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safety.

Environment Effects Statement | May 2021

western outer ring main

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APA VTS (Operations) Pty Ltd

Western Outer Ring Main Environment Effects Statement
Safety Report

May 2021

This Safety Report (Report):

1. Has been prepared by GHD Pty Ltd (“GHD”) for APA VTS (Operations) Pty Ltd (APA);
2. May only be used for the purpose of informing the Environment Effects Statement and Pipeline Licence Application for the Western Outer Ring Main Project (and must not be used for any other purpose); and
3. May be provided to the Department of Environment, Land, Water and Planning for the purpose of public exhibition as part of the Environment Effects Statement and Pipeline Licence Application for the Western Outer Ring Main Project.

The services undertaken by GHD in connection with preparing this Report were limited to those specifically detailed in section 4 of this Report. The opinions, conclusions and any recommendations in this Report are based on assumptions made by GHD when undertaking services and preparing the Report (Assumptions), as specified in section 1.3 and throughout this Report. GHD excludes liability for errors in, or omissions from, this Report arising from or in connection with any of the assumptions being incorrect. Subject to the paragraphs in this section of the Report, the opinions, conclusions and any recommendations in this Report are based on conditions encountered and information reviewed at the time of preparation. GHD has not, and accepts no responsibility or obligation to update this Report to account for events or changes occurring subsequent to the date that the Report was signed.

Executive summary

This technical report is an attachment to the Western Outer Ring Main (WORM) Project Environment Effects Statement (EES). It provides a Safety risk assessment for the project and defines the environmental management measures necessary to meet the EES evaluation objectives.

Overview

The Western Outer Ring Main Project (the Project) is a buried 600 millimetre nominal diameter high pressure gas transmission pipeline between APA Group's (APA) existing Plumpton Regulating Station (approx. 38 kilometres north west of Melbourne's Central Business District, CBD) and Wollert Compressor Station (approx. 26 kilometres north east of Melbourne's CBD), providing a high pressure connection between the eastern and western pipeline networks of the Victorian Transmission System (VTS).

The Project includes a new buried pipeline, three above ground mainline valves (with buried elements) along the pipeline alignment, and an additional compressor unit and regulating station at the existing APA Wollert Compressor Station.

APA is the proponent for the Project.

On 22 December 2019, the Minister for Planning determined that the Project would require an EES under the *Environment Effects Act 1978* (EE Act).

GHD was commissioned to undertake a Safety risk assessment for the purpose of the EES.

Safety context

This is a preliminary hazard and risk assessment undertaken in support of the EES to:

- Identify potential off-site risks to people, property and community infrastructure from the Project
- Determine if the relevant risk criteria will be met over the life of the Project and demonstrate the risks will be effectively managed
- Identify additional controls to further minimise the risk to people, property and community infrastructure, including any recommendations based on the risk analysis

Existing conditions

The pipeline would be approximately 51 kilometres in length. The pipeline would be within a 15 metre wide permanent easement and be buried for its entire length to a minimum depth of cover of 750 millimetres.

The WORM will utilise existing APA easement where 34% of the total length will be co-located with existing APA pipelines. These easements are already well known to the relevant landowners / occupiers, local shires and other relevant authorities.

A pipeline location class analysis was completed within the Safety Management Study (SMS) report (GPA, 2020) which is based on population density, existing and future land use. This then assists in the risk assessment and appropriate engineering and control measures to mitigate any potential threats. The Wollert Station will be upgraded to install a new Solar Centaur 50 compressor, an end of line scraper station and a pressure regulating station within the existing APA facility at Wollert. This is all located within the existing site boundary.

The location of the Project falls within the Melbourne Urban Growth Boundary. The Melbourne Urban Growth Boundary is defined by "Melbourne 2030 – Planning for Sustainable Growth" and associated planning zones as defined by Victorian Planning Authority (Department of Infrastructure, 2002).

Approximately 44% of the pipeline is in the Urban Growth Boundary. The pipeline Primary Location classification in this area is Residential (T1) (GPA, 2020).

The remaining 56% of the pipeline outside of the Urban Growth Boundary, has a location classification of mostly Rural (R1). The land under this classification is primarily used for grazing and cropping.

Within the pipeline alignment there are current significant features including the proposed Outer Metropolitan Ring (OMR) transport corridor which will potentially attract a secondary location classification of Crowd (C) in the future due to the potential for serious traffic congestion leading to large numbers of people being congregated in close proximity of the pipeline at certain periods. There is also existing APA easements and HV power easements. Lastly the pipeline alignment also is partly located in the Melbourne Water Kalkallo Retarding Basin land.

Risk assessment

The qualitative risk assessment conducted as per AS/NZS 2885.6 identified a number of causes that may lead to the loss of containment of natural gas from the Project. This included assessment of risks to people, property and community infrastructure as a result of ignited loss of containment events and the cumulative risk associated with other existing and proposed developments in the region.

The risk of bushfires originating outside the Project area, are not considered to be significant with regards to the Project design, operations and capability. However, the same consequences of injury or fatality is possible for Project personnel as with the public, particularly through the construction phase.

Both the SMS and EES safety assessment determined that all safety hazards have a residual risk level of low or below. The mitigation controls planned to be implemented by APA were identified. Some additional mitigation recommendations have been identified to further reduce the risks so far as is reasonably practicable (SFAIRP). Additional risk mitigation measures would continue to be identified by the Proponent and implemented to continue reducing risks to SFAIRP.

Environmental management measures

The risk assessment identified four environmental management measures (EMMs) to avoid or minimise safety risks. There was also reference to an EMM identified within the Contamination Report of this EES which was EMM #C6.

The EMM's recommended within this Safety report is summarised below. More detail is provided in Table 11.

Table 1 Summary of Safety EMMs

EMM #	Environmental Management Measure
SA1	The pipeline, MLV and compressor works will be designed, constructed and operated accordance with AS/NZS 2885.
SA2	Design and implement process control systems and automated emergency shutdown systems to ensure operations are within operating parameters, and alter operating set points if they are not.
SA3	Develop and implement a Health and Safety Management Plan.
SA4	Development of emergency response plans for construction and operation phases of the project.
SA5	Review and update the existing APA Bushfire Management Plan to consider the new infrastructure introduced by the WORM Project in consultation with relevant stakeholders including the Country Fire Authority and Fire Rescue Victoria.
SA6	Develop a Traffic Management Plan.

The WORM would be incorporated into the current Victorian Transmission System (VTS) Safety Case and existing APA safety management systems would be applied. APA are to apply for the safety management system to be amended under Section 130 of the *Pipelines Act 2005*. These systems would be updated to include the new infrastructure of the WORM project and the existing management measures would control threats imposed adequately.

Conclusion

The SMS workshop raised actions to complete investigations confirming the details of a small number of external interference threats that have the potential to cause pipeline failure resulting in injuries or fatalities. The requirement for further risk assessments would depend on the outcomes of these investigations. The SMS demonstrates that the requirements of AS/NZS 2885 have been achieved, subject to the effective implementation of these actions.

However, based on the threats that were reviewed and assessed in the SMS, and the risk assessment performed in this report, it can be concluded that residual risks to the workforce, nearby operations and public safety would be adequately managed. This is based on the proposed risk mitigation measures mentioned in Section 9.4 and the EMM's listed in Section 11.

Abbreviations

Abbreviation	Definition
°C	Degrees Celsius
AEMO	Australian Energy Market Operator
ALARP	As Low As Reasonably Practicable
APGA	Australian Pipeline and Gas Association
AS	Australian Standard
AS/NZS	Australian Standard/New Zealand Standard
BAL	Bushfire Attack Level
CBD	Central Business District
CEMP	Construction Environment Management Plan
CHMP	Cultural Heritage Management Plan
CIC	Common Infrastructure Corridor
DELWP	Department of Environment, Land, Water and Planning
DN	Nominal Diameter (measurement for pipeline diameter)
EE	Environment Effects
EES	Environment Effects Statement
EPBC	Environment Protection and Biodiversity Conservation
ESV	Energy Safe Victoria
FBE	Fusion bonded epoxy
GIS	Geographical Information System
GJ/s	Gigajoules per second (energy release rate)
ha	Hectare
HAZID	Hazard Identification
HAZOP	Hazard and Operability Study
HDD	Horizontal Directional Drill
HSEMS	Health and Safety and Environment Management System
HSMP	Health and Safety Management Plan
HV	High Voltage
HVPL	High Vapour Pressure Liquid
ICCP	Impressed current cathodic protection
JSA	Job Safety Analysis
km	Kilometre

Abbreviation	Definition
KP	Kilometre-point
kPag	Kilopascals gauge
kW/m^2	Kilowatts per metre squared (heat radiation flux)
LPE	Layer polyethylene
LV	Low Voltage
m	Metre
MAOP	Maximum Allowable Operating Pressure
MHF	Major Hazard Facility
MLV	Main Line Valve
mm	Millimetre
MPa	Mega Pascal
MSA	Melbourne Strategic Assessment
OHS	Occupational Health and Safety
OMR	Outer Metropolitan Ring
PAO	Public Acquisition Overlay
PPE	Personal Protective Equipment
R1	Rural location classification as defined in AS/NZS 2885
R2	Rural residential use location classification as defined in AS/NZS 2885
RTP	Resistance to penetration
s	Seconds
SCC	Stress corrosion cracking
SDS	Safety Data Sheet
SFAIRP	So Far As Is Reasonable Practicable
SIL	Safety Integrity Level
SMYS	Specified Minimum Yield Strength
UN	United Nations number
VNI	Victorian Northern Interconnect
VTS	Victorian Transmission System
WORM	Western Outer Ring Main
WT	Wall Thickness

Glossary

Term	Definition
Alignment	The centreline of the construction corridor selected for assessment in the EES.
APA	APA VTS (Operations) Pty Ltd, trading as APA Group, the proponent for the Project.
As low as reasonably practicable (ALARP)	Risks associated with a threat is deemed ALARP if the threat is controlled, or the residual risk is assessed to be low or negligible, or the residual risk is assessed to be intermediate and is formally demonstrated to be ALARP.
Assumption	A statement, quantity or formula accepted to be true, but without proof.
Bushfire	An uncontrolled fire burning in forest, scrub or grassland vegetation.
Cathodic protection system	Application of an electrical current to the pipeline exterior to prevent electrochemical corrosion.
Consequence	The severity associated with an event in this instance the heat radiation from jet fire, flash fire and fireball events or explosion overpressure, i.e. the potential effects of a hazardous scenario.
Consequence event	The end event associated with a failure and release, considering all detection, isolation and ignition factors, e.g. jet fire, flash fire etc.
Controlled threat	Where sufficient measures have been applied to a threat so that the possibility of a failure event due to that threat has been removed for all practical purposes at that location.
Easement	Final corridor to accommodate pipeline - typically 15 m in width.
Environmental management measure	Approaches, requirements or actions to avoid, mitigate or manage potential adverse impacts
Event frequency	The frequency assigned to a specific consequence event, expressed as the likelihood of an event occurring per annum.
Fireball	The instantaneous flashing of the material due to the catastrophic failure of the container vessel creating an expanding cloud of material. A fireball is created if this cloud is ignited, often from the flame source that caused the initial vessel failure. As buoyancy forces of the hot gases begin to dominate, the burning cloud rises and becomes more spherical in shape.
Flash fire	The delayed ignition of a vapour cloud. A flash fire occurs when a large release occurs forming a flammable gas cloud which eventually meets an ignition source, igniting the gas cloud, causing a fire that flashes back to the source of the leak, typically followed by a jet fire. In a flash fire, the gas cloud burns but no significant overpressure is created at the flame front. Unlike a vapour cloud explosion, the negligible overpressure created does not accelerate the flame front and thus energy released from the combustion does not take the form of an explosive blast. It is assumed there is a 100% likelihood of fatality within the ignited vapour cloud.
Frequency	The number of occurrences of an event expressed per unit time. It is usually expressed as the likelihood of an event occurring per annum.
Hazard	A situation with the potential for human injury, damage to property, damage to the environment or some combination of these.

Term	Definition
Hazardous scenario	The accidental release of a hazardous material from equipment or piping, from identified isolatable section of equipment.
Horizontal directional drilling (HDD)	A ‘trenchless technology’ by which a pipeline tunnel is drilled at a shallow angle under a crossing (e.g. a waterway, wetland, road or railway) through which the pipe is then threaded.
Hydrostatic pressure testing	A pipeline testing process used to test welds and pipeline integrity in high pressure hydrocarbon pipelines. The process involves filling the newly constructed pipeline with pressurised water or other medium, enabling the detection of leaks.
Jet fire	A jet fire occurs when a flammable liquid or gas, under some degree of pressure, is ignited after release, resulting in the formation of a long stable flame. A jet fire risk is present whenever there are pressurised flammable gases or liquids. Turbulence evoked by pressurised fluid escape entrains ambient oxygen and can create a mixture that lays within the materials flammability limits.
Kilometre point	Survey distance along the main pipeline, where zero kilometres represents Plumpton Regulating Station
Landholder	A general term used to refer to the legal owner or manager of a parcel of land. It may be a private landholder, Government or private utility, or a Government Agency responsible for management of a particular parcel of Crown land (e.g. National Parks or Forestry areas).
Location classification	The classification scheme, as defined in AS/NZS 2885, allows division of the pipeline design requirements according to whether the pipeline is to be installed in rural, semi-rural, suburban or urban areas.
Mainline valve (MLV)	An above ground facility consisting of a valve used to isolate sections of the pipeline, located at intervals along its length.
Maximum allowable operating pressure (MAOP)	Refers to the wall strength of a pressurised cylinder such as a pipeline or storage tank and how much pressure the walls may safely hold in normal operation.
Measurement length	The distance to the 4.7 kW/m2 contour from a full bore rupture at MAOP as defined in AS/NZS 2885. The Measurement Length is used to classify existing and reasonably foreseeable land use adjacent to the pipeline and drives the safety design of the pipeline to mitigate threats to and from the pipeline. The Measurement Length for this Project is 659 m.
Melbourne Strategic Assessment (MSA) area	The area between KP 0 to KP 3.2 and KP 28.16 - KP 28.57 and KP 32.07 - KP 51.04. which is within the area having MSA approvals. This approval is an agreement between the Victorian and Australian governments made under Part 10 of the EPBC Act whereby impacts on Matters of National Environmental Significance that are expected to occur within the Melbourne urban growth boundary are defined and accounted for a priori and can be considered early in the development of a plan, policy or program.
Non-credible threat	A non-credible threat is where the likelihood of an occurrence is so low that it does not exist for any practical purpose at the nominated location. The credibility of a threat is characteristic of the threat itself and is assessed independently of any protective or mitigation measures that may be applied.

Term	Definition
Pigging	The act of forcing a pipeline inspection gauge (PIG) through a pipeline for the purposes of displacing or separating fluids, and cleaning or inspecting the line.
Pipeline inspection gauge (PIG)	A tool which is inserted into a pipeline and propelled along by hydrotest water or by gas, to clean and inspect the pipe internally.
Pipeline licence	A licence granted under the Pipelines Act 2005 granting the right to construct and operate a pipeline to transport petroleum on land subject to the licence.
Pool Fire	A pool fire occurs if a flammable or combustible liquid accumulates in a pool on the ground and vapours caused by evaporation are subsequently ignited. The resultant fire covers the whole pool area. The thermal radiation from pool fires tends to attenuate rapidly with distance from the flame surface, and so thermal effects are relatively localised.
Purging	Removal of a substance from the pipeline e.g. using gas to remove all air from the pipeline.
Quantitative risk assessment (QRA)	A risk assessment undertaken by combining quantitative evaluations of event frequency and consequence.
Rehabilitation	Rehabilitation is the process of restoring a site or area's environmental attributes by returning an area to its pre-disturbance state. The process may include initial stabilisation, followed by regeneration, revegetation or restoration, depending upon the defined scope of works. Commonly the main objective of rehabilitation is either reinstatement of, or improvement on, the pre-existing condition.
Reinstatement	Reinstatement is the process of re-establishing a pre-existing physical condition, and usually involves bulk earth works and structural replacement of pre-existing attributes of a site, such as soil surface topography, drainage, culverts, fences and gates.
Risk	The combination of frequency and consequences, the chance of an event happening that can cause specific consequences.
Scoping requirements	The EES Scoping requirements for the Project issued by the Minister for Planning in August 2020.
Scraper station	An above-ground facility used to launch and receive PIGs into and from the pipeline system.
So Far As Is Reasonably Practicable (SFAIRP)	The SFAIRP principle (Australian Commonwealth, 2011) considers: • The nature and level of the risks assessed. The assessment of the risks needs to be based on the best available evidence and advice. • That the residual risks are not unduly high. • That the risks are periodically reviewed to ensure that they still meet the SFAIRP criteria, for example, by ascertaining whether further or new control measures need to be introduced to consider changes over time, such as new knowledge about the risk or the availability of new techniques for reducing or eliminating risks.

Term	Definition
Stringing	Laying the pipe adjacent to the pipeline trench.
Study area	The study area for the safety assessment includes the area surrounding the Project facilities to the extent that the Project can impact nearby people, property or community infrastructure. The Study Area encompasses the land from the pipeline alignment to the distance calculated for the pipeline measurement length.
The Project	The Western Outer Ring Main (WORM) gas pipeline Project. The Project is a proposed 600 millimetre nominal diameter high pressure gas transmission pipeline that will provide a high pressure connection between the eastern and western pipeline networks of the Victorian Transmission System (VTS). The Project has been designed to provide critical infrastructure for Victoria's gas supply, distribution, and consequent security, efficiency and affordability.
Urban Growth Boundary	Indicates the long-term limits of urban development and where non-urban values and land uses should prevail in metropolitan Melbourne. It is defined by the Victorian Planning Authority.
Vapour cloud explosion (VCE)	Vapour cloud explosions result from the combustion of flammable vapour clouds within a congested or confined area creating an overpressure in the process. Under certain conditions the flame front may be accelerated by the overpressure created to a high velocity producing considerable blast effects.

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1. Introduction

1.1 Purpose of this report

The Western Outer Ring Main (WORM) gas pipeline project (the Project) is a proposed 600 millimetre nominal diameter high pressure gas transmission pipeline that will provide a high pressure connection between the eastern and western pipeline networks of the Victorian Transmission System (VTS).

APA is the proponent for the Project. APA is Australia's largest natural gas infrastructure business. In Victoria, the VTS is owned and maintained by APA and consists of some 2,267 kilometres of gas pipelines. The VTS serves a total consumption base of approximately two million residential consumers and approximately 60,000 industrial and commercial users throughout Victoria.

The Project has been designed to provide critical infrastructure for Victoria's gas supply, distribution, and consequent security, efficiency and affordability. The key objectives of the Project are to:

- Improve system resilience and security of gas supply
- Increase the amount of natural gas that can be stored for times of peak demand
- Improve network performance and reliability
- Make provision for additional sources of gas to the East Coast Gas Grid
- Address potential gas shortages as forecasted by Australian Energy Market Operator (AEMO) in the March 2020 Victorian Gas Planning Report update

The Minister for Planning determined on 22 December 2019 that APA and the WORM gas pipeline project would require an Environment Effects Statement (EES) under the *Environment Effects Act 1978* (EE Act). The EES will inform assessment of approvals required for the Project including under the *Pipelines Act 2005*, *Aboriginal Heritage Act 2006* and *Environment Protection and Biodiversity Conservation Act 1999*.

The purpose of this report is to provide a safety risk assessment to satisfy the EES scoping requirements. This report integrates the risk assessment requirements for pipeline approval (AS/NZS 2885 SMS) with additional matters relevant under the scoping requirements. The SMS is a detailed analysis of Project safety primarily focused on design and operation and is summarised in Section 9 of this report. Risks posed during construction and risks beyond the scope of the SMS, are assessed in this report through the EES safety risk assessment. This report integrates the two assessments and considers management measures to reduce safety risks SFAIRP.

1.2 Why understanding Safety is important

The Safety report is important to help support the EES to:

- Identify potential off-site risks to people, property and community infrastructure from the Project
- Demonstrate the risks will be effectively managed to meet the risk criteria over the life of the Project
- Identify additional controls to reduce risks So Far As Is Reasonably Practicable (SFAIRP)for people, property and community infrastructure, including any recommendations based on the risk analysis

Having a better understanding of the safety hazards and risks associated with the Project enables the proponent to design systems and put in place procedures appropriate to the safeguarding of human life, assets and the environment.

1.3 Assumptions

As the Project is in the early stages of the Project lifecycle, assumptions have been made in the Safety assessment. In general, these assumptions have been conservative to assist in identification of the worst-case scenarios. The assumptions relevant to each type of hazard are detailed throughout the report.

