



Attachment N

Pipeline Route Options Report

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Melbourne Airport Jet Pipeline Project

Pipeline Route Options Report

Viva Energy Australia

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1 Introduction

Viva Energy Australia (Viva Energy) is proposing to construct and operate a new jet fuel pipeline to support the growing fuel needs at Melbourne Airport.

As Australia's second largest airport, annual passenger numbers for Melbourne Airport are expected to more than double by 2042 – increasing from 35 million to more than 76 million per year¹. In line with this projected increase in passenger numbers, the requirement for jet fuel is expected to increase significantly, with future demand expected to exceed the capacity of the existing fuel supply infrastructure. Currently, additional fuel is transported via truck to the Joint User Hydrant Installation (JUHI) facility. The development of the new pipeline will provide faster replenishment of fuel stocks, reduce truck movements on roads and provide a more robust fuel supply chain.

The proposed pipeline aims to:

- Help meet the increasing demand for jet fuel and support future growth at Melbourne Airport
- Increase the supply security of jet fuel which will contribute to the Victorian state economy
- Reduce the reliance on road transport for jet fuel supply with fewer trucks required to deliver fuel to the airport.

1.1 Purpose of this document

This report describes the route options assessment process undertaken in developing the proposed pipeline route.

2 Background and context

Melbourne Airport is supplied with jet fuel by either marine imports through terminals in Melbourne's west or by local production at the Geelong Refinery. Regardless of origin, there is a single pipeline system that services the airport – a combination of the sequential Altona to Somerton pipeline (PL118) and the Somerton to Tullamarine pipeline (PL119) which transfers jet fuel from Melbourne's terminals to the airport. Jet fuel from the Geelong Refinery is initially transferred to the Melbourne terminals via two multi-product pipelines (PL7 and PL8) before being subsequently stored and transferred through the previously described pipeline system.

The overall pipeline system has limited capacity as it is constrained by the final leg between Somerton and Tullamarine (i.e., PL119). PL119 is the final 11 km section of the pipeline system and is smaller than the rest of the system, creating a 'bottleneck' in the supply chain. This restriction means that the sole pipeline servicing Melbourne Airport is not capable of supplying its full jet fuel requirements.

There has been consideration and broad analysis of several concepts to resolve this limitation. Construction and operation of a new pipeline branching off from the higher-capacity PL118 and terminating at Melbourne Airport was selected as the basis for this proposed pipeline project and progressed to the pipeline route options identification, analysis, and selection stage. The route options assessment process and outcomes are detailed within this report.

¹ Melbourne Airport Preliminary Draft Master Plan 2022

3 Assessment methodology

Aurecon undertook a route options assessment to evaluate potential routes associated with the construction and operation of a new pipeline branching off from PL118 and terminating at Melbourne Airport. The development and assessment of the potential route options was undertaken through a staged approach that comprised:

- **Route options identification**

- This comprised the development of pipeline route options with consideration of the feasibility and constructability of the proposed pipeline, in conjunction with high-level analysis of potential impacts to landholders, community, and the environment. All routes where possible followed cadastral boundaries and attempted to minimise crossing roads, railway lines, watercourses and high-density suburban areas.

A summary of the pipeline route options identified for evaluation is provided in Section 4.

- **Evaluation of the route options**

- The route options were evaluated against a set of criteria developed with consideration of AS2885.1:2018 Pipelines – Gas and liquid petroleum. Part 1: Design and construction. The criteria are shown in Table 1 along with what was considered during the evaluation.

Information on the findings from the evaluation are provided in Section 5.

Table 1 Route options assessment criteria

Criteria	MCA weighting	Considerations
Safety	25%	<ul style="list-style-type: none"> - Risk to the public - Proximity to populated areas, third party assets, sensitive users, and residential land - Available access and space for construction to manage public and worker safety - Low or high consequence areas.
Environment	15%	<ul style="list-style-type: none"> - Environmentally sensitive areas - Threatened flora and fauna species and their habitat - Native vegetation - Waterway crossings - Areas of contamination.
Traffic and Transport	15%	<ul style="list-style-type: none"> - Impacts to traffic - Availability of construction access/space at road crossings - Number of roads crossed.
Hydraulics	15%	<ul style="list-style-type: none"> - Location of tie-in suitable for hydraulic considerations with respect to upstream supply storage locations - Length of pipeline route - Changes in direction along pipeline route.
Operational Access	10%	<ul style="list-style-type: none"> - Ease of locating associated operations facilities - Ability to carrying out routine operability and maintainability of plant and equipment - Space for right of way/easement tracks for integrity management (potholing, pipeline repairs) of the pipeline - Accessibility for cathodic protection test units
Heritage	5%	<ul style="list-style-type: none"> - Culturally significant areas - Registered heritage sites - Areas of cultural heritage sensitivity
Landowners	5%	<ul style="list-style-type: none"> - Number of landowners/land parcels - Public or private landowners - Existing land uses

Criteria	MCA weighting	Considerations
Future Land Use	5%	- Future land use - Conflicts with potential future land uses
Terrain Complexity	5%	- Difficulty in construction along proposed route (i.e. curved natural surfaces, creeks, hills grade condition) - Geology
Weighting total	100%	

■ Multi-criteria analysis of the route options

- Following evaluation of the route options, a weighted multi-criteria analysis (MCA) was developed to logically determine the preferred pipeline route. Each option was assessed against the criteria detailed in Table 1 and were then classified as either:
 - Low (L) – risks are considered standard or typical for a project of this nature and are expected to be mitigated through design or relevant guidance/legislation.
 - Medium (M) – most risks are considered standard or typical for a project of this nature, however some could be more significant, and project specific measures may need to be developed to manage potential risks.
 - High (H) – poses significant risks that are not typical for a project of this nature. Further assessment and project specific measures are likely required. Measures may not fully control risks and residual risks may be unacceptable.

Classifications were made with consideration of the conditions along each route, the proposed pipeline design and anticipated construction methodology and based on professional judgement and experience working on similar projects of this nature.

Scores of 1, 2 or 3 were applied to L, M, H classifications respectively. Scores were then multiplied by the MCA weighting presented in Table 1 to obtain a weighted score for each criterion. The sum of the weighted scores across all criteria for each route option was then calculated, resulting in rankings from most favourable (lowest score) to least favourable (highest score).

Results of the MCA are presented in Section 6.

■ Selection of a preferred pipeline route

- Following the MCA, a preferred pipeline route was selected for progression to detailed design. Details on the preferred option are presented in Section 7.

3.1 Limitations and assumptions

The following limitations and assumptions apply to the options assessment:

- The proposed jet fuel pipeline would be designed using a primary location class of T1 (Residential).
- The proposed jet fuel pipeline flow capability is required to match the current flow capability of PL118.
- The proposed pipeline would be DN350 grade X56 with nominal wall thickness of 11.8mm. Note PL118 is DN350 grade X42 with nominal wall thickness 7.92mm.
- For the purposes of the route options assessment, the pipeline specifications and auxiliary infrastructure are considered to be the same for each option.
- Hydraulic calculations / analysis was not performed on each pipeline route, only a high-level review (qualitative) of hydraulic performance with only a visual assessment of tie-in point location, pipeline length and change in direction (bends) was undertaken.
- Geology is assumed to be the same across all routes.
- No consideration was made regarding the availability of existing pipeline corridor opportunities.

- The options assessment has been undertaken with consideration of AS2885. Cost has not been documented in this report and not factored into MCA scoring/weighting. Viva Energy will consider costings of each option in final selection of pipeline route.
- The options assessment is based on industry experience with assessment of criteria and considerations outlined in sections below. This is qualitative assessment only and has not factored in any form of consequence and likelihood analysis in determination of the risk rating.

4 Route options identification

All routes were required to tie-in to PL118 and connect to the JUHI facility at Melbourne Airport. PL118 is located within the northern region of Melbourne. The pipeline runs adjacent to the railway freight line near Western Ring Road (M80) located southeast of the Melbourne Airport before it reaches Pascoe Vale Road and travels north to the Somerton Tank Farms.

At its closest alignment south-east of the airport, PL118 passes within 6 to 7 kms of the JUHI facility. Potential tie-in points to PL118 were chosen along this approximate 10 km section of PL118, between the Calder Freeway, Airport West and Barry Road, Dallas, to minimise the overall length of the route options. Tie-in points outside of these limits would unnecessarily increase the proposed pipelines length, increase the potential to impact the surrounding area and have little to no increased benefits.

