BEVERIDGE NORTH WEST PRECINCT STRUCTURE PLAN – HAZELWYNDE

11 October 2019

Yarra Valley Water's submission to the Victorian Planning Authority

Final Version

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The Victorian Planning Authority (VPA) has prepared Amendment C106 to the Mitchell Planning Scheme (Mitchell Shire Council).

This Amendment seeks to incorporate the Beveridge North West Precinct Structure Plan (PSP) into the planning scheme.

The following is Yarra Valley Water's (YVW) submission to the VPA as the landowner of Hazelwynde, 740ha of land within the Beveridge North West PSP (BNWPSP) area.

This submission is separate to any other submission to the VPA regarding servicing requirements and/or considerations from YVW as a service authority.

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1.0 HAZELWYNDE BACKGROUND

1.1 Situation

YVW owns 740Ha of land within the Beveridge North West PSP. This equates to approximately 60% of the Beveridge North West PSP area. The parcel, known as Hazelwynde, is intended to be used as a community asset to create further value for the State of Victoria and for YVWs customers. The land is currently required for operational purposes.

1.2 PSP response

This submission to the VPA is based on YVW's role as the landowner of the Hazelwynde property. The submission is targeted at realising the unique greenfield development opportunity presented by the Hazelwynde development to create a master planned community delivering on the Victorian Governments environmental, social and economic strategic directions contained in Plan Melbourne and Water for Victoria as well as providing significant economic benefits for the State. Further details on YVW's vision for the Hazelwynde development is outlined in section 2.

1.3 Location

Hazelwynde is bounded by Camerons Lane to the south, Old Sydney Road to the west and is near both the Hume Freeway and the Seymour Rail Line, both located to the east of Hazelwynde. The site is located 4km south of the Wallan Town Centre and is close to existing and future employment precincts including the Merrifield Town Centre, the Merrifield industrial estate and the future proposed inland freight terminal near Beveridge. The traditional owners of the land are the Wurundjeri people.

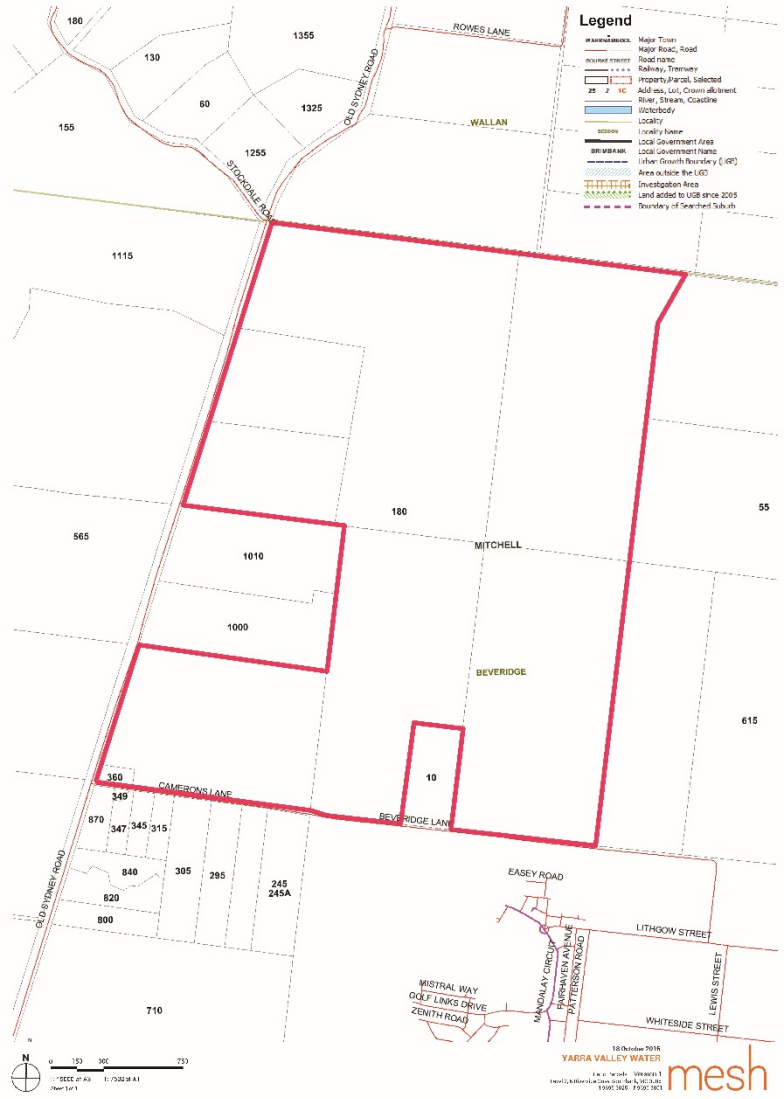

Figure 1: Hazelwynde Locality Plan

1.4 Opportunity

Rarely does a land holding this size exist in the Growth Areas of Melbourne in single land ownership. The scale, combined with the land ownership being a government-related entity, presents a unique opportunity. Hazelwynde will demonstrate the possibilities for achieving enhanced community outcomes in the growth areas of Melbourne.

YVW wishes to 'participate' in the future development of Hazelwynde and as such, will likely find a development partner or partners to assist in the delivery of the Hazelwynde project.

1.5 Partnerships

YVW has been working with key stakeholders including Mitchell Shire Council (MSC), VPA and the Department of Environment, Water, Land and Planning (DEWLP) to assess the possibilities for Hazelwynde and explore the vision and targets for the community. This includes key partnerships that will bring the necessary skills and experience to ensure future success.

YVW has formalised these relationships in the following ways:

1. A draft ***Memorandum of Understanding*** (MOU) between MSC and YVW to deliver best practice greenfield development. The MOU includes opportunities to:
    - Create a vision, masterplan, targets and a cohesive, sustainable and thriving community for the Hazelwynde Land Development Project;
    - Review planning policy and objectives to facilitate best practice placed based and community outcomes;
    - Explore opportunities for early delivery and funding of health, community, economic and transport infrastructure;
    - Explore enhanced public space maintenance and waste management opportunities for the development;
    - Be considered leaders in the design, development and implementation of exemplar land development projects in the greenfield setting; and
    - Explore opportunities for enhanced and streamlined development service delivery (approvals, information transfer etc.).

2. Participation in the ***Beveridge North West Partnerships Working Group*** hosted by MSC and including representation from several local health, education and community services organisations; and

3. Participation in the ***Resilient Melbourne*** project for the Beveridge North West area to achieve the Plan Melbourne 2017-2050 objective of fostering “inclusive, vibrant and healthy communities’ through participatory development”.

2.0 HAZELWYNDE VISION

2.1 Vision

YVW is currently exploring options for this land to be used to deliver a unique greenfield development opportunity that aims to deliver significant economic, social and environmental outcomes for the State. YVW is working closely with key stakeholders to pursue a course of action that will create a suburb that looks to set new standards for master planned communities.

YVW is undertaking further research to explore the potential for the following outcomes to be achieved:

- Delivery of a showcase of sustainable development which creates more water and energy than it uses;
- A water focused development which delivers quality and affordable utility services to its customers and delivers the aspirations of Water for Victoria;
- A development that showcases the application of the principles set out in Plan Melbourne;
- A locally and regionally connected community who enjoy access to sustainable transport options;
- A vibrant and diverse community of approximately 20,000 people with a diverse mix of local jobs and easy access to education and health services;
- A beautiful and fully master planned community which provides a range of affordable living options;
- Cashflow which reduces pressure on water prices and improves affordability; and
- A national and global demonstration of what is possible in sustainable urban development.

2.2 Strategic Objectives and Project Targets

YVW has established key strategic objectives which outline the key aspirations that Hazelwynde will build upon now and into the future. These are:

1. Bringing our purpose to life;
2. Maximising community and social value;
3. A connection to water;
4. Respecting the environment;
5. Supporting Indigenous values;
6. Reducing affordability pressure; and
7. Collaborating with others.

Further information on the above Strategic Objectives and Draft Project Targets can be found in Appendix A and Appendix B.

3.0 BEVERIDGE NORTH WEST EXHIBITED PSP

YVW has been working with the VPA and MSC on the preparation of the BNWPSP, along with other landowners and key stakeholders.

YVW wishes to thank VPA for their approach to engaging the stakeholders during the development of the PSP. The valuable insights gained working with all stakeholders (not just landowners) is apparent in the exhibited PSP.

YVW is supportive of the overall intent of the exhibited PSP. YVW believe that the direction this PSP is heading will ensure that the future community delivered within the Beveridge North West PSP will become the new standard in greenfield developments.

The elements within the PSP document that YVW wish to discuss further with the VPA to refine the PSP, are summarised within this document. These comments and considerations come from YVW as the landowner and from consultants representing YVW as the landowner.

These items have been categorised in the following way:

- 3.1 General PSP Comments
- 3.2 Vision
- 3.3 Future Urban Structure Plan
- 3.4 Density and Housing Typologies
- 3.5 Town Centres
- 3.6 Open Space
- 3.7 Traffic and Transport
- 3.8 Drainage and Water
- 3.9 Engineering and Servicing
- 3.10 Infrastructure Contributions Plan
- 3.11 Proposed Quarry

A full list of comments from YVW and its consultants on the exhibited documents can be found in Appendix C.

3.1 General PSP Comments

Table 1 below documents general errors, omissions, inconsistencies and queries about the exhibited PSP document from YVW and the consultant team.

Table 1 – General PSP Comments

Page	Item	Comments
1	Plan 1 – Regional Context	• Radial scale appears to be incorrect • Add Beveridge and Wallan train stations • Label Hume Freeway and Camerons Lane interchange
2	Introduction	While YVW is keen to continue to work closely with the VPA and MSC through the PSP process, we kindly request that YVW's name be removed from the sentence stating that the parties 'worked closely' together.

3	Plan 2 -Precinct Features	• Further information about the items on this plan and how they have been defined and what this means will be useful. For example:
		  ○ What is meant by a 'gateway entry point'?
		  ○ What do the different land categories relate to and how have they been defined (e.g. open plain, undulating terrain etc.)?
		  ○ Do these relate to any requirements or guidelines within the PSP?
		• YVW is concerned with the inclusion of the 'Proposed quarry WA1473' on this plan. Refer to section 3.11 of this submission for further information.

4	1.1 How to read this document	What is MSC's definition of 'general discretion'? How is the concept of 'generally in accordance with' defined within and applied to this document? Should the need and desire for flexibility within this PSP be documented somewhere?
8	2.3 Precinct Land Use Budget	Review calculations within table 1 as there appears to be some errors and omissions In addition, please refer to Appendix D for further work completed by Mesh Planning and Design on the dwelling and population figures for the Hazelwynde land holding. A realistic view of this landholding would be 6,500 lots and a population of 20,000 people (assuming 3.1 people per household).
10	3.1.1 Image, Character, Landscape and Heritage	G6 – What is an acceptable outcome in this instance? How is a 'sense of arrival' and 'entry' defined?
11	3.1.1 Image, Character, Landscape and Heritage	What is defined as a 'tree row'? This is not clear on Plan 8.

25	3.3.1 Open Space and Natural Systems	SR-01 states that the Northern Active Open Space is boarded by Southern Local Town Centre LTC-3 (south). This should be amended to Northern Local Town Centre. SR-03 should also be acknowledged as bounding the mixed-use precinct of the Southern Town Centre.
33	Plan 8 – Biodiversity	Clarify the categories within the legend of this plan. What do these categories mean and do they relate to any requirements or guidelines within the PSP?

RECOMMENDATIONS

- Review above comments and provide additional information or amendments where appropriate.

3.2 Vision

The vision for the PSP is defined on page 6 of the exhibited PSP document. While YVW supports the vision for the precinct, the vision does not acknowledge or reflect the uniqueness of this site and the opportunities and challenges which it presents such as:

- The significant amenity of the topography and hilltops and its effect on the landscape values within and beyond the boundaries of the PSP;
- The potential for blue/green spines and how this will improve amenity, walkability and assist in implementing the principles of a 20-minute city;
- Delivering better than 'business as usual' through early engagement and activation and grass roots stakeholder partnerships (such as the Beveridge North West Partnerships Group);
- The size of the YVW landholding and the opportunities that this presents, YVW's desire to 'participate' long term and the desire to do things differently; and
- The site being the 'gateway to the north' for Wallan and MSC.

RECOMMENDATIONS
• Review vision to reflect the uniqueness of the site, size, landholding and ambition of stakeholders

3.3 Future Urban Structure Plan

Plan 2 - Future Urban Structure Plan (FUSP) is located on page 5 of the exhibited PSP.

The exhibited FUSP is a significant improvement over earlier versions of the FUSP and positively incorporates key elements of the illustrative masterplan previously prepared by Mesh Planning and Design (Mesh), including:

- A large wetland/water treatment site on the north side of Camerons Lane;
- A town centre immediately adjoining the large wetland;
- A network of distributed but connected lower order town centres;
- Rationalisaition of the boundary of the landscape values land; and
- An offset grid of roads that have generally been aligned to respond to the topography of the site (with some exceptions).

While YVW is generally supportive of the intent of the FUSP, there are several elements on the FUSP which YVW would like to discuss in more detail with the VPA. These include:

- Housing density requirements and guidelines;
- Sloping land;
- Landscape values land;
- North-South Arterial Road and Internal Connector Road alignments;
- Open Space; and
- Town Centre land uses

Mesh, as part of their review of the exhibited document provides an alternative FUSP for consideration which addresses the above items. Refer figure 2 below.

Mesh's full submission to the exhibited PSP documents, including background information on the Alternative Future Urban Structure Plan, can be found in Appendix D.

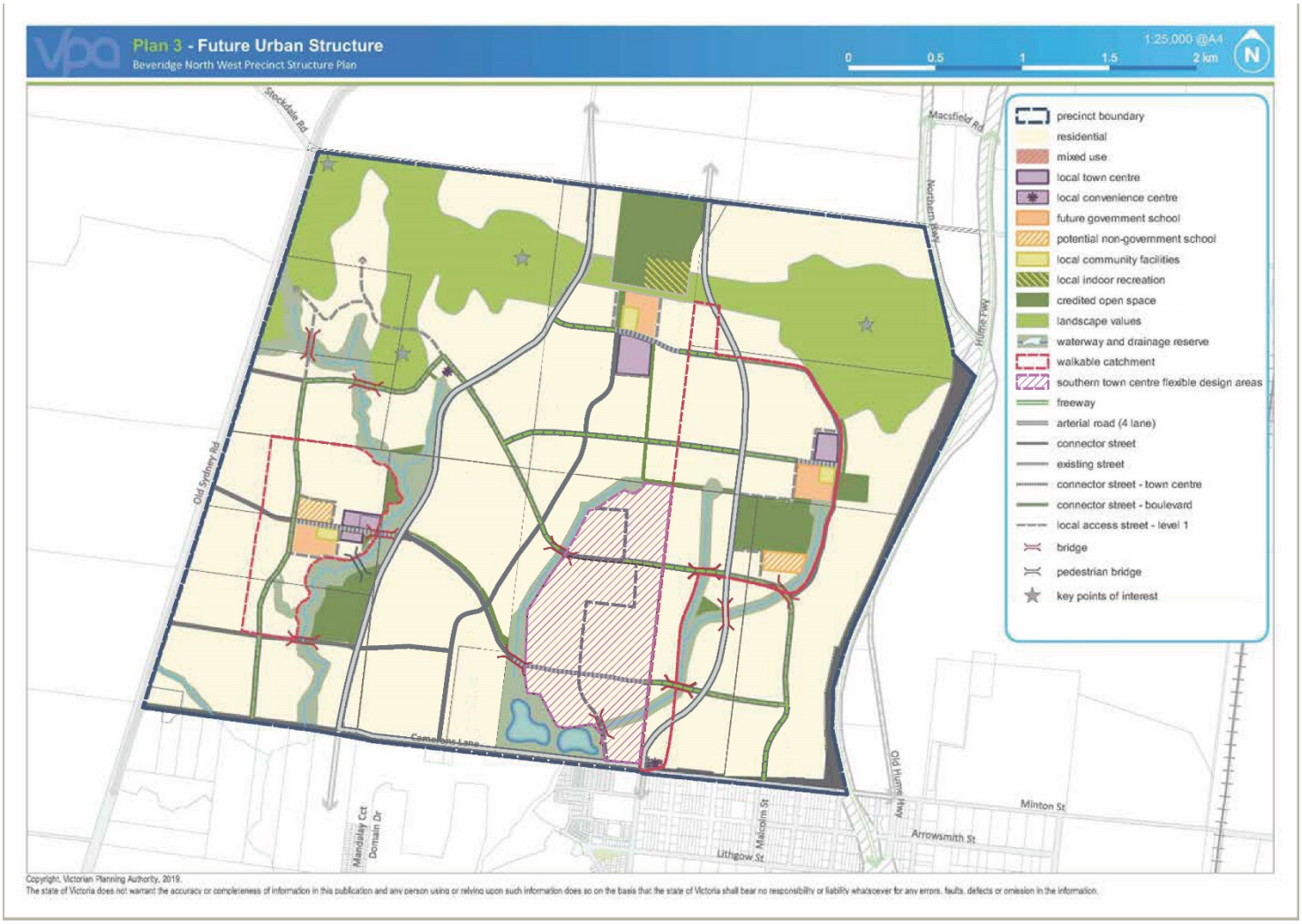

Figure 2 – Alternative Future Urban Structure Plan

RECOMMENDATIONS

- Further discussion with the VPA and MSC regarding the FUSP and recommended changes.

3.4 Density and Housing Typologies

Density and housing typologies are dealt with *Section 3.1. Image, Character, Heritage and Housing* on pages 10 to 16 of the exhibited PSP.

The key objectives which relate to density and housing typologies in section 2.2 (page 6) of the PSP are the following:

Objective 1	*Provide a framework for a high amenity and integrated urban environment that encourages a sense of place and community, as well as responds to the existing natural, cultural and built features.*
Objective 2	*Facilitate housing affordability and choice at densities that supports local services, access to jobs and sustainable transport options.*

3.4.1 Density and walkable catchment

R3 (page 11) states:

> *Subdivision of residential land within the walkable catchment and mixed-use areas as shown on Plan 3 must achieve an overall average minimum density of 30 dwellings per net developable area.*

Further, Table 4 Housing Density Guide identifies that the 'Residential within walkable catchment (applied RGZ) area' is approximately 238.42ha. The table also confirms that the density in this area is 30 dwellings per hectare.

YVW is concerned with this requirement as:

- This will yield approximately 7,000 dwellings and a population of 22,000 people in this area of the PSP. The area in which this requirement applies, 'walkable catchment', does not seem to respond to the amenity of the precinct and it is unclear how this 'walkable catchment' has been defined;
- It is contradictory to objectives 1 and 2 above as it is a prescriptive outcome rather than responding to the site features and amenity of the site and does not encourage diverse housing typologies;
- This will result in an average lot size of 233m2 across 238ha to achieve this density requirement; and
- Market forces will make this product difficult to sell which will stifle development within this PSP.

Considering that the land is in single ownership and will be subject to a MOU with MSC, it is requested that the target density requirement be revised down to 20 dwellings per hectare and the walkable catchment boundary to be either:

- Removed; or
- Amend R3 and G15 to clarify that densities to achieve the overall yield target can be redistributed on the YVW land.

Further information on Density and Walkable Catchment can be found in Appendix D.

3.4.2 Sensitive Interface Areas

R4 (page 11) states:

> *Development along the Sensitive Interface Areas identified in Plan 5 must respond to and achieve the outcomes identified in Table 2.*

YVW recognises the uniqueness of the site and the need to respond appropriately to the natural values of the landholding and interface to non-growth areas. However, the sensitive interface requirements are prescriptive in nature. In particular, the following requirements relating to the interface to Old Sydney Road should be revised:

- Single building on the lot
- Minimum 10m setback from Old Sydney Road reserve
- Minimum 3m side boundary setbacks
- Building height should not exceed 1 storey above ground

The topography in this location naturally falls away from Old Sydney Road and slopes downwards. As such, built form will naturally step down the slope away from Old Sydney Road. There should be no height restrictions or side setback requirements. In addition, the landscape values and views in this location towards the east and south lend themselves to quality built form outcomes. The above requirements restrict the built form product that can be delivered along this interface and should be removed.

Further information on Sensitive Interface Areas can be found in Appendix D.

3.4.3 Topography

R5 (page 12) states:

> *Subdivision and development applications for land on slope greater than 10% must respond to and address the dwelling construction methods as indicated by Figures 1, 2, 3 and Table 5. Alternative responses utilizing suspended floors instead of split levels will also be considered.*

Page 16 of the exhibited PSP also includes figures 1-3 and table 5 which are referenced in R5 above.

Upon reviewing the table and diagrams, YVW is unsure what the requirement is for developing housing on slope and how to implement R5 above. In addition, YVW is unsure how to interpret Plan 6 – Slope and Landform. YVW suggests removing these requirements.

3.4.4 Other comments

Table 2 below documents general errors, omissions, inconsistencies and queries from YVW and the consultant team for *Section 3.1 Image, Character, Heritage and Housing*.

Table 2 – 3.1 Image, Character, Heritage and Housing comments

Page	Item	Comments
11	G16 and G17	Up to 10% of NDA as affordable housing lots: ○ 10% of NDA is 81ha. If the PSP density average is 20 dwellings per hectare, this equates to 1,620 affordable housing dwellings. Is this the intent of the guideline? ○ Furthermore, G17 states that affordable housing should be located within the walkable catchment. The average density is 30 dwellings per hectare and therefore equates to 2,430 dwellings. Is this the intent of the guideline? YVW recommends reducing the measure of the guideline. Affordable housing should be encouraged across the PSP area and not just within the walkable catchment. In addition, YVW would like to understand how this affordable housing target relates to the work being prepared by MSC and Echelon Planning. YVW recommends confirming this guideline once this research work has been completed.
14	Table 4 – Housing Density Guide	• YVW would like further information on the underlying intent of the mixed-use precinct. • YVW would expect some interface densities of 17 dwellings/ha appropriate in the mixed-use precinct. • YVW would also like further information on the intent of mixed-use development in this precinct. For example, YVW would like to confirm that there is not an assumption that 'mixed use' is ground floor commercial/office and upper floor residential. The mixed-use precinct should allow for higher residential densities as well as uses which support the Southern Local Town Centre to establish (such as health, education, community and commercial uses). • What if densities greater than 9.5 dwellings/ha can be demonstrated in the future in Sensitive Interface Area A and C? • YVW requests some consistency between the legend on Plan 5 – Image, Character and Housing and Table 4. Currently the terminology between Plan 5 and Table 4 does not align and therefore it is difficult to interpret.
14	Table 3 – Housing by Lot Type	Add a tick for 'detached houses' in the '<300' lot size category

RECOMMENDATIONS

- Remove walkable catchment boundary and revise walkable catchment requirements and guidelines
- Set overall density targets for the PSP and allow amenity to drive density
- Remove restrictive requirements for Old Sydney Road interface
- Remove slope requirements
- Review comments in Table 2 and provide additional information or amendments where appropriate.

3.5 Town Centres

Town Centres are referenced in *3.2 Town Centres and Employment* on page 17 of the exhibited PSP document. The two local town centres which are within the YVW land holding are the Southern Local Town Centre 1 and the Northern Local Town Centre 3.

YVW is generally supportive of the intent of the town centres within the PSP. YVW is supportive of the flexibility afforded to the Southern Local Town Centre through the exclusion of the Local Town Centre Concept Plan and the inclusion of Performance Requirements and Guidelines.

However, there are a number of elements relating to town centres which YVW would like to discuss in more detail with the VPA:

3.5.1 Southern Local Town Centre

YVW has been working with the VPA, MSC and a range of stakeholders on the possibilities for the Southern Local Town Centre. This town centre is in a unique position to provide a range of uses and activities over time as:

- The land is owned by YVW;
- The land is located on Camerons Lane and has access to a north-south arterial road;
- The site has significant amenity with the adjacent wetlands, blue/green spines and views to the landscape values land; and
- Several stakeholders relating to community, education and health have begun to show interest in having a presence in this town centre.

A report prepared by SGS Economics and Planning in 2019 on behalf of YVW identified the above opportunities and identified that Hazelwynde is in a unique position to attract knowledge-based industries such as health, education and creative industries to the project through the following ways:

- Early provision of skill incubators such as the Western BACE at Melton City Council;
- Partnerships with TAFE and VET;
- Partnerships with Northern Health and Nexus Health;
- Implementing the principles of a 20-minute neighbourhood; and
- Continue to build partnerships in the region.

As a result of the above, YVW has set a target of 5,000 jobs within the precinct by 2050. YVW has therefore taken this into consideration when reviewing the exhibited PSP documentation and provides the following comments on the Southern Local Town Centre:

- The prescriptiveness of the local town centre 'shapes' – such as the location of schools, open space, town centre and mixed-use shapes. To reflect the above PSP objectives, employment targets and the intent of creating a town centre which is locally responsive, we request more flexibility in the PSP document, specifically the FUSP, to the location of these items. The location of these items should be determined through the master planning phase and in conjunction with stakeholders and their needs. Refer Figure 3 below.

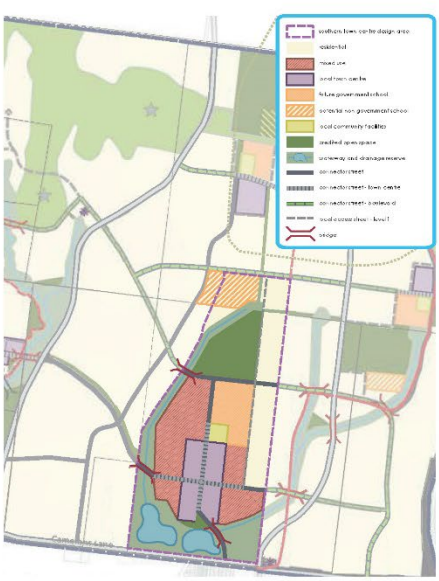

Figure 26- Activity Centre Diagram Option 1 (Source: Mesh)

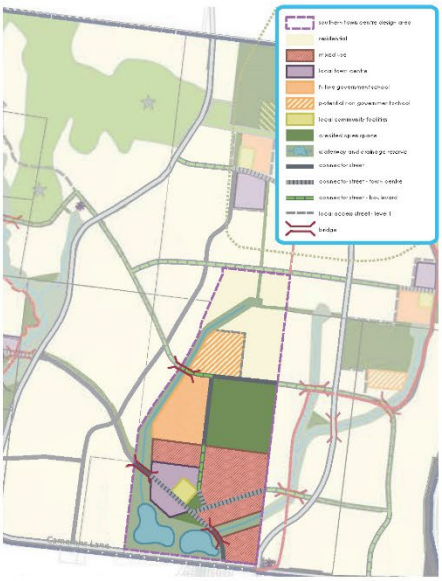

Figure 27 -Activity Centre Diagram Option 2 (Source: Mesh)

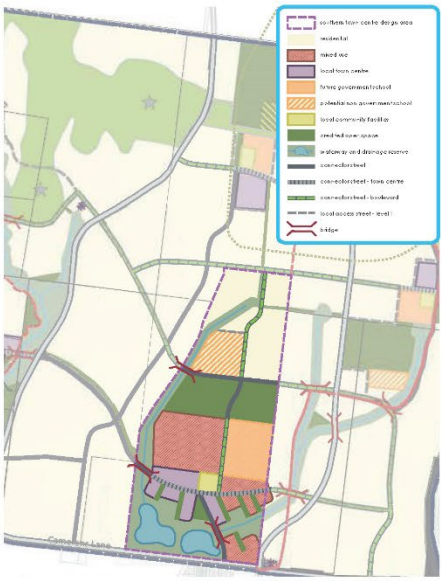

Figure 28 - Activity Centre Diagram Option 3 (Source: Mesh)

Figure 3 – Southern Local Town Centre Design Options

- Clarification of what happens next with Southern Local Town Centre. YVW supports that the next step should be to create a Development Plan (or similar) in partnership with MSC and relevant stakeholders to determine the form and function of the town centre. This would reflect the aspirations of YVW and the relevant stakeholders to deliver on the above objectives while maintaining flexibility;

- The retail floorspace requirement of 6,300 sq. m for both the Southern and Northern Local Town Centres. Priority should be given to the Southern Local Town Centre. In addition, as per the Ethos Urban Beveridge North West Precinct Structure Plan Economic Assessment regarding the retail floorspace of the Southern Local Town Centre:

Increasing this to say, 7,000m2 of retail floorspace to allow for additional specialty or mini-major retailing would not undermine the hierarchy of centres in the surrounding regional and would provide additional flexibility to the Southern Local Town Centre. (2019, page 34).

- The commercial floorspace requirement of 2,700 sq. m for both the southern and northern location town centres. Priority should be given to the Southern Local Town Centre.

- *Table 9 – Southern Town Centre – Performance Requirements and Guidelines* provides specific area requirements for the Local Town Centre such as:
    - Must provide an area of 7 net developable hectares for the provision of the LTC
    - Must provide a minimum mixed-use area of 27.98 net developable hectares
    - Must provide a minimum area of 11.8ha for provision of open space

  YVW wishes to understand where these area figures have originated from and how to encourage flexibility without being overly prescriptive.

Therefore, YVW recommends the following with regards to the Southern Local Town Centre:

- Delete the specific land use 'shapes' and areas relating to the Southern Local Town Centre from the FUSP;
- Include a requirement to prepare a Development Plan (or similar) for the Southern Local Town Centre;
- Retain Table 9 but include an acknowledgement that reduced land areas may be delivered with the agreement of the relevant parties;
- Amend the retail floorspace to 7,000m2; and
- Ensure that preference is given to the Southern Local Town Centre as the larger of the town centres within the PSP and the priority for retail and commercial growth.

3.5.2 Northern Local Town Centre

YVW provides the following comments on *Figure 5 - Northern Local Town Centre Concept Plan* (page 21):

- The plaza space seems quite large in comparison to the shapes identifying specialty retail and anchor retail. In addition, this space is located adjacent to a north-south green spine. YVW recommends reducing the size of the plaza and allowing the plaza to 'borrow' area from the green spine;
- Due to the size and the nature of this town centre, the specialty retail should be concentrated in the area of activity which is the plaza and community facility. Recommend deleting the southern 'specialty retail' shape; and
- Recommend re-labelling 'office/commercial' to 'future possible office/commercial'. YVW will encourage office and commercial land uses to firstly be located in the Southern Town Centre to add to the diversity and mix of the town centre; and
- Include a note on the Northern Town Centre Concept Plan to the effect that the concept plan is indicative only and that alternative design responses may be submitted with the consent of MSC.

3.5.3 Landscape Values Land

YVW also wishes to explore the opportunities of the landscape values land and the opportunities it provides for a regional destination due to its views and topography. YVW sees an opportunity to develop a hilltop destination which could include (but is not limited to) the following items:

- Café and/or restaurant
- Function space
- Shop (such as related to outdoor recreation activities in the area)

As such, YVW encourages VPA and MSC to consider this as part of the town centre planning and ensure that the above opportunities are considered in land use and schedule designation for the precinct.

This could be investigated as part of a DELWP feasibility study for the Wallan Regional Park that is proposed to incorporate the landscape values land.

RECOMMENDATIONS

- Increase the flexibility afforded to the Southern Local Town Centre to address the PSP objectives, YVW's employment targets and aspirations of stakeholders.
- Refer to a Development Plan (or similar) for the Southern Local Town Centre as the next step to provide certainty to the design and layout of the town centre.
- Amend the retail floorspace offering to 7,000 sq. m for the Southern Local Town Centre.
- Review comments relating to the Northern Local Town Centre and amend where appropriate.
- Consider the opportunities offered by the landscape values land and ensure that these opportunities are not precluded or prohibited through land use or schedule designation.

3.6 Open Space

Open Space is referenced on pages 23 – 33 of the exhibited PSP.

YVW and its consultants provide the following comments/queries relating to open space within the PSP:

- Given the YVW landholding is of such a significant size, we recommend including:
    - A set of principles within the PSP relating to the design, location and size of open space within the landholding; and
    - A land use budget response to the total amount of open space which should be provided.

  This will allow flexibility within the PSP and allow MSC and YVW to continue working in partnership to determine the best urban structure, size, shape and distribution of open space at master planning phase whilst achieving the total amount of open space required.

- YVW is supportive of *Plan 7 – Open Space and Community Facilities* and the treatment of credited open space as having 'location flexibility'. In order to achieve the PSP objectives, as well as achieving quality open spaces which address the principles of a 20-minute city, a greater degree of flexibility is encouraged as per the note above.

- YVW is aware that the landscape values land in the PSP is part of a DELWP feasibility study for the Wallan Regional Park. How will this affect the ultimate ownership and management of this land? What will be permitted to occur in the landscape values land? The PSP should consider the opportunity for outdoor recreational opportunities such as hiking trails, mountain bike trails and associated retail and commercial opportunities (refer section 3.5.3 above).

- The infrastructure schedule for SR-01 references 100% funding from the BNWPSP. YVW's understanding is that part of the demand for this regional open space is from the Lockerbie North PSP which is required to fund 25% of a 30-hectare regional open space within the BNWPSP. This is referenced in the Lockerbie North DCP document.

- Active open spaces within the PSP appear to overprovide for oval areas when compared to standard provisions within PSP. SR-03 appears to include 3 ovals rather than the growth area standard of 2 ovals. This will result in increased land area and increased construction costs. As per previous comments, YVW would prefer a land budget response in order to achieve best practice outcomes in a flexible way.

- G34 on page 26 refers to:

  > *Public recreation and open space areas should be located adjacent to significant landscape value areas and waterways to create and or enhance any buffer area.*

YVW recommends the deletion of this guideline. Given amenity drives density, public recreation and open space areas should be framed with housing as much as possible to provide a sense of place, amenity to diversify housing stock and to provide passive surveillance opportunities. Public recreation and open space areas should be linked by direct and safe pedestrian and cycle footpaths to ensure legibility and connectiveness in the precinct.

- YVW recommends removing the Sports Field Concept Plans from the PSP document (refer figures 7-10) to allow flexibility in the design of the facilities but to also allow for changing community needs over time (such as the use of the spaces for outdoor recreation uses not linked to traditional active recreation formats).

- Figure 11 – Linear Park Interface Concept Plan (page 31) should be removed to allow for greater flexibility in the ways these spaces are designed and implemented.

- Where linear parks adjoin Boulevard Connector Roads, consideration should be given to how the road cross section and linear open space will work together. For example, given the Boulevard Connector Cross Section includes off road bike paths, verges and pedestrian footpaths, the linear parks should be able to 'borrow' from the road cross section these features and reduce the area required for the linear open space or utilise this area for other landscape features.

Mesh Planning and Design's full submission to the exhibited PSP documents can be found in Appendix D of this document. GHD's full submission to the exhibited PSP documents can be found in Appendix E of this document.

RECOMMENDATIONS

- Consider allowing further flexibility within the PSP by providing a set of principles and a total land use area required for open space.
- Consider removing the open space concept plans for the PSP to provide a greater level of flexibility.
- Consider the relationship between Boulevard Connector cross sections and linear parks and how the linear parks can be efficiently delivered by 'borrowing' items from the cross sections (such as footpaths and cycle paths).

3.7 Traffic and Transport

Traffic and Transport is referenced in section *3.5 Transport and Movement* on pages 36 to 39 of the exhibited PSP.

Transport and Traffic Solutions (T&TS) acts on behalf of YVW for the BWNPSP and has provided their comments on both the GTA Strategic Transport Modelling Assessment and exhibited PSP. Their submission can be found in Appendix F and a summary of their comments can be found below.