2. EES scoping requirements

2.1 EES evaluation objectives

The scoping requirements for the EES, released by the Minister for Planning, set out the specific environmental matters to be investigated and documented in the Project's EES, and informs the scope of the EES technical studies. The scoping requirements include a set of evaluation objectives. These objectives identify the desired outcomes to be achieved in managing the potential impacts of construction and operating the Project.

The following evaluation objective is relevant to the Safety assessment:

- Provide for safe and cost-effective pipeline connection between the eastern and western sections of the Victorian Transmission System.

2.2 EES scoping requirements

The scoping requirements relevant to the Safety evaluation objectives are shown in Table 2, as well as the location where these items have been addressed in this report.

Table 2 Scoping requirements relevant to Safety

Scoping requirement	Section addressed
Identify key issues for workforce, nearby operations and public safety risks associated with the construction or operation of the project, including risks associated with or compounded by potential external threats (e.g. bushfire).	Section 3.4 Design, construction and operation considerations relevant to Safety Section 9 Safety Management Study (SMS) assessment and results Section 10 Bushfire hazard analysis
Characterise the human environment near the project relative to safety buffer standards for surrounding current land uses and reasonably foreseeable land uses.	Section 3.4 Design, construction and operation considerations relevant to Safety Section 5.1 Location and existing and reasonably foreseeable land use Section 5.2 Geology, topography Section 9.1.2 Location analysis
Describe the bushfire hazard for the immediate project area and broader landscape conditions and undertake appropriate risk assessment that considers the risk of bushfire to people, property and community infrastructure.	Section 10 Bushfire hazard analysis
Identify and assess the relevant risks that may be posed by the project, and feasible alternatives, and compare these to the expected project benefits.	Section 3.5 Hazardous materials Section 8 Risk assessment for aspects not addressed in the Safety Management Study Section 9.3 Threat analysis Section 10 Bushfire hazard analysis
Describe proposed measures to minimise risk and ensure safety for workforce, nearby operations and the public during construction and operation of the project.	Section 8 Risk assessment for aspects not addressed in the Safety Management Study Section 9.4 Risk mitigation measures

Scoping requirement	Section addressed
Identify and assess the relevant risks that may be posed by the project, and feasible alternatives, and compare these to the expected project benefits.	Section 8 Risk assessment for aspects not addressed in the Safety Management Study Section 9.3 Threat analysis
Describe the monitoring program to form part of the EMF to identify any unexpected impacts or hazards in time for corrective action to be taken.	Section 7 APA risk management philosophy Section 11 Environmental management
Describe the framework for emergency response, including contingency planning for foreseeable possible public safety or environmental emergencies.	Section 7.3.4 Emergency management

There are four other scoping requirements referenced within the Energy efficiency, security, affordability and safety section regarding Project energy security, efficiency and affordability. This is not included in the scope of this report, and instead these scoping requirements are addressed in EES Chapter 2 Project Rationale.

2.3 Linkages to other reports

This report relies on or informs the technical assessments as indicated in Table 3.

Table 3 Linkages to other technical reports

Specialist report	Relevance to this technical study
Technical report A: *Biodiversity and habitats*	Further details on ecology which is referenced within Section 10.
Technical report B: *Surface water*	Further details on flooding threats which is not considered within this report.
Technical report D: *Land stability and ground movement*	Further details on land subsidence which is listed as a potential threat in Section 8.2.5
Technical report E: *Contamination*	Further details on the Environmental Mitigation Measure #C6 used in Section 8**.**
Technical report F: *Noise and vibration*	Further details on blasting impacts which is referenced within Section 3.6.
Technical report K: *Land use*	Further details on the land classifications provided for the pipeline alignment.

3. Project description

3.1 Project overview

The Project provides a new link between APA's existing Plumpton Regulating Station (approx. 38 kilometres north west of Melbourne's CBD) and Wollert Compressor Station (approx. 26 kilometres north east of Melbourne's CBD). The Project includes the following key components:

- **A new pipeline**: The pipeline would be approximately 51 kilometres in length. The pipeline would be within a 15 metre wide permanent easement and be buried for its entire length to a minimum depth of cover of 750 millimetres.
- **Mainline valves**: Three mainline valves (MLV) would be located along the pipeline alignment. The area required for mainline valves would be subdivided and acquired by APA to provide ongoing access for any maintenance or inspection activities from the existing roads. The mainline valves would be spaced at intervals of approximately 15 kilometres, and located at approximately KP 6, KP 22 and KP 35.
- The **Wollert Compressor Station upgrade**: The installation of a new Solar Centaur 50 compressor, an end of line scraper station and a pressure regulating station within the existing APA facility at Wollert.

A schematic illustration of the Project context is shown in Figure 1.

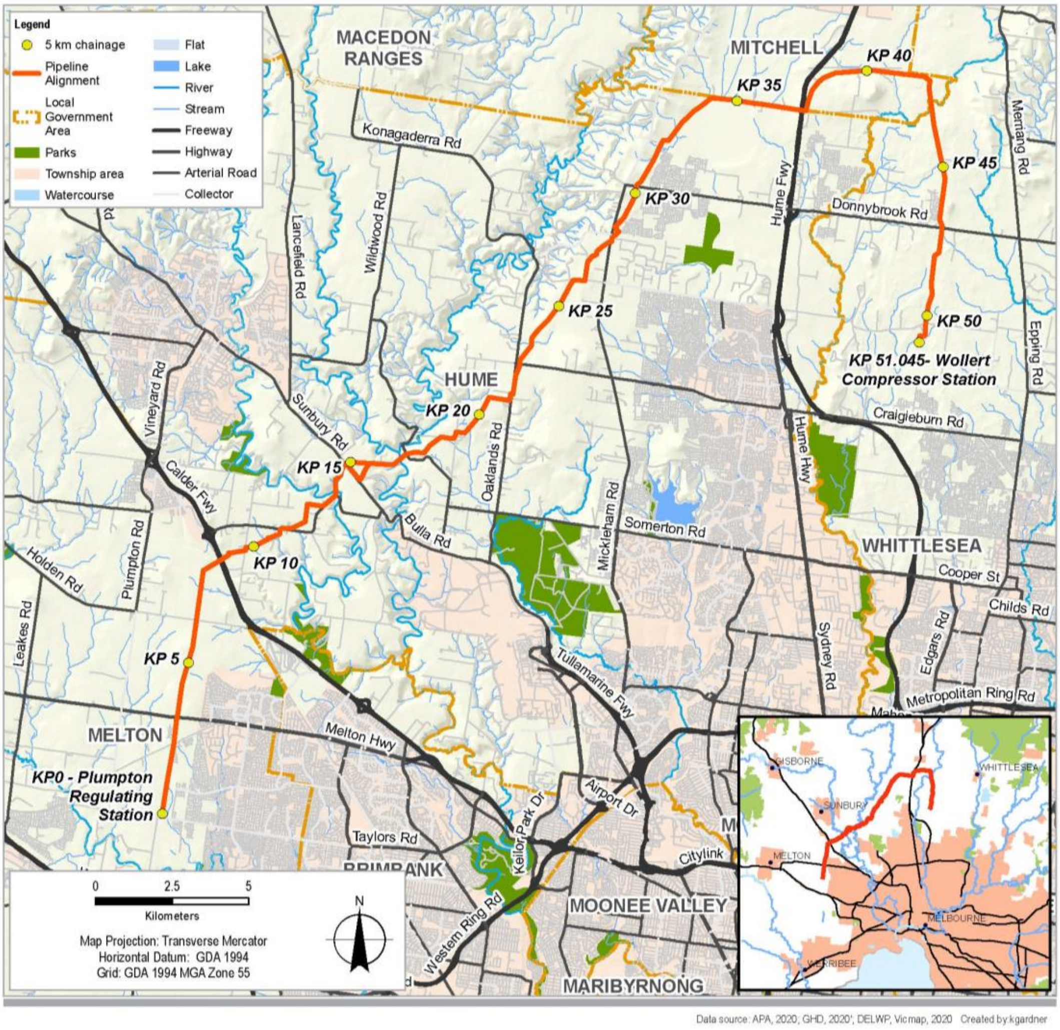


Figure 1 Western Outer Ring Main overview

3.2 Construction

Subject to the staging of the works, construction for the entire Project is expected to take approximately nine months. Key construction activities for the Project include:

- Establishing offsite construction sites and construction/laydown areas
- Constructing the pipeline
- Constructing three mainline valves
- Construction of upgrades associated with the Wollert compressor station
- Rehabilitation

3.2.1 Construction sites

Two temporary construction sites would be established for construction.

One offsite compound for the construction of the pipeline. This would be nominally 200 metres x 200 metres, include laydown and storage areas and would be located on a site where the activity is permitted under the relevant Planning Scheme, most likely within an existing industrial area.

The second temporary laydown area and construction offices would be established for the Wollert Compressor Station construction works. The construction offices and site laydown area for the compressor station equipment would be located within the existing compressor site area at Wollert.

3.2.2 Pipeline construction area

The Project would require a construction area for the pipeline, which would typically comprise a 30 metre wide corridor along the pipeline alignment. Most construction activity would be located within this construction area. The activities and facilities within the construction corridor would include access tracks and additional work areas such as vehicle turn around points and additional work spaces for crossings, stockpiling of materials and storage of pipe. Additional work areas up to 50 m x 50 m or 50 m x 100 m, such as for vehicle turn-around points, areas to accommodate horizontal directional drilling (HDD), would be required in some locations.

3.2.3 Pipeline construction methodology

The techniques used to construct the underground pipeline would include various methods including, open trench construction and alternative techniques at certain locations such as HDD or horizontal boring.

Where crossing watercourses, major roads, rail line reserves or other constraints, the pipeline may be constructed using trenchless construction techniques such as HDD or shallow horizontal boring, to avoid construction disturbance within the sensitive area. For Jacksons Creek, the method for construction is based on geotechnical, and other technical feasibility reports.

The pipeline construction sequence starts with survey works and continues with site establishment (including laydown area), clearing and grading, pipe stringing, pipe bending, welding and coating, open trench construction, lowering pipe into trench and backfilling, hydrostatic testing, commissioning, and finally rehabilitation.

There would be dedicated access points into the construction corridor with vehicular movements along the Project alignment kept within the construction corridor.

3.2.4 Constructing three mainline valves

The Main Line Valves (MLV) construction and rehabilitation process involves the following:

- Offsite Fabrication: A MLV "assembly" consists of a set of buried and above-ground piping, bypass valves and equipment. The MLV "assembly" will be fabricated and installed together at an offsite contractor workshop and delivered to the MLV site location for connection then to the main line. The MLV assembly will arrive pre-coated to site, other than at the ends where welding will occur.
- Surveying: Similar to the pipeline, survey works will be undertaken to mark the extent of the MLV compound and surrounding temporary construction area
- Clearing and grading: The construction area around the MLV will be cleared as part of the pipeline ROW, including removal of any trees, shrubs, surface rocks and groundcover vegetation.
- Trenching: Specialised trenching machines and excavators would be used to excavate the trench to allow sufficient space to lower-in the MLV assembly, complete welding, install valve foundations and structural support. The trench will be appropriately benched to allow safe access for personnel to complete the welding and coating.
- Tie-in works (welding): The pre-assembled MLV will be lowered into the trench, onto temporary supports, using a specialised sideboom equipment. The supports will enable the MLV to be welded to the main pipeline on either side. At the completion of welding, the ends will be coated on site.
- Civil and structural works: Concrete foundation will be poured around the buried valve to provide stability during operation. The above ground components will be also be supported using structural steel supports.
- Backfill and Rehabilitation: The trench will be backfilled with the previously excavated subsoil material. In areas of rock excavation, imported bedding and padding material may be required where the previously excavated subsoil is unsuitable for use. At the completion of backfill, the remaining above ground infrastructure will be installed, including concrete supports for above ground equipment, installation of MLV compound fencing, bollards, cathodic protection, and electrical/instrumentation equipment.

3.2.5 Construction of other facilities

The construction sequence for the Wollert Compressor Station works starts with survey works and continues with site establishment (including laydown area), bulk earthworks, civil works (concrete slab and footings), mechanical works, electrical and instrumentation works, hydrostatic testing, commissioning, and site completion.

Various components of the compressor are assembled offsite. When delivered to site the various components are assembled together in-situ. Cranes are used to lift the compressor into place with all connecting pipework fitted.

3.3 Operation

Following the reinstatement of land as part of the pipeline construction, the land would be generally returned to its previous use. When commissioned, the pipeline would be owned and maintained by APA. The pipeline would be contained within a 15 metre wide permanent easement corridor (within the area that formed the 30 metre construction corridor). Routine corridor inspections would be undertaken in accordance with APA procedures and AS 2885.3 to monitor the pipeline easement for any operational or maintenance issues.

Excavating or erecting buildings over the underground pipeline would be prohibited in accordance with the *Pipelines Act 2005* and pursuant to easement agreements with landowners.

Maintenance and inspections of the MLVs and the Wollert Compressor Station would also be conducted periodically in accordance with APA procedures. The activities usually include vegetation management, valve and compressor operation and corrective maintenance.

The key operation and maintenance phase activities include:

- Easement maintenance (vegetation control, weed management, erosion and subsidence monitoring)
- Pipeline, MLVs and compressor station maintenance
- Specialist pigging operations
- Cathodic protection surveys
- Mechanical and electrical preventative and corrective maintenance
- Monitoring and routine inspections and surveillance

3.4 Design, construction and operation considerations relevant to Safety

An access road running adjacent to the railway line in Beveridge is a possible access option for use by the Project. The access road is an existing access track recently constructed by Yarra Valley Water and no physical construction works is proposed by the Project. As such this access track has not been considered further with regards to the assessment for safety. A second informal access track option may be used by machinery and equipment to access the construction footprint from the north. This track follows the existing APA easement. No physical construction is expected to be required to establish this access and therefore this access track has not been considered further with regards to the assessment for safety.

The pipeline and facilities installed would be designed to be operated as an unmanned facility with remote control by AEMO or if required by APA Dandenong Control Room via the ClearSCADA system. It would also be provided with full local control facilities for flexibility of operation and maintenance trouble-shooting.

The systems will be designed for fully automated, safe operation with optimised maintenance routines, in keeping with APA General Procedure for Operability, Maintainability and Reliability Requirements (530-PR-A-0001).

The Wollert Compressor Station operating philosophy would have the following points in respect of design and construction of the facility:

- The facility would be normally unmanned and remotely operated by AEMO with monitoring by APA Dandenong Control Room. No site attendance would be required for normal operation of the station.
- The existing compressor units 4 and 5 and the proposed unit 6 would be capable of operating and delivering to the common station header.
- The Gas Turbine driven gas Compressors (GTC) would be operated by AEMO at the most economic operating mode that achieves the demand or contractual throughput and pressure.
- Performance and operating data would be transmitted by SCADA to allow effective remote control, monitoring, analysis and troubleshooting of the station.

- Additional remote functions to facilitate actuated valve isolations, reversal of flow direction and equalisation across the station as required.
- High level target for availability and reliability of the compressor station.

3.4.1 Pipeline design parameters

The WORM pipeline is designed for bi-directional flow. The key pipeline design parameters are summarised in Table 4 below.

Table 4 Summary of pipeline parameters

Description	Value
Nominal Diameter	DN 600
Length	51 km
MAOP (Maximum Allowable Operating Pressure)	10,200 kPag
Outer Diameter	610 mm
Line Pipe	API 5L Grade X52 SMYS – 360 MPa
Hoop Stress	245 MPa, (68% SMYS)
External Coating	Dual Layer Fusion Bonded Epoxy (FBE)
Pressure Design Factor	72%
Minimum Depth of Cover	750 mm (900 mm in location class T1 areas

3.5 Hazardous materials

Hazardous materials may be used throughout the life of the Project including dangerous goods and non-dangerous goods. A list of materials potentially associated with the Project is summarised in Table 5 below.

Table 5 Potentially hazardous materials

Material	Material properties	Description of use
Natural gas (methane) UN 1971 Class 2.1	Natural gas is considered a hazardous substance. It predominantly consists of methane.	Natural gas will be transferred in the pipeline. Natural gas will be present during commissioning and operations.
Diesel UN 1202 Combustible liquid	Diesel is a combustible liquid. If a large volume of diesel is released and ignited, a pool fire will form resulting in a thermal radiation hazard.	The diesel will be stored in accordance with AS 1940 The storage and handling of flammable and combustible liquids (Standards Australia, 2017). Diesel will be utilised during construction as the fuel source for mobile equipment (e.g. graders, trucks, excavators) and construction site generators. A small amount of diesel will be used in a diesel generator during operation but will not be stored onsite.

Material	Material properties	Description of use
Lubrication oils	Lubricants are typically non-hazardous, non-dangerous goods, however, are combustible liquids (Class 2, flashpoint greater than 150^{0}C) meaning they can burn if heated above 150^{0}C. If lubricants are released and ignited, a pool fire will form creating a heat radiation hazard.	Lubrication oils will be used for turbines during operation.

Natural gas (methane) and diesel are the only hazardous materials that are in sufficient quantities such that they may pose a potential risk to nearby people, property or environment. As such, these are discussed in further detail through the remainder of the report.

Natural gas

The predominant source of hazard from the Project is associated with the potential for a loss of containment of natural gas.

Natural gas consists predominantly of methane (typically greater than 97%), with up to 3% carbon dioxide (CO_2) and less than 0.1% oxygen. It may include very small quantities of propane and butane (less than 0.5%) and some ethane (less than 3%). Methane is an odourless, non-toxic and non-corrosive gas and is lighter than air at temperatures greater than minus 110°C. On release in the open, the non-ignited gas tends to disperse rapidly.

The lower flammability limit of methane is 5% and the upper flammability limit is 15%. This means that if the concentration of methane in air is less than 5%, the gas mixture is too dilute to burn and if it is greater than 15% there is not enough oxygen for it to burn. The auto-ignition point for methane is 580°C. This is the minimum temperature required for methane gas to ignite in air without a spark or flame being present.

If an ignition source is present near the release point and immediate ignition occurs, a jet fire could occur from ignition of the pressurised flammable gas.

If a gas release does not ignite immediately, a gas cloud may form which could find an ignition source distant from the release location leading to a flash fire or vapour cloud explosion. A flash fire is a slow deflagration of an unconfined, unobstructed gas cloud producing negligible overpressure. Thermal effects are the main hazard. A vapour cloud explosion is an explosion occurring with the release of a large quantity of flammable gas, which ignites following the formation of a flammable cloud within the upper and lower flammable limits causing a damaging pressure wave. Vapour cloud explosions from natural gas do not occur unless the gas is confined.

The gas is non-toxic, posing only an asphyxiation hazard. Asphyxia is a possibility if the oxygen concentration in the atmosphere is less than 19.5%. Due to its buoyancy, a release of natural gas in the open would not present an asphyxiation hazard.

The factors involved in natural gas releases leading to fire or explosion are:

- The pipeline or associated equipment must fail such that a release of gas occurs. There are several possible causes of failure including corrosion and damage by external sources.
- The released material must form a flammable mixture between the lower and upper flammability limits described above.

- The released material must come into contact with an ignition source. In some cases, this may be heat or sparks generated by mechanical damage, non-flame proof equipment, vehicles, or open flames.
- Depending on the conditions of the release including the volume of natural gas and how rapidly it ignites, the event may be a jet fire, a flash fire or a vapour cloud explosion.
- For there to be a safety risk, people must be present within the harmful range (consequence effect distance) of the fire or explosion. How close the people are to the release will determine whether any injuries or fatalities result.

Diesel fuel

Another hazard during the construction phase is a spill of diesel fuel. Diesel would be utilised during construction as the fuel source for mobile equipment (e.g. graders, trucks, excavators) and construction site generators.

Diesel is a pale yellow/straw to brown coloured liquid with characteristic gasoline like odour.

Diesel is classified as Category 4 Flammable Liquid according to the United Nations Globally Harmonised System of Classification and Labelling of Chemicals (GHS), meaning it has a flash point >60°C and ≤93°C. AS 1940:2017 The Storage and Handling of Flammable and Combustible Liquids (Standards Australia, 2017) classifies diesel as a combustible liquid (Class C1) for the purpose of storage and handling. Diesel is not classified as a dangerous good by the criteria of the Australian Dangerous Goods (ADG) Code (National Transport Commission, 2007) with a flash point greater than 60°C.

