Memorandum

Greater Avalon Employment Precinct (GAEP)

Date:	11 December 2025
Attention:	Victorian Planning Authority
Project:	Greater Avalon Employment Precinct / draft Amendment C477ggee
Purpose:	Submission on behalf of Avalon Ind 1 Pty Ltd - 15 Avalon Road, Avalon

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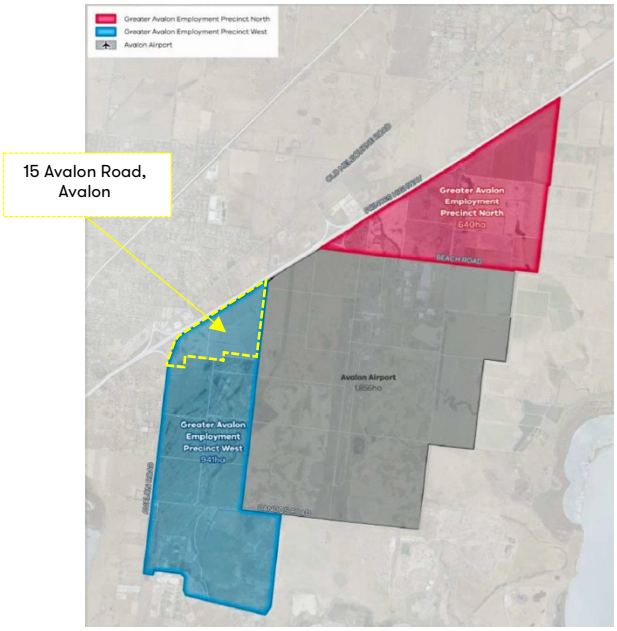
A Different City acts on behalf of Avalon Ind 1 Pty Ltd, who are the owners of the land at 15 Avalon Road, Avalon (**Subject Land**). The Subject Land forms part of the Greater Avalon Employment Precinct (**GAEP**), which is subject to draft Amendment C477 to the Greater Geelong Planning Scheme (**the Amendment**) prepared by the Victorian Planning Authority (**VPA**).

On behalf of our client, we have been instructed to prepare a submission to the exhibited Amendment as it relates to the Subject Land. This submission is supported by the following documentation which should be read in conjunction with this memo, forming part of our clients submissions:

- Phase 1 Stormwater Catchment Analysis 2025, prepared by *Rain*
- Transport Assessment memo, prepared by *Ratio*
- Infrastructure Assessment memo, prepared by *SPIIRE*

Background

The Subject Land is located in the western precinct of the GAEP area. The land holding has frontage to Avalon Road and the Princes Freeway and consists of a total site area of approximately 140 hectares. Refer below extract from Figure 3 of the Background Report to the Amendment which identifies the location of the Subject Land:



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Overall our client supports the intent of the Amendment and has worked closely with the Victorian Planning Authority for the past 2 years as the strategic planning for the GAEP has evolved. Specifically our client supports the implementation of the Avalon Corridor Strategy (2022) and the delivery of new industrial land in the Geelong region to assist in delivering economic activity and the jobs target established by *Victoria's Economic Growth Statement (2024).*

Our client has also worked closely and engaged with other key stakeholders in the GAEP area. This includes working closely with neighbours, MAB Corporation, who own the land immediately to the south of the Subject Land. Our client and MAB effectively control the entirety of the Western GAEP area.

Our client has engaged a number of technical experts to provide site specific design and development advice in relation to its landholding, including urban design, cultural heritage, ecology, drainage, civil infrastructure and traffic engineering. Specifically drainage and infrastructure considerations have been developed in conjunction with the MAB, who we continue to work closely with to ensure the development of the land occurs in an integrated fashion.

We note that substantial engagement has occurred with the VPA in relation to our clients site investigations and development direction to date. Our client remains committed to working closely with the VPA and other stakeholders to ensure that the future development of the land is consistent with State policy aspirations.

Submission to Amendment C477 to the Greater Geelong Planning Scheme

We understand that the Amendment seeks to make the following changes to the Greater Geelong Planning Scheme, as it relates to the Subject Land:

- Inserts a new Clause 11.03-6L-06 (Greater Avalon Employment Precinct).
- Rezones the Subject Land (including land in the GAEP West section identified for employment) from a Farming Zone (FZ) to Industrial 1 Zone (IN1Z).
- Inserts a new Schedule 53 to the Design and Development Overlay Schedule (DDO53) and applies DDO53 to the Subject Land and other land within the amendment area.
- Inserts a new Schedule 50 to the Development Plan Overlay Schedule (DDO50) and applies DPO50 to the Subject Land and other land within the amendment area.
- Amends the Schedule to Clause 52.16 Native Vegetation Precinct Plan to include native vegetation removal exemptions and offset requirements for areas within the precinct.
- Amends the Schedule to Clause 66.04 Referral of Permit Applications under Local Provisions to require referral of some permit applications to specific service authorities for land shown in Plan 1 to Schedule 50 of the Development Plan Overlay.
- Amends the Schedule to Clause 72.01 Responsible Authority for this Planning Scheme to list the Minister for Planning as the responsible authority for the approval and any amendment of a development plan under DPO50.
- Amends the Schedule to Clause 72.04 Schedule to the Documents Incorporated in this Planning Scheme to incorporate the *Greater Avalon Employment West Native Vegetation Precinct Plan*, WSP, November 2025.

Our client supports the proposal to rezone the Subject Land to an Industrial 1 Zone and apply a Development Plan Overlay (DPO) on the land to facilitate the coordinated development of the land for industrial purposes. However, our client has a number of concerns regarding the proposed drafting of the Amendment, specifically the requirements of the proposed Schedule 50 to the DPO, drafting of the proposed local policy and the inclusion of the proposed DDO and Schedule 53 of the DDO.

Having regard for the above we provide the following comments in relation to the draft Amendment, including:

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Draft Clause 11.03-6L-06 (Greater Avalon Employment Precinct)

The Amendment inserts a new Clause 11.03-6L-06 (Greater Avalon Employment Precinct) to include the GAEP Framework Plan and future vision for the whole precinct (west and north) and staging criteria for the sequencing of development may occur.

Our client supports the proposed objectives of the policy and drafting of strategies as they relate to the whole of the GAEP area. However it is considered that strategies in relation to the North Precinct should be removed from the draft provisions as they are premature to include as part of the Amendment having regard for the focus on the Western Precinct and the detail contained in the supporting background reports to the Amendment.

In our view the strategies related to the North Precinct lack sufficient basis for their inclusion in the Amendment without the supporting detail that would otherwise be included within a separate (future) Planning Scheme Amendment that specifically applies to the North Precinct.

It is therefore submitted that specific strategies related to the North Precinct should be deleted and the GAEP Framework Plan simplified to identify the North Precinct as subject to a future Planning Scheme Amendment.

Draft DPO Schedule 50

The Amendment seeks to insert a new Schedule 50 to the Development Plan Overlay Schedule (DPO50) to be applied to the Subject Land and the balance of the West Precinct.

Our client supports the application of the DPO and Schedule 50 to guide the future development of the land for industrial purposes. However, our client has significant concerns regarding the implementation of the schedule and ability for landowners to move forward with certainty given the complexity of the requirements of the schedule. Further the requirements for a Development Plan and permit conditions appear excessive to be included at the relevant stage of the planning process.

Having regard for the above we provide the following comments in relation to the drafting of the Schedule:

General Comments

- The schedule should include the ability for a Development Plan to be prepared and approved in parts. While our Client and MAB control the majority of the Precinct not all issues within the Precinct apply to both landholdings (ie. the environmental issues that apply at the south of the Precinct do not apply to the Subject Land). Therefore it is considered important to provide certainty for all stakeholder that the key landowners can move forward in a coordinated yet independent fashion. This includes the ability to amend a Development Plan independently, as may be necessary in the future post approval.

Clause 2.0 – Requirement before a permit is granted

- The exemptions for the grant of a permit before a development plan has been prepared should be expanded to include works that are consistent with the purpose / Section 1 uses allowed under the Industrial 1 Zone, including infrastructure and site preparation works. The inclusion of other temporary uses, super lot subdivision and works that may not prejudice the future development of the land in accordance with the industrial zone and DPO should also be included;
- Further details of the infrastructure requirements, timing, costings and apportionments need to be established in order to comment on the appropriateness of the requirements in relation to the Infrastructure Contributions Agreement and Transport Infrastructure Contributions Agreement at Clause 2 of the Schedule.

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We note infrastructure items to be funded and delivered by development within the GAEP West should have a clear nexus with the transport impacts and requirements. Ratio advise as currently proposed:

- *The extent of upgrade to the Avalon Road / Princes Freeway interchange is not clear acknowledging that the strategic traffic modelling undertaken to inform the amendment acknowledges that sources the other the GAEP West (including underlying Freeway traffic growth and traffic along Princes Freeway generated by the Airport) will be the primary driver for the need to upgrade this interchange;*
- *The active transport link across Princes Freeway shown adjacent to the interchange is not referenced. This link supports the whole of the GAEP and Avalon Airport and should be considered separately to the interchange;*
- *The upgrades to Avalon Road and the new intersection to Avalon Road as per the concept plan included within the Schedule to the DPO may not be required should direct access to the 15 Avalon Road land be permitted; and*
- *On the basis that the GAEP West Road network is delivered as per the concept plan included within Schedule 50 to the DPO, the Transport Infrastructure Contributions Agreement should include the extent of the internal road network required (land and construction) to provide access to the 15 Avalon Road land without relying in the internal road network to be delivered by others.*

Refer to Transport Assessment memo, prepared by *Ratio* and Infrastructure Assessment memo, prepared by *SPIIRE*.

Clause 3.0 Conditions & requirements for permits

- The requirement for a Stormwater Management Plan (SMP) to implement the Integrated Water Management Plan (IWMP), including climate change modelling, upstream/downstream impacts, and detailed civil plans should be deleted. SPIIRE advise that these requirements are duplicative and overly prescriptive, especially climate change modelling at subdivision stage, given detailed IWMP and a Storm water management strategy (SWMS) will have been developed during Development Plan stage (per Clause 4.0).
- The requirement for a Construction Environmental Management Plan (CEMP), should be applied only 'as relevant' to the part of the Development Plan area and not a mandatory condition. Further it is unnecessary for DEECA to be referred the CEMP post permit approval. We note that any requirements to be included in a CEMP will be explored during the planning permit process and can be assessed by the Responsible Authority (RA) to determine if the condition is satisfied;
- The requirement for a Preliminary Risk Screen Assessment should be deleted as the land will be developed for industrial purposes and will not be subject to any sensitive uses. Therefore the inclusion of the condition is unnecessary as part of a permit granted in accordance with the Development Plan;
- The inclusion of the requirement for Transport Infrastructure in Clause 3.0 of the Schedule is inappropriate and should be deleted as it is not a matter that should be included as a permit condition or requirement. Any response required in relation to transport infrastructure requirements should be implemented through the Development Plan itself.

Clause 4.0 – Requirements for development plan

- All requirements for Development Plan at Clause 4 of the Schedule should be expressed as 'as relevant' to the 'part of the GEAP area subject to the development Plan'. As per above 'General Comment', if the Development Plan is prepared in parts not all requirements may apply to the Subject Land as in other areas of the Precinct.
- All requirements for Development Plan at Clause 4 of the Schedule should be expressed as to the satisfaction of the Responsible Authority (RA) and the statutory authority ordinarily responsible as a referral authority only. It is unnecessary and inappropriate to require multiple stakeholders to be included in the assessment of 'satisfaction' test in each requirement / provision of the Schedule.

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- Clause 4 outlines the details required to be provided to the satisfaction of the RA. We note that the Minister for planning is proposed to be the RA for the approval and amendment of any development plan (per the proposed amended Schedule to Clause 72.01). This is supported by our client, however it is unnecessary to include reference to 'in consultation with the City of Greater Geelong'. Consultation with Council is implicit in the planning scheme and need not be included at this Clause of the draft schedule;
- It is considered unnecessary for the Development Plan 'site master plan' to include details of proposed land uses (beyond the terminology of 'industrial') proposed having regard for the 'interfaces' referred in Plan 1. This can be managed at the planning permit stage;
- Requirements to provide details of proposed cut and fill should be deleted in relation to the 'site master plan' condition, as these are matters for detailed design to be considered at the planning permit stage. This level of detail is unnecessary and subject to change at the Development Plan stage;
- The requirement for an Environment Protection and Biodiversity Conservation Report should be deleted from the Schedule. We note that biodiversity matters are dealt with via the EPBC Act and any recommendation implemented in the planning process via referral and permit conditions;
- Requirements in the schedule related to Avalon Airport Impacts Assessment (and similar) should be simplified or removed from the DPO schedule altogether. The Amendment proposes to facilitate the development of the land for industrial purposes in the known circumstance of the neighbouring airport environs. The proposed industrial use of the western precinct and form of development, including relevant building heights, is a threshold consideration of the planning process to determine if the rezoning / development of the land for industrial purposes is acceptable or will impact the airport operations. Once determined through this Amendment process it need not be considered again at the Development Plan stage.

  Further industrial development is unlikely to exceed heights that would conflict with Obstacle Limitations Surface (OLS) and Procedures for Air Navigational Services Aircraft Operations (PANs OPS) guidelines. Referral and engagement with Avalon Airport or the relevant Government department should be limited to a referral for comment during the planning scheme amendment process rather than via further reporting and assessment that is unnecessary in the context of a Development Plan or planning permits;
- The requirement for the preparation of an Integrated Water Management Plan (IWMP) and Drainage & Stormwater Management Strategy (DSWMS) should be prepared to the satisfaction of the RA and the relevant catchment management authority. While consultation with other stakeholders will occur as a matter of process through the consideration of the of the Development Plan it is unnecessary and inappropriate for other parties to be explicitly referred to in this Clause of the DPO, which adds confusion to the process and implementation. Referral and consultation for the Development Plan should occur consistent with the provision of the Planning & Environment Act.

  Refer to *SPIIRE* memo for further detail in relation to the IWMP & DSWMP comments.
- The preparation of an Integrated Transport Management Plan (ITMP) to inform the Development Plan is acceptable, however Ratio advise the following comments:
  - *State transport system is a broad catch-all term for all State transport infrastructure and is open ended. The ITMP should only be required to have consideration of such infrastructure that the GAEP West would materially rely on.*
  - *The strategic modelling undertaken to inform the Amendment has already considered the Airport and GAEP North. The purpose of any additional modelling for GAEP West should be to determine precinct specific traffic impacts and associated upgrade works required, and to test and refine the GAEP West road transport network.*
  - *It is not reasonable or appropriate for an ITMP to have regard to temporary traffic management arrangements, such as event traffic management associated with the Avalon Airshow, in assessing transport impacts or determining transport infrastructure required to support the GAEP West area.*

  Refer to Transport Assessment memo, prepared by *Ratio*.

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- The requirements for a Staging Plan should be limited the anticipated provision of infrastructure projects on a stage by stage basis arising from the 'site master plan' requirement. Reference to 'out of sequence' development should be deleted from the ordinance as it is not relevant in the context of two key parties that will be responsible for the delivery of all infrastructure in the Precinct. Delivery of infrastructure needs to be economically viable as triggered at the relevant stage of delivery or nexus;
- The requirement for an Environmentally Sustainable Development (ESD) assessment is unnecessary and may be better placed at the use and development stage implemented through policy reference. ESD matters at the development plan stage will largely be explored through water management considerations already forming part of the requirements of the Development Plan;
- The requirement for a Cultural Values Assessment should be deleted. It is considered that aboriginal cultural heritage matters should be addressed through the Aboriginal Heritage Act 2006 and the Aboriginal Cultural Heritage Regulations 2018, which implement requirements for the preparation of a Cultural Heritage Management Plans (CHMP). These matters were explored by the advisory committee in relation to Officer South PSP (Amendment C247card) who concluded that the Aboriginal Heritage Act was the appropriate and most suitable framework for identifying, protecting and managing Aboriginal cultural heritage matters.
- The requirement for 'design guidelines' that address *Greater Avalon Employment Precinct Landscape and Visual Impact Assessment Report* should be deferred to the planning permit stage of the subdivision, use and development approval process. It is suggested that the requirement be included as a permit condition at Clause 2.0 rather than a development plan requirements at Clause 4.0.

  Further it is considered that other design matters such as interface treatments and some of the provisions sought to form part of the Schedule 53 of the DDO could be simplified and translated to form part of the design guidelines permit requirement to guide future subdivision and built form outcomes. Refer below further comments in relation to DDO53.
- We acknowledge the importance of and risk associated with the APA Gas and VIVA Oil pipelines and the requirement to adequately protect the assets in the interests of operations and public safety. However it is considered that the requirements with reference to foreseeable threats to pipelines the Pipelines Act 2005 should be deleted from the Schedule. Protection measures and obligations should be dealt with under the Pipelines Act and are unnecessary to 'double up' as part of the Development Plan. Comments within Background Report note concrete slab protection for the entire length of both pipelines may be appropriate, which is a significant cost concern.
- The requirement for provisions of details of how the physical infrastructure meets City of Greater Geelong standards, including reference to *City of Greater Geelong Infrastructure Development Guidelines* (IDG) 2010 and the *City of Greater Geelong adopted Infrastructure Design Manual* (IDM) 2010 should be deleted. These documents are matters for consideration at the planning permit application stage. We note that they are now 15 years old and subject to potential change. It is inappropriate to include reference to these guidelines requirement and reference at the Development Plan stage (noting they are not background documents or incorporated into the Planning Scheme).

Plan 1 (Greater Avalon Employment Precinct West Concept Plan)

- In relation to content shown in Plan 1 we provide the following comments and suggested changes, including:
  - The designation of the land use for 'industry' as shown on Plan 1 (Greater Avalon Employment Precinct West Concept Plan) of the Schedule is supported.
  - The alignment of the collector road network is generally supported, however Plan 1 should be amended to align the proposed east-west connector road on the subject site along the north of the pipeline easement, as shown on the ADC concept plan. Further from an accessibility and visual connection / aesthetic the opportunity, alignment of the collector road with the pipeline easement will enable the efficient provision of bike

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infrastructure within a linear reserve (provided in the easement itself), rather than on the road pavement;

- Adopt the alignment of the proposed drainage strategy, including location of storm water treatment and retention assets, proposed by Rain, in relation to the Subject Land.