3.7.1 GTA Strategic Transport Modelling Assessment

- There are several inconsistencies between the GTA report and the exhibited FUSP. The GTA model should be updated to reflect the exhibited FUSP.
- There are several clarifications required relating to the assumptions in the GTA report and the underlying assumptions of the PSP (such as number of dwellings and total population).
- Refer Table 3 below for a comparison of the land use summary (dwellings, jobs and enrolments) between the 2014 GTA report, 2018 GTA report and the exhibited 2019 (Refer to Appendix F for more information.)

Table 3: Land Use Summary Comparison

Land Use	2014 GTA Report	2018 GTA Report	PSP 2019
Dwellings	9,421	14,000	16,286
Jobs	1,267	1,750	3,019
Enrolments	3,302	4,700	5,500 (estimated)

3.7.2 Exhibited PSP Comments

With regards to the exhibited PSP, YVW and their consultant team provide the following comments for consideration with regards to traffic and transport:

- As per T&TS comments above, the population and density assumptions used in the GTA traffic modelling seems to be significantly higher than what the PSP will be able to achieve. As such, YVW is concerned with the flow on effects to the following:
    - Assumptions around traffic movements and the subsequent effect on the arterial road network (one arterial road required, not two); and
    - The number, location and capacity assumptions relating to community and open space provisions within the PSP.

- Section 2.1 - Vision (page 6)
    - The vision states that the precinct will have:

      …an efficient connection to the Hume Freeway via the future construction of the Camerons Lane interchange and will be supported by a series of local arterial roads that can accommodate high frequency public transport.

        - We note that there is no mention of public transport within the PSP apart from identifying roads as bus capable roads. Confirmation is required as to what the vision statement refers to (i.e. is the intention to make Patterson Road a high frequency public transport route as per the GTA statement in their transport modelling report?)

- Section 2.3 - Precinct Land Use Budget (page 8)
    - *Plan 4 – Land Use Budget* and *Table 1: Precinct Land Use Budget* identifies the total area within the PSP required for transport infrastructure.
    - Confirmation is required as to how these areas have been calculated to ensure that an adequate allowance has been made.

- *Plan 9 – Public Transport and Path Networks* (page 35) includes a notation stating, 'potential east west connector over Hume Freeway'. YVW wishes to understand more about this notation and the funding, design, location and status of this connection.

- R11 on page 36 states:

  Any Road nominated in Plan 9 as a potential public transport route must be constructed (including partial construction where relevant) in accordance with the corresponding cross section in the PSP and the Public Transport Guidelines for Land Use Development to the satisfaction of the responsible authority.

  YVW requests that this requirement be revisited to allow flexibility in the planning and design of the public transport network with MSC and PTV. In addition, the requirement should be amended so that if roads shown on Plan 9 are no longer determined to be potential public transport routes, the design and cross sections can be amended and downgraded.

- *Plan 10 – Street Network* (page 37)
    - According to T&TS, there are a number of structural road network concerns which need to be addressed including:
        - Spacing of arterial roads – the FUSP currently has the arterial roads spaced at 700m not 1.6km as per the PSP Guidelines;
        - Consideration to straightening the WNS Arterial Road to avoid multiple horizontal short curves proposed along its alignment;

- Traffic volumes requiring 2 arterial roads. As per previous comments, the population and modelling assumptions which inform the GTA modelling appears to be incorrect. This then suggests that only one arterial road is required in contrast to the two arterial roads shown on the exhibited FUSP;
- Moving connector streets away from drainage reserves;
- Permeability of the Southern Town Centre design;
- Role of Hume Fwy and Northern Hwy upgrades – these are critical to unlocking the development potential of the site and are not referenced within the PSP document; and
- A number of street network changes. Refer to Appendix F for further information

- *Table 11 – Streets and Slopes* (page 39). YVW would like some further information on how to interpret this table and how it relates to any requirements and guidelines in section *3.5 Transport and Movement*.

- Old Sydney Road does not appear to form part of the FUSP and/or *Plan 9 – Public Transport and Path Networks* however a cross section for Old Sydney Road is included in Appendix 4 (page 64). YVW understood that this road was to be included within the boundary of the PSP and form part of the ICP. Please clarify the role and status of this road.

- YVW is supportive of the positive recognition of streetscape diversity and its benefits. However YVW notes that there are still standard streetscape outcomes referenced within the PSP. YVW and its consultants recommend that the PSP be amended to:

    - Strengthen recognition of the relative importance and need for a diverse range of streets as a requirement but with flexibility to design the streets at detailed design; and
    - Include a notation on the typical cross sections that variations may be proposed subject to the agreement of by the Responsible Authority.

- It is recommended that interim and ultimate year concept plans of the arterial road and intersections projects be prepared prior to the finalisation of the PSP. This will provide certainty on the road and intersection layouts and help streamline the Responsible Authority's approval process during the planning and design phase of the project.

- Flexibility with regards to the cross sections contained within the PSP will assist in delivering the objectives and targets of the Hazelwynde landholding. In 2019, YVW commissioned Ratio Consultants to prepare an opportunities and challenges report relating to transport and traffic at Hazelwynde. Ratio in their report suggested looking at alternative cross sections within the PSP to promote walking and cycling more than the standard greenfield development outcome. These alternative cross sections can be found in Appendix G.

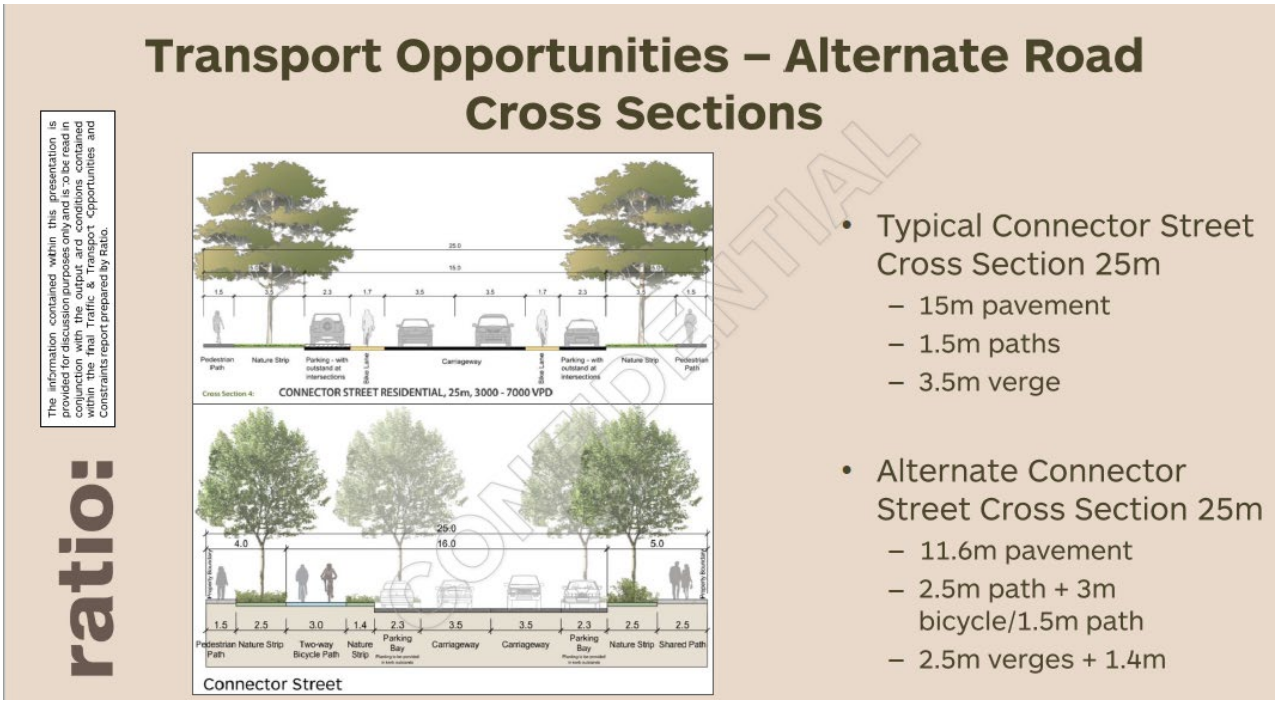

Figure 4: Alternative Road Cross Sections – Connector Street (Ratio Consultants, 2019).

3.7.3 Regional Infrastructure

The BNWPSP is located in a significant location, as depicted by *Plan 1 – Regional Context* (Page 1). As the Hazelwynde site is located in close proximity to Hume Freeway and Camerons Lane, the site is well positioned within the Northern Growth Corridor.

However, in order to unlock development at Hazelwynde and to achieve YVW's vision, objectives and targets, significant regional infrastructure investment is required within the corridor.

Ratio report also explored the opportunities and challenges relating to regional infrastructure delivery at Hazelwynde. Ratio's report identified the following:

- The need to unlock Camerons Lane interchange as a priority in order to facilitate development within the BNWPSP;
- The importance of Hume Freeway upgrades and Old Sydney Road upgrades to facilitate permeability throughout the site;
- The timing of Beveridge Rail Station;
- The need to provide quality jobs at Hazelwynde to reduce the daily traffic and public transport movements to and from the CBD; and
- Providing a high frequency, short distance public transport service when residents move in to connect the Southern Local Town Centre to Wallan Rail Station.

In the exhibited PSP, there is little to no mention of the above regional infrastructure. In addition, it is unclear if the ICP plays any role in the provision of funding for the above-mentioned items.

In addition, *Section 1 – Introduction* (page 2) states:

Generally, the PSP:

- *Outlines the projects required to ensure that future residents, visitors and workers within the area can be provided with timely access to services and transport necessary to support a quality and affordable lifestyle.*
- *Provides government agencies, the council, developers, investors and local communities with certainty about future development.*

Given the strategic importance of the regional infrastructure to meet the objectives of the PSP and to unlock the development of the PSP area, YVW recommends providing updates within the PSP around the importance, timing, costs and delivery of the above-mentioned regional infrastructure items.

RECOMMENDATIONS

- Consider comments made regarding the GTA Traffic Modelling report exhibited and the flow on affects to the PSP and FUSP.
- Consider the recommendations made to further refine the FUSP from a road network perspective.
- Consider a greater level of flexibility through the requirements and road cross sections relating to the Hazelwynde land holding.
- Consider including reference to the importance, timing, staging and funding of regional infrastructure for the precinct.

3.8 Drainage and Water

Drainage and water are addressed through *Section 3.6 Integrated Water Management* and *3.6.2 Utilities* on pages 40 to 41 of the exhibited PSP.

GHD acts on behalf of YVW for the BWNPSP and has provided their comments on both the exhibited PSP and background documents. Their submission can be found in Appendix E and a summary of their comments can be found below.

- As mentioned in Section 2.2 of this report, YVW has developed a series of objectives and targets relating to delivering the Hazelwynde project. YVW have targets which relate to urban heat island effect and enhancing the liveability of the project. These targets are:

  Hazelwynde will deliver waterways where the stormwater runoff is reduced by 50% above conventional subdivisions, which traditionally degrades those waterways

  Urban layout of Hazelwynde will be designed with green spaces, blue corridors and trees designed to both increase the community's connection with nature and to minimise the urban heat island effect delivering a subdivision that will be at least 2 degrees cooler than surrounding suburbs (such as Craigieburn)

  Hazelwynde will have a greater diversity of plant species and flora recorded compared to 2019.

  - Given YVW is placing a strong emphasis on reducing the urban heat and enhancing liveability, we recommend that the VPA provide greater certainty around how trees will be incorporated into the streetscape.

  - There are numerous clauses within the exhibited PSP that provide guidance around how trees could or should be integrated into the development including:

Page	Requirement/Guideline
26	Requirement 7
26	Guideline 29
34	Guideline 44
38	Guideline 55
41	Guideline 58

  - In order to ensure that trees within the streetscape becomes a priority in street design and service provision, we encourage that greater emphasis be placed on the importance of trees within the streetscape and therefore the requirements relating to tree canopies.

- We seek more clarity from the VPA on their requirements for the future maintenance of the unnamed natural wetland on the northern boundary of the PSP. This may have implications for the potential Taylors Creek diversion arrangements.

- We seek more clarity from the VPA on whether there is flexibility in how encumbered and unencumbered land can be utilised in the future. This will have implications for how YVW achieve its water vision, particularly the application of distributed WSUD/IWM approaches.

- There needs to be consistency between MSC Engineering Standards for WSUD and Street and Park Tree Policy to ensure to maintain healthy moist soils and tree cover.

In addition, YVW is currently working with GHD on regional and local initiatives relating to the following water targets:

> *Self-sufficient potable water supply system, removing the extra demand on Melbourne's reticulated water network that comes with traditional development.*

This involves a specific report on the opportunities and challenges of stormwater to potable strategies at Hazelwynde. GHD are working with YVW on this strategy and expect to have further information on this strategy to present to VPA and MSC by end 2019.

As such, YVW also requests that a requirement be added to *Section 3.6.1 Integrated Water Management* which reads:

> *Prior to the first permit being issued for the Hazelwynde land holding, a review of the Kalkallo Creek Development Services Scheme is required with MW, MSC and YVW to determine if any updates or changes are required in order to achieve the targets of the Hazelwynde project.*

RECOMMENDATIONS

- Review GHD's comments and recommendations and amend PSP where necessary.
- YVW will present findings of GHD further research on stormwater to potable opportunities and challenges by end 2019.
- Consider adding a requirement to review the DSS prior to the first permit being issued for the Hazelwynde land holding.

3.9 Engineering and Servicing

Engineering and Servicing is covered by *3.6.2 Utilities* and *3.6.3 Subdivisional Works* on pages 42 to 47 of the PSP.

Verve Projects Pty Ltd acts on behalf of YVW for the BWNPSP and has provided an Engineering Services Report based on the exhibited PSP. Their submission can be found in Appendix H.

In addition, YVW provides the following comments in relation to the exhibited PSP and background documents:

Beveridge North West PSP Background Report – August 2019

Page 28 of the Background Report states the following:

> *SP Ausnet has advised that the initial development within the precinct would be limited to approximately 500 lots. The precinct will be supplied from the New Kalkallo Zone Substation. The precinct would require at least 2-4 No. 22kV feeders and would be financed by the developers, less a contribution from SP Ausnet.*

YVW requests further information on the above including the status of the New Kalkallo Zone substation, the distance between Hazelwynde and the New Kalkallo Zone substation and the indicative cost of these infrastructure works.

Exhibited PSP Comments

YVW and its consultants provide the following queries and comments in relation to the exhibited PSP:

3.6.2 Utilities (page 42)

- Plan 12 – Utilities
    - This plan shows water, recycled water and sewer services which are not integrated with the FUSP. This could affect the liveability of the development through locations of easements and pipe tracks. YVW requests updating Plan 12 to reflect the FUSP.
- R20
    - This requirement should allow for flexibility as to where the additional open space should be located. If YVW needs to provide additional open space due to the location of above ground utilities, particularly in order to achieve the objectives and targets outlined in Appendix A and B of this document, YVW requests that the exact location, dimensions and configuration of this open space to be determined with the Responsible Authority at the master planning stage.

- G61
    - This guideline should be rewritten. Sewers are designated to run along waterway corridors. Due to the topography of the land, locating sewers outside of waterway corridors would increase the depth and cost of sewers.

3.7.2 Subdivisional Works (page 47):

- R22:
    - This requirement should include WSUD and best practice approaches to stormwater management.
    - The stated 'local drainage system' may not specifically support WSUD, IWM and support R7.
    - Can the reference to supply of gas infrastructure be removed? YVW is currently exploring a vision which does not encourage gas services.
- R23:
    - Remove the need for 'gas connection points' from this requirement.
    - Can reference be made within this requirement that alternatives may be considered and/or requirements can be altered, amended or modified where the landowner and responsible authority (MSC) agree?

RECOMMENDATIONS
• Review suggested amendments above and make necessary changes

3.10 Infrastructure Contributions Plan (ICP)

Page 2 of the exhibited PSP states the following:

> *The following planning documents have been developed in parallel with the PSP to inform and direct the future planning and development of the project*
>
> - *Beveridge North West Infrastructure Contributions Plan (ICP) requires development proponents to make a contribution toward infrastructure required to support the development of a Precinct.*

YVW's understanding is that the ICP will not be publicly exhibited as the ICP does not include any supplementary levy items. We request that the ICP document be made available for review and comment for the following reasons:

- YVW is concerned that a supplementary levy may be required:
  - There are several major road projects in this PSP including 2 arterial roads, 3 bridges and 9 intersections;
  - 3 sports reserves which appear larger than the standard provision open spaces as part of the growth area standards;
  - Fragile soil typologies and significant slope which may result in needing non-standard designs. Refer to Appendix E for further information.
- The existing working relationship with MSC where both organisations are committed to delivering better than best practice community facilities in a timely manner;
- YVW is aware of recent issues with standard costs in ICP. In YVW's opinion, the more experienced people looking at the costs, the more robust and accurate the costings will be;
- The lack of commentary within the PSP regarding the funding, staging, timing and role of regional infrastructure projects including:
  - Camerons Lane interchange;
  - Beveridge Train Station;
  - Old Sydney Road; and
  - Hume Freeway upgrades
- How Works In Kind Projects will work; and
- The part funding of projects in *Table 4.1 Precinct Infrastructure Plan* and where the remaining funding will be sourced from.

In addition, due to the scale of the YVW landholdings there is the added advantage of being able to divide the ICP projects into two discrete lists – firstly infrastructure that can be funded and delivered on the YVW land (up to or equal with the ICP liability) and secondly infrastructure that can be funded and delivered on the remaining privately owned land.

RECOMMENDATIONS

- Provide a copy of the ICP for BNWPSP for comment.
- Amend the PSP to recognise the opportunity to divide projects between the YVW land and the remaining privately-owned land to simplify and de-risk implementation of the ICP.

3.11 Proposed Quarry

YVW supports good and robust planning outcomes within the Beveridge North West PSP area and acknowledges that the proposed quarry on the western side of Spring Hill Cone on part of the land known as 175 Northern Highway Wallan (**Proposed Quarry**) is not shown on the Future Urban Structure Plan. YVW acknowledges that this is in line with the letter sent to Mr. Chris Brace of YVW by the Hon. Richard Wynne MP on the 18th September 2018.

The letter states:

> *The Victorian Government has determined that the draft PSP will be exhibited without an extractive industry investigation area in the precinct plan, noting that the Mitchell Shire Council has not supported a planning permit application for a quarry in this location. Works Authority 1473 will be referred to in the documents, given its existing status.*

YVW continues to support Mitchell Shire Council's position that a quarry is an inappropriate land use in an area proposed for future residential development.

YVW is concerned that *Plan 2 – Precinct Features Plan* shows the outline of the proposed work authority boundary for the Proposed Quarry. The Precinct Features Plan is intended to document the *existing natural, cultural and built feature*s of the precinct such as high points, slope, drystone walls, view lines, existing trees, cultural heritage and waterbodies. At the current point in time, the Proposed Quarry is not an existing feature of the precinct.

Further, the Proposed Quarry does not currently hold a work authority or a planning permit. The Background Report prepared by VPA for the Beverage North West PSP dated August 2019 notes that the planning permit application for the Proposed Quarry was refused by Mitchell Shire Council and accordingly a work authority has not been obtained.

In addition, the inclusion of the Proposed Quarry on *Plan 2 – Precinct Features Plan* is inconsistent with, and does not have appropriate regard to principles relating to urban growth including:

1. Strategic Planning Context;
2. Community Impact; and
3. Impacts on the Hazelwynde landholding

These matters are addressed in turn below.

3.11.1 Strategic Planning Context

As stated on page 2 of the exhibited BNWPSP, the PSP is informed by a number of documents including:

- Plan Melbourne – Metropolitan Planning Strategy, May 2017
- The Growth Corridor Plans: Managing Melbourne's Growth – Growth Areas Authority, June 2012

Plan Melbourne – Metropolitan Planning Strategy, May 2017

Plan Melbourne has designated the Proposed Quarry site as 'urban' on Map 2 of the Melbourne 2050 Plan on page 16 (see extract below).

Direction 1.4 of Plan Melbourne states:

> *Support the productive use of land and resources in Melbourne's non-urban areas*

The Proposed Quarry site is currently zoned Rural Conservation Zone and is located directly adjacent to Urban Growth Zone land (both areas of land having been rezoned to their current zoning approximately 9 years ago). Based on the zoning history of the Proposed Quarry site and the land adjacent, the Proposed Quarry site is not considered to be located within a non-urban area of Melbourne.

Map 2

Melbourne 2050 Plan

- Central city
- National employment and innovation cluster (NEIC)
- Metropolitan activity centre
- State-significant industrial precinct
- State-significant road corridor
- Rail network
- Rail improvements Sunbury to Cranbourne / Pakenham (including Metro Tunnel)
- Western Distributor
- Transport gateway – major airport
- Transport gateway – airport
- Transport gateway – seaport
- Potential transport infrastructure project
  1. Outer Metropolitan Ring / E6 reservation
  2. North East Link (alignment subject to investigation)
  3. Airport Rail Link
  4. Avalon Rail Link
  5. Western Port highway upgrade / Rail Link to Hastings
- Interstate freight terminal (indicative)
- Transport gateway – possible airport (indicative)
- Transport gateway – possible seaport (indicative)
- Water's edge parklands
- Green wedge land
- Urban growth boundary
- Urban area
- Waterway
- Waterbody
- Metropolitan Melbourne region

Source: Department of Environment, Land, Water and Planning

0 20 N

NOTE: POTENTIAL INFRASTRUCTURE PROJECTS AND GATEWAYS ARE SUBJECT TO INFRASTRUCTURE VICTORIA ADVICE AND VICTORIAN GOVERNMENT APPROVAL. THIS FRAMEWORK WILL BE UPDATED AT THE END OF 2017, FOLLOWING THE GOVERNMENT RESPONSE TO INFRASTRUCTURE VICTORIA'S 30 YEAR PLAN.

16

Figure 5 – Map 2 Melbourne 2050 Plan (Plan Melbourne)

The Growth Corridor Plans: Managing Melbourne's Growth – Growth Areas Authority, June 2012

The Northern Growth Corridor Plan designates the area shown as Proposed Quarry on Plan 2 – Precinct Features Plan as 'landscape values' with 'residential' located to the east and south of the Proposed Quarry site.

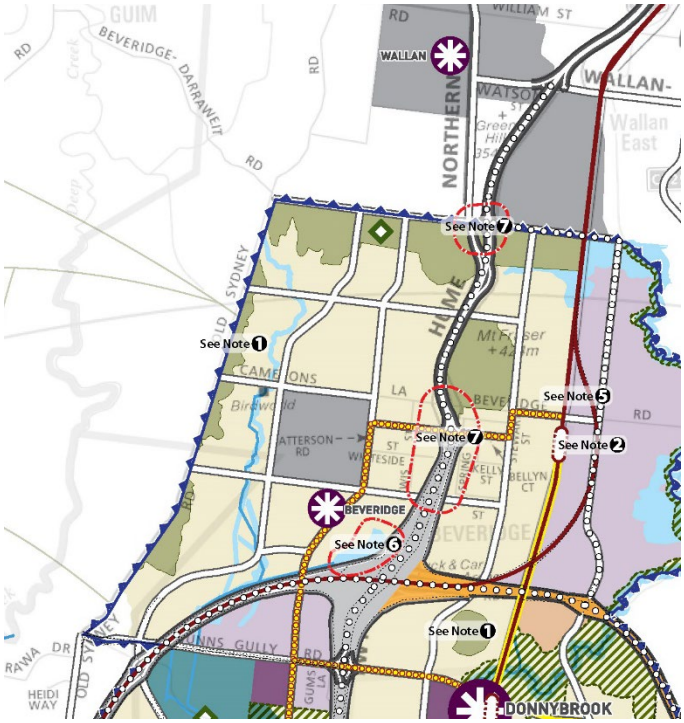

Figure 6 – Northern Growth Corridor Plan (2012)

Page 6 of the Growth Corridor Plan highlights:

> *The North Growth Corridor is characterised by a large valley floor space, flanked by the foothills of the Great Dividing Range, and incised by the Merri and Darebin creeks. The key landscape features that form part of the broader setting for urban development include:*
>
> - *Retention of key views to the hills that flank the Growth Corridor to the west, north and east;*
> - *Retention of distant views from the Growth Corridor to the Great Dividing Range to the north and north east.*
> - *Retention of an inter-urban break between the northern edge of the Growth Corridor and Wallan. The edge of urban development has been identified as just south of the saddle that commences at the intersection of Old Sydney Road and Beveridge Darraweit Road, and links south-east to Mt Fraser;*
> - *Retention of the red volcanic cones at Mt Frazer and Bald Hill, and the protection of vistas to these features from a range of vantage points across the Growth Corridor.*

In addition, the North Community Concept Plan on page 66, shows that the remaining land outside of the landscape values land is intended to form local residential neighbourhoods.

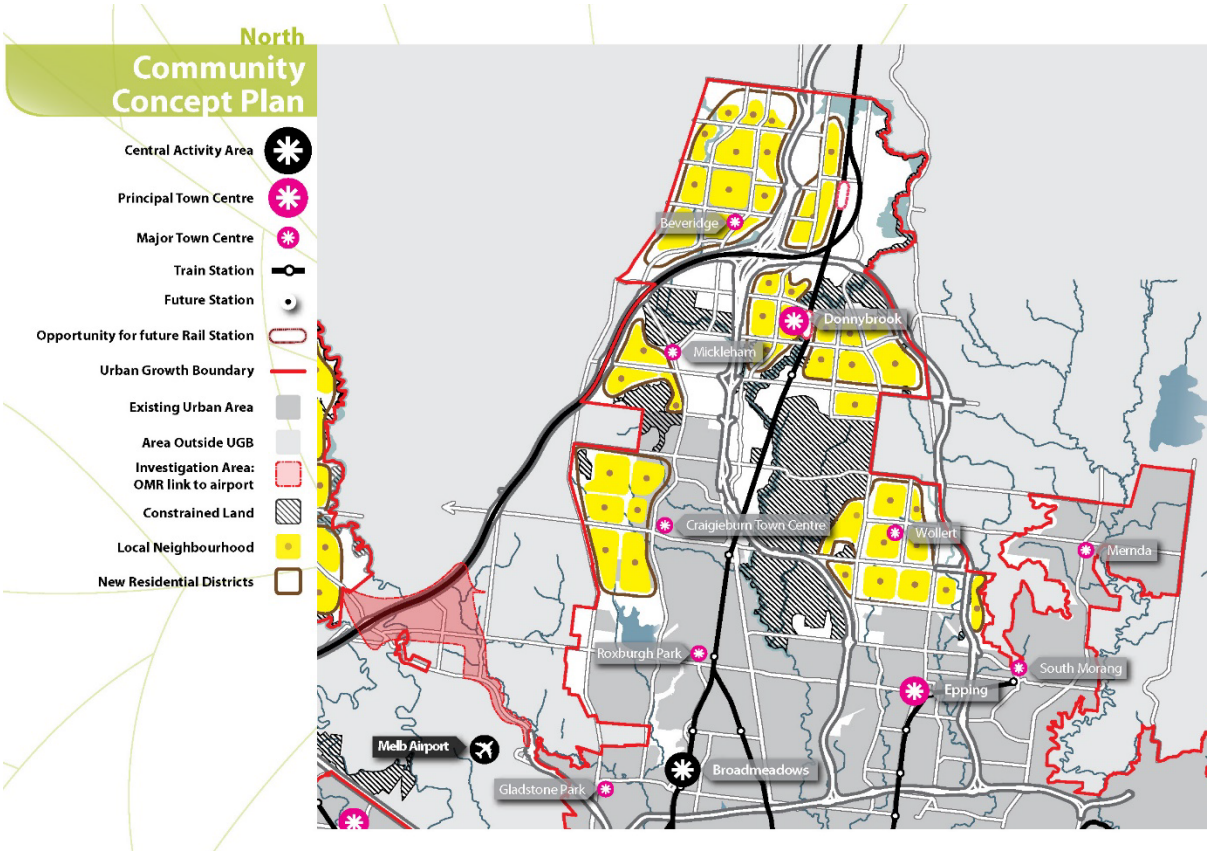

Figure 7 – North Community Concept Plan (2012)

The Proposed Quarry shown on Plan 2 - Precinct Features Plan is not identified within the Northern Growth Corridor Plan.

Therefore, YVW does not support the inclusion of the notation “Proposed Quarry WA1473” on the Precinct Features Plan. From a strategic planning context, the Proposed Quarry has not been previously identified in either the Plan Melbourne 2030 document or the Northern Growth Corridor Plan and as such, there is no strategic planning context for the Proposed Quarry in the location shown on *Plan 2 – Precinct Features Plan.*

YVW is aware that the site of the quarry is part of a DELWP feasibility study for the Wallan Regional Park. The proposed park would link the upper Merri Creek, through the foothills of the Great Dividing Range to Kalkallo Creek, creating a community asset of strategic significance for the region. YVW suggests that the suburban parks program section of DELWP be approached to comment on the potential impact of a quarry in this location.

3.11.2 Community Impact

In accordance with the submissions from the Beveridge North West Partnership not-for profit organisations, YVW supports the following view of the Beveridge North West Partnership Group, of which YVW is a member:

> *Beveridge North West PSP presents an opportunity to set a benchmark for successful greenfield development, a place where people are proud to live, work, learn and play. The success of Beveridge North West requires early delivery of infrastructure and services that supports health, improves resilience, future proofs liveability and livelihoods and provides employment opportunities from the time residents move in. We acknowledge the spectrum of elements considered in planning for quality urban environments. In responding to the Beveridge North West PSP, we wish to express our disappointment at the inclusion of works authority for the proposed quarry (Precinct Features map page 3).*
>
> *A proposed quarry in this location fundamentally alters the urban landscape; affecting liveability, viability of the nearby town centre, delivery of connected roads to Wallan South PSP and reducing the residential catchment that will support the planned open space and community infrastructure. It is a hostile land use that will quarantine land for decades that cannot be used for any other purpose other than protecting a quarry.*
>
> *As a part of the Beveridge North West Partnership, we are committed to setting a new standard for successful green-field development, ensuring the early and timely provision of services and infrastructure with the view to creating neighborhoods and communities that are healthy, connected and sustainable now and into the future*.

3.11.3 Impacts on Hazelwynde landholding

YVW is currently exploring options for the Hazelwynde project to deliver an industry leading greenfield development to deliver significant economic, social and environmental outcomes for the State in line with the Outcomes and Directions set out in Plan Melbourne. These include:

Table 4: Plan Melbourne Outcomes and Directions

Outcome	Directions
1. Melbourne is a productive city that attracts investment, supports innovation and creates jobs	1.2 Improve access to jobs across Melbourne and closer to where people live

2. Melbourne provides housing choice in locations close to jobs and services	2.1 Manage the supply of new housing in the right locations to meet population growth and create a sustainable city 2.2 Deliver more housing close to jobs and public transport 2.3 Increase the supply of social and affordable housing 2.5 Provide greater choice and diversity of housing
3. Melbourne has an integrated transport system that connects people to jobs and services and goods to the market	3.2 Improve transport in Melbourne's outer suburbs 3.3 Improve local travel options to support 20-minute neighbourhoods
4. Melbourne is a distinctive and liveable city with quality design and amenity	3.12 Create more great public spaces across Melbourne 4.3 Achieve and promote design excellence 4.6 Strengthen community participation in the planning of our city
5. Melbourne is a city of inclusive, vibrant and healthy neighbourhoods	5.1 Create a city of 20-minute neighbourhoods 5.2 Create neighbourhoods that support safe communities and healthy lifestyles 5.3 Deliver social infrastructure to support strong communities 5.4 Deliver local parks and green neighbourhoods in collaboration with communities
6. Melbourne is a sustainable and resilient city	6.1 Transition to a low-carbon city to enable Victoria to achieve its target of net zero greenhouse gas emissions by 2050 6.2 Reduce the likelihood and consequences of natural hazard events and adapt to climate change 6.3 Integrate urban development and water cycle management to support a resilient and liveable city

	6.4 Make Melbourne cooler and greener 6.5 Protect and restore natural habitats 6.6 Improve air quality and reduce the impact of excessive noise 6.7 Reduce waste and improve waste management and resource recovery

The inclusion of the Proposed Quarry on the Precinct Features Plan does not align to and in some instances is directly inconsistent with to the above-mentioned Plan Melbourne Outcomes and Directions.

YVW notes that the Beveridge North West Precinct has been identified as a priority PSP as part of the State Government's commitment to open new greenfield lots for development, with the aim of supporting the delivery of new homes and jobs in Melbourne's growth areas. The Hazelwynde landholding would also be affected by the development of a quarry in the north-west of the Beveridge North West PSP area in the following ways:

- Significantly affect the liveability of residential precincts in the northern section of the PSP;
- Reduce potential sales rates to due purchaser concern around purchasing in a precinct close to a quarry;
- The potential to establish a northern development front is compromised. Multiple development fronts are particularly important given the scale of the project;
- Affect the attractiveness of investing in the proposed Southern Local Town Centre and reduce the interest from industries that could be impacted by quarry operations to locate in the town centre;
- Affect the viability of the planned Northern Local Town Centre and the residential catchment which is required to service this centre due to the need for a 500m buffer;
- Delivery of connected roads to the Wallan South PSP to the north including the proposed bus capable roads to the north;
- The deliverability of the northern sporting reserve and community facility as the residential catchment that these facilities are planned to service will be reduced;
- Disadvantage future residents of the Beveridge North West PSP area by not being able to deliver regional open space facilities in a timely manner due to the quarantining of land; and
- The long-term impacts of quarantining land (500m buffers) due to an incompatible land use. If a 500m buffer is assumed as per the previous proposal (see Figure 9) a total area of 59.08ha of the YVW land is impacted. This is comprised of:
    - Credited Open Space – 17.19ha
    - Local indoor recreation – 4.92ha
    - Future Government School – 3.18ha

- Local Community Facility – 1.13ha
- Local Town Centre – 3.79ha
- Landscape Values – 2.37ha
- Residential land (30 dwellings/ha) – 26.5ha (including roads)

Figure 8: Quarry buffer impact on YVW landholding

- In addition to the quarry buffer impact on the YVW land, the buffer would also impact approximately 36.9ha of the area of the adjoining landholding to the south of the proposed quarry, approximately two thirds of which is developable.

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RECOMMENDATIONS

YVW requests that the notation indicating "Proposed Quarry WA1473" be removed from *Plan 2 Precinct Features Plan*.

YVW also submits that if any changes are made to the PSP document, in particular to the Future Urban Structure Plan, and the status of Proposed Quarry WA1473, that this should be treated as a fundamental change to the intent and outcomes of the PSP. If such a change occurs, it is YVW's view that the PSP must be re-exhibited so that landowners and affected parties can review the changes and provide further comments. YVW reserves its right to make additional submissions depending on the nature of the submissions made in relation to the Proposed Quarry by other submitters

4.0 CONCLUSION AND RECOMMENDATIONS

YVW wishes to thank the VPA for the opportunity to provide comments on the BNWPSP as part of the exhibition process.

YVW are generally supportive of the exhibited PSP and make the following comments and recommendations to the VPA in order to further refine the PSP so as to support YVW and stakeholders in their ambition to deliver a community of the future at Hazelwynde.