In the event of a spill, diesel is damaging to soils and aquatic ecosystems and fires can occur if ignited. A pool fire may occur if the diesel accumulates on the ground (e.g. in a bund) and vapours caused by evaporation are subsequently ignited. The resultant fire covers the whole pool area. The thermal radiation from pool fires tends to attenuate rapidly with distance from the flame surface, and so thermal effects are relatively localised.

3.6 Blasting activities

Blasting activities are planned for some of the Project areas where rock will be encountered, and structures are situated at sufficient separation distances. The impacts associated with blasting are detailed in the EES Noise report. APA has also engaged an independent consultant for a blasting study report which is referenced in Technical report F *Noise and vibration.*

4. Methodology

4.1 Overview of safety method

This section describes the methods used to assess potential safety risks of the Project. Figure 2 shows an overview of the assessment method used specifically for this report. The approach intends to integrate the stated risk assessment requirements and the additional risk assessment requirements for pipeline approval (AS/NZS 2885 safety management study) based on legislation outlined in Section 6.

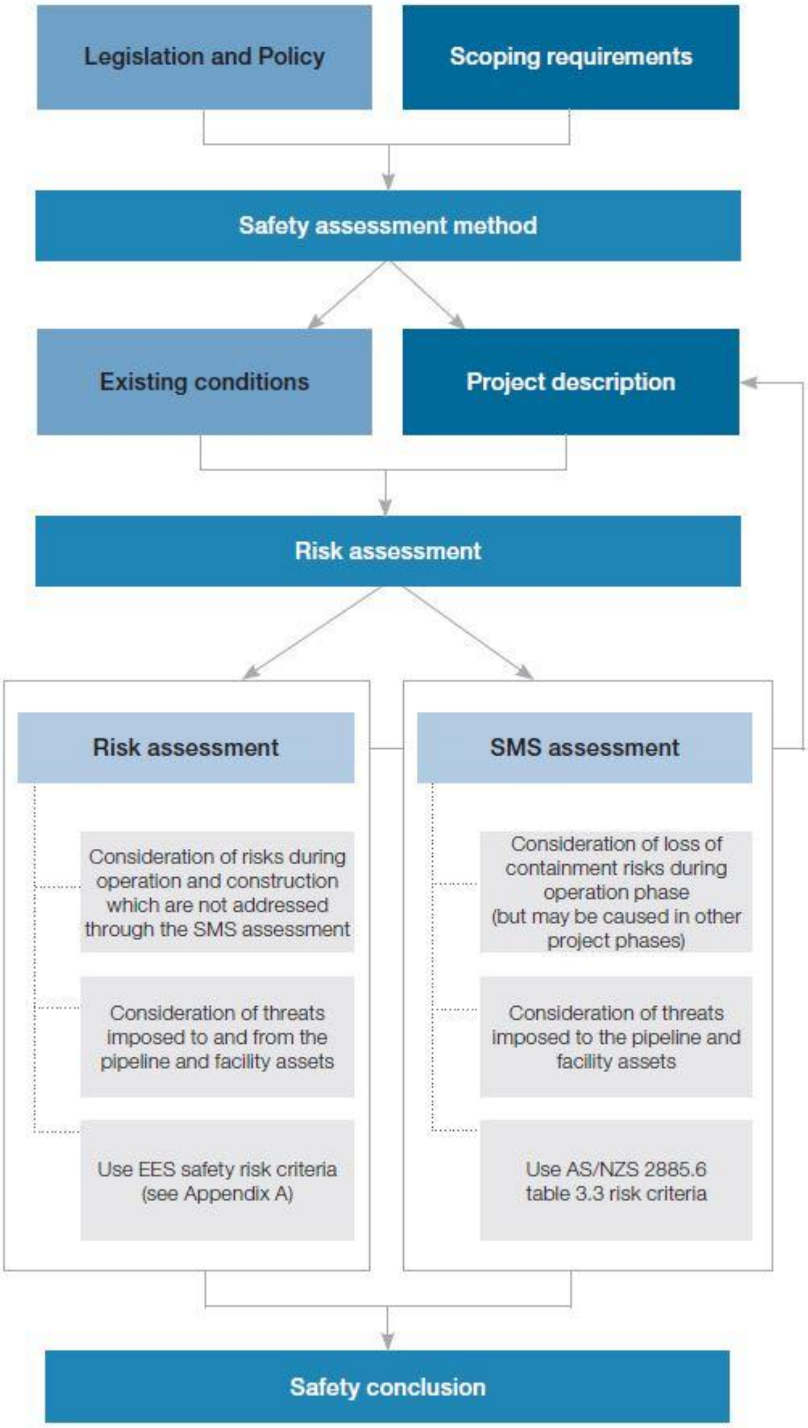


Figure 2 Overview of safety assessment method

As part of the safety assessment two different approaches were used to align with the requirements of AS/NZS 2885 and EES scoping requirements.

The safety and risk studies are ongoing. As areas of the design progress, these studies will be further refined as appropriate for the available design detail. This is the normal and accepted approach for projects of this nature.

The outcomes of these studies have been incorporated into the design elements for the Project and will form an integral part of developing safe operating practices for the Project to meet the objective of minimising risk SFAIRP by providing safe operations that meet community expectations. SFAIRP has been nominated by APA for this report because it is more stringent than as low as reasonably possible (ALARP). SFAIRP requires minimisation of all risk (not just to a certain level).

The intent of the two studies is to allow all relevant hazards associated with the Project to be identified and assessed in an appropriate manner. The AS/NZS 2885 pipeline SMS is a detailed analysis with a prescribed scope and methodology, focussing on threats to the pipeline, primarily during operations. Therefore, to integrate the identification and assessment of risks posed during other Project phases (e.g. construction) and risks posed to people and property from the Project that are beyond the scope of the SMS, an additional risk assessment has been completed for the EES assessment.

The conclusion and outcomes of both risk assessment processes are incorporated into the design, construction and operating philosophy (including management measures where relevant) of the Project to reduce safety risks SFAIRP.

The two safety assessment methodologies adopted for this report, including the use of risk criteria is discussed further in the following sections.

4.2 Existing conditions method

Establishing existing conditions uses the approach defined by AS/NZS 2885. This includes reviewing the Study Area defined by the Measurement Length. The method for calculating the Measurement Length is depicted in AS/NZS 2885 and for this Project was calculated as 659 m which is shown in Figure 4. The same Study Area is used for both the SMS and risk assessment provided in this report.

Once the Study Area is defined, the existing and reasonably foreseeable land uses are reviewed to assess the Measurement Length to enable land use classifications. This in turn outlines the safety design requirements of the pipeline.

As outlined in AS/NZS 2885.6 Section 2 Classification of location states that ‘the primary location class shall reflect the population density’.

The primary land use classifications are defined as:

- R1 – Rural Land that is unused, undeveloped or is used for rural activities such as grazing, agriculture and horticulture and includes infrastructure. Population is distributed in isolated dwellings.
- R2 – Rural Residential As defined by the local planning scheme or occupied by single residence blocks (typically in the range of one hectare to five hectares), or areas for which the number of dwellings within the Measurement Length radius from any point on the pipeline does not exceed approximately 50.

- T1 – Residential Land that is developed for community living or is defined in a local planning instrument as residential or its equivalent. This location class applies where multiple dwellings exist in proximity to each other and dwellings are served by common public utilities.
- 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 multistorey development predominates or where large numbers of people congregate in the normal use of the area. This location class contains more than approximately 50 dwellings per hectare.

The secondary land use classifications are:

- I – Industrial Land used for manufacturing, processing, maintenance, storage or similar which pose a different range of potential threats. This secondary location class applies where development for factories, warehouse, retail sales of vehicles and plant predominates.
- S – Sensitive use Land where the consequence of a failure event is increased because the land is used by sectors of the community who may be unable to protect themselves. Uses include schools, hospitals, aged care facilities and prisons.
- C – Crowd The crowd Location class shall be applied to location where there may be crowds or congestion leading to concentration of population that are both intermittent and much higher than typical for the prevailing primary location class
- 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-contain unusual threats to the pipelines systems.
- CIC – Common Infrastructure Corridor is land which, because of its function, results in multiple parallel infrastructure development within a common easement or reserve, or in easement which partially or fully overlay the pipeline easement.
- 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.

The land use classifications inform both direct threats to the pipeline and the consequences of a pipeline failure to adjacent land users.

4.3 Risk assessment method

A risk assessment for the purpose of the EES was carried out using an approach that is consistent with *AS/NZS ISO 31000:2018 Risk Management Process*. Consideration to risks associated with both the construction and operation phases of the Project were included, and threats imposed by the Project additional to those risks assessed through the Project SMS. Pipeline and facilities loss of containment risks during operation were not part of the EES risk assessment (as this is assessed in Section 4.4). The same Study Area determined for the SMS was used as the basis of the Study Area for the risk assessment.

This risk assessment was used to identify the issues for workforce, nearby operations and public safety which are not assessed through the SMS assessment and which were aspects identified in the EES scoping requirements.

The risk assessment methodology included:

- Defining the context for the risk assessment based on the existing assets, values and uses (baseline) assessments of each technical area and the proposed Project activities which interact with those existing conditions
- Identifying the risk pathways for the Project based on a specific cause and effect
- Identifying standard management/mitigation measures (including those in guidelines and standards) and whether additional mitigation measures may be required
- Analysing the consequence and likelihood of the identified risk based on a consequence guide developed for each technical area and a likelihood guide
- Defining the residual risk level based on the risk matrix

The further assessment in this report considered all those risks with a greater focus on those with a higher rating and/or where additional management/mitigation measures may be required.

The consequences of a safety risk occurring were assigned using consequence categories from insignificant to severe developed for hazard and risk technical areas based on the existing conditions and values in the study area. The consequence levels and descriptors are provided in Appendix A.

A likelihood rating for each identified risk was assigned ranging from 'frequent' where the event is expected to occur to 'rare', where the event may occur only in exceptional circumstances. The likelihood levels and descriptors are provided in Appendix A.

The risk matrix used to define each risk level is also provided in Appendix A.

The risk ratings were revisited during the risk assessment where environmental management measures were refined to identify the residual risks.

The results from this method is in Section 8.

4.3.1 Bushfire risk assessment method

A desktop bushfire risk assessment was undertaken for the Project. The bushfire risk assessment was undertaken based on a review of information provided by the Proponent and complemented by information obtained from publicly available information sources. It considered the potential bushfire risk factors associated with a fire being started through the construction and operation phases of the Project.

The Planning Practice Note 64 (PPN 64) produced by the Department of Environment, Land, Water and Planning (DELWP) states:

> 'The bushfire hazard is determined by vegetation, topography and weather….. Bushfire risk should be considered in terms of life, property and community infrastructure….. Central to local planning for bushfire is determining the level of risk and whether the risk has been reduced to an acceptable level.'

Likelihood and consequence, when applied to a bushfire risk assessment for the Project, are described below.

The risk matrix used in the bushfire hazard assessment is shown in Appendix A. Consequence levels and descriptors and likelihood levels and descriptors are also located in Appendix A.

The likelihood and consequence was considered for the risks of a bushfire igniting from a Project related activity and impacting on life and property.

The analysis considered the existing mitigation measures as well as additional measures to mitigate the risk to as low as is reasonably practicable (based on the SFAIRP principle as described in Section 7.3.2).

The risk of a bushfire igniting from a Project related activity and impacting on life and property has been assessed for both the construction and operational stages of the Project in Section 10.

4.4 SMS assessment method

The SMS assessment focuses on risks, which is both considering the consequence of a threat, and the associated likelihood of those consequences eventuating. The focus of the SMS is preventing damage and loss of containment from the pipeline during the operation phase, considering threats from all Project phases.

AS/NZS 2885.6 outlines mandatory requirements for eliminating risk, and where this is not practicable, maintaining risk at an acceptable level and provisions for a pipeline safety management process which consists of the following:

1. Threat identification
2. Application of physical, procedural and design measures to identified threats
3. Review and control of failure threats
4. Assessment of residual risk from failure threats using the risk matrix provided in AS/NZS 2885.6

The pipeline safety management process requires the application of multiple independent controls to protect the pipeline from each identified threat. An overview of the pipeline safety management process to be applied for the Project as provided in AS/NZS 2885.6:2018 is replicated in Figure 3 (Standards Australia, 2018c).

The Project would be designed, constructed, operated and maintained in accordance with the requirements of AS/NZS 2885. The requirements of the standard will be met throughout the Project.

The results from this assessment method is in Section 9.

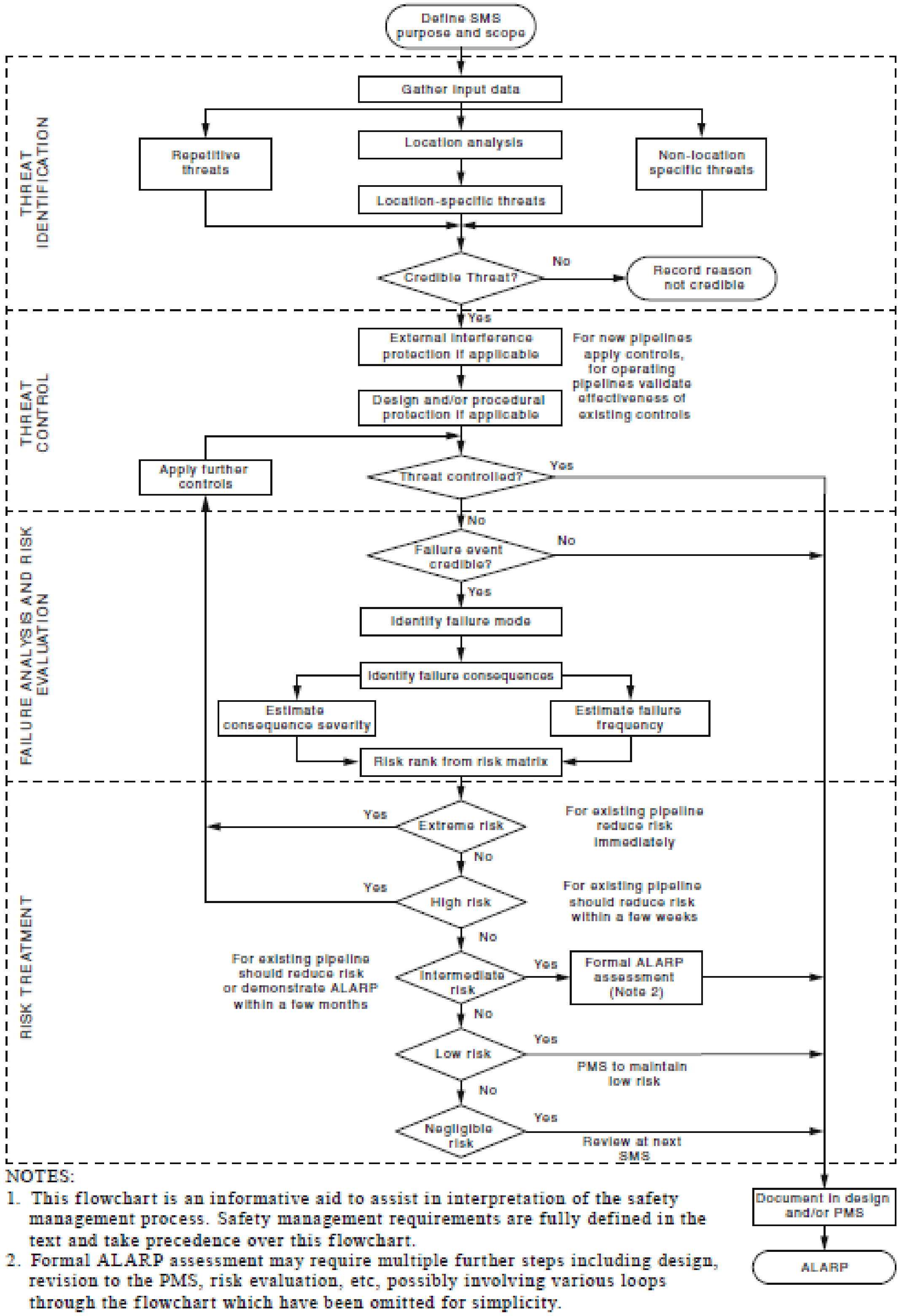


Figure 3 AS/NZS 2885.6 Pipeline Safety Management process

4.5 Stakeholder engagement

Community stakeholder engagement activities by APA have not identified any additional risks that are relevant to informing this assessment. The only relevant feedback from consultation has been the expectation that APA would identify potential safety hazards. Appropriate stakeholder engagement activities for this scope of work was performed specifically during the SMS study and additional consultation was not necessary.

5. Existing conditions

5.1 Location and existing and reasonably foreseeable land uses

This section describes the Project location and existing and reasonably foreseeable land uses.

To assess potential threats to or from the Project, firstly an understanding of the surrounding environment is required. Therefore, the existing and reasonably foreseeable land uses, population densities, and sensitive natural environmental areas in the vicinity are identified below that could potentially be impacted by hazards from the Project.

The location of the WORM falls within the Melbourne Urban Growth Boundary. The Melbourne Urban Growth Boundary is defined by "Melbourne 2030 – Planning for Sustainable Growth" and associated planning zones as defined by Victorian Planning Authority (Department of Infrastructure, 2002).

A summary of the land classification classes for the total length of the alignment has been provided in Table 8 shown in Section 9.1.2.

5.1.1 Location classification within the urban growth boundary

Sections of the pipeline are in the Urban Growth Boundary, this includes the following sections of the WORM:

- Plumpton Regulating Station to Melton Highway
- Sunbury Area (approx. KP 12-15) – note that the proposed route does not actually fall in the Urban Growth Boundary, but is located within the Study Area
- Mickleham Road to Wollert Compressor Station

The primary location classification in the Urban Growth Areas is Residential (T1) (GPA, 2020). There are no locations where a primary location classification of High Density (T2) applies. However, there are a number of locations where a secondary location classification Sensitive Use (S) applies, on the basis of zoning for educational facilities.

A Precinct Structure Plan (located inside an Urban Growth Boundary) designates areas where particular land can be used for sensitive land users (e.g. child care centres or aged care facilities). It does not mean that a developer has to utilise that land. Therefore, the scenario for Sensitive Use (S) location is a "highly probable" scenario. Typically, sensitive user locations are located within residential zoned land but the specific location is only known following planning approval.

Land currently not developed for residential use is subject to a different threat profile than those areas where residential developments are completed or under construction. Threats associated with major civil works for future residential developments do not apply to areas where residential developments have been constructed. Similarly, they do not apply where the WORM is located inside the Outer Metropolitan Ring Public Acquisition Overlay (OMR PAO), (refer to Section 5.1.3), and the Melbourne Water land (refer Section 4.4.4), where residential development is prohibited. For this reason, the T1 residential locations were split into "developed" and "undeveloped" location classifications to account for the different threats that are posed depending on development status.

5.1.2 Location classification outside the Urban Growth Boundary

Approximately 56% of the pipeline route is outside the Urban Growth Boundary, this includes the following sections:

- Melton Highway to Sunbury Area (KP 3.67 to ~KP 12.5)
- Sunbury Area to Mickleham Road (~KP 15.1 to KP 27.6)

The primary location classification outside the Urban Growth Areas is mostly Rural (R1) with some Rural residential (R2) and Residential (T1) (GPA, 2020). This land is primarily used for grazing and cropping.

5.1.3 Other significant features on the pipeline alignment

The following sections below describe additional significant features along the pipeline alignment.

Outer Metropolitan Ring (OMR)

The final design of the OMR is still not yet complete. Therefore, when there is certainty about the features and population densities, another SMS will be conducted to determine if there is any additional location classifications or further measures required to reduce risk as low as reasonably practicable.

The Department of Transport website advises that land acquisition and construction activities for the OMR are not expected to start before 2030 (VicRoads, 2018). However, the application of the PAO to the OMR corridor precludes other major development activities (e.g. residential developments) in that corridor except as may be required to service the development (e.g. roads, sewers, communications, electricity, gas distribution). These will tend to be located at pre-existing locations (e.g. existing road crossings), and will be subject to Department of Transport approval.

Existing APA Easements

The WORM utilises the following existing APA easements:

1) Licence No. 122 - T062 Derrimut to Sunbury T62 (Plumpton Regulating Station to Calder Freeway), 20 m wide easement

2) Licence No. 101 - T74 Victorian Northern Interconnect (VNI) to Wollert Compressor Station 35 m wide easement.

The main significance of this is that the WORM is co-located with existing APA pipelines in established easements which are well-known to the relevant landowners / occupiers, local councils and shires and other relevant authorities.

Approximately 34% of the total length of the WORM will be co-located with existing APA pipelines.

