March 2019

Route Options Report

Western Outer Ring Main Project

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Contents

1 Introduction

This document provides a summary of the process undertaken to select a preliminary pipeline route for the Western Outer Ring Main Project (the Project). The Project is a proposed 500mm diameter, buried, high pressure gas transmission pipeline approximately 50km long between Plumpton and Wollert (Figure 1).

Figure 1: Location of the Western outer Ring Main Project

1.1 About APA

APA Group (APA) is the proponent of the Project. APA is Australia's largest natural gas infrastructure business, owning and/or operating approximately $20 billion of energy assets, with gas transmission pipelines spanning every state and territory in mainland Australia delivering approximately half of the nation's gas usage.

APA currently owns and operates 15,000km of natural gas transmission pipelines, as well as owning or having interests in gas storage facilities, gas-fired power stations and wind/solar farms. In Victoria, the Victorian Transmission System (VTS) is owned and maintained by APA and consists of some 2,267km of gas pipelines.

Further information on APA operations and activities is available on the APA website: https://www.apa.com.au/

1.2 Project Overview

The Project will be a typical modern gas transmission pipeline. The Project will need to gain the relevant environmental approvals under state and federal laws. If approval is granted under these laws, the Project will be designed,

constructed, commissioned and operated in accordance with the Australian Standard for gas transmission pipelines, called AS2885.

The pipeline will occupy an easement of 20m width and be buried with a minimum depth of cover of 900mm for its entire length. APA will also be seeking temporary access to an additional 10m for construction purposes which will not form part of the final easement. Together these areas are referred to as the construction right of way (ROW), an indicative layout of which is shown in Figure 2.

Additional compression and a regulating station are also proposed as part of the Project at APA's existing Wollert Compressor Station Site.

An example of a similar sized pipeline during construction (January 2017) and following the completion of rehabilitation (July 2017) is shown in Figure 3 and Figure 4 respectively.

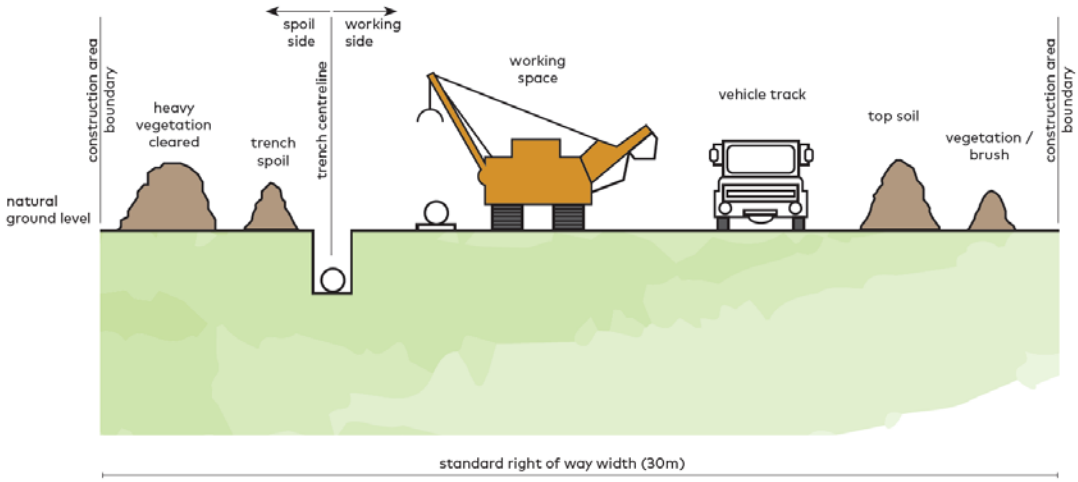


Figure 2 Typical construction right of way (ROW)

Figure 3: ROW during construction (Jan 2017)

Figure 4: ROW approximately 7 months after construction (July 2017)

1.2.1 *Approvals process*

APA will need to obtain a Pipeline Licence under the *Pipelines Act* 2005 (Vic) to allow for the construction and operation of the Project. In order to submit the Pipeline Licence application, APA is required to have given each landowner in the proposed pipeline corridor a Notice of Pipeline Corridor. The Pipelines Act also includes a requirement to prepare an Environmental Management Plan which demonstrates how the impacts of the project will be managed.

In Victoria, environmental assessment of the potential environmental impacts or effects of a proposed development may also be required under the *Environmental Effects Act* 1978. APA will refer the Project to the Minister for Planning to assess whether an Environmental Effects Statement (EES) is required.

APA will also refer the Project to the Commonwealth Department of Environment and Energy for the Minister to assess whether the Project requires further assessment under the *Environment Protection and Biodiversity Conservation Act* 1999 (Cth) for potential significant impacts to Matters of National Environmental Significance.

1.2.2 *Land Access and Compensation*

APA will initially be seeking landholder agreement to provide access to land along the pipeline route so that more detailed investigations regarding the route can be undertaken. This may include ecology, cultural heritage and other investigations necessary to confirm a preferred alignment and inform a detailed environmental assessment.

Once the preferred pipeline route has been confirmed APA will then commence negotiations with landholders to obtain an easement to contain the pipeline. An easement is an agreement registered on the title of the land that sets out the rights of a pipeline owner to install and maintain the pipeline and also defines the restrictions on the landowner in the area of the easement. Compensation for the easement is payable to the landowner and APA will also pay landowner legal and valuation costs reasonably incurred in negotiating an easement agreement.

2 Why is the Project required?

Natural gas is an essential source of energy for Victoria. Around two million households use gas every day for cooking, heating and hot water. Gas is also a critical fuel or feedstock for a range of industrial and manufacturing businesses. Gas fired power generation also plays a key role in ensuring reliable electricity supply.

Gas consumption in Victoria is around 200 petajoules (PJ) every year, which is around 30 per cent of all the gas consumed in eastern Australia excluding LNG export facilities. Most of the gas that supplies Victoria comes from offshore gas fields (the Gippsland Basin) in the Bass Strait south of Lakes Entrance, with smaller volumes produced from offshore fields near Port Campbell (the Otway Basin). Additional gas supplies are also available from the offshore Bass Basin and from fields in Queensland and South Australia[1].

Gas is transported from these gas sources to customers by a series of high pressure transmission pipelines called the Victorian Transmission System (VTS), as well as a number of lower pressure distribution networks. The VTS has three main branches, as follows:

- The Longford Dandenong Pipeline (LDP), which connects the Longford gas processing plant in south eastern Victoria to Dandenong in Melbourne's south east. This pipeline moves gas from the Gippsland Basin towards Melbourne;
- The Victorian Northern Interconnect (VNI), which connects Wollert in Melbourne's north and Wodonga. The VNI can move gas from Victoria into NSW or from NSW into Victoria; and
- The South West Pipeline (SWP), which connects Brooklyn in Melbourne's west and south western Victoria. This pipeline moves gas from Melbourne to the Iona underground gas storage facility at Port Campbell in summer to allow gas to be withdrawn and supplied to Melbourne in winter which is traditionally the peak gas demand period.

