Quality Water for Wannon

→ Port Fairy Options Comparison



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1 – Executive summary

Wannon Water is implementing the Quality Water for Wannon Program ("**the Program**"); a series of upgrades to drinking water supplies that will improve drinking water quality for net community benefit. The Program is focused on addressing poor aesthetic drinking water quality due to salinity in the towns of Portland, Port Fairy and Heywood. The Program was the subject of the Great Tasting Water Business Case (2022), and received a 50% funding contribution from the Federal Government in the 2023 Federal Budget.

GHD has been engaged by Wannon Water to assess two options for providing improved aesthetic water quality to Port Fairy as part of the Quality Water for Wannon Program. The options are:

1. Pipeline connection with the Otway water supply system (drawn predominantly from the Gellibrand River), supplied from the Warrnambool Water Treatment Plan (WTP). (**"Pipeline options**")
   Three alternative pipe routes have been considered:
   A. Koroit
   B. Princes Hwy
   C. Alternative route Via Koroit

2. Local treatment of groundwater at the Port Fairy Water Treatment Plant (WTP) including adding reverse osmosis (RO) to remove salinity at the site. ("**Local Treatment option**")

To compare these options, assessment criteria were identified via a workshop with GHD and Wannon Water stakeholders. The criteria included all elements raised by the Port Fairy Pipeline Supply Support Group during their advocacy to Wannon Water. The options were further explored with respect to these criteria to allow comparisons to be made. The criteria were:

• Water Quality	• Historical Heritage	• Planning Triggers	• Water Recycling
• Water Resources	• Cultural Heritage	• Costs	• Flora & Fauna
• Water Security	• Traditional Owner Perspectives	• Infrastructure	• Marine
• Energy & Greenhouse Gas Emissions	• Water Dependent Ecosystems	• Government Policies	• Legislative Triggers

Key considerations for WW and the Port Fairy community

- **Water quality:** Each option has challenges relating to aesthetic water quality which are generally manageable to achieve the fundamental water quality and taste objectives of the Program. The Local Treatment option will provide greater consistency of drinking water quality.
- **Water security:** The Pipeline options increase demands on the Otway surface water system, bringing forward system augmentation (which includes accessing the Dilwyn aquifer to support supply to Warrnambool).
  The Local Treatment option (which draws exclusively from the Dilwyn aquifer) will provide greater reliability and long-term supply security, particularly in the context of reduced availability of surface water predicted with climate change, as well as in drought years.
- **Financial:** A net present cost (NPC) analysis over 50 a year horizon has been completed.
  The Pipeline options (Option 1) have higher estimated NPC ranges than the Local Treatment option (Option 2). The alignments via Koroit (1A and 1C) have the highest cost of the Pipeline options, in part due to the longest overall pipeline route, and the need for relatively more pumping.
- Note that all pipeline costs have greater uncertainty due to being less developed, plus have wider cost implications including bringing forward augmentations to the Warrnambool and Otways supply system. This is estimated as being >$3 M in present cost terms.
  Potential future revenue was included in this analysis, but was shown to not have a significant impact on overall NPC comparisons between options.

Other considerations

- **Environmental impacts:** The Local Treatment option is expected to have the lowest relative environmental impacts across three areas:
  - Does not impact water dependent ecosystems, whereas Pipeline options add demand to an already stressed surface water resource.
  - Lower greenhouse gas emissions, due to overall lower energy requirements than supplying from the Otways via Warrnambool.
  - Smaller potential for impacts to native flora and fauna communities compared to the larger footprint/corridor required for construction of the Pipeline options
- **Social impacts:** All options have planning triggers and potential for impacts to heritage. The greater footprint of the Pipeline options increases the likelihood and extent of any impacts.
  None of the options align well with the Eastern Maar – Traditional Owner Statement in "Water is Life":.

Recommendation
The Local Treatment option is preferred overall using the identified assessment criteria, with lower costs and greater reliability of water quality and water security.
Criteria on which the Pipeline options appear marginally more favourable relate to the existing Port Fairy outfall and potential for recycling – however the differences depend on to be determined configurations for the Local Treatment option's brine disposal. Neither option is expected to materially change the marine environmental risk.
On other criteria, the options are comparable, with similar outcomes expected.
Overall, the Local Treatment option involving upgrading the Port Fairy WTP is the recommended approach to implementing Quality Water for Wannon at Port Fairy.

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1 - Introduction



1.1 Background

Quality Water for Wannon

Wannon Water is committed to improving the aesthetic quality of drinking water supplied to Port Fairy as part of the Quality Water for Wannon Program.

The 2022 Great Tasting Water Business Case found that a region-wide net benefit could be realised by improving the aesthetic quality of water supplies to three towns, including Port Fairy. Based on the Business Case, Wannon Water committed to installing new treatment infrastructure in at least one of the towns considered by the Business Case. The project was renamed as Quality Water for Wannon. The program's objectives are to supply high water of a high aesthetic quality (i.e. that is "great tasting"), by targeting a salinity of <300 mg/L total dissolved solids (TDS).

The 2023 Federal Budget provided funding via the National Water Grid to Wannon Water to implement the recommendations of the Business Case. This funding extended Quality Water for Wannon to become a program across all three towns.

Port Fairy's Drinking Water Supply

Port Fairy currently draws its drinking water from the Dilwyn aquifer, a highly reliable water resource. This drinking water meets the strict requirements of the Safe Drinking Water Regulations. However, the water is characterised by elevated salinity, resulting in low levels of customer satisfaction and consumption, and results in detrimental public health outcomes and economic costs to the community, in addition to financial impacts to local industry.

The Great Tasting Water Business Case identified options for improving the drinking water quality to realise overall community benefit. The Business Case was based on a Local Treatment option, involving upgrading the existing Port Fairy Water Treatment Plant (WTP), and made preliminary consideration of alternatives including construction of a piped supply from Warrnambool to supply surface water from the Otways. A number of alignments are possible for a Pipeline option.

Wannon Water is undertaking this options assessment to develop the preferred approach to implement the Quality Water for Wannon program for Port Fairy, to realise the community benefits of improved drinking water quality. This assessment will support ongoing community engagement by Wannon Water.

1.2 Purpose

The purpose of this report is to:

- Detail the methodology used to complete a rigorous and robust multi-criteria assessment of two water supply options for Port Fairy,
- Summarise the key inputs, parameters, and outcomes of this assessment, and
- Recommend a preferred option.

Additional technical details have been included as appendices to this report.

Scope & Limitations

- *This report: has been prepared by GHD for Wannon Water and may only be used and relied on by Wannon Water for the purpose agreed between GHD and Wannon Water as set out in section 1 of this report.*
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Options

→ 2.0.1 Options Evaluation – Assessment Framing

2.0.2 Conceptual Description of Options

2.0.3 Options Overview for Port Fairy

2.0.4 Options – Enabling Works

2.0.1 Options evaluation – assessment framing



2.0.1 Workshop 1 outcomes and framing of options evaluation

To identify the basis on which options would be examined and compared, a workshop was held with Wannon Water stakeholders. This session sought to identify a comprehensive set of criteria on which the different approaches to implement Quality Water for Wannon program at Port Fairy would be assessed.

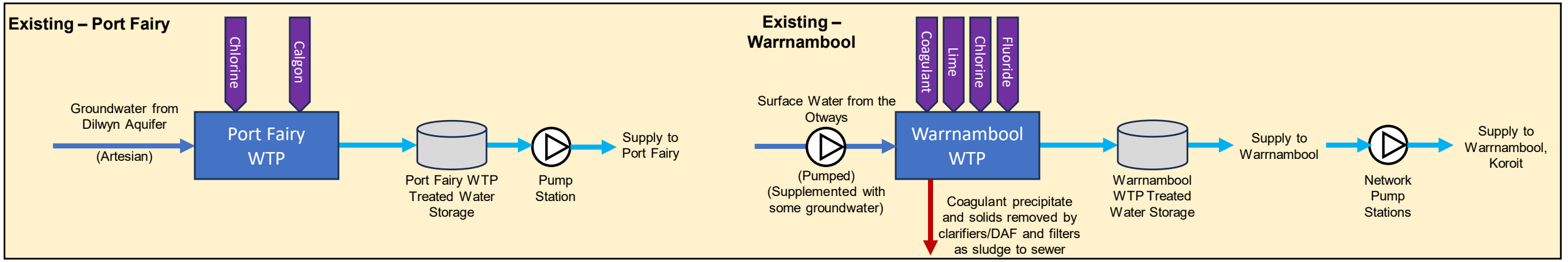
The identified criteria are intended to allow the relative advantages and disadvantages of the options to be assessed from various perspectives. The criteria included consideration of elements raised by the Port Fairy Pipeline Supply Support Group during their advocacy to Wannon Water.

The criteria identified from the workshop to form the basis of the options evaluation included:

- Drinking water quality
- Energy consumption and carbon emissions of the options
- Direct environmental impact
- Heritage, cultural heritage and traditional owner impact
- Planning and approvals
- Implications for existing outfalls
- Implications for water recycling opportunities
- Water resource implications
- Impact on existing infrastructure
- Potential new revenue streams
- Costs
- Other opportunities, such as fostering improved community perceptions and connecting additional customers to Wannon Water services.

This workshop identified that all potential criteria (as above) should be considered within this options assessment. This workshop also identified additional perspectives and points to consider for the listed criteria.

2.0.1 Conceptual Outline of Options



These figures provide a conceptual outline of the existing drinking water supply arrangement at both Port Fairy and Warrnambool, and the two approaches considered to deliver Quality Water for Wannon at Port Fairy:

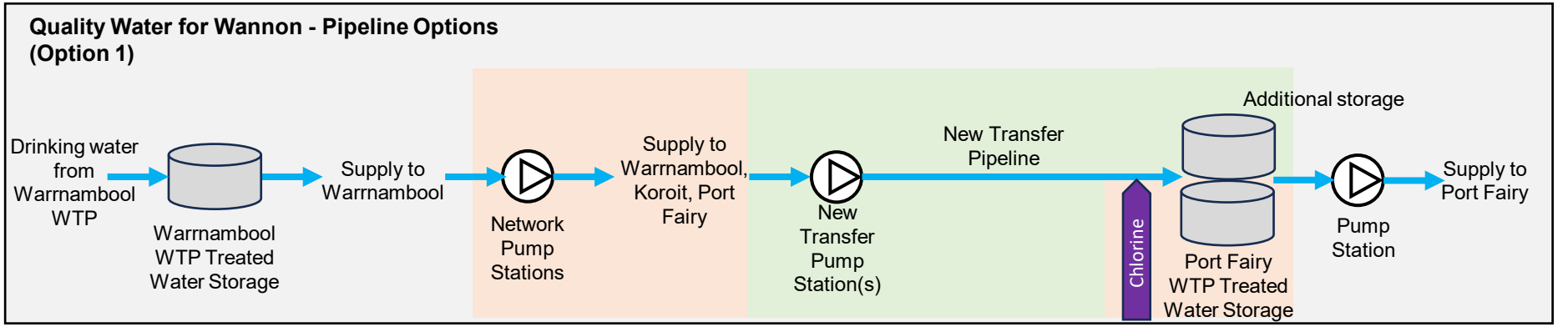
- A pipeline from Warrnambool ("**Pipeline options**", Option 1), and
- By upgrading the Port Fairy WTP ("**Local Treatment option**", Option 2).

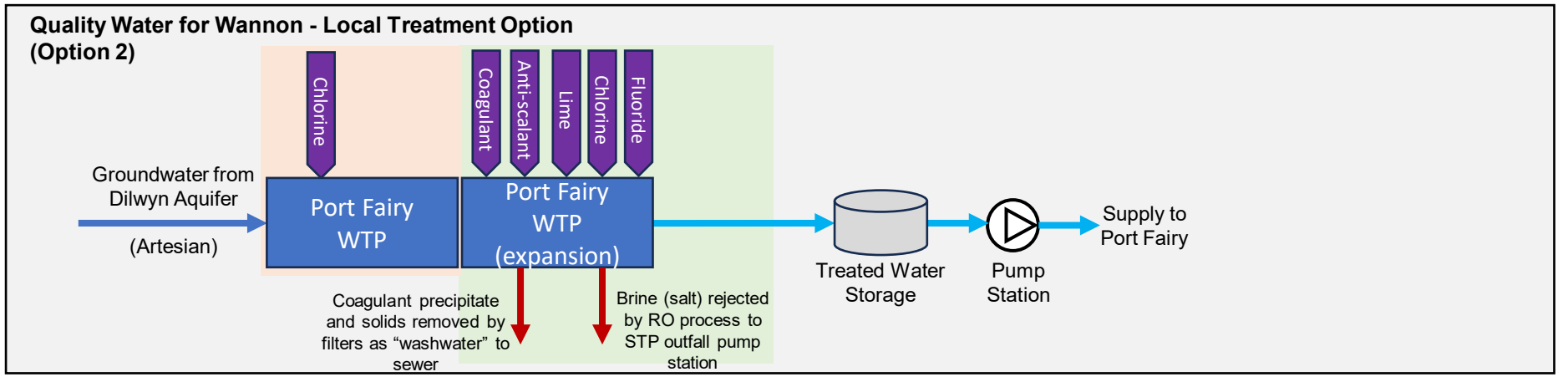
Note that these schematics are illustrative only, and do not show all details of storages, pump stations etc. in these networks.

Legend:

Modification of existing assets

New Works





2.0.2 Options Overview

The options considered in this study are outlined below and on the following pages.

1. Pipeline options:

Three potential pipeline alignments have been considered.

Alignments put forward by the Port Fairy Pipeline Supply Support Group during their advocacy to Wannon Water:

A) Pipeline via Koroit

New pipeline connecting Koroit network to Port Fairy WTP site (to reuse storage and existing pumping to standpipe and network).

GHD has expanded this option to include suitable provision upstream of Koroit to achieve supply.

B) Pipeline via Princes Hwy

New independent system from Illowa along Princes Hwy to Port Fairy WTP.

Alignment considered as part of the options phase during development of the Great Tasting Water Business Case:

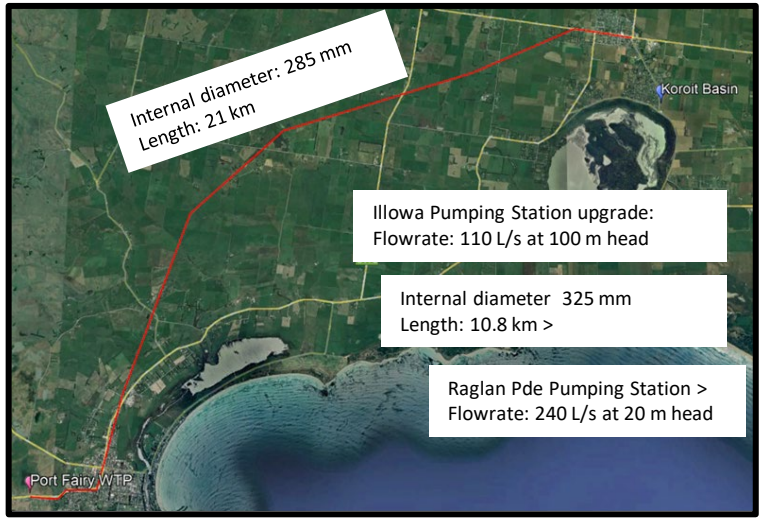
C) Pipeline via Koroit option 2

This option is very similar to the Pipeline Action Group's Pipeline via Koroit option and has been revised based on updated information of the Warrnambool water supply system.

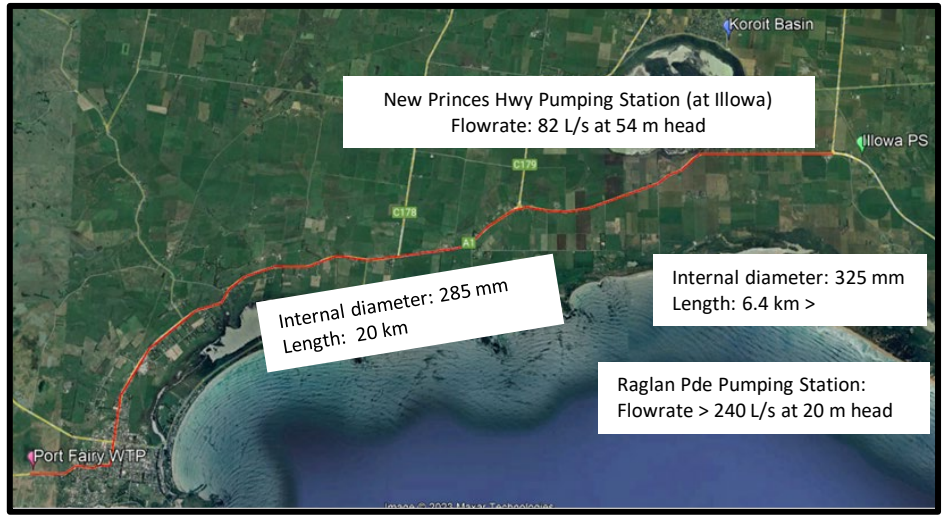
2. Local Treatment:

A groundwater desalination upgrade at Port Fairy WTP as developed for the Great Tasting Water Business Case.