HV Power

The WORM crosses the AusNet high voltage (HV) Power easement between ~KP 13. The WORM again crosses the AusNet HV Power easement near the intersection of Mickleham Road and Bardwell Drive (~KP 28). The route has been selected to minimise sections that are parallel to HV power lines.

Melbourne Water Kalkallo Retarding Basin

The pipeline route is located in Melbourne Water land from approximate KP 33 - 35. This land is within the Urban Growth Boundary, so the designated primary location classification is Residential T1. The land use is currently restricted to grazing and cropping. It will not be subject to residential development. Melbourne Water is planning to upgrade a number of drainage channels that traverse the pipeline route.

The sections of the pipeline in the Melbourne Water Kalkallo Retarding Basin have minimum mitigation measure requirements depending on the type of location classification nominated, this criteria is further explained in Section 9.4.

Wollert Compressor Station

The Wollert Compressor Station (approx. 26 kilometres north east of Melbourne's CBD) will be upgraded as part of the Project. This area will also be used for construction offices and site laydown area for the compressor station equipment.

The facility would be normally unmanned and remotely operated by AEMO.

There is minimal vegetation located around the facility. APA currently (and will continue) key easement maintenance activities such as vegetation management, weed management, erosion and subsidence monitoring.

Environmental (E) Locations

Within the Urban Growth Boundary individual PSPs define Zones such as Conservation Zones and Wetlands.

- The WORM does not traverse any conservation zones in the section from the Plumpton Regulating Station to Melton Highway
- The WORM is located in the OMR Public Acquisition Overlay from ~KP 28 to ~KP 42 (except departs the PAO around KP 34) and therefore does not directly traverse any conservation or wetland areas
- The WORM traverses a conservation zone (growling grass frog) where it is located in the existing APA easement around ~KP 42
- The WORM traverses a conservation area in the BCS that exists between ~KP 48 and ~KP 49

Outside of the Urban Growth Boundary, the planning zones include Rural Conservation Zones. However, the WORM route does not traverse any Rural Conservation Zones.

AS/NZS 2885.6, Appendix G4 notes that the environmental impacts of a gas pipeline failure are usually insignificant, as the release is to the atmosphere rather than directly impinging on nearby flora and fauna.

Notwithstanding the above, the technical studies included in the other technical reports of this EES submission detail other environmentally significant locations along the route which may be impacted by the construction of the pipeline and have been appropriately assessed.

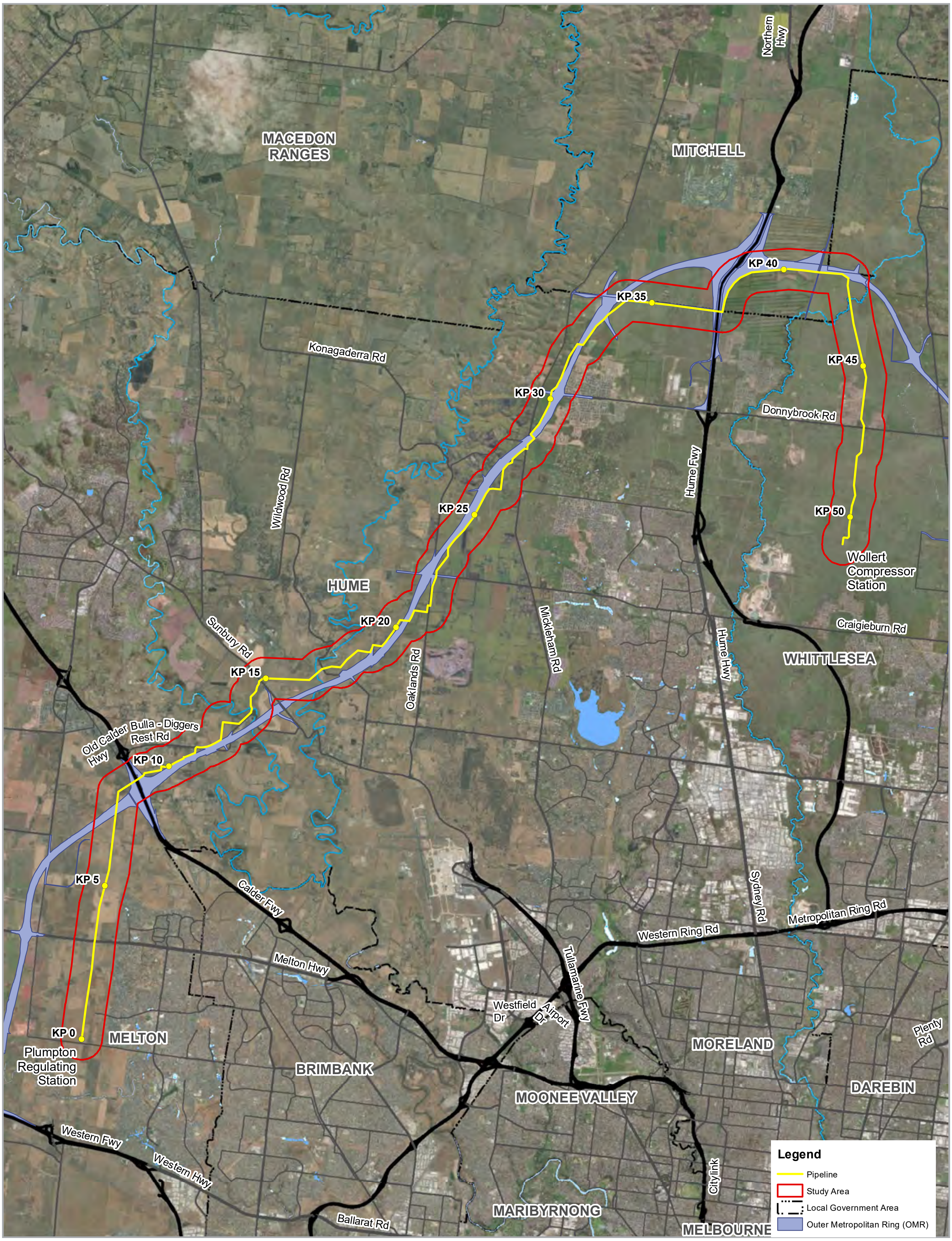
5.2 Geology, topography and landscape

Geographical Information System (GIS) information and APA experience shows that the vast majority of the route traverses areas which comprise near surface hard volcanic rock (basalt), overlayed by soil which generally varies between 0.5 m to 2.0 m deep. The soil layer contains large buried and protruding boulders (floaters). APA has conducted geotechnical investigations to confirm the depth of rock along the route.

The general topography is relatively flat except where the route traverses major creek or river crossings (including, Jacksons Creek, Deep Creek and Merri Creek).

The surrounding landscape contains large areas of near-contiguous woodland or grassland vegetation cover that can potentially support large, fast moving grass or bushfires. At the Project locations for above ground infrastructure (Wollert compressor station, Plumpton regulating station and the three MLVs), all sites are identified in VicPlan as being in bushfire prone area.

ArcGIS mapping provides a conservative classification of slope for bushfire analysis with two sites (MLV1 and MLV3) assessed as being flat and the other three sites assessed as having gentle topography (1-3°). The assessment identified that four of the sites are located within managed grassland and the Wollert Compressor Station site located within open woodland grassland.



Paper Size ISO A4

0 1 2 3 4

Kilometers

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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APA VTS (Operations) Pty Ltd
Western Outer Ring Main Gas Project

Project No. 31-12529997
Revision No. C
Date 02/03/2021

Pipeline Locality Map

Figure 3

Data source: DELWP, VicMap, 2020; Geoscience australia 2012, GHD, 2020,Vicmap basemap imagery Created by: kgardner

6. Legislation, policy and guidelines

6.1 Legislation, policy and guidelines

The EES is prepared under the EE Act and will inform assessment of approvals required for the Project. The legislation relevant to the principal approvals required for the Project is:

- Commonwealth approval under the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act). For the component of the Project that is located outside of the Melbourne Strategic Assessment (MSA) program area, the Project requires assessment and approval under the EPBC Act, under the assessment bilateral agreement with Victoria made under section 45 of the EPBC Act.

  The MSA program is the Victorian Government's approach to managing the impact of urban development in Melbourne's growth areas on significant vegetation communities, plants and animals. Areas within the approved MSA area occur between approximately KP 0 to KP 3.2, KP 28.16 to KP 28.57, and KP 32.07 to KP 51.04. Areas outside of the MSA occur approximately between KP 3.2 to KP 28.1, and KP 28.57 to KP 32.07.

- Pipeline Licence approval is required under the *Pipelines Act 2005* (Vic) (Pipelines Act) for the Western Outer Ring Main Project. The Pipeline Licence application is exhibited with the EES.

  Section 49 of the Pipelines Act requires that the following matters be considered before granting a licence:

  (a) the potential environmental, social, economic and safety impacts of the proposed pipeline;

  (f) the assessment of the Environment Effects Minister in relation to the proposed pipeline, if an assessment has been made;

  (g) any written comments received from the Planning Minister or the relevant responsible authority on the effect of the proposed pipeline on the planning of the area through which it is to pass;

  (h) any written comments received from the Water Minister and from the relevant Crown Land Minister on the impact of the proposed pipeline.

  Section 3 of the Pipelines Act state the objectives of the Act, including:

  (a) to facilitate the development of pipelines for the benefit of Victoria;

  (e) to protect the public from environmental, health and safety risks resulting from the construction and operation of pipelines;

  (f) to ensure that pipelines are constructed and operated in a way that minimises adverse environmental impacts and has regard for the need for sustainable development

  Section 4 of the Pipelines Act sets out the principles of sustainable development to be given regard in implementing the Act including that decision-making should be guided by a careful evaluation to avoid serious or irreversible damage to the environment wherever practicable and an assessment of the risk-weighted consequences of various options.

  Section 54(c) of the Pipelines Act states that conditions on a licence may include conditions concerning the protection of the environment.

- Cultural Heritage Management Plan (CHMP) under the *Aboriginal Heritage Act 2006 (Vic)* (AH Act). Two CHMPs are currently in progress for the Project (CHMP 16593 and CHMP 16594).

A number of legislative, policy, guidance and standard documents were found to be relevant to this Safety risk assessment and are discussed further in this report. The key legislation, policy and guidelines that apply to the Safety risk assessment for the Project are summarised in Table 6. Further detail is provided in the following sections.

Table 6 Key legislation and policy applicable

Legislation/policy	Relevance to this risk assessment
Occupational Health and Safety Act 2004 (Victoria)	This Act is the main workplace health and safety law in Victoria. It aims to protect the health, safety and welfare of employees and others. This includes ensuring that the health and safety of the public is not at risk due to workplace activities. Further detail in Section 6.2
Occupational Health and Safety Regulations 2017 (Victoria)	The objectives of these regulations are to promote occupational health and safety and to protect workers and other persons present at workplaces from work-related risks to their health, safety and well-being. The regulations support the objectives of the Occupational Health and Safety Act 2004. Further detail in Section 6.2
Pipelines Act 2005 (Victoria)	The Pipelines Act regulates the construction, operation and maintenance of pipelines. It outlines the requirements for obtaining a pipeline licence and the conditions of said licence. Further detail in Section 6.3
Pipeline Regulations 2017	The Pipeline Regulations 2017 are designed to streamline administrative process, reduce red tape and improve risk management, safety and reporting. Further detail in Section 6.3
Gas Safety Act 1997	The Gas Safety Act 1997 provides for the safe conveyance, sale, supply, measurement, control and use of gas in Victoria. The Act establishes an outcomes-based safety regime to ensure that gas companies operate assets and conduct activities to minimise risks and hazards to the community. Further detail in Section 6.4
Gas Safety (Safety Case) Regulations 2018	The Gas Safety (Safety Case) Regulations 2018 prescribes content requirements for safety cases and safety management systems, standards of gas quality and requirements for testing of gas conveyed through pipelines, and requirements for reporting of gas incidents to the regulator. Further detail in Section 6.4

Legislation/policy	Relevance to this risk assessment
AS 3959 Construction of Buildings in Bushfire-Prone Areas 2009	The aim of the construction of buildings in bushfire-prone areas standard is to prescribe particular construction details for buildings to reduce the risk of ignition from a bushfire while the fire front passes. This standard is primarily concerned with improving the ability of buildings in designated bushfire-prone areas to better withstand attack from bushfire thus giving a measure of protection to the building occupants (until the fire front passes) as well as to the building itself. Further detail in Section 6.5
AS/NZS 2885 Pipelines – Gas and Liquid Petroleum	AS/NZS 2885 gas and liquid petroleum is the suite of Australian Standards covering gas and liquid petroleum pipelines. AS/NZS 2885.6 outlines mandatory requirements for maintaining risk at an acceptable level and provisions for a pipeline safety management process. The pipeline safety management process requires the application of multiple independent controls to protect the pipeline from each identified threat. Further detail in Section 6.6
Dangerous Goods Act 1985	The main objects of this Act are to promote the safety of persons and property in relation to the manufacture, storage, transport, transfer, sale and use of dangerous goods and the import of explosives into Victoria; to ensure that adequate precautions are taken against certain fires, explosions, leakages and spillages of dangerous goods to allocate responsibilities to occupiers and owners of premises to ensure that the health and safety of workers and the general public is protected; to provide for licensing of persons required by the regulations to hold a licence in relation to dangerous goods. Further detail in Section 6.7
Dangerous Goods (Storage and Handling) Regulations 2012 (Victoria)	The aim of these regulations is to provide requirements for the safe storage and handling of dangerous goods. In particular, the regulations deal with the general duties of manufacturers and suppliers and the specific duties of occupiers in respect to consultation, information and training, hazard identification and risk control, preparedness for incidents, emergencies and incidents. Further detail in Section 6.7

6.2 Occupational Health and Safety Act and Regulation

The *Occupational Health and Safety Act* (OHS Act) 2004 is the main workplace health and safety law in Victoria. It sets out key principles, duties and rights about OHS. The OHS Act seeks to protect the health, safety and welfare of employees and other people at work. It also aims to eliminate, at the source, risks to the health, safety or welfare of employees and other persons at work; and ensure that the health and safety of the public is not put at risk by work activities.

The *Occupational Health and Safety Regulations* (OHS Regulations) 2017 build on the OHS Act. They set out how to fulfil duties and obligations, and particular processes that support the OHS Act. For example, they include requirements for:

- Safe operation of major hazard facilities and mines
- Training for high risk work
- Managing and removing asbestos
- Licences for specific activities

Chapter 1, Division 1 of Part 4.4, Division 1 of Part 5.2 and Chapter 7 of the OHS Regulations outlines specific requirements for dangerous goods. This includes the requirement to ensure risks to health and safety associated with the manufacture, storage, transport, transfer sale and use of dangerous goods and the import of explosives into Victoria are managed.

There are no specific requirements to be fulfilled during the preliminary Safety assessment for the EES, as outlined in the OHS Regulations, however the Project would be developed in compliance with the requirements of the OHS Act and OHS Regulations.

6.3 Pipelines Act and Regulation (Victoria)

The Pipelines Act regulates the construction, operation and maintenance of pipelines. It outlines the requirements for obtaining a pipeline licence and the conditions of said licence.

The Pipeline Regulations 2017 are designed to streamline administrative process and improve risk management, safety and reporting, and provide for:

- The reporting of safety and environmental incidents
- Standards for construction and operation of pipelines
- Specifications for Safety Management Plans, Environmental Management Plans and Decommissioning Plans
- Licencing procedures, application processes and forms
- Fees to improve cost recovery for government and administration efficiencies

The agencies responsible for providing regulatory approvals and oversight of the pipeline include Energy Safe Victoria (ESV) and the Department of Environment, Land, Water and Planning (DELWP). The Project also needs to receive consent to construct and consent to operate from ESV.

The Project would be designed, constructed, operated and maintained in accordance with the requirements of the Pipelines Act, the Pipeline Regulations 2017 and the conditions of any pipeline licence issued under that Act.

6.4 Gas Safety Act and Regulations

The *Gas Safety Act 1997* provides for the safe conveyance, sale, supply, measurement, control and use of gas in Victoria. The Act establishes an outcomes-based safety regime to ensure that gas companies operate assets and conduct activities to minimise risks and hazards to the community.

A key element of the *Gas Safety Act 1997* is to require gas companies to prepare safety cases – documents that set out how they will ensure they meet their general duties under the Act. The specific requirements to be included in a safety case are detailed in the Gas Safety (Safety Case) Regulations 2018.

The associated regulations include:

- The Gas Safety (Gas Installation) Regulations 2018 aims to reduce the risks associated with the use of gas appliances and gas fitting work, and to ensure that controls on gas appliances and complex gas installations operate efficiently
- The Gas Safety (Safety Case) Regulations 2018 prescribes content requirements for safety cases and safety management systems, standards of gas quality and requirements for testing of gas conveyed through pipelines, and requirements for reporting of gas incidents to ESV

The Project would be developed in compliance with the requirements of the Gas Safety Act and Gas Safety Regulations. The WORM will form part of the existing APA VTS Safety Case.

6.5 AS 3959 Construction of Buildings in Bushfire-Prone Areas 2009

The aim of the construction of buildings in bushfire-prone areas standard is to prescribe particular construction details for buildings to reduce the risk of ignition from a bushfire while the fire front passes. This standard is primarily concerned with improving the ability of buildings in designated bushfire-prone areas to better withstand attack from bushfire thus giving a measure of protection to the building occupants (until the fire front passes) as well as to the building itself and its contents.

The Project would be designed, constructed, operated and maintained in accordance with the requirements of AS 3959. The requirements of the standard will be met throughout the Project.

6.6 AS/NZS 2885 Pipelines – Gas and Liquid Petroleum

AS/NZS 2885 gas and liquid petroleum is the suite of Australian Standards covering gas and liquid petroleum pipelines.

- AS/NZS 2885.0:2018: Pipelines – Gas and liquid petroleum – General requirements (Standards Australia, 2018a), sets out the fundamental principles
- AS/NZS 2885.1:2018: Pipelines - Gas and liquid petroleum - Design and construction (Standards Australia, 2018b), defines the requirements for the design and construction of gas pipelines
- AS/NZS 2885.2:2020 Pipelines - Gas and liquid petroleum - Welding (Standards Australia, 2020), sets out the welding requirements
- AS 2885.3:2012: Operation and Maintenance (Standards Australia, 2012a) defines the requirements for operation and maintenance of the gas pipelines
- AS/NZS 2885.4:2016: Pipelines - Gas and liquid petroleum - Submarine pipeline systems, provides the minimum requirements for submarine pipelines (not applicable to the Project)
- AS/NZS 2885.5:2020: Pipelines - Gas and liquid petroleum - Field pressure testing (Standards Australia, 2020), sets out methods for the determination of the strength and the leak tightness of a pipeline test section
- AS/NZS 2886.6: 2018 Pipelines - Gas and liquid petroleum - Pipeline safety management (Standards Australia, 2018c), sets out the safety management process for pipeline systems and covers all elements of the system design, constructed or operated under the AS/NZS 2885 series of Standards

6.7 Dangerous Goods Act and Regulations 1985

The *Dangerous Goods Act* 1985 (DG Act) and related regulations aim to keep people and property safe from dangerous goods and explosives. The main objects of this Act are to promote the safety of persons and property in relation to the manufacture, storage, transport, transfer, sale and use of dangerous goods and the import of explosives into Victoria; to ensure that adequate precautions are taken against certain fires, explosions, leakages and spillages of dangerous goods to allocate responsibilities to occupiers and owners of premises to ensure that the health and safety of workers and the general public is protected; to provide for licensing of persons required by the regulations to hold a licence in relation to dangerous goods.

The aim of the *Dangerous Goods (Storage and Handling) Regulations* 2012 is to provide requirements for the safe storage and handling of dangerous goods. In particular, the regulations deal with the general duties of manufacturers and suppliers and the specific duties of occupiers in respect to consultation, information and training, hazard identification and risk control, preparedness for incidents, emergencies and incidents.

The DG Act also has a relationship to the EP Act and the *National Environment Protection Council (Victoria) Act 1995* for the transportation of prescribed waste or prescribed industrial waste.

The Project would be developed in compliance with the requirements of the DG Act and regulations.

7. APA risk management philosophy

7.1 APA risk management framework

APA have an established integrated health, safety, environment risk management system that complies with:

- AS/NZS ISO 31000:2018 – Risk management – Principles and guidelines (Standards Australia, 2018)
- AS/NZS ISO 14001:2015 – Environmental management systems (Standards Australia, 2015)
- AS/NZS 4801:2001 – Occupational Health and Safety Management Systems – Specification with guidance for use (Standards Australia, 2001)

The Health and Safety and Environment Management System (HSEMS) provides a clear set of health, safety and environment expectations so there is a consistent and effective approach across APA's activities and operations. The HSEMS addresses the management of risk associated with high frequency low consequence events as well as low frequency high consequence events which are typically process safety related events. The system is a dynamic tool that is continually being updated to ensure it is current and aligned with the APA business.