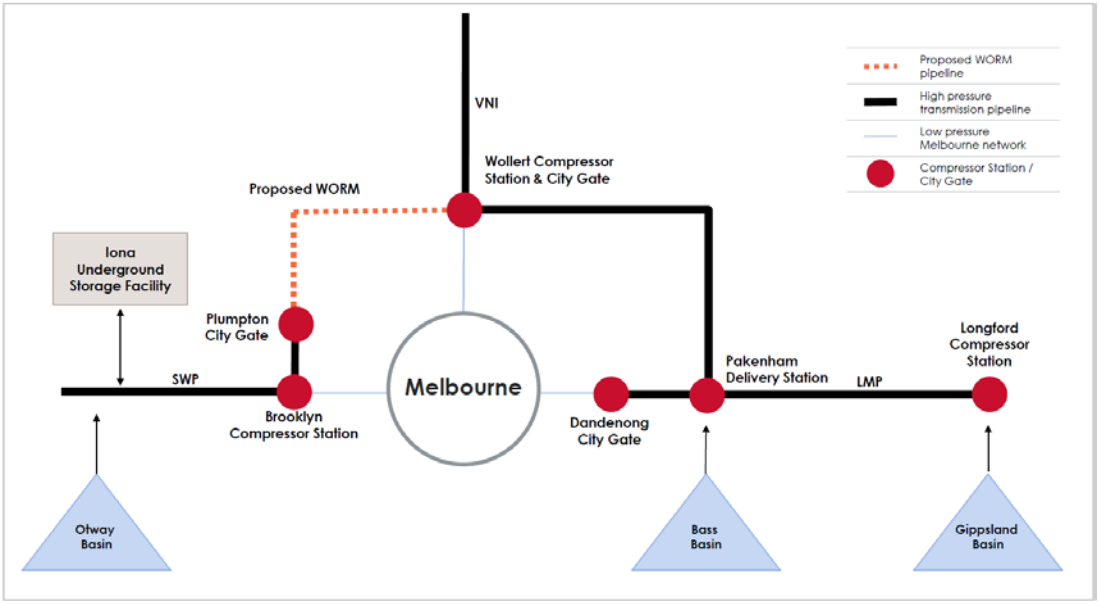
A high pressure connection called the Pakenham to Wollert Gas Pipeline links the LDP and the VNI. This link provides the ability to send gas under high pressure between these two pipelines. There is no equivalent high pressure link between the SWP and the VNI or LDP. Sending gas west into the SWP therefore requires gas to flow through the low pressure Melbourne network. This significantly limits the rate of gas flow to the west of Victoria, as well as introducing increased operational costs as gas pressure needs to be reduced

[1] AEMO 2018, Victorian gas operations plan – Winter 2018

when entering the low pressure system at Dandenong and then increased again at Brooklyn when entering the SWP. In effect, the low pressure Melbourne network is a bottleneck for the movement of gas between the SWP (west) and LDP (east).

The figure below (Figure 5) represents the VTS and the current constraint to gas flow between the SWP and the other transmission pipelines.

Figure 5: Western Outer Ring Main – Victorian Transmission System Context



The efficient movement of gas from the LDP or the VNI into the SWP is very important because the SWP supplies a gas storage facility near Port Campbell called the Iona Underground Storage Facility (UGS). Gas supplied by the Iona UGS is crucial for supplying gas demand on the coldest winter days, which are the times of peak gas demand in Victoria.

On these cold days the amount of gas produced is not enough to meet demand. To address this shortfall, the Iona UGS is filled with gas during summer when demand is low. Then, during winter, gas is extracted from the Iona UGS and piped through the SWP to areas of demand, particularly Melbourne.

Whilst gas supplies for the Iona UGS come from both the Otway and Gippsland basins, gas production from the Otway Basin has declined significantly in recent years and is forecast to fall further. This means that more gas from the Gippsland Basin needs to be transported to the Iona UGS during summer.

Because this gas needs to be transported through the bottleneck of the Melbourne low pressure network, there is a real possibility that the Iona UGS may not be filled sufficiently during coming summers. As a result, the Australian

Energy Market Operator (AEMO) has forecast the potential for gas supply shortfalls in Victoria from 2021 – 2022[2]. The main purpose of the Western Outer Ring Main is therefore to enable the efficient delivery of gas to the Iona UGS during summer so that gas is available to meet winter peak demand. For this reason, the costs associated with constructing and operating the Project have recently been approved by the Australian Energy Regulator (AER).

Delivery of the project will also result in a number of other benefits, including:

- Improved system resilience and security of gas supply in the event of planned or unplanned outages at one of the main gas processing facilities
- Opportunities for new offtakes (known as 'city gates') to provide gas supply to residential and employment growth areas along the route including Sunbury South, Mickleham and Kalkallo
- Increased capacity to supply existing and potential new gas fired peaking power generation demand for which is increasing as Victoria's reliance on renewable generation sources increases; and
- Increased storage capacity within the pipeline system.

The Western Outer Ring Main project will help ensure that all Victorians can continue to benefit from a reliable gas transmission system that meets the needs of the community both now and into the future.

[2] AEMO 2018, Victorian Gas Planning Report Update

3 How were pipeline route options identified?

For the project to be successful, a suitable pipeline route between Plumpton and Wollert needs to be agreed. As such, APA undertook a process to identify and then compare pipeline route options for the project.

This assessment of pipeline route options involved the following phases, which are discussed in subsequent sections:

- Review of the social and environmental characteristics of the area between Plumpton and Wollert (Section 3.1)
- Development of pipeline route options with consideration for social and environmental characteristics (Section 3.2)
- Comparison of pipeline route options (Section 0)
- Selection of a preferred pipeline route (Section 5).

To support this process, APA undertook a program of desktop assessments, site inspections and consultation with key stakeholders to understand the existing social and environmental conditions for the region between Plumpton and Wollert. This program of assessments was used to inform the identification of potential pipeline routes.

The desktop assessment involved the compilation and assessment of publically available spatial data and associated documentation for the region. Site inspections were also undertaken by APA staff.

Consultation was undertaken with the four relevant local councils (Melton City, Hume City, Whittlesea City and Mitchell Shire), to assist with understanding and considering local community values. The Department of Environment, Land, Water and Planning (DELWP), VicRoads and AusNet was also consulted.

Information obtained during this process was used to identify constraints and opportunities for locating pipeline route options, including:

- Identification of topographic features, vegetation cover, existing and proposed land uses and transport / energy infrastructure.
- Compilation and classification of all strategic constraints including environmental, land access, constructability, cultural heritage and community issues.

- Identification of conceptual corridors that consider the identified constraints and opportunities within which pipeline route options can be defined.

3.1 Existing environment

The region that will need to be traversed by the Project is located north of Melbourne and lies between Somerton in the south and Kalkallo in the north and between Sunbury to the east and Wollert to the west. A map of the key environmental and other relevant features within the Project area of interest is provided at Attachment 1.

The local government areas in this region are Melton City, Hume City, Mitchell Shire and Whittlesea City. Much of the land in this region is zoned as Green Wedge Zone and Urban Growth Zone.

Parts of the region are within the Melbourne Urban Growth Boundary (UGB), a state government declared zone which requires appropriate planning for the expansion of urban development. As part of the UGB, Precinct Structure Plans (PSP) have been developed as the primary plan guiding the development of an area. PSPs that are in place for the region that will need to be traversed by the Project are listed in Table 1 below.

Table 1: Precinct Structure Plans within the region of the Project

Complete and approved	Yet to be completed
Sunbury South	Plumpton
Lindum Vale	Greenvale West (R3)
Somerton Road	Greenvale Central
Northern Quarries	Aurora
Shenstone Park	Wollert
Cooper Street West	Merrifield West
Merrifield North	Folkstone Employment Area (E1)
	Lockerbie

Complete and approved	Yet to be completed
	Craigieburn North Employment Area
	Donnybrook
	Woodstock

The region also lies within the Victorian Volcanic Plain bioregion. This bioregion historically supported widespread grassland and grassy woodland communities, generally dominated by kangaroo grass with a variety of herbs. Much of the region has a long history of agricultural use and no longer supports extensive areas of wooded vegetation.

Remaining remnant vegetation in the region is of very high conservation significance, with intact grassland and grassy woodland communities considered to be critically endangered. In addition, the region supports populations of a number of threatened species, most notably the Golden Sun-Moth, Growling Grass Frog, Striped Legless-Lizard, Spiny Pimelea and Matted Flax-Lily.

The major watercourses in the region are Jacksons Creek, Emu Creek and Deep Creek in the west and Merri Creek in the east. The topography of the region is predominately flat to undulating, however the valleys of Deep creek, Jacksons Creek and Emu Creek are steep sided and deeply incised.

Other key features of the region to be considered when designing pipeline route options to connect Plumpton and Wollert are as follows:

- Areas of existing residential and industrial urban development at Taylors Hill, Hillside, Diggers Rest, Caroline Springs, Bulla, Greenvale, Mickleham, Merrifield, Roxburgh Park, Kalkallo, Craigieburn, Somerton and Epping.
- Areas where urban development planning is proposed or well-advanced within the urban growth boundary in line with approved or proposed precinct structure plans.
- Existing and proposed quarrying operations.
- The location of major public and private facilities, including the Calder Park Raceway, the Commonwealth quarantine station at Mount Ridley, and Melbourne Water operated assets at Greenvale Reservoir and the Kalkallo retarding basin.