  Refer Phase 1 Stormwater Catchment Analysis 2025, prepared by Rain;
- The 'active travel link to Lara station' on Plan 1 should be deleted. The designation is located outside the Amendment area and the supporting documentation does not provide sufficient detail of what is proposed or how it may be implemented via the Development Plan;
- The road network on Plan 1 does not provide equitable access to the Subject Land, with access reliant on delivery of internal connector roads through other land holdings. The identification of an ingress / egress point to the subject site direct from Avalon Road should be identified on Plan 1, as shown on the ADC concept plan. The access is critical to the initial development of the Precinct and the viability of the Subject Land to be developed independently of the MAB land holding and promote economic activity within the Precinct.

  The access should be included on the Plan 1 and within the Schedule and should be fully operational. Traffic engineers, Ratio, have undertaken design and assessment of the proposed access arrangements in this location having regard for the proximity with the round-a-bout and freeway offramp to the north west of the Subject Land. A concept for access is provided within the Transport Assessment memo, prepared by *Ratio*.
- The inclusion of 'interface' notations on Plan 1 should be deleted as their purpose or implementable basis is not established within the draft Schedule to the DPO. It is implicit in the Greater Geelong Planning Scheme that future use and development must respond to context, including interface conditions that apply to an application area;
- Further details of the need for the provision of the potential fire services facility and potential VICSES facility (including land area requirements) on the Subject Land should be provided, as shown on Plan 1. In our view these facilities should be relocated to have direct access to Avalon Road where access to the external road network is available to serve the wider area.
- Clarification of the implementation, delivery responsibility, embellishments and/or other infrastructure to be included in the Gillett's Road 'linear reserve' as shown in Plan 1 is required in the draft Schedule to the DPO;

Draft DDO Schedule 53

The Amendment seeks to insert a new Schedule 53 to the Design & Development Overlay Schedule (DDO53) to be applied to the Subject Land and the balance of the West Precinct.

Our client does not support the inclusion of the proposed DDO53 controls to be applied to the Subject Land. It is considered that the provisions will impose unnecessary design standards and controls that are not supported by any relevant background study or policy reference in relation to the Amendment. It is considered that the Precinct is subject to limited interface sensitivities and considerations that could otherwise be managed through the preparation of design guidelines (at the planning permit stage) that may be prepared at the direction of Clause 2.0 of the Development Plan Overlay Schedule 50. Refer comments above.

It is noted that a number of the provisions contained within the proposed DDO schedule duplicate content to be explored by the DPO controls and subsequent permit requirements of the draft schedule, including the requirements for ESD, landscaping, visual impacts and airport environs.

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It is considered that the application of the DDO Schedule 53 should be reconsidered and if necessary, include relevant design standards to be achieved integrated into the DPO schedule, as appropriate, through the requirement for design guidelines to be prepared as a permit condition.

In the event that the VPA determine to retain the proposed DDO Schedule 53 and draft DPO schedule 50 as proposed (or similar), we reserve the right to seek detailed refinements to the wording of the provisions. We would be pleased to work with the VPA, MAB and Council, as necessary, to refine the ordinance in order to ensure that the proposed controls are clear, concise, implementable and provide flexibility for the developer to deliver a state significant industrial development over an extend period of time.

Our client reserves the right to make further submissions to the Amendment should they arise from their ongoing review.

Should you have any questions of wish to discuss these matters further please do not hesitate to contact the undersigned on [redacted]

Kind Regards,

[redacted]

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MEMO

To:	[redacted]
From:	[redacted]
Date:	10 December 2025
Reference:	324159
Project name:	GAEP Draft Amendment c477ggee
Subject:	Infrastructure assessment

1. Purpose

This memorandum provides a review of the Greater Avalon Employment Precinct (GAEP) Draft Amendment C477ggee package, focusing exclusively on infrastructure matters. Our analysis identifies key issues requiring reconsideration and further investigation to ensure alignment with local context, precedent, and the precinct's state-significant status.

2. Sewer and Water Infrastructure Review

Within the Servicing and Infrastructure report we note Barwon Water has stated that developers within the GAEP will be required to design, fund and deliver all necessary water and sewerage infrastructure to service the precinct. They have also stated Negotiated Customer Contributions will also be applicable.

While we acknowledge uncertainty during Barwon Water's 2023–2028 Price Submission, the GAEP precinct is a state-recognised strategic employment hub.

Development will commence well before the 2028–2033 Price Submission cycle. It is unreasonable for developers to bear the full cost of critical enabling infrastructure that unlocks the precinct.

Recommendations:

- Barwon Water should fund major trunk infrastructure or establish mechanisms for reimbursement in the next Funding Plan (2028–2033).
- Clear guidance on cost-sharing arrangements should be embedded in the amendment documentation.

3. Transport Infrastructure Review

The GAEP is identified as a state-significant employment and freight hub. The NW corner parcel at Princes Freeway/Avalon Road is a gateway site, directly interfacing with the freeway and Avalon Road. Efficient transport access is critical to unlocking the precinct's industrial potential and attracting logistics investment.

We acknowledge the need for an Avalon Road/Princes Freeway interchange upgrade to accommodate full build-out traffic. This is state-interest infrastructure and should be led by DoT/VicRoads. While developer contributions are appropriate for GAEP-generated traffic, the interchange also serves Avalon Airport and regional movements.

To allow the precinct to progress, access off Avalon Road is appropriate and sufficient until DoT are able to deliver the interchange upgrade.

Avalon Road Upgrades: Widening, pavement strengthening, and intersection treatments will be required to support B-double and high productivity freight vehicles. While developers should contribute through the Development Contributions Plan (DCP), Avalon Road also functions as a regional connector to Avalon Airport and the Princes Freeway. Co-investment from DoT/VicRoads is warranted to reflect this dual role.

Recommendations:

- Formal commitment from DoT/VicRoads to deliver interchange upgrade within early stages of GAEP development.
- Inclusion of interchange works in the state capital works program, with clear timelines aligned to rezoning.
- Avalon Road upgrades should be co-funded by DoT/VicRoads, recognising their regional significance.
- Early staging parcels (such as the NW corner) should not be disproportionately burdened with upfront costs for infrastructure that benefits the entire precinct and Avalon Airport.
- Acceptance of access to 15 Avalon Road off Avalon Road to allow the precinct to commence ahead of the DoT Interchange upgrade.

4. Drainage

We acknowledge there are several drainage considerations.

The GAEP precinct is low-lying, flood-prone, and tidally influenced by Port Phillip Bay. Drainage approvals will be complex and require coordination with several stakeholders.

It is acknowledged that there have been several drainage strategies commissioned by VPA, LIVV and MAB.

While we acknowledge the HARC Position Paper and its conclusion that GAEP West is developable from a stormwater perspective, this document should serve as reference only, not as the guiding framework for future strategies.

We agree with the following HARC recommendations:

- A stormwater volumetric assessment is proposed for the GAEP, to provide a baseline existing condition from which to undertake an impact assessment. This is considered sensible and is a similar approach to what is currently being undertaken by Spiire for Hovells Creek/Elcho Road East PSP.
- Identification of new water body requirements in relation to Avalon Airport, to manage risk of birds impacting planes in flight. This is recognised as important to refine scope and requirements of SWMS.

- Section 3.1 Catchment A (page 11) outlines two possible stormwater outfall locations for Catchment A (which contains the LIVV site). Either west to Hovells or east to the existing waterway. Providing strategic stormwater outfall flexibility is supported.

We disagree with the following HARC recommendations:

- Questioning whether Best Practice Environmental Management Guidelines (BPEMG) for water quality targets is relevant, given the presence of the RAMSAR wetland or whether specific targets need to be identified is an easy and conservative approach. The risk here is that this creates a possible opening for very conservative water quality targets to be set for the project. Given the upstream external catchments, which are reportedly untreated, it may be unreasonable to suggest the developer provided water quality treatment which exceeds BPEM.
- "Dry" retarding basins are suggested as a method to control developed peak flows, without a permanent water body such as wetland in the base. WSUD assets co-located with retarding basins is the traditional approach and has advantages from a land take perspective. The nature of retarding basins, whether dry or co located with wetlands, should be subject to a water birds risk assessment.
- Raingardens are a possible alternative to wetlands given there are no permanent water bodies and have been successfully designed by Spiire at Melbourne Airport. However, this is subject to design levels and contributing catchment.
- Consolidated drainage outcomes between LIVV and MAB are desirable but independent interim strategies must remain feasible.

Recommendations:

- Treat the HARC Position Paper as a reference document only.
- Recognise the potential need for individual drainage strategies and interim solutions.
- Acknowledgement that drainage reserves/easements may be required through use of Public Acquisition Overlays.
- Recognise that Remove all conditions beyond BPEM Guidelines as a requirement of the SMS. These should be listed as potential requirements only.

5. APA & VIVA Pipelines Review

We acknowledge the importance of and risk associated with the APA Gas and VIVA Oil pipelines and the requirement to adequately protect the assets in the interests of operations and public safety.

We understand both APA and VIVA have undertaken Safety Management Studies (SMS) for their respective assets.

It is clear a conservative approach has been made from both companies as represented by very stringent and prescriptive actions and requirements detailed within the APA SMS. Similarly, whilst the VIVA SMS has not been made available, the comments within Background Report noting concrete slab protection for the entire length of both pipelines indicates a similar conservative approach.

Recommendations:

- Make the VIVA Safety Management Study (SMS) publicly available.

- Remove blanket requirements to adhere to all SMS actions from background reports.
- VPA to facilitate discussions between developers, APA, and VIVA to agree on practical, risk-based protection measures to facilitate efficient development for a state-significant employment and freight hub.
- Explore amenity and landscape options within pipeline easements (e.g., shared paths offering asset protection and public benefit).
- Include such options in land budgets and DCP cost allocations.

6. Ordinates Review (Infrastructure only)

6.1 Section 2.0 - Requirement before a permit is granted

6.1.1 Transport Infrastructure Contributions Agreement

The Transport Infrastructure Contribution Agreement effectively operates as a mechanism to levy GAIC where GAIC is otherwise not applicable. While it may be reasonable for development to contribute to State infrastructure upgrades, it is important to note that landowners in this precinct will also be liable for Windfall Gains Tax. By contrast, in more traditional rezonings to an Urban Growth Zone within GAIC areas, landowners are exempt from Windfall Gains Tax. This creates a significant difference in the overall cost burden for developers of this precinct.

The transport infrastructure items listed are regional/state transport assets for a nationally significant precinct whose benefits extend well beyond the precinct. Contributions should be proportionate to development impact and equitably shared with Council and Transport for Victoria.

This section outlines that a planning permit cannot be granted until the landowners have entered into an Infrastructure Contributions Agreement with the Council and a Transport Infrastructure Contributions Agreement with Transport for Victoria.

Whilst the importance of the agreements are acknowledged, TfV infrastructure is not critical to commencement of the precinct so execution of funding agreements for such infrastructure should not preclude commencement of the precinct.

Recommendations:

- Strike any requirement to have TfV funding agreements in place prior to planning permit issue.
- Seek clarity from Council and VPA on how these agreements will be negotiated. Ideally, a standard template should be adopted to ensure that the calculation of shared infrastructure costs is transparent, consistent, and based on reasonable assumptions. A template approach would also provide a clear framework for equitable contributions from all landowners, reducing uncertainty and potential disputes (which is important given this is being considered outside the Planning Scheme Amendment process and the option of the merits being considered by an independent Panel).

6.2 Section 3.0 - Conditions and requirements for permits

6.2.1 Drainage and Stormwater Management

This sections requires a Stormwater Management Plan (SMP) must comply with Integrated Water Management Plan (IWMP and Drainage Stormwater Management Strategy (SMS), including

climate change modelling, upstream/downstream impacts, and detailed civil plans. It lists requirements the SMP must include. These requirements are duplicative and overly prescriptive, especially climate change modelling at subdivision stage, given detailed IWMP and SMS will have been developed during Development Plan stage.

Recommendations:

- Remove the requirement list for the SMP and simply note the SMP must comply with IWMP.

6.3 Section 4.0 - Requirement for development plan

6.3.1 Site Master Plan

The requirements listed for the site master plan are too prescriptive with several requiring detailed design which is not practical at DP stage including site levels, staging plan, buildings and works.

6.3.2 Integrated Water Management Plan (IWMP)

The IWMP should be to the satisfaction of the responsible authority only, in this case the City of Greater Geelong (CoGG). The requirement to consult with all potential stakeholders is the responsibility of CoGG.

It is currently proposed that the IWMP and SMS be prepared as separate documents; however, given the significant overlap between them, greater efficiency could be achieved by consolidating the two into a single integrated document.

6.3.3 Drainage and Stormwater Management Strategy (SMS)

The SMS should be to the satisfaction of the responsible authority only, in this case the City of Greater Geelong (CoGG). The requirement to consult with all potential stakeholders is the responsibility of CoGG.

Several extensive environmental investigations, risk assessments and reports have been listed as required. These are in excess of BPEMG which are the current industry best practice. We acknowledge the presence of RAMSAR wetlands and the “possible” need for additional assessment above BPEM. However, given the upstream external catchments, which are reportedly untreated, it may be unreasonable to suggest the developer must provide water quality treatment which exceeds BPEM. It should not be the responsibility of these landowners to correct any potential existing environmental issues.

There are also multiple stormwater management solutions including outfall options that may not impact environmentally sensitive areas.

Recommendations:

- Remove below requirements from site master plan;
  - Details of the extent and location of cut and fill to occur across the site, including site levels.
  - A staging plan of the subdivision, buildings and works.
- Nominate CoGG as the responsible authority only for IWMP and SMS.
- Consolidate the Integrated Water Management Plan and Drainage Strategy into a single coordinated document to reduce duplication of studies and approvals.

- Remove all conditions beyond BPEM Guidelines as a requirement of the SMS. These should be listed as potential requirements only.

7. Closing Statement

The GAEP is a state significant employment and freight hub. Infrastructure delivery must reflect this status through equitable cost sharing, staged implementation, and risk-based solutions.

While supportive of the precinct's strategic intent, we submit that the above reports and ordinances impose excessive financial, technical, and administrative burdens on developers. Without amendment, these requirements risk deterring investment and delaying delivery of the Greater Avalon Employment Precinct West.

We therefore request that above recommendations are implemented.

To	[redacted]
From	[redacted]
CC	
Regarding	Amendment C477ggee – Greater Avalon Employment Precinct
Date	8-12-2025
Reference Number	21204T
Document Number	MEM-01

Dear [redacted],

As requested, we have reviewed the transport aspects of Amendment C477ggee for the Greater Avalon Employment Precinct (GAEP) and specifically how the transport provisions relate to the 15 Avalon Road land.

Amendment C477ggee – Greater Avalon Employment Precinct

The draft Amendment seek to:

— Introduce a Framework Plan for the whole of the GAEP area;

— Rezone the GAEP West land, including the 15 Avalon Road land, for industrial uses (INZ1) and rural conservation; and

— Introduces several overlays across the GAEP West land, including a Design and Development Overlay and Development Plan Overlay.

VPA have prepared a background report[1] that summarises the draft Amendment and the key findings of the various technical studies that have informed the draft Amendment.

These studies include:

— A strategic transport modelling assessment report[2];

— A transport assessment memo[3]; and

— An economic and scoping study[4]

Relevant to the delivery of GAEP West:

— The draft Schedule to the Development Plan Overlay (Schedule 50 to the DPO):

— Provides a concept plan for the GAEP West area (Plan 1);

— Requires a Transport Infrastructure Contributions Agreement under Section 173 of the Planning and Environment Act be prepared that specifies external transport infrastructure to be delivered by

[1] Greater Avalon Employment Precinct Background Report, November 2025 – Victorian Planning Authority
[2] Strategic Transport Modelling Assessment Report, Greater Avalon Employment Precinct – Transport Modelling Assessment, Jacobs, 5 November 2025
[3] Transport Assessment Memo Version B, Greater Avalon Employment Precinct – Transport Modelling Assessment, Jacobs, November 2025
[4] Greater Avalon Employment Precinct Economic & Scoping Study and Planning Framework, SGS Economics, November 2025

landowners / developers within GAEP West in agreement within City of Greater Geelong (CoGG) and Head, Transport for Victoria (TforV); and

— As part of a Development Plan, requires the preparation of an Integrated Transport Management Plan that assesses the traffic generation and traffic impacts of GAEP West, and would inform the transport infrastructure contributions agreement.

Background Report

The Background Report provides a summary of the technical studies that have been undertaken and considerations made in the development of the Framework Plan and GAEP West concept plan and adopted planning pathways.

Relevant to transport matters the Background Report:

— Identifies the capacity of State transport infrastructure and need for upgrades as a matter of Stage interest;

— Defers the development of the GAEP North area until upgrade of the Beach Road interchange and capacity on Princes Freeway is resolved for the benefit of Avalon Airport; and

— Introduces the use of Integrated Transport Management Plans (ITMPs) and Transport Infrastructure Contributions Agreements to identify, deliver and then apportion the cost of shared transport infrastructure across landowners/developers.

Reviewing the summary of technical studies within the Background Report, critical transport actions that are identified include:

— The upgrade of the Avalon Road and Beach Road interchanges;

— Duplication of the northern section of Avalon Road (including the entire frontage to 15 Avalon Road); and

— Addressing safety concerns at the Princes Freeway interchanges.

The Background Report does detail the specifics of how the above matters are to be resolved.

Relevant to the 15 Avalon Road land, and with implications on the GAEP West road network, the Background Report acknowledges the gas and oil pipelines that extend through the 15 Avalon Road land are sensitive and:

— Are subject to buffer zones (gas)

— Require protection from construction activity and installation of protective measures where cross by roads/rail.