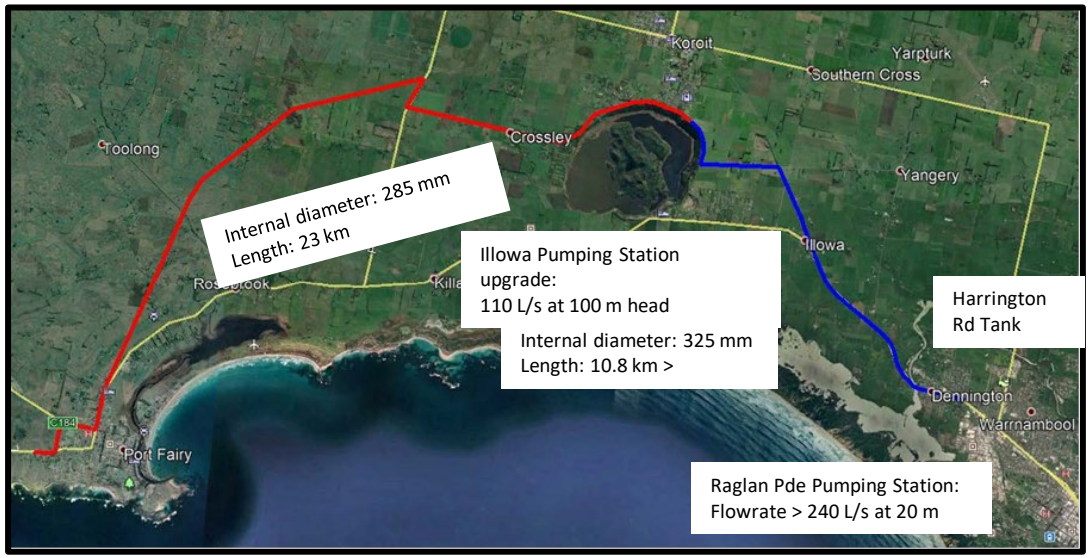
Option 1A: Pipeline via Koroit



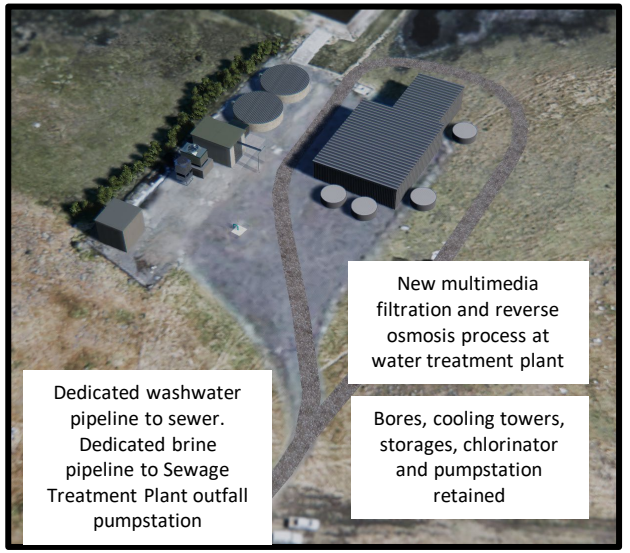
Option 1B: Pipeline Princes Highway



Option 1C: Variation on Pipeline via Koroit



Option 2: Local Treatment



2.0.3 Options Overview – Enabling works and security of supply

The scope of works required for some options includes additional enabling works to support implementation.

Pipeline options

Enabling works:

Adding Port Fairy's demand to the Warrnambool water supply system will bring forward expected supply augmentations and upgrades. The impact on timing of these expected augmentations was evaluated, based on these enabling works not being required immediately, but expedited by the addition of Port Fairy's demand.

For upgrades to the Warrnambool system, present value costs were evaluated based on Warrnambool's population growth vs. Port Fairy's current population:

- Port Fairy's current population equates to approximately 7 years of growth in Warrnambool.
- Connecting Port Fairy to the Warrnambool system therefore brings forward any infrastructure upgrades / supply augmentations by approximately 7 years.

Major enabling works include:

- Warrnambool Water Treatment Plant upgrade: increasing treatment capacity to supply a greater population in the Warrnambool system.
- Groundwater bores: Otways supply augmentation via groundwater bores (e.g., Curdievale),
- Ewens Hill storage expansion: a required expansion to Warrnambool's raw water storage for improved security of supply.

Security of supply:

For the Pipeline options to provide comparable security of supply to the existing system arrangement, the Pipeline options require construction of additional storage at Port Fairy.

Good practice for transfer of drinking water via a long pipeline such as this is to provide a storage equal to a peak day of demand. This ensures service can be maintained during peak demand periods in the event of a pipe break or other pipeline failure. For Port Fairy, this provides security during the high demand summer tourist season and during the Port Fairy Folk Festival in particular.

Options 1A and 1C will also increase demand on the existing Koroit basin, hence for these options additional storage would be needed at Koroit also to maintain existing levels of security of supply.

Local Treatment option

There are no additional enabling works for a Local Treatment option beyond those already included within the existing infrastructure and WTP upgrade works.

In this arrangement, the storage function is in the aquifer, and provision of infrastructure with suitable redundancy is used to maintain security of supply.

Outcome

The Pipeline options require additional works to support its implementation, primarily relating to maintaining security of supply at implementation, and upstream augmentation in the short-medium term.

The Local Treatment option requires no additional works, beyond providing sufficient redundancy in the upgraded water treatment plant to match current levels of redundancy.

Key criteria

→ 2.1 Water Quality

2.2 Water Resources

2.3 Water Security

2.1.1 Water Quality

Introduction / Context : Improving aesthetic water quality for Port Fairy by reducing salinity is the key project objective.

Assessment metrics

Salinity or total dissolved solids:

Salinity reduction is a key project objective. Water with elevated salinity has poor aesthetic quality, due to the salt adding a salty or mineral taste. The Australian Drinking Water Guidelines sets an aesthetic limit of 600 mg/L for total dissolved solids, however industry experience and literature nominates 300 mg/L as “good” quality, and a threshold below which the taste does not materially change. Currently drinking water in Port Fairy has salinity in the order of 900 mg/L.

Elevated salinity also has other impacts. Consumer appliances have shortened lifespans due to corrosion, and Sun Pharma is required to include additional treatment to meet their process requirements, adding cost and complexity to their operations. Reducing salinity will improve both the lifespan of consumer appliances and reduce treatment costs borne by industry.

Impact on taste:

Improving taste is a key outcome that reducing drinking water salinity will achieve at Port Fairy. It will increase water consumption and deliver community health benefits in line with the objectives of the Quality Water for Wannon Program. Note that there are relevant factors beyond salinity that can impact the taste of the water, these risks are outlined below.

Consistency of taste:

Consistency of taste has been highlighted as a concern for Wannon Water customers. Customer complaints about drinking water taste increase in response to changes in water treatment processes and raw water quality. Change in taste often being perceived as poorly as reduced quality. Hence minimising variability in water taste is important to achieving the Program’s outcomes.

Algal risk

The surface water from the Otways and its transfer to Warrnambool (including multiple open storages) can introduce algal taste and odour compounds (methoisoborneol (MIB) and geosmin in particular). Potential longer term plans include process upgrades at Warrnambool WTP to enable removal of these compounds. An expected impact of climate change is increased algal activity in open water storages, and will see this risk increase over time.

Presence of Ammonia

Groundwater from the Dilwyn Aquifer at Port Fairy includes natural ammonia, at concentrations that form di- and tri-chloramine compounds when chlorinated. These compounds can result in unpleasant taste at low concentrations (0.15 mg/L), and likely exacerbate the salinity related taste issue. The Local Treatment option will be designed to address this issue.

2.1.2 Water Quality

Parameter	Pipeline options	Local Treatment option
Fulfilment of total dissolved solids criteria	• Will meet project objectives	• Will meet project objectives
Impact on taste	• Will meet project objectives	• Will meet project objectives
Impact on consistency of taste	• Some variability in anticipated taste due to the variety of water quality issues the surface water system is likely to encounter. • Warrnambool customers sometimes express dissatisfaction with taste changes in the existing system.	• Consistent water quality from Dilwyn aquifer. Fluctuations in raw water chemistry and subsequent treatment requirements are not anticipated, providing consistent drinking water quality.
Potential risks (present)	• Algal taste and odour compounds from Otways surface water – Warrnambool WTP limited in capability to manage these compounds. Customer complaints occur annually • Shandying of groundwater from Curdievale and Albert Park bores with surface water to target a salinity <350 mg/L (target not expected to change).	• Natural presence of ammonia in groundwater from Dilwyn Aquifer, at concentration that causes formation of di- and tri-chloramine when chlorinated. • Temperature of groundwater.
Potential risks (future)	• Algal risk expected to increase due to impact of changing climate and increase in condition favourable to algal outbreaks (increased in dry periods resulting in higher water temperature). • Otways source augmentation will include additional groundwater being utilised in this system requiring covering of some storages to manage algal risk.	• (No change in water quality risks expected, treatment design will need to manage present risks re ammonia)
Relative advantages	• (Predominantly) Very good quality water now.	• Will provide high quality treated water. • Treated water quality will be consistent not expected to change over time.
Relative disadvantages	• Source quality, and hence treated water quality, can be variable. • Water quality expected to change over longer term due to additional groundwater inputs. • Climate change expected to increase algal activity and algal taste and odour risk.	

Outcome: Both the Pipeline options and the Local Treatment option will achieve the primary salinity objective. Both options have challenges that require management to achieve the Program objectives.

The Local Treatment option has the advantage of providing consistent water quality, and overall has fewer risks and disadvantages compared to the Pipeline options. On this basis the Local Treatment option is preferred with respect to water quality.

2.2.1 Water Resources: Dilwyn Aquifer

Introduction / Context : Understanding the characteristics of water resources is essential to ensuring their sustainable use and to managing risks to provide security in supplying drinking water demands to communities.

In this section we describe the primary water sources for both the Local Treatment and Pipeline options – being the Dilwyn aquifer and Gellibrand River respectively.

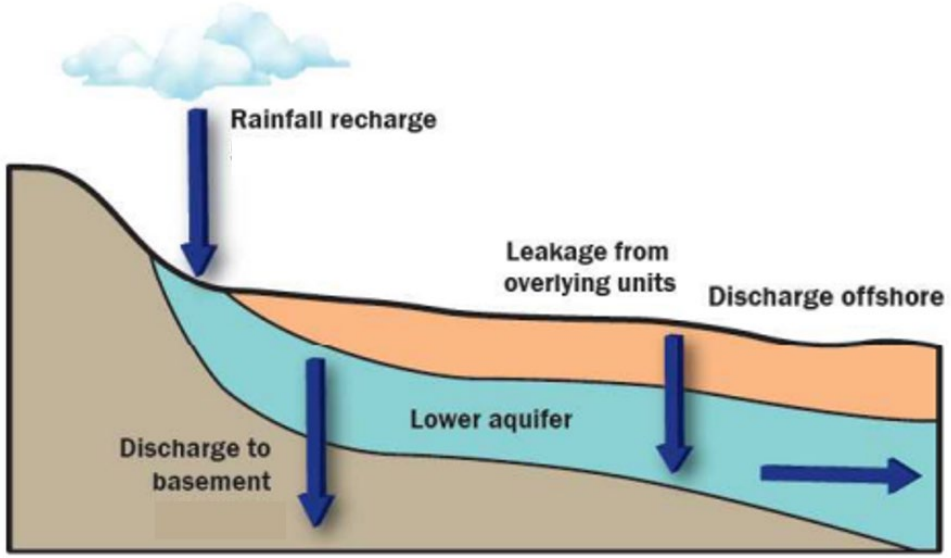
Port Fairy – Local Treatment option – A groundwater-based supply

The South West Victoria Groundwater Atlas (Southern Rural Water 2011) describes the lower aquifers including the Dilwyn as "one of the most substantial and reliable water sources in Victoria due to their massive storage".

Impacts to flow regime: Interaction with the surface water environment occurs in limited areas in the upper reaches of the aquifer. In such areas, groundwater extraction can impact streamflow. However at Port Fairy, extraction is from deeper, confined sections of the aquifer near to the coast. No observable change in surface water will occur. The Dilwyn aquifer discharges offshore.

Climate change: The recharge process for this resource occurs predominantly through leaking of overlying formations, which can take many decades to reach the aquifer. Only a small portion of annual recharge is from rainfall, where the aquifer interacts with the land surface in the Otway ranges. The reaction to external influences such as rainfall, climate trends and land use is so slow that the aquifers in some areas may still be responding to changes from thousands of years ago. As such, the aquifer was relied upon as a highly secure resource during the Millenium Drought.

Similarly, **Bushfire** and other events at the land surface does not have any perceptible impact to this system.



Recharge flow characteristics for the Dilwyn aquifer near Portland
Source: *South West Victoria Groundwater Atlas (Southern Rural Water 2011)*

2.2.2 Water Resources: Otway System

Otway System – Pipeline Options: Surface water-based supply

The Gellibrand River is the primary source for this system. Water is harvested from the North Otway system near the Carlisle River township, and the South Otway system pumps water from the Gellibrand River at Chapple Vale. Extractions from Arkins Creek and groundwater from bores at Warrnambool and Carlisle also contribute to the supply system. Unlike most surface water supply systems that have large storages that fill during winter and are used over summer, the Otway system has only small storages available.

Impacts to flow regime:

The Gellibrand is recognised as among the most important rivers in Victoria for the conservation of native fish. Extraction of water from the river for urban and rural uses, and storage in farm dams in the upper catchment, has resulted in significant declines of flow in the Gellibrand River.

Previously during summer months, significant flow reductions and a low compliance rate with the identified summer low environmental flow requirements were observed (2012 Alluvium study "*Assessment of the environmental benefits and risks of flows below the summer low flow recommendation in the lower Gellibrand River*"). Since that time compliance with summer low flow requirements has been achieved through careful management by Wannon Water.

Substantial efforts by both government and communities have been made towards improving the ecological health of the Gellibrand River by increasing flows in the river over summer. This has included water efficiency programs and developing alternative sources of supply. The Central and Gippsland Region Sustainable Water Strategy (2022) includes Action 8.9 to improve summer flows in the Gellibrand River. Adding demand to this system goes against current objectives for management of Gellibrand River flow targets, particularly summer flows.

Climate change: streamflow is predicted to decline under medium to high climate change.

Bushfire presents a risk for the region's surface water catchments. Water quality can be significantly affected by bushfire through ash and burnt material and exposed sediments entering waterways during post fire rainfall.

2.2.3 Water Resources: Summary

Water Resources Summary:

Dilwyn aquifer:

The Dilwyn is an exceptionally large water resource which is isolated from the effects of climate change and land use due to its depth. It is overlain by other formations which insulate the resource from surface influences.

Otway system:

The Otway region has extreme variation in the amount of surface water available, both seasonally between summer and winter flow regimes, and between flood years and drought years. The catchments are highly responsive to rainfall, and the river flow regime varies accordingly.

In the context of water supply systems in Victoria, the system is unlike others with limited storage. It does not have the ability to harvest streamflow only in winter for supply through summer, nor the storage volume to balance flows and demand over multiple years.

Aspect	Pipeline options	Local Treatment options
Impacts to flow regime	Likely to be significant / require mitigation & management	Not relevant
Climate change impact to resource availability	Likely to be significant / require mitigation & management	Not relevant
Bushfire impacts to water quality	Potential to require mitigation & management	Not relevant

Outcome / Recommendation : There are significant risks to the Otway system due to it being primarily a surface water harvesting system. By contrast, the Dilwyn system is insulated from resource risks.

The Local Treatment option is therefore preferred in the context of water resource considerations.

2.3.1 Water Security

Introduction / Context - Water security is "*The capacity of a population to safeguard sustainable access to adequate quantities of acceptable quality water for sustaining livelihoods, human well-being, and socio-economic development, for ensuring protection against water-borne pollution and water-related disasters, and for preserving ecosystems in a climate of peace and political stability"* (United Nations). For the purposes of this options evaluation, water security refers to issues that affect the ability to provide the various demands from either the surface water-based Otway system, or the existing groundwater supply from the Dilwyn aquifer.

Assessment metrics

System resilience – Pipeline options will access the Otway system. As this is a surface-water based system it is highly variable both annually (flood vs drought years), and seasonally (typically high winter stream flows vs low flows during summer). This variability means that the Otway surface water supply system is vulnerable to periods of drought and a drying climate.