- Review vision to reflect the uniqueness of the site, size, landholding and ambition of stakeholders;
- Further discussion regarding the FUSP and recommended changes;
- Remove walkable catchment boundary and revise walkable catchment requirements and guidelines;
- Set overall density targets for the PSP and allow amenity to drive density;
- Remove restrictive requirements for Old Sydney Road interface;
- Remove slope requirements;
- Increase the flexibility afforded to the Southern Local Town Centre to address the PSP objectives, YVW's employment targets and aspirations of stakeholders;
- Refer to a Development Plan (or similar) for the Southern Local Town Centre as the next step to provide certainty to the design and layout of the town centre;
- Amend the retail floorspace offering to 7,000 sq. m for the Southern Local Town Centre;
- Review comments relating to the Northern Local Town Centre and amend where appropriate;
- Consider the opportunities offered by the landscape values land and ensure that these opportunities are not precluded or prohibited through land use or schedule designation;
- Consider allowing further flexibility within the PSP by providing a set of principles and a total land use area required for open space;
- Consider removing the open space concept plans for the PSP to provide a greater level of flexibility;
- Consider the relationship between Boulevard Connector cross sections and linear parks and how the linear parks can be efficiently delivered by 'borrowing' items from the cross sections (such as footpaths and cycle paths);
- Consider adding a requirement to review the DSS prior to the first permit being issued for the Hazelwynde land holding;
- Consider comments made regarding the GTA Traffic Modelling report exhibited and the flow on affects to the PSP and FUSP;
- Consider the recommendations made to further refine the FUSP from a road network perspective;
- Consider a greater level of flexibility through the requirements and road cross sections relating to the Hazelwynde land holding;
- Consider including reference to the importance, timing, staging and funding of regional infrastructure for the precinct
- Provide a copy of the ICP for BNWPSP for comment;

- Amend the PSP to recognise the opportunity to divide projects between the YVW land and the remaining privately-owned land to simplify and de-risk implementation of the ICP.
- The notation indicating "Proposed Quarry WA1473" be removed from *Plan 2 Precinct Features Plan*.
- If any changes are made to the PSP document, in particular to the Future Urban Structure Plan, and the status of Proposed Quarry WA1473, that this should be treated as a fundamental change to the intent and outcomes of the PSP. If such a change occurs, it is YVW's view that the PSP must be re-exhibited so that landowners and affected parties can review the changes and provide further comments. YVW reserves its right to make additional submissions depending on the nature of the submissions made in relation to the Proposed Quarry by other submitters
- Review Appendices C to H which contain the full list of recommended changes from YVW and its consultants. Provide additional information or amendments where appropriate.

YVW are committed to working with the VPA and MSC on the BNWPSP and as such, are available to meet and/or workshop the above recommendations at your convenience.

If you have any questions, please do not hesitate to contact Victoria Cook Project Manager – Hazelwynde at victoria.cook@yvw.com.au

Regards,

Chris Saliba

Hazelwynde Land Development Manager

APPENDIX A – HAZELWYNDE STRATEGIC DIRECTIONS

October 2019

1. **Bringing our purpose to life**
   Hazelwynde will be a showcase for YVW core values, including integrated water management - capturing water across the catchment and recycling it to homes, businesses and open spaces. This will improve climate resistance and facilitate more affordable bills, contributing to the health and wellbeing of current and future generations.

2. **Maximising community and social value**
   We will seek to maximise the community value in this strategic land asset by exploring its potential to deliver a landmark community of the future. The residents of Hazelwynde will have access to quality local services and facilities. They will have real opportunities to connect to their community, and they will have access to quality open spaces. We envisage this as a community that will be resilient, prosperous, walkable, safe and liveable.

3. **A connection to water**
   Hazelwynde will lead in its approach to water and water-sensitive urban design, showcasing best practice outcomes in a greenfield setting. Hazelwynde will be an exemplar development, focusing on:
   - Integrated energy and water services that harness nature and keep utility bills affordable
   - Fostering cool green open spaces and tree-lined boulevards
   - Reducing the 'heat island effect'
   - Restoring and protecting healthy waterways and wetlands.

4. **Respecting the environment**
   Hazelwynde will demonstrate how urban development can take place with sensitivity and respect for the natural environment. This will be achieved by understanding the local context and ecological values of the site and focusing on enhancing and regenerating significant sites to create quality landscape outcomes and habitats for local flora and fauna.

5. **Supporting Indigenous Values**
   Early and ongoing involvement on past, present and future communities will be fundamental to the development of cultural, economic and generationally diverse neighbourhoods that are socially connected at Hazelwynde. This will include exploring cultural opportunities with local indigenous communities.

6. **Reducing affordability pressure**
   Hazelwynde has the potential to create an affordable community in the following ways:
   - It will be a one stop shop for water, waste and energy, creating more affordable bills and potentially creating a dividend payment to the community;

- It will provide local jobs, enabling reduced travel time and creating a local and prosperous community; and
- There will be a diverse range of transport options, allowing the community to be better connected.
- The community will have access to local services and facilities that are locally responsive.
- There will be the potential for alternative development options, which are currently being explored, aiming to reduce the impact on the initial householder's property mortgage.

7. Collaborating with others

We have begun working with leading sustainable development experts, along with stakeholders such as the VPA, MSC, Resilient Melbourne and Melbourne Water as we explore how we can bring to life transformational initiatives.

As we progress our thinking, we are referencing leading examples of urban development from across the globe. This includes exploring partnerships with other projects such as innovation aspirations.

APPENDIX B – HAZELWYNDE DRAFT TARGETS

October 2019

Objectives	Targets
1. Bringing YVW purpose to life	A one stop shop for water, waste and energy creating more affordable bills and potentially creating a dividend payment to the community
2. Maximising community and social value	Hazelwynde will assist the Beveridge North West PSP area achieve the following by 2050: • Immediate access to health and education services from day 1 of a resident moving in • All educational facilities are also considered community destinations after hours and on weekends • Residents will be able to age in place • Residents and visitors will consider the community a destination and a beautiful environment • Residents will have a better quality of life • Everyone feels welcome and a connection to place • A diverse range of housing typologies are delivered to create a diverse population.
3. A Connection to Water	By 2050, Hazelwynde will have a: • Water supply system that is a net water producer, removing the extra demand on Melbourne's reticulated water network that comes with traditional development • Sewer network with no infiltration • Waterway where the stormwater runoff is reduced by 50% above conventional subdivisions, which traditionally degrades those waterways • Urban layout designed with green spaces, blue corridors and trees designed to both increase the community's connection with nature and to minimise the urban heat island effect delivering a subdivision that will be at least 2 degrees cooler than surrounding suburbs (such as Craigieburn)
4. Respecting the Environment	By 205, Hazelwynde will: • Have a renewable energy system that is a net positive energy producer • Achieve zero net greenhouse gas emissions • Not use any grid supplied natural gas • Have returned a species within the regional ecosystem • Have a greater diversity of plant species and flora recorded compared to 2019

	• Divert 100% of household food waste and garden waste from landfill (assuming MSC will have implemented food waste collection service and/or FOGO waste to landfill will have been banned by 2050)
5. Supporting Indigenous Values	• The cultural history of the site is reflected through the narrative of Hazelwynde • Some native vegetation and native animals have returned to the region • Hazelwynde is considered a leader in how to incorporate ecological and indigenous values in an urban environment

6. Reducing Affordability Pressure	**Employment and Jobs**
	By 2050, Hazelwynde will:
	• Be home to at least 5,000 jobs
	  ○ Around 50-70% of people can work in local, flexible spaces locally in the first 5 years of moving to Hazelwynde
	  ○ Around 50-100% of local jobs are created in new commercial spaces in the first 5 years
	• At least 1 job per household within 20 minutes of travel time of Hazelwynde
	• A % of food is locally sourced (this target needs to be refined)
	
	Transport
	By 2050
	• 80% of daily trips are made by sustainable transport modes
	• 90% of all school related trips are made by sustainable transport modes
	• All residential addresses are within 400m walking distance of quality open spaces
	• No more than one car per household
	• A local and frequent public transport service connects the Hazelwynde town centre with the Wallan town centre and rail station
	• Dedicated bicycle paths and shared paths are within 200m of every dwelling
	• Provision of a public transport service from day 1 of residents moving in
	• Double the average Hume City Council mode share for public transport, walking and sustainable transport models
	
	Alternative Housing Options
	By 2050:
	• Hazelwynde has at least 10% affordable housing to make sure its key workers can live in, and be part of the neighbourhood
	• The cost of water and energy services to residents is significantly reduced in comparison to surrounding greenfield areas

	• The cost of living at Hazelwynde will be 20% cheaper that the Growth Area average
7. Collaborating with others	No specific targets nominated. The achievement of the other targets is only possible if we collaborate well with others.

APPENDIX C – YVW AND CONSULTANT COMMENTS SUMMARY

APPENDIX D – MESH PLANNING AND URBAN DESIGN COMMENTS

APPENDIX E – GHD WATER AND DRAINAGE COMMENTS

APPENDIX F – T&TS TRAFFIC AND TRANSPORT COMMENTS

APPENDIX G – RATIO ALTERNATIVE CROSS SECTIONS

APPENDIX H- VERVE ENGINEERING AND SERVICING REPORT

Yarra Valley Water

Beveridge North West PSP

10th October 2019

PAGE	SECTION	PARA	REF	Item	Query	Action Required / Suggested	Source
BNWPSP Exhibited							
Section 1 - Introduction							
1			Plan 1	Regional Context	Scale of radial distances is incorrect; show Beveridge and Wallan train stations; label Hume Fwy and Camerons Lane Interchange	Update plan	VC
2	1	6		Introduction	Beveridge North West Infrastructure Contributions Plan (ICP) has been developed in parallel with the PSP	YVW requests a copy of ICP to review	VC
2	1	7		Introduction	While YVW is keen to continue to work closely with the VPA and MSC through the PSP process, we kindly request that reference to YVW be removed from the sentence regarding 'worked closely'	Remove reference to YVW	VC
3			Plan 2	Precinct Features	Further information about the items on this plan and how they have been defined and what this means will be useful - what is meant by a 'gateway entry point'; what do the different land categories relate to and how have they been defined?	Please provide further information within PSP	VC
3			Plan 2	Precinct Features	Do not support the inclusion of the 'Proposed quarry WA1473' on this plan.	Remove from plan	VC
4	1.1	8		How to Read this Document	What is MSC definition of 'general discretion'. How is 'generally in accordance with' used and defined in the PSP?	Please provide further information in PSP	VC
5				Plan 3 - Future Urban Structure	Alignment of the eastern north-south arterial road. This alignment is 'too' direct and will sever the eastern side of the Southern Local Town Centre catchment. It is also likely to raise implementation concerns.	Update FUSP	Mesh
5				Plan 3 - Future Urban Structure	Lack of a secondary access point onto Camerons Lane to the west of the Southern Local Town Centre – higher order edge road aligned through privately owned land is problematic for 2 reasons - out of YVW control and a quieter edge road is preferred to maximise the amenity of the drainage line	Update FUSP	Mesh
5				Plan 3 - Future Urban Structure	How is the 'walkable' catchment defined? 30 dw/ha equates to 233m2 average lot sizes is restrictive and a poor amenity outcome; Should be located in high amenity locations to be determined such as blue/green spines, waterways and close to town centres	Update FUSP	VC/Mesh
5				Plan 3 - Future Urban Structure	Key points of difference on FUSP – what does this mean?	Remove from FUSP or provide further information	VC
5				Plan 3 - Future Urban Structure	Flexibility of Southern Town Centre Design and surrounding land uses. The prescriptiveness of the town centre shapes and their arrangement should be determined at a later date and therefore deleted from this plan. Clarification of what happens next with the Southern Local Town Centre. Support not requiring a UDF process but Development Plan might be required	Refine and update FUSP	VC and MESH
5				Plan 3 - Future Urban Structure	Realign the western arterial road in order to consolidate the walkable catchment of the Southern Local Town Centre and consolidate the value of the 'green spine' without the need for it to be crossed by an arterial road	Refine and update FUSP	Mesh and T&TS
5				Plan 3 - Future Urban Structure	Consider the opportunity to downgrade the northern part of the western arterial road and/or the eastern arterial road to connector streets as per T&TS advice	Refine and update FUSP	Mesh
Section 2 - Outcomes							
6	2.1			Vision	While YVW supports the vision for the precinct, the vision doesn't' seem to acknowledge or recognise the uniqueness of this site and the opportunities which it presents	Review vision statement	VC
6	2.1			Vision	We note that there is no mention of public transport within the PSP apart from identifying roads as bus capable roads.	Confirmation is required as to what the vision statement refers to (i.e. is the intention to make Patterson Road a high frequency public transport route as per the GTA statement in their transport modelling report?)	T&TS
8	2.3		Table 1	Precinct Land Use Budget	Community and Education figures do not add up (variation of 5ha), no regional open space figures. Review calculations within Table 1 as there appears to be some errors and omissions	Please review and update	VC
8	2.3		Table 1	Precinct Land Use Budget	Please refer to Appendix D for further work completed by Mesh Planning and Design on the dwelling and population figures for the Hazelwynde land holding. A realistic view of this landholding would be 6,500 lots and a population of 20,000 people	Review assumptions around population and density	VC and Mesh
8	2.3		Table 1	Precinct Land Use Budget	Plan 4 – Land Use Budget and Table 1: Precinct Land Use Budget identifies the total area within the PSP required for transport infrastructure	Confirmation is required as to how these areas have been calculated to ensure that an adequate allowance has been made.	T&TS
Section 3 - Implementation							
10	3.1.1		G6	Image, Character, Heritage and Housing	What is an acceptable outcome in this instance? How is a 'sense of arrival' and 'entry' defined?	Clarify what is meant by this guideline	VC
11	3.1.1		G13	Image, Character, Heritage and Housing	What is defined as a 'tree row'. This is not clear on Plan 8	Clarify what is meant by this guideline	VC
11	3.1.1		X	Image, Character, Heritage and Housing	Add a new requirement/guideline: "The elevated land in the north western part of the YVW land has been identified as containing landscape values that are worthy of retention. This land will either be transferred into public ownership and maintained in perpetuity as publicly accessible open space or the land may be developed for a combination of public and private purposes."	Consider including requirement/guideline	Mesh
11	3.11		X	Image, Character, Heritage and Housing	Following from the above: "If the land is developed for a combination of public and private purposes the land must contain: 1) one or more publicly accessible open spaces located at key vantage points; 2) a connected walking and cycle train system; 3) a site for commercial activities that is located at an accessible key vantage point; 4) a maximum number of 5-8ha rural living sized lots; and 5) nominated building envelopes	As above, consider including requirement/guideline	Mesh
11	3.1.2		R3	Housing	What defines the walkable catchment boundary? 30dw/ha as a blanket rule is too high. This is a very prescriptive requirement	Remove walkable catchment from FUSP. Revise to 20 dw/ha in line with other PSPS. Allow density to follow amenity	VC
11	3.1.2		R4	Housing	Very prescriptive requirements for Old Sydney Road interface.	Remove from PSP	VC
11	3.1.2		G16 and G17	Affordable Housing	Guideline yields up to 2,430 affordable housing dwellings. Is this the intent? How will these be managed and/or delivered? How does this relate to the affordable housing work MSC is currently undertaking? YVW recommends reducing the measure of the guideline. Affordable housing should be encouraged across the PSP area and not just within the walkable catchment. In addition, YVW would like to understand how this affordable housing target relates to the work being prepared by MSC and Echelon Planning. YVW recommends confirming this guideline once this research work has been completed.	Recommend reducing target and encouraging affordable housing throughout the PSP, not just within the walkable catchment	VC
12	3.1.3		R5	Topography	Further explanation of what is meant by slope plan and diagram and how these are applied to the PSP. Recommend removing from PSP to avoid confusion and/or prescriptive outcomes	Remove from PSP	VC and Mesh
13			Table 2	Sensitive Interface Area Outcomes	Unsure of quite specific requirements as Old Sydney Road/Urban Growth interface - Single building on the lot; Minimum 10m setback from Old Sydney Road reserve; Minimum 3m side boundary setbacks; Building height should not exceed 1 storey above ground	Remove restrictions to Old Sydney Road interface	VC
14			Table 3	Housing Type by Lot Size	Add detached housing to lots <300, Add 'tick'	Amend table	VC
14			Table 4	Housing Density Guide	Need to understand the underlying intent of the mixed use precinct - what is allowed? What is the density/height restrictions? What are the land uses permissable? Ensure that there is not an underlying assumption that mixed use is ground floor commercial with upper floor residential. The mixed use precinct should allow for uses which support the Southern LTC (such as health, education, community and commercial uses)	Provide further information and amend where necessary	VC
14			Table 4	Housing Density Guide	Can interface densities and housing typologies be used? What if densities greater than 9.5 dw/ha can be demonstrated in Sensitive Interface Area A and C? Need some consistency between legend on Plan 5 and Table 4 references. A note on Plan 5 linking table 4 would be useful	Provide further information and amend where necessary	VC
14			Table 4	Housing Density Guide	Include positive recognition that successful delivery of increased development densities will require a range of open spaces to be provided and that the preference is to deliver a network of linked open spaces of varying sizes, shapes and functions	Add note to PSP	Mesh
14			Table 4	Housing Density Guide	YVW requests some consistency between the legend on Plan 5 - Image, Character and Housing and Table 4. Currently the terminology between Plan 5 and Table 4 does not align and therefore it is difficult to interpret	Refine and amend where necessary	VC
15			Plan 6	Slope and Landform	Further explanation of what is meant by slope plan and diagram and how these are applied to the PSP. Recommend removing from PSP to avoid confusion and/or prescriptive outcomes	Remove from PSP	VC
16	3.1.3		Figures 1-3 and table 5	Slope diagrams and table	Unsure how these requirements are applied to land holding and PSP. How do you interpret and implement? Difference between design slope and natural slope needs to be recognised	Remove from PSP	VC
19	3.2.1		Table 9	Southern Town Centre	Include a requirement to prepare a Development Plan (or similar) for Southern Town Centre	Add requirement	VC
19	3.2.1		Table 9	Southern Town Centre	Retail floorspace to be 7,000 sq m for Southern LTC. Preference should be given to this town centre for future growth and hierarchy in the network of LTCs in the PSP	Amend document and add note	VC
19	3.2.1		Table 9	Southern Town Centre	Table 3 is quite specific around areas of sq m and area for land uses within the town centre. Does this need to be this specific? Why is there a requirement for an additional 1.15ha of local park? If table can not be deleted, include a specific acknowledgement that reduced land areas may be delivered with the agreement of the responsible authority	Include an acknowledgement that reduced land areas may be delivered with agreement of relevant parties	VC
21	3.5.2		Figure 5	Northern Town Centre	Plaza space seems quite large in comparison to the rest of the town centre; concentrate retail in area of the plaza and community facility; recommend re-labelling 'office/commercial' to 'future possible office/commercial' so that uses are directed to Southern Town Centre in the first instance	Amend Concept Plan	VC
21	3.5.2		Figure 5	Northern Town Centre	Include a note on the Northern Local Town Centre Concept Plan to the effect that the concept plans are indicative only and that alternative design responses may be submitted with the consent of MSC.	Add note to Concept Plans	Mesh
21	3.5.2		X	Landscape Values	Consideration should be given to uses permitted in landscape values land such as café/restaurant, function spaces, shop etc.	Consideration and amendments/inclusions where necessary	VC
23			Plan 7	Open Space and Community Facilities	What will be permitted to occur in the landscape values land. Refer above mentioned point as well as consideration for outdoor recreation activities. What will be the ultimate ownership of the landscape values land? Who will maintain and how will it be funded?	Consideration and amendments/inclusions where necessary	VC
24	3.3.1		Table 10	Credited Open Space Delivery Guide	Given YVW landholding is of a significant size we recommend including a set of principles within the PSP relating to design, location and size of open space within the landholding; and a land use budget response to the total amount of open space required. This would allow greater flexibility within the PSP	Consideration of principles and total amount of open space required rather than detailed response in PSP	VC
24	3.3.1		Table 10	Credited Open Space Delivery Guide	Delete this table and replace with a table which specifies only the **total area** of each of the types of creditable open space that must be provided	Amend table	Mesh
24	3.3.1		Table 10	Credited Open Space Delivery Guide	Active Open Spaces within the PSP seem to overprovide for oval areas when compared to standard provisions within the PSP. In particular SR-03 includes 3 ovals instead of the standard provision of 2 ovals	Please provide further information	VC and Mesh
25	3.3.1		Table 10	Credited Open Space Delivery Guide	SR-01 states that Northern Active Open Space is boarded by Southern Local Town Centre LTC-3. This should be amended to the Northern Local Town Centre. SR-03 should also be acknowledged as bounding the mixed use precinct surrounding the Southern Local Town Centre	Amend and update	VC and CS
26	3.3.1		R7	Open Space and Community Facilities	In order to ensure that trees within the streetscape becomes a priority in street design and service provision, we encourage that greater emphasis be placed on the importance of trees within the streetscape and therefore the requirements relating to tree canopies. This also applies to guidelines 29, 44, 55 and 58	Review and update where appropriate	GHD
26	3.31		R7	Open Space, Community Facilities and Education	MSC engineering standards for WSUD needs to be aligned with their Street Tree and Park Tree policy to ensure this requirement can be achieved	Please provide further information	GHD

PAGE	SECTION	PARA	REF	Item	Query	Action Required / Suggested	Source
26	3.3.1		G34	Open Space, Community Facilities and Education	Recommend deletion of this guideline. Amenity should drive density and therefore open spaces should be framed by dwellings as much as possible to diversify product, achieve density and provide passive surveillance	Delete guideline	VC
26	3.3.1		GX	Open Space, Community Facilities and Education	Include recognition that additional open space may be provided if supported by the MSC	Add guideline	Mesh
27-30	3.3.1		Figures 7 - 10	Concept Plans	Recommend removing Sports Field Concept Plans from the PSP document to allow greater flexibility. If these can not be removed, consider including a note on each of the active open spaces concept plans that states, "layouts are indicative only and may be changed with the agreement of MSC"	Delete concept plans or include note	VC and Mesh
31	3.3.1		Figure 11	Linear Park Interface Concept Plan	Recommend removing this concept plan to allow for greater flexibility with the ways these spaces are designed and implemented	Delete concept plans	VC
33	3.4.1		Plan 8	Biodiversity	Clarify these categories within the legend of this plan. What do these categories mean and do they relate to any requirements or guidelines within the PSP?	Clarify and provide further information	VC
35	3.5		Plan 9	Public Transport and Path Network	YVW wishes to understand more about the note 'potential east-west connector over Hume Freeway - funding, design, likelihood status of this connection	Clarify and provide further information	VC
36	3.5		R11	Public Transport	Requirement should be revisited to allow flexibility in the planning and design of the public transport network. If the roads shown on Plan 9 are determined to not be required for PT, they revert back to a standard cross section	Review and amend	VC
37	3.5		Plan 10	Street Network	GTA modelling seems higher that reality of the PSP with respect to number of dwellings and population projections. What affect does this have on road network and subsequent community and active open space catchments?	Clarify and provide further information within PSP	VC and T&TS
37	3.5		Plan 10	Street Network	Two proposed north-south aligned secondary arterial roads located along northern boundary of the site are located within 700m of each other. Typically 1.6km grid layout. In addition, Patterson Road south of Hadfield Road can be downgraded to a connector street standard	Review road network and hierarchy of roads	T&TS
37	3.5		Plan 10	Street Network	Consideration of further street network changes as per Figure 1: Proposed Street Network Modifications within the T&TS memo	Review road network	T&TS
37	3.5		Plan 10	Street Network	Concern with lack of permeability to Southern Town Centre on FUSP	Review road network	T&TS
37	3.5		Plan 10	Street Network	What is the role of Hume Fwy and Northern Hwy upgrades? These are critical to unlocking the development potential of the site and are not referred to within the PSP document	Provide further information	VC and T&TS
37	3.5		Plan 10	Street Network	Consideration should be given to straightening WNS Arterial Road to avoid proposed multiple horizontal short curves as superelevation may be required through some signalised intersections	Review road network	T&TS
37	3.5		Plan 10	Street Network	Old Sydney Road does not appear to form part of the FUSP or Plan 10 Street Network. YVW understood that this road was to be included within the boundary of the PSP an also included within the ICP. In addition, a cross section is shown in Appendix 4.5 for Old Sydney Road on page 64	Provide further information on status and funding of Old Sydney Road	VC
39	3.5.3		Table 11	Streets and Slopes	YVW would like some further information on how to interpret and implement this table	Provide further information or delete from PSP	VC
39	3.5.3			Street Network	Lack of information or commentary on regional infrastructure items such as Camerons Lane interchange, Hume Freeway upgrades, Beveridge rail station	Provide further information and reference importance, timing, staging etc in PSP	VC
39	3.5.3			Street Network	Strengthen recognition of the relative importance of and need for delivery of a diverse range of streets as a requirement but with flexibility to design the streets at detailed design. Refer to Ratio alternative cross sections in Appendix G	Add to PSP document	Mesh
39	3.5.3			Street Network	Recognise the relative importance of diverse streets in off setting increased densities	Add to PSP document	Mesh
39	3.5.3			Street Network	Recognise the specific need for diverse, more urban streets within the town centre and immediate surrounds	Add to PSP document	Mesh
40	3.6		Plan 11	Integrated Water Management	Separate the connector streets from the 'green spines'	Amend Plan and FUSP	GHD
41	3.6.1			Integrated Water Management	We seek more clarity from VPA on their requirements for the future maintenance of the unnamed natural wetland on the northern boundary of the PSP. This may have implications for the potential Taylors Creek diversion arrangements.	Please provide further information	GHD
41	3.6.1		Rx	Integrated Water Management	Include a requirement seeking a review of the MW DSS prior to permit to address YVW research and thinking into stormwater to potable objectives and initiatives	Add requirement	VC
41	3.6.1		Gx	Integrated Water Management	Greater flexibility of the use of encumbered and unencumbered open space to include blue/green spines and a connection to water	Review and consider this approach	GHD
41	3.6.1		G57	Integrated Water Management	Needs to be consistency between MSC Engineering Standards for WSUD and Street and Park Tree Policy	Review and provide update	GHD
42	3.6.2		Plan 12	Utilities	This plan shows water, recycled water and sewer services which are not integrated with the FUSP. This could affect the liveability of the development through locations of easements and pipe tracks. YVW recommends reviewing the servicing plan in light of FUSP.	Review and ament	CS
43	3.6.2		G61	Utilities	This guideline should be rewritten. Sewers are designated to run along waterway corridors, due to the topography of the land locating sewers outside of waterway corridors would increase the depth and cost of sewers.	Review and amend	CS
46	3.7.1		Rx	Development Staging	Recognise the opportunity to divide projects between the YVW land holding and the remaining privately owned land to simplify and de-risk implementation of the ICP	Add to PSP document	Mesh
47	3.7.2		R22	Subdivision Works	This requirement should also include WSUD and best practice approaches; the specified 'local drainage system' may not specifically support WSUD; Remove reference to gas infrastructure	Review and amend	GHD
47	3.7.2		R23	Subdivision Works	Include wording which references that alternatives are appropriate and/or requirements can be altered, amended or modified where the landowner and Responsible Authority agree	Review and amend	VC
49	4.1		Appendix	Precinct Infrastructure Plan	Request that the ICP document be made available for review	Make available for review and comment	VC
50	4.1		Appendix	Precinct Infrastructure Plan	IN-07 - why does this intersection need to be constructed to its ultimate layout?	Review and provide update	T&TS
49-50	4.1		Appendix	Precinct Infrastructure Plan	Apportionment varies from 50% to 75% for upgrade of road projects RD-01 and intersection projects IN-01, IN-03, IN-08 and IN09. Clarification of apportionment is required	Review and provide update	T&TS
52	4.1		Appendix	Precinct Infrastructure Plan	SR-01 states 100% funding from BNWPSP. It is our understanding that this regional open space has part funding from the Lockerbie North DCP	Review and provide update	Mesh
64-68	4.1		Appendix	Street Cross Sections	Include a notation on all plans stating that variations may be proposed subject to the agreement by the Responsible Authority	Add to Street Cross Sections	Mesh
64	4.5		Appendix	Old Sydney Road	Old Sydney Road is not included in Precinct Boundary. Who is responsible for this road upgrade including the 4.0m Unsealed Trail? No allowance has been made for parking on the carriageway.	Review and provide update	T&TS
66	4.5		Appendix	Connector Street (28m-31m) Boulevard	Where linear parks adjoin Boulevard Connector Roads, consideration should be given to how the road cross section and linear open space will work together and not 'double up'	Provide further information	VC
67	4.5		Appendix	Arterial Road	Clarification as to why 2m of shared path is located within the arterial road reserve under VicRoads management and 1m of the shared path is located within the service road road reserve under Council management?	Provide further information	T&TS
X	4.5		Appendix	Road and Intersection Concept Plans	Recommended that interim and ultimate year concept plans of arterial roads and intersections are prepared prior to finalisation of PSP	Review and provide update	T&TS
Background Reports							
PSP Background Report							
28	13.4	3		Electricity Supply	YVW requests further information on the above including the status of the New Kalkallo Zone substation, the distance between Hazelwynde and the New Kalkallo Zone substation and the indicative cost of these infrastructure works.	Review and provide update	SP
GTA Strategic Transport Modelling Assessment 10th December 2018							
4	2.2.5			Proposed Internal Road Network Layout	Figure 2.2 and 2.3-2.6 shows a key local access street through the Hilltop Reserve and a staggered T-intersection south of Hadfield Street. This is different to the FUSP	VITM model should be updated to match the FUSP	T&TS
4	2.25			Proposed Internal Road Network Layout	The FUSP shows a proposed a east-west aligned Connector Street - Boulevard connecting Old Sydney Road to the WNS Arterial Road north of Camerons Lane	VITM model should be updated to match the FUSP	T&TS
10	4.3.3			Land Use Refinements	Figure 4.7 and 4.8 show population and employment in an area mostly designated as Reserve and Regional Open Space. Other areas mostly designated as residential land uses also include employment uses	Update figures to show FUSP layout underneath. A more detailed land use summary be provided for analysis	T&TS
10	4.3.3			Land Use Refinements	Significant increase in of number of dwelling, jobs and enrolments between 2014 and 2018 reports	Clarification that these figures are correct and why such a significant increase?	T&TS
10	4.3.3			Land Use Refinements	2031 approx. 75% of PSP will be developed. This is a delivery rate of 1,050 dwellings p.a. between 2021 and 2031. By 2046 the remaining 25% will be delivered which equals 233 dwellings P.A between 2031 and 2046	This rate is too high for the reality of the development of the PSP over time. Amend VITM model to reflect	T&TS
10	4.3.3.			Land Use Refinements	Figure 4.7 and 4.8 show growth in land use is proportional over entire PSP area. I.e. development from the south moving north	Need a more detailed land use summary to determine in growth in land use over the BNWPSP is realistic	T&TS
11	4.4.1			Travel Demand Analysis	Mode share in table 4.2 has been frozen between 2031 and 2046. Historical data shows this should increase over time and therefore PT will increase	Consideration to be given to increase percentage of trips undertaken by PT in 2046 when compared to 2031	T&TS
13	4.4.2			Network Performance Analysis	Table 4.5 Peak Period Volume to Capacity Outputs and Level of Service is based on 2 hour traffic volume whereas lane capacity analysis is based on 1 hour traffic volume	Confirmation that 2hr volume has been converted to 1hr volume to determine level of service. Also beneficial to include a table detailing the 2031 and 2046 AM, PM, daily one way traffic volumes of key links including Camerons Lane interchange and Hume Fwy	T&TS
13	4.4.2			Network Performance Analysis	Table 4.6 Summary of Ultimate Daily Volumes on Key Roads (2046) should be include WNS Arterial Road and Patterson Road south of Hadfield Street, Hume Hwy and Camerons Lane Interchange off ramps for analysis	Amend table to reflect	T&TS
13	4.4.2			Network Performance Analysis	"The capacity afforded on some roads in the northern sections of the PSP, such as the WNS Arterial Road and Pattersons Road could be reduced and still perform acceptable operating conditions." 2046 volume plots in Appendix B, the proposed continuation of Pattersons Road north of the southern town centre can be downgraded to a Connector Street standard from a secondary arterial road standard	Future use of Pattersons Road and WNS Arterial Road to be discussed - downgraded and additional lanes used for PT priority	T&TS
13	4.4.2			Network Performance Analysis	in 2031, Patterson Road north of Camerons Lane northbound shows forced flow conditions, stoppages for long periods and low operating speeds. It is expected this become even worse at proposed intersection of Camerons Lane and Pattersons Road - the main entry point of access	Recommend reviewing the road network in and around the southern town centre, mixed use zone and school areas to improve access and permeability	T&TS
13	4.4.2			Network Performance Analysis	2031 - WNS Arterial Road has been modelled as four lane divided road. Traffic volumes justify a two lane two-way road.	2031 VITM model be to be updated to show the WNS Arterial Road as a two lane road.	T&TS
13	4.4.2			Network Performance Analysis	AM and PM 2031 volume/capacity ratio plots, the southbound and northbound traffic flows on Hume Fwy are very close to capacity and over capacity	Extra lane is required on both Hume Fwy and Northern Hwy and that the addition of these lanes will reduce the traffic volume on the BNWPSP road network	T&TS
15	4.6			Northern Highway On Ramp Scenario	2031 and 2046 traffic volumes increase on WNS Arterial Road	Role of Northern Hwy upgrades, Hume Fwy upgrades and impact on WNS Arterial Road	T&TS
15	4.6			Northern Highway On Ramp Scenario	Confirmation as to why there is an increase in traffic volume on WNS arterial road. If increases are due to land uses north of the BNWPSP, landowner should not be liable for funding of road	Landowner/developer should not be responsible for the full funding of this road	T&TS
15	4.6			Northern Highway On Ramp Scenario	Transport model shows the need for additional traffic lanes on Northern Hwy and Camerons Lane interchange 2031 and Hume Hwy in 2046	Is this the selected transport model that determines planned road network?	T&TS

7 October 2019

Victoria Cook
Project Manager
Yarra Valley Water Corporation
25 Lucknow St
Mitcham VIC 3132

Our ref: 3134596-LET-B-PSP Exhibition Response.docx
Your ref:

Dear Victoria

Beveridge North West Land Development Project
PSP Exhibition Response

This letter consolidates our feedback in relation to the exhibited Beveridge North West PSP. Our focus has been on reviewing the implications of the exhibited PSP on the water cycle given our role in providing water cycle advice to Yarra Valley Water (YVW) on its proposed land development project within the PSP.

This letter should be read in combination with the attached documents:

- GHD's stormwater management assessment report (29 August 2019), which explores an alternative business as usual stormwater management response to Melbourne Water's (MW) initial drainage services scheme.
- GHD's draft Geotechnical Investigation report (August 2019).

At the time of writing, a stage 2 water vision report is being prepared, which explores a number of innovative whole of water cycle concepts for the YVW site based on more contemporary stretch targets that are closely aligned with MW's Healthy Waterways Strategy.

Our key points of advice in relation to the implications of the contents of the exhibited PSP on the water cycle for YVW's site are as follows:

- Given YVW are placing a strong emphasis on reducing the urban heat and enhancing liveability as part of their early vision for their proposed development, it makes sense for YVW to recommend that the VPA provide greater certainty around how trees will be incorporated into the development streetscape. There are numerous clauses within the exhibited PSP that provide guidance around how trees could or should be integrated into the development. Requirement 7, Guideline 29, Guideline 44, Guideline 55 and Guideline 58 all provide guidance in relation to street tree integration from a water sensitive urban design (WSUD) and/or biodiversity perspective. Too often in new developments across Victoria, WSUD, street trees and associated structural systems take least precedence in the

streetscape as development densities and service provision take highest precedence. Provided YVW can get an acceptable reduction in development densities proposed in the exhibited PSP, we encourage YVW to show leadership and push for a number of the guidelines outlined above to be formalised into requirements so that the long term vision for a cooler climate liveable community is not lost or obstructed by other development conflicts as the year's progress.