The Background Report does not identify if intersections can be positioned above these pipelines.

Jacobs Transport Modelling and Transport Memo

The strategic transport modelling undertaken by Jacobs is based on VITM and relies on:

— The land use assumptions and the nominated road network for GAEP West as per the concept plan; and

— Employment densities as outlined within the SGS economics and planning study.

The SGS economics and planning study assumes:

— Land uses within the GAEP will predominately be industrial and likely large format (distribution / warehouse); and

— Site coverage (of NDA) will be in the order of 25-30 percent;

— Employment density will average 16.9 persons per hectare (NDA).

The modelling considers a number of 2056 scenarios that review:

— Avalon Airport development only at 100 percent build out / air passenger

— Full development of the GAEP with various Avalon Airport development scenarios (50 and 100 percent build out / air passenger scenarios)

— GAEP West only with various Avalon Airport development scenarios (50 and 100 percent build out / air passenger scenarios)

The modelling does not consider GAEP West or North in isolation. The modelling does not extent beyond road links and does not test the capacity or performance of intersections or Freeway interchanges.

From our review of the modelling report, we make the following observations:

Overall

— Significant traffic growth on Princes Freeway is predicted over time even without the development of GAEP and Airport.

— The Airport and the associated employment precinct are the significant generator of traffic and accounts for over 50 percent of all vehicle traffic in the full development (GAEP all plus Airport at 100 percent).

— Airport generated traffic and Princes Freeway growth are significant contributors to future traffic movement through both Freeway interchanges (more so Beach Road and to a lesser extent Avalon Road).

GAEP West

— GAEP West generates circa 16,000 vehicles per day when fully developed.

— The significant portion of this traffic relies on Avalon Road and the Avalon Road interchange, with limited traffic movement between GAEP West and the Airport/Beach Road (and with the bulk of movements on the Precinct link roads seemingly associated with Airport traffic).

Much of the above is acknowledged in the modelling assessment of the summary findings. The summary findings also comment that:

— The GAEP West area could potentially be delivered in full without significant upgrade of the Avalon Road interchange if proposed growth within the Airport was not to occur; and

— No analysis has been undertaken to isolate the impact of the GAEP West on the Avalon Road interchange.

The Transport Memo does little other than summarise background documents, opportunities / constraints and the outputs of the strategic modelling report.

Draft Schedule 50 to Clause 43.02 – Development Plan Overlay

Draft Schedule 50 to Clause 43.02 outlines requirements for permits and the preparation of a development plan for GAEP West.

The Schedule includes a concept plan (Plan 1, reproduced below) that is to be the basis of a Development Plan. Relevant to traffic and access, the concept plan shows:

— The GAEP West area as industrial land and a series of conservation areas;

— Access to industrial land within the GAEP West facilitated by:

— The upgrade of Avalon Road between the Princes Freeway interchange and southern boundary of 25 Avalon Road as Council arterial road;

— Avalon Road south of 25 Avalon Road to Dandos Road upgraded to a connector road;

— Dandos Road within the GAEP West area also upgraded to a connector road;

— A series of new connector roads extending from Avalon Road and Dandos Road that service the industrial land. This includes:

— A central north-south connector road from Dandos Road that extends into the 15 Avalon Road land and over the APA easement and black oil pipeline, before turning east and running parallel to Princes Freeway and into the Avalon Airport land; and

— Three east-west connector roads from Avalon Road to this north-south connector road. The northernmost connector road is along the southern boundary of the 25 Avalon Road land and includes a “key intersection” to Avalon Road.

— An active travel link across Princes Freeway at the Avalon Road interchange.

The concept plan does not nominate vehicle access to the 15 Avalon Road land other than through the future north-south connector road.

From our review:

— The road network on the concept plan does not provide equitable access to the 15 Avalon Road land, with access reliant on delivery of internal connector roads through other land holdings. How this would be resolved is not clear noting that connector roads (land or construction) are not typically shared infrastructure items within greenfield development areas.

— The duplication of the northern end of Avalon Road is warranted based on traffic volumes within the transport modelling but is at the lower end of the duplication threshold. Duplication would require:

  - At least a 23 metre strip of land along the frontage of 15 Avalon Road and 25 Avalon Road to provide for a second carriageway. Additional land may be required subject to how access to low density residential lots is maintained and the form of the key intersection at the southern end of the duplicated road section; and
  - Partial reconstruction of the Avalon Road interchange to transition the duplicated cross section at the southern interchange intersection.

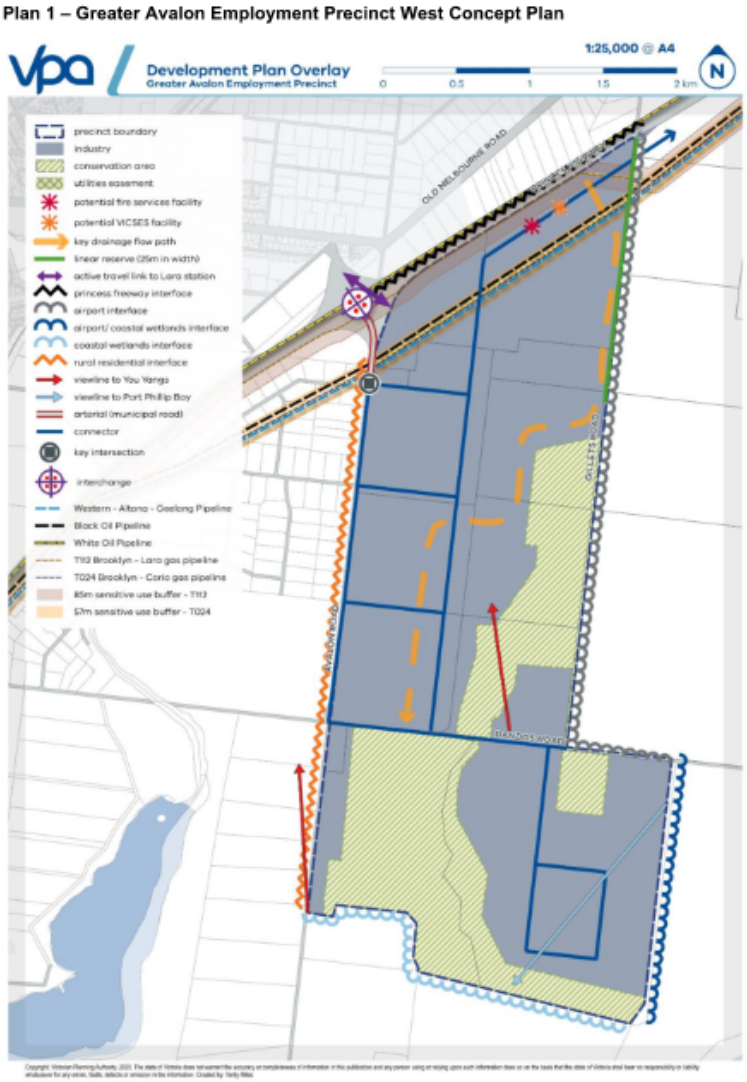
— Duplication of the road could be not delivered without removal of buildings and potentially the dwelling on 25 Avalon Road.

— The active transport connection across the Freeway would require either:

  - A separate pedestrian/cycle overpass over Princes Freeway; or
  - Widening of the existing overpass bridge to provide paths acknowledging no footpath or cycle infrastructure is provided.

We note also that there is no pedestrian or cycle infrastructure on the north side of the Freeway until McClelland Avenue such that this active transport connection would also likely need to resolve this network gap.

Figure 1 – Draft Schedule 50 to Clause 43.02 – Plan 1



As per our previous advice, we are of the view that direct access to the 15 Avalon Road land is possible with an option to achieve this being through the upgrade of the existing roundabout (see Figure 2 below).

From the strategic modelling outputs and against the above:

— Direct access to the 15 Avalon Road land from the interchange would reduce ultimate volumes on Avalon Road to the south and likely remove the need for duplication of the northern section of the road on the basis that:

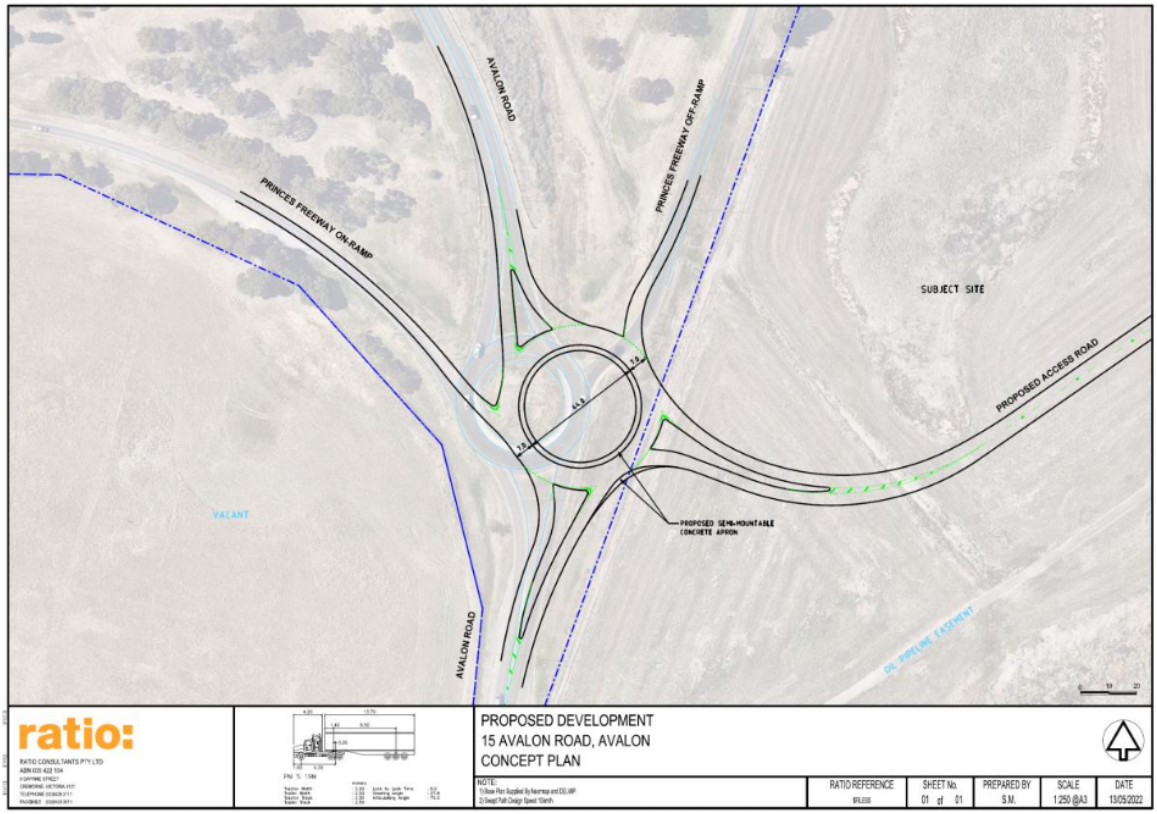
- Diversion of 5,000-6,000 vehicles per day through the 15 Avalon Road land would reduce traffic volumes further to south to that of a higher order connector road.

— Direct access to the 15 Avalon Road land from the interchange intersection would also resolve the issue of equitable access to the 15 Avalon Road land.

— Upgrade of the southern interchange intersection to support duplication of Avalon Road duplication will require a dual lane roundabout or duplication signalised intersection.

- Both options would result in a more complex intersection upgrade and likely required substantive reconstruction of the southern side of the interchange and additional land take to match to the existing overpass and on / off ramps.

Figure 2 – Interim Avalon Road Southern Interchange Roundabout Concept



Item 4.0 of the draft Schedule 50 to the DPO requires the preparation of an Integrated Transport Management Plan (ITMP) to inform the Development Plan.

The ITMP provisions are reproduced below.

- An **Integrated Transport Management Plan** prepared to the satisfaction of the responsible authority, Greater Geelong City Council and Head, Transport for Victoria and that includes:
  - An assessment of traffic generation and the impact on the adjoining road network, including consideration of impacts to the State transport system, Avalon Airport Master Plan 2015 (or subsequent version) and development of the north precinct.
  - Identification of any upgrade work required on the adjoining road network, including the State transport system, including the staging of any works.
  - Conceptual traffic access plans and cross-sections, showing all proposed new or upgraded intersections, crossovers and street frontages.
  - Identification of a bus capable road network including integration with the broader public transport network.
  - Identification of the active transport network including pedestrian and cycling links and access improvements including both internal and external connections
  - Consideration of operation of the road network during events such as the Avalon Airshow.

The preparation of an ITMP to inform the Development Plan is not unusual and is generally acceptable. However, we note:

— State transport system is a broad catch-all term for all State transport infrastructure and is open ended. The ITMP should only be required to have consideration of such infrastructure that the GAEP West would materially rely on.

— The strategic modelling undertaken to inform the Amendment has already considered the Airport and GAEP North. The purpose of any additional modelling for GAEP West should be to determine precinct specific traffic impacts and associated upgrade works required, and to test and refine the GAEP West road transport network.

— It is not reasonable or appropriate for an ITMP to have regard to temporary traffic management arrangements, such as event traffic management associated with the Avalon Airshow, in assessing transport impacts or determining transport infrastructure required to support the GAEP West area.

Item 2.0 of the draft Schedule 50 to the DPO requires the preparation of a Transport Infrastructure Contributions Agreement that would be implemented by way of a Section 173 agreement.

We understand that this contributions agreement would be informed by the Development Plan and ITMP.

The Transport Infrastructure Contributions Agreement are reproduced below.

Transport Infrastructure Contributions Agreement

Unless otherwise agreed to by the responsible authority and Head, Transport for Victoria, a permit must not be granted to subdivide or develop land until an agreement under Section 173 of the *Planning and Environment Act 1987* has been entered into between the owner of the land, the Greater Geelong City Council and the Head, Transport for Victoria, for the delivery by the developer and / or landowner, at its cost of Transport Infrastructure items between the Greater Avalon Employment Precinct West and the external road network servicing the use and development.

The agreement must specify:

- The scope of work and location of infrastructure items required as a result of the development, including any land provision or acquisition.
- The expected timing of provision of each infrastructure item and who is responsible for delivery.
- The cost of any items that are the subject of financial contributions rather than direct delivery by the owner.
- The equitable apportionment of costs between the developer, Council and Head, Transport for Victoria for any items which exceed the needs of the development.
- Operational and administrative provisions.

The agreement will apply to the following infrastructure items:

- Upgrades to the Avalon Road and Princes Freeway interchange.
- Construction of a new intersection on Avalon Road to provide access into the Greater Avalon Employment Precinct.
- Any upgrades to Avalon Road to facilitate the increased traffic volumes associated with providing access into the Greater Avalon Employment Precinct.

The owner will pay all costs and expenses of, and incidental to, the execution and recording of the agreement.

In our view infrastructure items to be included within the Transport Infrastructure Contributions Agreement should not prescriptive / fixed as this time and should be informed by the outcomes of the ITMP and resolved Development Plan.

It is also our view that infrastructure items to be funded and delivered by development within the GAEP West should have a clear nexus with the transport impacts and requirements of the GAEP West.

As currently proposed:

— The extent of upgrade to the Avalon Road / Princes Freeway interchange is not clear acknowledging that the strategic traffic modelling undertaken to inform the amendment acknowledges that sources the other the GAEP West (including underlying Freeway traffic growth and traffic along Princes Freeway generated by the Airport) will be the primary driver for the need to upgrade this interchange;

— The active transport link across Princes Freeway shown adjacent to the interchange is not referenced. This link supports the whole of the GAEP and Avalon Airport and should be considered separately to the interchange; and

— The upgrades to Avalon Road and the new intersection to Avalon Road as per the concept plan included within the Schedule to the DPO may not be required should direct access to the 15 Avalon Road land be permitted.

On the basis that the GAEP West Road network is delivered as per the concept plan included within Schedule 50 to the DPO, the Transport Infrastructure Contributions Agreement should include the extent of the internal road network required (land and construction) to provide access to the 15 Avalon Road land without relying in the internal road network to be delivered by others.

Clause 11.03-6L-06 & Draft Schedule 53 to Clause 43.02 – Design and Development Overlay

We have reviewed both Clause 11.03-6L-06 and the draft Schedule 53 to the DDO and have no concern with the transport aspects of either.

Should anything further be required, please contact the undersigned.

15 Avalon Road, Avalon

Phase 1 – Stormwater Catchment Analysis 2025

Prepared by Rain Consulting for

Livv Developments Pty Ltd

Deep Thinking for Better Water Outcomes

Document Control

Project Name	15 Avalon Road, Avalon – Phase 1 – Stormwater Catchment Analysis 2025
Client	Livv Developments Pty Ltd
Rain ID	400_02
Document Name	400_02_R01V01_j_Phase1.docx400_02_R01V01_i_Phase1.docx

Version Number	Status	Date	Authors	Reviewer
v01	Draft	1/4/25	SN, DTH	[redacted]
V02	Final	6/5/25	SN, DTH	[redacted]

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Cover Image

Coppins Lookout – July 2023

Custodians

Rain respectfully acknowledges the Traditional Owners of the lands on which we work, live and play. We also pay our respects to their Elders, past and present, and Aboriginal Elders of other communities.

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Rain Consulting deeply recognise our responsibility to address the environmental impacts of our businesses and those we are associated with. Human induced climate change has increased average and extreme temperatures, changed rainfall patterns and created more severe and less predictable storms. That's why we're striving for net negative carbon.

Carbon produced in the generation of this report has been offset.

0.138 tonnes of CO2 have been emitted in the creation of this project. In line with the 2C pathway, we have offset **2.5 times this (.345 tonnes offset)**.