The Local Treatment option uses groundwater from the Dilwyn Aquifer– this relies on recharge rates with much longer time periods; the Dilwyn system is also characterised by a vast recharge area. This combination of large timeframes and large recharge area results in the Dilwyn aquifer being highly resilient to impacts such as drought and climate change.

System yield in relation to demand – yield refers to the water volume that can be supplied without restrictions in 95% of years (i.e. restrictions implemented in only 1 of 20 years).

Wannon Water's Urban Water Strategy indicates that current yield from the Dilwyn aquifer licence for Port Fairy is 1,026 ML/yr, and the Otway system is ~10,418 ML/yr.

This provides for current demands of 600 ML/yr for Port Fairy and 9,300 ML/yr for communities currently supplied by the Otway system; with surpluses of 426 and 1118 ML/yr respectively (assuming medium climate trends). The addition of Port Fairy demands to the current Otway system would reduce current surplus to 518 ML/yr under a "medium" climate change forecast.

Over time this will decrease, with a shortfall of between 4,160 to 7,201 ML/yr by 2070. In contrasting to this, the Dilwyn system maintains a surplus for current and future demands.

Raw Water Demand (High)	Local Treatment - Port Fairy (Dilwyn Aquifer)	Otway system (Current)		Pipeline Options (Otway + Port Fairy demands)	
Current (ML)	600	9,300		9,900	
2070 (ML)	940	13,000		13,940	
Yield		Medium Climate Change	High Climate Change	Medium Climate Change	High Climate Change
Current (ML)	1,026	10,418	10,043	10,418	10,043
2070 (ML)	1,026	9,780	6,739	9,780	6,739
Surplus of Shortfall		Medium Climate Change	High Climate Change	Medium Climate Change	High Climate Change
Current (ML)	426	1,118	743	518	143
2070 (ML)	86	**-3,220**	**-6,261**	**-4,160**	**-7,201**

2.3.2 Water Security

Allocation access:

The pipeline options will add demand to a system that is already facing water stress. Otway system augmentation for increasing winter harvesting volumes by expanding system storage is planned for 2031 and Curdievale bore supply in 2035 (from the Dilwyn Aquifer). These are likely to be needed ~ 7+ years earlier if Port Fairy demands are added.

Local Treatment maintains utilisation of the Dilwyn aquifer allocation. Non-utilisation of the Dilwyn allocation risks the extraction licence not being renewed in the future, meaning loss of access to this resource

System flexibility:

A pipeline supply to Port Fairy provides a long-lasting asset (nominally 80 years) with relatively lower maintenance needs than the local water treatment plant. However, pipeline capacity is limited by the size of the pipe installed, and therefore increased demand beyond the current growth estimates cannot be accommodated by the pipeline options unless it is oversized (at additional cost).

Pipeline options also require additional storage at Port Fairy to maintain water security in the event of an outage at Warrnambool WTP or pipeline break. The need for storage (designed to meet one day's peak daily demand) adds scope and cost to the Pipeline options.

The Local Treatment option allows installed capacity to better match demand, providing a more efficient investment. Demand growth can be accommodated with modular increases if required.

Parameter	Pipeline Options	Local treatment
Resilience	• Low - seasonally & annually	• High resilience
Yield : Demand - Current	• Surplus	• Surplus
Yield : Demand - Future	• Shortfall	• Surplus
Flexibility	• Longer life cycle 50-80 years • Capacity fixed by pipe sizing	• Shorter life cycle 20-25 years • Capacity can be staged with demand
Allocation access	• Augmentation ~ 7 years earlier • Potential forfeit of allocation	• No impact

Outcome / Recommendation: Continuing to access the Dilwyn aquifer at Port Fairy maintains the use of a reliable resource and a high level of water security at Port Fairy.

The Local Treatment option is therefore preferred in the context of water security.

Environmental

→ 2.4 Energy Consumption and GHG Emissions

2.5 Implications for Existing Outfalls

2.6 Implications for Water Recycling

2.7 Direct Environmental Impact – Native Flora and Fauna

2.8 Direct Environmental Impact – Water Dependent Ecosystems

2.9 Potential Legislative Triggers

2.4 Energy & Greenhouse Gas Emissions

Introduction / Context : Wannon Water has committed to net zero emissions by 2030. Estimated energy consumption and resultant greenhouse gas emissions were evaluated for each option to determine if material differences are expected between options.

Methodology

Expected energy consumption:

Energy consumption for the Pipeline options was determined by modelling expected power use at the required pumping stations. Further, additional energy requirements for the Warrnambool system raw water extraction and Warrnambool WTP processes were quantified using Wannon Water energy consumption data.

Energy required for the Local Treatment option was determined using a model of expected groundwater desalination processes used in the preliminary design development.

Emissions (Scope 1, 2, and 3):

Scope 1 emissions were not evaluated as there are no material direct emissions expected for any option. Scope 3 emissions were excluded as they do not form part of mandatory reporting obligations at this time.

Scope 2 emissions (emissions from electricity use) were determined using National Greenhouse Accounts Factors (0.79 kg CO_2 eq. / kWh in Victoria). This factor is decreasing over time as Victoria's grid continues to transition towards renewable energy sources. Existing renewable energy generation deployed by Wannon Water was not factored in, as any additional energy usage for any option will result in additional net energy consumption from the Victorian grid and hence Scope 2 emissions.

Contributions vs. 2025 target:

Targeted scope 2 emissions are approximately 13,000 t CO_2 eq per year by 2025 (Wannon Water Carbon Neutrality Plan). Contribution percentage represents the portion of this target associated with each option. This metric indicates whether the differences between options are material.

Parameter	Pipeline Options	Local Treatment option
Relative advantages		• Lowest estimated emissions and energy consumption • Localised power consumption, easier to supplement with behind the meter renewable generation
Relative disadvantages	• Higher estimated scope 2 GHGs and energy consumption	

Aspect	Option 1A (Pipeline via Koroit)	Option 1B (Princes Highway Pipeline)	Option 1C (Alternate Pipeline via Koroit)	Option 2 (Local Treatment)
Indicative energy consumption	800 MWh/y	710 MWh/y	810 MWh/y	550 MWh/y
Future energy consumption	Otways groundwater supply augmentation will increase energy consumption of Pipeline Options via increased water transfer pumping, and treatment at Warrnambool WTP.			No change anticipated once implemented
Scope 2 GHG emissions	632 t CO_2 eq. / y	560 t CO_2 eq. / y	641 t CO_2 eq. / y	434 t CO_2 eq. / y
Scope 2 GHG emission / ML	1.1 t CO_2 eq/ML *	1.0 t CO_2 eq/ML *	1.1 t CO_2 eq/ML *	0.8 t CO_2 eq/ML *
Contributions vs. 2025 target	4.9%	4.3%	5.0%	3.4%

Outcome / Recommendation : When considering all energy used for water transfer and treatment, the pipeline options are expected to require more energy overall than the Local Treatment option.

The Local Treatment option is therefore preferred when considered against energy and greenhouse gas emission considerations.

2.5.1 Implications for the Port Fairy Outfall

Introduction / Context : Port Fairy's ocean outfall discharges treated effluent from the Port Fairy Sewage Treatment Plant (STP) (both domestic and industrial plants). The STP and outfall operate under an EPA licence.

The figures on this page illustrate how the configuration will change from current with the implementation of either the Pipeline options or the Local Treatment option.

Pipeline Options:

The Pipeline Option will see no change to the overall operation of the Port Fairy sewer network, STP or outfall, other than a reduction in salinity due to the supply of low TDS drinking water.

Local Treatment Option:

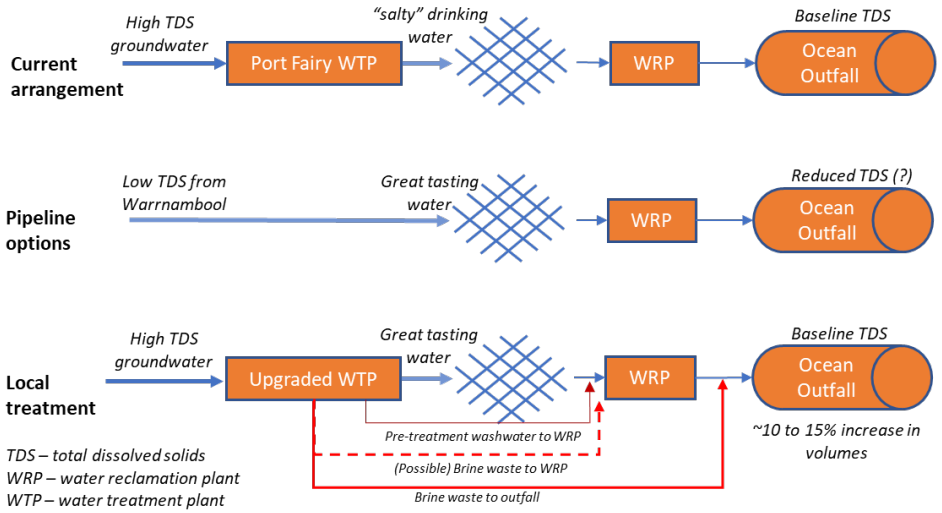
The Local Treatment Option will see two new waste streams generated at the Port Fairy WTP:

- Washwater – the water from backwashing the pre-treatment filters, including the filtered coagulant precipitate and filtered solids, will be transferred to sewer network, and in turn to the STP. The STP will treat this flow as part of the sewage from Port Fairy. The solids contained in this steam will be removed by the STP. There are no changes to the conditions at the outfall from the introduction of this waste to the sewer network. The washwater volumes are relatively small, and would typically amount to a few percent of total drinking water volumes.
- Brine – the RO process will produce a saline waste stream, a reject brine that comprises 10-15% of the total flow of treated water that will contain the salts removed by the process. It is proposed that this waste can be discharged via a new pipeline to the STP outfall pumpstation, for blending with the treated effluent from the STP for discharge to the ocean.
  Note that this is salt currently transported to the outfall via the drinking water and sewage network; in this option it is transferred via a different route.

The differences between the Pipeline Options and the Local Treatment option at the ocean outfall boil down to two things:

Total volume discharged:

- No material change expected from the Pipeline Option. Benchmarking of demand showed an increase in demand likely with improved water quality, however this is common to both Pipeline and Local Treatment.



- A 10-15% increase in overall volumes are expected from the Local Treatment Option due to the above mentioned brine waste . The design work to date has reviewed capacity in the outfall, and this existing volume can be accommodated.

Composition of the treated effluent discharged to the ocean:

- Nutrient and microbial discharges, which are relevant to the receiving water and its use, are not expected to change under either the Pipeline or Local Treatment option.
- The main difference in composition will be salinity, which is not relevant for marine discharges.
- The ecological impact of wastewater discharges relating to salinity are typically related to the lack of salt – i.e. fresh water can be toxic in the marine context.
- For either Pipeline or Local Treatment options the treated effluent will still be "fresh" in this context, which is managed by the mixing that occurs at the points of discharge and rapid dilution to background salinity levels.

Salinity is a central aspect for considering Implications for Water Recycling in 2.6.

2.5.2 Implications for Existing Outfall

Assessment metrics

Discharge quantities through outfall:

RO brine from Local treatment is to be blended with Port Fairy STP treated effluent at the outfall pump station, and discharged via the existing outfall.

It is expected that total discharged volumes will increase by ~10 to 15%.

Discharged effluent quality:

Effluent quality with respect to ecologically important contaminants and microbes will not be materially different between options.

Salinity will be the main difference in effluent quality. However as described previously salinity is not a concern for the receiving marine environment. The impact of this is relevant to consideration for water recycling in 2.6.

Potential risks:

GHD has not identified any significant outfall risks associated with the Pipeline Options.

Local Treatment will subtly change how the outfall operates as overall volumes increase, and periods of only brine being discharged might occur. This change may prompt a formal EPA approvals including revisiting the existing Port Fairly STP discharge licence (Noting that the EPA can initiate this discussion at any time regardless).

Future outfall implications:

The Port Fairy ocean outfall will be retained by Wannon Water as there is no other feasible way to dispose of all effluent from the Port Fairy STP. Even if recycling was to be significantly increased, there is a need to manage wet weather flows. High levels of reuse would likely require desalination of recycled water, and in turn generate a brine requiring disposal.

Overall, the existing outfall is a benefit to Wannon Water.

Warrnambool Sewage Treatment Plant outfall implications:

Pipeline options will increase total Warrnambool system water production which increases sludge production at Warrnambool WTP. This sludge is sent to Warrnambool Sewage Treatment Plant for processing. This will increase total volumes discharged via the outfall in Warrnambool however the increase is expected to be marginal, and not material for this assessment.

Implications for water recycling are discussed on the next page (refer to 2.6).

Aspect	Pipeline options	Local Treatment option
Discharge quantities through outfall	No significant difference from current scenario	Approx. 15% greater (corresponding to a 15% increase in total discharged salt)
Discharged water quality	In theory, reduced total dissolved solids (not ecologically important) In practice limited changes are expected	No significant difference from current effluent quality expected
Potential risks		Elevated likelihood of EPA involvement
Future outfall implications	No significant difference between options.	
Warrnambool STP implications	Marginal increase in sludge and volumes to be treated from the WTP – not material	None
Relative advantages	No significant change to existing arrangement	
Relative disadvantages		Changes risk EPA involvement

Outcome / Recommendation : Overall, there is little impact to the outfall operation from either Pipeline options or the Local Treatment option.

Given the reduced implications for the Port Fairy STP outfall from the Pipeline Options, both in terms of changes to flows and likelihood of EPA revisiting existing licence conditions, the Pipeline Options are preferred

It is noted that the EPA's response will not be known until any changes are implemented.

2.6 Implications for Water Recycling

Introduction / Context : Current and future demand projections for water recycling are low in Port Fairy. The relatively cool and wet local climate limits agricultural recycling opportunities. Shallow groundwater is also available in the some nearby area for uses that might otherwise seek recycled water.

The implications of the Pipeline options and the Local Treatment option on water recycling opportunities have therefore been assessed to determine if the implications of these options are material. It is noted that the previous section discussing outfall implications and salinity is relevant to this section.

Assessment metrics

Changes to recycling demand / application (Salinity):

The demand for recycled water will in part depend on its quality. For most reuse applications, a key consideration is salinity. In general, lower salinity recycled water is preferred for uses including agriculture (irrigation), industry (cooling water or as input to a manufacturing process) or for domestic use (either as dual pipe for Class A reuse, or in future as potable reuse).

The salinity of sewage at the STP, and hence treated effluent available for reuse, is expected to be about 1,100 mg/L for both the Pipeline options and the Local Treatment option (see text box with note about wastewater salinity from inflow and infiltration).

(This would change if the Local Treatment Option was reconfigured to send brine to the STP inlet, possibly by using the sewer to remove one of its waste pipelines).

The additional benefits of water with this level of salinity (1,100 mg/L), as opposed to 2,000 mg/L are likely to be marginal given that water is relatively abundant in the region from sources that are presently low cost (e.g. local groundwater).

Biosolids reuse opportunities

Wannon Water currently transports biosolids to Camperdown IWRP for drying and stockpiling prior to reuse. Reducing wastewater salinity might have marginal benefit for future biosolids reuse opportunities (slightly lower sodium content). This is common to all options.

Impacts on Port Fairy STP operations

No material impacts on STP operations are expected due to the proposed change in drinking water quality.

Discharge of brine from the Local Treatment option will reduce spare capacity at the outfall pump station depending on the discharge arrangement.

Contextual note regarding expected wastewater salinity

Drinking water in Port Fairy is approximately 900 mg/L total dissolved solids.
Currently the salinity of sewage at the domestic STP is about 2,000 mg/L total dissolved solids.
Hence the salt load of the sewage doubles between the point it is collected at homes and business, and when it reaches the STP for treatment.
Inflow and infiltration is estimated to contribute about 40% of the total salt load at the STP, or about 800 mg/L.
Hence with the implementation of Quality Water for Wannon and provision of improved drinking water at 300 mg/L total dissolved solids, it is estimated that wastewater salinity will be 1,100 mg/L on arrival at the STP.

Consideration	Pipeline Options	Local Treatment
Changes to recycling demand / applications	No significant difference between options, provided brine from local treatment is transferred to the outfall pump station.	
Biosolids reuse opportunities	No significant difference between options, provided brine from local treatment is transferred to the outfall pump station.	
Impacts on STP	No significant difference between options, provided brine from local treatment is transferred to the outfall pump station.	
Relative advantages	**N/A**	**N/A**
Relative disadvantages	**N/A**	**There is a possibility that brine will be transferred to the inlet of the STP, which negates any improvements to salinity**

Outcome / Recommendation: Provided brine from local treatment is transferred to the outfall pump station, there is no significant difference between options, this will be finalized in design.