- The potential future quarry shown on Plan 2 is concerning from a water cycle perspective. Should the quarry proceed there will be significant impacts to surface and groundwater systems, which will impact both YVW and MW's vision for both this site and the broader Kalkallo and Upper Merri Creek systems from both a hydrological and ecological perspective. The background reports provided with the exhibited PSP highlight these risks.

- We seek more clarity from VPA on their requirements for the future maintenance of the unnamed natural wetland on the northern boundary of the PSP. This may have implications for the potential Taylors Creek diversion arrangements.

- We seek more clarity from VPA on whether there is flexibility in how encumbered and unencumbered land can be utilised in the future. This will have implications for how YVW achieve its water vision, particularly the application of distributed WSUD/IWM approaches.

Regards

David Howard
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Environmental Engineer
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Attachments (2) Stormwater Management Assessment (GHD, 2019)
Draft Geotechnical Investigation Report (GHD, 2019)

29 August 2019

Victoria Cook
Project Manager
Yarra Valley Water Corporation
25 Lucknow St
Mitcham VIC 3132

Our ref: 3134596-LET-D-Stormwater Management Assessment.docx
Your ref:

Dear Victoria

Beveridge North West Land Development Project
Stormwater Management Assessment

1 Introduction

This letter presents the findings of a conceptual technical feasibility assessment of a variety of stormwater management scenarios that could be applied across a land development project in the Beveridge North West (BNW) growth precinct. The assessment includes a selected best practice water quality scenario, diverted/non-diverted catchment and end of line/distributed water sensitive urban design (WSUD) treatment sub-scenarios. Additional scenario assessments are proposed in the future.

This document has been developed in the context of an ongoing BNW Precinct Structure Plan (PSP) development process involving multiple stakeholders including Victoria Planning Authority (VPA), Mitchell Shire Council, Melbourne Water (MW) and Yarra Valley Water (YVW). The preliminary scenarios presented provide indicative sizes and locations of key stormwater infrastructure and are intended to inform the Structure Plan for the proposed development.

The proposed BNW land development project investigated in this assessment is Hazelwynde and is shown in the locality map of Figure 1.

2 Scenarios Investigated

This assessment focusses on identifying a 'base case' stormwater management approach for the Hazelwynde development. The 'base case' is defined as meeting the minimum stormwater treatment targets according to the Best Practice Environment Management Guidelines (BPEMG), which are consistent with MW's Kalkallo Development Services Scheme (DSS).

The base case stormwater management approach considers two sub-scenarios:

1. Where 70% of flow is diverted from the north adjacent Taylors Creek catchment; and
2. An undiverted scenario.

These two sub-scenarios are also assessed for both end of line and distributed WSUD initiatives. For background on the proposed diversion, refer to GHD's letters titled "Preliminary Investigation into the Taylors Creek Diversion" (dated 18/01/17) and "Beveridge North West Diversion Investigation" (dated 09/08/17), referred to herein as GHD 2017.

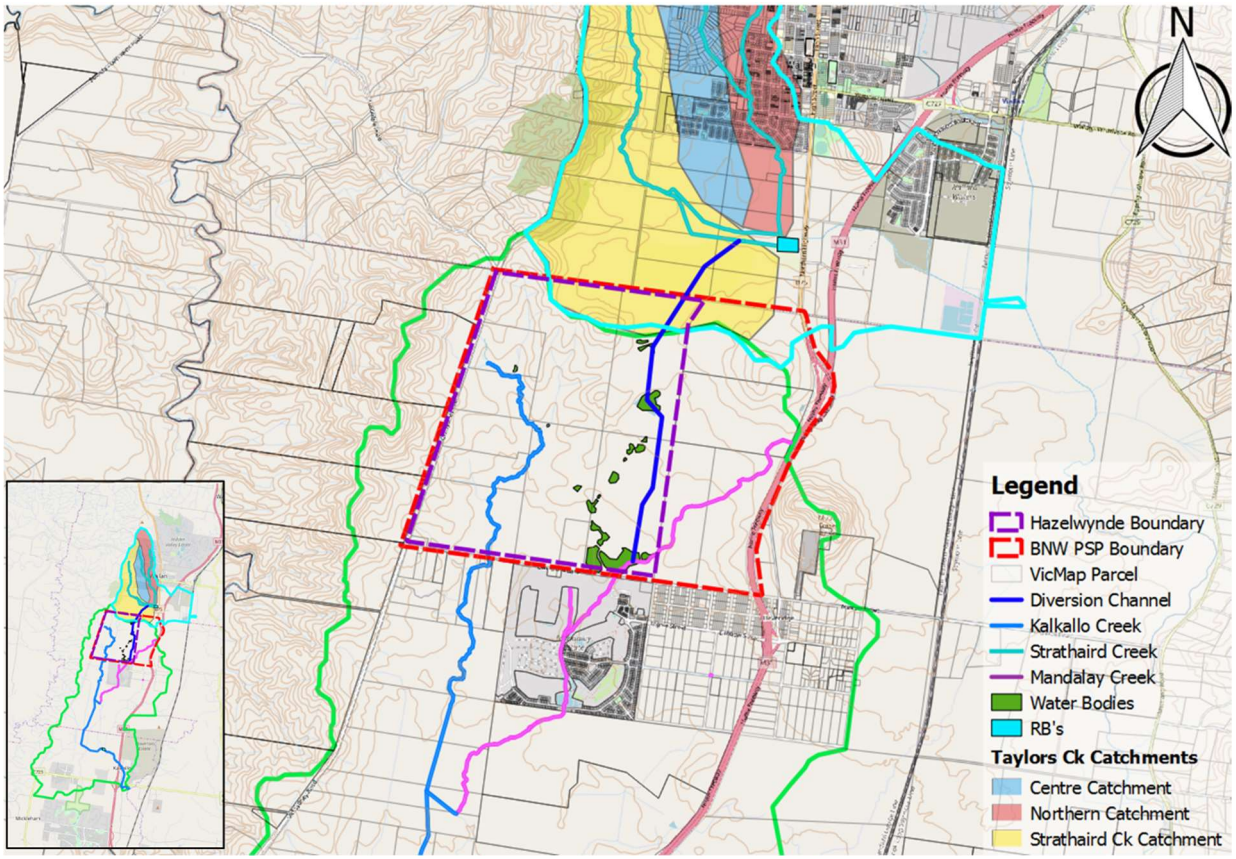


Figure 1 Locality map of the BNW growth precinct and Hazelwynde development site

The following software's were utilised in the modelling of scenarios for this assessment:

- Stormwater quality modelling was undertaken in MUSIC using the 1971-80 Melbourne Airport Climate Dataset in accordance with Melbourne Water MUSIC guidelines. This is representative of long term historical average climatic conditions;
- Hydrologic modelling was undertaken in RORB; and
- A conceptual three dimensional (3D) earthworks design was developed in 12D Model to determine appropriate channel, retarding basin and wetland footprints and volumes.

3 Drainage Infrastructure Plans

The location of key stormwater infrastructure for the non-diversion and diversion scenarios are shown in Figure 2 and Figure 3, respectively. A more detailed plan of the diversion arrangement is shown in Figure 4. Note: existing infrastructure located in parallel with the diversion channel alignment (shown conceptually in the figures below) has not been taken into consideration. There is potential in re-purposing existing infrastructure to form part of the broader WSUD strategy if deemed appropriate with further assessments.

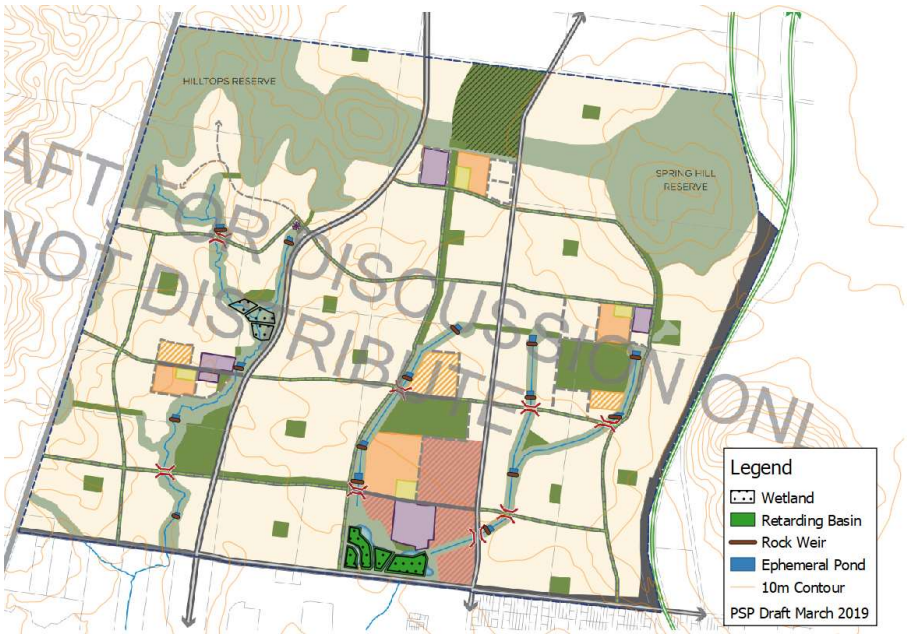


Figure 2 Stormwater Infrastructure Plan - No Diversion

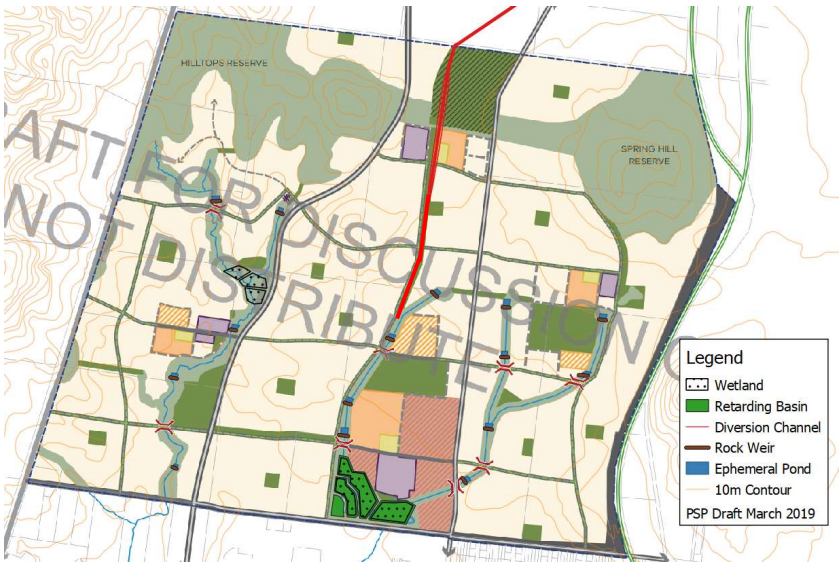


Figure 3 - Stormwater Infrastructure Plan - Diversion

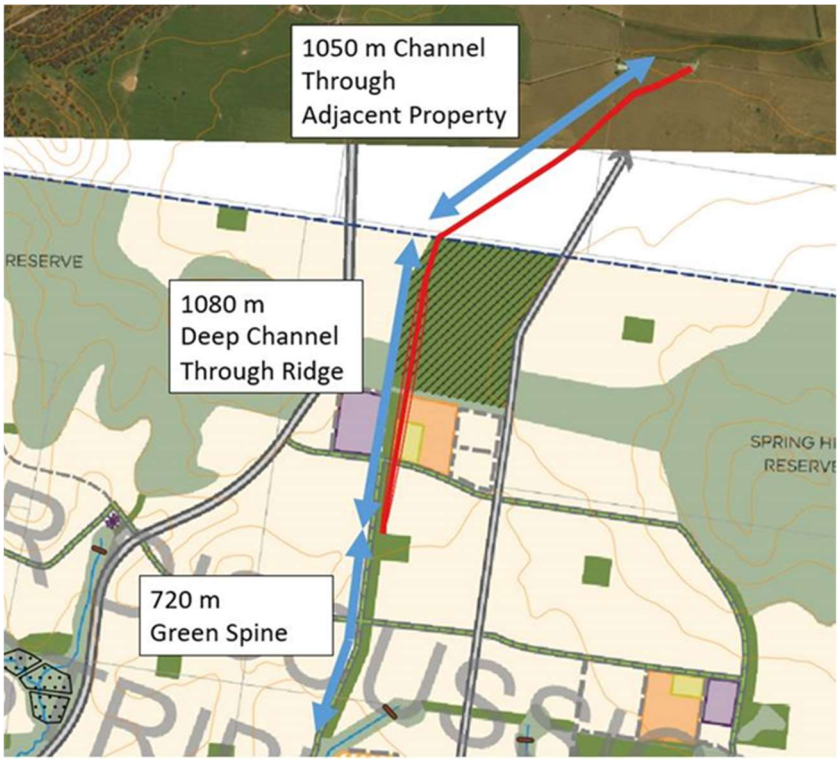


Figure 4 Stormwater Diversion Breakdown

4 Catchment Diversion Assessment

The GHD 2017 assessment included RORB modelling of the proposed diversion from Taylors Creek catchment to Hazelwynde. This investigation presented various options for diversion schemes that would divert sufficient flow away from Taylors Creek to replace the function of a proposed 20 ha Northern Hwy retarding basin (RB). Diversion Option 3 of GHD 2017 has been selected as part of this conceptual assessment.

This assessment of the Taylors Creek to Mandalay Creek diversion requirements identified that an open channel could be constructed to convey flows from the north in accordance with Diversion Option 3. This diversion option represents a balanced approach by diverting 70% of 100 yr average recurrence interval (ARI) peak flows from the Strathaird Creek and the Centre Catchment shown in Figure 5, resulting in a reduction in peak flows across a range of storm events. This diversion configuration more closely replicates the proposed function of Northern Hwy RB (as proposed in the current Taylors Creek DSS Plan), which also attenuates a range of flows. As a result, the Northern Hwy RB would not be required under this diversion configuration.

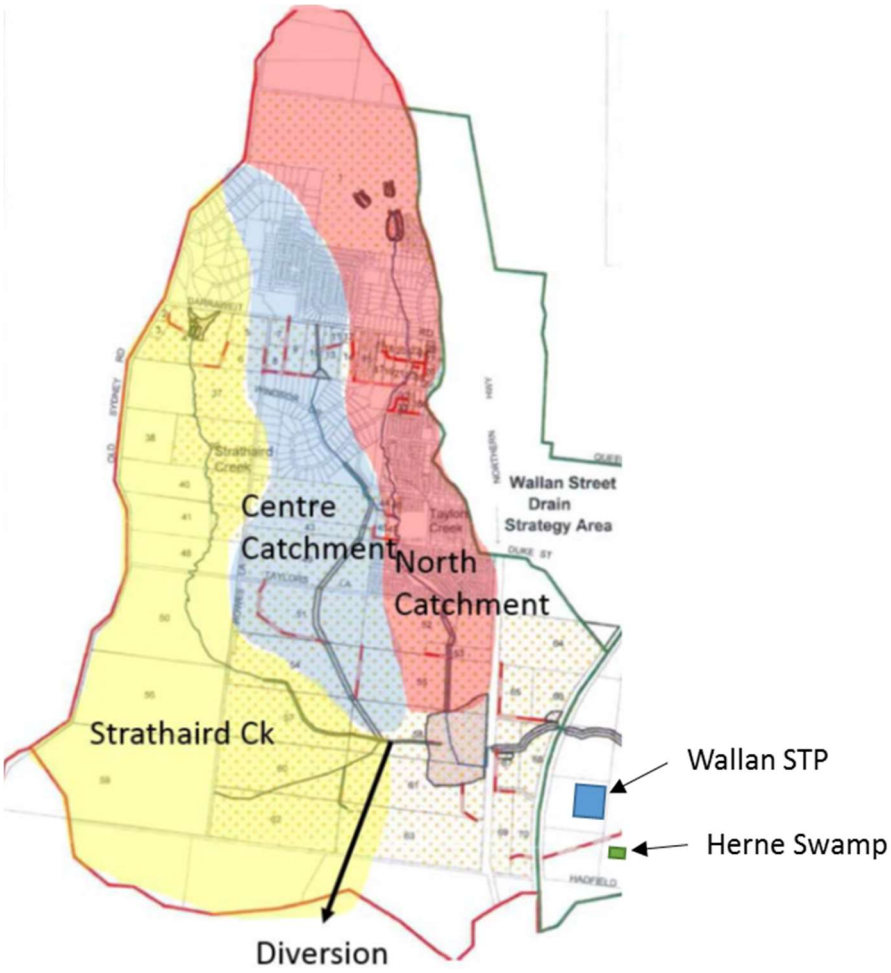


Figure 5 Northern Hwy Retarding Basin Catchments

Further consultation with MW is required regarding what the acceptable low flow diversion rate should be. However, as an early indication of what could be achieved, a potential low flow diversion configuration could involve diverting the difference in undeveloped and developed storm flows from the Central and Strathaird Creek catchments. This would yield up to 1.1 GL/yr, whilst maintaining baseflows in Taylors Creek.

Potential diversion limits for this scenario are presented in Table 1.

Table 1 Diversion Limits

Flow Range	Diversion
Baseflow (0-100 L/s)	Undiverted
Minor Stormflow (0.1 – 1 m^3/s)	100% diverted
Major Stormflow (>1 m^3/s)	70% diverted

In order to convey a peak flow of 4 m^3/s (70% of the 100 yr ARI peak flow) through the ridge separating Hazelwynde from the Taylors Creek catchment, the diversion channel gradually transitions across a variety of cross sectional dimensions as per the following:

- Initial channel cross section with a base width of 6 m, top width of 15 m, 1 in 4 batters and depth of 1 m; and
- Maximum channel cross section with a base width of 6 m, top width of 42 m, 1 in 4 batters and depth of 4.5 m. This represents the high point of the ridge that is being cut through.

The diversion channel has a longitudinal grade of 1 in 1500. Typical sections of the diversion are shown in Figure 6.

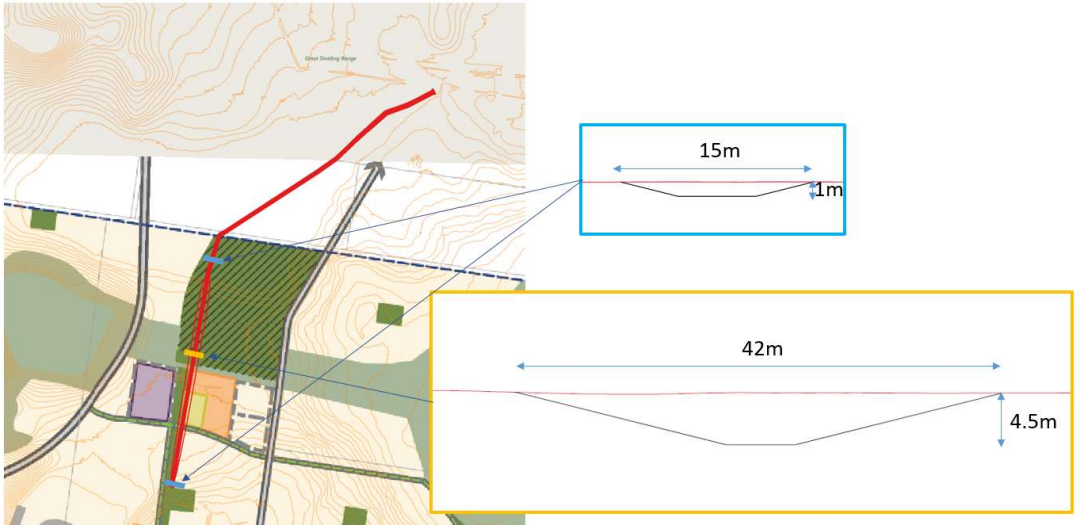


Figure 6 Stormwater Diversion Sections

The magnitude and distribution of flows contributing to the end of line wetland is subject to:

- Baseflow contribution;
- Attenuation and associated stage/discharge within the catchment (this includes formal and informal water bodies along the green spines/streetscape which could consist of ponds and riffles, frog habitat, wetlands, swale, raingardens feed by the internal and/or external catchment – these can attenuate flows for 12-36 hours and flatten the peaks associated with storm flows entering the wetland) refer to Section 6, Figure 14**,** Figure 17 and Figure 18;
- Wetland performance; and
- Harvesting rules (freeboard and pumping rules).

5 Retarding Basin Assessment

A feasibility assessment and concept design of the retarding basin requirements was undertaken to explore the impacts of incorporating Diversion Option 3 of GHD 2017.

The MW Kalkallo DSS Plan includes a retarding basin within the Hazelwynde development , located at Cameron's Lane. MW provided GHD with a RORB model of the Cameron's Lane RB and contributing watershed catchment which formed the basis for the conceptual design of the retarding basin with consideration to diverted flows from the Taylors Creek catchment. The Cameron's Lane RB conceptual

arrangement for the 8 ha Diversion Scenario and 6.5 ha No Diversion Scenario is illustrated in and , respectively.

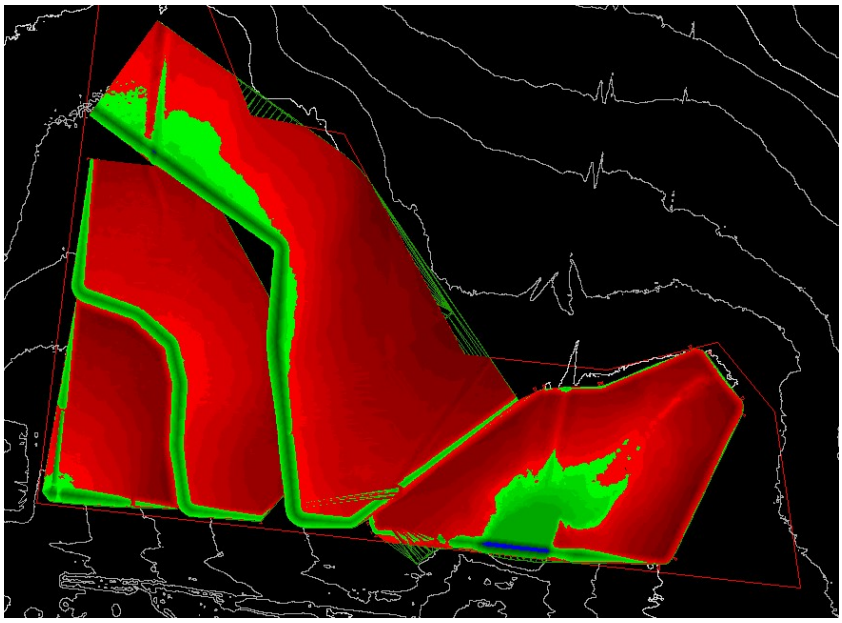


Figure 7 - Cameron's Lane RB – Diversion Scenario (8 Ha) - Cut (Red) and Fill (Green)

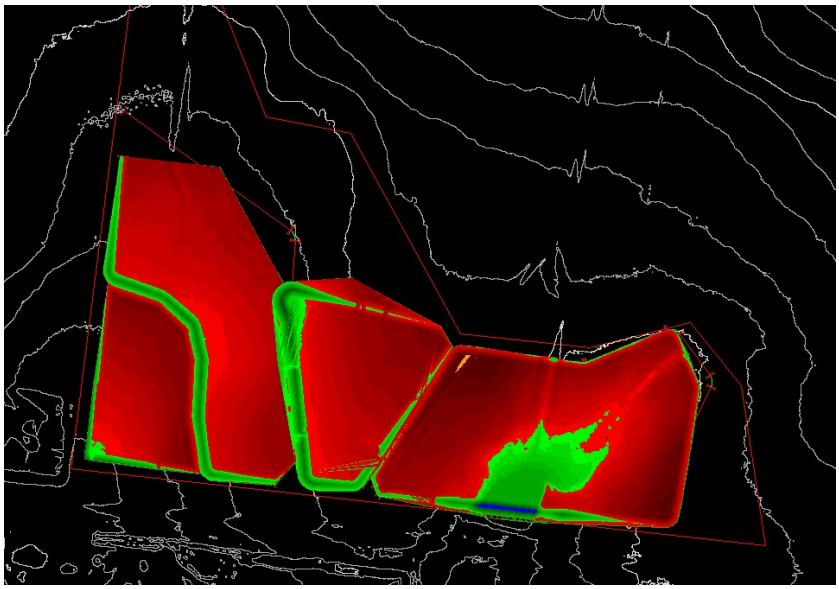


Figure 8 - Cameron's Lane RB – No Diversion Scenario (6.5 Ha) - Cut (Red) and Fill (Green)

As shown in and , the Cameron's Lane RB concept incorporates a tiered design approach. A tiered design has been adopted for two key reasons:

- It prevents the need to construct a very tall (3m+) embankment - embankments are limited to a height of 1.5 m (as per MW RB design standards) to enhance a more inclusive and open urban form; and
- It allows for a flat base for each tier, which in turn allows for wetlands to be constructed within the basin footprint.

The Cameron's Lane RB concept design has been configured for a peak outflow rate as per the original MW DSS RORB model for the critical 30 hr duration 100 yr ARI event.

Figure 9 and Figure 10 demonstrate that the Cameron's Lane RB concept design arrangements for both the 8 ha Diversion Scenario and 6.5 ha No Diversion Scenario, respectively, match the peak outflow of the original DSS RORB model.

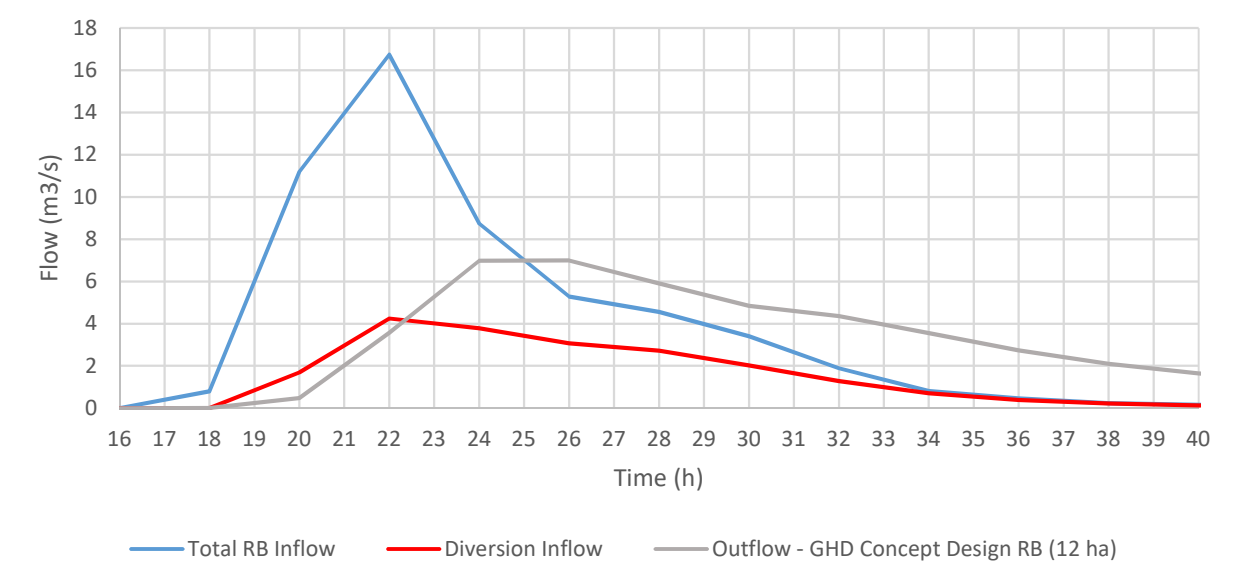


Figure 9 - Cameron's Lane RB 100y 30h Flows - Diversion scenario (8 Ha)

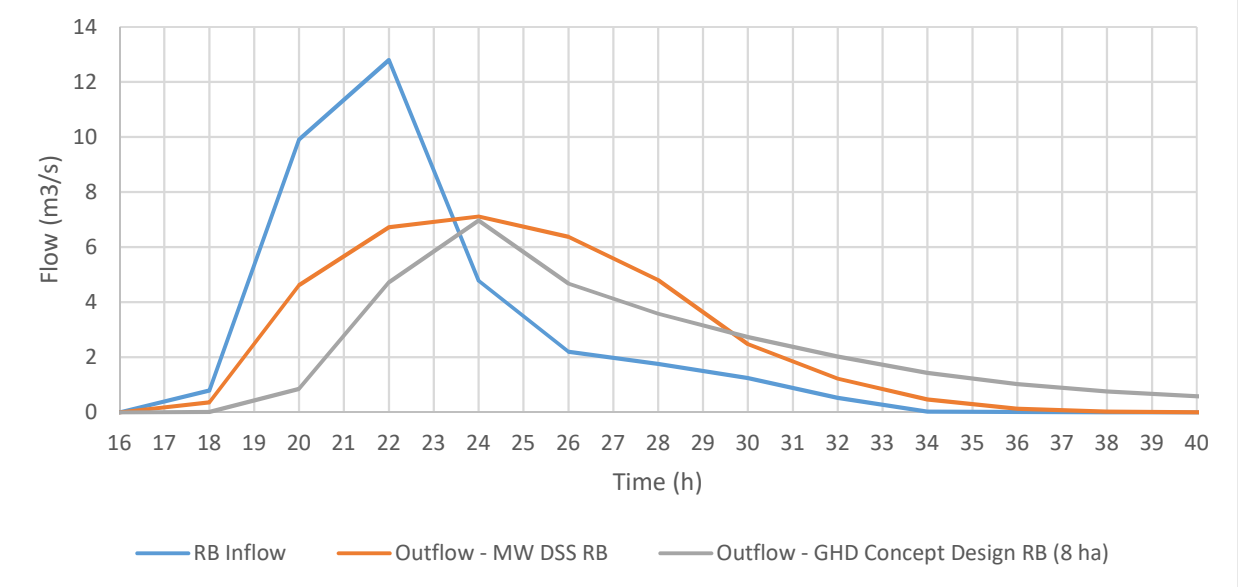


Figure 10 - Cameron's Lane RB 100y 30h Flows - No diversion scenario (6.5 Ha)

6 WSUD Assessment

The WSUD stormwater treatment measures that have been included in this preliminary conceptual design are discussed below.

6.1 Cameron's Lane Wetlands

Two alternative wetland footprints at Cameron's Lane have been explored for the diversion and non-diversion scenarios as part of the conceptual design process. These wetlands are proposed to be constructed within the base of Cameron's Lane RB. Due to the tiered basin levels, the wetland cells will subsequently also be tiered which. This configuration will require careful design to ensure stormwater is evenly distributed throughout the treatment cells. That being said, this is a relatively common approach to wetland design. As the wetlands are also a function of the Cameron's Lane RB's, the wetland area is consistent with that of the basins, approximately 8 ha for the diversion scenario and 6.5 ha for the no-diversion scenario, as shown in Figure 11.

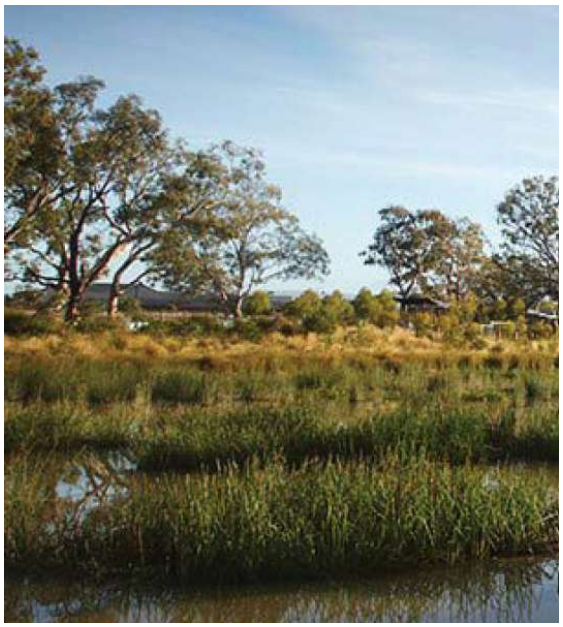
Figure 11 Cameron's Lane Wetlands, Diversion (8 ha) (L) and No Diversion (6.5 ha) (R)

Incorporating the wetlands within the Cameron's Lane RB footprint will enable strategic placement of large open water areas. This configuration will also satisfy MW's wetland design guidelines of up to 20% of wetland area to be open water. Furthermore, the permanent water within this wetland system will minimise the operational challenges associated with urban lakes. Example of large open water areas / wetlands are shown in Figure 12.

6.2 Climate adaptation and Community Benefits

The large open water area and vegetation will provide multiple benefits to the community including:

- Maintaining cooler land surface temperatures reducing heat island effects;
- Rejuvenate native flora and fauna developing rich and diverse ecosystems;
- Promote community outdoor activities through interaction and public access; and
- Increased amenity and liveability.



Source: GHD Woodhead, 2018. *Ideas for a Water Sensitive Hazelwynde: Discussion paper for Yarra Valley Water*.

Figure 12 Example Photos: Wetlands

6.3 Kalkallo Creek Wetlands

A single wetland footprint with the Kalkallo Creek has been assessed. This wetland is located in the upper reaches of Kalkallo Creek and is tiered due to the considerable slope of the land. The wetland covers an area of approximately 3 ha for both scenarios (refer below).

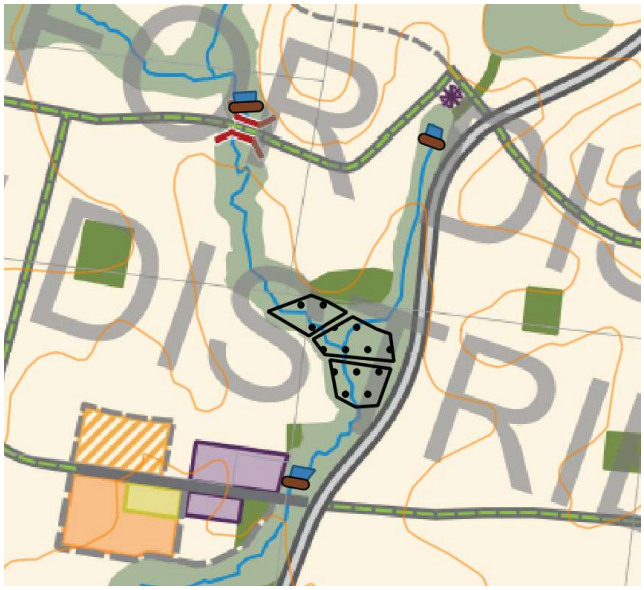


Figure 13 Kalkallo Creek Wetland Footprint

6.4 Distributed WSUD Initiatives

A range of distributed WSUD initiatives are explored below. These distributed WSUD initiatives effectively spread smaller footprint areas of water quality treatment zones across the development. These distributed initiatives also assist in marginally attenuating flows. As treatment and attenuation is also distributed, this reduces the area and volume requirements of the Taylors Creek and Cameron's Lane wetlands. Distributed WSUD initiatives also assist in climate adaptation. As the WSUD treatment zones are distributed throughout the development, urban vegetation, tree canopy and soil moisture ratios are increased. This approach reduces urban heat island effects, generates shaded urban streets, increasing amenity and promoting outdoor activities.

Green Spines, Ephemeral and Semi-Permanent Ponds

Green spines have been included as per the layout in the draft masterplan. An important consideration will be keeping the green spines 'green', given the low annual rainfall, especially during dry years. The conceptual design features include swales, ephemeral ponds, semi-permanent ponds, constructed with varying deep-water zones and rock weirs to hold back storm flows in the landscape. This allows for groundwater recharge during wet periods and serves as passive irrigation for riparian vegetation.

The green spines, varied and distributed pond systems promote healthy frog habitats and are good candidates for active irrigation, with harvested stormwater or recycled water.

Refer to Figure 14**,** Figure 17 and Figure 18 example photos of the aforementioned initiatives.

Source: GHD Woodhead, 2018. Ideas for a Water Sensitive Hazelwynde: Discussion paper for Yarra Valley Water.