Executive Summary

Rain Consulting have been engaged to undertake a Stormwater Concept Plan for 15 Avalon Road, Avalon. The works are broken down into 5 phases, and this report covers Phase 1 – Background Information, Site Assessment and Catchment Analysis, and the preliminary conceptual design for the drainage network. The project comprises of a 140 ha industrial subdivision of 15 Avalon Road, Avalon is located within the Avalon Employment Precinct Structure Plan, which is currently in development. The proposed development is for 160 industrial lots as shown on **Figure 2-1**. This layout is subject to change as the PSP, potential Develop Contribution Scheme and planning phases commence.

The site is bounded by the Princes Freeway to the north, Avalon Airport to the east, and contains a utilities corridor with high pressure gas mains. There is an LSIO across the site resulting from flow conveyed under the freeway through culverts, and, in larger events, over the freeway. The flows leave the subject site at three main points in existing conditions, discharging to a watercourse which heads south through RAMSAR wetlands (in MAB owned land) and discharges into Port Phillip Bay.

There are a number of planning requirements for this site, with the relevant ones for Phase 1 summarised in the table below, along with how they are addressed.

An indicative drainage strategy as shown in **Figure 1-1** is based on a number of assumptions and key principles as follows:

- Siphons required to convey flows across the gas and oil pipe track (i.e. beneath existing gas and oil pipelines) due to existing pipeline depths.
- Widened boulevard road cross section with central median acting as flow conveyance for the two external catchments north of the Princes Freeway.
- Widened boulevard roads with central watercourse to have inner edge strip treatment (i.e. no kerb) to allow rural road grading provisions which significantly reduces fill requirements. Crushed rock inner shoulder and vehicle exclusion barriers to be provided.
- Catchments split to avoid flow concentration and minimise pipeline diameters and depths therefore minimising fill.
- Low flow pipelines where possible to convey 1EY and lower flows as required to the WLRBs.
- Raingardens and bioretention treatment systems upstream of the gas and oil pipe track to treat water where possible prior to entering the main outfalls. These would be installed within road reserves either in a central median or adjacent roads.
- GPT's proposed for small, isolated catchments.
- Total outflow restricted to pre-developed flows at the outlet to the downstream property.
- Water treatment to achieve best practice targets.
- Maintaining outflow to pre-developed flows and volumes to the RAMSAR wetland downstream. It is understood that this is particularly sensitive to an increase in freshwater volume flooding through it over a 12-month period, and as a result, there will be a requirement to address/mitigate the increased volume at Avalon. The current proposal is that the downstream landowner, MAB is proposing to address this within their site via large evaporation ponds with a financial contribution from Livv.

There are some key assumptions underpinning this design that will be investigated further during the next stage of design, including:

- Gas pipeline as-constructed levels to be proven on site.
- Locations of culvert crossings of main central median flow conveyance.
- Outfall design is being undertaken by MAB. The levels of the constructed waterway will impact the proposed drainage network within the subject site. Additionally, it is likely that outfalls to the

RAMSAR wetland will need to be maintained to some extent to maintain flows/volumes.

- Channels will be required parallel with the freeway to capture overland flow across the freeway and convey it into the main flow conveyance channels. The extent and size of these channels will be explored in Phase 2, hydraulic modelling.
- Climate change has been considered using the SSP2-4.5 pathway. The City of Greater Geelong may require additional scenarios to be tested. We understand that Harc and the VPA are investigating these requirements with the City.

The key drainage assets are proposed as follows:

Catchment 1

- Sediment Basin 1
  - 1,000 m^2 at normal water level
  - Dry out area of 508 m^2
- Wetland area at normal water level of 7,000 m^2.
- Retarding Basin
  - Top water level area 13,513 m^2.
  - Peak elevation 1.64 m.
  - Peak storage volume 22,200 m^3.
  - 2 * 0.6 high * 1.8m wide culverts.

Catchment 2

- Bioretention 14,180 m^2.
- Atlan Vortceptor (SQIDEP Verified) OVOR.220
- Sediment Basin 1
  - 1,400 m^2 at normal water level
  - Dry out area of 914 m^2
- Wetland area at normal water level of 7,500 m^2.
- Retarding Basin
  - Top water level area 19,681 m^2.
  - Peak elevation 1.75 m.
  - Peak storage volume 34,400 m^3.
  - 2 * 0.6 high * 1.8m wide culverts.

Catchment 3

- Atlan Vortceptor (SQIDEP Verified) OVOR.220

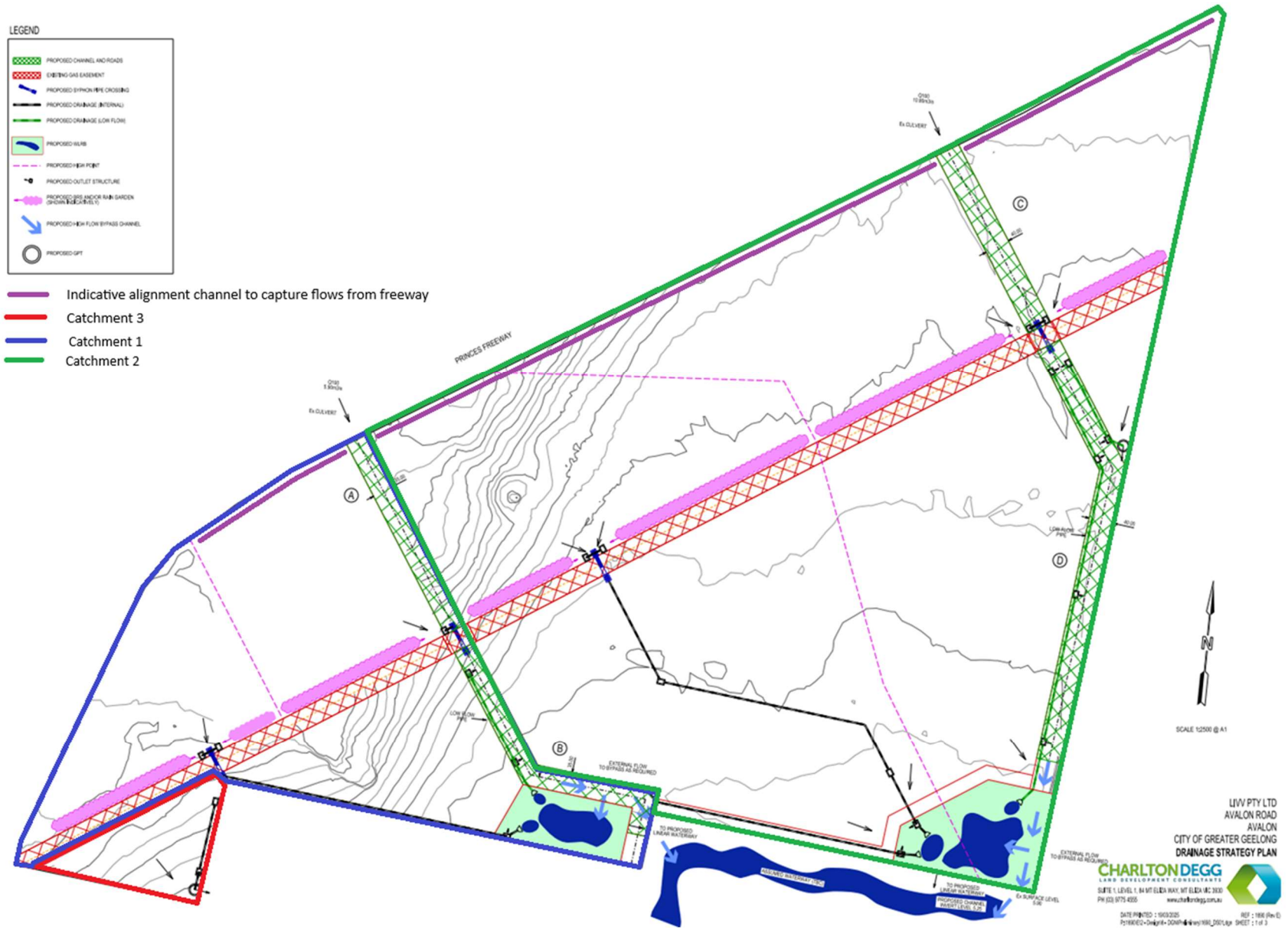

Figure 1-1 Proposed Drainage Strategy

Reference & Clause	Requirement	Phase & Report Section	Strategy
Victorian Planning Provisions Clause 53.18 (Victorian Planning Authority, 2018)	53.18-4 (W1) The stormwater management system should be designed and managed in accordance with the requirements and to the satisfaction of the relevant drainage authority.	Phase 1 Section 1, Phase 2 and Phase 3	Preliminary conceptual design is provided in this report demonstrating compliance with the key requirements, and proposed solutions required to achieve compliance on this site. Further compliance with these requirements will be demonstrated in Phases 2 and 3 of the project.
	53.18-4 (W1) The stormwater management system should be designed and managed in accordance with the requirements and to the satisfaction of the water authority where reuse of stormwater is proposed.	Phase 1 Section 1 & Phase 2 & Phase 3	Initial investigation into stormwater harvesting was undertaken in Section 7 of this report showing that tank sizes of greater than 15,000 m^3 can meet a target supply reliability of 75%. It is recommended that a cost benefit analysis around the installation and maintenance cost of installing tanks against the potable water cost savings over time. Further investigation of harvesting will be undertaken in Phases 2 and 3 of the project.
	53.18-4 (W1), Clause 53.18-5 (W2) The stormwater management system should be designed to meet the current best practice performance objectives for stormwater quality as contained in the Urban Stormwater-Best Practice Environmental Management Guidelines (Victorian Stormwater Committee,1999).	Phase 1 Section 1 Phase 3 – Construction Management Requirements	The proposed water quality treatment meets best practice as shown in Table 6-6. Catchments 1 & 2 – bioretention upstream of the pipe corridor, discharging into either the overland flow conveyance and into the retarding basin, or conveyed by pipe into further treatment in the downstream sediment basin/wetland system contained within a retarding basin. Catchment 3 – treatment via a GPT prior to discharge. This is a result of the catchment being quite small, and the other systems are over-designed to meet best practice. Best practice during construction will be addressed in Phase 3 – Construction Management Requirements.
	53.18-4 (W1) The stormwater management system should be designed to ensure that flows downstream of the subdivision site are restricted to pre-development levels unless increased flows are approved by the relevant drainage authority and there are no detrimental downstream impacts.	Phase 1 Section 5	Flows from the subject site are designed to be mitigated to the pre-developed outflow from the subject site, including flows from the upstream catchment. These flows are proposed to discharge to a constructed waterway in the downstream land. Some of the treated water can be discharged to the RAMSAR wetlands downstream as required. In the base case scenario, the post-developed flows are 8% lower than pre-developed at the outlet. In the climate change scenario, they are 3% higher.
	53.18-4 (W1), Clause 53.18-5 (W2) The stormwater management system should be designed to contribute to cooling, improving local habitat and providing attractive and enjoyable spaces.	Phase 1 Section 1	The proposed bioretention and overland flow conveyance in widened boulevard-style roads contribute to cooling, improving local habitat and providing attractive and enjoyable spaces.

	Clause 53.18-5 (W2) Minimise the impact of chemical pollutants and other toxicants including by, but not limited to, bunding and covering of roofing of storage, loading and work areas.	Phase 3 – Construction Management Requirements	This will be addressed in Phase 3 – Construction Management Requirements.
	Clause 53.18-6 (W3) Requires that application describes how the site will be managed prior to and during the construction period. It should set out requirements for: 1) Erosion and sediment 2) Stormwater 3) Litter, concrete and other construction wastes 4) Chemical contamination	Phase 3 – Construction Management Requirements	This will be addressed in Phase 3 – Construction Management Requirements.
	For all storm events up to and including the 20% Average Exceedance Probability (AEP) standard: ▸ Storm water flows should be contained within the drainage system to the requirements of the relevant authority; and, ▸ Ponding on roads should not occur for longer than 1 hour after the cessation of rainfall.	Phases 2 and 3	Compliance with these requirements will be demonstrated in Phases 2 and 3 of the project.
	For storm events greater than 20% AEP and up to and including 1% AEP standard: ▸ Provision must be made for the safe and effective passage of stormwater flows; ▸ All new lots should be free from inundation or to a lesser standard of flood protection where agreed by the relevant flood plain management authority; and, ▸ Ensure that streets, footpaths and cycle paths that are subject to flooding meet the safety criteria $d_aV_{ave} < 0.35$ m^2/s (where, da = average depth in metres and Vave = average velocity in metres per second).	Phase 1 Section5, Phases 2 and 3	The 1% AEP flows are proposed to be conveyed through the subject site through overland flow channels and proposed roads, meeting safety criteria. Some pipes will be designed to cater for the 1% AEP flow to convey runoff from upstream of the pipe track to the proposed retarding basins. The proposed retarding basins retain the 1% AEP event back to pre-developed flows as shown **in Table 5-8 and Table 5-9.**
	The design of the local drainage network should: ▸ Ensure stormwater is retarded to a standard required by the responsible drainage authority; ▸ Ensure every lot is provided with drainage to a standard acceptable to the relevant drainage authority; ▸ Wherever possible, stormwater should be directed to the front of the lot and discharged into the street drainage system or legal point of discharge;	Phases 2 and 3	Compliance with these requirements will be demonstrated in Phases 2 and 3 of the project.

	▸ Ensure that inlet and outlet structures take into account the effects of obstructions and debris build up; ▸ Any surcharge drainage pit should discharge into an overland flow in a safe and predetermined manner; and, ▸ Include water sensitive urban design features to manage stormwater in streets and public open space. Where such features are provided, an application must describe maintenance responsibilities, requirements, and costs.		
	Any flood mitigation works must be designed and constructed in accordance with the requirements of the relevant floodplain management authority.	Phases 2 and 3	Compliance with these requirements will be demonstrated in Phases 2 and 3 of the project.
Precinct Structure Planning Guidelines: New Communities in Victoria (Victorian Planning Authority, 2021)	F13.2 Drainage management measures should have sufficient capacity and be in accordance with relevant legislation, policy and guidelines (for example, CSIRO's Best Practice Environmental Management Guidelines for Urban Stormwater (BPEM). They should take into consideration what is expected to occur as a result of predicted climate change. Where appropriate and feasible, drainage solutions should prioritise environmental and amenity-based solutions over highly engineered solutions.	Phase 1 Section 5.3 & 8 Phases 2 and 3	The proposed water quality treatment meets best practice as shown in **Table 6-6** and the proposed retarding basins retain the 1% AEP event back to pre-developed flows as shown in **Table 5-8** and **Table 5-9**. Flows from the subject site are designed to be mitigated to the pre-developed outflow from the subject site, including flows from the upstream catchment. These flows are proposed to discharge to a constructed waterway in the downstream land. Some of the treated water can be discharged to the RAMSAR wetlands downstream as required. In the base case scenario, the post-developed flows are 8% lower than pre-developed at the outlet. In the climate change scenario, they are 3% higher.
	F13.1 Urban planning, including water systems, should have meaningful regard to the seven key Integrated Water Management (IWM) strategic outcomes: ▸ provide a safe, secure and affordable supply of water in an uncertain future ▸ use effective and affordable wastewater systems optimise opportunities to manage existing and future flood risks and impacts ▸ maintain and enhance healthy and valued waterways and marine environments ▸ maintain and enhance valued landscapes for health and wellbeing purposes ▸ strengthen community knowledge and local values and reflect them in place-based planning ▸ support jobs, economic benefits and innovation.	Phase 3	Compliance with these requirements will be demonstrated in Phase 3 of the project.

	▸ Note: the IWM strategic outcomes were produced by Victoria's Integrated Water Management Forums. These Forums bring together all organisations with an interest in water cycle, recognising that each has an important role to play in the management of water as a vital resource.		
	T14 - All streets containing canopy trees should use stormwater to service their watering needs.	Phase 3	Compliance with these requirements will be demonstrated in Phase 3 of the project.

Contents

Tables

Figures

1 Introduction

Rain Consulting have been engaged to undertake a Stormwater Concept Plan for 15 Avalon Road, Avalon. The works are broken down into 5 phases, and this report covers Phase 1 – Background Information, Site Assessment and Catchment Analysis, and the preliminary conceptual design of the drainage network..

The 140ha industrial subdivision of 15 Avalon Road, Avalon is located within the Avalon Employment Precinct Structure Plan, which is currently in development. Hydrological engineering support is required to develop a response to this workshop, and ultimately for the submission of a planning permit application to be approved by the Corangamite Catchment Management Authority (CCMA). The scope of the overall hydrological input has been broken down into 5 phases:

- Phase 1 - Background Information, Site Assessment and Catchment Analysis;
- Phase 2 - Concept Design;
- Phase 3 - Stormwater Management Strategy; and,
- Phase 4 - Functional Design Plans and Report. .

This report comprises Phase 1 of the works – the background information review, site assessment and catchment analysis.

The outcomes of this phase will determine the site's opportunities and limitations and act as a foundation of the design decisions in the subsequent phases.

1.1 Subject Site

The subject land comprises two lots, with a combined area of 140ha. The site is shown in **Figure 1-1**. The site is positioned on the south side of the Princes Freeway, and the east of Avalon Road.

The site is currently zoned as farming, with industrial zoning north of Princes Freeway and the Special Use Zone to the south and east of the proposed development, including Avalon Airport. It attracts a Land Subject to Inundation (LSIO) overlay on the eastern lot as shown in **Figure 1-2**. There is an Environmental Significance Overlay to the east of the site (but not within the site), and a portion of Aboriginal Cultural Heritage area down the western boundary as shown in **Figure 1-3**. The site is within a Designated Bushfire Prone Area. (Victoria Stage Government Environment, Land, Water and Planning, 2024). The work completed to date on the Avalon Employment Precinct Structure Plan indicates the site and some surrounding land will be re-zoned.

The land south of the subject site is owned by MAB and there are a significant number of wetlands throughout their property which may form part of the ultimate drainage scheme.

A preliminary cultural heritage finding (source) was that the risk is considered to be very low on this site considering the farming activities that had been on-going on the site over a number of years.

The site has a long history of agricultural land use and has been substantially modified through cropping activities.