Given this degree of uncertainty, pipeline options are marginally preferred with respect to implications for water recycling.

2.7.1 Direct Environmental Impacts – Native Flora and Fauna

Introduction / Context : Direct environmental impacts arise from the clearance of native vegetation communities associated with project construction. Approvals are required for the clearance of protected flora.

Assessment metrics

Interaction with Ecological Constraints

Depending on the potential impact, interactions with species listed under the Victorian Flora & Fauna Guarantee Act (FFG) or the Commonwealth Environment Protection & Biodiversity Conservation Act (EPBC) may trigger approval pathways.

The Victorian Biodiversity Atlas maps ecological vegetation classes (EVCs) of native vegetation listed under the FFG and EPBC Acts. No entries in the VBA are in the near vicinity of the Local Treatment option.

The quality and extent of native vegetation that may require removal will inform the level of assessment required to gain approval for the works.

Impacts to native vegetation

The Guidelines for the removal, destruction or lopping of native vegetation (DELWP 2017) guides how impacts on biodiversity should be considered.

There are three location categories that indicate the potential risk to biodiversity from removing even a small amount of native vegetation.

- Location 3 – includes locations where the removal of less than 0.5 hectares of native vegetation could have a significant impact on habitat for a rare or threatened species.
- Location 2 – includes locations that are mapped as endangered EVCs and/or sensitive wetlands and coastal areas (section 3.2.1) and are not included in Location 3.
- Location 1 – includes all remaining locations in Victoria.

Intersection of these by each option are shown in the following table.

Pipeline options have significant interactions with areas of native vegetation and protected ecological values.

The Local Treatment option also interacts with native vegetation but not any known ecological vegetation classes. The works are mostly located within an operating water treatment plant site.

For all options, surveys are required to gain required approvals for vegetation clearances.

Aspect	**Option 1A** (Pipeline via Koroit)	**Option 1B** (Princes Highway Pipeline)	**Option 1C** (Alternate Pipeline via Koroit)	**Option 2** (Local Treatment)
Does the option have interactions with known threatened ecological values?				
	• Yes	• Yes	• Yes	• No
What is the nature of EVCs intersected?				
	• Intersects with 2 identified EVCs (i.e. native vegetation)	• Intersects with 2 identified EVCs that have a bioregion conservation status (vulnerable and endangered)	• Intersects with 5 identified EVCs, 3 of which have a bioregion conservation status (endangered)	• None (Survey required to confirm)
Does the option have potential to impact protected native vegetation location categories?				
Location 3:	• None	• None	• None, but in proximity	• None
Location 2:	• Moderate	• Moderate	• Highest of options	• Minimal, but in proximity
Location 1:	• Will impact	• Will impact	• Will impact	• Will impact

Outcome / Recommendation: Pipeline options have significantly greater interaction with / requirement for clearance of native vegetation due to the larger areas of potential impact in relation to pipeline construction corridors.

Pipeline options will therefore require greater investment both in cost and duration of the approvals process, including the potential for delays relating to the need for identifying and obtaining vegetation offsets.

The Local Treatment option is therefore preferred in relation to direct environmental impacts associated with flora and fauna.

2.8.1 Direct Environmental Impacts – Water Dependent Ecosystems

Introduction / Context : Water dependent ecosystems include rivers, creeks, wetlands and lakes. These can be fed by surface or groundwater systems, and may be vulnerable to impacts arising from construction or operational project phases.

Assessment Metrics

Surface and groundwater dependent ecosystems occur across the region. Surface water ecosystems include rivers, creeks and wetlands, while groundwater ecosystems include aquatic and terrestrial ecosystems:

- Aquatic ecosystems that rely on the surface expression of groundwater – this includes surface water ecosystems which may have a groundwater component, such as some rivers, wetlands and springs. Marine and estuarine ecosystems can also be groundwater dependent, but these are not mapped in the Atlas.
- Terrestrial ecosystems that rely on the subsurface presence of groundwater–this includes all vegetation ecosystems.

The occurrence of regional aquatic and terrestrial groundwater dependent ecosystems (GDEs) is shown on the following page. Aquatic GDEs occur in conjunction with waterways of the region.

Pipeline options would involve crossing of several waterways where both surface and groundwater dependent ecosystems occur. Trenchless construction techniques (e.g. horizontal directional drilling) can be employed to minimise and avoid impact to surface waters. Some short-term impacts can be expected from construction, which could be minimised by implementing various control measures.

The Dilwyn Aquifer has little interaction with the surface environment, other than in the upper reaches in the Otway Ranges which do not contribute to the Dilwyn Aquifer recharge at Port Fairy. GDEs of the region are reliant on upper aquifers which occur close to the land surface Extraction from Dilwyn at Port Fairy would have no perceptible impact on surface interactions within any tangible timeframe.

Ecological impacts arising from surface flow harvesting is discussed in the earlier section on Water Resources.

Parameter	Pipeline options	Local Treatment option
Construction impacts to (fresh) water dependent ecosystems	Likely that numerous crossings will be required, however impacts would be short term and can be mitigated	No interaction with water dependent ecosystems
Operational impacts to (fresh) water dependent ecosystems	Increases extraction from the Gellibrand will impact flow requirements for native fish populations	No interaction with water dependent ecosystems.
Ocean outfall – brine impacts to seawater ecosystems	Unknown	Unknown

Both the pipeline option and local treatment will involve eventual ocean discharges. The impact will be low, and no material change in the characteristics of this impact at the outfall that occurs presently is expected.

Outcome / Recommendation : For this area of analysis, the Local Treatment option is preferred as has negligible impact to water dependent ecosystems, whereas pipeline options may have minor but manageable impacts to waterways associated with construction.

2.8.2 Direct Environmental Impacts – Water Dependent Ecosystems



Regional Aquatic Groundwater Dependent Ecosystems (GDEs)



Regional Terrestrial Groundwater Dependent Ecosystems (GDEs)

2.9.1 Potential Legislative Triggers

Introduction / Context : The table below is a summary of the potential legislative and approval environmental triggers that may arise from the options.

The tables below provide an indication of the likelihood of the trigger occurring, based on high-level desktop assessment, on-ground field surveys would be required to fully assess these for all options.

Relevant Legislation and Approval Triggers	Requirement	Pipeline Options	Local Treatment
Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)	A referral to the Australian Government Minister for the Environment is required for any action/s that has, will have, or is likely to significant impact an MNES under the EPBC Act – this can include threatened species, migratory species, threatened ecological communities, Ramsar sites, etc.	Yes	Unlikely
Flora and Fauna Guarantee Act 1988 (FFG Act)	The FFG Act aims to protect Victoria's biodiversity. It requires public authorities e.g. Wannon Water to consider the FFG Act when performing functions that might impact biodiversity. Interactions with protected or threatened flora or communities may require a permit under the Act unless impacts to these value can be avoided. Mitigation measures will be required to be implemented to avoid and minimise the impacts of works on threatened or protected values and limit Potentially Threatening Processes.	Yes	Yes
Environment Effects Act 1978 (EE Act)	A referral to the Minister for Planning would be required when a project has the potential to have significant environmental effects that would be of consequence to the state of Victoria, for example the potential long-term loss of a significant portion of habitat for a threatened species or clearing of 10 ha or more of native vegetation considered endangered in the bioregion.	Possible	Unlikely

2.9.2 Potential Legislative Triggers

Relevant Legislation and Approval Triggers	Requirement	Pipeline Options	Local Treatment
Guidelines for the removal, destruction or lopping of native vegetation (DELWP 2017) – the Guidelines.	The Guidelines are incorporated into the Victoria Planning Provisions and all planning schemes in Victoria. The Guidelines provide instruction on how an application for a permit to remove native vegetation is to be assessed under the P&E Act, including requirements to undertake a site assessment, the required site-assessment method, and any specific conditions that may form part of a granted permit, such as offsetting.	Yes	Yes
Wildlife Act 1975	A Management Authorisation (a permit under the Wildlife Act 1975) is required for the purposes of capturing, handling, or relocating fauna (e.g., if fauna need to be removed from hollows during lopping or tree removal, or from trenches that are left open). The need for a Management Authorisation can be determined following an assessment of potential fauna, fauna habitat and proposed construction methods and mitigation.	Possible	Unlikely
Water Act 1989	A Works on Waterways Permit is required for any works and activities in, under, on or over the bed and banks of Designated Waterway. The permit is provided by the relevant Catchment Management Authority	Yes	No
Planning and Environment Act 1987 (P&E Act)	The P&E Act is provided for under Clause 52.17 of the planning scheme, which stipulates that a permit is required for the removal of native vegetation. A permit to remove native vegetation is required for any works that impact patches of native vegetation, scattered trees and scattered native plants, unless otherwise exempt.	Yes	Yes

Outcome / Recommendation : The Pipeline options have a higher likelihood in of triggering various legislated requirements in delivery. These are expected to be manageable, and would likely impact the delivery program rather than impact overall viability. The Local Treatment option is therefore preferred in this regard, as it less likely to trigger these legislated requirements.

Social

→ 2.10 Historical Heritage

2.11 Cultural Heritage

2.12 Traditional Owner Interpretation

2.13 Planning

2.10 Historic Heritage

Introduction / Context : Historic heritage includes sites and places that illustrate the historical occupation, use and development of land and communities across Victoria.

Analysis process : Historic heritage registers, overlay and mapping were considered for each of the options.

Victorian Heritage Register (VHR) - Sites are those of Significance to the State of Victoria – if the works intersect with a VHR site, a permit or a permit exemption may be required. H2239 – Norfolk Island Pine Avenues of Port Fairy is the most likely to be impacted by the Pipeline options.

Final design should, where possible, avoid VHR sites. This may have other implications such as increased cost due to otherwise less preferred alignments.

Victorian Heritage Inventory (VHI) - Sites are those that contain archaeological significance. If the works intersect with a VHI site , consents may be required. Multiple VHI sites are known to be in proximity to the Koroit Pipeline options (1A, 1C).

Heritage Overlay (HO) - Sites of local significance - if the works intersect with a HO site permits may be required. Pipeline options intersect with HO sites 48 and 49, with additional HO sites within close proximity at Port Fairy, Koroit and Tower Hill. The local treatment option is in proximity of HO site 62.

Historic Heritage Findings

Historic heritage reports to accurately assess historic heritage values and regulatory requirements are needed for all options.

The Koroit pipeline is in closer proximity to more VHI sites than the other options.

Aspect	**Option 1A** (Pipeline via Koroit)	**Option 1B** (Princes Highway Pipeline)	**Option 1C** (Alternate Pipeline via Koroit)	**Option 2** (Local Treatment)
Victorian Heritage Register	May intersect with Heritage Register	May intersect with Heritage Register	May intersect with Heritage Register	May intersect with Heritage Register
Victorian Heritage Inventory	May intersect with Heritage Inventory locations in Port Fairy and Koroit	May intersect with Heritage Inventory locations in Port Fairy and Tower Hill	May intersect with Heritage Inventory locations in Port Fairy and Tower Hill	May intersect with Heritage Inventory in Port Fairy
Heritage Overlay	All options intersect with the Heritage Overlay in Port Fairy			

Outcome / Recommendation : There is little difference between the highway and alternate pipeline and the local treatment options. The Koroit pipeline option is least preferred with regard to historic heritage.

2.11.1 Cultural Heritage

Introduction / Context : A Cultural Heritage Management Plan (CHMP) will likely be required under the Aboriginal Heritage Regulations 2018.

Analysis process : Cultural heritage was assessed by considering whether the options are in areas of cultural heritage sensitivity; and whether each of the options could be considered high impact. Areas of cultural heritage sensitivity for the region are shown on following page – these include land within 200 metres of named waterways and land within 50 metres of registered Aboriginal cultural heritage places.

Regulation 25	*Registered cultural heritage place*
Regulation 26	Waterways - Moyne River, Murray Brook, Merri River, Yangery Creek, Tower Hill Lake and Belfast Lough
Regulation 34	*Koo Wee Rup Plain* - Swamp and lake deposits
Regulation 36	*Stony Rise* - Mt Rouse lava flow
Regulation 37	*Volcanic Cone*
Regulation 40	*Dune*
Regulation 41	*Sand Sheet*

Aspect	**Option 1A** (Pipeline via Koroit)	**Option 1B** (Princes Highway Pipeline)	**Option 1C** (Alternate Pipeline via Koroit)	**Option 2** (Local Treatment)
CHMP Mandatory	Yes			
Area/s of cultural heritage sensitivity	Yes			
High impact activity	Yes			
May contain registered Aboriginal places	Unknown	Yes		
Approximation of likely costs for CHMP*	Several $100k			<$100k

High impact activities are a mandatory trigger for a CHMP within an area of cultural heritage sensitivity. *High impact activity - Regulation 46 Buildings and works for specified uses:* The construction of a building or the construction or carrying out of works on land is a high impact activity if the construction of the building or the construction or carrying out of the works:

a) Would result in significant ground disturbance; and

b) is for, or associated with, the use of the land for any one or more of the following purposes—

xxvii. a utility installation, other than a telecommunications facility, if:

B. The works are a linear project that is the construction of a pipeline with a length exceeding 500 metres or

D. The works affect an area exceeding 25 square metres;

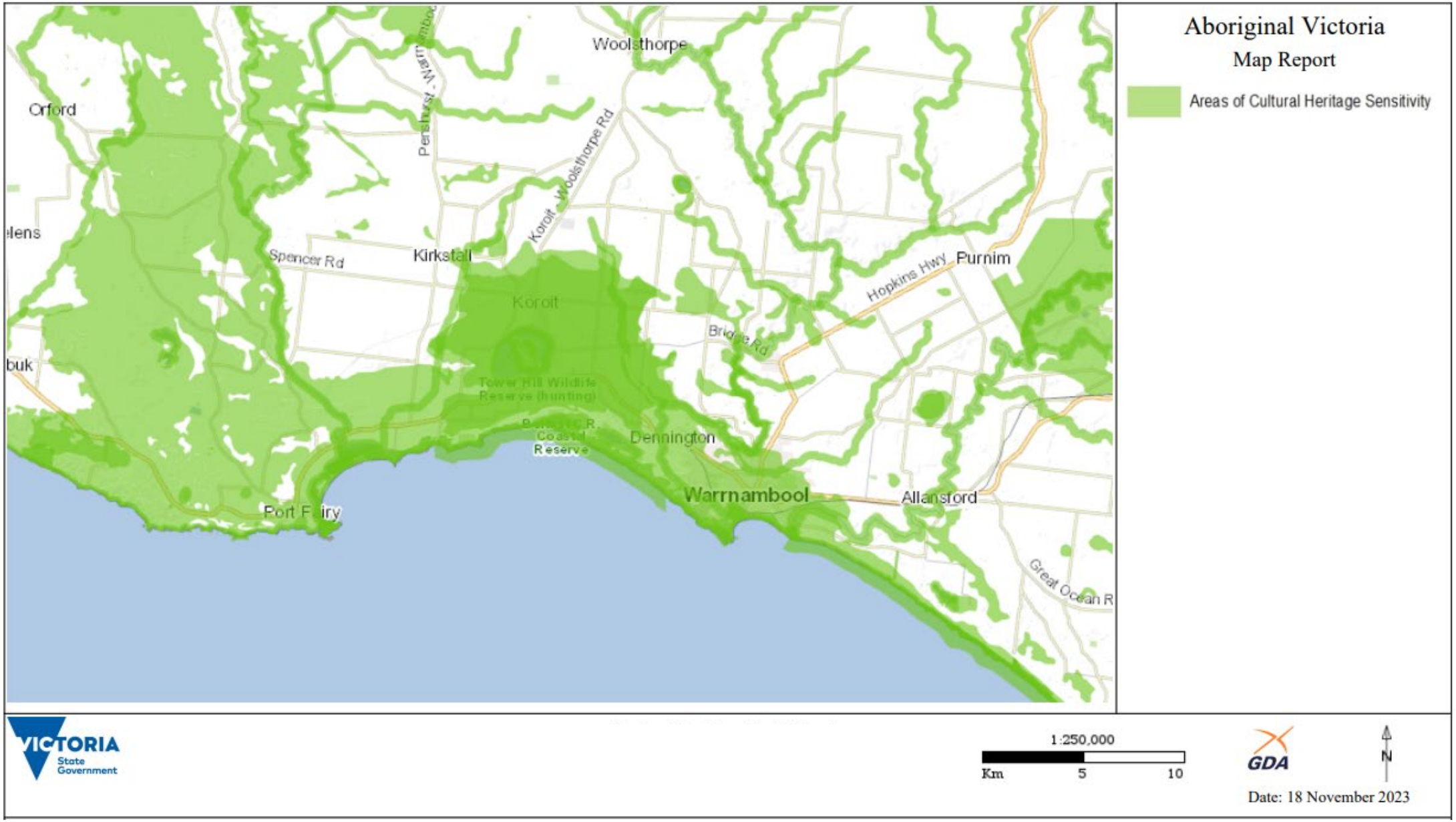
*Potential costs - There is a wide range of potential costs for CHMP, from a small block of land such as the Local Treatment option, which could be in the order of ~$80k, through to larger projects with significant areas of excavation and salvage programs which could be in the region of a $1M. It may be likely that the Pipeline options would fall somewhere in the middle, given the length of the pipeline and the amount of excavation required. However, this is difficult to estimate without further investigation to determine whether significant ground disturbances will occur.