Figure 14 Example Photos: Green Spines and Rock Weir Pools

Tree Pits

Biofiltration is an effective means of achieving pollutant reduction in stormwater. Tree pits are a type of biofiltration system that also incorporates trees and other varied height vegetation, similar to the example shown in Figure 15**Error! Reference source not found.**. The tree canopy also provides shade and evapotranspiration cooling benefits to the surrounding environment. Trees planted in biofiltration systems also require less irrigation, particularly when these systems have large storage spaces above or below the tree root ball for the retention of stormwater. For the concept design, tree pits have been included in order to supplement wetland and green spine swale treatments to reach the required BPEMG target.

Source: www.citygreen.com Lonsdale Street

Figure 15 Continuous Tree Pit: Application of the Stratacell System

Figure 15 shows a continuous tree pit in Lonsdale Street through the application of the Stratacell System. The Stratacell system consists of a load-bearing engineered plastic modular structural cell which can be interconnected to form any desired area or volume. The structural cells are filled with soil promoting tree-root growth. Stormwater is collected from the adjacent impervious surfaces and retained in the structural cells. This keeps the landscaped soils moist, providing a regular source of water to vegetation. Redundancy is built into these systems by means of a small overflow connection to conventional drainage infrastructure. A continuous tree pit system assists in establishing multiple green spines/urban canopies.

This approach to stormwater management is also referred to as ‘source control’.

6.5 Development Benefits of Distributed WSUD Initiatives

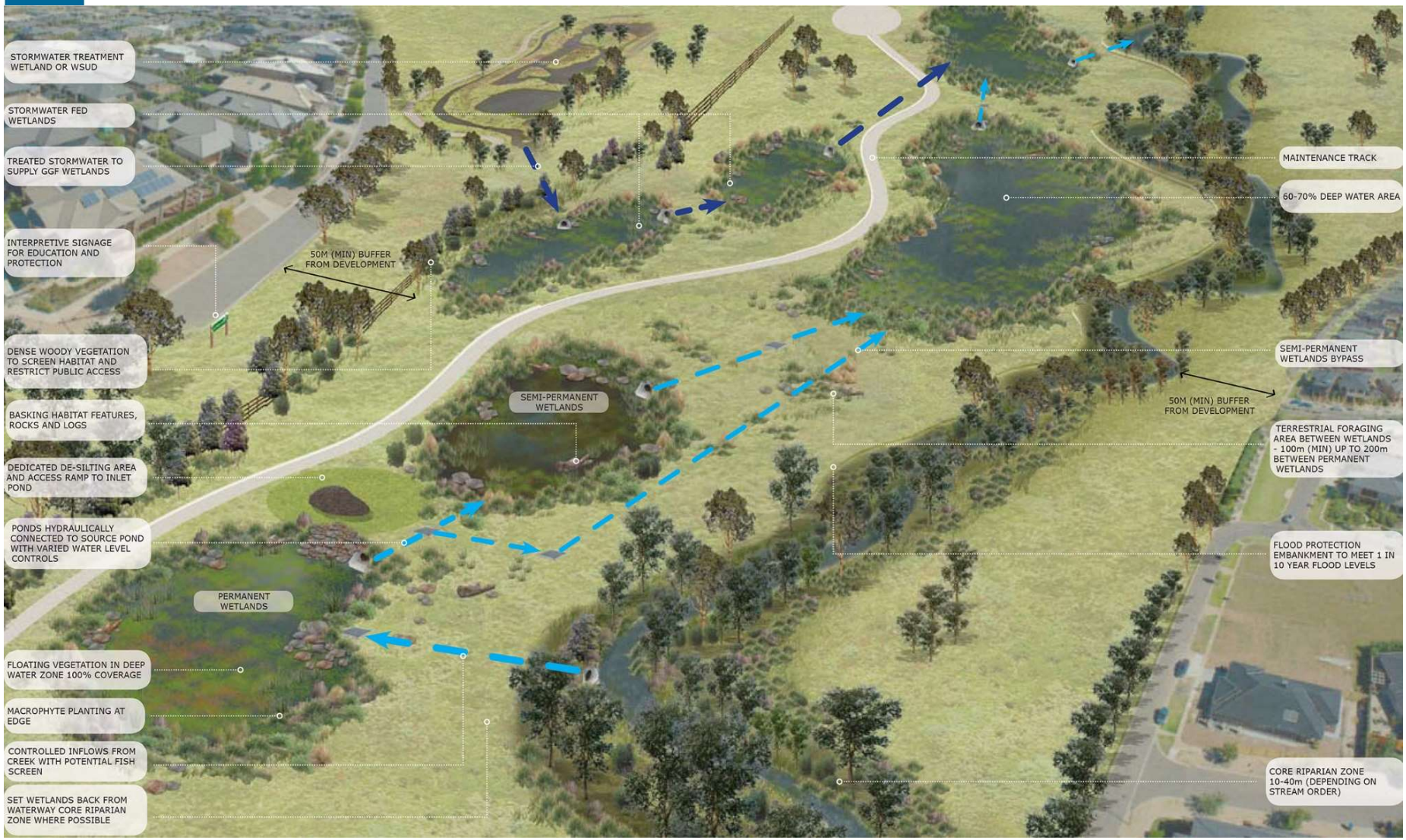
The application of distributed WSUD initiatives Green urban canopies can also generate economical benefits. The application of distributed WSUD initiatives and source control for stormwater management can significantly reduce the extent of end of line stormwater management systems, also reducing related infrastructure maintenance costs. For the developer, this approach to stormwater management can increase lot yield in the order of 3.5%[1] and green urban streets can also add up to $20,000 to house prices.[2]

Figure 16 Example of a Green Street

Source: www.domain.com.au: Justin McManus

[1] Richards, O. 2017. SOMe Source Control Stormwater Management. IPWEA International Conference, Perth, Western Australia.

[2] Malo, J. 2017. www.domain.com Leafy Streets and tree-filled backyards.



Source: GHD Woodhead, 2018. Ideas for a Water Sensitive Hazelwynde: Discussion paper for Yarra Valley Water.

Figure 17 – Distributed WSUD, Ponds and Frog Habitat

Source: GHD Woodhead, 2018. Ideas for a Water Sensitive Hazelwynde: Discussion paper for Yarra Valley Water.

Figure 18 - Restored Ecosystem / Waterway

6.6 Water Quality Modelling of Wetland & Distributed Initiatives

The Kalkallo, Mandalay and Taylors Creek catchments were modelled in MUSIC for pre-development and post-development conditions.

Impervious fractions adopted for the Kalkallo and Mandalay Creek catchments were in accordance with the land uses identified in the draft masterplan. These parameters are considered conservative in that they assume a relatively high impervious fraction (80%) for residential areas. These parameters can be refined, in future, when development densities are confirmed.

Taylors Creek impervious fractions were adopted from the MW RORB model, as there was no masterplan or other development documentation to derive a more accurate impervious fraction for this area.

The resulting treatment requirements for achieving the BPEMG Nitrogen reduction target of 45% are listed in Table 2. Other BPEMG requirements such as Gross Pollutants, Total Suspended Solids and Total Phosphorus have not been assessed at this stage to keep the assessment as simple as possible. Generally, achieving nitrogen reduction targets implies achieving reductions in other targets.

Table 2 BPEMG Performance

	Pre-development Nitrogen Load (kg/y)	Post-development Nitrogen Load (kg/y)	45% Nitrogen reduction target (kg/y)
Hazelwynde	1,630	9,200	3,407
Taylors Creek	1,090	4,910	1,719
Combined (Diversion Scenario)	2,720	14,110	5,126

In achieving the nitrogen reductions listed in Table 2, the following MUSIC model water quality treatment approaches listed in Table 3 have been applied.

Table 3 MUSIC Treatments

	No Diversion Scenario	Diversion Scenario
Cameron's Lane RB Wetlands	6.5 ha	8 ha
Kalkallo Creek Wetland	3 ha	3 ha
Green Spines (assumed to be swales for simplicity)	6.5 km	6.5 km
Tree Pits ($10m^2$)	160	3100 (~5 per ha)

Two approaches not considered in the MUSIC modelling that would have a substantial impact on pollutant reductions are:

- Stormwater harvesting and reuse; and
- Stormwater infiltration in the ephemeral ponds (subject to local soil testing).

If either of these initiatives are implemented, the required wetland sizes and distributed numbers may be further significantly reduced. Again, to keep the assessment as simple as possible, we have assumed that the ephemeral ponds, swales, tree pit and wetland are lined (impermeable based) systems.

There are many potential combinations of distributed biofiltration and wetlands that could be used to reduce the size of wetlands adopted in the modelling.

A simple indicative method of considering reductions to the size of the large wetlands is every 1 ha of wetland can be replaced by either of the following use a rule of thumb approach:

- 1 ha of distributed wetlands throughout the development; or
- 350 tree pits (10 m^2) or 1 tree pit per 2 ha of developed land.

For example, approx. 2,275 distributed tree pits (3 per ha) could eliminate the need for the 6.5 ha wetland in Cameron's Lane RB.

Based on the Hazelwynde MUSIC results, tree pits could achieve approximately 1.25 kg/y nitrogen reduction per 10 m^2 pit, whilst wetlands could achieve approximately 440 kg/y nitrogen reduction per ha. These results are provided for high level estimation purposes. Distributed treatment scenarios would need to be separately modelled in MUSIC to confirm actual treatment performance achieved.

7 Kalkallo Creek Rehabilitation

The rehabilitation of the Kalkallo Creek (as well as formalisation of the Mandalay Creek corridor) are important considerations for YVW to resolve with MW and other stakeholders during the masterplan development stage.

The existing eroded condition of the Kalkallo Creek is illustrated in Figure 19. A geomorphology assessment by Alluvium in 2012 (referred to herein as Alluvium 2012) highlighted:

- Active deepening and widening in the northern catchment;
- Opportunities to introduce significant ecological and geomorphological values to the waterway; and
- The need to accommodate hydraulic requirements in the future channel form.

There are several options (inclusive of rock riffles, channel modifications, floodplain hydraulic interactions, ecological enhancements etc.) for rehabilitation of the Kalkallo Creek waterway within the target reaches. It is recommended that a waterway rehabilitation plan be developed specifically for Kalkallo Creek. This plan should assess:

- The various rehabilitation options with a consideration of the hydrology/hydraulics of current and future conditions;
- Current geomorphic processes (as indicated in Alluvium 2012);
- Broader geotechnical findings from across the site (inclusive of cut to fill initiatives);
- Amenity requirements;
- Flora and fauna requirements/aspirations; and
- Indigenous/cultural heritage considerations.

Specific consideration should be given to:

- Current processes and options that address channel instability;
- The impact of stock exclusion (where relevant);
- Indigenous revegetation options; and
- How large woody debris can enhance the health of the reach.

An assessment of the impact of channel roughness should also be assessed to ensure that the hydraulics are not compromised by other elements of the rehabilitation strategy.

The culmination of these efforts should result in the re-establishment of a healthy waterway that also provides habitat for local fauna, with specific consideration given to rare and threatened species.

Figure 19 Kalkallo Creek, Existing Conditions

8 Geotechnical Considerations

A Ground Science desktop study (2017) has indicated that there are potentially complex geological (variable geology) and geomorphological (existing escarpments, gullies, hillwash slopes and water bodies) conditions that may potentially restrict development in certain areas. In addition, the study also identified that whilst groundwater is unlikely to affect residential developments and infrastructure, it could be a limiting factor in areas where the groundwater table is within 5 m of the surface level. This may be evident in location such as the existing escarpments, gullies and alluvial fan deposit zones.

GHD has subsequently undertaken further strategic field investigations and analysis (July 2019) to confirm the geotechnical considerations and constraints for the construction of waterway diversions,

waterway rehabilitation (inclusive of cut to fill considerations), retarding basins and wetlands. This work supersedes the Ground Science desktop study (2017). The following scope of works was performed by GHD as part of the July 2019 assessment:

- Review of background geological and geotechnical information;
- Management and co-ordination of field works;
- Drilling of nine (9) geotechnical at the location of the wetlands and diversion channel;
- Installation of groundwater monitoring wells in selected boreholes;
- Geotechnical laboratory testing on soil and rock samples; and
- Preparation of a geotechnical investigation report.

The key findings of this assessment are:

- There were three key geological conditions found on site. These include
  - Residual, possible fill, and alluvial soil;
  - Newer Volcanics Basalt; and
  - Kilmore Siltstone.
- The Newer Volcanics Basalt are high strength and will require special excavation techniques. These are present along the proposed diversion channel alignment and at the Cameron's Lane wetlands/retarding basin;
- The Kilmore Siltstone material may not require extensive excavation according to the current diversion channel profile. However; any excavation in the medium strength, highly to moderately weathered siltstone may require additional effort including the use of rock breakers or high capacity dozers.
- The dispersive and reactive nature of the residual clay soils indicate treatment will be required to prevent erosion.

We propose further geotechnical field assessment (stage 2) in the near future to gain additional insights as to the geological conditions across the site.

9 Preliminary Conceptual Cost Estimates

GHD has prepared preliminary conceptual cost estimates using information reasonably available to GHD employees(s) and based on assumptions and judgements made by GHD. The cost estimates have been prepared for planning purposes and must not be used for any other purpose. The cost estimates are preliminary estimates only. Actual prices, costs and other variables may be different to those used to prepare the cost estimate and as such may change. GHD does not represent, warrant or guarantee that the project can be undertaken at a cost which is the same or less than the cost estimate.

Cost estimates for key stormwater management infrastructure are presented in Table 4. These are high-level estimates which are based on a combination of the following sources:

- Rawlinsons Construction Handbook (Earthworks, Concrete, Vegetation Costs);
- GHD Project Experience (Wetland and Tree Pit Costs); and
- Melbourne Water DSS Costing Spreadsheet.

Two alternative scenarios were adopted for indirect costs. A 30% and 100% uplift was applied to the direct costs to account for Contracor's overheads, margins and contingencies. Design and project management allowances have not been accounted for.

Some key uncertainties that will have a substantial impact on the cost estimates include:

- Land acquisition rate for the Northern Hwy RB and wetlands (currently assumed $350,000 - $700,000/Ha, provided by MW);
- Location of proposed WSUD options, at this stage all WSUD options are designed within the available green space;
- Geotechnical conditions (noting filed work is proposed in the near future); and
- Contaminated soils.

Table 4 Preliminary Conceptual Cost Estimates

Item	Base Case (30% Contingency)	Base Case (100% Contingency)	Diversion (30% Contingency)	Diversion (100% Contingency)
Cameron's Lane RB	$1.3 M	$1.9 M	$1.6 M	$2.5 M
Wetlands	$14.8 M	$22.8 M	$17.2 M	$26.4 M
Tree pits	$0.3 M	$0.5 M	$6.1 M	$9.3 M
Diversion Channel	-		$2.7 M	$4.1 M
Green Spines (Ex Kalkallo Creek)	$0.8 M	$1 M	$1 M	$1.5 M
Informal Ponds	$1.3 M	$ 2.1 M	$0.5 M	$0.8 M
Total Costs	**$18.5 M**	**$28.3**	**$29.1 M**	**$44.6 M**
Land Acquisition Savings (Northern Hwy RB)	-		$9.1 M -18.2 M	$14.0-28.0 M
Construction Savings (Northern Hwy RB & Wetlands)	-		$15.1 M	$23.3 M
Total Savings	-		$24.2 - 33.3 M	$37.3 – 51.3 M
Net Cost	**$18.5 M**	**$28.3**	**-$4.2 M to + $4.9 M**	**-$6.7 M to + $7.3 M**

The preliminary conceptual cost estimate assumptions are summarised in Table 5 below.

Table 5 Preliminary Conceptual Cost Estimate Assumptions

Item	Assumptions
Cameron's Lane RB	8 ha RB 1.6 km of embankment core works 60,000 cubic m of excavation 4 Concrete outlets and a spillway
Wetlands	Cameron's Lane Wetland 6.5 ha Kalkallo Creek Wetland 3 ha Note – wetland requirements can be reduced with stormwater harvesting if the driver is purely based on a BPEMG nutrient reductions
Tree pits	80 urban style tree pits 80 rural style tree pits Note - tree pits requirements can be reduced with stormwater harvesting if the driver is purely based on a BPEMG nutrient reductions
Diversion Channel	76,000 cubic m of cut to fill. We have assumed that on-site cut to fill is possible with fill used for the rehabilitation of Kalkallo Creek (formal rehabilitation of Kalkallo Creek is not costed at this stage). This is subject to geotechnical findings in the coming weeks. 85,200 sq m of revegetation proposed
Green Spines (Ex Kalkallo Creek)	21,500 cubic m of excavation required 43,000 sq m of revegetation proposed
Informal Ponds	20 ponds each 1000 sq m (10,000 cubic m of excavation and 20,000 sq m of revegetation) 20 rock weirs, 30 m long, 1.5m high
Land Acquisition Savings (Northern Hwy RB)	20 ha at $350,000 - $700,000/ha
Construction Savings (Northern Hwy RB & Wetlands)	Northern Hwy RB 20 ha Northern Hwy Wetland 8 ha

10 Key Interim Findings

10.1 Review of the Current Drainage Services Scheme

Is the current Drainage Services Scheme adequate?

To assess the feasibility of the current DSS a detailed water balance assessment of the diversion/non-diversion scenarios is required. This assessment will quantify the benefits of the proposed drainage diversion from an urban water cycle and integrated water perspective. This should consider whether a portion of baseflows in Taylors creek could also be diverted into the Mandalay Creek catchment.

Currently our high-level assessment indicates:

- The DSS infrastructure can meet the 'base case' minimum stormwater treatment targets (i.e. current BPEMG). Additional scenarios are proposed to be assessed in the next stage of this assessment i.e. feasibility of achieving the MW HWS targets).
- The current DSS manages a raw stormwater yield of 1.9GL/yr at Cameron's Lane RB. It is too early to confirm if this will be adequate to assist YVW in achieving its interim potable, treated effluent and UHI targets (to be explored in the next stage of this assessment). To paint a picture, in relative terms the proposed drainage diversion will provide an additional raw stormwater yield of 1.1 GL/yr available relative to the DSS. This would contribute to more water in the landscape (in stream storage), larger and more engaged wetlands (equivalent to an additional 1.5 ha) and additional stormwater for reuse on the landscape, which would contribute to green urban canopies, amenity and contributing to urban cooling (detailed water balance to confirm exact benefit with/without a portion of Taylors Creek baseflow).

10.2 Review of the Current Future Urban Structure Plan

Does the current Future Urban Structure Plan make adequate provision for the drainage components?

For the non-diversion scenario, the current Future Urban Structure Plan makes adequate provision for waterways, retarding basins and wetlands to meet minimum stormwater treatment targets (i.e. current BPEMG). We have assumed the Kalkallo wetlands can be accommodated online within the current drainage corridor (i.e. uncredited open space).

For the diversion scenario, the credited open space spine up the middle of the development would need to be reallocated to either uncredited open space or an offset explored (i.e. crediting some of the flood prone land in the retarding basin that can be utilised for multiple purposes and effectively provides amenity). There is sufficient width in the credited open space spine up the middle of the development to accommodate the channel (i.e. channel top width is 15 m, leaving 15 m for other amenity assets).

We cannot comment on the adequacy to meet the more progressive MW HWS targets at this stage of the assessment.

Are the Green/Blue links shown in current Future Urban Structure Plan appropriately located?

Our feedback on the green/blue spines:

- To accommodate a stormwater diversion, the credited open space spine up the middle of the development would need to be reallocated to either uncredited open space or an offset explored (i.e. crediting some of the flood prone land in the retarding basin that can be utilised for multiple purposes and effectively provides amenity);
- Separating the connector and regional roads from the green spines improves the greening and amenity of these spaces;
- There are topographical challenges in sending stormwater from the Kalkallo Creek across to the Mandalay Creek/Cameron's Lane RB. Thus, any blue features between the Kalkallo and Mandalay Creeks will need to be either supplied by stormwater from:
    - One of the four key green-blue spines (Kalkallo Creek, Taylors Creek Diversion into Mandalay Creek branch one, or Mandalay Creek Branches two and three); or
    - A local source of stormwater runoff.

10.3 Opportunities and Challenges for Implementing the Catchment Diversion

The opportunities and challenges of implementing the catchment diversion are summarised in Table 6.

Table 6 Opportunities and Challenges of the Catchment Diversion

Category	Opportunities	Challenges
Economic	Consolidation of retarding basins and WSUD initiatives across multiple drainage services schemes introduces economic savings.	Consolidation of retarding basins across multiple drainage services schemes not typically undertaken. Need to explore alternative approach to cost recovery. Achieving the more stringent MW HWS Targets (feasibility to be confirmed)
Environmental	Creation of waterways and wetlands that provide local and regional (downstream) ecological benefits. Stormwater harvesting that provides local and regional (downstream) ecological benefits. Creation of green spines that provide habitat. Improvement to flow regime in Taylor's Creek (closer to pre-development regime)	Balancing ecological and amenity requirements for waterways and wetlands. Location of stormwater harvesting storage. Managing extraction versus wetland open water body cell amenity requirements if this forms the SWH storage. Achieving the more stringent MW HWS Targets (feasibility to be confirmed)
Social	Creation of waterways, wetlands and green spines that provide amenity benefits.	Balancing ecological and amenity requirements for waterways and wetlands.
Aesthetic	More stormwater to support the creation of waterways, wetlands and green spines that provide enhanced ecological and liveability/amenity benefits. This additional supply of stormwater allows for larger and more engaged wetlands and thriving landscapes (water balance to confirm	Balancing ecological and amenity requirements for waterways and wetlands.

Category	Opportunities	Challenges
	exact benefit with/without a portion of Taylors Creek baseflow).	
Developable Area	For the non-diversion scenario, the current Future Urban Structure Plan makes adequate provision for waterways, retarding basins and wetlands to meet minimum stormwater treatment targets (i.e. current BPEMG). We have assumed the Kalkallo wetlands can be accommodated online within the current drainage corridor (i.e. uncredited open space).	For the diversion scenario, the credited open space spine up the middle of the development would need to be reallocated to either uncredited open space or an offset explored (i.e. crediting some of the flood prone land in the retarding basin that can be utilised for multiple purposes and effectively provides amenity). We cannot comment on the adequacy to meet the more progressive MW HWS targets at this stage of the assessment.
Alignment with policy objectives	The current solution currently meets the minimum stormwater treatment targets (i.e. current BPEMG). Develop a regional solution in collaboration to achieving the MW HWS Targets. The exploration of the transfer of DSS flood and water quality savings from the Taylors Creek catchment would make the diversion infrastructure significantly more attractive.	Regarding the impact of the diversion on achieving water quality objectives beyond BPEMG, there are two potential scenarios. Firstly without stormwater harvesting, it will be difficult to exceed BPEMG targets, because there will be diminishing returns from including more wetlands and tree pits in the design. If substantial volumes of stormwater are harvested, then it will be possible to achieve significantly higher water quality objectives, even with the additional inflow/pollutants from the diversion. The next stage of this assessment will confirm the feasibility of achieving the more stringent MW HWS targets.

10.4 Local and Regional Benefits

The local and regional benefits associated with the catchment diversion are summarised in Table 7.

Table 7 Local and Regional Benefits of the Catchment Diversion

Category	Local Benefits (within the Hazelwynde development)	Regional Benefits
Economic	Integrated water approaches to stormwater, consisting of stormwater harvesting, treatment and recycling generate significantly greater environmental, amenity and economic benefits relative to the no diversion scenario. Exploration of the transfer of DSS flood and water quality savings from the Taylors Creek catchment would make the diversion infrastructure significantly more attractive.	Consolidation of the Northern Hwy and Cameron's Lane retarding basins into a single RB – better value for money from a DSS perspective.
Environmental	More stormwater to support the creation of waterways, wetlands and green spines that provide enhanced ecological benefits. This additional supply of stormwater allows for larger and more engaged wetlands and thriving landscapes (water balance to confirm exact benefit with/without a portion of Taylors Creek baseflow). Specifically these benefits include 1. Cooler landscape from an UHI perspective. 2. Higher quality passive/active open spaces. 3. The creation and support for higher value waterways, wetlands and indigenous vegetation providing new habitat for birds, macroinvertebrates, frogs etc.) 4. Enhanced urban food forest initiatives/opportunities.	By diverting 70% of flows from the Taylors Creek into the Mandalay Creek catchment allows for consolidating of IWM/WSUD initiatives on the Hazelwynde and Kalkallo RB sites so that the Healthy Waterway Strategy Upper Merri Creek Ecological Targets can be met (technical and economic feasibility to be confirmed in subsequent stage of this assessment). The diversion allows for a consolidating of stormwater initiatives to occur either at Hazelwynde or Kalkalo Creek RB to deliver on MW's commitment to reduce the quantity and improve the quality of stormwater that enters the Merri Creek under future developed conditions to more closely mimic natural conditions. These initiatives help preserve stream condition (form, vegetation conditions etc) and maintains or enhances habitat for birds, macroinvertebrates, frogs etc.
Social	More stormwater to support the creation of waterways, wetlands and green spines that provide enhanced liveability/amenity/connection to nature social benefits. This additional supply of stormwater allows for larger and more engaged wetlands and thriving landscapes (water balance to confirm exact benefit with/without a portion of Taylors Creek baseflow).	More stormwater for reuse on the landscape at Kalkallo – greening, amenity and contributing to urban cooling (detailed water balance to confirm exact benefit with/without a portion of Taylors Creek baseflow).

10.5 Trade-Offs Associated with the Implementation of the Diversion and Broader WSUD Initiatives

The trade-off's associated with the diversion and proposed WSUD are summarised below in Table 8.

Table 8 Trade-Offs

Category	Trade-Off Considerations	Influencing Factors
Diversion	Waterway v Pipe	Cost
		Land available for amenity/other uses
		Distribution of water in the broader development landscape
		Ecological requirements and objectives (i.e. creation of biodiversity corridors and habitat in certain parts of the site)
Wetlands	Distributed v End Line Wetlands	Land take efficiencies
		Operational efficiencies
		Lifecycle costs associated with distributed v end of line wetlands
		Diversifying treatment train
		Distribution of water in the broader development landscape
		Ecological requirements and objectives (i.e. creation of biodiversity corridors and habitat in certain parts of the site)
Tree Pits	Tree Pits v Wetlands	Desire for Passive Irrigation of Trees
		Alignment with Council's WSUD strategies and willingness to maintain distributed tree pits
		Alignment with Urban Heat Island objectives
		Desired mix of street trees relative to wetlands to achieve desired level of service
		Land available to achieve higher levels of service (BPEM+ and MW HWS targets)
		Lifecycle costs associated with tree pits relative to wetlands
		Amenity/liveability/biodiversity benefits of street trees

10.6 Meeting YVW's Targets

At this stage of the assessment, it is too early to say whether the YVW's interim targets are appropriate. Further work is required to confirm that the following targets are technically and economically feasible:

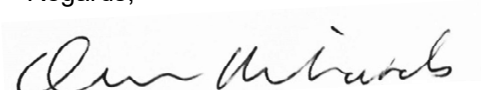
- Hazelwynde will be net positive with the use of potable water;
- Maintain natural water way by reducing urban runoff beyond the baseline;
- Nutrient discharges from stormwater and treated effluent from the site are reduced by 90%;
- Potable water demand of less than 100 litres per person, per day; and
- The urban heat island effect is reduced so that Hazelwynde will be at least 5 degrees cooler than surrounding suburbs (such as Craigieburn).

11 Next Steps

The proposed next steps are:

- Discuss the findings of this initial assessment of selected scenarios with a range of key stakeholders;
- More detailed water balance assessment of the diversion/non-diversion scenarios to better quantify the benefits of the drainage diversion from a water in the landscape, wetland engagement and stormwater harvesting perspective. This should consider whether a portion of baseflows in Taylors creek could also be diverted into the Kalkallo Creek catchment;
- Assess the feasibility of achieving more progressive nutrient and waterway flow regime targets in accordance with the Upper Merri Creek targets articulated in MW's Healthy Waterway Strategy;
- Assess the feasibility of stormwater to potable (as per YVW's request for this to be prioritised); and
- Assess the feasibility of achieving the interim YVW potable, treated effluent and UHI targets.

Regards,



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Yarra Valley Water Corporation

Beveridge Northwest Land Development
Geotechnical Investigation Report (Stage 1)

August 2019

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Appendices

1. Introduction

1.1 General

GHD Ltd Pty (GHD) has been engaged by Yarra Valley Water (YVW) to provide engineering services for the Beveridge Northwest Land Development Project ('the Site') located in Beveridge, Victoria. As part of the appointment, a two stage geotechnical site investigation was proposed to assist with the development works at the Site.

It was identified during the scope preparation phase that the development works that require geotechnical input comprising:

- The creation of wetlands within a retarding basin that is fed by Mandalay Creek, and located close to Camerons Lane.
- The creation of wetlands, located at the confluence of Kalkallo Creek and an unnamed tributary.
- The construction of a diversion channel from a watercourse associated with Duke Street Drain, to the north of the site, and Mandalay Creek, at a location approximately in the centre of the site.
- The channelizing of existing seasonal water courses within the eastern half of the site.
- General development throughout the site.

1.2 Geotechnical Scope of Works (Stage 1)

The Stage 1 investigations was undertaken by GHD in July 2019 with the results presented in this report.

Broadly, the following scope of works was performed for Stage 1:

- Review of background geological and geotechnical information;
- Management and co-ordination of field works;
- Drilling of nine (9) geotechnical at the location of the wetlands and diversion channel;
- Installation of groundwater monitoring wells in selected boreholes;
- Geotechnical laboratory testing on soil and rock samples; and
- Preparation of a geotechnical investigation report (the report).

This report presents the findings of the Stage 1 investigation works, with the Stage 2 works anticipated to be completed in the latter part of 2019.

1.3 Limitations

This report: has been prepared by GHD for Yarra Valley Water Corporation and *may only be used and relied on by Yarra Valley Water Corporation for the purpose agreed between GHD and Yarra Valley Water Corporation as set out Section 1.3 of this report.*

GHD otherwise disclaims responsibility to any person other than Yarra Valley Water Corporation arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

Investigations undertaken in respect of this report are constrained by the particular site conditions, such as the location of buildings, services and vegetation. As a result, not all relevant site features and conditions may have been identified in this report.

Site conditions (including the presence of hazardous substances and/or site contamination) may change after the date of this Report. GHD does not accept responsibility arising from, or in connection with, any change to the site conditions. GHD is also not responsible for updating this report if the site conditions change.

2. Site Setting

2.1 Site Location and Features

The site is located in Beveridge, a small township approximately 42 km north of Melbourne along the Hume Highway. The main site features are:

- The project study area ('the Site') comprises a parcel of land (approximately 1056 ha), bounded by Camerons Lane to the south, Old Sydney Road to the west, Hume Freeway to the east and pastoral fields to the north.
- The Site is currently occupied by grassed paddocks with residential development to the south of Camerons Lane.
- The Site topography varies in surface elevation of between approximately 260 and 360 m AHD. In the northwest and centre of the site, the land slopes down to Kalkallo and Mandalay Creeks and tributaries with the creeks flowing from north to south.
- Mount Fraser and Springs Hill form prominent topographic features in an otherwise gentle site topography.

2.2 Geological Setting

The surface geology of the site is provided on the 1:50,000 Kilmore Geology Map (Geological Survey of Victoria , 1991), with an extract provided in Figure A1 of Appendix A.

The site area is located between the Newer Volcanics Mount Fraser eruption point and an elevated north-south trending corridor of exposed Silurian age Kilmore Siltstone. Quaternary age alluvial deposits are shown near the contact between the basalt flow and elevated bedrock areas. Table 1 provides a brief description of the key geological units indicated to be present across the site area.

Table 1 Geological stratigraphy

Stratum (unit)	Composition	Age	Depositional environment
Alluvial Terrace (Qpj)	Alluvial flood plain deposits: Silt, sand, gravel; red silt probably with coarser sediments in subsurface.	Late Pleistocene to early Holocene	Alluvial
Gully Alluvium (Qpc)	Gully alluvium, hillwash and fan deposits: Various mixtures of gravel, sand, silt, and clay, poorly sorted, poorly rounded.	Early to late Pleistocene	Alluvial and colluvium
Newer Volcanics (Qvn)	Basalt flows: Dominantly olivine basalt but includes mafic to intermediate types; generally vesicular, but may be strongly weathered.	Pliocene	Extrusive volcanic
Kilmore Siltstone (Smk)	Siltstone, dark grey-green, medium to thick-bedded, with regular interbedded thin to very thin beds of fine sandstone.	Late Silurian	Shallow marine

3. Geotechnical Site Investigation

3.1 Stage 1 Geotechnical Investigation

The Stage 1 investigation was completed between 3 and 5 July 2019 and comprised the drilling of nine geotechnical boreholes (designated as BH01 to BH09) to a maximum depth of 6.3 m below ground level (bgl). Groundwater monitoring standpipes were also installed in two of the boreholes. The approximate location of the boreholes is presented on the Site Location Plan, Figure A2 in Appendix A of this report.

'Dial-Before-You-Dig' plans and excavation permits were acquired by GHD prior to drilling and on-site service clearance work was completed by a licenced service location subcontractor with any detected underground services marked out prior to commencement of drilling. Following the service detection process, the borehole positions were then set out and recorded using a handheld GPS. Borehole coordinates were not recorded at BH07 position.

All boreholes were drilled using a truck mounted Edson 100 drilling rig, owned and operated by Walsh Drilling and Grouting. Solid flight auger (SFA) drilling was used to advance the boreholes to effective refusal, prior to rock coring which was undertaken using rotary diamond coring techniques adopting a NMLC size core barrel.

All boreholes were supervised on a full time basis by a GHD geotechnical engineer who logged the soil profile and core recovered from the boreholes with reference to GHD's standard logging guidelines, which are in general accordance with AS 1726-2017 ('Geotechnical site investigations') (Australian Standards Limited, 2017). The borehole logs and core photos are presented in Appendix B. The borehole logs should be read in conjunction with our General Notes and Standard Sheets (also presented in Appendix B), which outlines the terms and symbols used, along with providing a discussion of the limitations of the logging process.

On completion of boreholes BH01 and BH04, 50 mm diameter groundwater monitoring wells were installed, with the screened depth ranges described in Table 2. The remaining boreholes were backfilled with a bentonite and drilling spoil. The borehole details, including available coordinates as determined with a handheld GPS unit and termination depths are presented in Table 2.

Table 2 Stage 1 borehole locations

Exploratory hole ID	Site	MGA94 Grid Reference Zone 55		Termination Depth (m bgl)	Standpipe Installation Response Zone (m bgl)
		Northing	Easting		
BH01	Camerons Lane Wetland	5851421	318977	6.0	3 – 6
BH02		5851436	319081	6.2	-
BH03		5851547	319152	4.6	-
BH04	Kalkallo Creek Wetlands	5852990	318111	6.3	3.3 – 6.3
BH05		5853062	318072	4.15	-
BH06		5853121	318113	4.35	-
BH07	Diversion Channel	Not recorded		6.2	-
BH08		5853693	319292	6.2	-
BH09		5854088	319348	6.1	-

3.2 In Situ Testing

Standard Penetration Testing (SPT) was competed at 1 m intervals in boreholes during drilling in the soil profile. Disturbed samples were taken from the SPT split spoon sampler for logging purposes as well as subsequent laboratory testing.

The SPT results are presented on the borehole logs in Appendix B. In general, the SPT 'N' values in the gully alluvium/residual soils ranged from 6 to 30 (11 tests) and the three tests in the Kilmore Siltstone strata yielded N values ranging from 30 to R (refusal).