Figure 1-1 Site Location

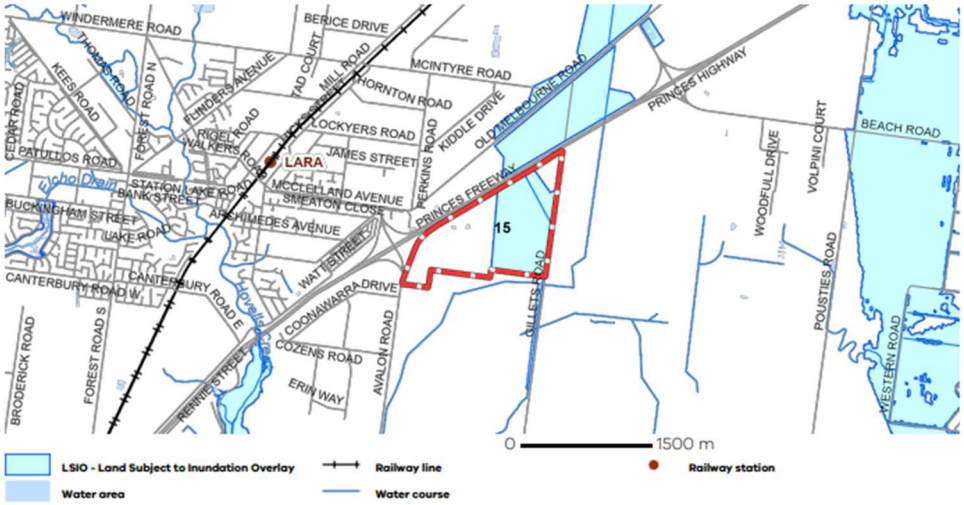

Figure 1-2 LSIO (Victoria Stage Government Environment, Land, Water and Planning, 2024)

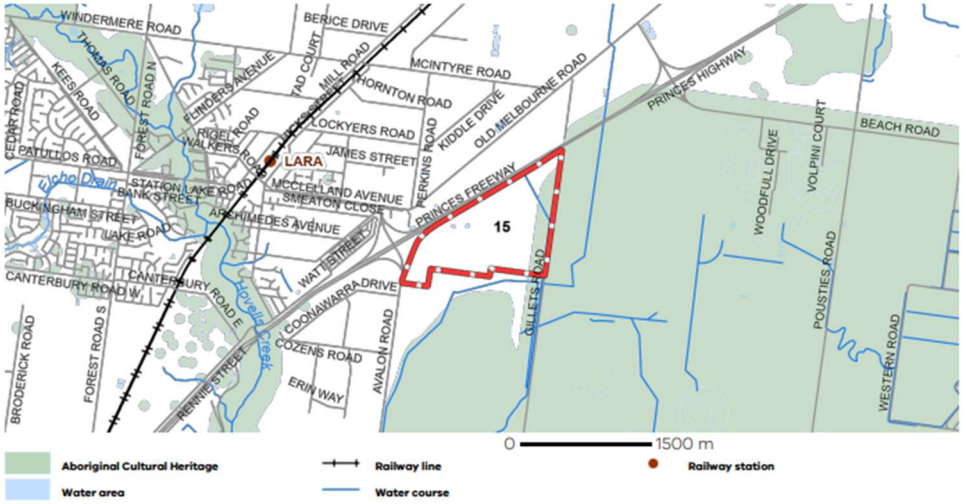

Figure 1-3 Aboriginal Cultural Heritage (Victoria Stage Government Environment, Land, Water and Planning, 2024)

The site ranges in topography from approximately 14.0 m AHD in the northwest and 9.5 m AHD in the northeast to 6.5m AHD in the southeast, as shown in **Figure 1-4**. There are four sub catchments from the north side of the freeway directed via culverts under the freeway, and, in larger events, across the freeway. The flows leave the subject site at three main points in existing conditions, discharging to a watercourse which heads south through RAMSAR wetlands (in MAB owned land) and discharges into Port Phillip Bay.

.

Figure 1-4 Topography

1.2 Planning Requirements

In October 2018, the Victorian Government created the new Clause 53.18, Stormwater Management in Urban Development, in the Victorian Planning Provisions to ensure that stormwater generated from all forms of urban development is managed in an integrated way to mitigate the impacts of stormwater runoff on the environment, property and public safety, and to provide cooling, local habitat and amenity benefits (Victorian Planning Authority, 2018). The following outlines the requirements of this clause:

> *One of the key elements to be met under this new clause is the stormwater management objectives and standards for subdivisions. The objectives for stormwater management for subdivisions are:*
>
> - *To minimise damage to properties and inconvenience to the public from stormwater;*
> - *To ensure that the street operates adequately during major storm events and provides for public safety;*
> - *To minimise increases in stormwater and protect the environmental values and physical characteristics of receiving waters from degradation by stormwater;*
> - *To encourage stormwater management that maximises the retention and reuse of stormwater; and,*
> - *To encourage stormwater management that contributes to cooling, local habitat improvements and provision of attractive and enjoyable spaces (Victorian Planning Authority, 2018).*

Table 1-1 outlines the specific requirements for this project, and the relevant sections of the report addressing these.

Table 1-1 Planning Requirements

Reference & Clause	Requirement	Phase & Report Section
Victorian Planning Provisions Clause 53.18 (Victorian Planning Authority, 2018)	53.18-4 (W1) The stormwater management system should be designed and managed in accordance with the requirements and to the satisfaction of the relevant drainage authority.	Phase 1 Section 1, Phase 2 and Phase 3
	53.18-4 (W1) The stormwater management system should be designed and managed in accordance with the requirements and to the satisfaction of the water authority where reuse of stormwater is proposed.	Phase 1 Section 7 & Phase 2 & Phase 3
	53.18-4 (W1), Clause 53.18-5 (W2) The stormwater management system should be designed to meet the current best practice performance objectives for stormwater quality as contained in the Urban Stormwater-Best Practice Environmental Management Guidelines (Victorian Stormwater Committee,1999).	Phase 1 Section 1 Phase 3 – Construction Management Requirements
	53.18-4 (W1) The stormwater management system should be designed to ensure that flows downstream of the subdivision site are restricted to pre-development levels unless increased flows are approved by the relevant drainage authority and there are no detrimental downstream impacts.	Phase 1 Section 5
	53.18-4 (W1), Clause 53.18-5 (W2) The stormwater management system should be designed to contribute to cooling, improving local habitat and providing attractive and enjoyable spaces.	Phase 1 Section 1
	Clause 53.18-5 (W2) Minimise the impact of chemical pollutants and other toxicants including by, but not limited to, bunding and covering of roofing of storage, loading and work areas.	Phase 3 – Construction Management Requirements
	Clause 53.18-6 (W3) Requires that application describes how the site will be managed prior to and during the construction period. It should set out requirements for: 1) Erosion and sediment 2) Stormwater	Phase 3 – Construction Management Requirements

	3) Litter, concrete and other construction wastes 4) Chemical contamination	
	For all storm events up to and including the 20% Average Exceedance Probability (AEP) standard: ▸ Storm water flows should be contained within the drainage system to the requirements of the relevant authority; and, ▸ Ponding on roads should not occur for longer than 1 hour after the cessation of rainfall.	Phases 2 and 3
	For storm events greater than 20% AEP and up to and including 1% AEP standard: ▸ Provision must be made for the safe and effective passage of stormwater flows; ▸ All new lots should be free from inundation or to a lesser standard of flood protection where agreed by the relevant flood plain management authority; and, ▸ Ensure that streets, footpaths and cycle paths that are subject to flooding meet the safety criteria $d_aV_{ave} < 0.35$ m^2/s (where, da = average depth in metres and Vave = average velocity in metres per second).	Phase 1 Section5, Phases 2 and 3
	The design of the local drainage network should: ▸ Ensure stormwater is retarded to a standard required by the responsible drainage authority; ▸ Ensure every lot is provided with drainage to a standard acceptable to the relevant drainage authority; ▸ Wherever possible, stormwater should be directed to the front of the lot and discharged into the street drainage system or legal point of discharge;	Phases 2 and 3
	▸ Ensure that inlet and outlet structures take into account the effects of obstructions and debris build up; ▸ Any surcharge drainage pit should discharge into an overland flow in a safe and predetermined manner; and, ▸ Include water sensitive urban design features to manage stormwater in streets and public open space. Where such features are provided, an application must describe maintenance responsibilities, requirements, and costs.	
	Any flood mitigation works must be designed and constructed in accordance with the requirements of the relevant floodplain management authority.	Phases 2 and 3
Precinct Structure Planning Guidelines: New Communities in Victoria (Victorian Planning Authority, 2021)	F13.2 Drainage management measures should have sufficient capacity and be in accordance with relevant legislation, policy and guidelines (for example, CSIRO's Best Practice Environmental Management Guidelines for Urban Stormwater (BPEM). They should take into consideration what is expected to occur as a result of predicted climate change. Where appropriate and feasible, drainage solutions should prioritise environmental and amenity-based solutions over highly engineered solutions.	Phase 1 Section 5.3 & 8 Phases 2 and 3
	F13.1 Urban planning, including water systems, should have meaningful regard to the seven key Integrated Water Management (IWM) strategic outcomes: ▸ provide a safe, secure and affordable supply of water in an uncertain future ▸ use effective and affordable wastewater systems optimise opportunities to manage existing and future flood risks and impacts	Phase 3

	▸ maintain and enhance healthy and valued waterways and marine environments ▸ maintain and enhance valued landscapes for health and wellbeing purposes ▸ strengthen community knowledge and local values and reflect them in place-based planning ▸ support jobs, economic benefits and innovation. ▸ Note: the IWM strategic outcomes were produced by Victoria's Integrated Water Management Forums. These Forums bring together all organisations with an interest in water cycle, recognising that each has an important role to play in the management of water as a vital resource.	
	T14 - All streets containing canopy trees should use stormwater to service their watering needs.	Phase 3

1.3 Greater Avalon Employment Precinct Structure Plan Workshop

The workshop was held on the 17th August 2023 with approximately 85 stakeholders present. Rain did not attend this workshop.

The workshop had two key objectives; to explore the aerotropolis land use concept, and to develop a high-level draft place-based plan primarily to enable flood modelling to commence. Key considerations identified included:

- Natural features, including biodiversity, open space, RAMSAR site protection and conservation areas;
- Location of conservation areas due to proximity to the airport runways;
- Drainage scheme that meets the requirements set by Melbourne Water and the Corangamite Catchment Management Authority (CCMA);
- Avalon Airport identified four exit points for drainage from their site in the northwest southeast, and southwest corners, and the Beach Road/Pousties Road intersection. The drainage scheme to correlate with the Avalon Airport Master Drainage Scheme;
- Protect bird life;
- Protect the operations of the airport;
- Management of infrastructure and parkland along the pipeline easement;

The VPA notes the following future works required to support the PSP:

- Confirmation of the location of existing wetlands;
- Determine appropriate conservation areas;
- Further investigation into best practice for protecting RAMSAR wetlands;
- Work with stakeholders to determine appropriate land use and interfaces with these areas;
- Work with Avalon Airport, DTP and the Department of Energy, Environment and Climate Action (DEECA) to ensure the appropriate controls are put in place to protect existing and future conservation areas from airport operations and development;
- Work with Melbourne Water and the CCMA to determine appropriate locations for drainage assets;
- Adopt the recommended outcomes of Integrated Water Management (IWM) studies being undertaken on a corridor and precinct scale to ensure that the drainage outcomes protect the conversation value of the Ramsar wetlands;
- Flood modelling is required to identify pre-development flows for the Ramsar wetlands;
- Conduct a gas and oil safety management study to understand how to effectively plan for areas within their sensitive use buffer zones.

The VPA will ensure the planning scheme ordinance appropriately reflects risks of contamination, and which requirements permit applications must meet for development to occur;

- Refine the place-based plan once the updated Avalon Airport Masterplan is available;
- Investigate the most appropriate planning controls that deliver a balance between providing flexibility in employment land uses while delivering a sub-precinct approach for the GAEP;
- Refine the draft sub-precinct approach that was explored at the workshop.
- Identify key gateways into the precinct where there are important road connections and arrival points.
- Determine the location of all native flora and fauna that needs to be protected under federal and state legislation.
- Investigate measures to mitigate risk of bird strike.
- Determine the viability of land uses including hotels, required to support a visitor economy precinct.
- Identify appropriate floor spaces for retail uses.
- Investigate the viability of including childcare centres in the precinct.
- Investigate opportunities for innovative drainage solutions for the precinct through the Avalon Corridor IWM strategy and the GAEP IWM strategy.
- Undertake a safety management study for the gas and oil pipelines.
- The Arboricultural Assessment identifies the moderate and high retention value trees on the site, and the proposed open space locations have been selected to facilitate retention of some of these. Further work will be undertaken to identify further opportunities to retain these trees in additional open spaces and road reserves (Victorian Planning Authority, 2023).

2 Proposed Development

The proposed development is for 160 industrial lots as shown on **Figure 2-1**. This layout is subject to change as the PSP, potential Develop Contribution Scheme and planning phases commence.

2.1 Proposed Drainage Strategy

An indicative drainage strategy as shown in **Figure 2-2** and **Appendix D** is based on a number of assumptions and key principles as follows:

- Siphons required to convey flows across the gas and oil pipe track (i.e. beneath existing gas and oil pipelines) due to existing pipeline depths.
- Widened boulevard road cross section with central median acting as flow conveyance for the two external catchments north of the Princes Freeway.
- Widened boulevard roads with central watercourse to have inner edge strip treatment (i.e. no kerb) to allow rural road grading provisions which significantly reduces fill requirements. Crushed rock inner shoulder and vehicle exclusion barriers to be provided.
- Catchments split to avoid flow concentration and minimise pipeline diameters and depths therefore minimising fill.
- Low flow pipelines where possible to convey 1EY and lower flows as required to the WLRB's.
- Raingardens and bioretention treatment systems upstream of the gas and oil pipe track to treat water where possible prior to entering the main outfalls. These would be installed within road reserves either in a central median or adjacent roads.
- GPT's proposed for small isolated catchments.
- Total outflow restricted to pre-developed flows at the outlet to the downstream property.
- Water treatment to achieve best practice targets.
- Maintaining outflow to pre-developed flows and volumes to the RAMSAR wetland downstream. It is understood that this is particularly sensitive to an increase in freshwater volume flooding through it over a 12 month period, and as a result, there will be a requirement to address/mitigate the increased volume at Avalon. The current proposal is that the downstream landowner, MAB is proposing to address this within their site via large evaporation ponds with a financial contribution from Livv.

There are some key assumptions underpinning this design that will be investigated further during the next stage of design, including:

- Gas pipeline as-constructed levels to be proven on site.
- Locations of culvert crossings of main central median flow conveyance.
- Outfall design is being undertaken by MAB. The levels of the constructed waterway will impact the proposed drainage network within the subject site. Additionally, it is likely that outfalls to the RAMSAR wetland will need to be maintained to some extent to maintain flows/volumes.
- Channels will be required parallel with the freeway to capture overland flow across the freeway and convey it into the main flow conveyance channels. The extent and size of these channels will be explored in Phase 2, hydraulic modelling.
- Climate change has been considered using the SSP2-4.5 pathway. The City of Greater Geelong may require additional scenarios to be tested. We understand that Harc and the VPA are investigating these requirements with the City.

Figure 2-1 Proposed Development

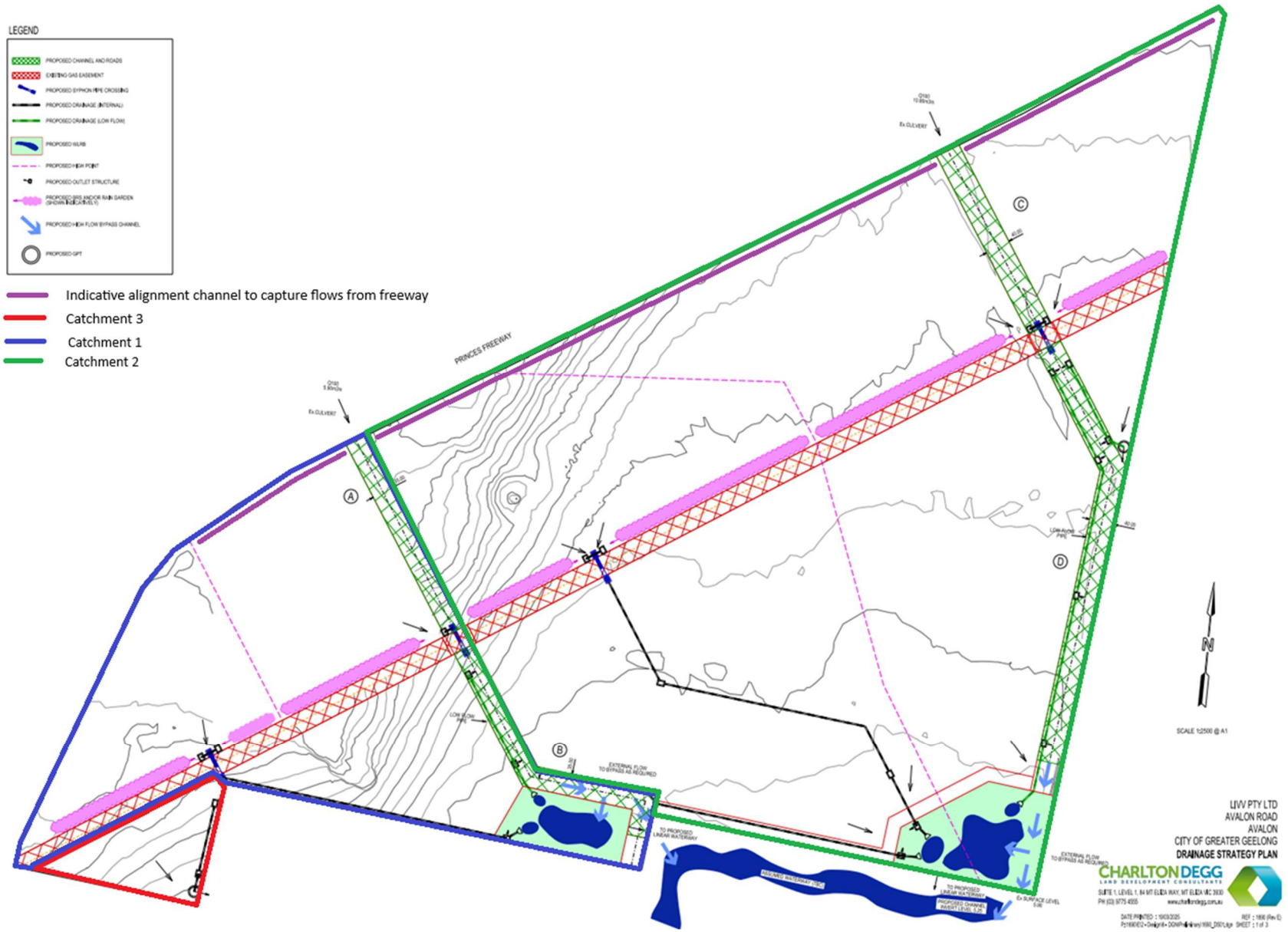

Figure 2-2 Proposed Drainage Strategy

3 Background Information

3.1 Preliminary Drainage Study

A preliminary drainage study has been conducted by Incitus in 2022. The following key points are noted for background information. These form the basis for this body of works.