Outcomes :

- All options are within areas of cultural heritage sensitivity.
- Each of the options are considered as high impact activities.
- Pipeline options have significantly greater potential for cultural heritage impacts, simply due to the much greater length (<5km vs ~30 km) and impacted areas involved.

Recommendation : While each option is similar in their requirements regarding cultural heritage, it is highly likely that the pipeline options will encounter significantly more cultural heritage sites and this will increase costs of associated approvals.

2.11.2 Cultural Heritage



2.12 Traditional Owner Interpretation

Introduction / Context : The Eastern Maar are the Traditional Owners of south western Victoria. Eastern Maar Aboriginal Corporation is the professional organisation that represents the Eastern Maar People of South West Victoria – is the Registered Aboriginal Party for the region and manage their Native Title rights and interests.

Eastern Maar are aware of the options assessment being undertaken for water supply options to Port Fairy and directed by Wannon Water, as part of the assessment, to take into consideration the Traditional Owner Nation Statement developed in response to the State Governments Water is Life: Traditional Owners Access to Water Roadmap process.

Analysis process : The Eastern Maar Nation Statement provides insight as to how the options can be assessed. The water supply options were considered and interpreted by GHD against Eastern Maar Traditional Owner Nation Statement.

Eastern Maar Traditional Owner Nation Statement - Water is Life

Eastern Maar view Parreeyt (water) as a bio-cultural value. Their primary objective is to restore waterways to a healthy condition. This will then provide a stable foundation that supports a rich and abundant biodiversity, providing greater contributions to the overall health of all Victorians.

Eastern Maar recognise that fresh, brackish, and saline systems are of equal value and must be managed as part of the greater bio-cultural landscape.

Their Statement identifies several intrusive practices that have been and are undertaken, to the detriment of the Parreeyt resource. These include:

- Diversion schemes
- Wetland drainage
- Watercourse channeling
- Wholesale habitat destruction, eradication of native flora and fauna, endangerment and extinction of critical flora and fauna species
- Dam construction in waterways and waterbodies
- Excessive drilling and installation of bores

Water is Life objective	Pipeline Options	Local Treatment
Primary objective to restore waterways to a healthy condition, with their approach based on caring for parreeyt (water)	None of the options are focused on improving the state of the resource; arguably, the pipeline options would have greater impact to the surface water resource than accessing additional groundwater.	
Recognise that fresh, brackish, and saline systems are of equal value	✘ Devalues local groundwater based on salinity	✓ Values locally available water resources
Focus on bio-cultural regions and landscapes	✘ Exporting of surface water outside its natural catchment can be interpreted as going against this.	✘ Groundwater extraction through pumping is likely also against this
Practices considered intrusive and manipulation of natural systems	✘ Diversion schemes	✓ No new bores proposed. Uses existing artesian bores.

Outcome / Recommendation : None of the options completely align with the Eastern Maar Traditional Owner Nation Statement. The local treatment option does not impact waterways which support native biodiversity, whereas pipeline options increase pressure on the Gellibrand River / Otway system.

2.13.1 Planning Triggers

Introduction / Context : Interaction with the planning system is a necessary element of the project. Understanding the planning requirements for each option can assist in determining if one or more option/s is more onerous in this regard.

Methodology

- This assessment includes a high-level identification of planning permit triggers within the Moyne Shire Planning Scheme and Warrnambool City Planning Scheme. It does not include a detailed assessment of the proposed works against relevant planning policy or other approvals outside of the Planning Scheme. This assessment is high-level and cannot be relied upon to progress approvals.
- The desktop assessment undertaken for each option was performed using the online software VicPlan provided by the Department of Energy, Environment and Climate Change (DEECA). VicPlan was used to identify the preliminary location of each option and which zones and overlays are applicable to each option.
- It is assumed that the works are limited to works associated with pipeline construction along the preliminary alignments provided.
- Planning permit triggers have been reviewed for land use, buildings and works and vegetation impacts under each planning control in the following pages. Within each assessment, planning permit triggers are highlighted in **blue**.

Summary of Planning Triggers:

Planning permit likely to be required	**Option 1A** (Pipeline via Koroit)	**Option 1B** (Princes Highway Pipeline)	**Option 1C** (Alternate Pipeline via Koroit)	**Option 2** (Local Treatment)
Moyne Shire Council	Yes	Yes	Yes	Yes
Warrnambool City Council	Yes	Yes	Yes	NA

Outcome / Recommendation :

For all options it is recommended that a comprehensive planning assessment is undertaken to confirm planning permit triggers, confirm if other planning approvals are required, and to identify approval pathways and to assess the project against the Planning Policy Framework.

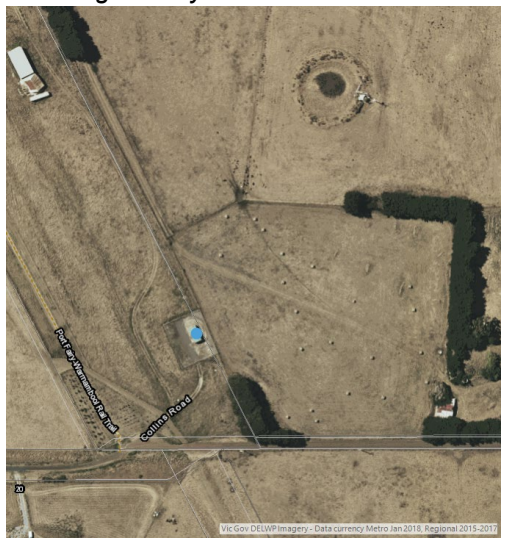
- All options have multiple planning permit triggers.
- In general, one planning permit application can be prepared for the project within the one council area. Applications are likely to be required for both Moyne Shire and Warrnambool City Councils for the Pipeline options. This compares with a single application for Moyne Shire for the Local Treatment option.

2.13.3 – Planning Assessment (Koroit Pipeline continued)

Planning zones



Planning overlays



Illowa PS Upgrade – Moyne Shire Planning Scheme			
Land use definition	*Utility installation* as it is land used *to collect, treat, transmit, store or distribute water.*		
Planning control	**Is a planning permit required for:**		
	Land use?	**Buildings and works?**	**Vegetation impacts?**
Farming Zone (FZ)	✕ No as use is existing	✕ No – exempt under clause 62.02-2 works are internal as the gross floor area of the building, or the size of the works, is not increased and the number of dwellings is not increased.	✕ No
Clause 52.17 Native Vegetation	✕ No	✕ No	Unlikely native vegetation impacts will occur as works are internal ✓ **Yes** if works need to remove, destroy or lop native vegetation, including dead native vegetation

Planning zones



Planning overlays

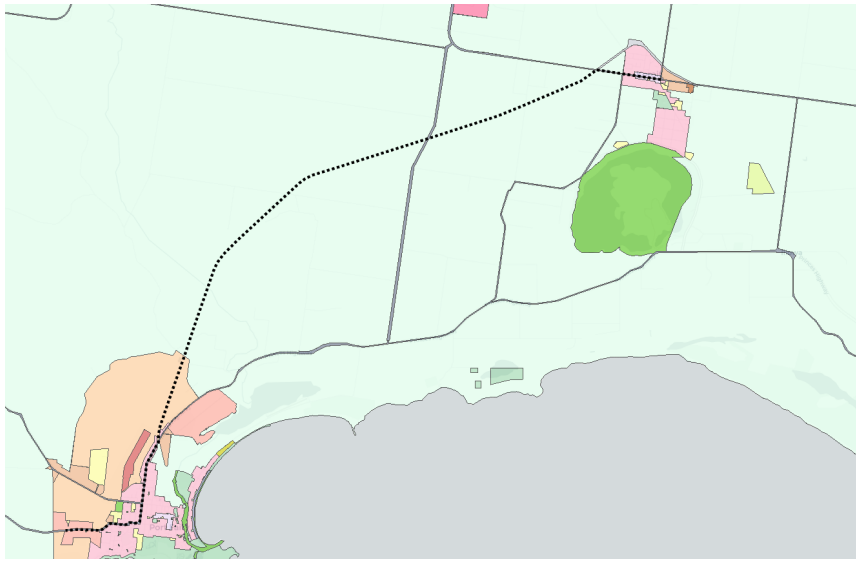


Raglan St PS Upgrade – Warrnambool City Planning Scheme			
Land use definition	*Utility installation* as it is land used *to collect, treat, transmit, store or distribute water.*		
Planning control	**Is a planning permit required for:**		
	Land use?	**Buildings and works?**	**Vegetation impacts?**
Transport Zone 2 (TRZ2)	✕ No as use is existing	✕ No – exempt under clause 62.02-2 works are internal as the gross floor area of the building, or the size of the works, is not increased and the number of dwellings is not increased.	✕ No
Clause 52.17 Native Vegetation	✕ No	✕ No	Unlikely native vegetation impacts will occur as works are internal ✓ **Yes** if works need to remove, destroy or lop native vegetation, including dead native vegetation

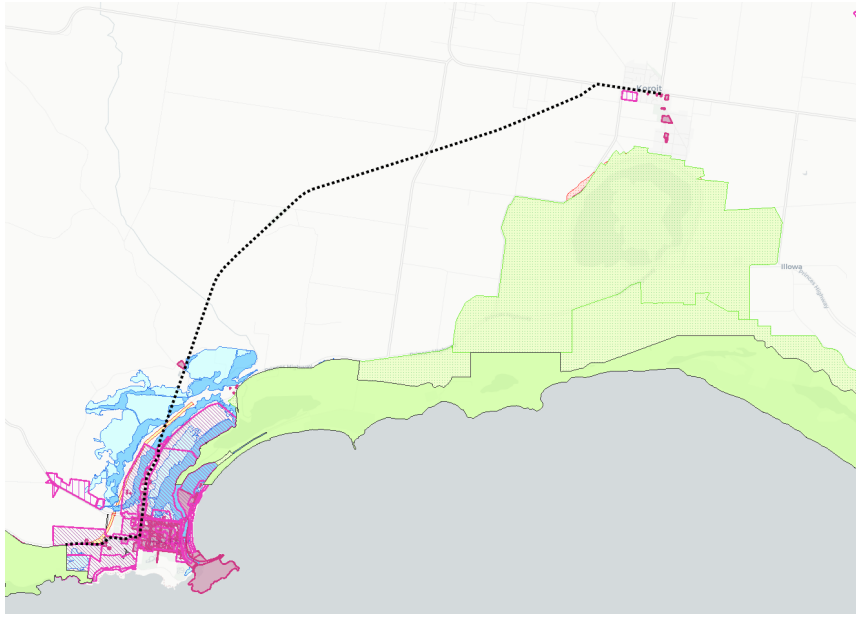
2.13.2 – Planning Assessment

Option 1A – Pipeline via Koroit

Planning zones



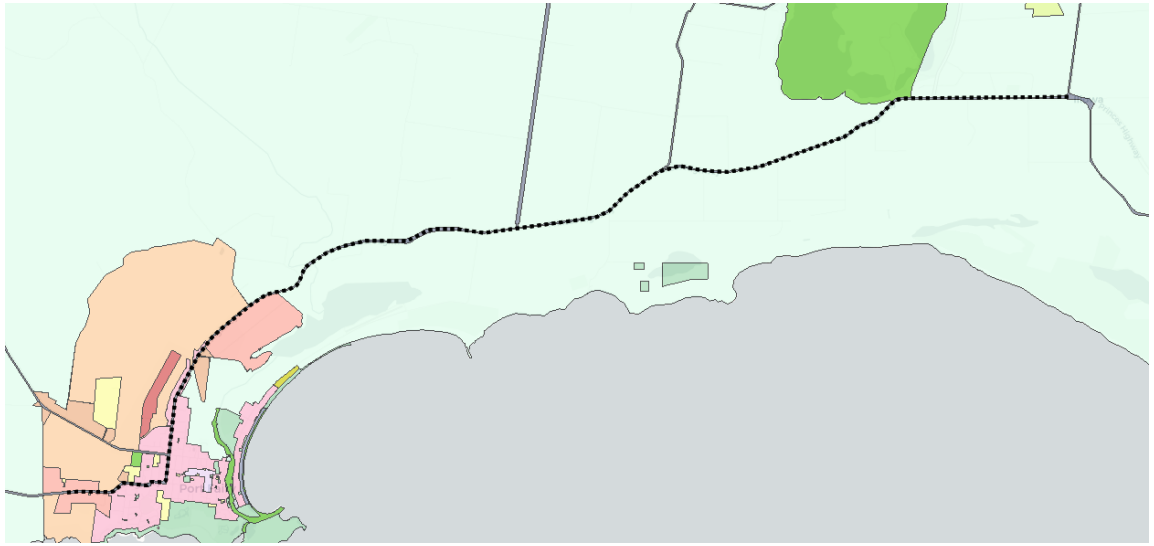
Planning overlays



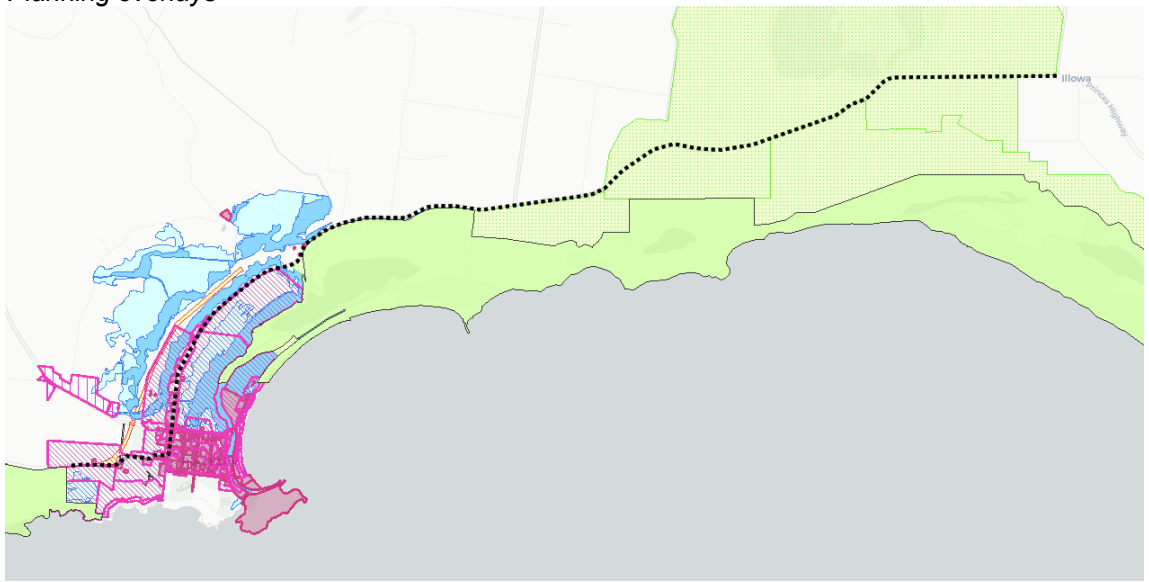
Moyne Shire Planning Scheme			
Land use definition	*Utility installation* as it is land used *to collect, treat, transmit, store or distribute water.*		
Planning control	**Is a planning permit required for:**		
	Land use?	**Buildings and works?**	**Vegetation impacts?**
Transport Zone 2 (TRZ2)	✓ **Yes**	✓ **Yes**	✕ No
Farming Zone (FZ)	✓ **Yes**	✓ **Yes**	✕ No
Rural Living Zone (RLZ)	✓ **Yes**	✓ **Yes**	✕ No
Design and Development Overlay (DDO21)	✕ No	✓ **Yes**	✕ No
Heritage Overlay (HO48)	✕ No	✓ **Yes**	✕ No
Heritage Overlay (HO49)	✕ No	✓ **Yes**	✓ **Yes** tree controls apply to 5 x Norfolk Island Pines at Princes Highway Road Reserve
Floodway Overlay (FO)	✕ No	✓ **Yes**	✕ No
Land Subject to Inundation Overlay (LSIO2)	✕ No	✕ No – subject to approved plans to the satisfaction of responsible authority that underground water mains do not alter topography	✕ No
Public Acquisition Overlay (PAO1)	✓ **Yes** – to use land for any Section 1 or 2 use within the respective zone	✓ **Yes**	✓ **Yes** to damage, remove or destroy any vegetation
Clause 52.17 Native Vegetation	✕ No	✕ No	✓ **Yes** to remove, destroy or lop native vegetation, including dead native vegetation