3.3 Geotechnical Laboratory Testing

Selected soil and rock samples collected from the boreholes were submitted to GHD's NATA accredited laboratory in Traralgon, Victoria, and Bamford Rock Testing Services (BRTS) in Melbourne for geotechnical testing in general accordance with AS 1289-2000 (Testing of soils for engineering purposes) and AS 4133 (Methods of testing rock for engineering purposes).

A summary of the geotechnical laboratory test schedule is presented in Table 3.

Table 3 Geotechnical Laboratory Testing

Laboratory Test	Geological Formation and Number of Tests Conducted		
	Gully Alluvium / residual soil	Newer Volcanics	Kilmore Siltstone
Moisture Content	10	-	-
Atterberg Limits	10	-	-
Particle Size Distribution	7	-	-
Hydrometer Analysis	7	-	-
Linear Shrinkage	10	-	-
Emerson Class	10	-	-
Specific Gravity	1	-	-
Uniaxial Compressive Strength (UCS)	-	1	-
Point Load Index Test (PLT)	-	8	2

4. Ground Conditions

4.1 Ground Model

The following generalised subsurface profiles have been developed based on the boreholes drilled as part of the Stage 1 investigations, with a separate ground model developed for each project area. A more detailed description of each of the units is provided in Table 4.

It is noted that the topsoil layer has been excluded from the models presented below and the details of the topsoil layer is presented on the borehole logs in Appendix B.

Table 4 Generalised ground models

Unit	Soil/Rock Description	Depth to top of layer (m bgl)	Depth to base of layer (m bgl)	Encountered Thickness (m)
Camerons Lane Wetlands (BH01-BH03)				
1a	**Clay,** stiff to very stiff *(residual soils)*	0	0.6 – 1.1	0.6 – 1.1
2	**BASALT,** high to very high strength, variably weathered XW basalt layer recovered as Clayey GRAVEL[1] *(Newer Volcanics Basalt)*	0.6 – 1.1 (1.0 – 4.2)	Not encountered	3.6 – 5.4 (0.3 – 2.2)
Kalkallo Creek Wetlands (BH04-BH06)				
1b	**Clay/Sandy Clay,** stiff to very stiff *(alluvial soils / residual soil)*	0	4 – 6	4 – 6
3	**Clayey Sand / Silty Sand,** dense *(XW Kilmore Siltstone)*	4 – 6	Not encountered	0.1 – 0.3
Diversion Channel (BH07-BH09)				
1a	**Clay,** firm *(possible fill / residual soil)*	0	0.9 – 3.9	0.9 – 3.9
2	**BASALT,** high to very high strength, slightly weathered to fresh rock *(Newer Volcanics Basalt)*	0.9 – 2.3	Not encountered	3.8 – 5.3
3	**Siltstone,** medium to high strength *(HW-MW Kilmore Siltstone)*	3.9	Not encountered	2.3

[1] Extremely Weathered (XW) rock, described and expected to behave with soil like properties (AS 1726)

Unit 1 Residual / Possible Alluvial / Possible Fill Soils

Unit 1 is a combined unit of residual, possible fill, and alluvial soil and was encountered as firm to very stiff clay and sandy clay soils with SPT N-values ranging from 6 to 30 (average value of 17).

Unit 2 Newer Volcanics Basalt

The Newer Volcanics were encountered at the Camerons Lane Wetland and Diversion Channel areas, and was typically described as high to very high strength, slightly to fresh weathered, vesicular Basalt.

The basalt encountered at the Cameron Lane project area differed from the typical description above, in that at the top (BH03), and base (BH01 and BH02) of the fresh to slightly weathered vesicular basalt there is a thin layer (0.3 to 2.2 m thickness) of extremely weathered basalt described as Clayey GRAVEL. The basalt at Cameron Lane had more defects than that encountered along the diversion creek alignment.

Unit 3 Kilmore Siltstone

The siltstone material of the Kilmore Siltstone unit was recovered during the drilling of borehole BH07 and was encountered as medium to high strength rock with minimal jointing. The siltstone was observed to be overlain by residual soils of typically clay and clayey sand.

4.2 Groundwater Conditions

During the Stage 1 investigation, groundwater was not encountered within the soil profile. Coring techniques were utilised within the rock profile which required the introduction of water/fluid to aid drilling and therefore restricted the opportunity for groundwater observations.

As detailed above, groundwater monitoring wells were installed in boreholes BH01 and BH04.

The groundwater level was measured in the standpipe installed in BH01 at 2.3 m bgl following the completion of drilling (5 July 2019). Borehole BH04 was measured as ‘dry’ to 6.3 m bgl when dipped on the same date.

5. Laboratory Test Results

Table 5 and Table 6 provide a summary of the laboratory testing completed on the soil and rock samples, respectively. Laboratory testing certificates are provided in Appendix C of this report.

Table 5 Geotechnical soil laboratory test results

Borehole ID:	BH04			BH05			BH06		BH07		BH07	
Depth:	1.0 m	3.0 m	6.0 m	1.0 m	1.0 m	4.0 m	1.0 m	4.0 m	1.0 m	2.5 m	1.0 m	2.0 m
Soil Description	CLAY trace sand (CI)	-	-	CLAY trace Sand (CH)	CLAY trace Sand (CH)	-	-	Sandy CLAY (CL)	CLAY trace Sand (CH)	-	-	CLAY trace Sand (CH)
Field moisture content (%)	18.3	18.4	-	26.9	26.9	-	19.7	11.9	26.9	16.7	28.7	32.1
Liquid limit (%)	42	49	-	75	75	-	58	31	75	34	70	80
Plasticity index (%)	27	32	-	54	54	-	39	17	54	21	51	60
Linear shrinkage (%)	12.5	14.5	-	18.0	18.0	-	14.5	9.0	18.0	8.0	19.5	20.0
Emerson Class Number	1	1	-	1	1	-	1	1	1	1	1	1
Specific Gravity (g/cm^3)	-	-	2.61	-	-	-	-	-	-	-	-	-
Percentage clay (%)	45	-	32	61	61	19	-	30	61	-	-	63
Percentage silt (%)	47	-	45	35	35	26	-	29	35	-	-	36
Percentage sand (%)	8	-	23	4	4	53	-	40	4	-	-	1
Percentage gravel (%)	-	-	-	-	-	2	-	1	-	-	-	-

Table 6 Geotechnical rock laboratory test results

Borehole ID:	BH01			BH02		BH03	BH07		BH08	BH09	
Depth (m):	1.25 to 1.45	1.45 to 1.55	4.07 to 4.12	2.53 to 2.6	5.3 to 5.4	3.43 to 3.48	4.25 to 4.37	5.45 to 5.6	1.2 to 1.3	3.1 to 3.2	4.0 to 4.1
Rock Type	Basalt	Basalt	Basalt	Basalt	Basalt	Basalt	Siltstone	Siltstone	Basalt	Basalt	Basalt
Weathering[2]	SW-FR	SW-FR	HW	FR	HW	HW	HW-MW	HW-MW	SW	SW	FR
Is_{50} (MPa) [3]	-	3.52	1.87	2.20	1.63	1.19	0.98	0.68	5.77	4.39	4.94
UCS (MPa) [4]	64.98	-	-	-	-	-	-	-	-	-	-
Strength [1]	Very High	Very High	High	High	High	High	Medium	Medium	Very High	Very High	Very High

Notes:

[1] *Indicative strength based on AS 1726-2017*

[2] *Weathering observations made in the field based on AS 1726-2017*

[3] *Is_{50} = Point Load Index strength*

[4] *UCS = Uniaxial Compressive Strength*

6. Engineering Assessment

6.1 Proposed Works

The geotechnical advice provided in this section relates to the components of the project investigated in Stage 1 including the two basin areas (Camerons Lane Retarding Basin and Kalkallo Creek Wetlands) and the diversion channel.

At the time of preparing this report, details (or drawings) for the development were not available and, as such, the recommendations are based on initial concepts and the GHD Stormwater Management Assessment report (GHD document ref 3134596-LET-C) (Richards, 2019).

It is strongly recommended that as the development progresses, the recommendations provided herein are reviewed and revised by GHD to ensure they are relevant to the proposed scope.

6.2 Diversion Channel

The proposed diversion channel will convey storm water over a distance of approximately 2.5 km in an open channel through the central portion of the site from Taylors Creek to Mandalay Creek. The GHD stormwater management assessment indicates the diversion channel would require an initial cross-section with 1V:4H batters to a depth of 1 m, transitioning to a maximum channel depth of 4.5 m at the high point along the ridge and reducing back to 1 m depth south of the ridge.

6.2.1 Geotechnical Conditions

The investigation works (boreholes BH07 to BH09) only covered that section of channel through the site and did not cover the portion of the channel to the north of the site boundary. It is also noted there is a large farm dam located between BH07 and BH08 (refer Figure A2, Appendix A) and ground conditions at the dam location have not been investigated.

The three boreholes completed for the diversion channel encountered ground conditions as follows:

- BH07 encountered approximately 4 m of stiff residual soils overlying moderately to highly weathered siltstone rock of the Kilmore Siltstone. The tactile assessment and laboratory testing indicates the moderately to highly weathered siltstone is generally of medium to high strength.
- BH08 and BH09 encountered a layer of firm residual clay soils (0.9 and 2.3 m thick) overlying high to very high strength, slightly to fresh weathered basalt with limited jointing.

The regional geology maps indicates the diversion channel to be underlain by basalt of the Newer Volcanics Formation underlain by the basement bedrock (Kilmore Siltstone). The absence of basalt at location BH07 is consistent with the indications on the geology map; which suggests the southern portion of the diversion channel is underlain by the Kilmore Siltstone.

6.2.2 Diversion Channel Geometry and Stability

The concept plans show the diversion channel has a maximum depth of 4.5 m and side batter slopes not exceeding 1V:4H. Within the encountered material (residual clays, basalt and siltstone) these batter angles are considered appropriate provided the following recommendations are adhered to:

- Permanent cut batters in residual, stiff or better, basaltic clays are considered to be stable at 1V:3H provided the slope height does not exceed 3 m, the water table is sufficiently deep (below the toe slope) and there are no surcharge loads at or near the slope crest.

- The dispersion testing (Emerson Class of 1) and reactive nature (liquid limit typically above 70%) of the residual clay soils indicate that any permanent batters in these materials will need erosion protection. The erosion protection can be provided by means of soil treatment or protection by proprietary erosion control products, such as MacMat®R or Concrete Canvas®. The dimensional stability and dispersivity of basaltic clays can be modified (treated) by the addition of hydrated lime of typically 2% to 3% (Peck, Neilson, Olds, & Seddon, 1992); although the optimum lime application rate need to be confirmed by appropriate laboratory testing.
- Permanent batters in the basaltic rock encountered in boreholes BH08 and BH09 may be constructed at gradients steeper than the concept design batters of 1V:4H, and if so, will need to be assessed and confirmed during. construction. The jointing in the basalt will control the achievable 'safe batter angle' and zones of increased fracturing will need to be battered back at shallower angles or may require localised scaling or stabilizing (spot bolting). As well, the use of dynamic, or energetic, excavation methods (such as blasting) may alter the structure and reduce the achievable 'safe batter angle'. An experienced geotechnical practitioner should review the design profile once confirmed.
- Erosion of the basalt is not considered to be an issue, however a clay liner is likely to be required to limit the volume of water lost in the basalt joints; which were generally recorded as being horizontal to sub-horizontal. Comments on clay liners are provided in the General Earthworks Section below (6.5.1).
- The diversion channel is expected to transition from basaltic to siltstone geology between the location of boreholes BH07 and BH08 (a separation distance of approximately 600 m). The exact location and nature of the transition is not known and it is considered likely the basalt will progressively thin out prior to termination and may be quite 'rubbly' and weathered at its termination point. The siltstone material encountered in BH07 will be more erodible than the basalt and may not achieve the same batter angles as the basaltic rock. It is recommended that the upper profile of the siltstone rock is protected from erosion. The current profile near BH07 suggests the channel will be confined to the residual soils and siltstone excavation may be limited.

6.2.3 Diversion Channel Earthworks

The following should be considered in the design of the diversion channel and is based on the current understanding of the alignment and expected channel depths:

- The residual soils are generally firm to stiff and of high plasticity and are likely to be excavated within the operating capacity of typical mechanical excavators. Basaltic clays are often highly fissured and liable to open up with deep cracks when they lose moisture and shrink. Slabs of clay may release from weak surfaces and trimming back excavations can reduce the risk of batter instability.
- The high to very high strength basalt with minimal jointing is considered to be extremely difficult to excavate and significant effort will be require to excavate this material. It is recommended that an experienced contractor is engaged to assist with assessing the most suitable option for excavation. The presence of slightly weathered to fresh rock with wide joint spacing can present problems to hydraulic excavators and rock breakers, and blasting may be required to achieve the required design profile.
- The siltstone material may not require extensive excavation according to the current diversion channel profile. However; any excavation in the medium strength, highly to moderately weathered siltstone may require additional effort including the use of rock breakers or high capacity dozers.

6.3 Kalkallo Creek Wetlands

The GHD stormwater management assessment proposes a single wetland footprint located in the upper reaches of Kalkallo Creek and is expected to be tiered due to the topography.

Details of the depth of the wetlands and cut-fill contours were not available at the time of report preparation and the commentary and recommendations below will need to be reviewed and revised once these details are developed.

6.3.1 Geotechnical Conditions

The three boreholes completed for the Kalkallo Creek Wetlands (BH04 to BH06) encountered a ground profile comprising stiff to very stiff, generally high plasticity clays to a depth of 4 to 6 m overlying extremely weathered siltstone or sandstone of the Kilmore Siltstone geology unit.

6.3.2 Kalkallo Wetland Geotechnical Considerations

The following should be considered in the design and construction of the Kalkallo wetland area and is based on the current understanding of the wetland position:

- The residual soils are generally stiff and of high plasticity and are likely to be excavated within the operating capacity of typical mechanical excavators. The drilling investigation did not penetrate into the underlying rock far enough to make permit a definitive assessment of its excavation characteristics.
- Permanent cut batters in the stiff or better natural clays are considered to be stable at 1V:3H provided the slope height does not exceed 3 m, the water table is sufficiently deep (below the toe slope) and there are no surcharge loads at or near the slope crest. Erosion testing of the soils at the Kalkallo Wetlands area yielded Emerson Class values of 1 (highly dispersive) which suggests mitigation will be required. As above, erosion protection or mitigation can be achieved by means of soil treatment or protection by proprietary erosion control products, such as Grassroots® or Jute matting. A compliant clay liner (refer Section 6.5.1) will function as a liner and erosion protection.

6.4 Camerons Lane Retarding Basin

The GHD stormwater management assessment included a potential general arrangement for the Camerons Lane Wetland / Retarding Basin. The concept provided includes a cut-fill plan which shows an extensive area of cut and areas of fill along the southern edges of the ponds. The GHD assessment indicates the embankment heights will be limited to 1.5 m high. Further details of the basin were not available at the time of preparing this report.

6.4.1 Geotechnical Conditions

The three boreholes completed for the Camerons Lane Retarding Basin (BH01 to BH03) encountered a ground profile comprising stiff to very stiff, high plasticity residual clay soils to a depth of 0.6 to 1.1 m. The residual clays overlie variable weathered and fractured vesicular basalt. The cored section of each boreholes is observed to be highly variable and is likely related to the proximity to the Mount Fraser eruption point. For example, boreholes BH01 and BH02 both comprise an approximately 3 m thick layer of competent basalt which is underlain to base of the borehole by a soil-like material with scoria clasts. Borehole BH03 appears to have encountered scoria clasts and soil with no competent basalt recovered.

A single groundwater measurement in borehole BH01 indicated a water table at 2.3 m bgl; however it must be borne in mind that groundwater levels will fluctuate seasonally.

6.4.2 Camerons Lane Retarding Basin Geotechnical Considerations

The following should be considered in the design and construction of the Camerons Lane Retarding Basin and is based on the current understanding of the wetland position:

- The residual soils at the Camerons Lane area are approximately 1 m thick and are generally stiff and of high plasticity and are likely to be excavated within the operating capacity of typical mechanical excavators. Excavations below the groundwater table should be carefully considered and less stable excavation conditions can be expected.
- The high to very high strength competent basalt encountered in the upper portions of boreholes BH01 and BH02 will be difficult to excavate and significant effort will be required to undertake excavations in this material. It is recommended that an experienced contractor is engaged to assist with assessing the most suitable option for excavation. The use of rock breakers or a suitable capacity dozer(s) is likely to be required. The scoria material appears to be within a soil matrix and it may be possible that for this material rock breaking is not required and a suitable capacity excavator, with ripper or rock bucket, may be sufficient. The depth of required excavation into rock material for the retarding basin was not known at the time of report preparation.
- Permanent batters in the stiff or better clays are considered to be stable at 1V:3H provided the slope height does not exceed 3 m, the water table is sufficiently deep (below the toe slope) and there are no surcharge loads at or near the slope crest. The residual soils are likely to be high dispersive and erosion mitigation will be required. The erosion protection or mitigation can be achieved by means of soil treatment or protection by proprietary erosion control products, such as Grassroots® or Jute matting. A compliant clay liner (refer Section 6.5.1) will function as a liner and erosion protection.
- The excavated material may be suitable as a clay liner provide it is treated as per the guidance below. Basin floors within the basalt will need to be lined due to the high fractured and variable nature of the basalt encountered at this location.

The formation of bunds and embankments using excavated soil material is appropriate provided the following is adhered to:

- The material adopted should be free of topsoil, tree roots and organic matter and compacted to achieve a minimum dry density ratio of 95% relative to standard compaction.
- The material excavated is likely to be highly erosive and reactive and should be protected, by encapsulation for example, from erosion and excessive moisture fluctuations. As a minimum the material should be compacted at 95% of Standard Maximum Dry Density (SMDD) at a moisture content of 0 to 2% wet of Optimum Moisture Content (OMC) and protected by a stabilised (non-reactive and non-erosive) clay cap, or other approved erosion protection product. All material to be re-used for embankment construction should be approved by an experienced geotechnical practitioner on-site who should also be involved in the development of the project Technical Specification.

6.5 General Earthworks Considerations

Earthworks should be undertake in general accordance with AS 3798-2007 (Australian Standards Limited, 2007).

6.5.1 Channel and Pond Lining

To achieve the objectives of a suitable clay liner, the following requirements are to be met:

- Clay liner material should have an Emerson Class > 4 and liquid limit of between 30 and 60% (as per Victorian EPA guidance). The material encountered during the investigation does not meet this criteria and imported clay material, geo-synthetic clay liner (GCL) or soils stabilisation (hydrated lime) is required. The addition of lime will reduce reactivity and help mitigate dispersion. It is critical that the correct amount of lime is added, utilising formal lime stabilisation plant. If too much lime is added the soil will become brittle and crack and if too little lime is added, the material will fail to achieve the desired design objectives. As such, lime demand testing will need to be completed prior to construction to assess the appropriate amount of lime required, which is typically in the order of 2 to 4% by dry weight. Emerson tests should be conducted on lime treated material to assess the residual risk of erosion on the treated soil.
- Good subgrade preparation is necessary to provide a sound and stable base for liner construction. Topsoil and organic material should be removed and the subgrade should be compacted to a minimum of 95% of SMDD to a minimum depth of 150 mm.
- The material adopted for the clay liner should be free of topsoil, tree roots and organic matter and compacted to achieve a minimum of 98% of SMDD at a moisture content of OMC to OMC+3%. The compacted clay liner must have a minimum thickness of 300 mm and be constructed in two layers of 150 mm each following compaction with an in-situ co-efficient of permeability of less than 1×10^{-9} m/s. An effective bond should be created between successive layers by scarification.
- A GCL (if adopted) must be installed in accordance with the manufacture's Specifications and will need to be anchored at the top of the batters and protected from damage by a compacted soil layer.

6.5.2 Site Trafficability

The clay horizons encountered are highly plastic and are subject to volume change and softening with changes in moisture content and are considered difficult to work. It is expected that it will be necessary to construct access tracks on the site using road base type materials. Details of the proposed approach for temporary access tracks should be sought from the Contractor prior to commencement of any works.

6.5.3 Protection of Earthworks

The site soils were determined to be highly dispersive and any exposed or de-vegetated areas are likely to be prone to relatively rapid erosion by surface water runoff. In order to manage this, it is recommended that:

- De-vegetation of the site be kept to a minimum practicable level.
- Where de-vegetation is necessary, drainage measures be put in place to manage and control surface runoff and surface protection measures are implemented.

The specification for the works will place the responsibility for the protection of any exposed areas to the Contractor, as is typical for such a project.

6.5.4 Geotechnical Site Verification

A number of items will require site verification and it is important these inspection or verification points are included in the project documentation including drawings and specifications. A suitably experienced geotechnical practitioner should be engaged in the process of witnessing critical inspection and hold points, with this work ideally performed under Level 1 supervision as per AS 3798-2007.

6.6 Plan Review

As development plans are subject to change, we consider it important that we are given the opportunity to review the drawings as they evolve to ensure recommendations relating to site development are in accordance with this report and have been interpreted as intended.

6.7 Stage 2 Investigations

The scope of the Stage 2 geotechnical investigations should be reviewed and refined following the findings of this report and further design development. The stabilisation of excavated material using lime should also be further explored to limit the importation of clay liner material.

7. References

Australian Standards Limited. (2000). *Methods for testing soils for engineering purposes AS 1289.0-2000.* Sydney: SAI Global Limited.

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Australian Standards Limited. (2007). *Methods of testing rocks for engineering purposes Rock strength tests AS 4133.4.2.1:2007.* Sydney: SAI Global Limited.

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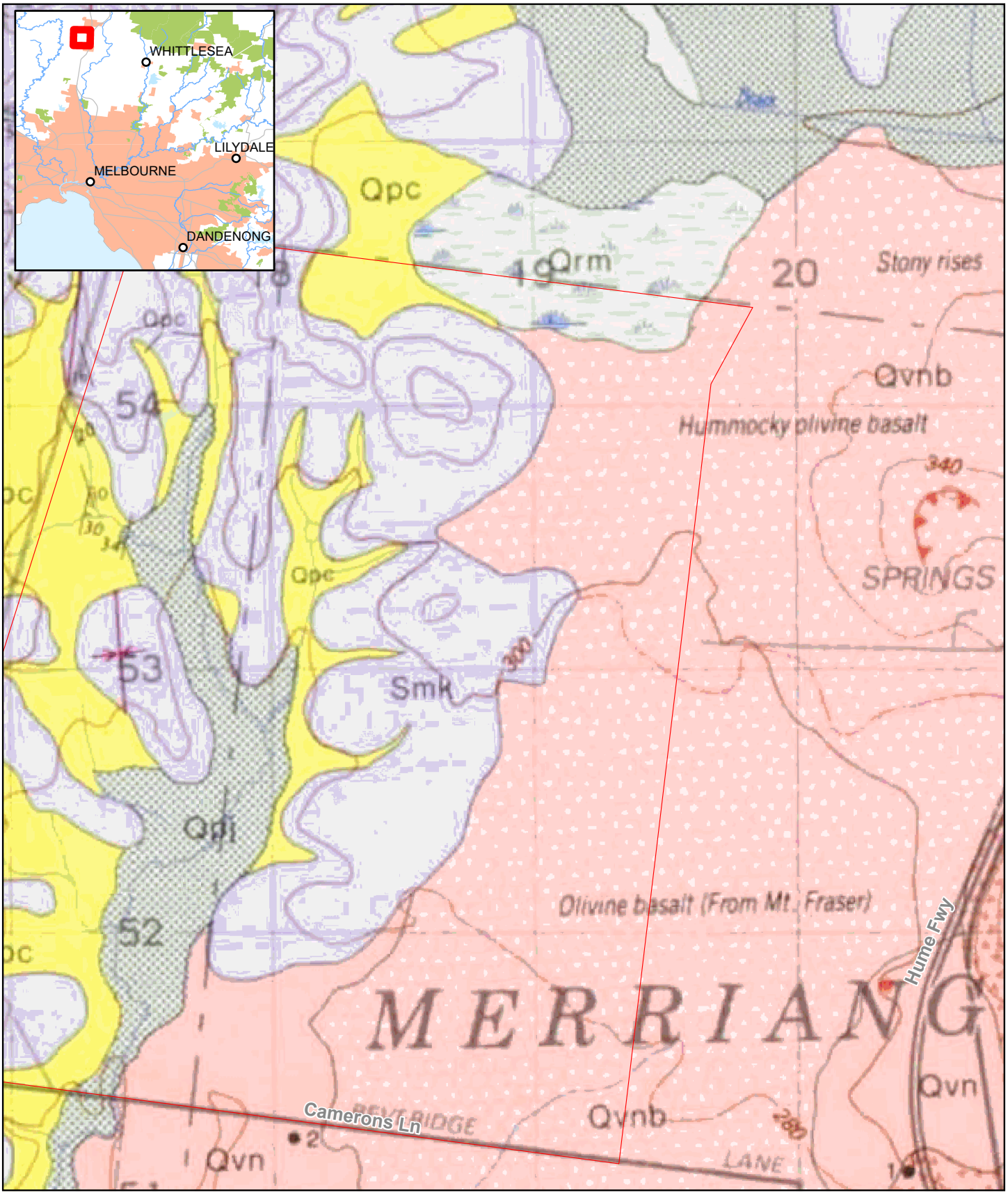
Peck, W. A., Neilson, J. L., Olds, R. J., & Seddon, K. D. (1992). *Engineering Geology of Melbourne.* Rotterdam: AA Balkema.

Richards, O. (2019). *Beveridge North West Land Development Project.* GHD Pty Ltd.

Appendices

Appendix A – Figures



Site boundary

Paper Size A4
0 200 400
Metres
Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

GHD

Yarra Valley Water Corporation
Beveridge Northwest Land Development

Geological Map Series (1:50,000)
Kilmore, Geological Excerpt

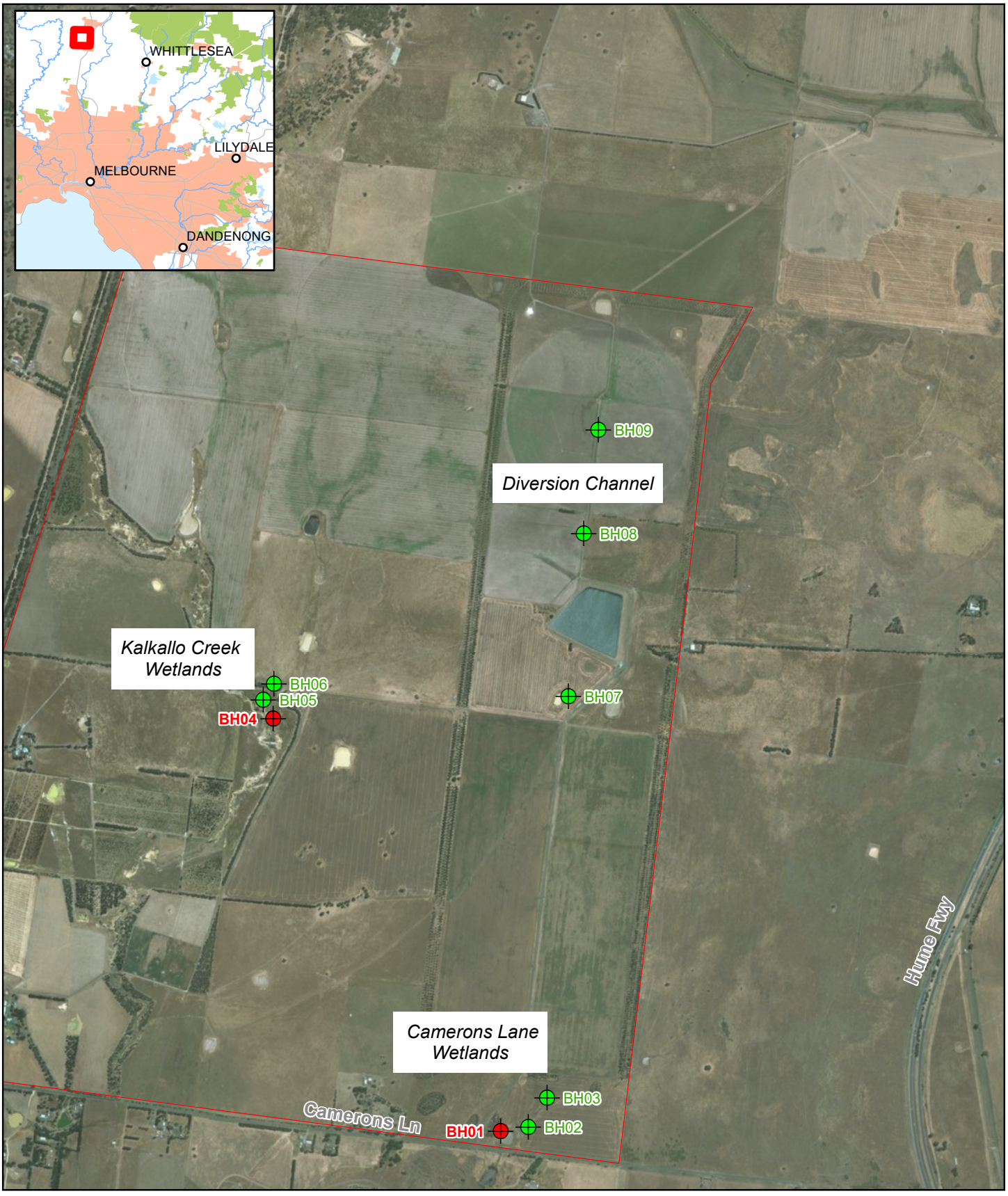
Job Number 31-34596
Revision A
Date 21 Aug 2019

Figure A1

180 Lonsdale Street Melbourne VIC 3000 Australia T 61 3 8687 8000 F 61 3 8687 8111 E melmail@ghd.com W www.ghd.com

\\ghdnet\ghd\AU\Melbourne\Projects\31\34596\GIS\Maps\Working\31-34596_01_Geologicalmap_A4P_RevA.mxd

Data source: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community. Created by:ajwilson



Stage 1 Borehole locations

Stage 1 Borehole locations with standpipe monitoring wells

Site boundary

Paper Size A4

0 200 400

Metres

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

N

GHD

Yarra Valley Water Corporation
Beveridge Northwest Land Development

Site Investigation Location Plan - Stage 1

Job Number 31-34596
Revision C
Date 21 Aug 2019

Figure A2

180 Lonsdale Street Melbourne VIC 3000 Australia T 61 3 8687 8000 F 61 3 8687 8111 E melmail@ghd.com W www.ghd.com

\\ghdnet\ghd\AU\Melbourne\Projects\31\34596\GIS\Maps\Working\31-34596_01_ProposedLocations_A4P_RevC.mxd

Data source: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community. Created by:ajwilson

Appendix B – Borehole Logs

GENERAL NOTES

GHD
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The report contains the results of a geotechnical investigation or study conducted for a specific purpose and client. The results may not be used or relied on by other parties, or used for other purposes, as they may contain neither adequate nor appropriate information. In particular, the investigation does not cover contamination issues unless specifically required to do so by the client.

To the maximum extent permitted by law, all implied warranties and conditions in relation to the services provided by GHD and the report are excluded unless they are expressly stated to apply in the report.

TEST HOLE LOGGING

The information on the test hole logs (boreholes, test pits, exposures etc.) is based on a visual and tactile assessment, except at the discrete locations where test information is available (field and/or laboratory results). The test hole logs include both factual data and inferred information. Moreover, the location of test holes should be considered approximate, unless noted otherwise (refer report). Reference should also be made to the relevant standard sheets for the explanation of logging procedures (Soil and Rock Descriptions, Core Log Sheet Notes etc.).

GROUNDWATER

Unless otherwise indicated, the water depths presented on the test hole logs are the depths of free water or seepage in the test hole recorded at the given time of measuring. The actual groundwater depth may differ from this recorded depth depending on material permeabilities (i.e. depending on response time of the measuring instrument). Further, variations of this depth could occur with time due to such effects as seasonal, environmental and tidal fluctuations or construction activities such as a change is ground surface level. Confirmation of groundwater levels, phreatic surfaces or piezometric pressures can only be made by appropriate surveys, instrumentation techniques and monitoring programmes.

INTERPRETATION OF RESULTS

The discussion or recommendations contained within this report normally are based on a site evaluation from discrete test hole data, often with only approximate locations (e.g. GPS). Generalised, idealised or inferred subsurface conditions (including any geotechnical cross-sections) have been assumed or prepared by interpolation and/or extrapolation of these data. As such these conditions are an interpretation and must be considered as a guide only.

CHANGE IN CONDITIONS

Local variations or anomalies in ground conditions do occur in the natural environment, particularly between discrete test hole locations or available observation sites. Additionally, certain design or construction procedures may have been assumed in assessing the soil-structure interaction behaviour of the site. Furthermore, conditions may change at the site from those encountered at the time of the geotechnical investigation through construction activities and constantly changing natural processes.

Any change in design, in construction methods, or in ground conditions as noted during construction, from those assumed or reported should be referred to GHD for appropriate assessment and comment.

GEOTECHNICAL VERIFICATION

Verification of the geotechnical assumptions and/or model is an integral part of the design process - investigation, construction verification, and performance monitoring. Variability is a feature of the natural environment and, in many instances, verification of soil or rock quality, or foundation levels, is required. There may be a requirement to extend foundation depths, to modify a foundation system and/or to conduct monitoring as a result of this natural variability. Allowance for verification by appropriate geotechnical personnel must be recognised and programmed for construction.

FOUNDATIONS

Where referred to in the report, the soil or rock quality, or the recommended depth of any foundation (piles, caissons, footings etc.) is an engineering estimate. The estimate is influenced, and perhaps limited, by the fieldwork method and testing carried out in connection with the site investigation, and other pertinent information as has been made available. The material quality and/or foundation depth remains, however, an estimate and therefore liable to variation. Foundation drawings, designs and specifications should provide for variations in the final depth, depending upon the ground conditions at each point of support, and allow for geotechnical verification.

REPRODUCTION OF REPORTS

Where it is desired to reproduce the information contained in our geotechnical report, or other technical information, for the inclusion in contract documents or engineering specification of the subject development, such reproductions must include at least all of the relevant test hole and test data, together with the appropriate Standard Description sheets and remarks made in the written report of a factual or descriptive nature.

Ref: DS5.5.1 Issue 0 Date: 05/10/2018

SOIL DESCRIPTION AND CLASSIFICATION

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www.ghd.com/Geotechnical

Soil is described in general accordance with Australian Standard AS 1726-2017 (Geotechnical Site Investigations) in terms of visual and tactile properties, with potential refinement by laboratory testing. AS 1726 defines soil as particulate materials that occur in the ground and can be disaggregated or remoulded by hand in air or water without prior soaking. Classification of the soil is undertaken following description.

SOIL DESCRIPTION

The soil description includes a) Composition, b) Condition, c) Structure, d) Origin and e) Additional observations. 'FILL', 'TOPSOIL' or a 'MIXTURE OF SOIL AND COBBLES / BOULDERS' (with dominant fraction first) is denoted at the start of a soil description where applicable.

a) Soil Composition (soil name, colour, plasticity or particle characteristics, secondary and then minor components)

Soil Name: A soil is termed a *coarse grained soil* where the dry mass of sand and gravel particles exceeds 65% of the total. Soils with more than 35% fines (silt or clay particles) are termed *fine grained soils*. The soil name is made up of the primary soil component (in BLOCK letters), prefixed by applicable secondary component qualifiers. Minor components are applied as a qualifiers to the soil name (using the words 'with' or 'trace').

Particles are differentiated on the basis of size. 'Boulders' and 'cobbles' are outside the soil particle range, though their presence (and proportions) is noted. While individual particles may be designated as silt or clay based on grain size, fine grained soils are characterised as silt or clay based on tactile behaviour or Atterberg Limits, and not the relative composition of silt or clay sized particles.