The structure of the management system is based on guidance provided by WorkSafe Australia and *AS/NZS 4801:2001 Occupational Health and Safety Management Systems*; and includes the following elements:

- Policies
- Leadership, management, accountability and commitment
- Hazard and risk management
- Information and documentation
- Design and construction
- Incident management
- Management of change
- Contractor management
- Emergency preparedness and response
- Purchasing
- Systems of work/operations and maintenance
- Personnel
- Health and fitness for work
- Monitoring, auditing, review and improvement

7.2 APA Health and Safety Management Plan

As part of APA's risk management system, APA implements a Health and Safety Management Plan (HSMP), to ensure the effective and continued management of HSE risks throughout the lifecycle of any project. The HSMP for construction establishes effective health and safety systems to ensure the safety of all those who access the Project site, including direct employees, contractors and visitors who are involved in the construction phase of the Project. Safety management associated with operations and maintenance activities during the operations phase of the Project will be done through the integration of the Project into the APA VTS Safety Management System and VTS Safety Case.

APA are committed to providing a zero harm work environment to all parties. APA will consult, coordinate and cooperate with all relevant parties and stakeholders to ensure that risks to health and safety are managed appropriately and that a structured safety management system is implemented to achieve a consistently high standard of safety performance. In addition, the HSMP and Safety Management System will serve to ensure that the Project personnel and Contractors meet the obligations of its internal occupational health and safety policy and all relevant Work Health Safety legislation.

7.3 Management of risk

APA's HSMP and Safety Management System also covers all aspects of the management of risk, including the requirements for controls, the management of incidents and emergencies, and the reporting and auditing of safety management systems and procedures.

7.3.1 Hierarchy of control

The hierarchy of controls is a commonly used principle applied across the industry in the management of safety hazards. It involves a prioritised order of control types from the most effective strategies to the least effective strategies.

The aim of applying the hierarchy of control is to have a combination of control strategies to manage a specific risk and to use the hierarchy to reduce the risk so far is reasonably practicable.

The hierarchy of control includes:

- Elimination: Remove or avoid the hazard completely
- Substitution: Replacing with a safer alternative
- Isolation: Separating the hazard from the person, environment or process at risk by isolation, guarding, barricading, alternate duties etc.
- Engineering controls: Constructing new devices to reduce the risk
- Administrative controls: Promote awareness of hazards e.g. signage, procedures, training etc.
- Personal Protective Equipment (PPE): Considered only when other controls are not practical or to increase protection

By undertaking a risk assessment during the early stages of the Project, APA has the ability to implement the hierarchy of control to its fullest extent. During the design stages, control strategies higher in the hierarchy can be applied to eliminate, substitute, isolate or engineer the site, infrastructure and equipment to reduce the risks so far is reasonably practicable.

7.3.2 SFAIRP demonstration

AS/NZS 2885.6 requires that risks be reduced As Low As Reasonably Practicable (ALARP). The Gas Safety Act references As Far As Practicable (AFAP) as the test to be applied in a safety case to show risks are meeting the owners' statutory general duties and obligations. The Work Health and Safety Act and Regulations require risks to be managed So Far As Is Reasonably Practicable (SFAIRP) imposed on a person to eliminate risks to health and safety so far as is reasonably practicable, and if not reasonably practicable to do so, to minimise the risks so far as is reasonably practicable.

Due to the varying definitions of risk reduction legislative obligations, this report has adopted the SFAIRP demonstration as this principal recognises that no industry activity is entirely free from risk, and that there remains a level of risk where the cost of additional risk reduction measures is grossly disproportionate to the risk reduction achieved.

Demonstration of SFAIRP includes:

- Systematically identifying and assessing all the hazards and potential major incidents associated with the facilities
- Assessing the effectiveness of the controls in place and determine whether the controls are adequate and justify why any additional controls were not included
- Identifying potential upgrades to existing controls or additional controls that could be implemented
- Implementing risk reduction measures if it is reasonable and practicable to do so
- Ensuring that design processes consider inherent safety and the hierarchy of controls
- Identification of systems that are critical to the safety and development of their performance standards to ensure the effectiveness of controls to minimise the risk of a major incident
- The development and maintenance of safety management systems for the facilities that are linked to those controls and include:
  - Ongoing monitoring of the facility integrity
  - Contractor selection and management processes to manage interfaces with any third parties required to perform work at the facility
  - The development and testing of a comprehensive emergency response plan
  - Operational controls, training and competency of operational staff
- That relevant regulations, codes, standards and industry guidelines have been identified and are being met
- That the Facility Operators' policies, procedures, guidelines and standards are being met and are reflective of current industry good practice
- That a consultation process has been followed and that risks associated with the operation of the facilities have been effectively communicated with stakeholders

SFAIRP has been nominated by APA for this report because it is more stringent than ALARP and AFAP. Therefore, assisting the process of analysing hazards and risks in the Project to apply the highest level of protection, so far as is reasonably practicable.

7.3.3 Incident management

In the event of an unplanned health or safety incident occurring, APA will implement an incident management procedure which aims to identify the hazards and system deficiencies to prevent an incident reoccurring through an investigation and corrective action process.

APA's incident management process enables:

- On-going identification of hazards and reporting of incidents by any site personnel
- Investigation of all reported incidents
- Follow up and close-out of identified corrective actions
- Communication of incidents across the organisation and statutory reporting if required
- Use of findings from incident investigations to improve systems, processes and procedures

7.3.4 Emergency management

An important element of the management system is emergency response. This incorporates the emergency response systems, procedures and resources.

The Project will form part of the existing VTS Emergency Response Plan during operation. The Project will develop an Emergency Response Plan during construction works. The APA Health and Safety Management Plan details the requirements for the Principal Contractor to develop an Emergency Response Plan based on a risk assessment that systematically identifies all foreseeable site emergencies and assessment of the HSE impacts. The Emergency planning is to include:

- Nomination of an emergency response controller(s), first aiders and emergency personnel
- Emergency procedures such as Health and Safety, Environmental, traffic and contact with services
- Emergency evacuation
- Assembly points
- Contact telephone numbers
- Dissemination of information
- Location of emergency equipment

Where Works take place on or near existing APA assets, APA will produce an Emergency Response Bridging Plan in consultation with the Principal Contractor prior to those Works. The Emergency Response Bridging Plan will bridge any gaps between construction emergencies and APA Gas Emergencies.

7.3.5 Reporting and audits

An effective management system includes a monitoring, auditing, review and improvement cycle.

The APA monitoring, auditing, review and improvement process includes:

- Routine inspections of assets
- Routine monitoring of control implementation (e.g. workplace observation programs)
- Document control system to enable routine review and update of all standards, procedures, Safe Work Method Statement (SWMS) and work instructions / job safety analysis (JSAs)
- A training management system to identify and track training requirements of all personnel, including refresher training programs
- APA permit to work process to monitor and control specific higher risk activities (applies for construction activities at all existing APA easements and APA sites)
- A change management system to assess the impacts of changes made
- A communication strategy to notify all relevant personnel of changes made

APA are to extend existing audit programs to include the Project to confirm compliance with the health and safety legislative requirements and company / operations specific processes and procedures. This will also include independent external authorities conducting audits as necessary.

7.4 Risk studies

Safety in design aims to prevent HSE incidents through methodical analysis of hazards throughout the engineering design phase. A project with a safe design is a key opportunity for the elimination of hazards in subsequent phases.

Specific safety studies will be completed by APA throughout the Project phases to further identify and mitigate hazards and reduce risks to SFAIRP. These include, but are not limited to studies such as:

- Detailed Design Safety Management Study for the pipeline (SMS) as per project SMS plan in accordance with AS/NZS 2885.6
- Hazard and Operability Study (HAZOP) for the pipeline and facilities
- Functional Safety Integrity Level (SIL) Assignment for the facilities
- Health and Safety Management Plan
- Layout review
- Construction review
- Commissioning review

These studies will be conducted in accordance with the relevant codes and standards.

8. Risk assessment for aspects not addressed in the Safety Management Study

A risk assessment of the Project construction and operation was performed in accordance with the methodology described in Section 4. This assessment informs the focus of this safety study for those aspects not addressed through the SMS.

The initial risk ratings considered an initial set of mitigation measures (where relevant), which are based on compliance with legislation and standard requirements that are typically incorporated into the delivery of infrastructure projects of similar type, scale and complexity. Risk ratings were applied to each of the identified risk pathways assuming that these mitigation measures were in place.

The assessment of the potential risks associated with construction and operation of the Project is presented in the following sections of this report.

8.1 Risk assessment summary

The risk register showing the risk pathways and findings of the safety risk assessment is attached in Appendix A.

Five construction risks were identified and assessed and one risk which applied in both phases. A summary of the risk assessment results is presented in Table 7.

Table 7 Risk results

Risk ID	Risk description	Construction/ operation	Pipeline / MLV / compressor	Initial risk rating	Residual risk rating
SA1	Fire starts from Project related activities and spreads offsite in an uncontrolled manner from ignition of vegetation, leading to injury or death of workers or public. Sources of ignition include hot work, vehicles moving through long grass etc.	Construction	Pipeline / MLV / Compressor	Low	Low
SA2	Bushfire starting offsite and burning into the Study area where above ground assets or workers may be, leading to asset damage (coating) or smoke inhalation to workers.	Construction / Operation	Pipeline / MLV / Compressor	Medium	Low
SA3	Blasting activities produce flyrock impacting workers or public, leading to potential injury or death	Construction	Pipeline	Low	Low

Risk ID	Risk description	Construction/ operation	Pipeline / MLV / compressor	Initial risk rating	Residual risk rating
SA4	Loss of containment and ignition of flammable liquids e.g. diesel leading to localised impact to environment or potential injury or death of workers or public	Construction	Pipeline	Low	Low
SA5	Open trench construction method used for installation of pipeline collapses creating unstable ground conditions while personnel are nearby	Construction	Pipeline	Low	Low
SA6	Increased vehicle movements during construction leads to a vehicle incident with potential injury or death of workers or public.	Construction	Pipeline / MLV / Compressor	Low	Low

Note that risks during construction and further mitigation measures are detailed in APA's Health and Safety Management Plan for construction and operation. These plans will be submitted to ESV for approval under the Pipelines Act.

8.2 Risk assessment discussion

APA will implement the same HSEMS as described in Section 7.1, this includes (but not limited to):

- Emergency Response Plans will be developed and implemented for both the construction and operations phases of the Project
- Qualified person(s) will be appointed as Site Safety Advisor(s) during construction and will have on-site a set of the relevant safety data sheets (SDS) for hazardous and dangerous materials

Each risk assessed in Section 8.1 is explained in further below, including reasoning for the risk ranking and risk mitigation measures.

8.2.1 SA1 – Fire from the Project spreading offsite

During construction and commissioning, the potential causes of fires originating from the Project include hot work (welding, cutting grinding, mulching), vehicles / machinery driving through potentially long grass, accidental ignitions (such as from cigarettes) or ignition of gas from a loss of containment event (during commissioning only when gas has been introduced). These have been discussed in detail in Section 10.2.7.

The likelihood of bushfires being ignited from Project activities during construction and commissioning has been initially assessed as 'rare'. This is because. proposed prevention measures would be implemented that reduce the likelihood of fires being ignited from Project activities and the consequence of these. Such measures would be detailed in the Health and Safety Management Plan (EMM SA3) and bushfire management (EMM SA5) as further explained in section 10.3.

A bushfire originating within the construction corridor spreading at a fast speed, cutting off access and egress to parts of the site, and impacting the work site is a credible threat. Unless mitigated, it may result in an uncontrollable bushfire spreading from the site which may have the potential to result in serious injury and / or loss of life. In the same scenario, there is also potential for the fire to spread to locations of residential sensitive receptors with the same consequences. Of the hazards identified, the worst case people consequence rating is 'major'.

Property damage may result from a fire originating from the Project. For example, a fire burning into adjoining private property areas may impact assets or primary production values. Of the property damage hazards identified, the worst case consequence rating is 'major'.

Biophysical impacts may also occur to the extent of significant disturbance of terrestrial ecosystems, forestry or agricultural land, depending on the location. Of the hazards identified, the worst case biophysical environment consequence rating is 'major'.

With prevention measures implemented, the residual risk of a bushfire igniting from a Project-related activity and impacting on people, property or the biophysical environment during construction and commissioning of the Project is considered to be 'low'.

8.2.2 SA2 – Bushfire starting offsite and burning into Project area

As the Project traverses through vegetated areas, there is potential for fires to originate outside of the Project area and spread into the Project area, impacting Project infrastructure or personnel. This could occur during construction and commissioning or during operations and maintenance phases.

During construction and commissioning, bushfires originating outside the Project may impact Project personnel to the same extent as described in the event of bushfires originating from the Project. This may include fires cutting off access and egress to parts of the site. This has the potential to lead to serious injury and/or loss of life. This has been assessed as a consequence rating of 'major'.

Fires occur in the area of the Project relatively frequently, as discussed in Section 10.2.1. Therefore, this risk has been given an initial risk rating of 'medium'. However, with the proposed Bushfire Management Plan (EMM SA5) plus the bushfire suppression, early warning and evacuation measures implemented by fire and emergency services during response have led to the likelihood assessment of safety impacts being reduced from initial level of 'remote' to residual level of 'rare'.

During operations, there is a potential for a bushfire originating outside the Project area to cause damage to Project infrastructure. There is negligible risk to personnel during operations due to the limited operation staffing and ability to avoid this risk. Damage to the pipeline itself is not a credible threat due to the minimum adopted depth of cover (750 mm). Damage to surface facilities (MLVs, compressor station) is however possible. The design of these facilities would consider the risk of bushfire including incorporating suitable fire breaks (EMM SA5). The Asset Protection Zones (APZs) detailed in Table 10 alongside the design measures are expected to provide sufficient separation of the surface facilities from the vegetation and reduce likelihood to 'rare'.

It is also noted that Gunns Gully Road is listed as a primary fire break in the *Municipal Fire Management Plan – Hume City Council* (v1, 2017). This will support the proposed APZ and further reduce the likelihood of bushfire risk to the Project at this site. Suitable fire breaks will be established at the other surface infrastructure sites.

The residual risk ranking is low.

8.2.3 SA3 – Blasting activities produce flyrock

Blasting operations are planned for particular areas of the Project where rock will be encountered and there is separation distance (typically 100 m or more) set for both workers and to the nearest receptors. This is to mitigate both overpressure and vibration down to reduced levels. This is also sufficient for safety distances to avoid flyrock hitting a worker or member of public.

Areas will be evacuated and cleared before blasting activities take place. Therefore, there should be no one within a potential impact zone. However due to human factors, the most reasonable consequence is a fatality which is a consequence of 'major'.

The likelihood of both human factor errors taking place (e.g. incorrect design, overcharging, not sufficiently clearing the site) is 'rare'.

This results in a residual risk ranking of low.

8.2.4 SA4 – Loss of containment and ignition of flammable liquids

A release involving diesel (used in mobile equipment) may occur during construction due to mechanical damage, corrosion or equipment failure.

Dangerous goods, as defined by the Australian Dangerous Goods Code, and flammable and combustible liquids will be stored and handled in accordance with all relevant Australian Standards.

To minimise the likelihood of a release of diesel during construction, controls have been nominated during the risk assessment which were either required by the standards and from APA management systems. These include:

- Hazardous material storage as per AS 1940 requirements
- Isolation valves
- Foam for firefighting purposes
- Routine visual monitoring and recording of chemicals and fuel storage facilities will occur
- Refuelling of vehicles within temporary construction camps will be undertaken with suitable containment
- Refuelling of vehicles and machinery on the construction corridor, other than hand held machinery, will utilise auto shut off valves. Refuelling of vehicles and machinery will not occur within 50 m of a watercourse.

Based on these mitigation measures (EMM SA3) the most credible consequence would be someone experiencing a burn which was selected as a 'minor' consequence. The associated likelihood of this consequence was considered as 'unlikely' as this event could occur if certain circumstances prevail.

This results in a residual risk ranking of low.

8.2.5 SA5 – Open trench construction leading to collapse

Open trench construction activities are eliminated where possible. For example, trenchless Horizontal Directional Drilling (HDD) has been selected in areas were deemed appropriate.

When open trench construction activities are required for laying the pipeline or relocating services during construction, there is a sequence of steps followed by the construction contractor to minimise the potential consequence of a trench collapse.

The machine size and boom length / capacity are selected depending on depth of excavation and the rock expected. This is all detailed within APA's Excavation Procedure.

Stability measures are put in place to compact the trench to avoid collapse an inundation. Impermeable barriers are placed in the trench during pipe laying to prevent erosion along the pipeline in the backfilled trench. They are generally installed adjacent to watercourses and in sloping terrain and are designed to allow water to seep up and out of the backfilled trench, where it is diverted away from the pipeline construction area by erosion control berms.

A credible consequence would be someone sustaining serious injuries requiring hospitalisation due to land subsidence. Workers shouldn't be in the trench if it was showing signs of failure and therefore a fatality consequence (due to engulfment) was not seen as credible. This equates to a consequence of 'moderate'.

A likelihood of 'remote' was selected as the event could occur but is not anticipated and may occur if certain abnormal circumstances prevail.

This results in a residual risk ranking of low.

8.2.6 SA6 – Vehicle movement and interactions

Vehicles are required during construction to deliver materials. Moving vehicles and an increase in traffic movements presents a risk to the workforce and the public.

A Traffic Management Plan (TMP) would be developed by the construction contractor to manage vehicles and equipment movements on public roads and at the site access points (EMM S3). The TMP would also manage risk to the public where there are modified road access/conditions/crossings. Management measures may include signage, speed restrictions and traffic control depending on the location, the activity and the identified site-specific hazard.

The workforce would travel to site from pre-existing accommodation and other nearby towns. They may travel independently, share vehicles or be transported via bus where possible.

A credible consequence is two vehicles interacting or a vehicle and pedestrian interacting and causing one to two fatalities. This equates to a consequence of 'major'.

With the TMPs in place the likelihood of experiencing a fatality event is only conceivable only in exceptional circumstances, and thus a likelihood of 'rare' was selected.

This results in a residual risk ranking of low.

8.3 Cumulative safety risk

Cumulative safety risks from the project and other existing and proposed developments in the region may be present during construction and operation. This risk assessment has incorporated the potential for interaction with existing and proposed developments, whereby the causes of a particular risk may be due to such developments and / or the extent of the consequences are influenced by those developments. As an example, bushfire risk considers both external fires encroaching on the project, and the project initiating a fire, as discussed in more detail in Section 10. Increased vehicles movements would also be impacted by concurrent proposed developments, such as the Melbourne Water Yan Yean to Bald Hill pipeline project and the Major Road Projects Victoria's (MRPV) Sunbury Road upgrade project. Should the construction of these projects coincide with the construction of the WORM, increased vehicle movements will be observed, thus influencing the risk of vehicle incidents. The SMS (refer to Section 9) also considers the risk of existing and future developments through the identification of threats to the pipeline as a result of those developments.

These cumulative risks have been addressed through the above risk assessment and appropriate prevention and mitigation measures have been identified based on the known cumulative risks at this time. Further consultation and co-ordination with other project developers will be completed as required if projects are identified to occur concurrently and any additional preventative and mitigation measures will be identified and implemented at the time.

9. Safety Management Study (SMS) assessment and results

The SMS is the primary risk study completed for the pipeline and associated facilities where threats and control strategies to mitigate those threats to the pipeline are identified, and the consequence and likelihood associated with the identified threats are assessed. The SMS is a requirement under the Pipelines Act and informs the risk assessment, rather than a requirement of the EES process specifically.

The scope of the SMS includes all infrastructure within the Project as described in Section 3, inclusive of buried and above ground facilities, including those at the Wollert Compressor Station.

9.1 SMS outputs

9.1.1 Measurement length determination

The measurement length is the radial distance of a 4.7 kW/m^2 heat contour for an ignited full bore rupture calculated in accordance with the method outlined in Appendix B of AS/NZS 2885.6.

Measurement length is used in the determination of location class (existing and reasonably foreseeable land uses) and the respective protective requirements irrespective of whether a pipeline rupture is a credible failure mode. The 4.7 kW/m^2 heat flux level represents the heat exposure where second degree burns, and injury may occur after 30 seconds.