- The location of existing major transport infrastructure including Melbourne Airport, the Sunbury and Craigieburn rail lines, the Calder and Hume freeways, and arterial roads.
- Major topographic features, comprised of steeply incised valleys (Deep Creek, Emu Creek and Jacksons Creek) and rises (Mount Fraser, Bald Hill, Redstone Hill, Aitken Hill, Mount Ridley, Woody Hill, Summer Hill).
- Areas of high biodiversity or geologic value, including Organ Pipes National Park, Woodlands Historic Park, Holden Flora Reserve, Mount Ridley and Craigieburn Grassland nature conservation reserves, conservation areas prescribed under the Melbourne Strategic Assessment (MSA), likely occurrences of threatened species and ecological communities, and Merri Creek.
- Features and areas of social and cultural heritage significance, such as areas of indigenous cultural heritage sensitivity, site listed on the Victorian Heritage Registry and inventory including the Holden cobbled stone road and the Mickleham Avenue of Honour, Merri Creek, Jacksons Creek and places of religious significance.

Existing and proposed linear infrastructure easements within the region were also investigated for the potential to co-locate pipeline route options. Co-location can provide many benefits for pipeline construction and operation including restricting environmental impacts to an area that has already been disturbed, reducing the area of new easements on land titles, and potential for greater community support of a proposed route.

Key proposed or existing linear infrastructure easements identified as having potential for co-location of pipeline route options in the region are as follows:

- The proposed Outer Metropolitan Ring / E6 transport corridor (OMR/E6).
- Existing and proposed arterial roads, railways and drainage reserves.
- The existing easement for the Ausnet 500kV high voltage overhead powerline easement.
- Existing APA pipeline easements associated with the Sunbury Pipeline, Keon Park to Wollert pipeline and the VNI.

3.2 Identification of pipeline route options

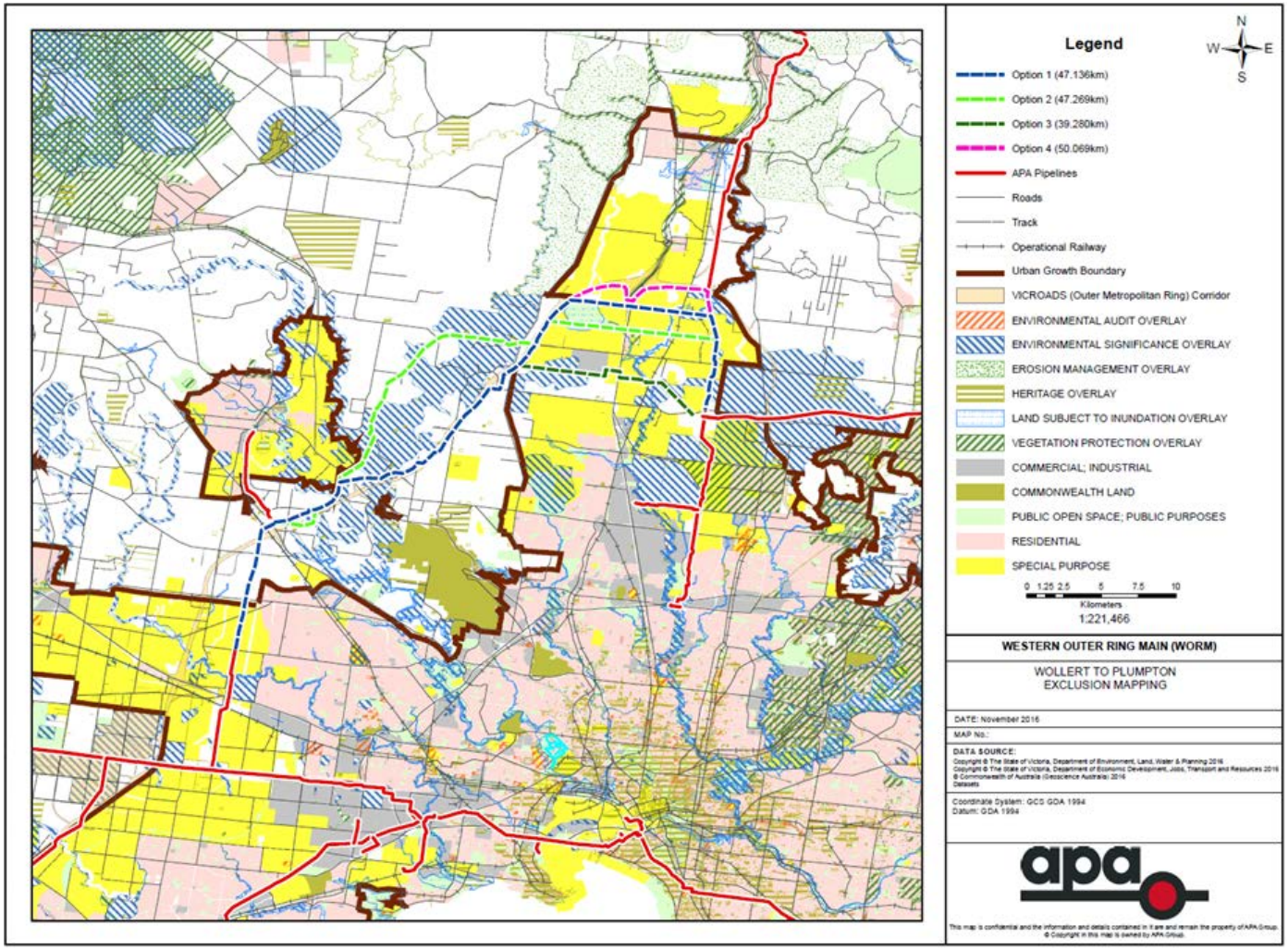
Route options for the Project have been under consideration for a significant period of time. Most recently, route options were developed for a 2017 business case submission from APA to the Australian Energy Regulator (AER).

Four route options were considered as part of APA's business case submission to the AER (Figure 6), which consisted of:

- Option 1 – 47.1km in length following the existing Sunbury pipeline easement, the proposed OMR, Gunns Gully Road and the existing VNI easement south to Wollert.
- Option 2 – 47.3km in length following the Sunbury pipeline easement, OMR and Wildwood Road before traversing cross country to the north east through open rural land. This option then crosses the OMR near Donnybrook Road before crossing the Hume Highway between Donnybrook Road and Gunns Gully Road and then following the VNI south to Wollert.
- Option 3 – 39.3km in length following the same route as Option 1 to Mickleham Road but then following the Ausnet 500kV easement through Mount Ridley to Wollert.
- Option 4 – 50.1km in length following the same route as Option 1 to Gunns Gully Road but then continuing to follow the OMR through the intersection with the VNI.

Option 4 was the preferred route that formed the basis for the costings included in the approved AER business case. Accordingly, this option formed the base case for further consideration of alternative routes. The AER submission can be found at this link.

Figure 6: Route Options from the Project AER Business Case Submission



The rate of development in Melbourne's northern and western growth corridors has occurred at such a rapid pace that the pipeline route options identified in the 2017 AER submission have become increasingly constrained. As such, a further program of desktop assessments, site inspections and consultation with key stakeholders was undertaken to identify feasible pipeline route options, based on existing work.

The outcome of this review was the identification of five pipeline route options to connect Plumpton and Wollert. The pipeline route options address the identified constraints to various degrees.

The five pipeline route options are described as Options A, B, C, D, and E.

All pipeline route options share a common alignment from KP0 through to approximately KP15, commencing at the Plumpton pressure reduction station, just north of Taylors Road and traversing generally north for approximately 9km within the existing Deer Park to Sunbury pipeline easement. The route traverses land zoned as Urban Growth Zone for the initial 3.5km and then Green Wedge Zone from approximately KP3.5 to KP9. All pipeline route options cross the Sunbury rail line and the Calder Freeway and traverse in a north-easterly direction for approximately 4km through land zone as Green Wedge A Zone. From approximately KP13 to KP15 all pipeline route options traverse generally north within the existing Ausnet 500kV high voltage powerline easement.