2.13.4 – Planning Assessment
Option 1B – Pipeline via the Princes Highway

Planning zones



Planning overlays



Moyne Shire Planning Scheme			
Land use definition	*Utility installation* as it is land used *to collect, treat, transmit, store or distribute water.*		
Planning control	**Is a planning permit required for:**		
	Land use?	**Buildings and works?**	**Vegetation impacts?**
Transport Zone 2 (TRZ2)	✓ **Yes**	✓ **Yes**	✕ No
Environmental Significance Overlay (ESO1)	✕ No	✓ **Yes**	✓ **Yes**
Significant Landscape Overlay (SLO5)	✕ No	✓ **Yes**	✓ **Yes** to remove, destroy or lop any vegetation except weeds, planted gardens or dead vegetation
Significant Landscape Overlay (SLO6)	✕ No	✓ **Yes**	✓ **Yes** to remove, destroy or lop any vegetation except weeds, planted gardens or dead vegetation
Design and Development Overlay (DDO15)	✕ No	✓ **Yes**	✕ No
Design and Development Overlay (DDO21)	✕ No	✓ **Yes**	✕ No
Heritage Overlay (HO48)	✕ No	✓ **Yes**	✕ No
Heritage Overlay (HO49)	✕ No	✓ **Yes**	✓ **Yes** tree controls apply to 5 x Norfolk Island Pines at Princes Highway Road Reserve
Land Subject to Inundation Overlay (LSIO2)	✕ No	✕ No – subject to approved plans to the satisfaction of responsible authority that underground water mains do not alter topography	✕ No
Floodway Overlay (FO)	✕ No	✓ **Yes**	✕ No
Bushfire Management Overlay (BMO)	✕ No	✕ No	✕ No
Clause 52.17 Native Vegetation	✕ No	✕ **No**	✓ **Yes** to remove, destroy or lop native vegetation, including dead native vegetation

2.13.5 – Planning Assessment (Option 1B Pipeline via the Princes Highway continued)

Construction of new pumping station adjacent to Illowa pumping station

Planning zones



Planning overlays



New PS adjacent to Illowa PS – Moyne Shire Planning Scheme			
Land use definition	*Utility installation* as it is land used *to collect, treat, transmit, store or distribute water.*		
Planning control	**Is a planning permit required for:**		
	Land use?	**Buildings and works?**	**Vegetation impacts?**
Farming Zone (FZ)	✕ No as proposed location is within the site currently used for pump station	✓ **Yes**	✕ No
Clause 52.17 Native Vegetation	✕ No	✕ No	✓ **Yes** to remove, destroy or lop native vegetation, including dead native vegetation

Planning zones



Planning overlays

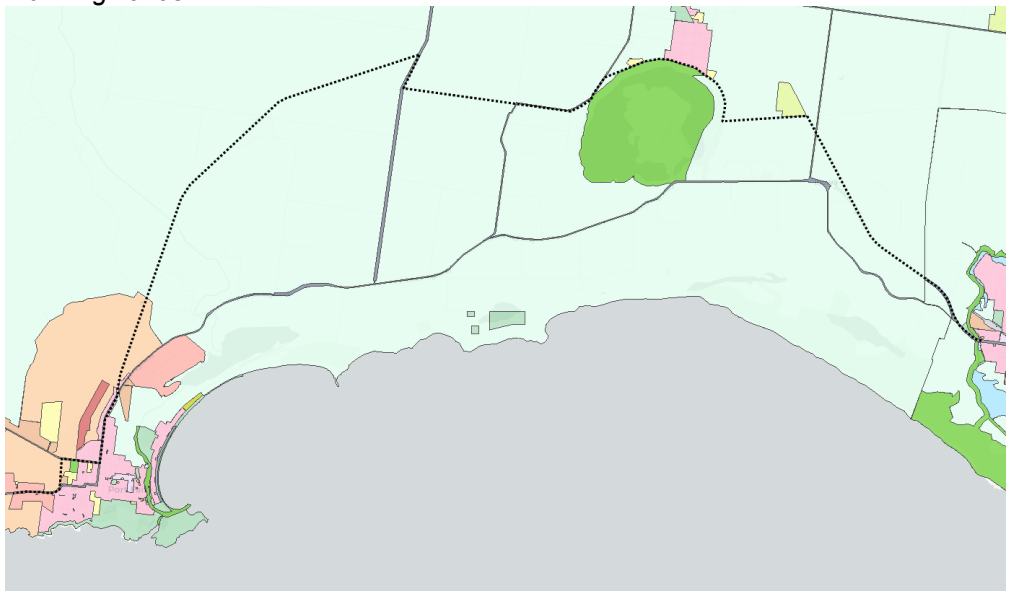


Raglan St PS Upgrade – Warrnambool City Planning Scheme			
Land use definition	*Utility installation* as it is land used *to collect, treat, transmit, store or distribute water.*		
Planning control	**Is a planning permit required for:**		
	Land use?	**Buildings and works?**	**Vegetation impacts?**
Transport Zone 2 (TRZ2)	✕ No as use is existing	✕ No – exempt under clause 62.02-2 works are internal as the gross floor area of the building, or the size of the works, is not increased and the number of dwellings is not increased.	✕ No
Clause 52.17 Native Vegetation	✕ No	✕ No	Unlikely native vegetation impacts will occur as works are internal ✓ **Yes** if works need to remove, destroy or lop native vegetation, including dead native vegetation

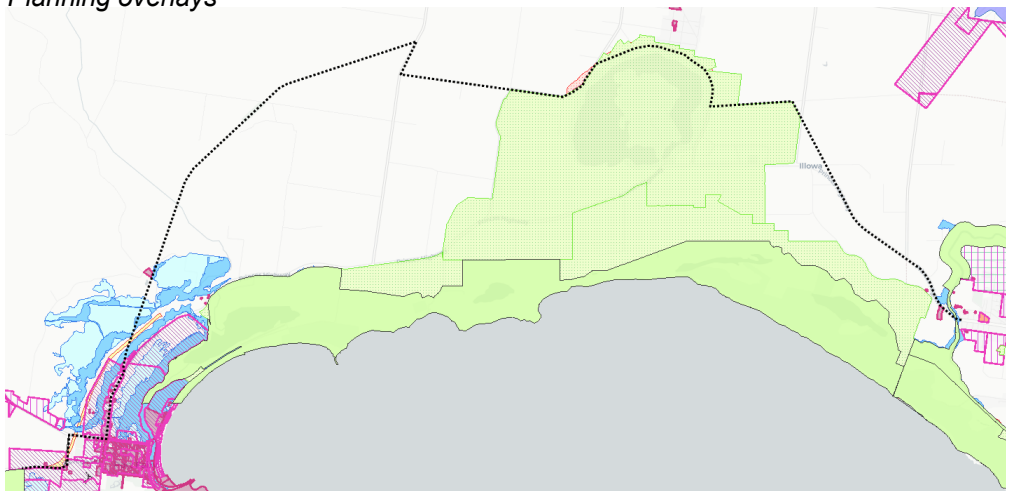
2.13.6 – Planning Assessment

Option 1C - Alternate Pipeline via Koroit

Planning zones



Planning overlays



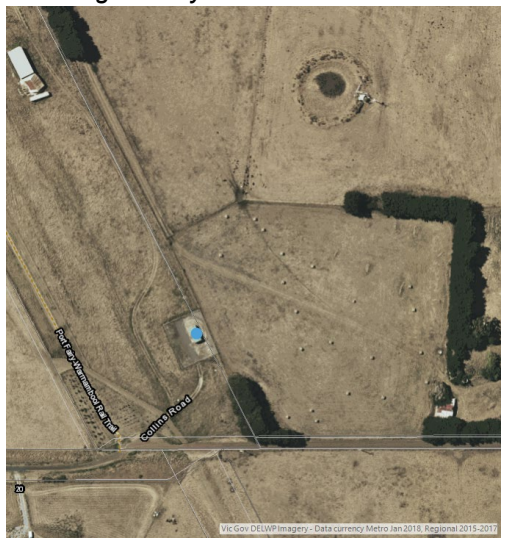
Moyne Shire Planning Scheme			
Land use definition	*Utility installation* as it is land used *to collect, treat, transmit, store or distribute water.*		
Planning control	**Is a planning permit required for:**		
	Land use?	**Buildings and works?**	**Vegetation impacts?**
Farming Zone (FZ1)	✓ **Yes**	✓ **Yes**	✕ No
General Residential Zone 1 (GRZ1)	✓ **Yes**	✓ **Yes**	✕ No
Transport Zone 2 (TRZ2)	✓ **Yes**	✓ **Yes**	✕ No
Rural Living Zone (RLZ)	✓ **Yes**	✓ **Yes**	✕ No
Industrial Zone 1 (IN1Z)	✓ **Yes**	✓ **Yes**	✕ No
Significant Landscape Overlay (SLO6)	✕ No	✓ **Yes**	✓ **Yes** to remove, destroy or lop any vegetation except weeds, planted gardens or dead vegetation
Bushfire Management Overlay (BMO)	✕ No	✕ No	✕ No
Floodway Overlay (FO)	✕ No	✓ **Yes**	✕ No
Land Subject to Inundation Overlay (LSIO2)	✕ No	✕ No – subject to approved plans to the satisfaction of responsible authority that underground water mains do not alter topography	✕ No
Public Acquisition Overlay (PAO1)	✕ No	✓ **Yes**	✓ **Yes** to damage, remove or destroy any vegetation
Design and Development Overlay (DDO15)	✕ No	✓ **Yes**	✕ No
Design and Development Overlay (DDO19)	✕ No	✓ **Yes**	✕ No
Design and Development Overlay (DDO21)	✕ No	✓ **Yes**	✕ No
Heritage Overlay (HO48)	✕ No	✓ **Yes**	✕ No
Heritage Overlay (HO49)	✕ No	✓ **Yes**	✓ **Yes** tree controls apply to 5 x Norfolk Island Pines at Princes Highway Road Reserve
Clause 52.17 Native Vegetation	✕ No	✕ No	✓ **Yes** to remove, destroy or lop native vegetation, including dead native vegetation

2.13.7 – Planning Assessment (Alternate Pipeline continued)

Planning zones



Planning overlays



Illowa PS Upgrade – Moyne Shire Planning Scheme			
Land use definition	*Utility installation* as it is land used *to collect, treat, transmit, store or distribute water.*		
Planning control	**Is a planning permit required for:**		
	Land use?	**Buildings and works?**	**Vegetation impacts?**
Farming Zone (FZ)	✕ No as use is existing	✕ No – exempt under clause 62.02-2 works are internal as the gross floor area of the building, or the size of the works, is not increased and the number of dwellings is not increased.	✕ No
Clause 52.17 Native Vegetation	✕ No	✕ No	Unlikely native vegetation impacts will occur as works are internal ✓ **Yes** if works need to remove, destroy or lop native vegetation, including dead native vegetation

Planning zones



Planning overlays

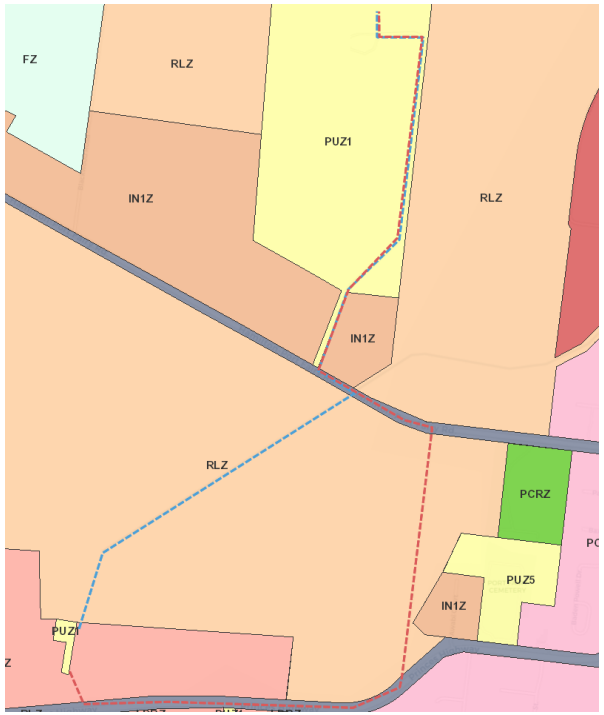


Raglan St PS Upgrade – Warrnambool City Planning Scheme			
Land use definition	*Utility installation* as it is land used *to collect, treat, transmit, store or distribute water.*		
Planning control	**Is a planning permit required for:**		
	Land use?	**Buildings and works?**	**Vegetation impacts?**
Transport Zone 2 (TRZ2)	✕ No as use is existing	✕ No – exempt under clause 62.02-2 works are internal as the gross floor area of the building, or the size of the works, is not increased and the number of dwellings is not increased.	✕ No
Clause 52.17 Native Vegetation	✕ No	✕ No	Unlikely native vegetation impacts will occur as works are internal ✓ **Yes** if works need to remove, destroy or lop native vegetation, including dead native vegetation

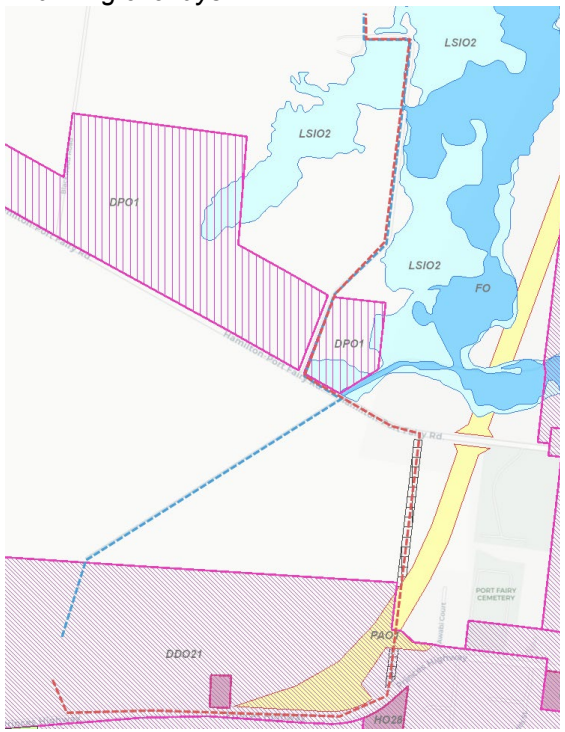
2.13.8 – Planning Assessment

Option 2 – Local Treatment Option

Planning zones



Planning overlays



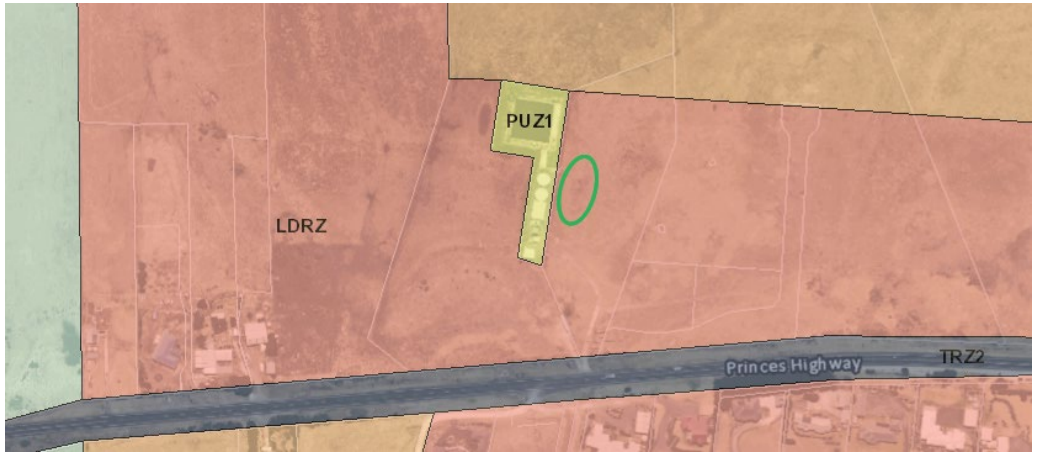
Moyne Shire Planning Scheme

Land use definition	*Utility installation* as it is land used *to collect, treat, transmit, store or distribute water.*		
Planning control	**Is a planning permit required for:**		
	Land use?	**Buildings and works?**	**Vegetation impacts?**
PIPELINE 1 (blue line)			
Public Use Zone 1 (PUZ1)	✕ No	✕ No	✕ No
Transport Zone 2 (TRZ2)	✓ **Yes**	✓ **Yes**	✕ No
Rural Living Zone (RLZ)	✓ **Yes**	✓ **Yes**	✕ No
Low Density Residential Zone (LDRZ)	✓ **Yes**	✓ **Yes**	✕ No
Design and Development Overlay (DDO21)	✕ No	✓ **Yes**	✕ No
Land Subject to Inundation Overlay (LSIO2)	✕ No	✕ No – subject to approved plans to the satisfaction of responsible authority that underground water mains do not alter topography	✕ No
Clause 52.17 Native Vegetation	✕ No	✕ No	✓ **Yes** to remove, destroy or lop native vegetation, including dead native vegetation
PIPELINE 2 (red line)			
Public Use Zone 1 (PUZ1)	✕ No	✕ No	✕ No
Transport Zone 2 (TRZ2)	✓ **Yes**	✓ **Yes**	✕ No
Low Density Residential Zone (LDRZ)	✓ **Yes**	✓ **Yes**	✕ No
Design and Development Overlay (DDO21)	✕ No	✓ **Yes**	✕ No
Public Acquisition Overlay (PAO1)	✓ **Yes** – to use land for any Section 1 or 2 use within the respective zone	✓ **Yes**	✓ **Yes**
Development Plan Overlay (DPO1)	✕ No	✕ No	✕ No
Land Subject to Inundation Overlay (LSIO2)	✕ No	✕ No – subject to approved plans to the satisfaction of responsible authority that underground water mains do not alter topography	✕ No
Clause 52.17 Native Vegetation	✕ **No**	✕ **No**	✓ **Yes** to remove, destroy or lop native vegetation, including dead native vegetation

2.13.9 – Planning Assessment

Option 2 – Local Treatment Option continued

Planning zones



Planning overlays



Moyne Shire Planning Scheme			
Land use definition	*Utility installation* as it is land used *to collect, treat, transmit, store or distribute water.*		
Planning control	**Is a planning permit required for:**		
	Land use?	**Buildings and works?**	**Vegetation impacts?**
WTP site only			
Low Density Residential Zone (LDRZ)	✓ **Yes**	✓ **Yes**	✕ No
Design and Development Overlay (DDO21)	✕ No	✓ **Yes**	✕ No
Clause 52.17 Native Vegetation	✕ No	✕ No	✓ **Yes** to remove, destroy or lop native vegetation, including dead native vegetation

Comment on WTP site zoning

Wannon Water own land immediately east of the PUZ1 parcel shown on VicPlan mapping. This additional land was purchased relatively recently, and has been incorporated within the WTP site fence line (it is used for truck turning). Note that the aerial imagery predates this acquisition.