Five potential routes options were identified for evaluation. These are shown in Figure 1 and discussed in Sections 4.1 to 4.5.

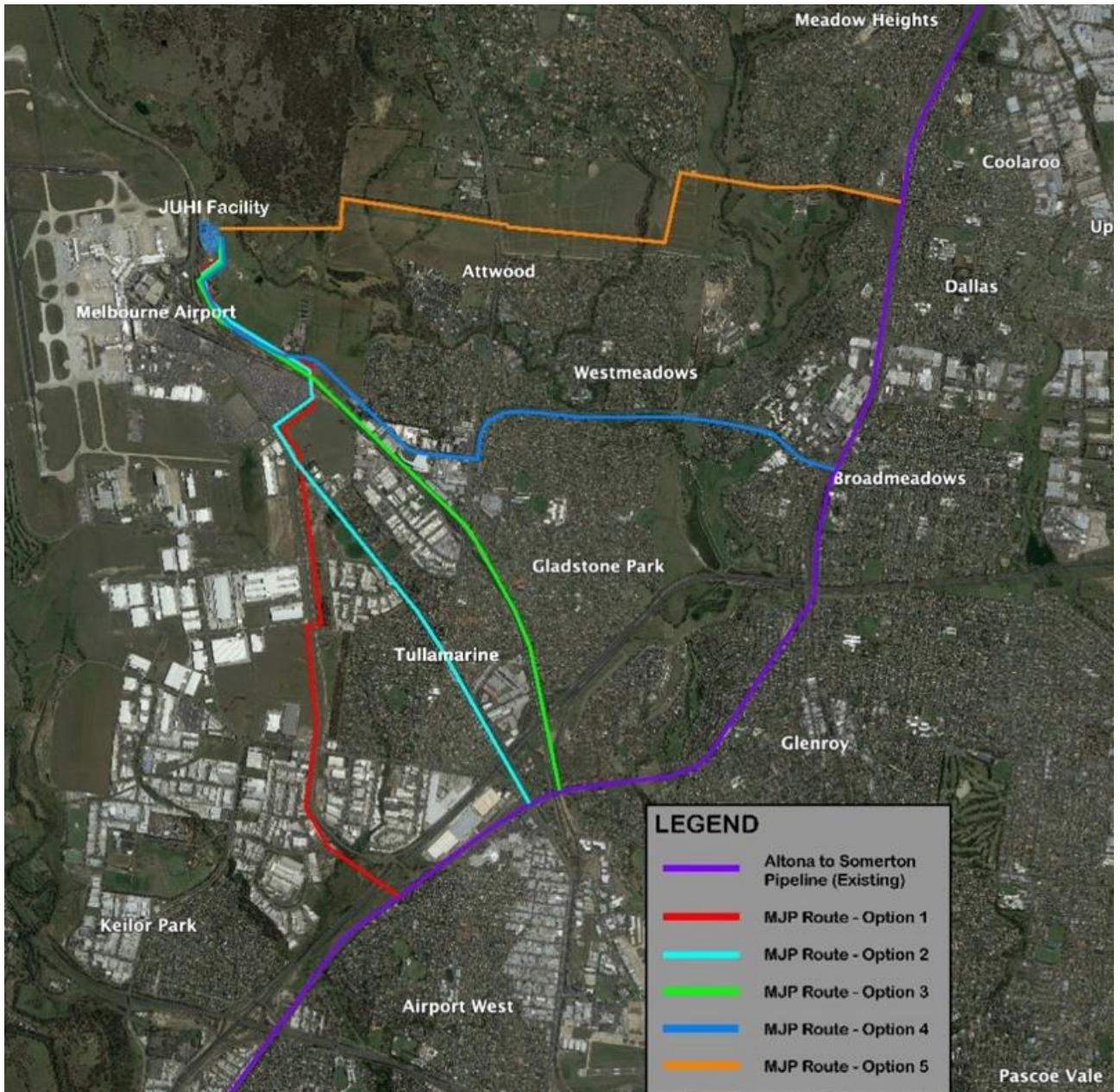


Figure 1 Pipeline route options

4.1 Route Option 1

Option 1, shown in Figure 2, commences near the intersection of Western Ring Road (M80) and Airport Drive. The option crosses under the Western Ring Road and then has a north running alignment adjacent to Airport Drive before traversing northeast adjacent to Mercer Drive and then following a northwest alignment along the Tullamarine Freeway (M2) to the JUHI facility.

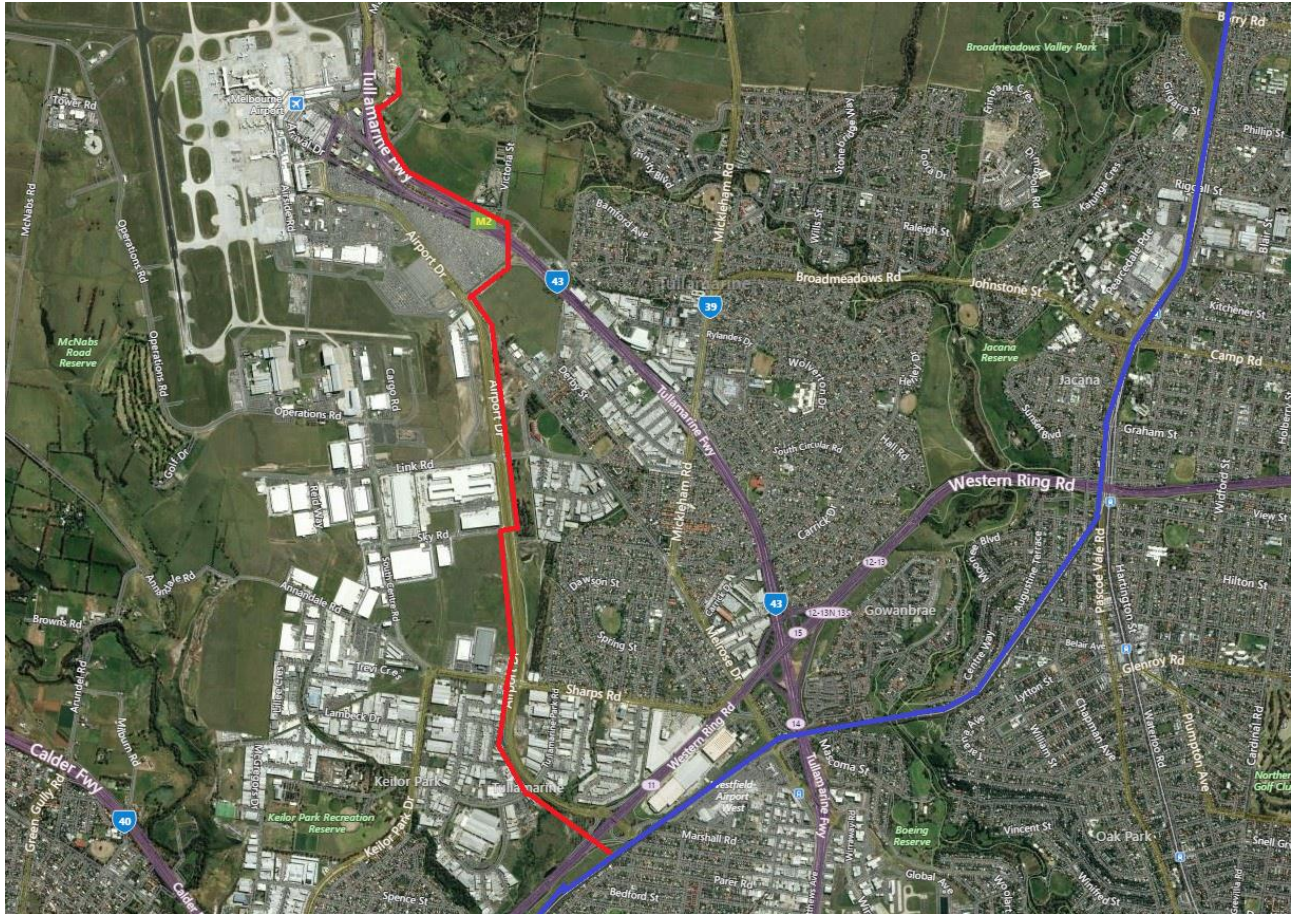


Figure 2 Route Option 1

Three locations along the route are expected to require horizontal directional drilling (HDD) crossings. One to cross the Western Ring Road, a second to pass under Tullamarine Park Road (also crossing under Steele Creek) at a combined approximate total length of 500m and a third at Mercer Drive and the Tullamarine Freeway, at an approximate total length of 280m.