3.2.1.1 Option A (50.4km)

From KP13 to approximately KP27, Option A traverses in a generally north-easterly direction following the existing Ausnet 500kV easement to the intersection of Bardwell Drive and Mickleham Road. After leaving the Ausnet 500kV easement (approximately KP27) the route continues north-east through land zoned as Green Wedge Zone following the proposed OMR/E6 easement to approximately KP31.5. Option A then crosses the proposed OMR easement due east before heading north-east again for approximately 4km through land zone as Urban Growth Zone, Public Use Zone and Farming Zone. From KP36 the route traverses due south for approximately 1km before heading east to cross the Hume Freeway, north-east for approximately 1km and then east to approximately KP41.5. From KP41.5, Option A follows the existing APA VNI pipeline easement due south for approximately 8.5km to terminate at the WCS.

3.2.1.2 *Option B (39.6km)*

Option B follows the same alignment as Option A from KP13 to approximately KP27. From KP27, Option B remains in the Ausnet 500kV easement and traverses east for approximately 9km. From approximately KP29 to KP30.6, the route traverses the Mount Ridley Nature Conservation Reserve and an adjoining MSA conservation area. At approximately KP33, the route does leave the Ausnet 500kV easement for approximately 1.5km to avoid a proposed substation site at this location. From KP36 to KP39 the alignment traverses in a south-easterly direction, still within the Ausnet 500kV easement. Option B crosses Merri Creek at approximately KP36. The route traverses east across land zoned as Farming Zone for the final 600m to terminate at the WCS.

3.2.1.3 *Option C (51.1km)*

From approximately KP15, Option C traverse east for 2km and then north-east for 2km through land zoned as Green Wedge Zone. From KP19 to approximately KP28, the route traverses north-east through Green Wedge Zone following the proposed OMR easement. From approximately KP28 through to termination at KP51 the route follows the same alignment as described for Option A. This Option is essentially the same as Option 4 from the 2018 AER submission.

3.2.1.4 *Option D (40.1km)*

From approximately KP15 through to KP28, Option D follows the same route as described for Option C above. From KP28 it follows the existing Ausnet 500kV easement traversing east to the WCS as described for Option B. This Option is essentially the same as Option 3 from the 2018 AER submission.

3.2.1.5 *Option E (42.8km)*

From KP15, Option E traverses east through land zoned as Green Wedge Zone for approximately 8km to KP23. Option E then traverses south for 1km before heading east again to KP28. Through this section, Option E runs parallel to Somerton Road through land zoned as Green Wedge Zone, Urban Growth Zone, Road Zone and Public Use Zone. From KP28, the option traverses north for approximately 1km, north-east for 1km and east for 1km through land zoned as General Residential Zone. In this area, this option passes downslope of the Greenvale Reservoir and traverses through drainage reverses bordered by existing residential areas. From KP31 to approximately KP32.5, Option E traverses east through Industrial 1 Zone at the Somerton Industrial Estate, and crosses the Craigieburn rail line, before entering into the existing APA Somerton

pipeline easement. Due to the narrow width of the Somerton pipeline easement, the Project ROW would be required to extend beyond the existing easement. From approximately KP32.5 through to KP36, the route traverses east along the existing Somerton pipeline easement before traversing generally north to the termination point at approximately KP43, within the existing Koen Park to Wollert pipeline easement.

A map of the pipeline route options described above is provided at Attachment 2.

4 How were pipeline route options compared?

A Multi-Criteria Assessment (MCA) was used to compare the opportunities and constraints of the five identified pipeline route options, and to provide a decision support tool for selection of the preferred alignment.

The MCA used qualitative and quantitative scoring of the five pipeline route options through assessment of nine separate parameters, each comprised of a number of criteria, as listed in Table 2. Criteria provide a specific metric which each option is scored against.

Table 2: Parameters and criteria used for the MCA

Parameter	Criteria
Capital cost	Approvals cost, offset cost, labour costs, land procurement costs and capital costs
Relative length	Relative length of each pipeline option
Constructability	Design and engineering complexity, terrain and geology risks, complex crossings, space for efficient construction, logistics and access for construction, worker safety
Operability	Operational complexity, pipeline third party damage risk, worker safety, soil types, rehabilitation and easement maintenance risks
Infrastructure	Number of State and Federal roads, local roads and railways intersected
Approvals	Complexity of approval pathway, length of existing or proposed infrastructure easements followed, schedule impact of approval pathway
Community	Potential community benefit, community safety, impacts to known areas of high value to the community
Land	Variation in number of parcels intersected between options, residential tenure (current or zoned), industrial tenure, resource tenure (production), resource tenure (exploration), forestry tenure, conservation tenure, future land use conflicts
Environment and heritage	Special biodiversity values, length of MSA conservation areas intersected, length of threatened ecological communities intersected, extent of remnant vegetation, watercourses, wetlands, floodplains, registered heritage sites, cultural

Parameter	Criteria
	heritage sensitivity, native title claims, amenity impacts (noise, dust, visual)

Each criterion was ranked as either low (L), medium (M) or high (H) for each option based on metrics designed for that criteria. Scores of 1, 2 or 3 were applied to L, M, H rankings respectively. As such, low scores indicated a more favourable outcome than high scores.

Once each criterion had been scored, these scores were summed for each parameter group and divided by the number of criteria to provide a parameter score. The sum of each parameter score was calculated for each option, which were then ranked from most favourable (lowest score) to least favourable (highest score). The scoring matrix detailing the outcomes of this process is provided as Attachment 3 and summarised in Table 3.

Table 3: MCA Scoring Summary

Criteria Group	Weighting		A	B	C	D	E
Capital cost	**15%**		0.30	0.15	0.30	0.15	0.15
Relative length	**5%**	**20%**	0.10	0.05	0.10	0.05	0.05
Constructability	**5.0%**		0.11	0.11	0.08	0.09	0.13
Operability	**5.0%**		0.08	0.10	0.06	0.08	0.09
Infrastructure	**5.0%**		0.12	0.12	0.12	0.12	0.13
Approvals	**5.0%**	**20%**	0.12	0.12	0.10	0.12	0.10
Community	**20%**		0.27	0.33	0.27	0.33	0.33
Land	**20%**		0.28	0.33	0.28	0.33	0.33
Environment and heritage	**20%**	**60%**	0.38	0.42	0.31	0.38	0.38
TOTAL	**100%**	**100%**					
MEAN			1.75	1.72	1.61	1.64	1.69
RANK			5	4	1	2	3

A weightings system, which emphasises community and environment values, was applied to the parameter groups. The score for each criteria was multiplied by this weighting to produce a score. Weightings are shown in Table 4 below.

Table 4: Weightings for each parameter

Parameter Group	Weighting Group	Weighting
Capital cost	Cost	20%
Relative length		
Constructability	Project complexity	20%
Operability		
Infrastructure		
Approvals		
Community	Community and environment	60%
Land		
Environment and heritage		

5 What is the preferred pipeline route?

The assessment process identified that, using the weightings as described in Section 4 which emphasise community and environment values, option C is the most favourable and Option A the least favourable. Options C and D group closely together as the most favourable routes. Options B and E group closely together as less favourable routes but are more favourable than option A.

The scoring strengths and weaknesses of each option are discussed below.

Option C – Rank 1

As the longest alignment, option C scores poorly on capital cost and relative length. However, this option has best or equal best scores for all other parameters. This option has the shortest shared length with the Ausnet 500kV easement, with a consequent reduction in design, construction and operational complexity. This option also intersects the lowest number of land parcels, avoids residential and industrial tenure, avoids formal conservation tenure, has the lowest impact on MSA conservation areas and has the lowest impact on remnant vegetation.

Option D – Rank 2

As the second shortest alignment option D scores well on capital cost and relative length. Scores for operability and constructability are relatively good as this option avoids most of the dissected terrain associated with Deep Creek.

This option scores relatively poorly on environment and heritage due to the intersected length of MSA conservation reserves, threatened ecological communities and remnant vegetation. Intersection with remnant vegetation and MSA conservation reserves in the Mount Ridley area is the main contributor to this poor score. Land also scores poorly for this option as it intersects the second highest number of land parcels (182) as well as formal conservation tenure at the Mount Ridley Nature Conservation Reserve. This option generally has average scores for other parameters.