- The site must aim to meet best practice objectives, including:
  - Providing flood protection and drainage;
  - Protecting the downstream aquatic ecosystems;
  - Removing contaminants;
  - Promoting stormwater elements as part of the urban form.
- The site drains from north-west to south-east, towards a channel, which traverses the site across the north-east corner and along the eastern boundary heading south. The site must allow for the conveyance of an external catchment through the site from the north via an existing culvert crossing of the Princes Freeway connecting to the channel which traverses the site, and an external catchment from the north entering the site near the intersection of Avalon Road and the Princes Freeway.
- The preliminary drainage study recommends minimal crossings of the existing infrastructure and to grade the main road north of the easement to the east, including removal of an existing high point, to facilitate this. Two crossings of the easement are recommended at proposed road intersections crossing to the south to reduce potential pipe sizes.
- At the time of writing, retardation was recommended to mitigate the runoff from the development to pre-development flows. There are two locations proposed – in the southeast (48,000 m^3) and southwest corners (750 m^3) of the site owing to the topography and reducing fill requirements. It is noted that the constructed wetland within the southeast retarding basin is proposed to be set 3m below the existing surface levels to obtain a drainage outfall and provide sufficient retarding volume. The wetland has been designed in MUSIC and will require 2.7 ha area at the normal water level (NWL). This will provide best practice treatment for the overall development, offsetting the gap generated by reduced treatment e.g. a gross pollutant trap (GPT) from the southwest corner. Total Nitrogen and Total Suspended Solids (TSS) are the controlling pollutants.
- A preliminary flow path scheme is shown in **Figure 3-1**.
- Regarding the outlet, the report notes:

  The channel along the eastern boundary of the site is only approximately 350 – 400 mm in depth. As the wetland will be set approximately 3 m below the existing surface to provide a pipe outlet, the development will need to negotiate with the downstream landowners to increase the depth and width of the existing channel so that the site can obtain a free draining outlet. Based on the flat grades towards the bay, it is estimated that the outlet may need to go all the way to Dandos Road.
  The alternative would be to fill the site and build an embankment for the retarding basin, lifting the outlet to close to the existing surface level. This option may prove problematic though, as the site will need to match in to the existing culvert crossing of the Princes Freeway and is already relatively flat. Also, the drainage will still need to cross the easement, so consideration would be needed to go over the asset and still have cover on the pipes. Filling the site to minimise the outfall works would require up to 3 m of fill over the majority of the site.
  The proposed allotment in the southwest corner of the site will also need to negotiate an outfall with the downstream land owner. It is anticipated that a 300 m long cut drain will be required to connect to an existing channel in the property to the south to provide a free draining outfall for the site (Incitus, 2022).

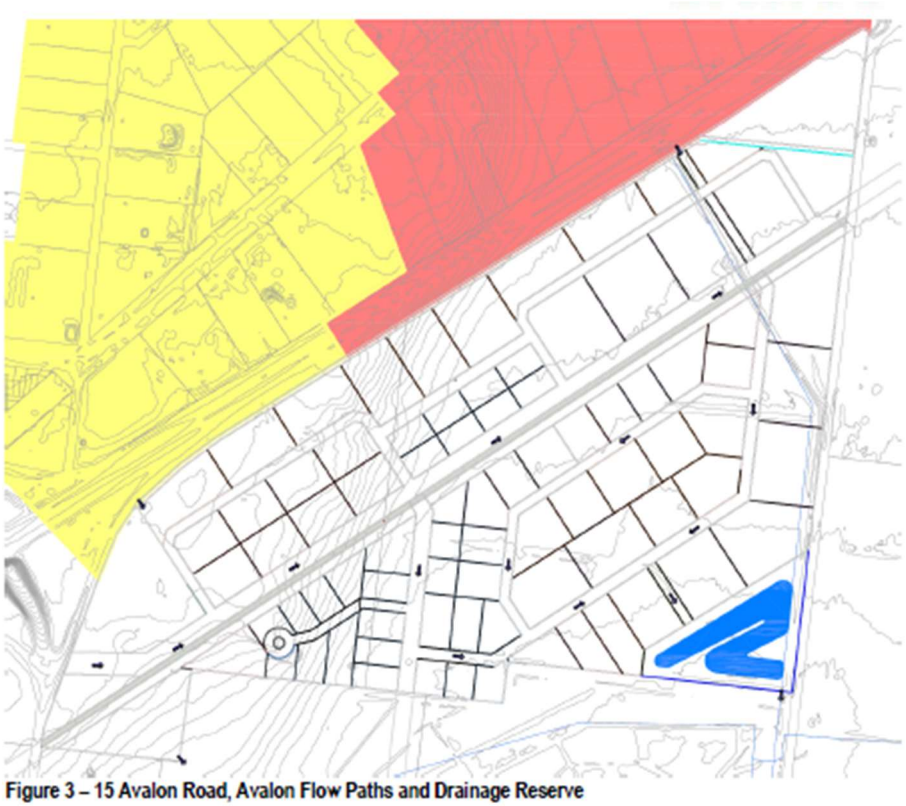

Figure 3-1 Preliminary Flow Paths (Incitus, 2022)

3.2 Aviation Constraints

Guideline C – Managing the Risk of Wildlife Strikes in the Vicinity of Airports (National Airports Safeguarding Framework) provides a list of compatible and incompatible land use within proximity to the airport. It is noted that wildlife sanctuary/conservation area – wetland is incompatible within a radius of 3km (Area A) of the aerodrome reference point, and to mitigate it within 8km (Area B). Water infrastructure (drains, channels, basins) are noted to be mitigated in both Areas A and B. These zones are shown in **Figure 3-2**. This is on the basis that wildlife is attracted to sources of food, water and shelter and these types of land uses attract wildlife. Wildlife increases the risk of bird strike and safety issues for departing and arriving aircraft.

Mitigation notes that these land use elements should be eliminated, adjusted or managed to ensure they do not act as food, water or shelter. Options to manage this can be found in the ICAO Airport Services Manual and these should be considered during the design, including auditory and visual deterrents, physical barriers e.g. netting, environmentally safe repellent chemicals (tactile or behavioural), traps (International Civil Aviation Organisation, 2024). Monitoring is required to maintain the relevant mitigations or improve them as required (National Airports Safeguarding Framework).

It is understood that conversations between the VPA and Avalon Airport are underway to determine the impact of these requirements on the broader PSP area, including the impact of and to the existing RAMSAR wetland downstream of the subject site, which are also within the Area A zone.

Figure 3-2 Areas A & B

3.3 Existing Infrastructure

This information is provided for background information for the stormwater drainage design.

It is noted that there are minimum clearance dimensions required for APA gas transmission pipelines, although APA will review the proposed infrastructure on a case-by-case basis. Approval by APA is required for all crossings. These clearances are as follows:

- Stormwater drains < DN500
  - Minimum 1000mm horizontal clearance to edge of pipeline;
- Stormwater drains > DN 500
  - Minimum 3000mm horizontal clearance to edge of pipeline;
- Minimum cover over pipeline:
  - Under road pavements: 1200mm
  - Protective slabbing must be installed where minimum depth of cover requirements cannot be met or required to meet specific safety requirements or bridge slabbing installed for protecting the pipeline from excessive loads.

Changes to surrounding surface levels or conditions must also consider drainage and the potential to result in erosion of cover for pipelines.

Clearances during construction must also be maintained in accordance with APA requirements and additional fill over the pipelines will also require approval (APA, 2021).

4 Site Inspection

A site visit was conducted by Rain Consulting on the 5th July 2024. The site visit photos can be found in Appendix A. The site visit confirmed anticipated flow paths, existing channels and crossings.

5 Hydrology

A new RORB hydrological model was constructed to estimate the site inflows and outflows under existing and developed conditions. Climate change has been considered as outlined in Section 5.3.

A full range of AEP events have been modelled, with the model set up and results provided below. The model was run using RORB version 6.51 and ARR 2019 requirements.

The RORB hydrological model results provide various flows for the subject site and its surrounding catchment. Additionally, the RORB model has been used to develop preliminary sizing of retarding requirements to meet planning requirements for the site.

5.1 RORB model Development

5.1.1 Existing Conditions Catchment Delineation

A review of the topography upstream of the site indicated a large catchment from the north with the potential to direct flows through the site in two main channels. These channels are directly downstream of the culverts under the Freeway.

Sub catchments were derived from these catchments, ensuring a minimum of 4 sub catchments were included upstream of a print point in the RORB model. Reach lengths were established based on the centre points of these sub catchments to print points. All reaches were set as natural.

The model layout is shown in **Figure 5-1**.

5.1.2 Values of Fraction Imperviousness

Values of fraction imperviousness (FI) were determined through aerial imagery and zoning, adopting standard values from the Melbourne Water MUSIC Guidelines (Melbourne Water, 2023). Sub catchment areas and associated existing and developed fraction impervious values are shown in Appendix B

5.1.3 Design Parameters

Six interstation areas were adopted, five upstream of the subject site and one at the subject site catchment outlet. The Kc value was calculated for each catchment using various accepted kc calculation methods in RORB, and reconciled against the RFFE tool and Rational Method, ultimately resulting in use of the Pearse et al. (2002) methodology as the best fit:

$Kc = 1.25 \times D_{av}$

Calculations for the reconciliation of kc can be provided on request. The non-linearity exponent, m, remains unchanged from the default value of 0.8. The initial and continuing losses were obtained from the ARR2016 Data Hub (Ball J, Babister M, Nathan R, Weeks W, Weinmann E, Retallick M, Testoni I). These losses were based upon the most recent ARR2019 guidelines which are to be adopted in ungauged catchments, and initial losses adjusted to remove pre-burst losses, and adjusted for indirectly connected areas in urban settings, and for the continuing losses, factored up to account for the model running at a timestep of less than an hour.

Parameters adopted for RORB modelling are outlined in **Table 5-1**. The D_{av} value at the outlet was slightly different between existing and developed conditions, so the Kc was modified to maintain a consistent Kc/d_{av} ratio.

Print points are located at the interstation point locations and four outflow points downstream of the subject site (A, B, C, and Outlet) recorded flows for each AEP event.

Table 5-1 Adopted RORB Parameters

Scenario	Interstation	Kc	IL (mm)	CL (mm/h)
Existing	WG27	0.45	8.6 (PA)	3.0 (PA)
	Eupstream	2.11	8.6 (PA)	3.0 (PA)
	Fupstream	0.92	8.6 (PA)	3.0 (PA)
	F1upstream	0.22	8.6 (PA)	3.0 (PA)
	F2upstream	1.83	8.6 (PA)	3.0 (PA)
	Catchment Outlet	0.9	8.6 (PA)	3.0 (PA)
Developed	WG27	0.45	8.6 (PA)	3.0 (PA)
	Eupstream	2.11	8.6 (PA)	3.0 (PA)
	Fupstream	0.92	8.6 (PA)	3.0 (PA)
	F1upstream	0.22	8.6 (PA)	3.0 (PA)
	F2upstream	1.83	8.6 (PA)	3.0 (PA)
	Catchment Outlet	1.12	8.6 (PA)	3.0 (PA)

5.2 Developed conditions RORB model

The developed conditions RORB model was updated for fraction impervious values and reach lengths in proposed development areas updated to suit the proposed development. This is shown in **Figure 5-2** and updated fraction impervious values are shown in Appendix B.

The developed condition RORB model has additional print points at the retarding basins inflow and outflow (RB1 inflow, RB1 outflow, RB2 inflow, and RB2 outflow).

Two retarding basins are proposed at locations B (WLRB1 = central) and A (WLRB2 = southeast corner). The stage storage relationships are shown in Appendix C.

5.3 Climate Change

In accordance with ARR 2019 V4.2 and discussion with surrounding landowners, and in the absence of direction from the VPA, a check on climate change flows was undertaken for SSP2 – 4.5, 2100. This will need to be confirmed with the VPA and CoGG.

Initial losses and continuing losses were amended in line with the adjustments from data hub, resulting in 12.1 mm and 2.44 mm/hr respectively. Results

Peak flow results for various AEP events and points of interest are shown in **Table 5-2** to **Table 5-7**.

Table 5-2 Existing Conditions RORB Results, Base Case

Print point	1% AEP (m^3/s)	20% AEP (m^3/s)	4EY (m^3/s)
E	10.09	2.14	0.43
F	5.75	1.38	0.28
A	12.19	2.67	0.53
B	1.95	0.62	0.12
C	3.23	1.07	0.21
Outlet	14.76	3.88	0.78

Table 5-3 Existing Conditions RORB Results with Climate Change SSP2-4.5, 2100

Print point	1% AEP (m^3/s)	20% AEP (m^3/s)	4EY (m^3/s)
E	16.01	3.69	0.74
F	9.13	2.48	0.50
A	19.54	4.61	0.92
B	2.92	0.98	0.20
C	4.85	1.63	0.32
Outlet	23.28	5.90	1.18

Table 5-4 Developed Conditions RORB Results – unmitigated, base case

Print point	1% AEP (m^3/s)	20% AEP (m^3/s)	4EY (m^3/s)
E	10.09	2.14	0.43
F	5.75	1.38	0.28
A	13.52	5.84	1.17
B	10.39	2.76	0.55
C	1.30	0.52	0.10
Outlet	21.3	8.86	1.77

Table 5-5 Developed Conditions RORB Results – unmitigated with Climate Change SSP2-4.5, 2100

Print point	1% AEP (m^3/s)	20% AEP (m^3/s)	4EY (m^3/s)
E	16.01	3.69	0.74
F	9.13	2.48	0.50
A	19.94	8.48	1.70
B	15.97	4.29	0.86
C	1.88	0.77	0.15
Outlet	32.45	13.04	2.61

Table 5-6 Developed Conditions RORB Results – mitigated, base case

Print point	1% AEP (m^3/s)	20% AEP (m^3/s)	4EY (m^3/s)
E	10.09	4.11	0.82
F	5.75	3.88	0.78
A	8.32	3.17	0.63
B	5.87	2.02	0.40
C	1.30	0.52	0.10
Outlet	13.54	4.89	0.98

Table 5-7 Developed Conditions RORB Results – mitigated with Climate Change SSP2-4.5, 2100

Print point	1% AEP (m^3/s)	20% AEP (m^3/s)	4EY (m^3/s)
E	16.01	3.69	0.74
F	9.13	2.48	0.50
A	16.40	4.23	0.85
B	9.55	3.43	0.69
C	1.88	0.77	0.15
Outlet	24.03	7.17	1.43

Table 5-8 Existing and Developed Outflow RORB Results in 1% AEP

	Base Case			Climate Change SSP2-4.5, 2100		
Outflow point	Existing Conditions 1% AEP (m^3/s)	Developed Conditions, mitigated 1% AEP (m^3/s)	Decrease in flow %	Existing Conditions 1% AEP (m^3/s)	Developed Conditions, mitigated 1% AEP (m^3/s)	Decrease in flow %
A	12.19	8.32	-32%	19.54	16.40	-16%
B	1.95	5.87	201%	2.92	9.55	227%
C	3.23	1.3	-60%	4.85	1.88	-61%
Outlet	14.76	13.54	-8%	23.28	24.03	3%

In the base case scenario, the overall developed mitigated flows are 8% lower than pre-developed, and in the climate change scenario, there is a 3% increase in flows in the 1% AEP event.

The retarding basin have the following results, indicating that in the climate change scenario, the water will back up over the spillway and there will be pipe and spillway flow, but can still be contained within the retarding basin stage storage.