Multiple bored crossings are also expected to be required, including along Airport Drive, Sharps Road and Link Road. Each bored crossing is expected to be approximately 100m in length.

4.2 Route Option 2

Option 2, shown in Figure 3, connects into PL118 further downstream from Option 1 near the intersection of Western Ring Road (M80) and Melrose Drive. The option has a north running alignment along Melrose Drive until intersecting with Airport Drive. The alignment then continues along the same route as Option 1, along Mercer Drive and Tullamarine Freeway (M2) to the JUHI facility.

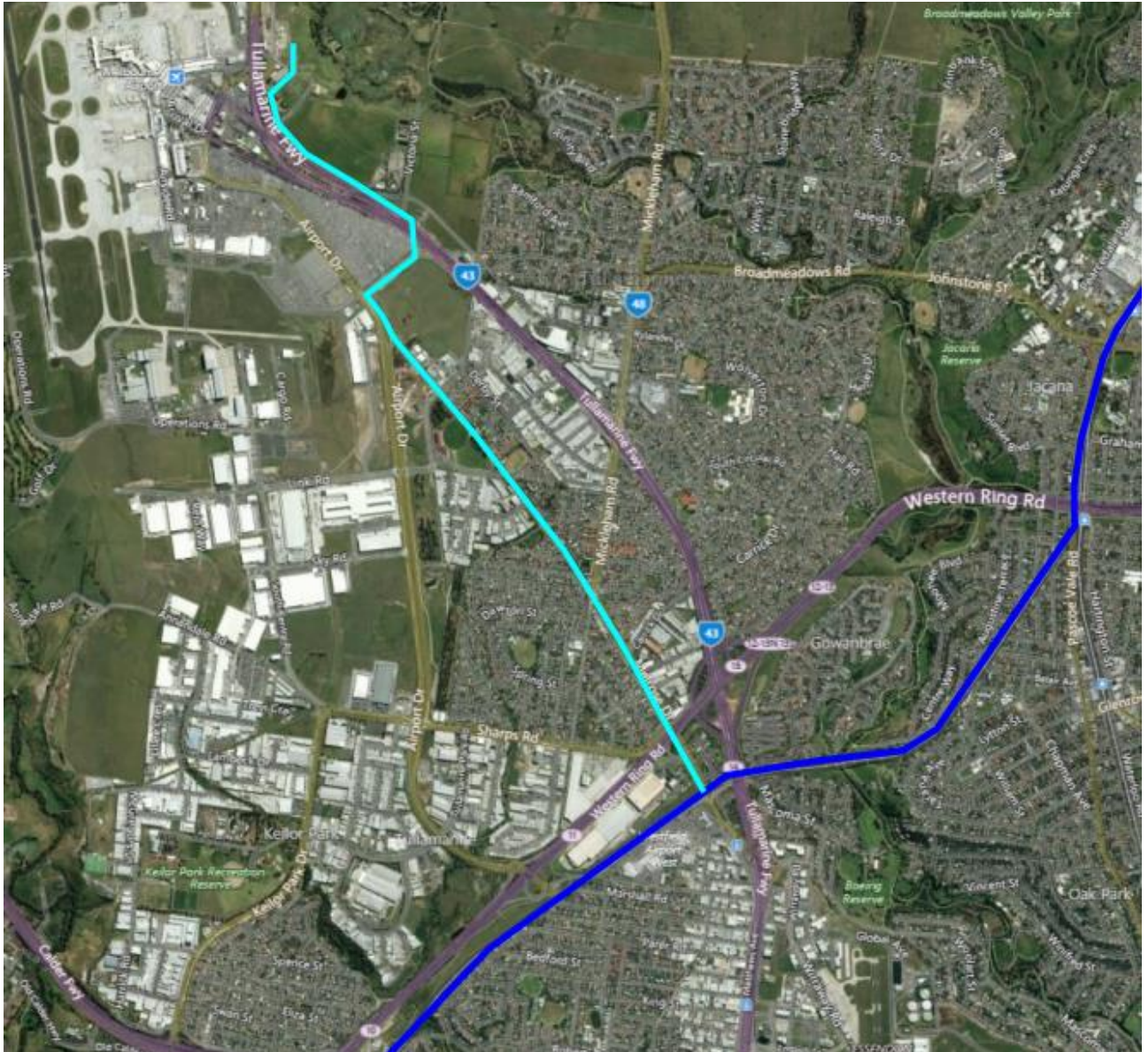


Figure 3 Route Option 2

Two locations along the route are expected to require HDD crossings, one crossing under the Western Ring Road at an approximate total length of 600m and another for Mercer Drive and the Tullamarine Freeway (M2) at an approximate total length of 120m.

Multiple bored crossings may be required along Melrose Drive, including under Broadmeadows Road, Trade Park Drive and Watson Drive.

The new pipeline would run parallel to Melrose Drive, in the easement between the main road and a smaller local road. HDD is expected to be required to cross the Western Ring Road (M80). HDD in this location would be difficult due to the limited space between Melrose Drive.

This route is highly residential, so has an increased risk to the community and is more likely to have delays during construction. The northern section of Melrose Drive would require the pipeline to be installed close to residential driveways.

4.3 Route Option 3

Option 3, shown in Figure 4, connects into PL118 on the eastern side of the Tullamarine Freeway. This option has a north and north-east running alignment along the Tullamarine Freeway (M2) to the JUHI facility.

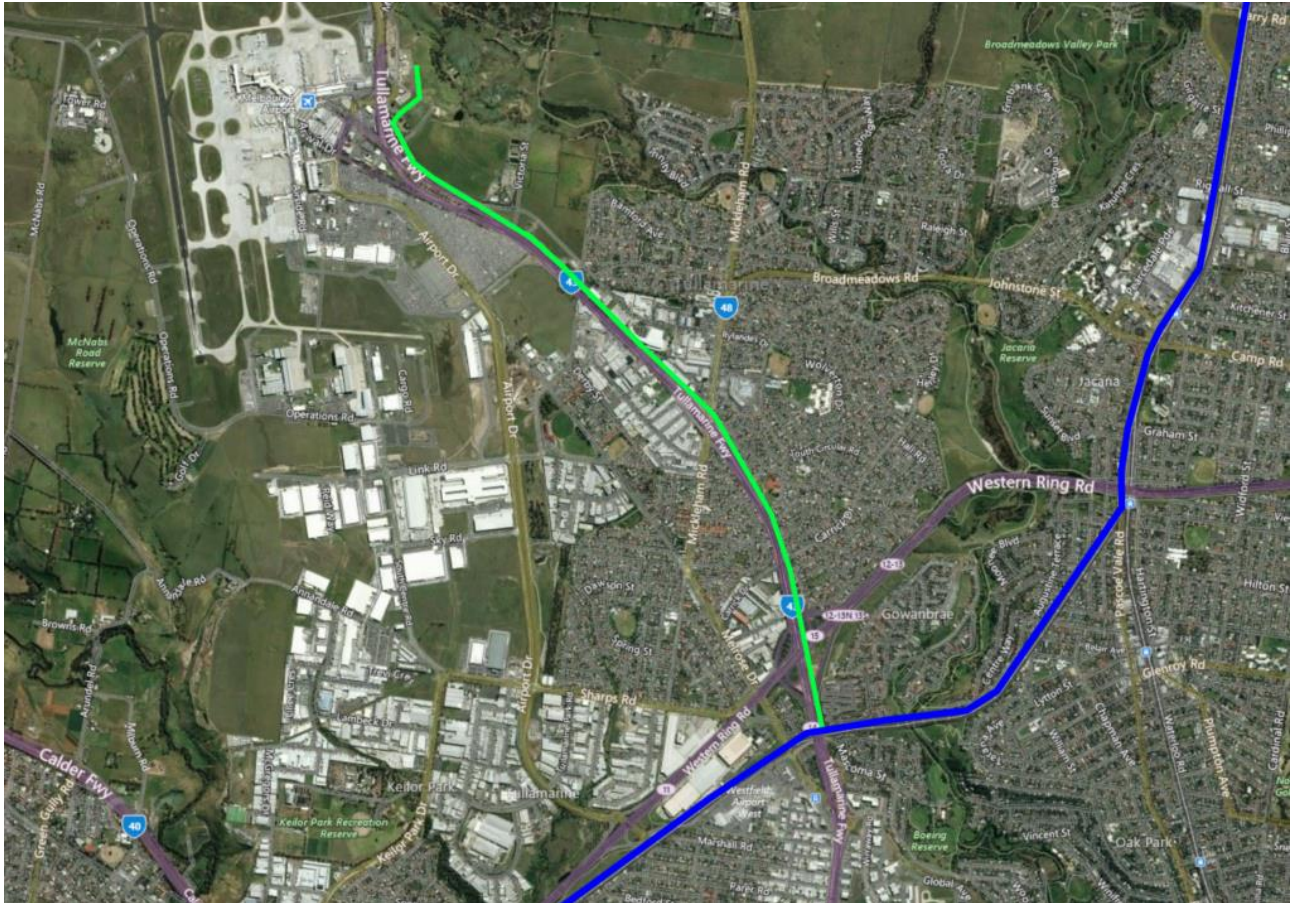


Figure 4 Route Option 3

HDD crossings are expected to be required at two locations, one under the Western Ring Road (M80) at an approximate total length of 800m and a second under Mickleham Road at an approximate total length of 200m. A single bored crossing is also expected to be required along Carrick Drive.