Option E – Rank 3

Option E is the third shortest option and scores well on capital cost and relative length. This option also scores relatively well on environment and heritage, with the shortest area of remnant vegetation intersected.

However, this option has the least favourable ranking for constructability and infrastructure. Constructability scores poorly as this option traverses highly

constrained areas adjacent to Somerton Road, the Greenvale Reservoir, drainage easements bordered by residential areas at Craigieburn / Roxborough Park and a rail siding in the Somerton Intermodal Terminal. Infrastructure scores poorly because two rail lines and a rail siding are intersected. This option also scores relatively poorly on operability due to the complexity of operations and increased risk of third party damage in congested easements and drainage reserves, and land, due to the length of residential and industrial tenure.

Option B – Rank 4

Option B is the third shortest option and scores well on capital cost and relative length.

However, this option has the least favourable ranking for operability and environment and heritage. This option follows the Ausnet 500kV easement for most of its length, with associated operation complexity and increased worker safety risks. The relatively long length of slopes >10% and area subject to landslip risk associated with following the Ausnet 500kV easement adjacent to the Deep Creek valley increases easement rehabilitation and maintenance risks. This option scores poorly for environment and heritage as it intersects the greatest length of remnant vegetation and MSA conservation areas.

Option A – Rank 5

As the second longest alignment, Option A scores poorly on capital cost and relative length. This option also scores relatively poorly on constructability, operability, approvals and environment and heritage.

5.1 Preferred pipeline route

Option C is the preferred pipeline route for the Project for the following reasons:

1. Alignment with objectives of the *Pipelines Act 2005*

Two of the six objectives of the Pipelines Act specifically relate to the minimisation of social and environmental impacts. These objectives are as follows:

- To protect the public from environmental, health and safety risks resulting from the construction and operation of pipelines.

- 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.

The remaining four objectives of the Pipelines Act do not explicitly emphasise cost or project complexity as matters to consider when considering pipeline routes, although one objective is to "to establish processes to determine the most efficient and suitable route for each pipeline". Section 4 of the Pipelines Act also requires the principles of sustainable development to be regarded in administration of the Act.

Option C is considered to be the option which aligns most closely with the objective of the Pipelines Act.

2. Minimised co-location with the Ausnet 500kV easement

Option C avoids approximately 10km of co-location with the Ausnet 500kV easement relative to option D.

The smaller length of co-location reduces risks associated with corrosion management, electrical protection and worker safety during pipeline construction and operations. Additionally, consultation with Ausnet has indicated that the ability to use the easement for additional HV overhead lines needs to be preserved and co-location of a pipeline within the HV easement would therefore not be supported.

For these reasons, option C is considered preferable to option D with regard to risks of co-location with the Ausnet 500kV easement.

3. Avoidance of impacts to the Mount Ridley Nature Conservation Reserve and adjoining MSA conservation area

Option D would likely require a trenchless crossing of around 1.2km to avoid impacts to the Mount Ridley Nature Reserve and adjoining MSA CA. The feasibility of undertaking a crossing of this nature at this location given the prevailing geology is uncertain, and the contingency of open cut construction through the NR and CA would likely need to be maintained. Option C avoids this area of high biodiversity value completely.

4. Minimisation of impacts to Merri Creek

Merri Creek has been identified through consultation as a site of community importance, as well as providing significant biodiversity values, notably as habitat for the Growling Grass Frog. Option D would require a new crossing location for the crossing of Merri Creek at approximately KP36, which is an

area with numerous records of the Growling Gras Frog. Option C would utilise the existing crossing already in place for the existing APA pipeline easement at approximately KP43 and therefore is assessed to have reduced potential for environmental impacts.

5.2 Route refinement

Following the selection of Option C as the preferred route option a process of further route refinement was undertaken. The intention of this process was to identify a preliminary pipeline alignment (PPA) which will form the basis of engagement with directly affected landholders and other stakeholders.

As part of this process a number of refinements were made to the Option C alignment, including:

- Minor alignment changes at the crossings of Jacksons Creek, Sunbury Road and Deep Creek to better respond to terrain, more closely follow property boundaries and avoid impacts to urban growth land within the Sunbury South PSP area.
- Refinements to the alignment's position relative to the OMR corridor at various locations following further consultation with VicRoads in relation to the interface between the two projects.
- Amendment of the alignment between Gunns Gully Road and the Hume Freeway to reduce the overall alignment length by following Gunns Gully Road rather than the OMR corridor further to the north.

A map of the PPA is provided at Attachment 4. The PPA will now be subject to ongoing refinement, informed by consultation with affected landholders regarding direct property impacts as well as the findings of field surveys to confirm the extent of constraints such as areas of biodiversity and cultural heritage values.

6 Conclusion

The Western Outer Ring Main Project will assist in ensuring that Victorians have access to safe, clean and affordable gas by increasing capacity to transfer gas flows between east and west Victoria, with subsequent increases in gas supply security for both domestic (i.e. heating, cooking and hot water) and industrial (i.e. manufacturing) customers.

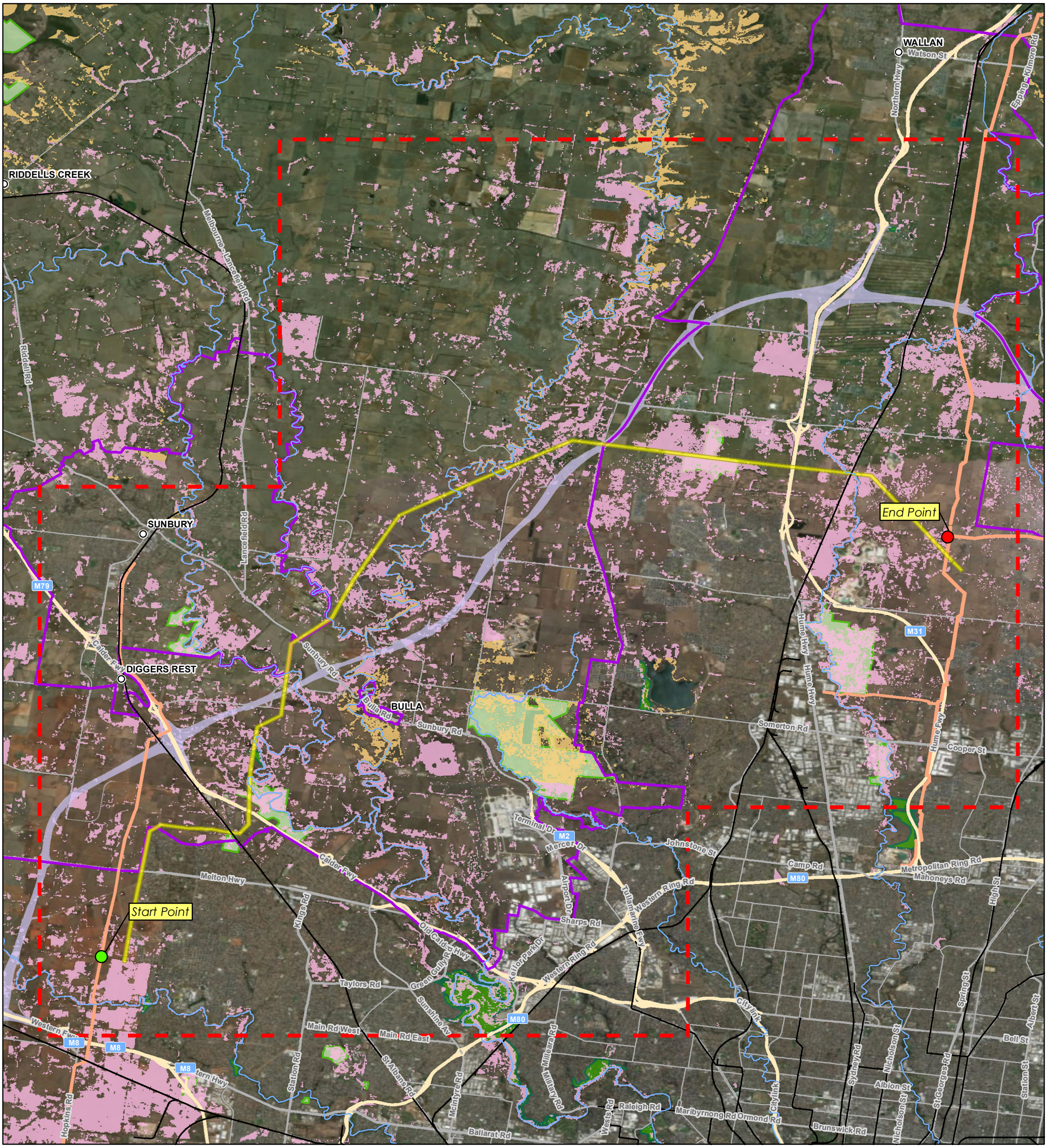
A program of desktop assessment, initial site inspections and consultation with key stakeholders has been undertaken, based on existing previous completed work, to identify five technically feasible pipeline alignments (Options A through E).