The measurement length for a full bore rupture of the proposed DN 600 gas pipeline operating at a pressure of 10,200 kPag, for the purposes of determining the land use adjacent to the pipeline, has been calculated at 659 m.

9.1.2 Location analysis

As part of the SMS (GPA, 2020), the pipeline alignment was sectioned according to the location classification based on the kilometre-point. This measurement is a survey distance along the main pipeline, where zero kilometres represents Plumpton Regulating Station.

For each section of the pipeline a primary location class is selected based on population density and existing and reasonably foreseeable land uses land use within the measurement length. Where appropriate, one or more secondary location classes reflecting special land use were allocated to locations along the proposed alignment. The location classifications were based on the requirements of AS/NZS 2885.6.

A summary of the classifications based on the total distance of the pipeline is shown in Table 8 (GPA, 2020).

Table 8 Summary of Location Classifications

Location Class	Approx. total km's	% of total pipeline
R1	14.4	28.3
R2	4.09	8.0
T1	21.3	41.7
T1, C	0.0579	0.1
T1, S	9.31	18.2
T1, S, C	1.87	3.7

As indicated in Table 8, 64% of the total pipeline length is a residential location classification and the remaining 36% is rural location classification. Based on these classification, specific risk mitigation measures are required to be incorporated into the design, as described in Section 9.4.

9.1.3 Pipeline heat radiation and energy release

The hazards associated with a release of gas and ignition arise from the thermal radiation for jet or flash fires and the overpressure effects from a potential explosion of a gas cloud, as follows:

- Jet fires, resulting from the ignition of a continuous high pressure release gas producing a long, stable, high temperature flame. In case of a low-pressure, low-velocity or intermittent release, the resulting fire may be much shorter and less stable than in the case of a jet fire and generally would not result in equipment damage or injury.
- Flash fires, occurring when a cloud of gas is ignited, resulting in a flame travelling through the cloud.
- Vapour cloud explosion, occurring when a large cloud of gas is ignited. Vapour cloud explosions associated with lighter-than-air gases (such as natural gas) generally require confinement (such as in a building or enclosure) for the cloud to accumulate. Because of the requirement for gas to be confined, vapour cloud explosions are not considered credible for a pipeline release.

AS/NZS 2885.6 requires determination be made of the distances of thermal radiation from an ignited release of gas with heat flux values of 4.7 kW/m^2 and 12.6 kW/m^2. AS/NZS 2885.6 Appendix B1 defined the two heat flux levels as:

- A thermal radiation level of 4.7 kW/m^2 will cause injury, at least second degree burns, after 30 seconds of exposure
- A thermal radiation level of 12.6 kW/m^2 represents the threshold of fatality, for normally clothed people, resulting in third degree burns after 30 seconds of exposure

The distance from the pipeline at which these thresholds will be reached are dependent on hole size, release pressure and properties of the gas.

AS/NZS 2885.1 Clause 4.9.3 and AS/NZS 2885.6 Clause 2.4 combine to provide limits on the energy release rates relative to the respective location classification. With respect to the pipeline the following apply:

- Residential (T1) / Industrial (I) - Where there are residential areas (i.e. community living) within the measurement length, the energy release rate shall not be greater than 10 GJ/s. The same requirements have been applied to Industrial locations (I).
- Sensitive location (S) - Where there is a sensitive development (i.e. schools, hospital, aged care facility, prison) within the measurement length, the energy release rate shall not be greater than 1 GJ/s

The calculated radiation contours for the relevant energy release rates for the proposed DN 600 gas pipeline operating at 10,200 kPag are:

- 10 GJ/s energy release consistent with a 123 mm hole producing a 12.6 kW/m^2 radiation contour of 126 m and a 4.7 kW/m^2 radiation contour of 206 m
- 1 GJ/s is from a 39 mm hole producing a 12.6 kW/m^2 radiation contour of 40 m and a 4.7 kW/m^2 radiation contour of 65 m

9.1.4 Resistance to penetration

The resistance to penetration (RTP) calculations have been performed by APA for excavators fitted with various teeth.

Based on the typical tooth dimensions presented in AS/NZS 2885.1 Table E5, for a 12.7 mm Wall Thickness (WT) pipe:

- Under normal operating conditions, the pipe cannot be penetrated by any tooth fitted to a 55 tonne excavator
- Under aggressive operating conditions, the pipe can be penetrated by a “penetration tooth” or the single point of a tiger tooth fitted to a 35 tonne excavator. In either case, the failure mode is a leak. For excavators larger than the 35 tonne (up to and including the 55 tonne) the failure mode is still a leak.

Note that the calculations are independent of whether excavator size and tooth combination is actually a credible threat to the pipeline.

The hole size (equivalent diameter) which results in a 1 GJ/s release is 39 mm. Based on Table E5 of AS/NZS 2885.1, should penetration occur, a hole size may be caused by a penetration tooth fitted to a 35 tonne excavator, while a tiger tooth cannot produce a hole size for any excavator listed.

Excavators ranging in size from 13 t to 50 t may be used in the new residential developments along the WORM pipeline. These may be fitted with tiger teeth, general purpose teeth or "flat penetration teeth”.

At the time of the SMS Workshop, investigations to determine how the dimensions of the "penetration teeth" actually used on site compare to those that are recorded in AS/NZS 2885.1 Table E5 had not been completed. Site investigations were completed in late December 2019 and in January 2020. This involved observing and recording the typical equipment used for major residential development construction. The types of teeth used and the dimensions of the teeth were also recorded. APA observed that the teeth predominantly used for excavation were either general purpose teeth or "flat penetration teeth". The measured dimensions of the flat penetration teeth were similar to those of the general purpose teeth, and significantly larger than the dimensions of the penetration tooth dimension recorded in AS/NZS 2885.1 Table E5. When these actual dimensions are applied to the formulas in AS/NZS 2885.1 Appendix E, it is concluded that such equipment cannot penetrate the 12.7 mm WT pipe.

APA also confirmed with the Civil Contractor Project Manager that twin point tiger teeth could also be used, but none of these were being used on site at the time of the visit. As discussed in above, the single point of a tiger tooth fitted to a 30 tonne excavator can penetrate the 12.7 mm WT pipe under aggressive operating conditions.

Excavators are used to break rocky soil and establish general levels on site for construction of roads and services (either on a stand-alone basis or to clear rock spoil that has been broken up by a rock hammer). They are similarly used for open trench construction operations.

APA is aware of an instance where an 80 t excavator had been used in the general area to construct a deep trench to install a sewer (excavation and rock breaking operations). This was major construction operation which involved benching a wide trench to reach the target depth. Use of similar equipment (e.g. 70 t excavator) for major residential developments was also confirmed by the Civil Contractor Project Manager during APA site visits after the workshop. However, this is an uncommon requirement. Due to factors such as the planning and approvals processes required to be completed prior to mobilising to site (including liaison with APA), and the extensive preparation activities (e.g. route survey, establish land access, clear and grade route) which would be obvious well in advance of mobilising equipment of this size to site, it was deemed not be a credible threat to the pipeline for the purposes of the design.

9.2 Historical review of operational threats

Some of the potential safety incidents associated with the Project are loss of containment events. A desktop literature review of gas pipeline incidents in Australia was completed to ensure all relevant threats have been identified in Table 7 and the SMS. This review is summarised below.

Since the 1970s the Australian pipeline industry has been capturing data on incidents in which pipelines have been damaged or threatened (Tuft & Bonar, 2009).

Although there have been some damage and loss of containment incidents within the industry there has never been a fatality or injury recorded in connection with damage to a gas pipeline in Australia (Tuft & Bonar, 2009). In general, the Australian gas pipeline industry maintains an excellent safety record as a result of the high standards adopted in the design and management of the facilities.

An analysis of gas pipeline incidents as reported in the Australia Pipeline incident database (database is not available for public access) shows a breakdown of all recorded incidents (Tuft, 2013). The analysis indicates 17 loss of containment events from 2001 to 2018 (Symonds, 2018), noting that the data is routinely updated, however the latest published information is to 2018.

Of the 17 loss of containment events over the seventeen-year period, 12% were a result of natural events, 51% from third party interference, 7% material / construction defects, 28% from corrosion, and the remaining 2% for other events.

The Australia Pipeline incident database classifies damage into six levels of severity. The analysis by Tuft and Bonar (2009) indicates the following distribution of damage severity for all Australian incidents since 2001:

- Coating damage 31% (no loss of containment)
- Gouge 19% (no loss of containment)
- Leak 12%
- Deformation 10% (no loss of containment)
- Stress corrosion cracking / corrosion 26% (no loss of containment)
- Rupture 2%

The majority of the reported leaks were not ignited and therefore did not result in an injury or fatality.

AS/NZS 2885 is the primary standard that will be used as a basis for the design, construction, operation and maintenance of the Project. The standard outlines mandatory requirements for maintaining risk at an acceptable level and outlines the requirements for a pipeline safety management process, which requires multiple independent controls to protect the pipeline from each identified threat, including those that have caused pipeline incidents within the industry.

Potential threats associated with all incidents identified above were incorporated into the SMS. Based on this desktop review the greatest risk to people is an ignited gas release, through either a hole or a rupture. However, this threat is reviewed in detail in the SMS which shows that the nominated mitigation controls for this Project ensures that this threat is controlled, or the risk is SFAIRP or lower (refer to Section 9.4).

9.3 Threat analysis

The SMS threat analysis incorporated detailed review of the pipeline alignment and identification of threats that were either general / repetitive along the pipeline route or location specific. Threats were broadly identified under the categories of:

- External interference
- Corrosion
- Natural events and geohazards
- Faults in design, material or construction
- Faults in operations, maintenance and management systems
- Intentional damage
- Other miscellaneous threats

A full list of identified threats and associated pipeline and facilities protection measures, hazard prevention, failure analysis and risk evaluation for credible threats is provided in the SMS workshop report (GPA, 2020). The following is a summary of the types of threats identified:

Note the following definitions as outlined in AS/NZS 2885.0:

- A controlled threat is where sufficient protective measures have been applied so that the possibility of a failure event due to the identified threat has been removed for all practical purposes
- A non-credible threat is where the likelihood of an occurrence is so low that it does not exist for any practical purpose at the nominated location. The credibility of a threat is characteristic of the threat itself and is assessed independently of any protective or mitigation measures that may be applied.

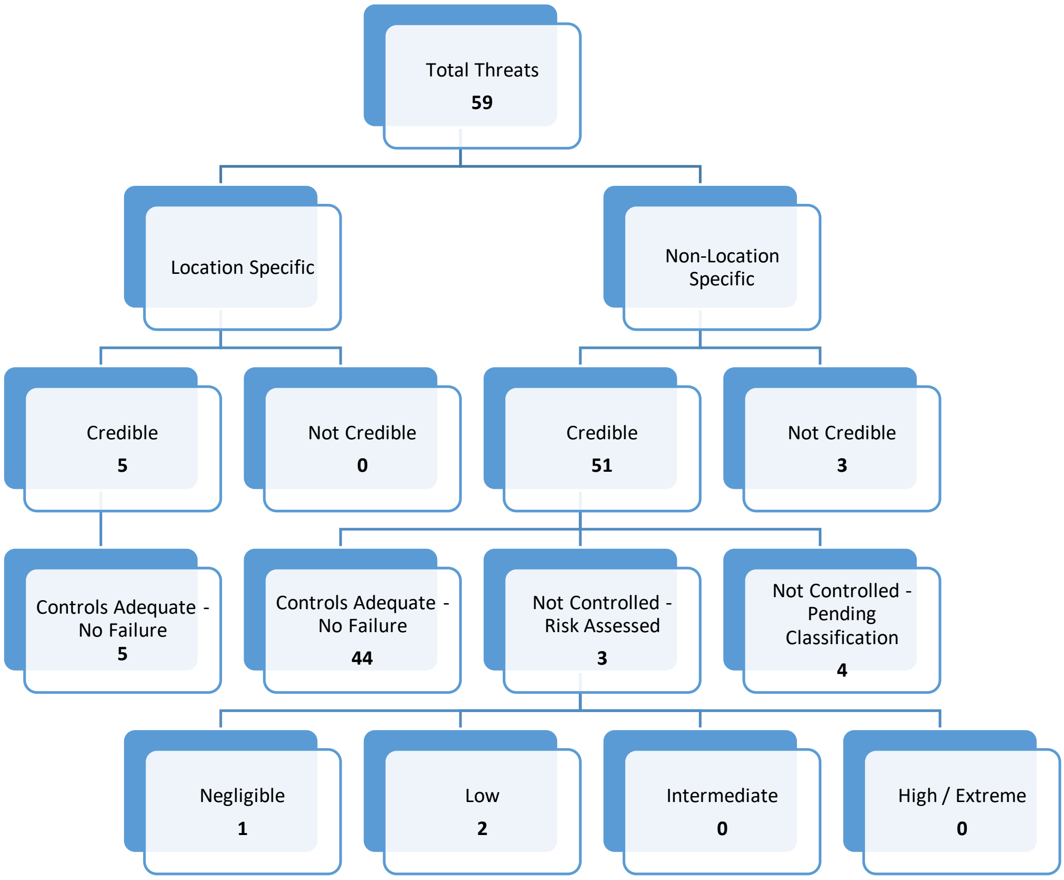

Figure 5 Identified threat summary

Only credible threats were considered for further risk evaluation. Each credible scenario was evaluated further to determine if the controls identified are adequate to prevent a failure. A summary of risk mitigation measures is explained in Section 9.4.

For credible threats that are not controlled adequately to eliminate a failure, a risk rating was provided using the risk matrix of Table 3.3 of AS/NZS 2885.6. Figure 5 summarises the identified threats from the SMS. Note the risk criteria used is not the same as that used for this EES report. The threats assessed use the risk matrix in AS/NZS 2885.6.

The three threats that were assessed for risk include:

- Threat SMS2020-15505 Lightning strikes either a facility or the pipeline – residual risk 'Negligible'. This was deemed not controlled on the basis that although the above ground facilities are protected, there is currently no known mitigation for protection of the buried pipeline against lightning damage. The negligible risk was assigned on the basis of a 'minor' consequence severity rating due to lightning causing a maximum reasonable consequence of a pinhole leak and a 'hypothetical' likelihood rating as it is theoretically possible but has not occurred on a similar pipeline. This takes into account the fact that there are no known similar incidents in Victoria, and for injury to occur, the gas would need to be ignited, a person would need to be present within 5 m of the release and unable to move away.
- Threat SMS2020-15533 Dam construction in rural locations (R1/R2) – residual risk 'Low' to be confirmed by further risk assessment. This was deemed not controlled on the basis that although numerous procedural controls will be implemented, the physical control of wall thickness is only sufficient of excavators and scrapers, but not for dozer rippers. The 'Low' risk rating was assigned on the basis of a 'major' consequence severity rating and 'hypothetical' likelihood rating due to the number of procedural controls. Further assessment is required to determine if the threat has the capacity to penetrate the pipeline and if so, characterise the damage, therefore it was recommended that a further risk assessment is required.
- Threat SMS2020-15534 Installation of new cross-country (R1/R2 location) power line – residual risk 'Low' to be confirmed by further risk assessment. This was deemed not controlled on the basis that although numerous procedural controls will be implemented, the physical controls of protective slabs and wall thickness may not provide protection for all scenarios. The 'Low' risk rating was assigned on the basis of a 'major' consequence severity rating and 'hypothetical' likelihood rating due to the number of procedural controls and the physical controls providing protection in most circumstances. Further assessment is required to determine if the threat has the capacity to penetrate the pipeline and if so, characterise the damage, therefore it was recommended that a further risk assessment is required.

As per the AS/NZS 2885.6 SMS methodology, all risks identified as 'not controlled' have additional mitigation measures identified for implementation such that the risk is reduced SFAIRP.

The workshop raised actions to investigate and confirm the details of a small number of external interference threats that have the potential to cause pipeline failure, resulting in injuries or fatalities. This included determination of whether the threats have the capacity to penetrate the pipeline and if so, characterise the resulting damage and subsequent consequences. The requirement for further risk assessments is dependent on the outcomes of these investigations.

External interference threats which may require risk assessment or further assessment to confirm the assigned risk rating are:

- Threat SMS2020-15533 – Dam construction in rural locations (R1/R2) (a draft risk rating of 'Low' has been assigned, subject to further assessment, refer above for rationale)
- Threat SMS2020-15534 – Installation of new cross-country (R1/R2 location) powerline (a draft risk rating of 'Low' has been assigned, subject to further assessment, refer above for rationale)
- Threat SMS2020-15540 – HDD (Micro HDD) installation of minor utilities
- Threat SMS2020-15498 – HDD (Mini HDD) installation of minor utilities

Upon risk assessment of the above threats, the SMS methodology will require that all risks are reduced SFAIRP and therefore additional mitigation measures will be incorporated as required.

The risk of gas release and/or ignition through rupture is not a credible threat as the pipeline would be designed to meet the requirements in AS/NZS 2885.1 (for example, wall thickness and depth of cover) and engineering controls would be implemented such as the layout and design of the infrastructure would be in compliance with the relevant codes, technical standards, and industry best practice.

9.4 Risk mitigation measures during operation

To minimise the risk of a gas release, a number of mitigation measures (high level controls) will be implemented through the design of the Project infrastructure and its ongoing management.

It is noted that the existing Safety Case for the Victorian Transmission System (VTS) already has established and approved controls by the regulator. The new piping and equipment being installed as part of the Project will be updated in the Safety Case.

Engineering controls such as the layout and design of the infrastructure will be in compliance with the relevant codes, technical standards, and industry best practice.

The Australian Standard AS/NZS 2885 series (Standards Australia, 2012a, 2012b, 2018a, 2018b, 2018c, 2020) sets the minimum standard for high-pressure pipelines in Australia. This code gives detailed requirements for the design, construction and operation of gas and liquid petroleum pipelines, and pipeline safety management.

AS/*NZS* 2885.1:2018 specifies minimum design requirements (e.g. wall thickness and depth of cover) based on its location classification. The classification scheme allows division of the pipeline design requirements according to whether the pipeline is to be installed in rural, semi-rural, suburban or urban areas. AS 2885.3:2012 also mandates the integrity of the pipeline is maintained throughout its operating life.

Potential hazards and risks identified in the Project will continue to be mitigated and reduced to SFAIRP as the design progresses through the Project phases. Specific safety in design studies will be completed by APA throughout the Project to further identify and mitigate hazards.

Application of Hierarchy of Control for SMS

The total pipeline alignment has been classified using the land classification criteria mentioned in Section 4.2. Specific mitigation controls have been put in place based on the specific location classifications. The SMS identified the following as a minimum for external interference protection controls:

- Separation AND resistance to penetration physical controls
- Awareness AND detection procedural controls

For Rural Land (R1 & R2) locations, the following minimum protection controls are required:

- Separation OR resistance to penetration physical controls
- Awareness OR detection procedural controls

For T1 and T2 threats where only one physical control was identified, or for R1 and R2 threats where a physical control could not be identified practical for large segments of pipeline, a failure analysis and risk assessment was performed to understand residual risk.

The key mitigation measures for the Project are summarised below:

Physical controls

- Pipeline wall thickness
- Depth of cover (varies according to location, at least 750 mm, 900 mm based on T1 location classification)
- Automated safety shutdown system
- Bollards will be installed where vehicles are required to enter the compounds, in accordance with APA standard requirements
- Concrete protection slabs installed at table drain inverts
- Separation by distance from the pipeline centreline or pipeline easement

Engineering controls

- Cathodic protection system to protect against corrosion
- Dual Layer of Fusion Bonded Epoxy (FBE) coating
- High build epoxy joint coatings
- Exposed piping will be painted

Procedural controls

A single procedural control cannot be claimed to be absolutely effective. AS/NZS 2885 requires at least two effective procedural controls be applied at all locations, but also states that as many methods as are reasonably practicable should be applied to reduce the risk.

Measurements to prevent uncontrolled activities from being planned on the easement include:

- Landowner liaison – this includes face to face meetings with local government authorities (councils, catchment management authorities); utility owners (electricity, communications, gas, water – including Melbourne Water); Department of Transport; and Emergency Services
- Dial Before You Dig (DBYD) – the pipeline will be available using DBYD service
- Work procedures and permits – this will be in place for all work activities (e.g. safe operating procedures, control of ignition sources during work activities)
- Pipeline awareness programs – APA will conduct this with landholders of the properties along the pipeline route
- Easement agreements – legislative mechanism that intend to alert pipeline operators of proposed activities on pipeline easements

Measures to prevent uncontrolled activities from proceeding on the easement include:

- Patrolling
- Pipeline marker signs will be installed along the length of the pipeline, to indicate the pipeline location in accordance with AS/NZS 2885.1:2018 Section 5.4.6

Marker tape signage will be installed as per the requirements of AS/NZS 2885.1 Section 4.10, with sign spacing guided by Table 4.10.1 (as per location classification). Signage will be intervisible and double sided. Signs will be placed at either side of road crossings, property boundaries, changes of direction, and at major utility crossings where practical.