The new pipeline will have limited space for most of its length parallel to the Tullamarine Freeway.

Like Option 2, this option contains high-density residential areas and therefore has an increased risk to the community and delays during construction are likely. The HDD crossing under the Western Ring Road (M80) would be difficult due to the length and availability of space through this large intersection. It is likely that multiple entry shafts would be required assuming the HDD technology used is micro tunnelling.

4.4 Route Option 4

Option 4, shown in Figure 5, commences near the intersection of Pascoe Vale Road and Johnstone Street. This option has a westerly running alignment along Johnstone Street/Broadmeadows Road, south along Mickleham Road, and then following Western Avenue with a west and north-west alignment to the JUHI facility.

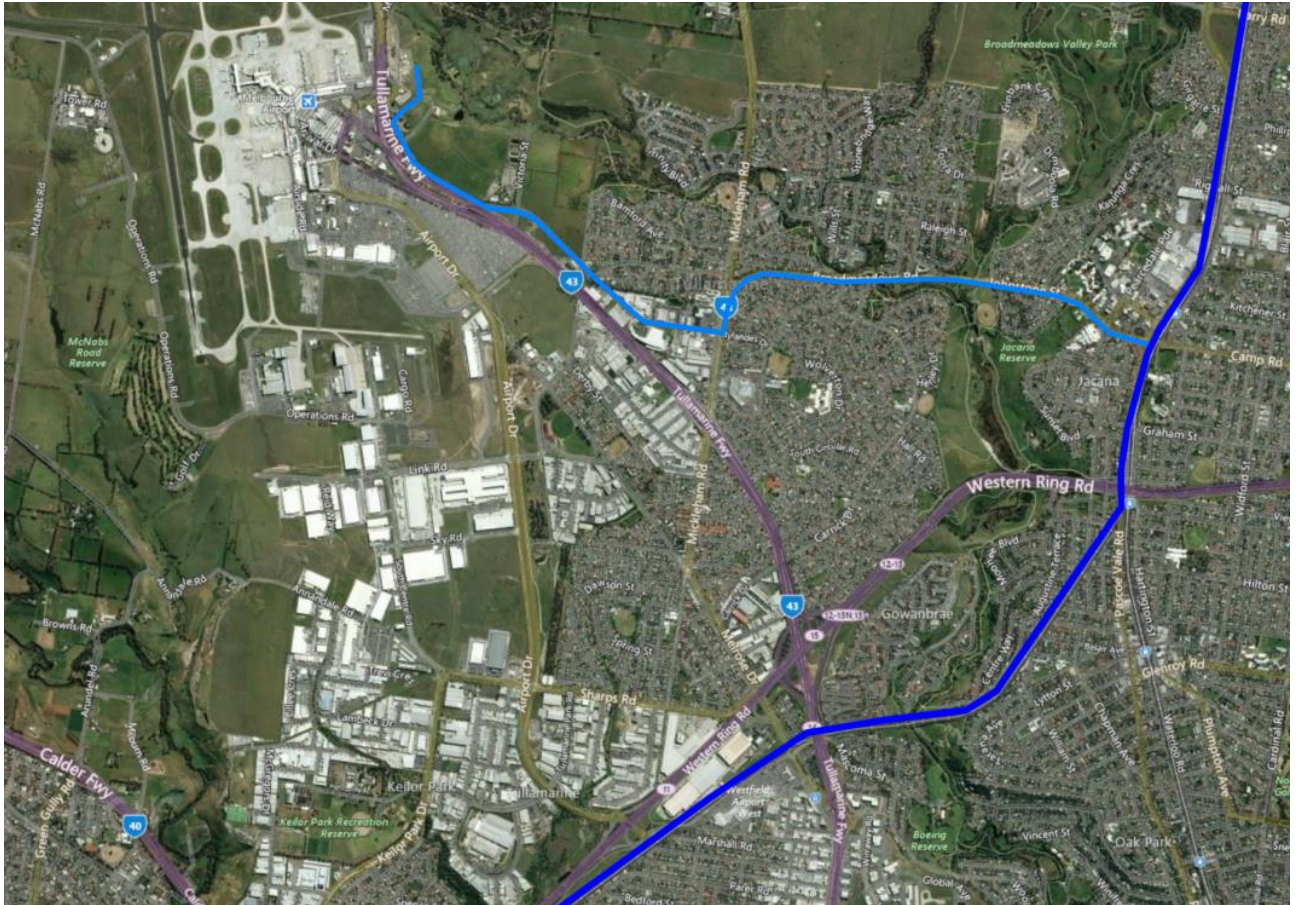


Figure 5 Route Option 4

HDD crossings are expected to be required at four locations along the route. One under Pascoe Vale Road at an approximate total length of 200 m, one at Yuroke Creek and another at Moonee Ponds Creek along Broadmeadows Road, both at approximately 80 m long and one located at the Western Avenue and Mickleham Road intersection at approximately 100 m in length.

Multiple bored crossings are expected to be required along the proposed route including under Bamburgh Street, Lorraine Crescent, Hendricks Crescent and North Circular Road.

Most of the route option is in moderate density residential areas including some higher density residential/commercial areas in its western extent.

4.5 Route Option 5

Option 5, shown in Figure 6, connects into PL118 further downstream of all other options and commences near the intersection of Pascoe Vale Road and Barry Road. The option has a westerly running alignment from Pascoe Vale Road, initially along the southern side of Barry Road and then through largely open land to the JUHI facility (crossing Crescent Drain, Yuroke Creek, Attwood Creek, and Moonee Ponds Creek).