Colour: The prominent colour is noted, followed by (spotted, mottled, streaked etc.) then secondary colours as applicable. Roughly equally proportioned colours are prefixed by (spotted, mottled, streaked etc.). Colour is described in its moist condition, though both wet and dry colours may also be provided if appropriate.

Plasticity: Fine grained soils are designated within standard ranges of plasticity based on tactile assessment or laboratory assessment of the Liquid Limit.

Particle Characteristics: The particle shape, particle distribution and particle size range within a coarse grained soil is described using standard terms. Particle composition may be described using rock or mineral names, with specific terms for carbonate soils.

Secondary and Minor Components: The primary soil is described and modified by secondary and minor components, with assessed ranges as tabulated.

Carbonate Soils: Carbonate content can be assessed by use of dilute '10%' HCl solution. Resulting clear sustained effervescence is interpreted as a *Carbonate soil* (approximately >50% carbonate), while weak or sporadic effervescence indicates *Calcareous soil* (< 50% carbonate). No effervescence is interpreted as a non-calcareous soil.

Organic and Peat Soils: Where identified, organic content is noted. *Organic soil* (2% to 25% organic matter) is usually identified by colour (usually dark grey/black) and odour (i.e. 'mouldy' or hydrogen sulphide odour). *Peat* (>25% organic matter) is identified by a spongy feel and fibrous texture. Peat soils' decomposition may be described as '*fibrous*' (little / no decomposition), '*pseudo-fibrous*' (moderate decomposition) or '*amorphous*' (full decomposition).

Fraction	Components		Particle Size (mm)
Oversize	BOULDERS		> 200
	COBBLES		63 - 200
Coarse grained soil particles	GRAVEL	Coarse	19 - 63
		Medium	6.7 -19
		Fine	2.36 - 6.7
	SAND	Coarse	0.6 - 2.36
		Medium	0.21 - 0.6
		Fine	0.075 - 0.21
Fine grained soil particles	SILT		0.002 - 0.075
	CLAY		< 0.002

Plasticity Terms (Fine Grained Soils)		Laboratory Liquid Limit Range
Silt	**Clay**	
N/A	N/A	(Non Plastic)
Low Plasticity	*Low Plasticity*	≤ 35%
	Medium Plasticity	> 35% and ≤ 50%
High Plasticity	*High Plasticity*	> 50%

Particle Distribution Terms (Coarse Grained Soils)	
Well graded	good representation of all particle sizes
Poorly graded	one or more intermediate sizes poorly represented
Gap graded	one or more intermediate sizes absent
Uniform	essentially of one size

Particle Shape Terms (Coarse Grained Soils)		
Rounded	*Sub-angular*	*Flaky or Platy*
Sub-rounded	*Angular*	*Elongated*

Secondary and Minor Components for Coarse Grained Soils			
Fines (%)	**Modifier** (as applicable)	**Accessory coarse (%)**	**Modifier** (as applicable)
≤ 5	*'trace silt / clay'*	≤ 15	*'trace sand / gravel'*
> 5, ≤ 12	*'with clay / silt'*	> 15, ≤ 30	*'with sand / gravel'*
> 12	*prefix 'silty / clayey'*	> 30	*prefix 'gravelly / sandy'*

Secondary and Minor Components for Fine Grained Soils	
% Coarse	**Modifier** (as applicable)
≤ 15	add *"trace sand / gravel"*
> 15, ≤ 30	add *"with sand / gravel"*
> 30	prefix soil *"sandy / gravelly"*

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b) Soil Condition (moisture, relative density or consistency)

Moisture: Fine grained soils are described relative to plastic or liquid limits, while coarse grained soils are assessed based on appearance and feel. The observation of seepage or free water is noted on the test hole logs.

Moisture - Coarse Grained Soils

Term		Tactile Properties
Dry	*('D')*	Non-cohesive, free running
Moist	*('M')*	Feels cool, darkened colour, tends to stick together
Wet	*('W')*	Feels cool, darkened colour, tends to stick together, free water forms when handling

Moisture - Fine Grained Soils

Term		Tactile Properties
Moist, dry of plastic limit	*('w < PL')*	Hard and friable or powdery
Moist, near plastic limit	*('w ≈ PL')*	Can be moulded
Moist, wet of plastic limit	*('w > PL')*	Weakened, free water forms on hands with handling
Wet, near liquid limit	*('w ≈ LL')*	Highly weakened, tends to flow when tapped
Wet, wet of liquid limit	*('w > LL')*	Liquid consistency, soil flows

Relative Density (Non Cohesive Soils): The Density Index is inherently difficult to assess by visual or tactile means, and is normally assessed by penetration testing (e.g. SPT, DCP, PSP or CPT) with published correlations. Assessment may be affected by moisture and *in situ* stress conditions. Density Index assessment may be refined by combination of *in situ* density testing and laboratory reference maximum and minimum density ranges.

Consistency (Cohesive Soils): May be assessed by direct measurement (shear vane, CPT etc.), or approximate tactile correlations. Cohesive soils include fine grained soils, and coarse grained soils with sufficient fine grained components to induce cohesive behaviour. A 'design shear strength' must consider the mode of testing, the *in situ* moisture content and potential for variations of moisture which may affect the shear strength.

Relative Density (Non-Cohesive Soils)

Term and (Symbol)		Density Index (%)
Very Loose	*(VL)*	≤ 15
Loose	*(L)*	> 15 and ≤ 35
Medium Dense	*(MD)*	> 35 and ≤ 65
Dense	*(D)*	> 65 and ≤ 85
Very Dense	*(VD)*	> 85

Consistency assessment can be influenced by moisture variation.

Consistency (Cohesive Soils)

Term and (Symbol)		Tactile Properties	Undrained Shear Strength
Very Soft	*(VS)*	Extrudes between fingers when squeezed	< 12 kPa
Soft	*(S)*	Can be moulded by light finger pressure	12 - 25 kPa
Firm	*(F)*	Can be moulded by strong finger pressure	25 - 50 kPa
Stiff	*(St)*	Cannot be moulded by fingers	50 - 100 kPa
Very Stiff	*(VSt)*	Can be indented by thumb nail	100 - 200 kPa
Hard	*(H)*	Can be indented with difficulty by thumb nail	> 200 kPa
Friable	*(Fr)*	Easily crumbled or broken into small pieces by hand	-

c) Structure (zoning, defects, cementing)

Zoning: The *in situ* zoning is described using the terms below. *'Intermixed'* may be used for an irregular arrangement.

'layer' (a continuous zone across the exposed sample)

'lens' (a discontinuous layer with lenticular shape)

'pocket' (an irregular inclusion of different material).

'interbedded' or *"interlaminated'* (alternating soil types)

Defects: Described using terms below, with dimension orientation and spacing described where practical.

'parting' (an open or closed surface or crack sub parallel to layering with little / no tensile strength - open or closed)

'fissure' (as per a parting, though not parallel or sub parallel to layering – may include desiccation cracks)

'sheared seam' (zone of sub parallel near planar closely spaced intersecting smooth or slickensided fissures dividing the mass into lenticular or wedge shaped blocks)

'sheared surface' (a near planar, curved or undulating smooth, polished or slickensided surface, indicative of displacement)

'softened zone' (in clayey soils, usually adjacent to a defect with associated higher moisture content)

'tube' (tubular cavity, singly or one of a large number, often formed from root holes, animal burrows or tunnel erosion)

'tube cast' (an infilled tube – infill may vary from uncemented through to cemented or have rock properties)

'infilled seam' (sheet like soil body cutting through the soil mass, formed by infilling of open defects)

Cementation: Soils may be cemented by various substances (e.g. iron oxides and hydroxides, silica, calcium carbonate, gypsum), and the cementing agent shall be identified if practical. Cemented soils are described as:

'weakly cemented'	easily disaggregated by hand in air or water
'moderately cemented'	effort required to disaggregate the soil by hand in air or water

Materials extending beyond '*moderately cemented'* are encompassed within the rock strength range. Where consistent cementation throughout a soil mass is identified as a duricrust, it is described in accordance with duricrust rock descriptors. Where alternate descriptors of cementation development are applied for consistency with regional practices or geology, or client requirements, these are outlined separately.

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d) Origin

An interpretation is provided based on observations of landform, geology and fabric, and may further include assignment of a stratigraphic unit. The use of terms 'possibly' or 'probably' indicates a higher degree of uncertainty regarding the assessed origin or stratigraphic unit. Typical origin descriptors include:

Residual	Formed directly from in situ weathering with no visible structure or fabric of the parent soil or rock.
Extremely weathered	Formed directly from in situ weathering, with remnant and/or fabric from the parent rock.
Alluvial	Deposited by streams and rivers (may be applied more generically as transported by water).
Estuarine	Deposited in coastal estuaries, including sediments from inflowing rivers, streams, and tidal currents.
Marine	Deposited in a marine environment.
Lacustrine	Deposited in freshwater lakes.
Aeolian	Transported by wind.
Colluvial and Slopewash	Soil and rock debris transported down slopes by gravity (with or without assistance of water). Colluvium is typically applied to thicker / localised deposits, and slopewash for thinner / widespread deposits.
TOPSOIL	Surficial soil, typically with high levels of organic material. Topsoils buried by other transported soils are termed *'remnant topsoil'*. Tree roots within otherwise unaltered soil does not characterise topsoil.
FILL	Any material which has been placed by anthropogenic processes (i.e. human activity).

e) Additional Observations

Additional observations may be included to supplement the soil description. Additional observations may consist of notations relating to soil characteristics (odour, contamination, colour changes with time), inferred geology (with delineation of soil horizons or geological time scale) or notes on sampling and testing application (including the reliability, recovery, representativeness, or condition of samples or test conditions and limitations). If the material is assessed to be not representative, terms such as 'poor recovery', 'non-intact', 'recovered as' or 'probably' are applied.

SOIL CLASSIFICATION

Classification allocates the material within distinct soil groups assigned a two character Group Symbol:

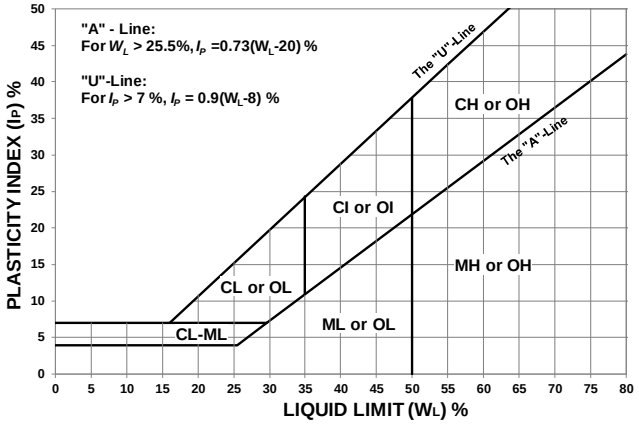
Coarse Grained Soils (sand and gravel: more than 65% of soil coarser than 0.075 mm)		
Major Division	**Group Symbol**	**Soil Group**
GRAVEL (more than half of the coarse fraction is > 2.36 mm)	GW	GRAVEL, well graded
	GP	GRAVEL, poorly graded
	GM	Silty GRAVEL
	GC	Clayey GRAVEL
SAND (more than half of the coarse fraction is < 2.36 mm)	SW	SAND, well graded
	SP	SAND, poorly graded
	SM	Silty SAND
	SC	Clayey SAND

Fine Grained Soils (silt and clay: more than 35% of soil finer than 0.075 mm)		
Major division	**Group Symbol**	**Soil Group**
SILT and CLAY (low to medium plasticity)	ML	SILT, low plasticity
	CL	CLAY, low plasticity
	CI	CLAY, medium plasticity
	OL	Organic SILT
SILT and CLAY (high plasticity)	MH	SILT, high plasticity
	CH	CLAY, high plasticity
	OH	Organic CLAY / SILT
Highly Organic	Pt	PEAT

Coarse grained soils with fines contents between 5% and 12% are provided a dual classification comprising the two group symbols separated by a dash, e.g. for a poorly graded gravel with between 5% and 12% silt fines (poorly graded 'GRAVEL with silt'), the classification is GP-GM.

For the purpose of classification, *poorly graded, uniform,* or *gap graded* soils are all designated as poorly graded. Soils that are dominated by boulders or cobbles are described separately and are not classified.

Classification is routinely undertaken based on tactile assessment with the soil description. Refinement of soil classification may be applied using laboratory assessment, including particle size distribution and Atterberg Limits. Atterberg Limits testing is applied to the sample portion finer than 0.425 mm. Fine grained soil components are assessed on the basis of regions defined within the Modified Casagrande Chart.



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Rock is described in general accordance with Australian Standard AS 1726-2017 (Geotechnical site investigations) in terms of visual and tactile properties, with potential refinement by laboratory testing. AS 1726 defines rock as any aggregate of minerals and/or organic materials that cannot be disaggregated by hand in air or water without prior soaking. The rock description and classification distinguishes between rock material, defects, structure and rock mass.

ROCK DESCRIPTION AND CLASSIFICATION

a) Description of rock material (rock name, grain size and type, colour, texture and fabric, inclusions or minor components, moisture content and durability)

Rock Name: Simple rock names are used to provide a reasonable engineering description rather than a precise geological classification. The rock name is chosen on the basis of origin, with common types summarised below. Additional, non-exhaustive, terminology is included in AS 1726. Rock names not described within AS 1726 may be adopted, with geological characteristics typically noted within accompanying text.

<table>
<tr><th rowspan="2">Grain Size (mm)</th><th colspan="4">Sedimentary</th><th colspan="2">Metamorphic</th><th colspan="3">Igneous</th></tr>
<tr><th colspan="2">Clastic or Detrital</th><th colspan="2">Carbonate</th><th rowspan="2">Pyroclastic</th><th rowspan="2">Foliated</th><th rowspan="2">Non-Foliated</th><th rowspan="2">Felsic</th><th rowspan="2">↔</th><th rowspan="2">Mafic</th></tr>
<tr><th>Low Porosity</th><th>Porous</th></tr>
<tr><td>>2.0</td><td colspan="2">CONGLOMERATE
(rounded grains in a finer matrix)

BRECCIA
(angular or irregular fragments in a finer matrix)</td><td rowspan="4">LIMESTONE
(Predominantly $CaCO_3$)

or

DOLOMITE
(Predominantly $CaMgCO_3$)</td><td>CALCIRUDITE</td><td>AGGLOMERATE
(rounded grains in a finer matrix)

VOLCANIC BRECCIA
(angular fragments in a finer matrix)</td><td>GNEISS</td><td>MARBLE
(carbonate)

QUARTZITE</td><td>GRANITE</td><td>DIORITE</td><td>GABBRO</td></tr>
<tr><td>2.0-0.06</td><td colspan="2">SANDSTONE</td><td>CALCARENITE</td><td>TUFF</td><td>SCHIST</td><td rowspan="3">SERPENTINITE

HORNFELS</td><td>MICRO-GRANITE</td><td>MICRO-DIORITE</td><td>DOLERITE</td></tr>
<tr><td>0.06-0.002</td><td rowspan="2">MUDSTONE
(silt and clay)</td><td>SILTSTONE
(mostly silt)</td><td>CALCISILTITE</td><td rowspan="2">Fine grained TUFF</td><td rowspan="2">PHYLLITE or SLATE</td><td rowspan="2">RHYOLITE</td><td rowspan="2">ANDESITE</td><td rowspan="2">BASALT</td></tr>
<tr><td><0.002</td><td>CLAYSTONE
(mostly clay)</td><td>CALCILUTITE</td></tr>
</table>

Reproduced with modification from Tables 15, 16 and 17, Clause 6.2.3.1, AS 1726-2017, Geotechnical site investigations.

Grain size: For rocks with predominantly sand sized grains the dominant or average grain size is described as follows:

Rock type	Coarse grained	Medium grained	Fine grained
Sedimentary rocks	Mainly 0.6 mm to 2 mm	Mainly 0.2 mm to 0.6 mm	Mainly 0.06 mm (just visible) to 0.2 mm
Igneous and metamorphic rocks	Mainly >2 mm	Mainly 0.06 mm to 2 mm	Mainly <0.6 mm (just visible)

Colour assists in rock identification and interpolation. Rock colour is generally described in a *"moist"* condition, using simple terms (e.g. grey, brown, etc.) and modified as necessary by *"pale"*, *"dark"*, or *"mottled"*. Borderline colours may be described as a combination of these colours (e.g. red-brown).

Texture refers to the arrangement of, or the relationship between, the component grains or crystals (e.g. porphyritic, crystalline or amorphous).

Fabric refers to visible grain arrangement along a preferential orientation or a layering. Fabric may be noted as *"indistinct"* (little effect on strength) or *"distinct"* (rock breaks more easily parallel to the fabric). Common terms include *"massive"* or *"flow banding"* (igneous), *"foliation"* or *"cleavage"* (metamorphic). Sedimentary layering is described as *"bedding"* or (where thickness < 20 mm) *"lamination"*. The typical orientation, spacing or thickness of these structural features can be described directly in millimetres and metres. Further quantification of bedding thickness applied by GHD is as follows:

Bedding Term	Thickness
Very thickly bedded	>2 m
Thickly bedded	0.6 to 2 m
Medium bedded	0.2 to 0.6 m
Thinly bedded	60 to 200 mm
Very thinly bedded	20 to 60 mm
Laminated	6 to 20 mm
Thinly laminated	<6 mm

Features, Inclusions and Minor Components are typically only described when those features could influence the engineering behaviour of the rock. Described features may include: gas bubbles in igneous rocks; veins of quartz, calcite or other minerals; pyrite crystals and nodules or bands of ironstone or carbonate; cross bedding in sandstone; clast or matrix support in conglomerates and breccia.

Moisture content may be described by the feel and appearance of the rock, as follows: *"dry"* (looks and feels dry), *"moist"* (feels cool, darkened in colour, but no water is visible on the surface), or *"wet"* (feels cool, darkened in colour, water film or droplets visible on the surface). The moisture content of rock cored with water may not represent in situ conditions.

Durability of rock samples is noted where there is an observed tendency of samples to crack, breakdown in water or otherwise deteriorate with exposure.

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b) Classification of the rock material condition (strength, weathering and/or alteration)

Estimated Strength refers to the rock material and not the rock mass. The strength is defined in terms of uniaxial compressive strength (UCS), though is typically estimated by either tactile assessment or Point Load Strength Index ($Is_{(50)}$) (measured perpendicular to planar anisotropy). A correlation between $Is_{(50)}$ and UCS is adopted for classification, though is not intended for design purposes without appropriate supporting assessment. A field guide follows:

Term and (Symbol)		UCS (MPa)	$Is_{(50)}$ (MPa)	Field Guide
Very Low	*(VL)*	0.6 – 2	0.03 - 0.1	Material crumbles under firm blows with sharp end of geological pick; can be peeled with knife; too hard to cut a triaxial sample by hand. Pieces up to 30 mm thick can be broken by finger pressure.
Low	*(L)*	2 - 6	0.1 - 0.3	Easily scored with knife; indentations 1 to 3 mm show in the specimen with firm blows of a geological pick point; has dull sound under hammer. A piece of core 150 mm long by 50 mm diameter may be broken by hand. Sharp edges of core may be friable and break during handling.
Medium	*(M)*	6 - 20	0.3 - 1.0	Readily scored with a knife; a piece of core 150 mm long by 50 mm diameter can be broken by hand with difficulty.
High	*(H)*	20 - 60	1 - 3	A piece of core 150 mm long by 50 mm diameter cannot be broken by hand but can be broken by a geological pick with a single firm blow; rock rings under hammer.
Very High	*(VH)*	60 - 200	3 -10	Hand specimen breaks with geological pick after more than one blow; rock rings under hammer.
Extremely High	*(EH)*	>200	>10	Specimen requires many blows with geological pick to break through intact material; rock rings under hammer.

Based on Table 19, Clause 6.2.4.1, AS 1726-2017, Geotechnical site investigations. Refer to source document for further detail.

Material with strength less than *"very low"* is described using soil characteristics, with the presence of an original rock texture or fabric noted if relevant.

Weathering and Alteration: The process of weathering involves physical and chemical changes to the rock resulting from exposure near the earth's surface. A subjective scale for weathering is applied as follows:

Weathering Term and (Symbol)		Description
Residual Soil	*(RS)*	Material has weathered to such an extent that it has soil properties. Mass structure and material texture and fabric of original rock are no longer visible, but the soil has not been significantly transported.
Extremely Weathered	*(XW)*	Material has weathered to such an extent that it has soil properties. Mass structure, material texture and fabric of original rock are still visible.
Highly Weathered	*(HW)*	The whole of the rock material is discoloured, usually by iron staining or bleaching to the extent that the colour of the original rock is not recognisable. Rock strength is significantly changed by weathering. Some primary minerals have weathered to clay minerals. Porosity may be increased by leaching, or may be decreased due to deposition of weathering products in pores.
Moderately Weathered	*(MW)*	The whole of the rock material is discoloured, usually by iron staining or bleaching to the extent that the colour of the original rock is not recognisable, but shows little or no change of strength from fresh rock.
Slightly Weathered	*(SW)*	Rock is partially discoloured with staining or bleaching along joints but shows little or no change of strength from fresh rock.
Fresh	*(Fr)*	Rock shows no sign of decomposition of individual minerals or colour changes.

Modified based on Table 20, Clause 6.2.4.2, AS 1726-2017, Geotechnical site investigations. Refer to source document for further detail.

Where physical and chemical changes to the rock are caused by hot gases or liquids at depth, the process is called alteration. Unlike weathering, the distribution of altered material may occur at any depth and show no relationship to topography. Where alteration minerals are identified the terms *"extremely altered" (XA)*, *"highly altered" (HA)*, *"moderately altered" (MA)* and *"slightly altered" (SA)* can be used to describe the physical and chemical changes described above.

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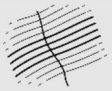
c) Description of defects (defect type, orientation, roughness and shape, coatings and composition of seams, spacing, length, openness and thickness, block shape)

Defects often control the overall engineering behaviour of a rock mass. AS 1726 defines a defect as “a discontinuity, fracture, break or void in the material or materials across which there is little or no tensile strength”. Describing the type, character and distribution of natural defects is an essential part of the description of many rock masses.

Commonly described characteristics of defects within a rock mass include type, orientation, roughness and shape, coatings and composition of seams, aperture, persistence, spacing and block shape.

The degree of detail required for defect descriptions depends on project requirements. All defects judged of engineering significance for the site and project are described individually. Where appropriate, generalised descriptions for less significant, or multiple similar, defects can be provided for delineated parts of rock core or exposures. A general description of delineated defect sets is provided when sufficient orientation data is available.

Defect Type is described using the terms summarised below. On core logs, only natural defects across which the core is discontinuous are described (i.e. inferred artificial fractures such as drill breaks are excluded). Incipient defects are described using the relevant texture or fabric terms. Healed defects (those that have been re-cemented by minerals such as chlorite or calcite) are described using the prefix “healed” (e.g. healed joint).

Type and (Symbol)		Description	Diagram
Parting	(Pt)	A surface or crack across which the rock has little or no tensile strength. Parallel or sub-parallel to layering (e.g. bedding) or a planar anisotropy in the rock material (e.g. cleavage). May be open or closed.	
Joint	(Jt)	A surface or crack with no apparent shear displacement and across which the rock has little or no tensile strength, but which is not parallel or subparallel to layering or to planar anisotropy in the rock material. May be open or closed.	
Sheared Surface	(SS)	A near planar, curved or undulating surface which is usually smooth, polished or slickensided and which shows evidence of shear displacement.	
Sheared Zone	(SZ)	Zone of rock material with roughly parallel near planar, curved or undulating boundaries cut by closely spaced joints, sheared surfaces or other defects. Some of the defects are usually curved and intersect to divide the mass into lenticular or wedge-shaped blocks.	
Sheared Seam	(SSm)	Seam of soil material with roughly parallel almost planar boundaries, composed of soil materials with roughly parallel near planar, curved or undulating boundaries cut by closely spaced joints, sheared surfaces or other defects. Some of the defects are usually curved and intersect to divide the mass into lenticular or wedge-shaped blocks.	
Crushed Seam	(CSm)	Seam of soil material with roughly parallel almost planar boundaries, composed of disoriented, usually angular fragments of the host rock material which may be more weathered than the host rock. The seam has soil properties.	
Infilled Seam	(ISm)	Seam of soil material usually with distinct roughly parallel boundaries formed by the migration of soil into an open cavity or joint, infilled seams less than 1 mm thick may be described as a veneer or coating on a joint surface.	
Extremely Weathered Seam	(WSm)	Seam of soil material, often with gradational boundaries. Formed by weathering of the rock material in place.	

Modified based on Table 22, Clause 6.2.5.2, AS 1726-2017, Geotechnical site investigations. Refer to source document for further detail.

Defect Orientation is recorded as the “dip” (maximum angle of the mean plane, measured from horizontal) and the “dip direction” (azimuth of the dip, measured clockwise from true north). Dip and dip direction is expressed in degrees, with two-digit and three-digit numbers respectively, separated by a slash (e.g. 45/090). For vertical boreholes, the defect dip is measured as the acute angle from horizontal. Rock core extracted from vertical boreholes is generally not oriented, so the dip direction cannot be directly measured. For non-oriented inclined boreholes, a defect “alpha” (α) angle is measured as the acute angle from the core axis. For vertical and non-oriented inclined boreholes, the dip direction can sometimes be estimated from the relationship of the defect to a well-defined site structure such as fabric. For oriented inclined boreholes, the measurement of the defect orientation is carried out and recorded in a form suited to the particular device being used and later processed to report true dip and dip direction.

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Roughness and Shape of the defect surface combine to have significant influence on shear strength. Standard descriptions and abbreviations include:

Roughness and (Symbol)		Description
Very Rough	(VR)	Many large surface irregularities (amplitude generally more than 1 mm). Feels like, or coarser than very coarse sand paper.
Rough	(Rf)	Many small surface irregularities (amplitude generally less than 1 mm). Feels like fine to coarse sand paper.
Smooth	(So)	Smooth to touch. Few or no surface irregularities.
Polished	(Pol)	Shiny smooth surface.
Slickensided	(Slk)	Grooved or striated surface, usually polished.

Shape and (Symbol)		Description
Planar	(Pln	The defect does not vary in orientation.
Curved	(Cu)	The defect has a gradual change in orientation.
Undulating	(Un)	The defect has a wavy surface.
Stepped	(St)	The defect has one or more well defined steps.
Irregular	(Ir)	The defect has many sharp changes of orientation.

Although the surface roughness of defects can be described at small (10-100 mm) scales of observation, the overall shape of the defect surface can usually be observed only at medium (0.1-1 m) and large (>1 m) scale.

Where it is necessary to assess the shear strength of a defect, observations are generally made at multiple scales. Surface roughness may also be characterised by using the joint roughness coefficient (JRC) profiles established by Barton and Choubey (1977). Where large-scale observations are possible, further measurement of defect "waviness" (angle of the asperities relative to the overall dip angle of the plane) is made.

Coatings and Composition of Seams: Many defects have surface coatings, which can affect their shear strength. Standard descriptions include:

Coating and (Symbol)		Description
Clean	(Cn)	No visible coating.
Stained	(Sn)	No visible coating but surfaces are discoloured.
Veneer	(Ve)	A visible coating of soil or mineral substance, but too thin to be measured may be patchy.
Coating	(Co)	A visible coating up to 1 mm thick. Soil material greater than 1 mm thick is described using defect terms (e.g. infilled seam). Rock material greater than 1 mm thick is described as a vein (Vn).

Common Minerals and (Symbol)	
Clay	(CLAY)
Calcite	(Ca)
Carbonaceous	(X)
Chlorite	(Kt)
Iron Oxide	(Fe)
Micaceous	(Mi)
Manganese	(Mn)
Pyrite	(Py)
Quartz	(Qz)

The composition of seams are described using soil description terms as given on the SOIL DESCRIPTION AND CLASSIFICATION Standard Sheet. Where possible the mineralogy of coatings is identified. Common mineral coatings include:

Aperture: Defects across which there is little or no tensile strength can be either *"open"* (*Op*) or *"closed"* (*Cl*). For rock core, the width of the "open" defect is measured whilst still in the core barrel splits. The descriptor *"tight"* (*Ti*) can only apply to healed or incipient defects (i.e. veins, foliation, etc.).

Persistence and Spacing of defects is described directly in millimetres and metres. If the measurement of defect persistence is limited by the extent of the exposure, the end conditions are noted (i.e. 0, 1 or 2 defect ends observed). The spacing between defects of similar orientation (i.e. within a specific defect set) is recorded when possible.

The frequency of defects within rock core can be measured as either: the spacing between successive defects; or the "Fracture Index", which is the number of defects per metre of core.

Spacing Term	Thickness
Very wide	>2 m
Wide	0.6 to 2 m
Medium	0.2 to 0.6 m
Closely	60 to 200 mm
Very closely	20 to 60 mm
Extremely closely	6 to 20 mm

Block Shape: Where it is considered significant, block shape can be described using the subjective terms as follows:

Block Shape	Description
Polyhedral	Irregular discontinuities without arrangement into distinct sets, and of small persistence.
Tabular	One dominant set of parallel discontinuities, for example bedding planes, with other non-continuous joints; thickness of blocks much less than length or width.
Prismatic	Two dominant sets of discontinuities, approximately orthogonal and parallel, with a third irregular set; thickness of blocks much less than length or width.
Equidimensional	Three dominant sets of discontinuities, approximately orthogonal, with occasional irregular joints, giving equidimensional blocks.
Rhomboidal	Three (or more) dominant, mutually oblique, sets of joints giving oblique-shaped, equidimensional blocks.
Columnar	Several, usually more than three sets of continuous, parallel joints usually crossed by irregular joints; lengths much greater than other dimensions.

Modified based on Table 23, Clause 6.2.5.7, AS 1726-2017, Geotechnical site investigations. Refer to source document for further detail.

Ref: DS6.5.2.1 Issue 2.0 Date: 01/08/2019

ROCK DESCRIPTION AND CLASSIFICATION

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d) Interpreted stratigraphic unit

Stratigraphic units may be interpreted and reported, in accordance with The Australian Stratigraphic Units Database (ASUD). The terms *"possibly"* or *"probably"* indicate increased uncertainty in this interpretation.

e) Geological structure

After describing the rock material and defects, an interpretation of the nature and configuration of rock mass defects may be presented in logs, charts, 2D sections and 3D models (e.g. dipping strata, folds, unconformities, weathering profiles, defect sets, geological faults, etc.).

PARAMETERS RELATED TO CORE DRILLING

Drill Depth and Core Loss: Drilling intervals are shown on GHD Core Log Sheets by depth increments and horizontal marker lines.

"Core loss", or its inverse "total core recovery" (TCR), is measured as a percentage of the core run. If the location of the core loss is known, or strongly suspected, it is shown in a region of the column bounded by dashed horizontal lines. If unknown, core loss is assigned to the bottom of a core run.

Rock Quality Designation (RQD), described by Deere et al. (1989), may be recorded on GHD Core Log Sheets.

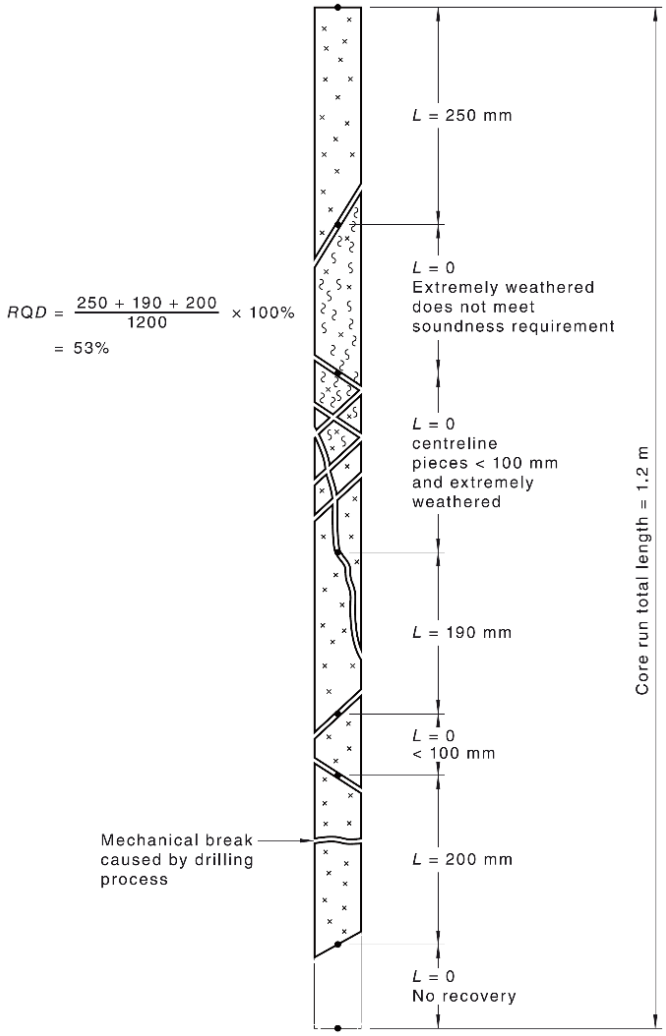
For certain projects, such as tunnelling or underground mining investigations, rock mass ratings or classifications can be required as part of the design process. The RQD forms a component of these rock mass ratings and provides a quantitative estimate of rock mass quality from rock core logs.

The rock core must be "N" sized (nominally 50 mm) or greater for derivation of RQD. The RQD is expressed as a percentage of intact rock core (excluding residual soil and extremely weathered rock) greater than 100 mm in length over the total selected core length.

Deere et al. (1989) recommends measuring lengths of core along the centreline, as shown right.

RQD is expressed as:

$$RQD = \frac{\sum Length\ of\ sound\ core\ pieces > 100\ mm\ in\ length}{Length\ of\ core\ run}\ x\ 100\%$$



RQD measurement procedure
(reproduced from Figure 13, Clause 6.2.9.4, AS 1726-2017, Geotechnical site investigations)

ROCK MASS CLASSIFICATION

Rock mass classification schemes may be used to represent the engineering characteristics of a rock mass. A large variety of classification schemes have been developed by various authors, ranging from simple to complex. All of the schemes are limited in their application and many rock mass classification systems assume that the rock mass is isotropic, which is rarely the case.

References

STANDARDS AUSTRALIA (2017). AS 1726-2017. GEOTECHNICAL SITE INVESTIGATIONS.
BARTON, N. AND CHOUBEY, V. (1977). THE SHEAR STRENGTH OF ROCK JOINTS IN THEORY AND PRACTICE. ROCK MECHANICS 10, 1-54. SPRINGER.
DEERE, D.U. AND DEERE, D.W. (1989). ROCK QUALITY DESIGNATION (RQD) AFTER TWENTY YEARS. CONTRACT REPORT GL-89-1. ARMY CORPS OF ENGINEERS. WASHINGTON DC, 1989.