Table 5-9 Existing and Developed Outflow RORB Results in 1% AEP

	Base Case					Climate Change SSP2-4.5, 2100		
RB	TWL area (m^2)	Depth at TWL (m)	Peak Storage (m^3)	Outflow	Spillway	TWL area (m^2)	Depth at TWL (m)	Peak Storage (m^3)
1	13,513	1.64	22,200	2 * 0.6 high * 1.8m wide culverts	1.94	14,541	2.10	30,800
2	19,681	1.75	34,400	2 * 0.6 high * 2.1m wide culverts	2.05	21,516	2.38	51,000

Figure 5-1 Existing RORB Model

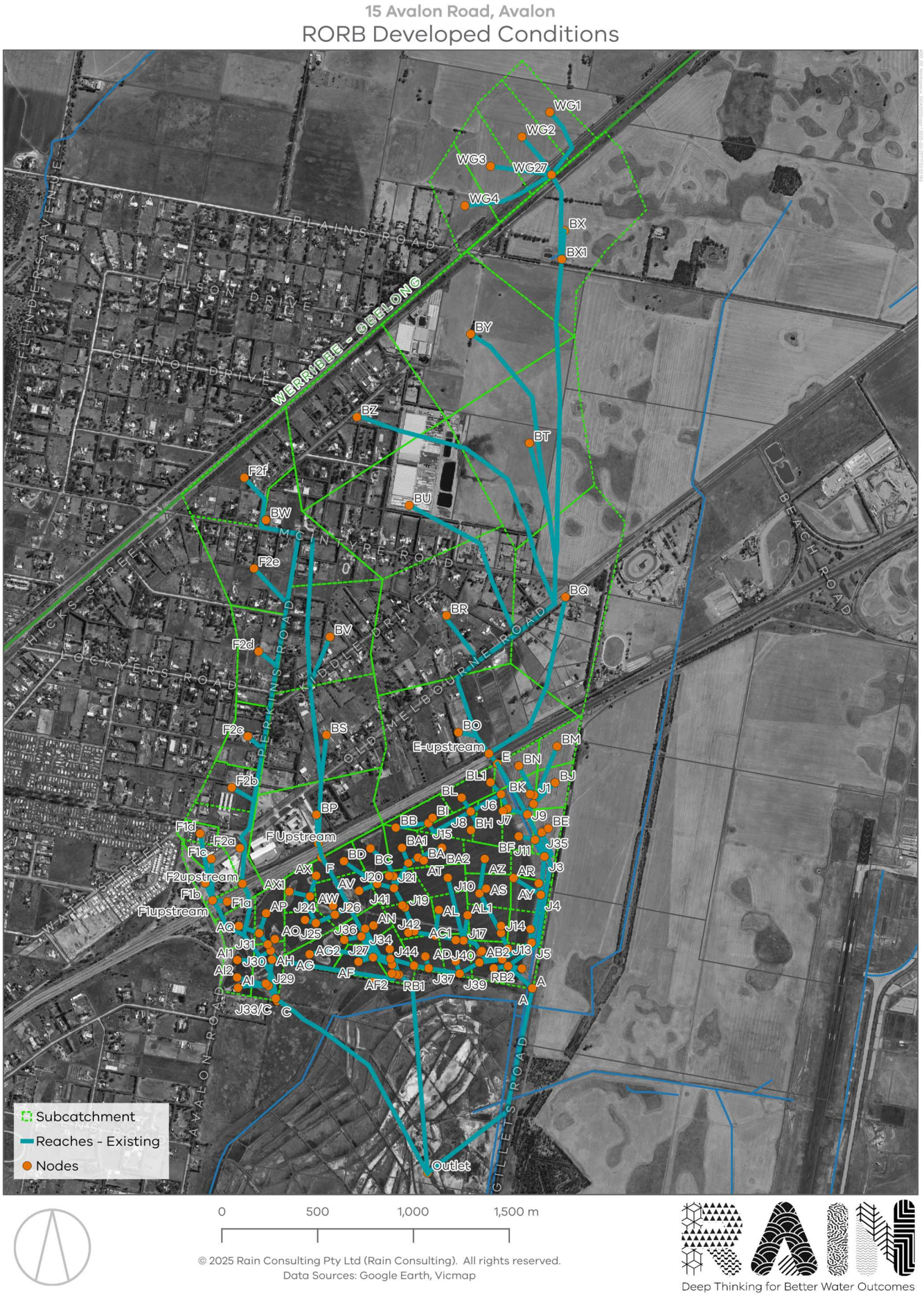

Figure 5-2 Developed RORB Model

6 Water Quality Treatment Train

6.1 Introduction

To mitigate increases in contaminants in surface water runoff due to the proposed development, a MUSIC model was developed using the developed fraction impervious and catchment sizes outlined in Appendix B. MUSIC is software that simulates rainfall, stormwater runoff and pollution. It also simulates pollution removal and flow reduction through stormwater management systems such as sediment ponds, wetlands, bioretention and stormwater harvesting.

As per the MUSIC – Modelling Approach and Parameters Design Note 3 (City of Greater Geelong, 2019), stormwater management minimum requirements for water quality are set by the Victorian Environmental Protection Agency (EPA) through the Best Practice Environmental Management Guidelines (BPEMG), which have been adopted for this analysis. They are as follows:

- Total Suspended Solids (TSS) 80% retention of the typical urban annual load;
- Total Phosphorus (TP) 45% retention of the typical urban annual load;
- Total Nitrogen (TN) 45% retention of the typical urban annual load; and,
- Gross Pollutants 70% retention of the typical urban annual load.

The rainfall and evapotranspiration data were adopted from the Geelong Australia database. The data used for the analysis in MUSIC was the Little River 1992 to 2001, 10-year period, 6-minute dataset.

The proposed treatment train for each catchment is as follows:

- Catchments 1 & 2 – bioretention upstream of the pipe corridor, discharging into either the overland flow conveyance and into the retarding basin, or conveyed by pipe into further treatment in the downstream sediment basin/wetland system contained within a retarding basin.
- Catchment 3 – treatment via a GPT prior to discharge. This is a result of the catchment being quite small, and the other systems are over-designed to meet best practice.

The following sections outline the concept design for each catchment.

6.2 Sediment Basin

Initial sizing of the sediment basin was completed using a Fair and Geyer equation (Equation 10.3 WSUD Stormwater Technical Manual 2005). **Table 6-1** shows the sediment ponds key parameters, with the sizing of SB1 upsized due to the MUSIC results.

Table 6-1 Sediment Basin Concept Design Parameters

Parameter		SB1	SB2
Conditions	Contributing Developed Catchment (ha)	33.45	60.12
	Area of Basin (m^2) at NWL	1,000	1,400
Capture Efficiency	Settling Velocity of Target Sediment (mm/s) (Particle Size of 125 µm)	0.011	0.011
	Hydraulic Efficiency (λ)	0.26	0.26
	Permanent Pool Depth (m)	1.5	1.5
	Extended Detention Depth (m)	0.35	0.35
	Turbulence Factor, n	1.35	1.35
	Depth below permanent pool that is sufficient to retain sediment (m)	1.00	1.00
	Design Discharge (m^3/s)	0.32	1.12
	Capture Efficiency	99.2%	97.4%
	Check (>95%)	Ok	Ok
Sediment Storage	Sediment Loading rate, Lo ($m^3/s/ha/yr$)	1.60	1.60
	Desired clean-out frequency, Fr (years)	5	5

	Storage volume required (m^3)	254	457
	Available Sediment Storage Volume (m^3)	381	519
	Check (Available Storage > Storage volume required)	Ok	Ok
Sediment Dewatering	Depth for dewatering area (m)	0.5	0.5
	Area required for dewatering (m^2)	508	914

Expected velocities across a range of AEP events have been analysed as shown in **Table 6-2** and

Table 6-3. A flow depth of 0.35m, which is the extended detention depth, has been assumed for the 4EY flows. Note that the 1EY and larger flows are diverted around the treatment asset via the high flow bypass.

A manual calculation has been used to check the flow velocities through the assets for the design. This calculates the flow area from the flow depth (between extended detention depth and normal water level) and the average width in that area. The average width is determined from the narrowest part of the macrophyte zone or sediment basin (the minimum design width).

The maximum width of the sediment basin is to be designed using the length to width ratio of at least 1:1.5.

Table 6-2 Velocity Checks – SB1

	Parameter	4EY	1EY	20% AEP
Flow Conditions	Design flow (m^3/s)	0.32	0.8	2.62
	Flow depth (m)	0.35	0.35	0.35
SBA5	Width at NWL (m)	25.82	25.82	25.82
	Width at EDD (m)	29.42	29.42	29.42
	Average Width (m)	27.62	27.62	27.62
	Flow area (m2)	9.67	9.67	9.67
	Flow velocity (m/s)	0.03	0.08	0.27
	Check	<0.5 OK	<0.5 OK	<0.5 OK

Table 6-3 Velocity Checks – SB2

	Parameter	4EY	1EY	20% AEP
Flow Conditions	Design flow (m^3/s)	0.65	1.77	3.25
	Flow depth (m)	0.35	0.35	0.35
SBA5	Width at NWL (m)	21.60	21.60	21.60
	Width at EDD (m)	25.20	25.20	25.20
	Average Width (m)	23.40	23.40	23.40
	Flow area (m2)	8.19	8.19	8.19
	Flow velocity (m/s)	0.08	0.22	0.40
	Check	<0.5 OK	<0.5 OK	<0.5 OK

Sediment dry out areas are also required and must be located above the 10% AEP flood level.

During construction, sediment loads are generally higher. A rate of 50 m^3/ha/year could be estimated for developing conditions. A clean out is required every 2 months. This can be minimised with effective erosion control around the site during the construction period.

6.3 Proposed treatment train

The proposed treatment train comprises of a sediment basin upstream of each of the two proposed wetland within the proposed retarding basins. It is noted that the bypass for SB1 is for a 4EY event, and for SB2 is for a 1EY, to ensure best practice is met.

There are 2 GPTs proposed to capture flows from smaller catchments. It is proposed to include bioretention in road reserves upstream of the gas main

reserve to enable flows to be distributed to the overland flow paths through the two main overland flow paths.

The wetland parameters are shown in **Table 6-4**, bioretention and GPTs shown in **Table 6-5** and the results shown in **Table 6-6**.

Table 6-4 Constructed Wetland design parameters and checks

Parameter	Parameter	WLRB1	WLRB2
	Extended Detention Depth (EDD) (m)	0.35	0.35
	High Flow By-pass (m^3/s)	0.32	2.99
	NWL Surface Area (m^2)	7,000	7,500
	Permanent Pool Volume (m^3)	2,800	3,000
	Initial Volume (m^3)	3,600	3,000
	Exfiltration Rate (mm/hr)	0	0
	Evaporative Loss as % of PET	125	125
	Notional Detention Time (hrs)	73.4	73.2

Table 6-5 Bioretention & GPT information

Catchment	Bioretention Area (m^2)	Filter Depth (m)	GPT
2a	7,150	0.50	
2b	4,550	0.50	
2c	2,480	0.50	
2e	N/A	N/A	Atlan Vortceptor (SQIDEP Verified) OVOR.220
3	N/A	N/A	Atlan Vortceptor (SQIDEP Verified) OVOR.220

Table 6-6 Treatment Train Results

Pollutant	Reduction Target	Reduction Achieved WLRB1	Reduction Achieved WLRB2	Overall Reduction Achieved
Total Suspended Solids	80%	76.3%	80.1%	79.9%
Total Phosphorus	45%	67.2%	65.1%	66.3%
Total Nitrogen	45%	49.3%	51.3%	50.6%
Litter/Gross Pollutants	70%	85.0%	95.0%	93.0%

The proposed treatment is shown in **Figure 6-1**.

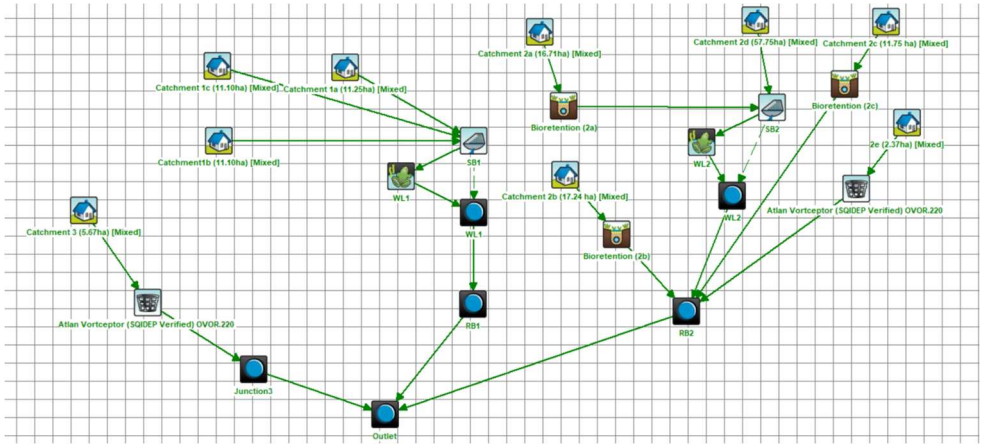

Figure 6-1 MUSIC model treatment train

7 Stormwater Harvesting

To assess the feasibility of stormwater reuse, rainwater tanks were modelled in MUSIC for three different rainwater tank options. The rainfall

and evapotranspiration data were adopted from the Geelong Australia database. The data used for the analysis in MUSIC was the Little River 1989 to 2008, 20-year period, 6-minute dataset. Demands were incorporated into the model of 4.5ML/ha/year, adopted from the City of Greater Geelong, MUSIC modelling approach and parameter document for cool season turf (The City of Greater Geelong, 2018), along with the monthly distribution of the reuse demand. The percentage of annual demand is higher in drier months and lower in wetter months (The City of Greater Geelong, 2018).

To ensure feasibility of stormwater harvesting, a target supply reliability of 75% is recommended. A number of tank sizes were trialled, and this target was able to be met, as shown in **Table 7-1**.

It is recommended that a cost benefit analysis around the installation and maintenance cost of installing tanks against the potable water cost savings over time.

Table 7-1 Rainwater Tank Parameters and checks

Parameter	Option 1	Option 2	Option 3
Tank sizes tested (kL)	12,000	15,000	20,000
% Reuse Demand Met	71.8	76.3	82.3
Water use / Demand (ML/ha/year)	4.5	4.5	4.5

8 Recommendations

This report has covered Phase 1 of the project works, and provided a preliminary conceptual design for the drainage network.

The proposed drainage strategy is underpinned by a number of core principles outlined below:

- Siphons required to convey flows across the gas and oil pipe track (i.e. beneath existing gas and oil pipelines) due to existing pipeline depths.
- Widened boulevard road cross section with central median acting as flow conveyance for the two external catchments north of the Princes Freeway.
- Widened boulevard roads with central watercourse to have inner edge strip treatment (i.e. no kerb) to allow rural road grading provisions which significantly reduces fill requirements. Crushed rock inner shoulder and vehicle exclusion barriers to be provided.
- Catchments split to avoid flow concentration and minimise pipeline diameters and depths therefore minimising fill.
- Low flow pipelines where possible to convey 1EY and lower flows as required to the WLRB's.
- Raingardens and bioretention treatment systems upstream of the gas and oil pipe track to treat water where possible prior to entering the main outfalls. These would be installed within road reserves either in a central median or adjacent roads.
- GPT's proposed for small isolated catchments.
- Total outflow restricted to pre-developed flows at the outlet to the downstream property.
- Water treatment to achieve best practice targets.
- Maintaining outflow to pre-developed flows and volumes to the RAMSAR wetland downstream. It is understood that this is particularly sensitive to an increase in freshwater volume flooding through it over a 12 month period, and as a result, there will be a requirement to address/mitigate the increased volume at Avalon. The current proposal is that the downstream landowner, MAB is proposing to address this within their site via large evaporation ponds with a financial contribution from Livv.

There are some key assumptions underpinning this design that will be investigated further during the next stage of design, including:

- Gas pipeline as-constructed levels to be proven on site.
- Locations of culvert crossings of main central median flow conveyance.

- Outfall design is being undertaken by MAB. The levels of the constructed waterway will impact the proposed drainage network within the subject site. Additionally, it is likely that outfalls to the RAMSAR wetland will need to be maintained to some extent to maintain flows/volumes.
- Channels will be required parallel with the freeway to capture overland flow across the freeway and convey it into the main flow conveyance channels. The extent and size of these channels will be explored in Phase 2, hydraulic modelling.
- Climate change has been considered using the SSP2-4.5 pathway. The City of Greater Geelong may require additional scenarios to be tested. We understand that Harc and the VPA are investigating these requirements with the City.

The key drainage assets are proposed as follows:

Catchment 1

- Sediment Basin 1
  - 1,000 m^2 at normal water level
  - Dry out area of 508 m^2
- Wetland area at normal water level of 7,000 m^2.
- Retarding Basin
  - Top water level area 13,513 m^2.
  - Peak elevation 1.64 m.
  - Peak storage volume 22,200 m^3.
  - 2 * 0.6 high * 1.8m wide culverts.

Catchment 2

- Bioretention 14,180 m^2.
- Atlan Vortceptor (SQIDEP Verified) OVOR.220
- Sediment Basin 1
  - 1,400 m^2 at normal water level
  - Dry out area of 914 m^2
- Wetland area at normal water level of 7,500 m^2.
- Retarding Basin
  - Top water level area 19,681 m^2.
  - Peak elevation 1.75 m.
  - Peak storage volume 34,400 m^3.
  - 2 * 0.6 high * 1.8m wide culverts.

Catchment 3

- Atlan Vortceptor (SQIDEP Verified) OVOR.220

It is recommended that the preliminary drainage strategy and the associated principals are incorporated into the DPO.