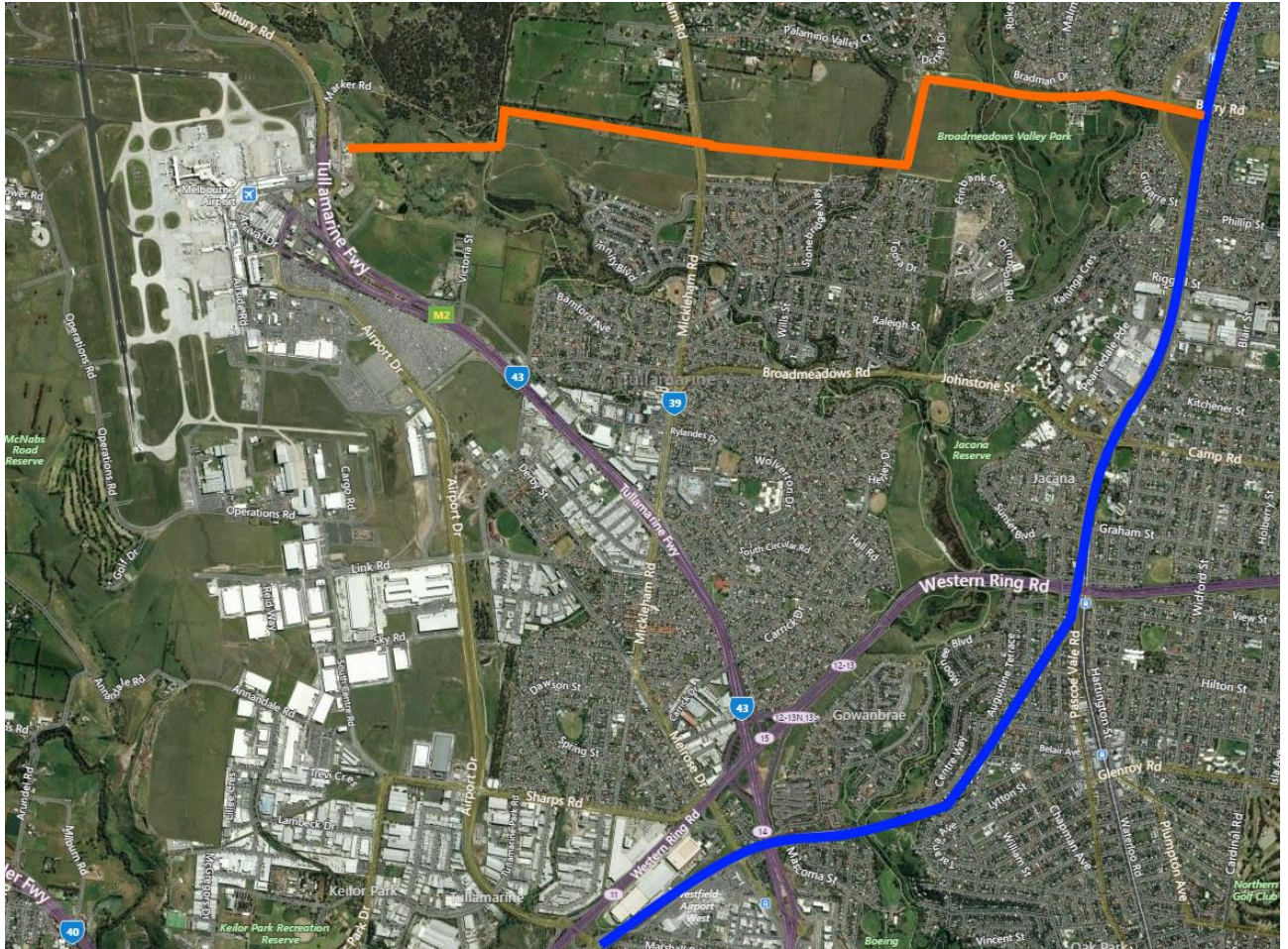


Figure 6 Route Option 5

This route passes through publicly accessible land including Broadmeadows Valley Park, as well as a range of small dirt roads and bicycle/walking trails. Further west the route runs along the boundary of the Woodlands Historic Park before reaching the tie-in point at the JUHI facility.

5 Evaluation of the route options

5.1 Conditions along each pipeline route

Information relevant to the assessment and comparison of the different route options is set out in Table 2 and Table 3.

Table 2 Key route option statistics

Statistic	Option 1	Option 2	Option 3	Option 4	Option 5
Pipeline route length (km)	6.9	6.3	6.1	6.9	6.7
PL118 tie-in point approximate chainage i.e. distance of tie-in from Altona Refinery (km)	21	22.6	22.8	26.9	29.4
Distance of flow path from Altona Refinery to JUHI facility via pipeline option route (km)	27.9	28.9	28.9	33.8	36.1
Number of freeways/highways crossed	2	2	1	1	1
Number of roads crossed	7	15	4	6	1
Number of watercourses crossed	1	0	0	2	4
Number of residential properties (within approximately 50m)	0	160	50	110	0
Total length of HDD required (km)	0.78	0.72	1	0.46	0.3
Number of pipeline direction changes in route	4	4	3	4	4

Table 3 Length of route through various land area types

Land area type	Length of route in area type (km)				
	Option 1	Option 2	Option 3	Option 4	Option 5
Residential areas	0	2.8	1.3	2.3	0
Industrial areas	1.6	0.5	1.3	0	0
Agricultural land	1.2	1.1	1.3	1.5	0
Public service and utility land	0	0	0	1.0	2.7
Park and recreational areas	0	0	0	0.2	1.6
Commercial areas	0	0	1.6	1.3	0
Commonwealth / green wedge land	4.1	1.9	0.6	0.6	2.4
Cultural heritage sensitive areas	1.7	0.4	0	1.4	1
High level biodiversity value areas	0.8	0.3	0	0.2	1.1

5.2 Safety

Table 4 Safety evaluation

Option	Evaluation
General	<p>All route options, except Option 5, pass through a small portion of agricultural zoned land north of the Tullamarine Freeway. Passing through this portion of land does not necessarily increase the risk of damage to the pipeline unless it is found that large ground-breaking equipment or deep rippers are used as part of regular farming activity. Additional depth of cover may be required in areas where this is expected.</p>
Option 1	<p>Option 1 is located mainly in industrial or open areas and is away from most residential areas. This option has low consequence areas along route and is unlikely to cause significant disturbance to the public and surrounding assets. This option has a low potential to damage properties during construction.</p> <p>Option 1 also provides accessibility for construction access and adequate areas for construction and operational activities to manage potential safety risks to workers and the public.</p> <p>Sensitive uses along the route include:</p> <ul style="list-style-type: none"> ■ Creative Garden Early Learning Tullamarine ■ The Joey Club Melbourne - Childcare Centre.
Option 2	<p>A large portion of Option 2 passes through high density residential areas where the risk of loss of containment is likely to be one of the dominant considerations in relation to public safety. The option has high consequence areas along route.</p> <p>Installing the proposed pipeline in this area is also likely to present challenges with existing buried services. Careful planning through this section would be required, including assessment to identify any potential obstructions, existing assets and all other pertinent data along the proposed route.</p> <p>This option has limited available space for construction between the major roads in the surrounding area which could increase the safety risk to workers and the public.</p> <p>Sensitive uses along the route include:</p> <ul style="list-style-type: none"> ■ Tullamarine Complete Health Centre ■ Creative Garden Early Learning Tullamarine ■ The Joey Club Melbourne - Childcare Centre.
Option 3	<p>Option 3 is located along a major road and passes through high density residential areas. This option also has high consequence areas along route. The considerations for this route are similar to that of Option 2 in that there is an increased risk to public safety and there is limited space for construction activities which could increase the safety risk to workers and the public.</p> <p>Sensitive uses along the route include:</p> <ul style="list-style-type: none"> ■ Tullamarine Clinic Medical Centre ■ Peer Medical Centre ■ Creative Garden Early Learning Tullamarine.

Option	Evaluation
Option 4	<p>A large portion of the route for Option 4 passes through residential areas and public service land where the route runs adjacent to parks and reserves. This route passes the greatest number of properties when compared to the other routes. The option has high consequence areas along route.</p> <p>This option also has limited available space for construction which could increase the safety risk to workers and the public.</p> <p>Sensitive uses along the route include:</p> <ul style="list-style-type: none"> ■ Gowrie Broadmeadows Valley Child Care Centre ■ Broadmeadows Hospital ■ Northern Music School ■ Broadmeadows Valley Primary School ■ Aspirational Care Services (Aged Care) ■ Creative Garden Early Learning Tullamarine.
Option 5	<p>Option 5 is located on the south side of Barry Road while all residential areas are on the north side of Barry Road. Separation between the pipeline and the residential areas can be achieved by placing the proposed pipeline south of Barry Road. This option has the low consequence areas along route.</p> <p>Option 5 provides accessibility for construction access and adequate areas for construction and operational activities to manage potential safety risks to workers and the public.</p> <p>Sensitive uses along the route include:</p> <ul style="list-style-type: none"> ■ Meadow Heights Medical Practice.

5.3 Environment

Table 5 Environment evaluation

Option	Evaluation
General	<p>A portion of each route option passes into the Sunbury Green Wedge, with the Melbourne Airport recognised as a key feature in the southern part of the Green Wedge. Most of the Sunbury Green Wedge land is recognised as high value terrestrial habitat in the Victorian Volcanic Plains Bioregion, however, none of the routes will impact on the most biodiverse parts of this land.</p> <p>All routes have the potential for contamination to be present due to historic and current land use along each route and in the surrounding area.</p>
Option 1	<p>Option 1 is mainly located in already developed urban and industrial areas. Small areas of native vegetation have the potential to occur along Airport Drive and Western Avenue. If present it is expected that this vegetation could be avoided during construction of the pipeline. There are also amenity plantings along the route.</p> <p>There is the potential for threatened flora and fauna species to be present along the route although historical recordings are minimal. Due to the urbanised setting of the option, it is considered unlikely that significant habitat would be impacted.</p> <p>The main environmental receptor along the route is Steele Creek North. The option crosses Steele Creek North in the southern extent of the route.</p>