Wannon Water to advise on whether the additional part of fence line this site will be rezoned to PUZ, or remain as LDRZ.

2.14 Revenue

→ **Additional customer & profit opportunities**

2.14.1 Additional customers & profit opportunities

Introduction / Context :

The potential for Wannon Water to supply new customers was considered across pipeline options and compared to local treatment opportunities. A distinction was drawn between the immediate and longer-term potential for new customers. The immediate potential considers properties adjacent to newly established pipelines, while the longer-term potential considers future supply improvements with each option.

Methodology

Potential for additional customers (immediate):

To evaluate immediate opportunities for additional customers, GHD evaluated the number of properties along each pipeline route.

- The high revenue scenario assumes that 100% of eligible properties receive connections and become customers.
- The low revenue scenario assumes a 50% connection rate.

Annual consumption to calculate revenue for each connected property was estimated based on an assumed average of 2.5 people per property and average consumption of 150 L/person/day.

Immediate opportunities to connect agricultural customers was considered negligible as it was assumed that readily accessible and cheap groundwater supplies will continue to be utilised. No other significant commercial or manufacturing opportunities were identified, as major customers are already connected to the Port Fairy / Warrnambool systems.

When compared with Wannon Water's experience with customers wanting to connect to other transfer mains (e.g. existing Koroit main), this rate of uptake is likely optimistic.

Annual revenue vs. annual profit:

A Wannon Water supplied sale price of $2.44 / kL was used to estimate revenue. This figure only considers additional water sales and does not consider operating expense estimates for each option.

Profit was determined as 'revenue' – 'costs'. This analysis indicates that there are no clear profit opportunities via additional customer connections. Note that a full net present cost analysis is presented in 2.15.5

Aspect	**Option 1A** (Pipeline via Koroit)	**Option 1B** (Princes Highway Pipeline)	**Option 1C** (Alternate Pipeline via Koroit)	**Option 2** (Local Treatment)
Estimated number of connected properties	14 - 27	83 – 166	14 – 28	0
Average daily consumption (kL/day)	5 – 10	31 – 62	5 - 11	0
Annual revenue*	< $ 10 k	$ 30 – 60 k	< $ 10 k	$ 0 k
Future customer connection opportunities	Limited future opportunities due to pipe capacity limitations			Opportunities to expand the Port Fairy network to include additional customers

* Refer 2.15.7 for net operating costs associated with each option

Potential for additional customers (longer-term):

After immediate customer opportunities via pipeline options are realized, there are expected to be limited additional opportunities as the pipeline will be sized for Port Fairy's demand. A local treatment plant can undergo modular upgrades for subsequent capacity improvements. This creates future opportunities to connect customers via extensions of the current Port Fairy network

Outcome / Recommendation : Pipeline options have the potential to generate revenue for Wannon Water by connecting additional customers. The estimated additional revenue is small in the context of the operating costs for these options.

The Local Treatment option does not introduce any new revenue opportunities.

On this basis the Pipeline options are preferred.

2.15 Costs

→ **CAPEX**

OPEX

NPC

Costs Comparison

2.15.1 Costs – Pipelines CAPEX

Introduction / Context : The CAPEX directly associated with pipeline options implementation was evaluated as inputs to a net present cost assessment. Note that this CAPEX does not include the costs for enabling works (refer 2.15.2).

Methodology - CAPEX

Pipeline costs have been reviewed based on recent similar projects across regional Victoria. The following pipe rates were used for trenched construction, with low and high estimates considered as the internal diameters of the pipes required fall within the rates available:

The following rates were used for trenchless installation (HDD) at river and major road crossings:

Diameter	Greenfield – Open Cut ($/m)	Greenfield – HDD 6m deep ($/m)
225	$ 270	$ 568
300	$ 350	$ 672
375	$ 542	$ 789

Existing pump station costs assume major upgrade (costs will be less if existing building / pipework/ electrical can be reused)

Easement acquisition / road reinstatement costs were collectively modelled as low and high range scenarios:

- Low range assumes all pipework is laid within a 5 m wide easement at $10/m2 (i.e. $50 per linear metre of pipeline). Actual construction corridor will be wider then 5 m.
- High range assumes the entire length of pipework requires road reinstatement costs of $100/m (which also accounts for a high easement acquisition cost scenario)

The Port Fairy security of supply storage was sized using the town's expected peak day demand in 2046 (5.8 ML/d). Since Port Fairy's existing storages are required to maintain network flow and pressure, additional security of supply was modelled as 2 No. 2.9 ML storages. Costs were evaluated using recent inflation-adjusted Wannon Water project costs. These costs were cross-referenced with inflation-adjusted costs from other recent examples in regional Victoria.

Outcome / Recommendation : Refer 2.15.5 for net present cost analysis and 2.15.7 for overall options comparison using outputs from this section

All costs $ in Millions	**Option 1A** (Pipeline via Koroit)		**Option 1B** (Princes Highway Pipeline)		**Option 1C** (Alternate Pipeline via Koroit)	
Estimate bounds	*Low*	*High*	*Low*	*High*	*Low*	*High*
Raglan Pde Pump Station	$ 0.6*	$ 1.1	$ 0.6*	$ 1.1	$ 0.6*	$ 1.1
Illowa St Pump Station	$ 0.5*	$ 0.9	NA	NA	$ 0.5*	$ 0.9
Princes Hwy	NA	NA	$ 0.8	$ 0.8	NA	NA
DN325 Harr Tank to Illowa	$ 2.2	$ 3.5	$ 2.2	$ 3.5	$ 2.2	$ 3.5
DN325 Illowa to Koroit	$ 1.5	$ 2.4	NA	NA	$ 1.5	$ 2.4
DN285 Koroit to Port Fairy	$ 5.7	$ 7.4	NA	NA	$ 6.2	$ 8.1
DN285 Princes Hwy to Pt Fairy	NA	NA	$ 5.4	$ 7.0	NA	NA
HDD total	$ 0.4	$ 0.6	$ 0.4	$ 0.6	$ 0.4	$ 0.6
Easement &/ Rd reinstatement	$ 1.6	$ 3.2	$ 1.3	$ 2.6	$ 1.6	$ 3.2
Subtotal base construction	$ 12.5	$ 19.0	$ 10.7	$ 15.6	$ 12.5	$ 19.0
Port Fairy security of supply	$ 5.7 M					
+ 10% design, 20% PM, 30% contingency	**$ 29.0**	**$ 39.4**	**$ 26.2**	**$ 34.0**	**$ 29.9**	**$ 40.7**
Not included	**Approvals and offsets / Upgrade at Albert St PS / enabling works / decommissioning costs**					

*Low cost pertains to pump upgrades should the existing pump station be able to be upgraded. This may not be technically viable due to specific high flow/low head duty of existing pump station.

2.15.2 Costs – Pipeline Options enabling works CAPEX

Introduction / Context : The CAPEX associated with enabling works for pipeline options implementation was evaluated in terms of a net present financial impact to Wannon Water

Methodology - CAPEX

Cost estimates for key enabling works were developed using escalated values from prior Wannon Water estimates or upgrades (refer table).

It is noted that costs for enabling works will be brought forward by introduced demand from Port Fairy, not solely by pipeline options.

The financial impact of enabling works was considered using a base case (i.e., no pipeline to Port Fairy) versus a pipeline option scenario. As previously discussed (refer 2.0.3), pipeline options bring forward enabling works by an estimated 7 years. Note that a definite date for these works under the base case is not currently available for this analysis.

The financial impact of enabling works was therefore estimated by comparing the full (escalated to 2023) cost estimates for these works against the discounted value of enabling works after 7 years:

Net Present Cost	=	Enabling work costs	-	Enabling work costs in 7 years discounted back to 2023

Outcome / Recommendation : Refer 2.15.5 for net present cost analysis and 2.15.7 for overall options comparison using outputs from this section

All costs $ in Millions	Ewens Hill storage expansion dam	Curdievale groundwater extraction	Warrnambool WTP upgrade
Cost of works (Estimate, escalated to 2023)	*$ 4.9 M*	*$ 2.2 M **	*$ 3.6 M ***
Present (discounted) value of works under base case	$ 3.6 M	$ 1.6 M	$2.7 M
Impact on net present cost	**$ 1.3 M**	**$ 0.6 M**	**$ 0.9 M**
Indicative total present cost impact	**$ 2.8 M *****		

* Assuming 2 no. additional boreholes at depth > 500 m. Initial stage will involve recommissioning existing bore, with additional bores to follow with demand growth. Additional costs are expected for infrastructure (e.g. pipelines, pumping stations) to connect Curdievale groundwater to the Warrnambool system.
**Scaled upgrade costs are based on DAFF upgrades (2004). Attempts were made to adjust this estimate for inflation however the actual Warrnambool WTP upgrade costs are expected to be higher.
*** This estimate does not include design, project management, or contingency allowances and is presented as an indicative estimate of the impact of pipeline options.

2.15.3 Costs – Pipelines OPEX

Introduction / Context : GHD developed an operating cost (OPEX) estimate for both direct and indirect OPEX as follows:

- Direct OPEX: Pumping energy use and maintenance of pump station and pipeline assets
- Indirect OPEX: Marginal costs of additional water supplied from Warrnambool, considering raw water extraction, treatment and all water transfer

OPEX is an input to the net present cost analysis used to compare overall cost of the options.

Methodology - OPEX

Operating costs have been informed by current costs incurred by Wannon Water in the operation and maintenance of the Otways system and Warrnambool WTP and other assets.

Direct costs:

- Operation and maintenance requirements were estimated as 3% of pump station CAPEX, 0.1% of pipeline CAPEX, and 1-2% of security of supply CAPEX (OPEX ranges reflect the application of O&M to the CAPEX range for these assets).
- Energy consumption costs were modelled at $300/MWh (30 cents per kWh) to allow for the supply of 100% Greenpower, expected network price rises, and uncertainty.

Indirect costs:

- Incremental costs for raw water extraction and transfer costs from the existing headworks and Otways pipelines (pumping energy costs at the energy rate noted above)
- Marginal cost for additional treated water to be produced by the Warrnambool WTP including energy and chemical costs.
- Fixed operating costs (e.g. maintenance and labour) were not included. The marginal cost of sludge disposal was not included as was assessed as not being material to the analysis.

10% contingency was applied to all OPEX items.

Parameter	**Option 1A** (Pipeline via Koroit)	**Option 1B** (Princes Highway Pipeline)	**Option 1C** (Alternate Pipeline via Koroit)
Electricity (pumping to PF)	*$ 70 k*	*$ 45 k*	*$ 75 k*
Electricity (Raw water extraction)	*$ 145 k*	*$ 145 k*	*$ 145 k*
Electricity (Warrnambool WTP)	*$ 25 k*	*$ 25 k*	*$ 25 k*
Total electricity	$ 240 k	$ 210 k	$ 240 k
Warrnambool WTP chemicals	$ 25 k	$ 25 k	$ 25 k
Pipeline operation and maintenance	$ 10 - 15 k	$ 10 k	$ 10 - 15 k
Pump stations operation and maintenance	$ 30 - 60 k	$ 40 - 60 k	$ 30 - 60 k
Security of supply operation and maintenance	$ 60 – 110 k	$ 60 – 110 k	$ 60 – 110 k
Contingency (10%)	$ 35 – 45 k	$ 30 – 35 k	$ 35 - 45 k
OPEX	$ 400 - 500 k	$ 380 - 460 k	$ 400 - 500 k
Cost ($ / ML)	$ 685 - 855	$ 650 - 790	$ 690 - 860

Outcome / Recommendation : Refer 2.15.5 for net present cost analysis and 2.15.7 for overall options comparison using outputs from this section

2.15.4 Costs – Local Treatment CAPEX & OPEX

Introduction / Context : CAPEX and OPEX estimates were taken from the concept development work that underpinned the Great Tasting Water Business Case and subsequent funding submissions for use in the option cost comparison.

Methodology

CAPEX

Port Fairy WTP upgrade costs were escalated from costs developed for Great Tasting Water Business Case (2021) to bring up to present day values.

- 40% escalation to the start of 2023 as per “Business Case Addenda: Capital Cost Increases” to reflect current industry trends since the original costs were developed, including inflation and post-pandemic construction market conditions.

Future costs:

- Port Fairy WTP upgrades will reach end-of-life earlier than a pipeline (Approx. 20 to 25 years asset life for mechanical and electrical assets). The NPC analysis has factored in this replacement cost.

OPEX

- Port Fairy WTP OPEX items (chemicals, O&M, replacement components) escalated from costs developed for GTW Business case (40% to start of 2024). Electricity costs were estimated using WTP’s projected energy consumption at $0.3 / kWh.
- 10% contingency was applied to all OPEX items

Outcome / Recommendation : Refer 2.15.5 for net present cost analysis and 2.15.7 for overall options comparison using outputs from this section

CAPEX Items	Local Treatment
Contractor Overheads/Preliminaries	$ 0.8 – 1.2 M
Chemical & Mechanical Works	$ 3.8 – 5.5 M
Site Pipework	$ 0.1 – 0.2 M
Civil Works	$ 3.0 – 4.4 M
Electrical and Control Works	$ 0.9 – 1.3 M
Commissioning and Testing	$ 0.2 – 0.3 M
Engineering and Approvals (15%)	$ 1.3 – 1.9 M
Contingency (30%)	$ 3.1 – 4.4 M
Total CAPEX	**$ 13.3 - 19.2 M**

OPEX Items	Local Treatment
Electricity	$ 150 – 215 k
Chemicals	$ 55 – 80 k
Operation and maintenance	$ 80 – 115 k
Replacement of membranes, cartridge filters	$ 20 – 25 k
Contingency (10%)	$ 30 – 45 k
Total OPEX (Annual)	$ 330 – 480 k
Cost ($ / ML)	$ 570 - 830

2.15.5 Costs – NPC Analysis

Introduction / Context : High and low range net present costs (NPC) were evaluated for each option.

