	4/27/2022,	4/27/2022,	1h 12m	james.hodgens@melbournewater.com.au	Presenter	james.hodgens@melbournewater.com.au