Option	Evaluation
Option 2	<p>Option 2 mainly passes through already developed urban and industrial area and does not cross any creeks or other waterbodies. Small areas of native vegetation have the potential to occur along Airport Drive and Western Avenue. If present it is expected that this vegetation could be avoided during construction of the pipeline. There are also amenity plantings along the route.</p> <p>There is the potential for threatened flora and fauna species to be present along the route although historical recordings are minimal. Due to the urbanised setting of the option, it is considered unlikely that significant habitat would be impacted.</p> <p>Tullamarine Reserve and the Trade Park Reserve are the only potentially sensitive environmental receptors along the route, although these are not considered environmentally significant sites.</p>
Option 3	<p>Option 3 mainly passes through already developed urban and industrial area and does not cross any creeks or other waterbodies. Small areas of native vegetation have the potential to occur along Western Avenue. If present it is expected that this vegetation could be avoided during construction of the pipeline. There are also amenity plantings along the route.</p> <p>There is the potential for threatened flora and fauna species to be present along the route although historical recordings are minimal. Due to the urbanised setting of the option, it is considered unlikely that significant habitat would be impacted.</p> <p>Elmhurst Park the only potentially sensitive environmental receptors along the route, although it is not considered environmentally significant site.</p>
Option 4	<p>Option 4 is also located in already developed urban areas, however it crosses two creeks and multiple parks and/or reserves. The main environmental receptors along the route are Yuroke Creek and Moonee Ponds Creek.</p> <p>Small areas of native vegetation have the potential to occur along Western Avenue. If present it is expected that this vegetation could be avoided during construction of the pipeline. The route also contains extensive amenity plantings along Johnstone Street and Broadmeadows Road.</p> <p>There is the potential for threatened flora and fauna species to be present along the route although historical recordings are minimal. Due to the urbanised setting of the option, it is considered unlikely that significant habitat would be impacted.</p>
Option 5	<p>Option 5 is in predominantly vacant land that has a number of environmentally sensitive receptors including Broadmeadows Valley Park and the nearby Woodlands Historic Park. The proposed route does cross four waterways: Crescent Drain, Yuroke Creek, Attwood Creek, and Moonee Ponds Creek.</p> <p>There is the potential for threatened flora and fauna species to be present along the route, with significant recordings in the eastern extent of the route. The route also contains areas of native vegetation that are unlikely to be able to be avoided.</p>

5.4 Traffic and transport

Table 6 Traffic and transport evaluation

Option	Evaluation
Option 1	<p>Option 1 is located mostly in industrial areas. It is estimated this route will be unlikely to cause major disruptions to traffic and transport. Accessibility for construction and installation is not expected to be a significant issue along this route due to the availability of space adjacent to the road for majority of its length. Where necessary it should be possible to redirect traffic along multiple alternative routes.</p>
Option 2	<p>Option 2 passes through the largest portion of residential area where interruption to transport and businesses is likely to occur. Sections of Melrose Drive are expected to be closed to traffic for the construction period causing significant local traffic delays.</p> <p>This option also has limited availability for construction access and space.</p>

Option	Evaluation
Option 3	Option 3 runs parallel to the Tullamarine Freeway and passes through a large portion of urban areas. Construction through this route is likely to be difficult as a large portion involves works along the Tullamarine Freeway where availability of space for vehicles and pipeline construction and installation procedures may be a limiting factor. Any interruption to traffic during construction activities along this route will also affect regular transport to and from the airport. Interruption to traffic along Tullamarine Freeway for an extended period is likely to be unacceptable.
Option 4	Option 4 would likely result in temporary road closures during construction along Johnstone Street all the way along Broadmeadows Road. This will likely cause significant disturbances to traffic and transport along this 4 km section of the route. Traffic would likely have to be redirected via Western Ring Road for the majority of the construction duration. This option also has limited availability for construction access and space.
Option 5	Option 5 runs predominantly through empty or reserve land. There may be minor disruption to traffic along Barry Road, but this is expected to be minimal. The two major road crossings for this option, Pascoe Vale Road and Mickleham Road would be via HDD and disruptions could be minimised. The option also provides sufficient availability of construction access/space at road crossings.

5.5 Hydraulics

Table 7 Hydraulics evaluation

Option	Evaluation
General	All route options have different tie-in locations along PL118. Hydraulics fundamentally relates to the operating performance of the fluid transfer from upstream supply to downstream discharge. This is a function of the tie-in distance along PL118. As each pipeline change in direction is comparable, hydraulic favourability has been based on tie-in location along PL118 and total new route pipeline distance.
Option 1	Option 1 is hydraulically favourable given the location of tie-in in proximity to the upstream supply of storage. Option 1 has the closest tie-in position along PL118 to upstream supply and has the shortest total route at approximately 27.9 km.
Option 2	Option 2 has the second closest tie-in position along PL118 to upstream supply and the equal second shortest total route at approximately 28.9 km.
Option 3	Option 3 has the third closest tie-in position along PL118 to upstream supply and the equal second shortest total route at approximately 28.9 km.
Option 4	Option 4 has the fourth closest tie-in position along PL118 to upstream supply and the fourth shortest total route at approximately 33.8 km.
Option 5	Option 5 is hydraulically least favourable to all options given location of tie-in in proximity to the upstream supply of storage – furthest away. It has the longest total route of approximately 36.1 km.

5.6 Operational access

Table 8 Operational access evaluation

Option	Evaluation
General	Each end of the pipeline will require above ground facilities including isolation valves, metering facilities, safety valves, pig launchers and receivers. These facilities will require fencing and security as well as access roads for operation and, as such, will need to be located near the tie-in points in an appropriate area with available space. For the purposes of the route options assessment, require above ground facilities are considered to be the same for each option.
Option 1	Option 1 has available space for the above ground facilities in a relatively clear area south of the Western Ring Road. Access to these facilities for pigging and maintenance activities should be readily available via an access track that branches from either Fullarton Road, south of the tie-in point, or off the Westfield Drive. There is available access along the route for pipeline operation maintenance activities.
Option 2	Option 2 is located on the western side of Melrose Drive and the facilities would be located nearer the industrial buildings, with residential properties on the opposite side of the road. Access to operate the facilities is available via an access track off Melrose Drive or one of the nearby branching streets. There are areas of constrained access along the route for pipeline operation maintenance activities.
Option 3	The available space for above ground facilities for Option 3 is limited due to the Tullamarine Freeway and the closely located surrounding properties. There are areas of constrained access along the route for pipeline operation maintenance activities.
Option 4	The available space for Option 4 at the Pascoe Vale Road tie-in point near Johnstone Street is restricted with mostly residential properties in the surrounding area. This will make locating above ground facilities away from properties difficult. There are areas of constrained access along the route for pipeline operation maintenance activities.
Option 5	South of Barry Road where Pascoe Vale Road curves out to the west is an area with available space for the above ground facilities associated with Option 5 to be located. This area is clear of any properties and should be accessible via an access track from one of the surrounding roads. There is available access along the route for pipeline operation maintenance activities.

5.7 Heritage

Table 9 Heritage evaluation

Option	Evaluation
General	None of the options pass within close proximity to any heritage sites listed on national, state or local heritage registers.
Option 1	Option 1 encounters areas of Aboriginal cultural heritage sensitive, with approximately 1.7 km of route located within these areas. A cultural heritage management plan (CHMP) would be required for this option.
Option 2	Option 2 encounters areas of Aboriginal cultural heritage sensitive, with approximately 0.4 km of route located within these areas. A CHMP would be required for this option.
Option 3	Option 3 does not encounter any areas of Aboriginal cultural heritage sensitive.

Option	Evaluation
Option 4	Option 4 encounters areas of Aboriginal cultural heritage sensitive, with approximately 1.4 km of route located within these areas. A CHMP would be required for this option.
Option 5	Option 5 encounters areas of Aboriginal cultural heritage sensitive, with approximately 1.0 km of route located within these areas. A CHMP would be required for this option.