Inspections and maintenance

A routine inspection and maintenance program will be implemented during pipeline operation. Inspection of the easement for issues such as erosion, weeds, subsidence, revegetation and third party activity will be undertaken on a regular basis by ground and aerial patrols.

Aerial patrols will typically be undertaken monthly with ground patrols conducted annually. Frequency of inspections may vary depending upon the particular issue being inspected, or in response to specific conditions such as major rainfall events. Ground patrols of the easement will be generally undertaken by travelling along accessible sections of the easement in light vehicles.

Ongoing activities to maintain pipeline integrity will include mainline valve and scraper station maintenance, cathodic protection surveys and scheduled internal pipeline inspections.

Monitoring of mainline valves and scraper stations will typically occur monthly where they will be tested to ensure they operate correctly, and the fenced compound maintained.

Cathodic protection surveys will typically be undertaken annually at a minimum, but legislative requirements may require more frequent inspections (6 monthly). Surveys involve travelling the pipeline easement and stopping to measure cathodic protection point output. These surveys will commence once cathodic protection has been installed.

Pigging operations will be managed in accordance with APA procedures.

Regular contact will be maintained with landholders of all properties traversed by the pipeline during the pipeline operation.

9.5 SMS summary

By application of the SMS methodology, threats to the Project that could lead to safety consequences for nearby personnel, assets or the environment have been identified and assessed.

Of the threats identified, the majority were determined to be controlled such that failure of the pipeline is not possible by means of the physical, procedure and inspection and maintenance controls incorporated into the design and operating philosophy of the Project.

Those risks that were deemed not controlled (such that failure may be possible) were assessed qualitatively and / or to be assessed in more detail when the design is further progressed (as is the typical process for SMS and projects of this nature), these include.

- Threat SMS2020-15505 Lightning strikes either a facility or the pipeline – residual risk ‘Negligible’
- Threat SMS2020-15533 Dam construction in rural locations (R1/R2) – residual risk ‘Low’ to be confirmed by further risk assessment

- Threat SMS2020-15534 Installation of new cross-country (R1/R2 location) power line – residual risk 'Low' to be confirmed by further risk assessment
- Threat SMS2020-15540 – HDD (Micro HDD) installation of minor utilities – risk to be assessed
- Threat SMS2020-15498 – HDD (Mini HDD) installation of minor utilities – risk to be assessed

The SMS workshop raised actions to complete investigations confirming the details of a small number of external interference threats that have the potential to cause pipeline failure resulting in injuries or fatalities. The requirement for further risk assessments is dependent on the outcomes of these investigations. Subsequent risk assessment identifying additional preventative and mitigative controls will be continued to reduce these remaining risks SFAIRP.

By completing the SMS, the threats to the Project have been identified along with the associated design and operational controls to manage those threats. Through the identification of additional preventative and mitigative controls to reduce residual risks to SFAIRP, the Project would be compliant with the energy release rate limits within AS/NZS 2885.1 Clause 4.9.3 relative to the respective location classifications (as indicated in Section 9.1.3).

10. Bushfire hazard analysis

This section addresses the risk of a bushfire (which includes grassfires in the context of this analysis) during construction and operations including:

- Fires igniting from a Project related activity that escalates to a bushfire outside of the Project area; or
- Fires igniting outside the Project area and impacting on the Project

These potential ignitions would need to coincide with a period of elevated fire danger (such as a hot dry windy day), dry elevated fuel conditions (such as cured high grass sward and/or fine vegetation fuel with low fuel moisture) and occur despite proposed mitigation measures.

10.1 Bushfire risk

Likelihood, when applied to a bushfire risk assessment refers to the potential that a bushfire might occur from a Project related activity. It assumes that a sequence of steps occurs including ignition, spread/growth and intensification and impact upon at-risk values. The likelihood of a bushfire impact event is the product of the likelihood of each of the steps occurring.

Physical environmental factors that can influence bushfire risk include:

- Vegetation/fuel factors such as:
  - Where fuels are
  - How extensive they are
  - How flammable they are
  - What fire behaviour they can give rise to
  - How contiguous fuels are (which influences how large a fire can get)
  - What fire ignition potential exists
  - The degree to which local climate/weather factors influence fire seasonal patterns and behaviour
  - Vegetation cover in the surrounding landscape
  - Proximity of woody/forested vegetation to an asset or ignition source
- Spotting and ember attack potential of vegetation
- Land management practices on adjoining land
- Topography and access within and surrounding the site
- Potential ignition sources within the site
- Detection of new ignitions
- Initial and sustained attack capacity

Some or all of the factors can vary significantly across the Project area.

Consequence refers to the potential adverse outcomes associated with the scale and impact of a bushfire on life and property.

The level of consequence arising from a bushfire impact event will be driven by:

- The scale of the bushfire hazard (size, intensity and the scale of the impact zone)
- The degree of exposure of at-risk values
- How vulnerable to damage/loss the at-risk values are
- Capability
- Occupational health and safety (staff and public)

The most significant potential consequences would be loss of life or injuries to persons and long term environmental impacts. Indirect or secondary impacts may occur such as adverse social or economic impacts. Such impacts include the loss of community infrastructure, impacts on agricultural and commercial livelihoods, and associated effects on the local economy if operations were required to temporarily close.

Under adverse conditions a fire could spread at high intensity before it could be controlled, and potentially impact local roads (and vehicles using local roads), people in the open undertaking work or recreation pursuits in local forests/bushland, or spread on to private property potentially impacting assets/people living or working in those locations.

Project related activities which, if not mitigated, may have the potential to generate an ignition that would result in a bushfire. Examples could include, hot works, vehicles/machinery driving through long grass and/or accidental ignitions (such as from cigarettes).

These potential ignitions would need to coincide with a period of elevated fire danger (such as a hot dry windy day) and would have to be initiated in contravention of current process, procedures and contract requirements.

10.2 Bushfire context and hazard assessment

10.2.1 Bushfire history

The Project area traverses the local government areas of Melton, Hume, Mitchell and Whittlesea.

Bushfire history for the Project area is summarised in the municipal fire management plans for each municipality.

The *Municipal Fire Management Plan – City of Melton* (v11, 2020) identifies from the fire history that significant fires occur on days of high or extreme fire danger and travel from northwest to southeast under a strong north-westerly influence.

The *Municipal Fire Management Plan – Hume City Council* (v1, 2017) details a history of significant grass fires with 8 significant fires occurring in the years after the Black Saturday fires in 2009 until 2017. The plan characterises the historical fire behaviour of these intense and fast running grass fires as commonly occurring between January and March.

The *Mitchell Shire Municipal Fire Management Plan 2020-2023* (v5, 2020) informs it is located within the East Central Bushfire Risk Landscape (BRL) and has the most risk of all Victoria's BRLs due to the high population density in close proximity to forests. Most of the bushfires in this shire occur between October and April with the largest and most damaging occurring in summer. The plan reports the DELWP responded to an average of 104 bushfires per year in the 20 bushfire seasons to 2013-14.

The *City of Whittlesea Municipal Fire Management Plan 2016-2019* (v11, 2016) identifies a similar fire history to Melton – a history of significant grass fires that occur on days of severe or extreme fire danger and travel from northwest to southeast under a strong north-westerly influence. Whittlesea also has forested areas and steep topography to the north.

10.2.2 Landscape bushfire potential

The Project area and surrounding landscape contain large areas of near-contiguous woodland or grassland vegetation cover that can potentially support large, fast moving grass or bushfires. A fire starting within the Project area has a higher risk of becoming a large landscape level fire, where continuous landscape vegetation cover is located nearby (such as a wet winter/spring following a drought period when a tall contiguous grass cover may develop simultaneous with reduced grazing pressure) coinciding when adverse fire weather (hot north to westerly wind) is present.

The fuel hazard risk in the surrounding landscape is the responsibility of the land managers (such as Department of Environment, Land, Water and Planning, Parks Victoria, local land services and private landholders).

The fuel hazard risk within the Project area will be managed by the implementation and maintenance of firebreaks surrounding the Project infrastructure.

10.2.3 Vegetation and topography at above-ground locations

It is not necessary to assess the vegetation and topography through most of the Project area as the gas pipeline will be located underground to a minimum depth of 750 mm. At this depth underground, an intense bushfire will have no impact on the underground pipeline. However, it is necessary to classify the vegetation and slope at the Project locations above-ground as required by *AS 3959:2018 Construction of buildings in bushfire prone areas* (Standards Australia, 2018d). These locations are the Wollert compressor station, Plumpton regulating station and the three MLVs.

The vegetation and topography were assessed in a desktop review utilising the GHD ArcGIS mapping platform and the VicPlan mapping tool (VicPlan, 2020). All five of the sites were identified in VicPlan as being in bushfire prone area. While ArcGIS is a valuable tool, it is recognised that ground truthing might reveal some variances not shown on a map. However, the mapping provides sufficient detail to be confident that the assessment of the topography was accurate for the purposes of this classification. The assessment has taken a conservative approach and the two sites that were assessed as being flat had a slope attributed to them of >0˚-5˚.

The assessment is detailed in Table 9. The conclusion from the desktop assessment is that four of the sites are located within grassland on land with gentle topography. The fifth site (KP 51) has been assessed as located within open woodland on land with gentle topography.

It is noted that there were a row of trees along the roadside at both KP 0 and KP 22. In both cases, the rows were less than 20 m wide and were excluded from the vegetation assessment on the basis of Clause 2.2.3.2 (d) in AS 3959 which considers such narrow strips of vegetation to be 'low threat vegetation'. The grassland at all four sites (i.e. all sites except KP 51) appears to be managed grassland and therefore, could potentially be classified as low threat vegetation in accordance with Clause 2.2.3.2 (f) in AS 3959, if confirmed by site assessment to be managed in a low threat condition. Nevertheless, this assessment has adopted a conservative approach and classified the sites as grassland.

Table 9 Project locations on bush fire prone land

ID	KP	Access	Bush fire prone land / Category[1]	Slope attributed (assessment)
Plumpton Regulator	KP 0	Taylors Rd, Plumpton	Bush Fire Prone / Vegetation "G"- Grassland (managed)	>0^0-5^0 (1^0-3^0 assessed)
MLV 1	KP 6	Holden Road, Diggers Rest	Bush Fire Prone / Vegetation "G"- Grassland (managed)	>0^0-5^0 (Flat assessed)
MLV 2	KP 22	Oaklands Road, Oakland Junction	Bush Fire Prone / Vegetation "G"- Grassland (managed)	>0^0-5^0 (1^0-3^0 assessed)
MLV 3	KP 35	Gunns Valley Road, Beveridge	Bush Fire Prone / Vegetation "G"- Grassland (managed)	>0^0-5^0 (Flat assessed)
Wollert Compressor	KP 51	Summerhill Road, Wollert	Bush Fire Prone / Vegetation "G"– Grassland (low open woodland)	>0^0-5^0 (1^0-3^0 assessed)

10.2.4 Proximity of woody / forested vegetation on adjoining lands

The intensity and rate of spread of a bush or grass fire is significantly influenced by the amount of fuel or the height of grass sward present. Assets located in close proximity to fire-prone vegetation may experience direct flame contact, radiant heat or ember attack. The Australian Standard AS 3959:2018 (Standards Australia, 2018) identifies that assets located within 100 m of fire prone forest or woodland vegetation (and within 50 m of unmanaged grassland vegetation) require construction to specified requirements, according to assessed Bushfire Attack Levels (BAL) (assessed in accordance with AS 3959) in order to improve their resistance to bushfire attack from embers radiant heat flame contact and combinations of all three forms.

Therefore, the separation distance between the vegetation hazard and an asset in which a person may work or reside or which has important financial or capability (i.e. production value), is an important risk factor for consideration. Areas where people work, congregate or sleep are particularly susceptible.

As discussed in Section 10.2.3, the mainline valves (MLVs), compressor station and regulating station are located in land mapped as bushfire prone. It is proposed to provide appropriate setbacks and asset protection zones (APZ). In the case of the MLVs, above-ground components are constructed from steel. As 3959 is principally concerned with preventing ignition of combustible building materials (either by flame contact, radiant heat exposure or ember attack) and failure of non-combustible building materials when exposed to bushfire attack, it does not explicitly address structures such as steel risers/pipework and valves. GHD has applied the principles of AS3959 in considering the extent to which steel may fail during exposure to bushfire.

[1] Based on Table 2.3 of AS 3959 and estimated at the desktop level (ie not ground truthed).

Wotton et al (2011) measured temperature profiles of flames in experimental fires in eucalypt forests and concluded that the temperature of the visible flame tip was ~300^{0}C. Strength loss for steel is generally accepted to begin at about 300ºC and increases rapidly after 400ºC. By 550ºC steel retains about 60% of its room temperature yield strength. At temperatures below about 600ºC, if the steel is cooled it returns to its original strength, stiffness and ductility.

GHD notes that it is common for steel structures such as electricity transmission line towers and steel fence posts to be situated in grassland fuels in bushfire prone areas. Accordingly, GHD considers that providing setbacks/Asset Protection Zones under which the steel structure is beyond the BAL Flame Zone can be considered a conservative approach to providing bushfire protection for such assets.

The widths of the APZs have been determined by reference to Table 2.4 in AS 3959. The minimum width of the APZ at each asset site is detailed in Table 10 below.
Table 2.4 in AS 3959 provides a width range of seven metres separation from grassland and 15 metres separation from grassy woodland vegetation (assuming slopes of >0-5^0). Conversely, the maximum width has been stated as the width required for the APZ in the site that is not managed grassland.

Note that the minimum distance of the APZ from the asset is generally taken to be the distance from the closest wall of a building. In this assessment, the minimum width of the APZ is the distance all around the pipe structure of the MLVs and not the distance from the edge of a slab on which the MLVs might be located. With reference to the APZ, the two critical distances are the perpendicular distances from the pipework closest to both edges of the easement as the easement might not extend the full distance required by the APZ.

Table 10 Proposed APZ widths at Project locations

ID	KP	Access	Vegetation Category	APZ minimum width from asset (all directions)
MLV 1	KP 6	Holden Road, Diggers Rest	Grassland	7 m
MLV 2	KP 22	Oaklands Road, Oakland Junction	Grassland	7 m
MLV 3	KP 35	Gunns Valley Road, Beveridge	Grassland	7 m
Wollert Compressor	KP 50	Summerhill Road, Wollert	Woodland	15 m

10.2.5 APZ requirements

The following management measures are recommended within the APZs:

- Vegetation would be managed within the easement and MLV compounds.
- Existing trees within the APZ at the Wollert compound are not required to be removed and the tree canopy cover would be managed so the canopy cover remains at less than 15% of the area.
- Existing trees within the APZs at the MLVs are not required to be removed and the tree canopy cover would be managed so the canopy cover remains at less than 15% of the area.

- The trees would be managed so any low hanging branches (i.e below two metres from ground level) are removed.
- If the APZ extends beyond the APA easement and vegetation management is unable to be maintained by APA for the full distance of the APZ, additional mitigation measures would be required.
- If the above-ground steel structure of the MLVs is comprised of steel that has been tested to withstand temperatures of 650^0C, this would be considered adequate mitigation for those circumstances in which the APZ extends beyond the APA easement.

10.2.6 Spotting and ember attack potential of vegetation

Ember attack occurs when windborne burning or smouldering vegetative matter such as leaves or bark settles on, and in turn sets fire to, vulnerable buildings. The burning or smouldering vegetative matter causes fire by penetrating gaps or openings in buildings, accumulating in corners, or through burning exposed timbers.

Spotting occurs when a piece of loose bark or leaf catches fire and, under the influence of convective wind at the front of the fire, travels ahead of a bushfire (sometimes many kilometres) and starts a new fire. It is to be noted that certain vegetation groups and species are more likely to create embers and spotting materials.

In the event of a bushfire, woody vegetation may generate ember attack on Project assets, where people work or sleep or escape routes/refuges. Where assets are not appropriately prepared this may result in structure loss where embers are able to penetrate structures.

10.2.7 Potential ignition sources within and surrounding the Project

Examples of Project-related activities with the potential to generate an ignition could include untended vegetation around hot work (welding, cutting grinding, mulching), vehicles/machinery driving through long grass, gas appliances at the temporary construction camps (e.g. BBQs) and/or accidental ignitions (such as from cigarettes) or ignition of gas from a loss of containment event.

Historically on adverse fire days, ignitions have the potential to develop into large fires and potentially involve large areas very quickly.

There is an increased potential for ignitions on days of elevated fire danger (if mandatory mitigation and prohibition measures were not adhered to), caused by Project-related activities, vegetation contact with power lines (where not buried) or accidental ignitions.

Ignition sources in the surrounding landscape that may result in bushfire are predominantly from lightning (>50% of ignitions), but other sources include arson (typically along the road corridors), escaped agricultural burns, accidental (including vehicle accidents) and overhead power line and associated infrastructure ignitions.

10.2.8 Detection of new ignitions

Due to the large expanses of flat open grasslands, sections with relatively low population and generally flat topography, fires may develop unnoticed for a period. Fires starting next to or near the roads may be informally reported by motorists.

10.2.9 Topography and access within and surrounding the Project

Gentle to flat surrounding topography and good site access surrounding a site will increase control options for fire fighters in suppressing bushfires through direct or indirect means. Where site access is restricted there can be delays to fire control, thereby requiring indirect suppression strategies to cover larger areas (such as burning out to prepared containment lines).

Restricted access can also create enhanced risk for emergency access and egress, particularly if they have to traverse large vegetated areas.

It is noted the locations of the MLVs, compressor station and regulating station have gentle topography and have good access from the local road network

10.2.10 Fire prevention and initial attack capacity

The location and number of fire suppression resources will directly influence the success of initial attack while the fire is small. These factors will also influence the ability of an ignition to develop and grow into a large uncontrollable fire. Historically, the number of fire suppression resources in the landscape has been declining with the consolidation of farms and an aging rural workforce (i.e. resulting in less firefighting volunteers).

Project staff and contractors do not undertake initial or sustained attack of fires originating outside the Project area, which is the responsibility of external firefighting authorities. However, Project resources such as dozers may, under the direction of a fire authority, assist in control.

Project staff will have access to and be trained in the use of handheld firefighting equipment (i.e. fire extinguishers) for use on accidental fires if started by Project-related activities. Project staff and contractors undertaking hot works will be required to obtain hot works permits prior to hot work commencement, and to carry fire extinguishers in accordance with hot works permit conditions.