Option C is the preferred alignment for the Project for the following reasons:

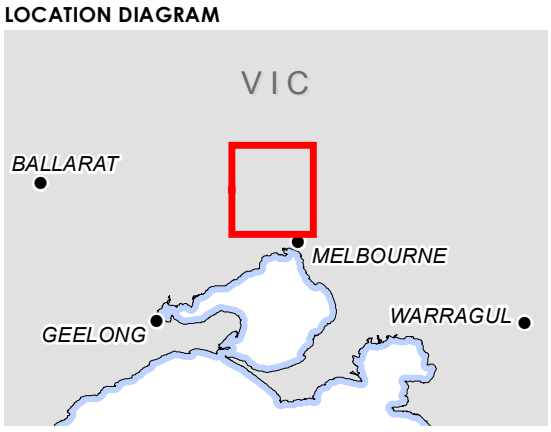
- Alignment with objectives of the Pipelines Act 2005
- Minimised co-location with the Ausnet 500kV easement
- Avoidance of impacts to the Mount Ridley Nature Conservation Reserve and adjoining MSA conservation area
- Minimisation of impacts to Merri Creek

Ongoing alignment refinement will continue to be undertaken which will be informed by consultation with stakeholders affected by the alignment as well as findings of field surveys undertaken for the Project.

Attachment 1 – Project Area of Interest



LOCATION DIAGRAM



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LEGEND:

- Town
- Medium Watercourse
- Rail
- Area of Interest
- Urban Growth Boundary
- Western Outer Ring Rd
- HV Powerline Easement
- APA Easements

Bioregion Conservation Status

- Endangered
- Vulnerable

Public Land Management

- National Parks and Conservation Reserves
- Other Conservation Reserves

DRAFT

PROJECT:	WESTERN OUTER RING MAIN
TITLE:	Area of Interest
SUBTITLE:	Project Area
DATE:	12/11/2018

DATA SOURCE:
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

DOCUMENT NUMBER: WPT-MAP-L0007

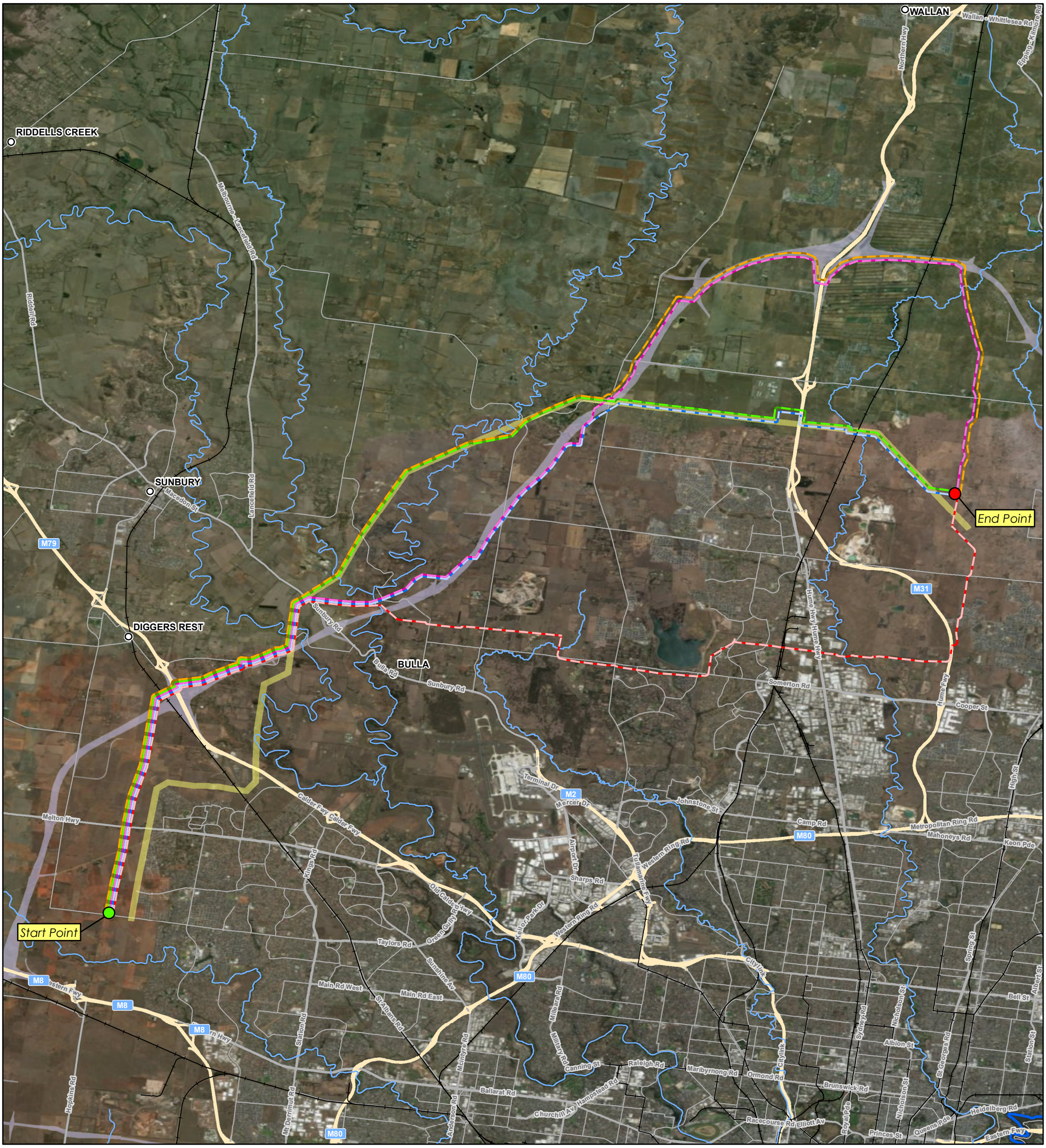
Revision	Description	Drawn	Checked	QC	Approved	Date
0.1	DRAFT	MB	BC	TH	JF	12/11/18

SCALE: 1:140,000 @ A3 GCS GDA 1994

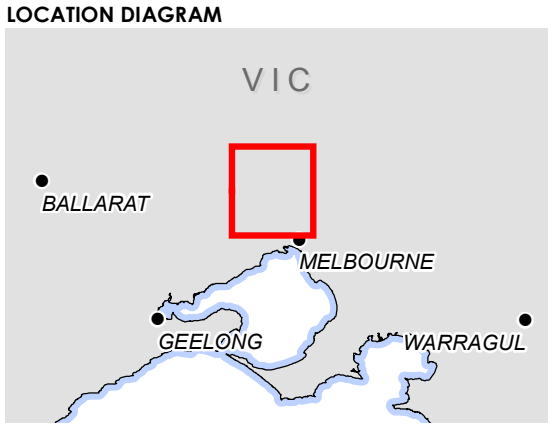
0 1 2 4 6 8
Kilometres

\\pipelinetrust\apps\GIS\Projects\WORM\Work Requests\WR6819_AOI_Map\WPT-MAP-L-0007_AOI_Rev0.1.mxd - 12 Nov 2018 - marbec

Attachment 2 – Map of Route Options



LOCATION DIAGRAM



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LEGEND:

- Town
- Large Watercourse
- Medium Watercourse
- Rail
- Western Outer Ring Rd (OMR) - Public Acquisition Overlay
- HV Power Easement

Alignment Options

- Option A
- Option B
- Option C
- Option D
- Option E

PRELIMINARY ONLY FOR CONSULTATION

PROJECT:	WESTERN OUTER RING MAIN
TITLE:	Route Option Analysis
SUBTITLE:	Options A, B, C, D & E
DATE:	6/03/2019

DATA SOURCE:
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

DOCUMENT NUMBER: WPT-MAP-L-0008

Revision	Description	Drawn	Checked	QC	Approved	Date
1.0	Issued for Use	ST				6/03/19
0.4	DRAFT	ST	MD	MD	MD	22/11/18
0.3	DRAFT	ST	JF	JF	JF	21/11/18
0.2	DRAFT	MB	JF	JF	JF	24/09/18
0.1	DRAFT	MB	BC	TH	JF	24/09/18

SCALE: 1:140,000 @ A3 GCS GDA 1994

0 1 2 4 6 8
Kilometres

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Attachment 3 – Option Scoring Matrix

Pipeline route option assessment spreadsheet

APA Parameter	Details	Metric	Notes / Assumptions	Route options A	B	C	D	E
Capital Cost	Length of alignment	Km		50.4	39.6	51.1	40.1	42.8
	Length of alignment within land zoned as Urban Growth Zone	Km		17.8	7.7	17.8	7.7	8.1
	Capital cost	**$M**		**$153.90**	**$129.53**	**$149.31**	**$122.48**	**$130.92**
1. Capital Cost	a. Variation in capital cost between options	L - Ratio to lowest cost between 1 and 1.2 M - Ratio to lowest cost is between 1.2 and 1.4 H - Ratio to lowest cost is 1.4 or greater		M	L	M	L	L
2. Relative length	a. Variation in length between options	L - Ratio to shortest option between 1 and 1.2 M - Ratio to shortest option between 1.2 and 1.4 H - Ratio to shortest option is 1.4 or greater		M	L	M	L	L
3. Constructability	a. Design and engineering complexity b. Assessment of design complexity including requirements for special coatings, non standard or additional corrosion management, electrical protection and any other	L - standard design complexity M - above standard design complexity H - signifcant design complexity	Option B follows (witithin or adjacent to) the Ausnet HV easement for most of its length. Option E traverses highly constrained areas along Somerton Road, residential drainage reserves and industrial estates.	M	M	L	M	H
	c. Terrain and geology risks d. Extent of alignment with slope>10%, known ground stability issues, shallow rock/floaters or subject to inundation.	L - Terrain and geology risk areas traversed, ratio to shortest length between 1 and 1.2 M - Terrain and geology risk areas traversed, ratio to shortest length between 1 .2 and 1.4 H - Terrain and geology risk areas traversed, ratio to shortest length 1.4 or greater	Slope >10% - A 7.25km, B 7.28km, C 1.31km, D 1.35km, E 2.59 Ground stability (GMU landslip risk H or VH) - A 4.3km, B 4.3km, C 1.6km, D 1.6km, E 1.7km Shallow rock (GMU 6.1.2, 6.1.3) - A 38.9km, B 33.7km, C 43.9km, D 38.5km, E 33.9	M	L	M	L	L
	e. Number of complex crossings. f. A complex crossing is any crossing likely to require trenchless methods. Assume trenchless crossings of M/H watercourses, freeways, highways, railways and the proposed ORM.	L - <10 M - 10-18 H - >18	Options B and D require 16 and 16 complex crossings respectively. Options A, C and E all require over 18 complex crossings.	H	M	H	M	H
	g. Space for efficient construction h. Assessment of availability of space for suitable ROW width, positioning extra workspaces and entry and exit locations for trenchless crossings.	L - no significant space constraints M - <20% of length has significant space constraints H - 20% or more of length has significant space constraints	Option E traverses the urban area of Craigieburn / Roxburgh Park and space for extra workspaces may be restricted through such areas. Powerline easement options will have constraints based on final location of easement.	M	H	L	M	H
	i. Logistics and access for construction j. Quality of roads, bridges and access to the ROW, access to lay-down and possible camp locations	L - no significant access constraints M - <20% of length has significant access constraints H - 20% or more of length has significant access constraints	Option C will have no significant access constraints. Options A, B and D (following the powerline for sections) has some significant access constraints. Option E has significant constraints through the urban areas of Craigieburn / Roxburgh Park.	M	M	L	M	H
	k. Worker safety	L - standard safety risks M - above standard safety risks H - significant safety risks	Option B presents significant safety risk as it follows (witithin or adjacent to) the Ausnet HV easement for most of its length. All other options present above standard safety risks.	M	H	M	M	M
4. Operability	a. Operational complexity b. Suitable access to easement, complexities with common infrastructure corridors.	L - standard operational complexity M - above standard operational complexity H - significant operational complexity	Option B follows (witithin or adjacent to) the Ausnet HV easement for most of its length. Option E traverses highly constrained areas along Somerton Road, residential drainage reserves and industrial estates.	M	H	L	M	H
	c. Pipeline third party damage risk	L - standard third party damage risk M - above standard safety third party damage risk H - significant safety third party damage risk	Option E presents significant safety third party damage risk. All other Options present above standard safety third party damage risk.	M	M	M	M	H
	d. Worker safety	L - standard safety risks M - above standard safety risks H - significant safety risks	Option C presents standard safety risks, Options A, D and E present above standard safety risks and Option B presents significant safety risks as it follows (witithin or adjacent to) the Ausnet HV easement for most of its length.	M	H	L	M	M
	e. Soil types (saline, acidic, high EC), effect on corrosion and CP	L - standard soil effects to CP and corrosion M - above standard soil effects to CP and corrosion H - significant soil effects to CP and corrosion	Due to the lack of detialed soil mapping itr is assumed that soil propoerties do not differ signifcantly between route opitons.	L	L	L	L	L
	f. Rehab and easement maintenance risks. Extent of alignment with problematic soils, (dispersive, ASS, reactive, saline), slope>10%, or known ground stability issues	L - standard rehab and easement maintenance risks M - above standard rehab and easement maintenance risks H - significant rehab and easement maintenance risks	For options A and B length of slope >10% is >7km and >20% is >3km. Ground stability (GMU landslip risk H or VH) - A 4.3km, B 4.3km, C 1.6km, D 1.6km, E 1.7km This presents a significant rehab risk for A and B.	H	H	M	M	M
5. Infrastructure	a. Number of State and Federal roads intersected	L - 0 M - <4 H - 4 or more	All route options intersect 6 or more State / Federal Roads	H	H	H	H	H
	b. Number of local roads intersected	L - 10 M - 11-50 H - >50	All route options intersect between 17 and 35 local roads.	M	M	M	M	M
	c. Number of railways intersected	L - 0 M - <3 H - 3 or more	Two railways are intersected by all route options except Option E.	M	M	M	M	H
5. Approvals	a. Complexity of approval pathway	L - Local authority approvals M - Greater than local authority but EES level assessment unlikely H - EES level assessment or equivalent. Commonwealth Ministerial approval likely to be required for works in conservation areas.	EES considered unlikely for all options. Options C and E are lower risk of requiring ministerial approval for impacts to MSA conservation areas due to less length of CA intersected.	H	H	M	H	M
	b. Length of existing or proposed infrastructure easements followed	L - > 50% of alignment M - 20 to 50% of alignment H - < 20% of alignment	All Options following existing or proposed infrastructure easements for over 75% of the alignment.	L	L	L	L	L
	c. Schedule impact of approval pathway	L - 3 months post submission M - 3 to 12 twelve H - >12 months post submission	All route options likely to be considered as a 'controlled action' under the EPBC Act.	H	H	H	H	H
6. Community	a. Potential community benefit due to opportunity to provide gas supply to areas traversed by the alignment	L - Provides significant opportunities for new city gates. M - Provides some opportunities for new city gates. H - Does not provide opportunity for new city gates		L	M	L	M	M
	b. Community safety - safety and health risks to the public due to construction and operation of the pipeline	L - standard safety and health risks M - above standard safety and health risks H - significant safety and health risks	All options will be subject to design, construction and operation in accordance with AS2885	L	L	L	L	L
	c. Impacts to known areas of high value to the community	L - No known areas of high community value intersected M - <3 known areas of high community value intersected H - 3 or more known areas of high community value intersected	Currently identified as Jacksons Creek and Merri Creek based on meetings with Melton, Hume and Whittlesea City Councils.	M	M	M	M	M
7. Land	a. Variation in number of parcels intersected between options	L - no of parcels, ratio to lowest number between 1 and 1.2 M - no of parcels, ratio to lowest number between 1 .2 and 1.4 H - no of parcels, ratio to lowest number 1.4 or greater	Options A 146, Option B 143, Option C 143, Option D138, Option E 159	L	L	L	L	L
	b. Residential tenure (current or zoned)	L - avoids residential tenure M - traverses residential tenure but no conflict expected H - traverses residential tenure and land use conflict expected	Options A and C avoid residential tenure. Options B and D traverse approximately 700m of residential tenure while Option E traverses approximately 3.2km of residential tenure.	L	M	L	M	M
	c. Industrial tenure	L - avoids industrial production tenure M - traverses industrial tenure but no conflict expected H - traverses industrial tenure and land use conflict expected	Options A and C avoid industrial tenure. Options B and D traverse approximately 40m of industrial tenure while Option E traverses approximately 1.2km of industrial tenure.	L	M	L	M	M
	d. Resource tenure - production (not including gas production tenements providing gas to the line)	L - avoids resource production tenure M - traverses resource production tenure but no conflict expected H - traverses resource production tenure and land use conflict expected	All options have similar impacts on resource tenure with any conflicts likely to be resolvable through minor alignment refinements.	M	M	M	M	M
	e. Resource tenure - exploration	L - avoids M - intersects H - NA	All route options avoid exploration resource tenure.	L	L	L	L	L
	f. Forestry tenure	L - avoids M - intersects H - NA	All route options avoid forestry tenure.	L	L	L	L	L
	g. Conservation tenure	L - avoids by 500m M - within 500m or intersects but will be avoided H - intersects	Options B and D intersect Mount Ridley Nature Conservation Reserve. Options A and C avoid all conservation tenure by at least 500m. Option E is within 500m of the Craigieburn Grassland Nature Conservation reserve.	L	H	L	H	M
	h. Future Land use conflicts UGZ - Urban Growth Zone, CDZ - Comprehensive Development Zone	L - Land use conflict length traversed, ratio to shortest length between 1 and 1.2 M - Land use conflict length traversed, ratio to shortest length between 1 .2 and 1.4 H - Land use conflict length traversed, ratio to shortest length 1.4 or greater	Options B and D both traverse approximately 7.7km of UGZ and CDZ, options A and C traverse approximately 17.8km of UGZ and CDZ, while Option E traverses approximately 10.4km of UGZ and CDZ.	H	L	H	L	M
8. Environment and heritage	a. Special biodiversity values (Ramsar, World Heritage, Biosphere Reserve)	L - 0 M - NA H - 1 or more	No special biodiversity values (Ramsar, World Heritage, Biosphere Reserve) are impacted by any of the route options.	L	L	L	L	L
	b. Length of MSA conservation areas intersected	L - CA length traversed, ratio to shortest length between 1 and 1.2 M - CA length traversed, ratio to shortest length between 1 .2 and 1.4 H - CA length traversed, ratio to shortest length 1.4 or greater	A - 1651m, B - 3516m, C - 1553m, D - 3418m, E - 2308m	L	H	L	H	H
	c. Length of threatened ecological communities and habitat for threatened species intersected	L - TEC length traversed, ratio to shortest length between 1 and 1.2 M - TEC length traversed, ratio to shortest length between 1 .2 and 1.4 H - TEC length traversed, ratio to shortest length 1.4 or greater	Options A, B and D traverse approximately 7.3km, 9.2km and 7.7km respectively of endangered and vulnerable ecological communities. Options C and E traverse approximately 5.7km and 5.5km respectively.	M	H	L	H	L
	d. Extent of remnant vegetation	L - remnant veg length traversed, ratio to shortest length between 1 and 1.2 M - remnant veg length traversed, ratio to shortest length between 1 .2 and 1.4 H - remnant veg length traversed, ratio to shortest length 1.4 or greater	Options A, B and D traverse approximately 7.3km, 9.2km and 7.7km respectively of remnant vegetation. Options C and E traverse approximately 5.7km and 5.5km respectively.	M	H	L	H	L
	e. Watercourses - number of crossings of major watercourses	L - 0 M - <3 H - 3 or more	All alignments cross 3 or more major watercourses.	H	H	H	H	H
	f. Wetlands - number	L - 0 M - <3 H - 3 or more	Option D does not traverse any wetlands, Options B and E traverse a single wetland, Option C traverses 2 and Option A traverses 3 wetlands.	H	M	M	L	M
	g. Floodplains - length intersected	L - floodplain traversed, ratio to shortest length between 1 and 1.2 M - floodplain traversed, ratio to shortest length between 1 .2 and 1.4 H - floodplain traversed, ratio to shortest length 1.4 or greater	Scored as low throughout as LSIO intersection is less than 200m for all routes	L	L	L	L	L
	h. Registered heritage sites	L - 0 M - <3 H - 3 or more	All Options intersect a single registered heritage site	M	M	M	M	M
	i. Cultural Heritage Sensitivity - length intersected	L - CH sensitivity length traversed, ratio to shortest length between 1 and 1.2 M - CH sensitivity length traversed, ratio to shortest length between 1 .2 and 1.4 H - CH sensitivity length traversed, ratio to shortest length 1.4 or greater	Option D traverses approximately 3.3km of cultural heritage sensitivity, Options B and C traverse approximately 4.3km and 4.2km respectively and Options A and E traverse approximately 5.1km and 5.5km respectively.	H	M	M	L	H
	j. Native title claims	L - 0 M - <3 H - 3 or more	There are no native title claims traversed by any of the route options.	L	L	L	L	L
	h. Amenity impacts (noise, dust, visual)	L - standard amenity impacts during pipeline construction M - above standard amenity impacts during pipeline construction H - significant amenity impacts during pipeline construction	All routes considered to have above standard amenity impacts due to construction though a residential area for the first 3.3km. In addition, Option E traverses existing residential areas between Mickleham Road and the Hume Highway so is assessed to have significant amenity impacts.	M	M	M	M	H