Methodology and Assumptions

NPC evaluated over 50 years at a 4.2% discount rate (Wannon Water provided discount rate)

CAPEX applied at year 1 and OPEX applied from year 2

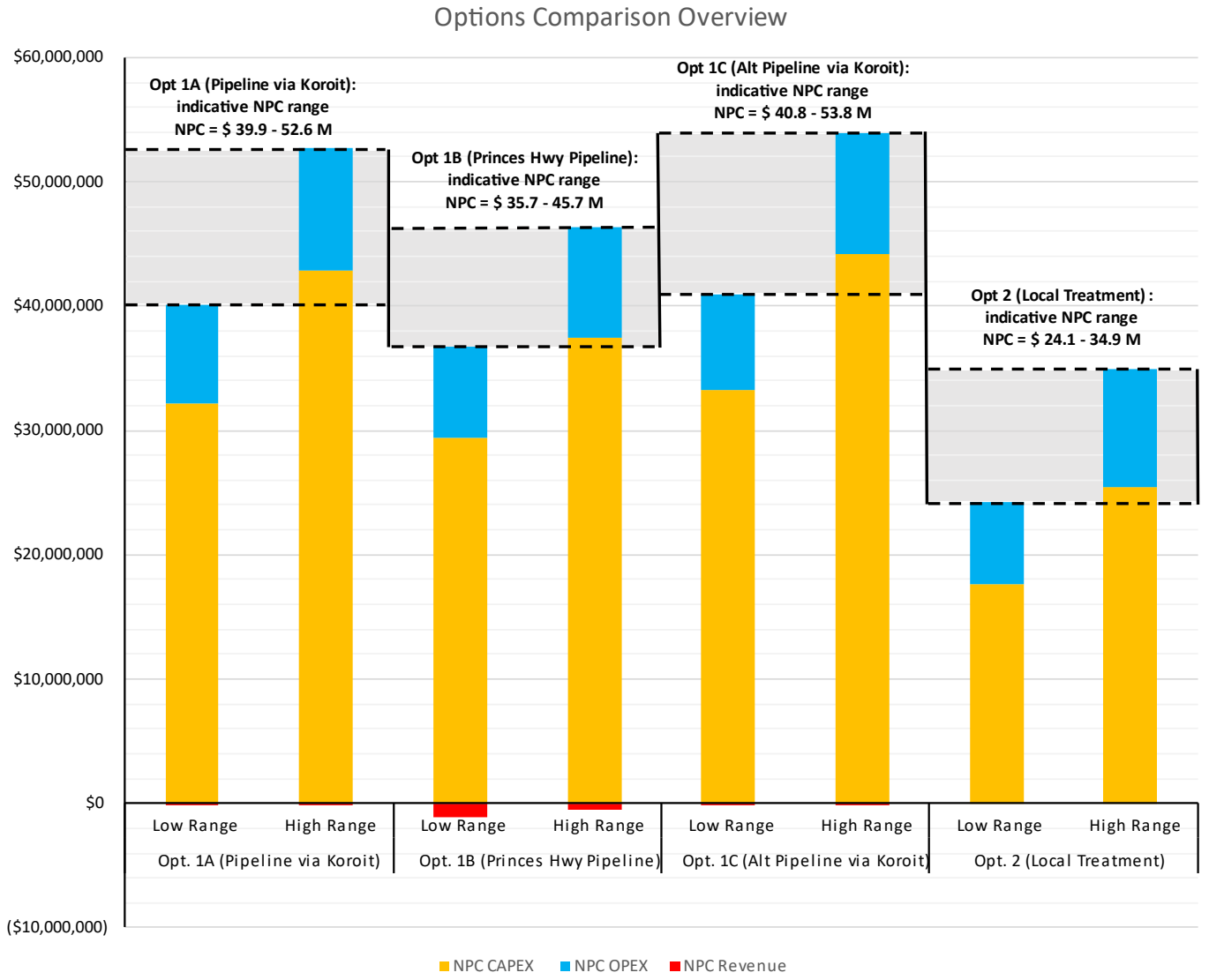
For the option cost comparison, consideration is made of the different asset life and renewals profile required for treatment and pipeline options. A full CAPEX renewal was modelled after the expected lifespans for each asset class (civil, electrical, mechanical, and pipework-related) was exceeded.

No depreciation or residual/salvage value calculated.

The present cost of enabling works was included as a single capital expenditure within year 1 (refer 2.15.2)

Asset type	Adopted lifespan (years)	CAPEX breakdown (Pipeline options)	CAPEX breakdown (Local Treatment)
Civil	50	35%	35%
Electrical	20	5%	10%
Mechanical	20	5%	50%
Pipelines	80	55%	5%

Outcome / Recommendation : The expected range of net present cost of local treatment is significantly lower than the expect range of net present treatment for pipeline options. Local treatment is the preferred option under this criteria.



2.15.6 Costs – NPC: Residual Value & Sensitivity

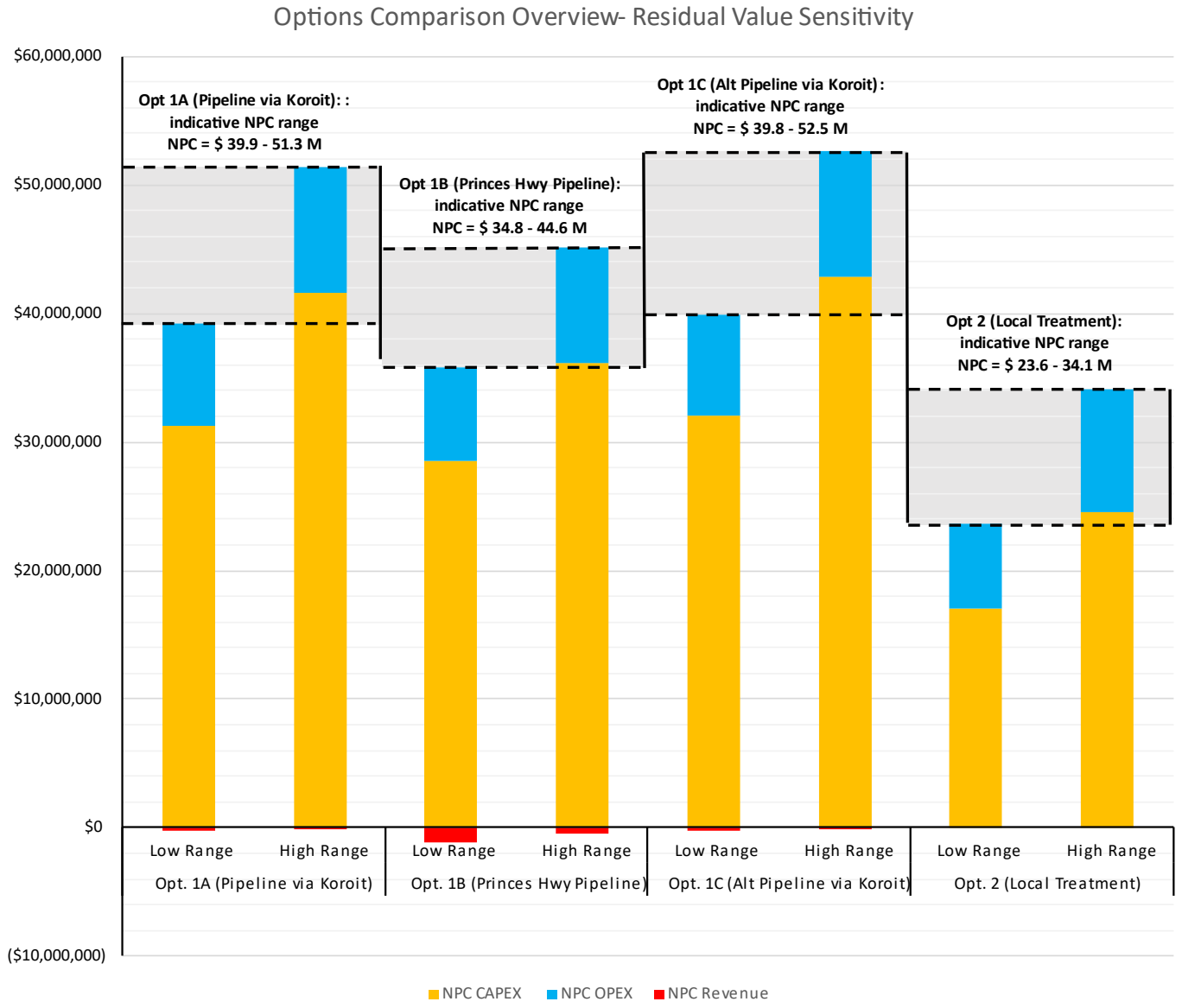
Introduction / Context : A net present cost sensitivity scenario has been considered to measure the impact of including residual value on the viability of each option

Methodology and Assumptions

- NPC methodology as per 2.15.5
- Residual value for assets with remaining life has been included, calculation has assumed straight-line depreciation (depreciation costs not included in cashflow).

Outcome / Recommendation : Inclusion of the residual value makes little difference to the analysis, as the value provided is heavily discounted in the NPC at the 50 year mark.

Local Treatment remains as the preferred option on an NPC basis.



2.15.7 Costs – Options Comparison

Introduction / Context : Immediate and "bring forward" costs were evaluated to determine if they were a significant point of difference between options.

Options comparison:

CAPEX:

GHD's high level cost assessment indicates that local treatment is more competitive from an "immediate" capital expenditure perspective.

OPEX and Cost/ML

There is no major difference between options for the cost of producing water per ML.

Enabling works:

Pipeline options introduce > $ 3 M (discounted to present value) of enabling works. Refer 2.15.2.

Net Present Cost:

Despite opportunities for additional customers and increased asset lifespans, pipeline options are expected to have significantly higher net present costs relative to local treatment.

Outcome / Recommendation : Local treatment is the overall preferred option on a cost basis.

	Option 1A (Pipeline via Koroit)	Option 1B (Princes Highway Pipeline)	Option 1C (Alternate Pipeline via Koroit)	Option 2 (Local Treatment)
CAPEX	$ 29.0 – 39.4 M	$ 26.2 – 34.0 M	$ 29.9 – 40.7 M	$13.3 – 19.2 M
OPEX	$ 400 - 500 k	$ 380 - 460 k	$ 400 - 500 k	$ 330 – 480 k
Cost / ML	$ 685 - 855	$ 650 - 790	$ 690 - 860	$ 570 – 830 /ML
Enabling works	Net present cost impacts Warrnambool WTP: > $ 1.3 M Ewens Hill storage expansion: > $ 0.6 M Otways supply augmentation (e.g. bores): > $ 0.9 M			None
Net present cost	$ 39.9 – 52.6 M *Including enabling works' costs*	$ 35.7 – 43.7 M *Including enabling works' costs*	$ 40.8 – 53.8 M *Including enabling works' costs*	$ 24.1 – 34.9 M *Includes 1 x WTP renewal*
Relative advantages	(Relatively) simple to operate. Long asset life.			Low initial capital cost. Scalable.
Relative disadvantages	Capital Intensive. Less able to respond to unexpected demand growth.			Higher ongoing renewals, shorter asset life. More complex operation.

*These estimates do not include an allowance for environmental or cultural heritage planning & approvals work.

Other Considerations

→ **2.16 Impact on Existing Infrastructure**

2.17 Relevant Government Policies

2.16 Impact on Existing Infrastructure

Introduction / Context : The potential for each option to impact existing Wannon Water infrastructure was evaluated.

System component	Option 1A (Pipeline via Koroit)	Option 1B (Princes Highway Pipeline)	Option 1C (Alternate Pipeline via Koroit)	Option 2 (Local Treatment)
Upstream of Warrnambool WTP				
• Headworks	• Bring forward resource augmentation by approx. 7 years (worst case, likely less). This includes additional bores at Curdievale (drawing from Dilwyn Aquifer at this location).			No impact
• NOP/SOP	• Bring forward off-stream storage (Ewens Hill) by approx. 7 years (worst case, likely less).			No impact
Warrnambool WTP and Downstream				
• WTP	• Bring forward capacity augmentation of Warrnambool WTP by approximately 7 years. Augmentation includes accessing the Dilwyn aquifer at Curdievale.			No impact
• Warrnambool Network	• Additional demand lowers pressure in reticulation, and triggers major upgrade at Raglan Pde PS. • Albert St PS requires upgrade (or similar solution to boost pressures in multiple locations by ~5m).			No impact
• Illowa PS and Koroit Main	• Existing main insufficient; options all include a duplication (325 ID)			No impact
• Koroit Basin	• 1A & 1C - Higher turnover and reduction in security of supply for Koroit in event of upstream transfer failure. • No impacts from Option 1B (via Princes Hwy direct)			No impact
• Warrnambool STP & Outfall	• Slight increase in solids loading via additional sludge from Warrnambool WTP. Marginal increase in biosolids production and treated effluent volumes discharged through the outfall.			No impact
Port Fairy WTP	Retain chlorinator, storages and High Lift Pump Station. Decommission cooling towers and Calgon system Security of supply compromised, need to include new storage tank			Upgraded to add new process units. New washwater and brine pipelines to sewer/STP respectively.
Port Fairy Water Supply Network	No change expected			No hydraulic change expected Consideration of impact of soft water on network assets.
Port Fairy STP (Domestic and Industrial)	No change expected. (Lower salinity influent for all options)			
Port Fairy Outfall	No change expected. (Lower salinity effluent for all pipeline options)			Small increase in flows (within capacity of outfall)

Outcome / Recommendation : Local treatment is the preferred option when considered against impact to existing Wannon Water infrastructure. There are minimal impacts, and these are confined to Port Fairy. The Pipeline options include infrastructure implications across the Otways/Warrnambool system and at Port Fairy.

2.17 Relevant Government Policies

- A consistent theme across all policies is the recognition of climate change and population growth vulnerabilities. Resource resilience and diversification of water sources are key approaches to address these. Water security therefore needs to be at the forefront of transparent decision making.
- Improving summer flows in the Gellibrand River is an action in the CGRSWS, which also supports the use of alternative and manufactured water including desalination.
- Groundwater Management 2030 recognizes the crucial contribution that groundwater makes to Victoria's total water resources; the policy has a priority to enable the use of saline groundwater – although is targeted towards agricultural irrigation, the concept that use of saline groundwater reduces pressure on surface water resources is relevant.
- The emphasis on connection in Victoria's Water Grid is to improve security of water supplies and therefore should not be considered as directly applicable to the pipeline options.

Water for Victoria: Water Plan (2016) - There is a potential for 50% reduction in streamflow by 2065 and Victoria's population will almost double by 2051. Reducing reliance on surface water and increasing use of diverse water sources including desalination to achieve secure water supplies is featured in the Water Plan.

Central and Gippsland Region Sustainable Water Strategy (2022) - Key challenges: climate change, growing population, rivers needing more water to maintain health, and traditional owner involvement in water planning. An action in the strategy is improving summer flows in the Gellibrand River. The strategy seeks to secure future water supplies through manufactured water - including desalinated, recycled and treated stormwater, as essential in meeting future water challenges. Groundwater supplies are considered a climate-dependent water source, (however the Dilwyn aquifer is amongst the least vulnerable due to its depth and large recharge area).

Groundwater Management 2030 (2022) - Groundwater seen as a crucial part of water security in Victoria. Shared understanding of groundwater resources, based on evidence; development of tools for flexible management; effective licensing and trade rules to enable flexible use of groundwater. Enabling and managing the use of saline groundwater is a priority under this policy document.

Wannon Water Urban Water Strategy (2022) - Considers threats including climate change, bushfire, droughts, and changing population demands; identifies augmentation options including winter flow harvesting from surface water, alternative water supply options such as ongoing expansion of the Warrnambool Roof Water Harvesting system, increased storages planned for 2031, followed by Curdievale bore supply.

Victoria's Water Grid (2023) - Maximise community benefit from a connected grid that contributes to water affordability and underpins water security - Potential solutions include infrastructure and alternative water. Getting water to where and when it is needed is becoming more difficult in some river systems with different supply points becoming less reliable and reductions in capacity in some areas.

Draft Victorian Waterway Strategy 2023 – This has three themes including Healthy waterways in a changing climate; Caring for Country – living, connected water landscapes and Community connections to waterways. The strategy seeks to strengthen the focus on climate change threats in the management of waterways.

Summary

→

3.0 Summary of Analysis

This section brings together the individual parameters that were considered, and simply presents a table of the preferred options/options for each section

Area of Analysis	Option 1A (Pipeline via Koroit)	Option 1B (Princes Highway Pipeline)	Option 1C (Alternate Pipeline via Koroit)	Option 2 (Local Treatment)
2.1 Water Quality				Preferred
2.2 Water Resources				Preferred
2.3 Water Security				Preferred
2.4 Energy & GHG				Preferred
2.5 Outfalls	Preferred			
2.6 Water Recycling	Preferred			
2.7 Flora & Fauna				Preferred
2.8 Water Dependent Ecosystems				Preferred
2.9 Environmental Legislative Triggers				Preferred
2.10 Historical Heritage	No preferred option - All options relatively similar			
2.11 Cultural Heritage				Preferred
2.12 Traditional Owner Interpretation	No preferred option - All options relatively similar			
2.13 Planning Triggers				Preferred
2.14 Revenue	Preferred			
2.15 Costs				Preferred
2.16 Infrastructure				Preferred
2.17 Policies				Preferred


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