9 References

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Appendix A. Site Visit Photos

Deep Thinking for Better Water Outcomes

15 Avalon Road, Avalon

Site Visit Photo Locations

Subject Site

Site Visit Photo Location

Data Sources: Google Earth, VicMap

0 200 400 m

400_02_Workspace_GDA2020.qgz | 2024-07-17T16:43:46.640

IMG_4320

IMG_4322

IMG_4326

IMG_4339

IMG_4343

IMG_4352

IMG_4357

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IMG_4374

IMG_4419

IMG_4310

IMG_4348

Appendix B. RORB Subcatchment Parameters

Catchment	Existing Area (km²)	Fraction Impervious (existing)	Developed Area (km²)	Fraction Impervious (developed)
AB2		0.1	0.017	0.816
AA	0.035	0.1		
AB	0.037	0.1		
AC	0.033	0.1	0.024	0.865
AC1			0.017	0.814
AD	0.031	0.1	0.018	0.9
AE	0.042	0.1	0.022	0.838
AF	0.033	0.1	0.025	0.843
AF2			0.022	0.54
AG	0.041	0.1	0.032	0.656
AG2			0.033	0.712
AH	0.045	0.1	0.017	0.52
AH2			0.027	0.812
AH3			0.022	0.894
AI	0.038	0.187	0.008	0.646
AI1			0.02	0.535
AI2			0.009	0.616
AJ	0.031	0.1	0.024	0.771
AJ2			0.031	0.05
AJ3			0.022	0.05
AK	0.038	0.1	0.036	0.881
AL	0.037	0.1	0.029	0.9
AL1			0.032	0.863
AM	0.043	0.1	0.024	0.834
AN	0.037	0.1	0.018	0.783
AO	0.038	0.1	0.03	0.804
AP	0.045	0.139	0.027	0.74
AQ	0.038	0.14	0.037	0.236
AR	0.034	0.1	0.043	0.9
AS	0.039	0.1	0.024	0.84
AT	0.036	0.1	0.036	0.652
AU	0.043	0.1	0.038	0.87
AU2			0.047	0.671
AV	0.033	0.1	0.027	0.857
AW	0.032	0.1	0.033	0.764
AX	0.034	0.1	0.025	0.611
AX1			0.022	0.647
AY	0.031	0.1	0.037	0.8
AZ	0.038	0.1	0.032	0.684
BA	0.034	0.1	0.019	0.835
BA1			0.02	0.84
BA2			0.02	0.884
BB	0.039	0.1	0.018	0.512
BC	0.035	0.101	0.021	0.725
BD	0.035	0.101	0.024	0.63
BE	0.035	0.1	0.03	0.716
BF	0.032	0.1	0.039	0.651
BG	0.035	0.1	0.039	0.814
BH	0.032	0.1	0.034	0.833
BI	0.031	0.1	0.037	0.697
BJ	0.037	0.1	0.028	0.9
BK	0.03	0.1	0.02	0.9
BL	0.035	0.1	0.024	0.73
BL1			0.027	0.727
BM	0.04	0.1	0.044	0.9
BN	0.035	0.1	0.024	0.76
BO	0.481	0.304	0.481	0.304
BP	0.265	0.493	0.265	0.493
BQ	0.458	0.171	0.458	0.171
BR	0.476	0.208	0.476	0.208
BS	0.303	0.206	0.303	0.206
BT	0.48	0.101	0.48	0.101
BU	0.451	0.159	0.451	0.159
BV	0.252	0.207	0.252	0.207
BW	0.142	0.213	0.142	0.213

BX	0.441	0.155	0.441	0.155
BY	0.44	0.142	0.44	0.142
BZ	0.424	0.233	0.424	0.233
F1a	0.021	0.412	0.021	0.412
F1b	0.032	0.203	0.032	0.203
F1c	0.032	0.869	0.032	0.869
F1d	0.019	0.806	0.019	0.806
F2a	0.079	0.496	0.079	0.496
F2b	0.064	0.211	0.064	0.211
F2c	0.068	0.216	0.068	0.216
F2d	0.111	0.217	0.111	0.217
F2e	0.187	0.213	0.187	0.213
F2f	0.185	0.306	0.185	0.306
WG1	0.09	0.1	0.09	0.1
WG2	0.126	0.1	0.126	0.1
WG3	0.105	0.1	0.105	0.1
WG4	0.103	0.1	0.103	0.1

Appendix C. Retarding Basin Stage Storage Relationships

Proposed Stage Storage Relationship – RB1

Stage	Storage (m^3)	Area (m^2)
0	0	9800
0.1	998	10011
0.2	2038	10224
0.3	3121	10439
0.4	4248	10656
0.5	5419	10875
0.6	6635	11096
0.7	7896	11319
0.8	9204	11544
0.9	10558	11771
1	11960	12000
1.1	13410	12231
1.2	14908	12464
1.3	16455	12699
1.4	18052	12936
1.5	19699	13175
1.6	21397	13416
1.7	23146	13659
1.8	24948	13904
1.9	26802	14151
2	28710	14400
2.1	30672	14651
2.2	32688	14904
2.3	34759	15159
2.4	36886	15416
2.5	39069	15675

Proposed Stage Storage Relationship – RB2

Stage	Storage (m^3)	Area (m^2)
0	0	15000
0.1	1520	15251
0.2	3091	15504
0.3	4712	15759
0.4	6386	16016
0.5	8111	16275
0.6	9890	16536
0.7	11722	16799
0.8	13608	17064
0.9	15549	17331
1	17545	17600
1.1	19597	17871
1.2	21706	18144
1.3	23871	18419
1.4	26095	18696
1.5	28376	18975
1.6	30717	19256
1.7	33117	19539
1.8	35577	19824
1.9	38098	20111
2	40680	20400
2.1	43324	20691
2.2	46031	20984
2.3	48800	21279
2.4	51634	21576
2.5	54531	21875
2.6	57494	22176
2.7	60522	22479
2.8	63616	22784
2.9	66777	23091
3	70005	23400

Appendix D. Proposed Drainage Strategy

LEGEND

- PROPOSED CHANNEL AND ROADS
- EXISTING GAS EASEMENT
- PROPOSED SYPHON PIPE CROSSING
- PROPOSED DRAINAGE (INTERNAL)
- PROPOSED DRAINAGE (LOW FLOW)
- PROPOSED WLRB
- PROPOSED HIGH POINT
- PROPOSED OUTLET STRUCTURE
- PROPOSED BRS AND/OR RAIN GARDEN (SHOWN INDICATIVELY)
- PROPOSED HIGH FLOW BYPASS CHANNEL
- PROPOSED GPT

PRINCES FREEWAY

Q100
10.80m3/s
Ex.CULVERT

Q100
5.90m3/s
Ex.CULVERT

A
B
C
D

35.00
35.00
40.00
40.00

LOW FLOW PIPE
LOW FLOW PIPE

EXTERNAL FLOW TO BYPASS AS REQUIRED
EXTERNAL FLOW TO BYPASS AS REQUIRED

TO PROPOSED LINEAR WATERWAY
TO PROPOSED LINEAR WATERWAY

ASSUMED WATERWAY (TBC)

PROPOSED CHANNEL INVERT LEVEL 5.25

Ex SURFACE LEVEL 5.90

N

SCALE 1:2500 @ A1

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AVALON ROAD
AVALON
CITY OF GREATER GEELONG
DRAINAGE STRATEGY PLAN

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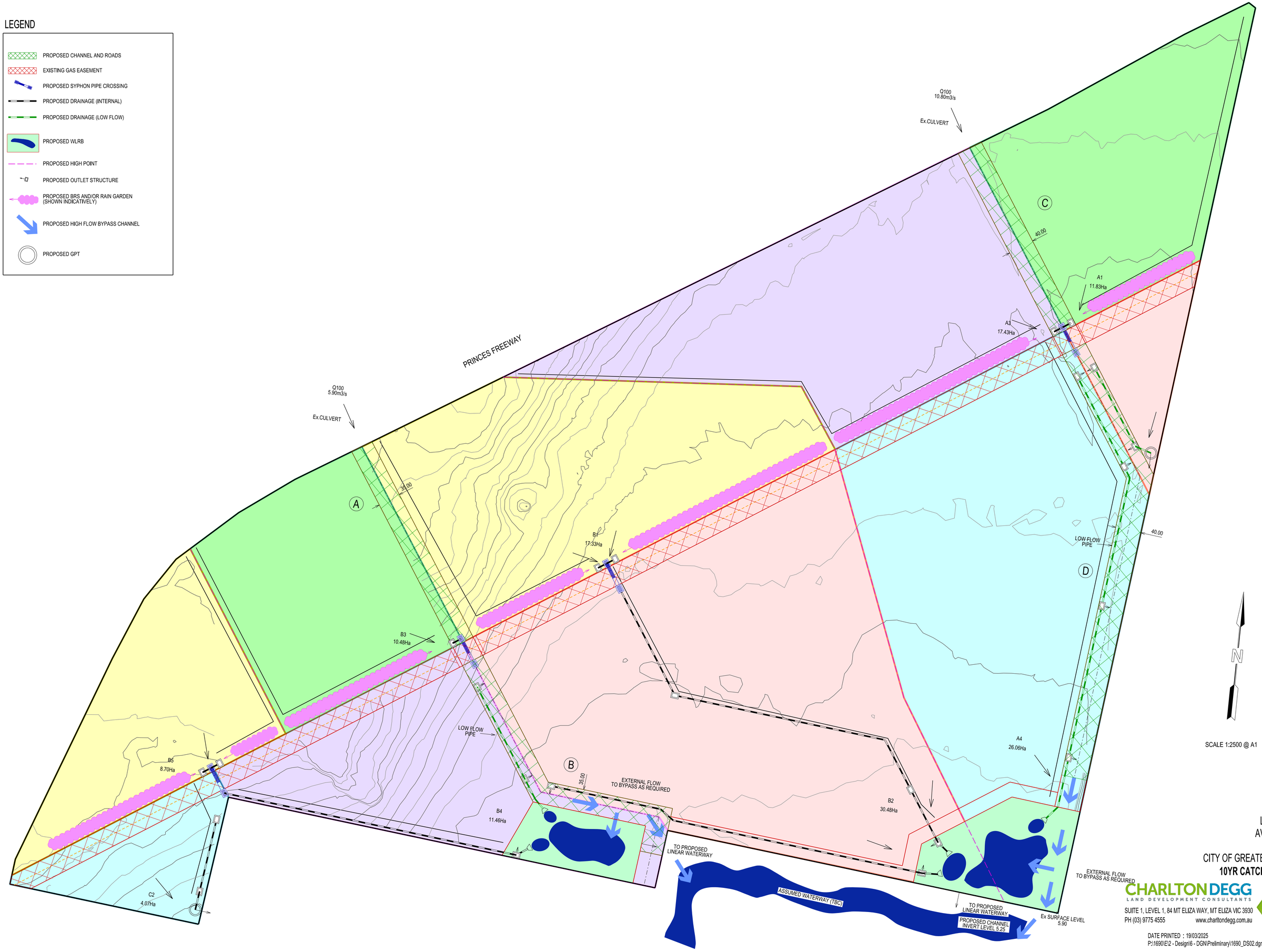
LEGEND

- PROPOSED CHANNEL AND ROADS
- EXISTING GAS EASEMENT
- PROPOSED SYPHON PIPE CROSSING
- PROPOSED DRAINAGE (INTERNAL)
- PROPOSED DRAINAGE (LOW FLOW)
- PROPOSED WLRB
- PROPOSED HIGH POINT
- PROPOSED OUTLET STRUCTURE
- PROPOSED BRS AND/OR RAIN GARDEN (SHOWN INDICATIVELY)
- PROPOSED HIGH FLOW BYPASS CHANNEL
- PROPOSED GPT



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SCALE 1:2500 @ A1

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AVALON
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10YR CATCHMENT PLAN

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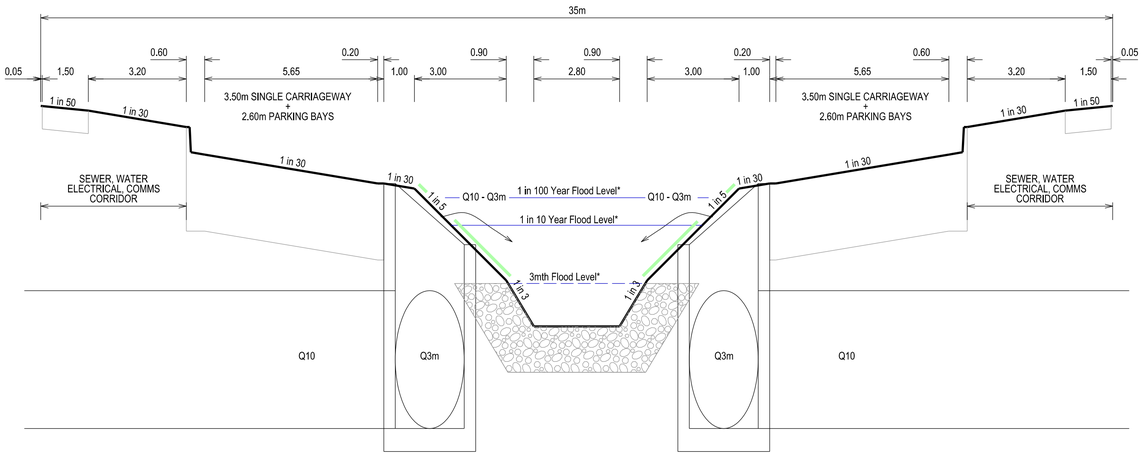
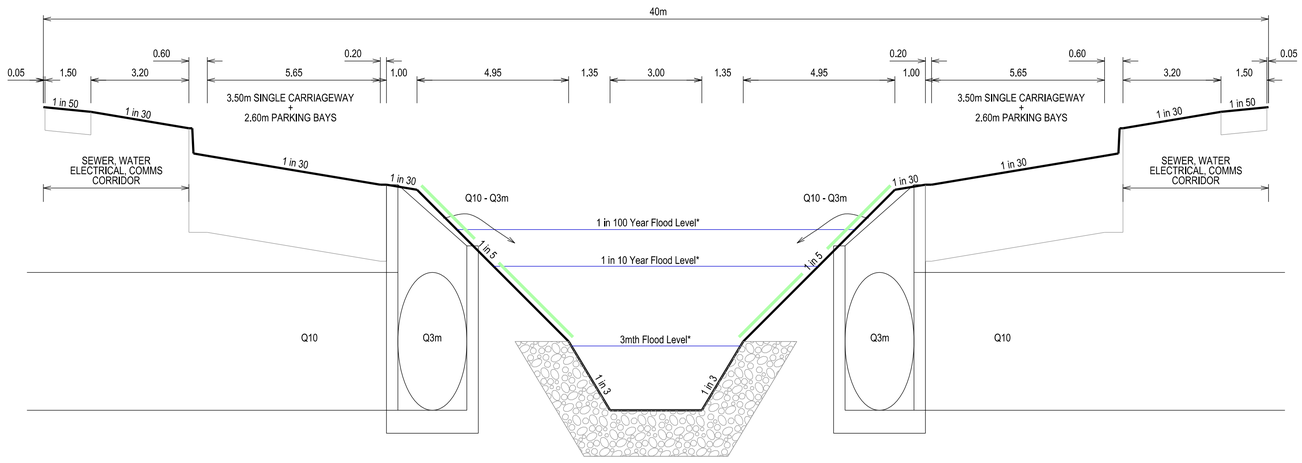
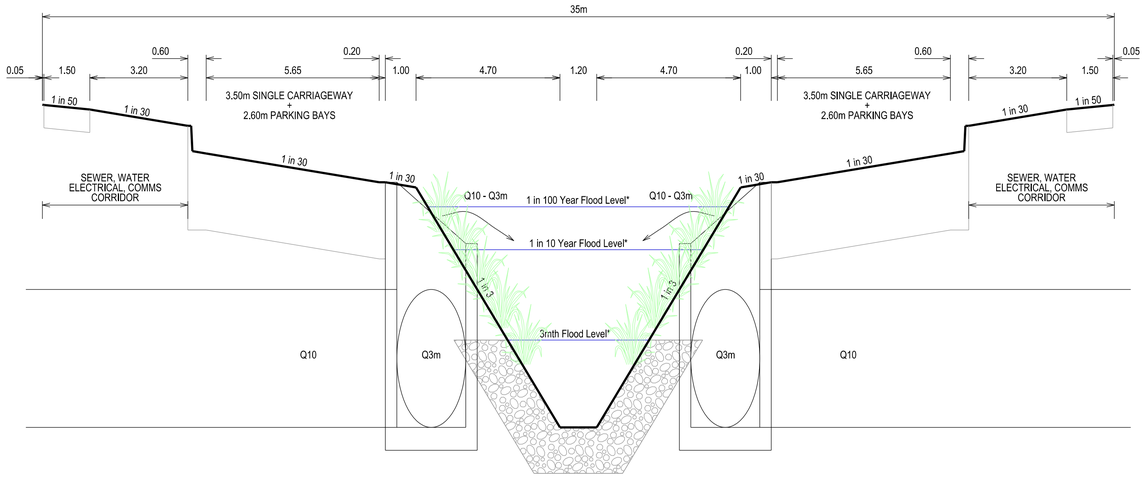


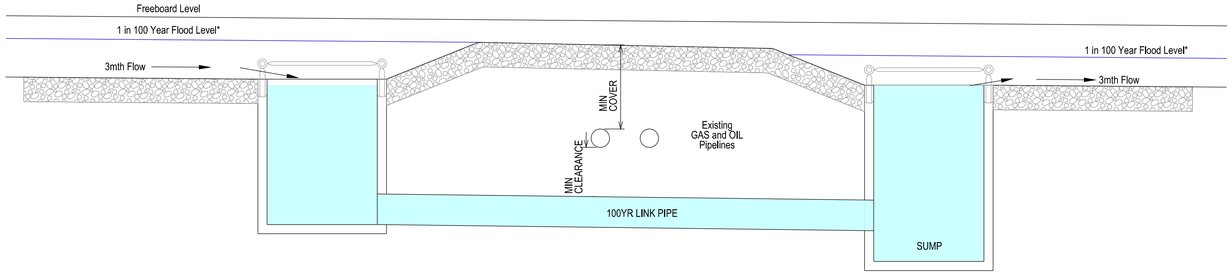
CHANNEL TYPICAL SECTION - A & B
(NTS)



CHANNEL TYPICAL SECTION - C & D (OPTION 1)
(NTS)



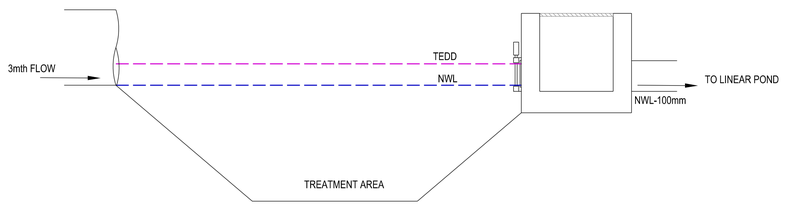
CHANNEL TYPICAL SECTION - C & D (OPTION 2)
(NTS)



NOTE:

* INDICATIVE FLOOD LEVEL FOR EXTERNAL CATCHMENT

PROPOSED CROSSING TYPICAL SECTION
(NTS)



PROPOSED OUTLET ARRANGEMENT
(NTS)

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TYPICAL SECTIONS

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Deep Thinking for Better Water Outcomes