5.8 Landowners

Table 10 Landowner evaluation

Option	Evaluation
Option 1	<p>Most of the Option 1 route can be located within land owned or managed by Melbourne Airport or VicRoads. A breakdown of area use and zoning is shown below.</p> <p>Area Use and Zoning Include:</p> <ul style="list-style-type: none"> ■ Travels adjacent to 0 km of residential areas ■ Travels adjacent to 1.6 km of industrial areas ■ Travels adjacent to 1.2 km of agricultural land ■ Travels adjacent to 0 km of commercial areas ■ Has 0 residential properties within approximately . 50 metres of route <p>The comparatively low number of landowners / operators and proximity to varied zoning presents lower difficulties and risks in obtaining approvals for this design option.</p>
Option 2	<p>Option 2 has high potential to impact to existing land use in the form of the following area use and zoning.</p> <p>Area Use and Zoning and Include:</p> <ul style="list-style-type: none"> ■ Travels adjacent to 2.8 km of residential areas ■ Travels adjacent to 0.5 km of industrial areas ■ Travels adjacent to 1.1 km of agricultural land ■ Travels adjacent to 0 km of commercial areas ■ Has 160 residential properties within approximately 50 metres of route <p>The comparatively high number of landowners / operators and proximity to varied zoning presents elevated difficulties and risks in obtaining approvals within this design option.</p>
Option 3	<p>Design option 3 has high potential to impact to existing land use in the form of the following area use and zoning.</p> <p>Area Use and Zoning and Include:</p> <ul style="list-style-type: none"> ■ Travels adjacent to 1.3 km of residential areas ■ Travels adjacent to 1.3 km of industrial areas ■ Travels adjacent to 1.3 km of agricultural land ■ Travels adjacent to 1.6 km of commercial areas ■ Has 50 residential properties within approximately 50 metres of route <p>The comparatively high number of landowners / operators and proximity to varied zoning presents elevated difficulties and risks in obtaining approvals within this design option.</p>

Option	Evaluation
Option 4	<p>Design option 4 has high potential to impact to existing land use in the form of the following area use and zoning.</p> <p>Area Use and Zoning and Include:</p> <ul style="list-style-type: none"> ■ Travels adjacent to 2.3 km of residential areas ■ Travels adjacent to 0 km of industrial areas ■ Travel adjacent to 1.5 km of agricultural land ■ Travels adjacent to 1.3 km of commercial areas ■ Travels adjacent to 1.0 km of public service and utility land ■ Travels adjacent to 0.2 km of park and recreational areas ■ Has 110 residential properties within approximately 50 metres of route <p>The comparatively high number of landowners / operators and proximity to varied zoning presents elevated difficulties and risks in obtaining approvals within this design option.</p>
Option 5	<p>Most of option 5's route can be located within land owned or managed by Melbourne airport, VicRoads, VicTrack, and Hume City. A breakdown of area use and zoning is shown below.</p> <p>Area Use and Zoning and Include:</p> <ul style="list-style-type: none"> ■ Travels adjacent to 0 km of residential areas ■ Travels adjacent to 0 km of industrial areas ■ Travels through 0 km of agricultural land ■ Travels adjacent to 0 km of commercial areas ■ Travels adjacent to 2.7 km of public service and utility land ■ Travels adjacent to 1.6 km of park and recreational areas ■ Has 0 residential properties within approximately 50 metres of route <p>The comparatively low number of landowners / operators and proximity to varied zoning presents lower difficulties and risks in obtaining approvals for this design option.</p>

5.9 Future land use

Table 11 Future land use evaluation

Option	Evaluation
General	According to information provided in Plan Melbourne 2017-2050 and the precinct structure plans by the Victorian Planning Authority, there are no plans for any future urban growth, industrial precincts, future activity centres or proposed conservation areas for the land along any of the route options.
Option 1	Option 1 is already heavily developed however there is potential for further developments within Melbourne Airport and associated industrial parks.
Option 2	Option 2 is already heavily developed however there is potential for further developments within Melbourne Airport and associated industrial parks.
Option 3	Option 3 is already heavily developed however there is potential for further developments within Melbourne Airport and associated industrial parks.
Option 4	Option 4 is already heavily developed however there is potential for further developments within Melbourne Airport and associated industrial parks.
Option 5	There are possible development opportunities across Option 5 as there is an abundance of space to facilitate growth either side of Mickleham Road. Some of the land is within the 'noise zone' and may be developed for industrial purposes in the future.

5.10 Terrain complexity

Table 12 Terrain complexity evaluation

Option	Evaluation
General	The geology for each option was found to consist mostly of basalt rock with small areas of Red Bluff Sandstone and Melbourne Formation.
Option 1	Option 1 comprises mainly level industrial land.
Option 2	Option 2 has limited space along Melrose Drive and comprises large areas of residential land.
Option 3	Option 3 has limited space along Tullamarine Freeway and comprises large areas of residential land.
Option 4	Option 4 would require multiple creek crossings and comprises large areas of residential land.
Option 5	Option 5 would require multiple creek crossings and has an undulating terrain.

6 Multi-criteria analysis

A summary of the MCA is shown below in Table 13. Further information on the MCA ranking is presented in Appendix A.

Table 13 MCA score summary

Criteria	MCA weighting	Option 1			Option 2			Option 3			Option 4			Option 5		
		C	S	WS	C	S	WS	C	S	WS	C	S	WS	C	S	WS
Safety	25%	L	1	0.25	H	3	0.75	H	3	0.75	H	3	0.75	L	1	0.25
Environment	15%	M	2	0.30	L	1	0.15	L	1	0.15	M	2	0.30	H	3	0.45
Traffic and transport	15%	L	1	0.15	H	3	0.45	H	3	0.45	H	3	0.45	L	1	0.15
Hydraulics	15%	L	1	0.15	M	2	0.30	M	2	0.30	M	2	0.30	H	3	0.45
Operational access	10%	L	1	0.10	H	3	0.30	H	3	0.30	H	3	0.30	L	1	0.10
Heritage	5%	M	2	0.10	M	2	0.10	L	1	0.05	M	2	0.10	M	2	0.10
Landowners	5%	L	1	0.05	H	3	0.15	H	3	0.15	H	3	0.15	L	1	0.05
Future land use	5%	L	1	0.05	L	1	0.05	L	1	0.05	L	1	0.05	M	2	0.10
Terrain complexity	5%	L	1	0.05	H	3	0.15	H	3	0.15	M	2	0.10	M	2	0.10
Total Weighted Score		1.2			2.40			2.35			2.5			1.75		
(Ranking)		(1st)			(4th)			(3rd)			(5th)			(2nd)		

Notes: C = classification, S = score, WS = weighted score, L = low, M = medium, H = high.

7 Preferred pipeline route

Overall, Option 1 was selected as the preferred option and will be progressed to detailed design.

Option 1 received the lowest MCA score compared to all other Options with lowest inherent risk when assessed with each criterion.

Option 1 minimises impacts to landholders by travelling through mostly industrial areas and also has ample available space for construction activities along Airport Drive.

Option 5 received second lowest weighted score, however, has several factors presenting risk which make it a less desirable choice. Due to its tie-in location, the hydraulic losses of this option will be much higher than the other options. The area Option 5 currently passes through is largely empty, but there is a risk that future developments could take place in this location. Option 5 also passes through the highest number of creeks and high value biodiversity land, presenting the highest environmental risk.

Options 2, 3 and 4 all pass-through residential areas increasing the risk of traffic, safety and operational/maintenance issues, hence these options all receive low scores for these criteria. These options also present construction challenges due to the limited workspace along the majority of Melrose Drive and the Tullamarine Freeway.

8 Conclusion

The concept of constructing and operating a new pipeline branching off from the higher-capacity PL118 and terminating at Melbourne Airport is proposed to resolve the restrictions of the existing pipeline system supplying Melbourne Airport with jet fuel.

Five potential route options for the proposed jet fuel pipeline were identified and underwent in-depth analysis against a consistent set of criteria that was developed with consideration of Australian Standard AS2885 Pipelines – Gas and liquid petroleum.

As a result of this assessment, Option 1 was selected as the most suitable option. Option 1 minimises impacts to landholders by travelling through mostly industrial areas and also has ample available space for construction activities along Airport Drive. Option 1 will be progressed to detailed design where refinement will occur to further minimise potential impacts to the surrounding receivers.

9 References

- APGA, 4th September 2017, Code of Environmental Practice, Onshore Pipelines, Rev 4, Australian Pipelines and Gas Association Ltd.
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- DELWP, 15th January 2019, Interactive Maps, <https://www2.delwp.vic.gov.au/maps/maps-and-services/interactive-maps>, The State of Victoria Department of Environment, Land, Water and Planning.
- DELWP, December 2017, Biodiversity information explanatory document, The State of Victoria Department of Environment, Land, Water and Planning.
- GHD, October 2018, Project Starburst Design Basis, 41-32098-PI-REP-001, Rev B.
- Welch S.I., Higgins D.V., Callaway G.A., (eds), 2011, Surface Geology of Victoria 1 : 250 000, Geological Survey of Victoria, Department of Primary Industries.