10.3 Bushfire risk mitigation measures

It is recommended that the Project adopt the risk mitigation measures as described below for all phases of the Project:

- The Project will implement the APA HSE Management System
- The APA HSE Management System will require assessment of risks of accidental fire ignition (for all Project works) with identification of Safe Work Method Statements which prevent fire ignition
- A Hot Works Permit system will be developed and implemented for the Project as part of the Principal Contractor PTW system to ensure hot works are not conducted during adverse fire weather conditions, and that appropriate controls to prevent fire ignition are applied at other times
- Open fires, including open barbeques, billy fires, and brush burning, will not be permitted on site
- The Project will be designed, constructed and operated in accordance with Australian Standard AS/NZS 2885 Pipeline – Gas and Liquid Petroleum APZs would be established and maintained as detailed in Table 10

During construction the following additional mitigation measures will be implemented:

- Water trailer where needed on site to wet down surrounding areas
- Cleared area around machinery of 10 metres
- No hot works during Total Fire Ban day unless a Section 40 permit is in place from CFA, MFB or DELWP on Total Fire Ban Days. Note Operations do receive these Permits
- Where possible vehicles should drive on cleared ROW, access tracks or on hardstand. Vehicles should avoid driving over long dry grass which when it contacts hot surfaces under the vehicle it could start a bushfire

10.3.1 Recommendations for reducing bushfire risk

Prior to the commencement of construction APA will need to review, and if necessary, update, their existing Bushfire Management Plan, in consultation with their bushfire working group. The current APA Bushfire Management Plan includes:

- The intent of this plan is to help prevent fires, prepare as best as possible and respond in an emergency
- The plan includes a Bushfire Action Plan (doc number 320-GD-ER-0008) to follow in a bushfire emergency, along with a summary of requirements during Fire Danger Season specific to field activities and travel
- The Plan has been developed by Operations and a bushfire working group that includes three of APA's Rural Fire Service volunteers
- Bushfire Management at APA is aligned with Australia's national Fire Danger Rating System and the national Bushfire Warning System
- The Bushfire Management Plan applies to all APA employees and contractors working on APA managed operational assets and projects. – the Project will need to ensure alignment for Construction works within Brownfield areas

During the revision of the current Bushfire Management Plan, consideration should be made to ensuring the following elements are covered:

- Include formal preparedness procedures for staff and contractors to monitor daily fire danger ratings during the declared bush fire danger period, and disseminate these to staff and contractor to enable them to adjust their activities, including:
  - Identification of appropriate work practices to prevent accidental fire ignition by Project personnel and contractors
  - Hot work restrictions and procedures
  - Preparedness actions required (such as the location of plant and personnel)
- Specifically identify the risks to which staff, contractors, visitors and fire fighters may be exposed
- Detail procedures to respond to a formal bushfire warning being issued by emergency services
- Identify actions in the event of a fire outbreak including incident command and control structure and responsibilities
- Identify areas where asset protection zones and fuel reduced areas are to be established and maintained

- Provide evacuation procedures which provide for orderly evacuations well in advance of bushfire impacts, including nominating and mapping access and egress routes that are suitable for use in an emergency. Maps and details of areas suitable for use as refuge areas and safer places to assemble are also to be included. Areas identified as refuges of last resort must be appropriately prepared (structure and setbacks) and of sufficient size (may exceed 100 m) for the personnel which may assemble there.
- Document communication procedures, links and 'black-spots'
- Detail formal fire reporting and response procedures (including command and control structure) and the required frequency and means by which these arrangements are communicated to all staff and contractors
- Confirm fire reporting and response actions

APA is not a fire authority and fires occurring on or APA managed land will be under the incident control authority of one of the Victorian Fire Authorities (Country Fire Authority, Fire Rescue Victoria, Department of Environment, Land, Water and Planning or Parks Victoria). To assist in the coordination of fire response actions the Proponent will provide a Liaison Officer to the fire authority incident management team to provide local knowledge and advice during fire incidents. The details, timing and frequency of these arrangements will be documented in the Bushfire Management Plan prepared for the Project.

It should be noted the allocation of external resources to respond to a fire will be dependent on the risk a fire poses relative to the risk from other fires which may also be running at the same time, availability of resources and the safety and effectiveness in deploying resources. Fire response and mitigation measures applied to the Project need to ensure that the assets and staff are well prepared and able to respond (i.e. evacuate or seek shelter) to a bushfire. These arrangements, including the locations of firefighting resources and fire control advantages are to be documented in the Bushfire Management Plan.

10.4 Bushfire hazard summary

The residual risk of bushfires from the Project to the surrounding people, property and biophysical environment has been assessed as 'low'. This is based on the level of consequence that could occur if a bushfire were to escalate outside the Project area being rated as 'major'. However, the residual risk for fires to start and escalate is considered to be 'rare' based on the mitigation measures that would be implemented by the Project.

The risk of bushfires originating outside the Project area, impacting the Project are not considered to be significant with regards to the Project design, construction and operations. However, the same consequences of injury or fatality is possible for Project personnel as with the public, particularly through the construction phase when there is a large construction workforce.

The Proponent, as with other activities located in similar bushfire prone environments, and despite comprehensive current and proposed mitigation measures, is unable to influence the consequence of a bushfire event. While mitigation actions can be used to reduce the likelihood, there are no actions which can be applied to change the potential worst case consequence of a grass or bushfire event, which is fatalities and / or severe irreversible disability.

However, the proposed additional mitigation measures including separation distances (APZ) and other measures in the Bushfire Management Plan would reduce the likelihood from 'remote' to 'rare', with a residual risk of low.

11. Environmental management

11.1 Environmental management measures

Table 11 lists the recommended environmental management measures relevant to this Safety risk assessment as discussed in the preceding sections.

In developing the EMMs, the assessment adhered to the mitigation hierarchy that is, an obligation to first avoid the risk, followed by minimising risk. Rehabilitation and offsetting are not considered relevant for safety. The mitigation hierarchy is consistent with APA's risk management philosophy and systems where a prioritised order of control types is applied to manage a specific risk and to use the hierarchy to reduce the risk so far as is reasonably practicable. The hierarchy of hazard control is first to eliminate or avoid the hazard, followed by substitution (also a form of avoidance), followed by controls to minimise risk through isolation, engineering controls and administrative controls. Refer to Section 7.3 for further discussion on the approach to management of risk including the hierarchy of control.

Application of the mitigation hierarchy for each EMM is identified in the 'mitigation hierarchy' column in Table 11.

Table 11 Recommended environmental management measures

EMM #	Environmental Management Measure	Stage	Mitigation hierarchy
SA1	**Pipeline, MLV and Compressor Works safety standards** Design, construct and operate the pipeline, MLV and compressor works in accordance with AS/NZS 2885, including: • Completion of identification/assessment of threats and mitigating strategies as part of detailed design • Maintenance and inspections of the pipeline in accordance with APA procedures and AS/NZS 2885 Maintain and inspect the MLVs and the Wollert compressor station at a frequency in accordance with APA procedures. This must include vegetation management, valve and compressor operation and corrective maintenance.	Design, construction and operation	Avoidance
SA2	**Process control system and automated emergency shutdown systems** Monitor the operation of the WORM using an automated process control system, with the capability of initiating an emergency shutdown, local alarms and remote alarms. Ensure the shutdown systems are fail-safe and designed with redundancies. Provide training to personnel, in field and in the control room.	Design, and operation	Avoidance / minimisation
SA3	**Fire protection** Develop and implement a Health and Safety Management Plan that requires: • Provision of fire detection for liquid fires and gas fires in the turbine enclosure • Storage of diesel in storage tanks in accordance with AS 1940:2017 and provision of foam for firefighting purposes at diesel stations and implementation of routine monitoring to manage the risk of any fire events. Manage diesel in accordance with the HSEMS, including the creation of Emergency Response Plan(s).	Construction and operation	Minimisation

EMM #	Environmental Management Measure	Stage	Mitigation hierarchy
SA4	**Emergency response plans** Develop and implement emergency response plans, such as for spills, for both the construction and operations phases of the Project.	Construction and operation	Minimisation
SA5	**Bushfire Management Plan** Review and update the existing APA Bushfire Management Plan to consider the new infrastructure introduced by the WORM Project in consultation with relevant stakeholders including the Country Fire Authority and Fire Rescue Victoria.	Construction and operation	Minimisation
SA6	**Traffic Management Plan** Develop and implement a Traffic Management Plan to manage risks to both workers and the public on the movement of vehicles on public roads and at site access points as per EMM S3.	Construction and operation	Minimisation
C6	**Manage chemicals, fuels and hazardous materials** The spoil management measures must include requirements for management of chemicals, fuels and hazardous materials including to: • Minimise chemical and fuel storage on site and store hazardous materials and dangerous goods in accordance with the relevant guidelines and requirements. • Comply with the Victorian WorkCover Authority and Australian Standard AS1940 Storage Handling of Flammable and Combustible Liquids and EPA Victoria publications 1834 Civil construction, building and demolition guide and Publication 1698: Liquid storage and handling guidelines – EPA Victoria. • Develop and implement management measures for dangerous substances, including: – Creating and maintaining a dangerous goods register – Disposing of any hazardous materials, including asbestos, in accordance with Industrial Waste Management Policies, regulations and relevant guidelines – Implementing requirements for the installation of bunds and precautions to reduce the risk of spills. • Develop and implement contingency and emergency response procedures to handle fuel and chemical spills, including availability of on-site hydrocarbon spill kits • Make spill kits available at all locations where machinery/plant are operating, refuelling points and fuel and chemical storage locations. • Limit the type and volume of liquid material (fuel, oil, lubricant) stored on-site for construction activities to only that which is required. • Liquid material must not be stored within 50 metres of waterways.	Construction	Avoidance / Minimisation

EMM #	Environmental Management Measure	Stage	Mitigation hierarchy
NV3	**Blast Management Plan** Develop a detailed blast study and impact management plan in accordance with AS 2187.2 – 2006 *Explosives-storage and use* and other relevant documents to confirm blasting impacts and implement any further management measures required.	Construction	Avoidance / Minimisation
S3	**Community and residential access and connectivity:** The following must be implemented to manage potential impacts to local access roads during construction: a Approved Traffic Management Plans (TMPs) to mitigate risks to workers and the public arising from the movement of construction vehicles on public roads and at site access points b Stakeholder and communications arrangements in accordance with the Project Consultation Plan (Refer to EMM S6) c Measures to prevent impacts to emergency services access.	Construction	Minimisation

11.2 Monitoring and performance criteria

Under AS/NZS 2885.6 demonstration of the SFAIRP approach includes development of performance standards to ensure the effectiveness of controls to minimise the risk of a major incident.

As outlined in Section 7, APA would implement a management system that includes a monitoring, auditing, review and improvement cycle. The Project Health and Safety Management Plan for construction establishes effective health and safety systems for the construction phase of the Project, and for the operation phase, the Project would be integrated into the APA VTS Safety Management System which is approved by Energy Safe Victoria through the approved Safety Case.

The management system would include:

- Routine inspections of assets such as monitoring of mainline valves and scraper stations and cathodic protection surveys
- Document control system to enable routine review and update of all standards, procedures, Safe Work Method Statement and work instructions
- A training management system to identify and track training requirements of all personnel, including refresher training programs
- APA permit to work process to monitor and control specific higher risk activities
- A change management system to assess the impacts of changes made
- A communication strategy to notify all relevant personnel of changes made

APA would extend existing audit programs to include the Project to confirm compliance with the health and safety legislative requirements and company / operations specific processes and procedures.

Bushfire mitigation measures would include the following monitoring activities:

- Monitoring daily fire danger ratings during the declared bush fire danger period and disseminate these to staff and contractors to enable them to adjust their activities.

12. Conclusion

The purpose of this report is to provide a Safety risk assessment to inform the preparation of the EES required for the Project.

A summary of the key assets, values or uses potentially affected by the Project, and the associated risk assessment are summarised below.

12.1 Existing conditions

A location analysis was completed within the Safety Management Study (SMS) report (GPA, 2020) which uses location classes based on population density and existing and reasonably foreseeable land uses to determine appropriate engineering and procedural control measures to mitigate any potential threats.

Some of the WORM falls within the Melbourne Urban Growth Boundary. The Melbourne Urban Growth Boundary is defined by “Melbourne 2030 – Planning for Sustainable Growth” and associated planning zones as defined by Victorian Planning Authority (Department of Infrastructure, 2002).

Approximately 44% of the pipeline is in the Urban Growth Boundary. The primary location classification in this area is Residential (T1) (GPA, 2020).

The remaining 56% of the pipeline outside of the Urban Growth Boundary, has a location classification of Rural (R1) Residential (T1). This land is primarily used for grazing and cropping.

Within the pipeline alignment there are current significant features including the Outer Metropolitan Ring (OMR). The final design of the OMR is still not yet complete. Therefore, when there is certainty about the features and population densities, another SMS will be conducted to determine if there is any additional location classifications or further measures required to reduce risk as low as reasonably practicable. There is also existing APA easements and HV power easements. Lastly part of the pipeline alignment also is located in Melbourne Water Kalkallo Retarding Basin land.

12.2 Risk assessment

The risk assessment was informed by a qualitative risk assessment in accordance with AS/NZS 2885. The qualitative risk assessment of loss of containment and subsequent ignition events identified a number of causes that may lead to the loss of containment of natural gas in the construction and operation of the Project phases. This included assessment of risks to people, property and community infrastructure as a result of ignited loss of containment events and the cumulative risk associated with other existing and proposed developments in the region.

Both the SMS and EES safety assessment determined that all safety hazards have a residual risk level of low or below. The mitigation controls planned to be implemented by APA were identified, including some additional mitigation recommendations to further reduce the risks so far as is reasonably practicable (SFAIRP). Additional risk mitigation measures would continue to be identified by the Proponent and implemented to continue reducing risks to SFAIRP.

Risks considered in the SMS that were deemed not controlled (such that failure may be possible) are to be assessed in more detail when the design of the Project is further progressed.

These include:

- Lightning strikes either a facility or the pipeline – residual risk 'Negligible'
- Dam construction in rural locations – residual risk 'Low' to be confirmed by further risk assessment
- Installation of new cross-country power line – residual risk 'Low' to be confirmed by further risk assessment.
- HDD (Micro HDD) installation of minor utilities – risk to be assessed
- HDD (Mini HDD) installation of minor utilities – risk to be assessed

The EES safety assessment considered the following risks which were all consider to have a residual risk rating of 'low':

- Fire from the Project spreading offsite
- Bushfire starting offsite and burning into the Project area
- Blasting activities produce flyrock
- Loss of containment and ignition of flammable liquids
- Open trench construction leading to collapse
- Vehicle movement and interactions.

The key risk identified in the construction phase is fire risk from fire starting either within or outside the construction corridor.

The residual risks during construction would be controlled using appropriate construction management and emergency response plans that are developed by the construction contractor with specific controls for risks such as bushfires, and other low likelihood construction related risks associated with the management of hazardous materials, blasting and vehicle movement. A blast management plan would provide a detailed approach to blasting including impact and exclusion zones based on the contractor's methodology.

The key credible threats in the operation phase relate to external impact (e.g. from horizontal directional drilling (HDD) or bulk civil works), natural events, geohazards and intentional damage. Bushfire is also a risk in the operation phase.

The risk of gas release and/or ignition through rupture is not a credible threat as the pipeline would be designed to meet the requirements in AS/NZS 2885.1 (for example, wall thickness and depth of cover) and engineering controls would be implemented such as the layout and design of the infrastructure would be in compliance with the relevant codes, technical standards, and industry best practice.

The SMS workshop raised actions to complete investigations confirming the details of a small number of external interference threats that have the potential to cause pipeline failure resulting in injuries or fatalities. The requirement for further risk assessments is dependent on the outcomes of these investigations. The SMS demonstrates that the requirements of AS/NZS 2885 have been achieved, subject to the effective implementation of these actions.

However, based on the threats that were reviewed and assessed in the SMS, and the risk assessment performed in this report, it can be concluded that residual risks to the workforce, nearby operations and public safety would be adequately managed. This is based on the proposed risk mitigation measures mentioned in Section 9.4 and the EMM's listed in Section 11.

The mitigation measures listed in this report would be monitored and validated to assess performance using the criteria established and approved within APA's Safety Case regime. The Safety Case specifies assurance related activities to assess the robustness of control measure performance.

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Appendices

Appendix A – Risk assessment

The scoping requirements require a risk-based approach to be adopted during the design of EES studies, so that a greater level of effort is directed at investigating and managing those matters that pose relatively higher risk of adverse effects.

The risk assessment as part of the assessment framework for the EES, is described in Chapter 5 *Evaluation and assessment framework.*

As part of the safety assessment two different approaches were used to align with the requirements of AS/NZS 2885 and EES scoping requirements. The risk assessment was used to identify the issues for workforce, nearby operations and public safety which are not assessed through the SMS assessment.

The risk pathways define the cause and effect topics relevant to Safety based on an understanding of the existing conditions and the Project activities. The risk pathways are provided in Table A4. Each pathway shows the initial risk rating based on standard management measures, and a residual risk rating based on additional management measures (if required) recommended through the risk assessment process.

The consequence of the risk occurring were assigned using a consequence guide specific for each technical discipline. The consequence guide is provided in Table A1.

The likelihood was assigned using a likelihood guide applied to all technical disciplines. The likelihood guide is provided in Table A2.

The risk rating was determined using the risk matrix developed for this EES. The risk matrix is shown in Table A3.

Table A1 Consequence approach

Level	People	Assets/property	Biophysical environment
Insignificant	Minimal impact on health & safety	Maximum risk less than $5,000	No effect; minor on-site effects rectified immediately with negligible residual effect
Minor	Injuries requiring first aid treatment	Maximum risk less than $500,000	Impact very localised (<0.1 ha) and very short term (weeks), minimal rectification
Moderate	Injury or illness requiring hospital treatment	Maximum risk less than $5 million	Localised (<1 ha) and short term (<2 year) effects, substantially rectified within a year or so
Major	One or two fatalities, several people with life-threatening injuries	Maximum risk less than $50 million	Major impact well outside pipeline corridor or site; long term severe effects or rectification difficult
Severe	Multiple fatalities result	Risk may exceed $50 million	Impact widespread; viability of ecosystems or species affected; permanent major changes

Table A2 Likelihood approach

Level		Description
1	Rare	The event is conceivable and may occur only in exceptional circumstances
2	Remote	The event could occur but is not anticipated and may occur if certain abnormal circumstances prevail
3	Unlikely	The event is unlikely but could occur if certain circumstances prevail
4	Likely	The event will probably occur in most circumstances
5	Almost certain	The event is expected to occur in most circumstances or is planned to occur

Table A3 Risk rating approach

		Consequence rating				
		Insignificant	Minor	Moderate	Major	Severe
Likelihood rating	Almost certain	Low	Medium	High	Very high	Very high
	Likely	Low	Low	Medium	High	Very high
	Unlikely	Negligible	Low	Medium	High	High
	Remote	Negligible	Negligible	Low	Medium	High
	Rare	Negligible	Negligible	Negligible	Low	Medium

Table A4 Risk pathways

Study	Risk No.	Works Area	Staging		Risk Pathway	Initial Environmental Management Measures	Initial Risk			Additional Environmental Management Measures	Residual Risk		
Safety	SA1	All	C		Fire starts from Project related activities and spreads offsite in an uncontrolled manner from ignition of vegetation, leading to injury or death of workers or public. Sources of ignition include hot work, vehicles moving through long grass etc.	**EMM SA3 (initial) -** Health and Safety Management Plan. **EMM SA4 (initial)** - Emergency response plan (both in construction and then during operation it will be part of the VTS ERP) **EMM C6 (initial) -** Manage chemicals, fuels and hazardous materials (construction) **EMM SA5 (initial)** – Bushfire Management Plan	Major	Rare	Low	No additional EMMs required	Major	Rare	Low
Safety	SA2	All	C	O	Bushfire starting offsite and burning into the Study area where above ground assets or workers may be, leading to asset damage (coating) or smoke inhalation to workers.	**EMM SA3 (initial) -** Health and Safety Management Plan. **EMM SA4 (initial) -** Emergency response plan (both in construction and then during operation it will be part of the VTS ERP). This includes total fire ban days restrictions, weather monitoring, water tanks available, engagement with local authorities. **EMM SA5 (initial)** – Bushfire Management Plan	Major	Remote	Medium	SA5 (final) – Bushfire management Plan includes separation distances (APZ)	Major	Rare	Low

Study	Risk No.	Works Area	Staging		Risk Pathway	Initial Environmental Management Measures	Initial Risk			Additional Environmental Management Measures	Residual Risk		
Safety	SA3	Pipeline	C		Blasting activities produce flyrock impacting workers or public leading to 1-2 fatalities	Exclusion zones will be established and monitored during blasting activities. Personnel to wear PPE (minimum of hardhats, high visibility clothing, eye protective wear, steel toe boots) **EMM NV3 (initial)** - Blast Management Plan.	Major	Rare	Low	No additional EMMs required	Major	Rare	Low
Safety	SA4	Pipeline	C		Loss of containment of flammable liquids e.g. diesel, leading to potential injury or death of workers or public	**EMM SA3 (initial) -** Health and Safety Management Plan. **EMM SA4 (initial)** - Emergency Response Plans will be developed and implemented for both the construction and operations phases of the Project **EMM C6 (initial)** - Manage chemicals, fuels and hazardous materials (construction)	Minor	Unlikely	Low	No additional EMMs required	Minor	Unlikely	Low
Safety	SA5	Pipeline	C		Open trench construction method used for installation of pipeline collapses while personnel are nearby creating unstable ground conditions, leading to injuries requiring hospitalisation	**EMM SA4** Emergency Response Plans will be developed and implemented for both the construction and operations phases of the Project. APA Excavation Procedure.	Moderate	Remote	Low	No additional EMMs required	Moderate	Remote	Low

Study	Risk No.	Works Area	Staging		Risk Pathway	Initial Environmental Management Measures	Initial Risk			Additional Environmental Management Measures	Residual Risk		
Safety	SA6	All	C	O	Increased vehicle movements during construction leads to a vehicle incident with potential injury or death of workers or public.	**EMM SA1 (initial) –** Work safety Standards **EMM S3 (initial)** – Traffic Management Plans	Major	Rare	Low	No additional EMMs required	Major	Rare	Low

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Document Status

Revision	Author	Reviewer		Approved for Issue		
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