Criteria Group	Weighting		Weighted A	B	C	D	E
Capital cost	**15%**		0.30	0.15	0.30	0.15	0.15
Relative length	**5%**	**20%**	0.10	0.05	0.10	0.05	0.05
Constructability	**5.0%**		0.11	0.11	0.08	0.09	0.13
Operability	**5.0%**		0.08	0.10	0.06	0.08	0.09
Infrastructure	**5.0%**		0.12	0.12	0.12	0.12	0.13
Approvals	**5.0%**	**20%**	0.12	0.12	0.10	0.12	0.10
Community	**20%**		0.27	0.33	0.27	0.33	0.33
Land	**20%**		0.28	0.33	0.28	0.33	0.33
Environment and heritage	**20%**	**60%**	0.38	0.42	0.31	0.38	0.38
TOTAL	**100%**	**100%**					
MEAN			1.75	1.72	1.61	1.64	1.69
RANK			5	4	1	2	3

Attachment 4 - Map of Preliminary Alignment for Consultation

MAP DETAILS

SHEET: **SERIAL #:** WPT-MAP-L-0016

AUTHOR: ST **DATE:** 15/02/2019

DATA SOURCE:

Service Layer Credits: © OpenStreetMap (and) contributors, CC-BY-SA Esri, HERE, Garmin, © OpenStreetMap contributors, and the GIS user community

SCALE: 1:100,000 **PAGE SIZE:** A3

N

0 2.5 5km

GDA 1994 MGA Zone 55

LEGEND

- Western Outer Ring Main – Preliminary Alignment for Consultation
- Existing APA Pipelines
- HV Powerline Easement
- Outer Metropolitan Ring Road (OMR) Public Acquisition Overlay

OVERVIEW

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Western Outer Ring Main – Overview

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