Appendix A – Multi-criteria analysis

Criteria and Considerations	MCA weighting	Option 1		Option 2		Option 3		Option 4		Option 5	
		Comments	Rank (L/M/H)	Comments	Rank (L/M/H)	Comments	Rank (L/M/H)	Comments	Rank (L/M/H)	Comments	Rank (L/M/H)
Safety -Does the route present significant risk to the public? -Proximity to populated areas, third party assets, sensitive users and residential land? -Available access for Construction Equipment? -Is the pipeline route located in low or high consequence areas?	25%	-Located mainly in industrial or open areas. -Adequate access for construction equipment -Low consequence areas along route	L	-Passes through heavy residential areas -Reduced access for construction equipment. -Above ground facilities will incur risk by operators due to limited available space. -High consequence areas along route.	H	-Passes through heavy residential areas. -Reduced access for construction equipment -High consequence areas along route.	H	-Passes through heavy residential areas. -Reduced access for construction equipment -High consequence areas along route.	H	-Separation between pipeline and residential areas can be achieved. -Ample open environment, allowing access for construction equipment. -Low consequence locations.	L
Environment -Does the route pass through any environmentally sensitive areas? -Does the route impact threatened flora and fauna species and their habitat? -Does the route have potential to impact native vegetation? -Does the route have potential impact to waterways -Will disturbance of contaminated land risk environmental harm?	15%	-Passes through Steele Creek North. -Majority of route is industrial land. -Passes through minimal reported areas of threatened flora and fauna species. -Route passes through contaminated areas adjacent East of the airport.	M	-Does not pass through any waterways. -Located wholly within developed urban and industrial areas. -Does not pass through any major environmentally sensitive areas. -Passes through minimal reported areas of threatened flora and fauna species. -Route passes through contaminated areas adjacent East of the airport.	L	-Does not pass through any waterways. -Located predominantly within developed urban and industrial areas, passing through Elmhurst Park. -Passes through minimal reported areas of threatened flora and fauna species. -Route passes through contaminated areas adjacent East of the airport.	L	-Passes through Yuroke Creek and Moonee Ponds Creek -Passes through multiple reserves. -Passes through minimal reported areas of threatened flora and fauna species -Route passes through contaminated areas adjacent East of the airport.	M	-Passes through Crescent Drain, Yuroke Creek, Attwood Creek, and Moonee Ponds Creek -Passes through multiple reserves. -High concentration of reported threatened flora and fauna species -Route passes through large, contaminated areas adjacent East of the airport.	H
Traffic and Transport -Will construction or maintenance adversely affect traffic? -Availability of construction access/space at road crossings	15%	-Some minor disruptions possible on Airport Drive. -Mostly passes through industrial or agricultural areas. -Adequate access for construction equipment.	L	-Possible major disruptions to traffic on Melrose Drive. -Passes through largest residential areas, potentially causing delays. -Limited availability of construction access/space at road crossings.	H	-Possible major disruptions to traffic on the Tullamarine Freeway an important and busy roadway. -Passes through significant residential and commercial areas, potentially causing delays. -Limited availability of construction access/space at road crossings.	H	-Possible major disruptions to traffic on Broadmeadows Road and Johnstone Street. -Passes through portions of residential and commercial properties, potentially causing some delays. -Reduced availability of construction access/space at road crossings.	H	-Limited disruptions to Barry Street. -Least highways/roads crossed along pipeline. -Predominantly crosses empty or reserve land. -Proficient availability of construction access/space at road crossings.	L
Hydraulics -Location of tie-in suitable for hydraulic considerations with respect to upstream supply storage locations -Length of pipeline route impacting hydraulic performance -Changes in direction along pipeline route impacting hydraulic performance	10%	-Most hydraulically favorable option as tie-in along Somerton Pipeline is closest to upstream supply. -Approximate total new route path from the commencement point of the Somerton Pipeline to JUHI is 27.9km which is the shortest path compared to Options 2,3,4 and 5.	L	-Less hydraulically favorable option compared to Option 1. -Tie-in is further along Somerton Pipeline (approx. +1.6km from Option 1). -Approx. total new route path from the commencement point of the Somerton Pipeline to JUHI is 28.9km which is greater than Option 1 and equal to Option 3.	M	-Less hydraulically favorable compared to Options 1 & 2. -Tie-in is further along Somerton Pipeline (Approx. +1.8km from Option 1 and +0.2km from Option 2). -Approx. total new route path from the commencement point of the Somerton Pipeline to JUHI is 28.9km which is greater than Option 1 and equal to Option 2.	M	-Less hydraulically favorable compared to Options 1, 2 & 3. -Tie-in is further along Somerton Pipeline (Approx. +5.9km from Option 1, Approx. +4.3km from Option 2 and approx. + 4.1km from Option 3). -Approx. total new route path from the commencement point of the Somerton Pipeline to JUHI is 33.8km which is greater than Option 1,2 and 3.	M	-Hydraulically unfavorable compared to Options 1,2,3 & 4. -Tie-in location furthest from point of supply (Approx. +8.4km from Option 1, Approx. +6.8km from Option 2, Approx. +6.6km from Option 3, Approx. + 2.5km from Option 4). -Approx. total new route path from the commencement point of the Somerton Pipeline to JUHI is 36.1km which is greater than Options 1, 2,3 and 4.	H

Criteria and Considerations	MCA weighting	Option 1		Option 2		Option 3		Option 4		Option 5	
		Comments	Rank (L/M/H)	Comments	Rank (L/M/H)	Comments	Rank (L/M/H)	Comments	Rank (L/M/H)	Comments	Rank (L/M/H)
Operational Access -Ease of locating associated operations facilities -Ability to carrying out routine operability and maintainability of Plant and Equipment -Does the pipeline route allow Right of Way / Easement tracks for integrity management (potholing, pipeline repairs) of the pipeline? -Accessibility for Cathodic protection test units	10%	-Suitably clear land for facilities at multiple locations. -Adequate space for pipeline Right of Way and CP test units.	L	-Limited space for facilities. -Reduced ability to construct Right of Way and CP test units.	H	-Limited space for facilities due to size of Tullamarine Freeway and proximity to surrounding properties. -Reduced ability to construct Right of Way and CP test units.	H	-Limited space for facilities. -Reduced ability to construct Right of Way and CP test units.	H	-Large areas of free land for operations and maintenance facilities. -Adequate space for pipeline Right of Way and CP test units.	L
Heritage -Does the route pass through any culturally significant areas? -Does the location option impact registered cultural heritage sites?	5%	-Route passes through 1.7 km of culturally sensitive areas.	M	-Route passes through 0.4 km of culturally sensitive areas.	M	-Route passes through 0 km of culturally sensitive areas.	L	-Route passes through 1.4 km of culturally sensitive areas.	M	-Route passes through 1.0 km of culturally sensitive areas.	M
Landowners -Number of landowners, public or private -Will the pipeline route affect existing land use?	5%	-Melbourne airport, VicRoads and VicTrack. -0 residential properties within 50 meters along route. -0 km length of route passing through residential areas. -1.6 km length of route passing through industrial areas. -1.2 km length of route passing through agricultural land. -0 km length of route passing through commercial areas.	L	-Potential impact to existing land use. -160 residential properties within 50 meters along route. -2.8 km length of route passing through residential areas. -0.5 km length of route passing through industrial areas. -1.1 km length of route passing through agricultural land. -0 km length of route passing through commercial areas.	H	-Potential impact to existing land use. -50 residential properties within 50 meters along route. -1.3 km length of route passing through residential areas. -1.3 km length of route passing through industrial areas. -1.3 km length of route passing through agricultural land. -1.6 km length of route passing through commercial areas.	H	-Potential impact to existing land use. -110 residential properties within 50 meters along route. -2.3 km length of route passing through residential areas. -0 km length of route passing through industrial areas. -1.5 km length of route passing through agricultural land. -1.3 km length of route passing through commercial areas.	H	-Melbourne airport, VicRoads, VicTrack, Hume city. -0 residential properties within 50 meters along route. -0 km length of route passing through residential areas. -0 km length of route passing through industrial areas. -0 km length of route passing through agricultural land. -0 km length of route passing through commercial areas.	L
Future Land Use Zone for future residential, commercial or industrial use	5%	-No further development plans.	L	-No further development plans.	L	-No further development plans.	L	-No further development plans.	L	-Due to abundant space, lots of area for residential, commercial, and industrial development. -Areas along route classified "noise zones," potentially areas for industrial development.	M
Terrain Complexity Difficulty in installing pipeline along proposed route	5%	-Mainly level industrial land.	L	-Limited space between Melrose Drive and residential land.	H	-Congested space between Tullamarine Freeway and residential land.	H	-Multiple creek crossings, trees and residential areas.	M	-Some elevated sections of land, multiple creek crossings.	M

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