BOREHOLE LOG SHEET

GEO_BOREHOLE_VIC 3134596 LOGS.GPJ GHD_GEO_TEMPLATE_VICTORIA.GDT 21/8/19

Client : Yarra Valley Water Corporation
Project : Beveridge Northwest Land Development - Stage 1
Location : Camerons Lane Wetland, Beveridge, Victoria 3088

HOLE No. BH01

SHEET 1 OF 2

Position : 318977.0 E 5851421.0 N	**Surface RL:** NR	**Angle from Horiz. :** 90°		**Processed :** MJ
Rig Type : Edson 1000 **Mounting:** Truck	**Contractor :** Walsh Drilling	**Driller :** Pat Walsh		**Checked :** EF
Date Started : 3/7/19	**Date Completed :** 3/7/19	**Logged by :** DH		**Date :** 05/08/2019

DRILLING					MATERIAL						
SCALE (m)	Drilling Method	Hole Support / Casing	Water	Samples & Tests	Depth / (RL) metres	Graphic Log	USC Symbol	Description SOIL TYPE, colour, structure,minor components (origin), and ROCK TYPE, colour, grain size, structure, weathering, strength	Moisture Condition	Consistency / Relative Density	Comments/ Observations
	SFA	Nil			0.60		CH	TOPSOIL: CLAY, dark brown; trace rootlets	W<PL	St	0.0m: TOPSOIL
1								Start of coring at 0.6 metres. For Cored interval, see Core Log Sheet.			
2											
3											
4											
5											
6											
7											
8											
9											
10											

See standard sheets for details of abbreviations & basis of descriptions

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CORE LOG SHEET

GEO_COREHOLE 3134596 LOGS.GPJ GHD_GEO_TEMPLATE_VICTORIA.GDT 21/8/19

Client : Yarra Valley Water Corporation		**HOLE No. BH01**	
Project : Beveridge Northwest Land Development - Stage 1			
Location : Camerons Lane Wetland, Beveridge, Victoria 3088		**SHEET 2 OF 2**	
Position : 318977.0 E 5851421.0 N	**Surface RL:** NR	**Angle from Horiz. :** 90°	**Processed :** MJ
Rig Type : Edson 1000 **Mounting:** Truck	**Contractor :** Walsh Drilling	**Driller :** Pat Walsh	**Checked :** EF
Casing Dia. : 75.7 **Barrel (m) :** 1.5	**Bit :** diamond	**Bit Condition :** good	**Date :** 05/08/2019
Date Started : 3/7/19 **Date Completed :** 3/7/19	**Logged by :** DH	**Date Logged :** 05/07/2019	

DRILLING						MATERIAL					NATURAL FRACTURES		
Progress													
SCALE (m)	Drilling & Casing	Water	Drill Depth (m)	(Core Loss / Run %)	RQD (%)	Depth / (RL) metres	Graphic Log	Description ROCK TYPE, colour, grain size, structure (texture, mineral composition, hardness, alteration, cementation, etc. as applicable) and SOIL TYPE, moisture, colour, consistency, structure, minor components (origin)	Weathering	Estimated Strength $Is_{(50)}$ MPa EL 0.03 VL 0.1 L 0.3 M 1 H 3 VH 10 EH	Spacing (mm) 20 40 100 300 1000	Visual	Additional Data (joints, partings, seams, zones and veins) Fracture type, orientation, infilling or coating, shape, roughness, other.
						0.60		Start of coring at 0.6 metres. For Non Cored interval, see Borehole Log Sheet.					
1	NQ Coring	2.3m (5/07/19 pm)	1.60	(0)	72			BASALT, dark grey with red-orange staining; slightly vesicular, vesicles 2-10mm	SW-FR				0.6m: NEWER VOLCANICS 0.75, DB 0.8, DB, 70° 1.05, JT, 60°, PLN, CT, dark brown clay 1.1, JT/IS, 5°, IR, RF, gravelly clay, dark brown 1.2, JT, 50°, PLN, S, ST, orange brown 1.4, IS, 50°, PLN, S, orange brown dark brown clay (CH) 1.5, JT, 70°, CU, CT, dark brown clay 2.25, JT, 15°, PLN, RF, CT, dark brown clay 2.55, JT, 20°, PLN, VR, UN 2.8, DB
2				(0)	100								
3			3.00					3.40, becoming pale red					3.2, JT, 50°, CU, S, dark brown clay 3.25, JT, 20°, CU, RF, dark brown clay 3.3, JT/IS, 15°, IR, RF, gravelly clay dark brown 3.4, JT/IS, 30°, IR, RF, red clay 3.5, JT/IS, 60°, IR, RF
4				(0)	23	3.65		Gravelly CLAY (CL), dark red grey; gravel is fine to coarse of vesicular basalt. W<PL, H (EXTREMELY WEATHERED SEAM)	XW				
						4.05							
						4.30		BASALT, dark grey with red-orange staining; slightly vesicular, circular vesicles 2-10mm	HW				
			4.50					Gravelly CLAY (CL), dark red grey; gravel is fine to medium of vesicular basalt. W<PL, H (EXTREMELY WEATHERED SEAM) 4.8m, becoming red-brown	XW				
5				(0)	45	5.30			HW				
								At 5.5m, becomes dark red-grey	SW				5.55, JT, 70°, PLN, RF, CT, clay 5.7, 2xJT, 60°, IR, RF, CT, clay
6			6.00			6.00							
								Standpipe installation was constructed in borehole Borehole terminated 6.0 m. Target Depth.					
7													
8													
9													
10													

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BOREHOLE LOG SHEET

GEO_BOREHOLE_VIC 3134596 LOGS.GPJ GHD_GEO_TEMPLATE_VICTORIA.GDT 21/8/19

Client : Yarra Valley Water Corporation
Project : Beveridge Northwest Land Development - Stage 1
Location : Camerons Lane Wetland, Beveridge, Victoria 3088

HOLE No. BH02

SHEET 1 OF 2

Position : 319081.0 E 5851436.0 N	**Surface RL:** NR	**Angle from Horiz. :** 90°		**Processed :** MJ
Rig Type : Edson 1000 **Mounting:** Truck	**Contractor :** Walsh Drilling	**Driller :** Pat Walsh		**Checked :** EF
Date Started : 3/7/19	**Date Completed :** 3/7/19	**Logged by :** EF		**Date :** 05/08/2019

DRILLING					MATERIAL						
SCALE (m)	Drilling Method	Hole Support / Casing	Water	Samples & Tests	Depth / (RL) metres	Graphic Log	USC Symbol	**Description** SOIL TYPE, colour, structure,minor components (origin), and ROCK TYPE, colour, grain size, structure, weathering, strength	Moisture Condition	Consistency / Relative Density	**Comments/ Observations**
1	SFA	Nil			0.30		CL	TOPSOIL: CLAY, dark brown	W<PL	F	0.0m: TOPSOIL
							CH	CLAY, dark brown	W<PL	St	0.3m: POSSIBLE ALLUVIUM
					1.10			Start of coring at 1.1 metres. For Cored interval, see Core Log Sheet.			

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CORE LOG SHEET

GEO_COREHOLE 3134596 LOGS.GPJ GHD_GEO_TEMPLATE_VICTORIA.GDT 21/8/19

Client :	Yarra Valley Water Corporation			**HOLE No. BH02**	
Project :	Beveridge Northwest Land Development - Stage 1				
Location :	Camerons Lane Wetland, Beveridge, Victoria 3088			**SHEET 2 OF 2**	
Position :	319081.0 E 5851436.0 N	**Surface RL:** NR		**Angle from Horiz. :** 90°	**Processed :** MJ
Rig Type :	Edson 1000 **Mounting:** Truck	**Contractor :** Walsh Drilling		**Driller :** Pat Walsh	**Checked :** EF
Casing Dia. :	75.7 **Barrel (m) :** 1.5	**Bit :** diamond		**Bit Condition :** good	**Date :** 05/08/2019
Date Started :	3/7/19 **Date Completed :** 3/7/19	**Logged by :** EF		**Date Logged :** 05/07/2019	

DRILLING						MATERIAL					NATURAL FRACTURES		
Progress													
SCALE (m)	Drilling & Casing	Water	Drill Depth (m)	(Core Loss / Run %)	RQD (%)	Depth / (RL) metres	Graphic Log	Description ROCK TYPE, colour, grain size, structure (texture, mineral composition, hardness, alteration, cementation, etc. as applicable) and SOIL TYPE, moisture, colour, consistency, structure, minor components (origin)	Weathering	Estimated Strength $Is_{(50)}$ MPa EL 0.03 VL 0.1 L 0.3 M 1 H 3 VH 10 EH	Spacing (mm) 20 40 100 300 1000	Visual	Additional Data (joints, partings, seams, zones and veins) Fracture type, orientation, infilling or coating, shape, roughness, other.
1						1.10		Start of coring at 1.1 metres. For Non Cored interval, see Borehole Log Sheet.					
2	NQ Coring	GNO	2.60	(0)	23	1.60		Clayey GRAVEL, dark grey and brown, angular, fine to coarse fragments of basalt (POSSIBLE CRUSHED SEAM)					1.1m: NEWER VOLCANICS 1.15m, JT, 10°, ST, RF 1.4, JT, 90°, IN, clayey (F-C), CU, RF 1.55, JT, 50°, PLN, RF, CT/IS 1.65, DB 1.70, JT, 44°, ST, RF 1.8, JT, 10°, CU, S, VN, grey clay 1.87, JT, 80°, PLN, RF, CT, clayey 1.9, JT, 50°, PLN, RF, SN 2.2, JT, 90°, IR, RF, IS, clay grey 2.26, JT, 20°, PLN, S, CN 2.30, JT, 48°, ST, RF 2.33, JT, IR, RF,IS pale grey brown clay 2.40, JT, 47°, IR, CT, clay 2.80, JT, 44°, ST, RF 2.9, DB 2.95, JT, 70°, PLN, RF, IS, dark brown clay 3.05, JT, 40°, PLN, RF, SN, red 3.15, JT, 70°, CU, RF, VN 3.2, JT, 10°, PLN, RF, VN 3.32, JT, 30°, CU, RF, CT, infill pale grey 3.7, JT, 80°, IR, VR, CT, clay
3				(0)	40			BASALT, dark grey stained orange brown; highly vesicular, circular vesicles 1-7mm	FR				
4			4.10			4.20		3.70m, becoming red-brown	SW HW				
5				(0)	0	4.40 5.20		CORE LOSS (0.2m): 4.2m to 4.4m Clayey GRAVEL (GC), dark brown grey, fine to coarse, angular fragments of vesicular basalt; M, D (EXTREMELY WEATHERED SEAM)	XW				
6			5.40 6.20	(0)	0	6.20		BASALT, dark grey brown; highly vesicular, circular vesicles 1-5mm	HW				
7								Borehole backfilled with bentonite and drilling spoil Borehole terminated 6.2 m. Target Depth					
8													
9													
10													

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BOREHOLE LOG SHEET

GEO_BOREHOLE_VIC 3134596 LOGS.GPJ GHD_GEO_TEMPLATE_VICTORIA.GDT 21/8/19

Client : Yarra Valley Water Corporation
Project : Beveridge Northwest Land Development - Stage 1
Location : Camerons Lane Wetland, Beveridge, Victoria 3088

HOLE No. BH03

SHEET 1 OF 2

Position : 319152.0 E 5851547.0 N	**Surface RL:** NR	**Angle from Horiz. :** 90°		**Processed :** MJ
Rig Type : Edson 1000 **Mounting:** Truck	**Contractor :** Walsh Drilling	**Driller :** Pat Walsh		**Checked :** EF
Date Started : 3/7/19	**Date Completed :** 3/7/19	**Logged by :** DH		**Date :** 05/08/2019

DRILLING					MATERIAL						
SCALE (m)	Drilling Method	Hole Support / Casing	Water	Samples & Tests	Depth / (RL) metres	Graphic Log	USC Symbol	Description SOIL TYPE, colour, structure,minor components (origin), and ROCK TYPE, colour, grain size, structure, weathering, strength	Moisture Condition	Consistency / Relative Density	Comments/ Observations
1	SFA	Nil			0.30		CL	TOPSOIL: CLAY, dark brown; trace rootlets	W<PL	F	0.0m: TOPSOIL
							CH	CLAY, dark brown	W<PL	F-St	0.3m: POSSIBLE ALLUVIUM
					1.00			Start of coring at 1 metres. For Cored interval, see Core Log Sheet.			
2											
3											
4											
5											
6											
7											
8											
9											
10											

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CORE LOG SHEET

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Client :	Yarra Valley Water Corporation			**HOLE No. BH03**	
Project :	Beveridge Northwest Land Development - Stage 1				
Location :	Camerons Lane Wetland, Beveridge, Victoria 3088			**SHEET 2 OF 2**	
Position :	319152.0 E 5851547.0 N	**Surface RL:** NR		**Angle from Horiz. :** 90°	**Processed :** MJ
Rig Type :	Edson 1000 **Mounting:** Truck	**Contractor :** Walsh Drilling		**Driller :** Pat Walsh	**Checked :** EF
Casing Dia. :	75.7 **Barrel (m) :** 1.5	**Bit :** diamond		**Bit Condition :** good	**Date :** 05/08/2019
Date Started :	3/7/19 **Date Completed :** 3/7/19	**Logged by :** DH		**Date Logged :** 05/07/2019	

DRILLING						MATERIAL					NATURAL FRACTURES		
Progress													
SCALE (m)	Drilling & Casing	Water	Drill Depth (m)	(Core Loss / Run %)	RQD (%)	Depth / (RL) metres	Graphic Log	Description ROCK TYPE, colour, grain size, structure (texture, mineral composition, hardness, alteration, cementation, etc. as applicable) and SOIL TYPE, moisture, colour, consistency, structure, minor components (origin)	Weathering	Estimated Strength $Is_{(50)}$ MPa EL 0.03 VL 0.1 L 0.3 M 1 H 3 VH 10 EH	Spacing (mm) 20 40 100 300 1000	Visual	Additional Data (joints, partings, seams, zones and veins) Fracture type, orientation, infilling or coating, shape, roughness, other.
						1.00		Start of coring at 1 metres. For Non Cored interval, see Borehole Log Sheet.					
1	NQ Coring	GNO		(0)	0			GRAVEL (GW), dark brown grey, fine to coarse, angular of vesicular basalt; with clay. W, MD (EXTREMELY WEATHERED SEAM)					1.0m: NEWER VOLCANICS
2			2.50	(0)	0			1.70m, becoming red mottled grey	XW				
3			3.20	(0)	46	3.20		BASALT, dark grey stained red; highly vesicular, circular vesicles, 1-5mm					3.4, JT, 60°, IR, RF, CN
								3.60m, becoming red	HW				3.55, JT, 40°, PLN, RF, CT, grey clay 3.85, JT, 70°, IR, VRF, orange to grey red clay
4						4.10							4.05, DB
						4.40		CLAY (CL) dark grey stained pale brown (EXTREMELY WEATHERED SEAM)	XW				4.2, JT, 45°, IR, RF, SN 4.4, DB
			4.60			4.60		BASALT, dark grey; highly vesicular, circular vesicles, 1-5mm	SW				4.5, JT, 45°, IR, RF, SN 4.55, JT, 40°, PLN, RF, SN, red 4.6, DB
5								Borehole backfilled with bentonite and drilling spoil Borehole terminated 4.6 m. Target Depth.					
6													
7													
8													
9													
10													

See standard sheets for details of abbreviations & basis of descriptions

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BOREHOLE LOG SHEET

GEO_BOREHOLE_VIC 3134596 LOGS.GPJ GHD_GEO_TEMPLATE_VICTORIA.GDT 21/8/19

Client : Yarra Valley Water Corporation
Project : Beveridge Northwest Land Development - Stage 1
Location : Kalkallo Creek Wetlands, Beveridge, Victoria 3088

HOLE No. BH04

SHEET 1 OF 1

Position : 318111.0 E 5852990.0 N | **Surface RL:** NR | **Angle from Horiz. :** 90° | **Processed :** MJ
Rig Type : Edson 1000 | **Mounting:** Truck | **Contractor :** Walsh Drilling | **Driller :** Pat Walsh | **Checked :** EF
Date Started : 5/7/19 | **Date Completed :** 5/7/19 | **Logged by :** DH | **Date :** 05/08/2019

DRILLING					MATERIAL						
SCALE (m)	Drilling Method	Hole Support / Casing	Water	Samples & Tests	Depth / (RL) metres	Graphic Log	USC Symbol	Description SOIL TYPE, colour, structure,minor components (origin), and ROCK TYPE, colour, grain size, structure, weathering, strength	Moisture Condition	Consistency / Relative Density	Comments/ Observations
1	SFA	Nil		SPT 9/11/13 N=24	0.20		CL	TOPSOIL: CLAY,dark brown	W<PL	F	0.0m: TOPSOIL
							CI	CLAY, dark brown	W<PL	St-VSt	0.2m: GULLY ALLUVIUM
								1.0m, pale brown mottled grey; trace silt			
2				SPT 6/10/12 N=22	1.70		CH	CLAY, pale brown; trace sand	W=PL		
								2.08m, mottled grey orange			
3				SPT 5/7/10 N=22							
								3.60m, becoming pale grey with orange staining			
4				SPT 5/7/10 N=17							
5				SPT 5/6/9 N=15							
6				SPT 8/13/17 N=30	6.00		SM	Silty SAND, pale grey-orange, fine to coarse grained sand			6.0m: POSSIBLE KILMORE
					6.30			Standpipe installation was constructed in borehole Borehole terminated 6.3 metres. Target Depth.			SILTSTONE
7											
8											
9											
10											

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BOREHOLE LOG SHEET

GEO_BOREHOLE_VIC 3134596 LOGS.GPJ GHD_GEO_TEMPLATE_VICTORIA.GDT 21/8/19

Client : Yarra Valley Water Corporation
Project : Beveridge Northwest Land Development - Stage 1
Location : Kalkallo Creek Wetlands, Beveridge, Victoria 3088

HOLE No. BH05

SHEET 1 OF 1

Position : 318072.0 E 5853062.0 N **Surface RL:** NR **Angle from Horiz. :** 90° **Processed :** MJ
Rig Type : Edson 1000 **Mounting:** Truck **Contractor :** Walsh Drilling **Driller :** Pat Walsh **Checked :** EF
Date Started : 5/7/19 **Date Completed :** 5/7/19 **Logged by :** DH **Date :** 05/08/2019

DRILLING					MATERIAL						
SCALE (m)	Drilling Method	Hole Support / Casing	Water	Samples & Tests	Depth / (RL) metres	Graphic Log	USC Symbol	Description SOIL TYPE, colour, structure,minor components (origin), and ROCK TYPE, colour, grain size, structure, weathering, strength	Moisture Condition	Consistency / Relative Density	Comments/ Observations
1	SFA	Nil		SPT 4/5/6 N=11			SW	SAND, dark brown, fine to medium grained	M	L	0.0m: GULLY ALLUVIUM
					0.60		CH	CLAY, pale brown	W=PL	St - VSt	
2				SPT 4/5/7 N=12				1.8m, becoming red brown			
3				SPT 6/8/9 N=17				2.80m, red-orange staining			
					3.70		CI	Sandy CLAY, orange; fine to medium grained sand	W<PL		
4				SPT 24/ for ~~150mm~~ bouncing N=ref	4.00 4.15		SM	Silty SAND pale grey, fine to coarse grained (XW ROCK)	M	MD	4.0m: POSSIBLE KILMORE SILTSTONE
								Borehole backfilled with bentonite and drilling spoil Borehole terminated 4.15 metres. Refusal.			
5											
6											
7											
8											
9											
10											

See standard sheets for details of abbreviations & basis of descriptions

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Job No.
31-34596

BOREHOLE LOG SHEET

GEO_BOREHOLE_VIC 3134596 LOGS.GPJ GHD_GEO_TEMPLATE_VICTORIA.GDT 21/8/19

Client :	Yarra Valley Water Corporation	**HOLE No. BH06**	
Project :	Beveridge Northwest Land Development - Stage 1		
Location :	Kalkallo Creek Wetlands, Beveridge, Victoria 3088	**SHEET 1 OF 1**	
Position :	318113.0 E 5853121.0 N	**Surface RL:** NR	**Angle from Horiz. :** 90°	**Processed :** MJ
Rig Type :	Edson 1000 **Mounting:** Truck	**Contractor :** Walsh Drilling	**Driller :** Pat Walsh	**Checked :** EF
Date Started :	5/7/19	**Date Completed :** 5/7/19	**Logged by :** DH	**Date :** 05/08/2019

DRILLING					MATERIAL						
SCALE (m)	Drilling Method	Hole Support / Casing	Water	Samples & Tests	Depth / (RL) metres	Graphic Log	USC Symbol	Description SOIL TYPE, colour, structure,minor components (origin), and ROCK TYPE, colour, grain size, structure, weathering, strength	Moisture Condition	Consistency / Relative Density	Comments/ Observations
					0.20		SM	TOPSOIL: Silty SAND, dark brown, fine to medium grained sand, trace rootlets.	D	L	0.0m: TOPSOIL
							SM	Silty SAND, dark brown, fine to medium grained sand.	M	L-MD	0.2m: GULLY ALLUVIUM
					0.80		CH	CLAY, dark brown	W<PL	St-VSt	
1				SPT 6/8/8 N=16				1.0m, becoming pale brown			
2	SFA	Nil		SPT 3/7/7 N=14							
3				SPT 3/8/10 N=14				3.0m, becoming mottled pale brown-grey	W=PL		
								3.60m, becoming yellow, trace gravel of extremely weathered rock	W<PL		
4				SPT 10/17/11 for 50mm N=ref	4.00 4.35		SC	Clayey SAND, pale grey with orange staining, fine to medium grained sand (XW ROCK)	M	MD	4.0m: POSSIBLE KILMORE SILTSTONE
								Borehole backfilled with bentonite and drilling spoil Borehole terminated 4.35 metres. Refusal.			
5											
6											
7											
8											
9											
10											

See standard sheets for details of abbreviations & basis of descriptions

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Job No. **31-34596**

BOREHOLE LOG SHEET

GEO_BOREHOLE_VIC 3134596 LOGS.GPJ GHD_GEO_TEMPLATE_VICTORIA.GDT 21/8/19

Client : Yarra Valley Water Corporation

Project : Beveridge Northwest Land Development - Stage 1

Location : Diversion Channel, Beveridge, Victoria 3088

HOLE No. BH07

SHEET 1 OF 2

Position : Refer to test location plan	**Surface RL:** NR	**Angle from Horiz. :** 90°		**Processed :** MJ
Rig Type : Edson 1000 **Mounting:** Truck	**Contractor :** Walsh Drilling	**Driller :** Pat Walsh		**Checked :** EF
Date Started : 4/7/19	**Date Completed :** 4/7/19	**Logged by :** EF		**Date :** 05/08/2019

DRILLING					MATERIAL						
SCALE (m)	Drilling Method	Hole Support / Casing	Water	Samples & Tests	Depth / (RL) metres	Graphic Log	USC Symbol	Description SOIL TYPE, colour, structure,minor components (origin), and ROCK TYPE, colour, grain size, structure, weathering, strength	Moisture Condition	Consistency / Relative Density	Comments/ Observations
1	SFA	Nil		SPT 2/3/5 N=8	1.00		CH	CLAY, dark brown, rootlets	W<PL	F	0.0m: TOPSOIL / POSSIBLE FILL
2				SPT 6/12/16 N=28	2.95		CH	CLAY, pale brown, stained yellow 1.40m, becoming yellow-pale brown	W<PL	F	1.0m: RESIDUAL SOIL
3								Start of coring at 2.95 metres. For Cored interval, see Core Log Sheet.			
4											
5											
6											
7											
8											
9											
10											

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CORE LOG SHEET

GEO_COREHOLE 3134596 LOGS.GPJ GHD_GEO_TEMPLATE_VICTORIA.GDT 21/8/19

Client :	Yarra Valley Water Corporation			**HOLE No. BH07**	
Project :	Beveridge Northwest Land Development - Stage 1				
Location :	Diversion Channel, Beveridge, Victoria 3088			**SHEET 2 OF 2**	
Position :	Refer to test location plan	**Surface RL:** NR		**Angle from Horiz. :** 90°	**Processed :** MJ
Rig Type :	Edson 1000 **Mounting:** Truck	**Contractor :** Walsh Drilling		**Driller :** Pat Walsh	**Checked :** EF
Casing Dia. :	75.7 **Barrel (m) :** 1.5	**Bit :** diamond		**Bit Condition :** good	**Date :** 05/08/2019
Date Started :	4/7/19 **Date Completed :** 4/7/19	**Logged by :** EF		**Date Logged :** 06/07/2019	

DRILLING						MATERIAL					NATURAL FRACTURES		
Progress													
SCALE (m)	Drilling & Casing	Water	Drill Depth (m)	(Core Loss / Run %)	RQD (%)	Depth / (RL) metres	Graphic Log	Description ROCK TYPE, colour, grain size, structure (texture, mineral composition, hardness, alteration, cementation, etc. as applicable) and SOIL TYPE, moisture, colour, consistency, structure, minor components (origin)	Weathering	Estimated Strength $Is_{(50)}$ MPa EL 0.03 VL 0.1 L 0.3 M 1 H 3 VH 10 EH	Spacing (mm) 20 40 100 300 1000	Visual	Additional Data (joints, partings, seams, zones and veins) Fracture type, orientation, infilling or coating, shape, roughness, other.
1								Start of coring at 2.95 metres. For Non Cored interval, see Borehole Log Sheet.					
2						2.95		CLAY (CH), pale brown stained orange; VSt-H, W<PL.					2.95m: KILMORE SILTSTONE
3						3.30		Clayey SAND (SC), fine to medium grained; D, M.	XW				3.18 - 3.24, WSM, clay pale brown 3.37, DB
4	NQ Coring	GNO	4.10	(0)	0	3.65		CLAY (CH), pale grey brown stained orange; with gravel, VSt, PL>W. Gravel is coarse sub angular of siltstone fragments.					3.63 - 3.68, WSM, clay pale brown 3.9, JT x 2, 70°, PLN, RF, SN, orange brown
5			5.60	(0)	84	3.90		SILTSTONE, pale brown, stained orange red; indistinctly bedded 4.7m, becomes distinctly bedded, thinly laminated at 40-50°	HW-MW				4.0, JT, 20°, PLN, VR, SN, orange brown 5.15, JT, CU/IR, RF, 60°, SN, orange 5.24, JT, 30°, CU, RF, SN, orange 5.46, JT, 40°, PLN, S, CN 5.6, DB
6			6.20	(25)	100	6.05 6.20		CORE LOSS (0.15m), 6.05 to 6.2m Borehole backfilled with bentonite and drilling spoil Borehole terminated 6.2 m. Target Depth					5.8, DB 5.95, JT, 70°, CU, RF, CT, clay 6.0, JT, 70°, PLN, RF, CN 6.06, JT, 30°, CU, S, SN, orange brown
7													
8													
9													
10													

See standard sheets for details of abbreviations & basis of descriptions

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BOREHOLE LOG SHEET

GEO_BOREHOLE_VIC 3134596 LOGS.GPJ GHD_GEO_TEMPLATE_VICTORIA.GDT 21/8/19

Client : Yarra Valley Water Corporation
Project : Beveridge Northwest Land Development - Stage 1
Location : Diversion Channel, Beveridge, Victoria 3088

HOLE No. BH08

SHEET 1 OF 2

Position : 319292.0 E 5853693.0 N **Surface RL:** NR **Angle from Horiz. :** 90° **Processed :** MJ
Rig Type : Edson 1000 **Mounting:** Truck **Contractor :** Walsh Drilling **Driller :** Pat Walsh **Checked :** EF
Date Started : 4/7/19 **Date Completed :** 4/7/19 **Logged by :** EF **Date :** 05/08/2019

DRILLING					MATERIAL						
SCALE (m)	Drilling Method	Hole Support / Casing	Water	Samples & Tests	Depth / (RL) metres	Graphic Log	USC Symbol	Description SOIL TYPE, colour, structure,minor components (origin), and ROCK TYPE, colour, grain size, structure, weathering, strength	Moisture Condition	Consistency / Relative Density	Comments/ Observations
	SFA	Nil			0.90		CH	CLAY, dark brown	W<PL	F	0.0m: TOPSOIL / POSSIBLE SOIL
1								Start of coring at 0.9 metres. For Cored interval, see Core Log Sheet.			
2											
3											
4											
5											
6											
7											
8											
9											
10											

See standard sheets for details of abbreviations & basis of descriptions

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Job No. 31-34596

CORE LOG SHEET

GEO_COREHOLE 3134596 LOGS.GPJ GHD_GEO_TEMPLATE_VICTORIA.GDT 21/8/19

Client : Yarra Valley Water Corporation		**HOLE No. BH08**	
Project : Beveridge Northwest Land Development - Stage 1			
Location : Diversion Channel, Beveridge, Victoria 3088		**SHEET 2 OF 2**	
Position : 319292.0 E 5853693.0 N	**Surface RL:** NR	**Angle from Horiz. :** 90°	**Processed :** MJ
Rig Type : Edson 1000 **Mounting:** Truck	**Contractor :** Walsh Drilling	**Driller :** Pat Walsh	**Checked :** EF
Casing Dia. : 75.7 **Barrel (m) :** 1.5	**Bit :** diamond	**Bit Condition :** good	**Date :** 05/08/2019
Date Started : 4/7/19 **Date Completed :** 4/7/19	**Logged by :** EF	**Date Logged :** 06/07/2019	

DRILLING						MATERIAL					NATURAL FRACTURES		
Progress													
SCALE (m)	Drilling & Casing	Water	Drill Depth (m)	(Core Loss / Run %)	RQD (%)	Depth / (RL) metres	Graphic Log	Description ROCK TYPE, colour, grain size, structure (texture, mineral composition, hardness, alteration, cementation, etc. as applicable) and SOIL TYPE, moisture, colour, consistency, structure, minor components (origin)	Weathering	Estimated Strength $Is_{(50)}$ MPa EL 0.03 VL 0.1 L 0.3 M 1 H 3 VH 10 EH	Spacing (mm) 20 40 100 300 1000	Visual	Additional Data (joints, partings, seams, zones and veins) Fracture type, orientation, infilling or coating, shape, roughness, other.
						0.90		Start of coring at 0.9 metres. For Non Cored interval, see Borehole Log Sheet.					
1	NQ Coring	GNO		(0)	100			BASALT, dark grey; highly vesicular, circular vesicles 1-5mm	SW				0.9m: NEWER VOLCANICS 1.2, DB 1.4, DB 1.65, DB
2			2.40										1.95, JT, 30°, CU, VR, CL, red brown clay 2.15, DB
3				(0)	100								2.7, HB 2.8, DB 3.0, DB 3.2, JT, 10°, CU, RF, CT, orange brown clay
			3.50										3.5, DB
4				(0)	100				FR				3.7, HB 3.8, DB
5			5.00					3.7m, becomes slightly vesicular					4.75, HB 5.0, JT, 20°, PLN, S, VN, red-brown
				(0)	93	5.65			SW				5.3, DB 5.4, DB 5.45, JT, 50°, CU, RF, SN, red brown
						5.75		Gravelly CLAY (CH) dark red brown; fine to coarse, angular fragments of vesicular basalt (EXTREMELY WEATHERED SEAM)	XW				5.5, JT, 45°, IR, VR, CT, red brown
6			6.20			6.20		BASALT, dark grey stained red; highly vesicular, circular vesicles 1-5mm	MW				5.6, JT, IS, IR, RF, SN 5.85, JT, IS, CU, RF, SN, orange red 5.95, DB
								Borehole backfilled with bentonite and drilling spoil Borehole terminated 6.2 m. Target Depth					
7													
8													
9													
10													

See standard sheets for details of abbreviations & basis of descriptions

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Job No. **31-34596**

BOREHOLE LOG SHEET

GEO_BOREHOLE_VIC 3134596 LOGS.GPJ GHD_GEO_TEMPLATE_VICTORIA.GDT 21/8/19

Client :	Yarra Valley Water Corporation	**HOLE No. BH09**	
Project :	Beveridge Northwest Land Development - Stage 1		
Location :	Diversion Channel, Beveridge, Victoria 3088	**SHEET 1 OF 2**	
Position :	319348.0 E 5854088.0 N	**Surface RL:** NR	**Angle from Horiz. :** 90°	**Processed :** MJ
Rig Type :	Edson 1000 **Mounting:** Truck	**Contractor :** Walsh Drilling	**Driller :** Pat Walsh	**Checked :** EF
Date Started :	4/7/19	**Date Completed :** 4/7/19	**Logged by :** EF	**Date :** 05/08/2019

DRILLING					MATERIAL						
SCALE (m)	Drilling Method	Hole Support / Casing	Water	Samples & Tests	Depth / (RL) metres	Graphic Log	USC Symbol	Description SOIL TYPE, colour, structure,minor components (origin), and ROCK TYPE, colour, grain size, structure, weathering, strength	Moisture Condition	Consistency / Relative Density	Comments/ Observations
1	SFA	Nil		SPT 2/3/3 N=6	0.20		CH	TOPSOIL: Gravelly CLAY, dark grey to dark brown	W<PL	F	0.0m: TOPSOIL
							CL	CLAY, dark brown	PL>W	F	0.2m: POSSIBLE FILL
2				SPT 3/5 for 40mm N=ref	1.00		CH	CLAY, red brown orange	PL>W	F	1.0m: RESIDUAL SOIL
					2.30			Start of coring at 2.3 metres. For Cored interval, see Core Log Sheet.			
3											
4											
5											
6											
7											
8											
9											
10											

See standard sheets for details of abbreviations & basis of descriptions

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Job No. **31-34596**

CORE LOG SHEET

GEO_COREHOLE 3134596 LOGS.GPJ GHD_GEO_TEMPLATE_VICTORIA.GDT 21/8/19

Client :	Yarra Valley Water Corporation			**HOLE No. BH09**	
Project :	Beveridge Northwest Land Development - Stage 1				
Location :	Diversion Channel, Beveridge, Victoria 3088			**SHEET 2 OF 2**	
Position :	319348.0 E 5854088.0 N	**Surface RL:** NR		**Angle from Horiz. :** 90°	**Processed :** MJ
Rig Type :	Edson 1000 **Mounting:** Truck	**Contractor :** Walsh Drilling		**Driller :** Pat Walsh	**Checked :** EF
Casing Dia. :	75.7 **Barrel (m) :** 1.5	**Bit :** diamond		**Bit Condition :** good	**Date :** 05/08/2019
Date Started :	4/7/19 **Date Completed :** 4/7/19	**Logged by :** EF		**Date Logged :** 06/07/2019	

DRILLING						MATERIAL					NATURAL FRACTURES		
Progress													
SCALE (m)	Drilling & Casing	Water	Drill Depth (m)	(Core Loss / Run %)	RQD (%)	Depth / (RL) metres	Graphic Log	Description ROCK TYPE, colour, grain size, structure (texture, mineral composition, hardness, alteration, cementation, etc. as applicable) and SOIL TYPE, moisture, colour, consistency, structure, minor components (origin)	Weathering	Estimated Strength $Is_{(50)}$ MPa EL 0.03 VL 0.1 L 0.3 M 1 H 3 VH 10 EH	Spacing (mm) 20 40 100 300 1000	Visual	Additional Data (joints, partings, seams, zones and veins) Fracture type, orientation, infilling or coating, shape, roughness, other.
1													
2						2.30		Start of coring at 2.3 metres. For Non Cored interval, see Borehole Log Sheet.					
3	NQ Coring	GNO	3.20	(0)	100			BASALT, dark grey; highly vesicular, circular to elongated vesicles, 1-10mm	SW				2.3m: NEWER VOLCANICS 2.85, DB 2.95, HB 3.2, DB
4					100								3.65, DB
5				(0)	100			5.1m, infilled vesicles, dark grey quartz, 1-5mm 5.3m, becomes slightly vesicular, vesicles are 1-30mm	FR				4.3, JT, 45°, PLN, VR, CT, red-brown clay 4.34, JT, 60°, PLN, RF, CT, clay 4.45, DB 4.55, DB 5.1, DB 5.5, DB 5.65, DB 5.75, DB
6			6.10			6.10		Borehole backfilled with bentonite and drilling spoil Borehole terminated 6.1 m. Target Depth					6.05, DB
7													
8													
9													
10													

See standard sheets for details of abbreviations & basis of descriptions

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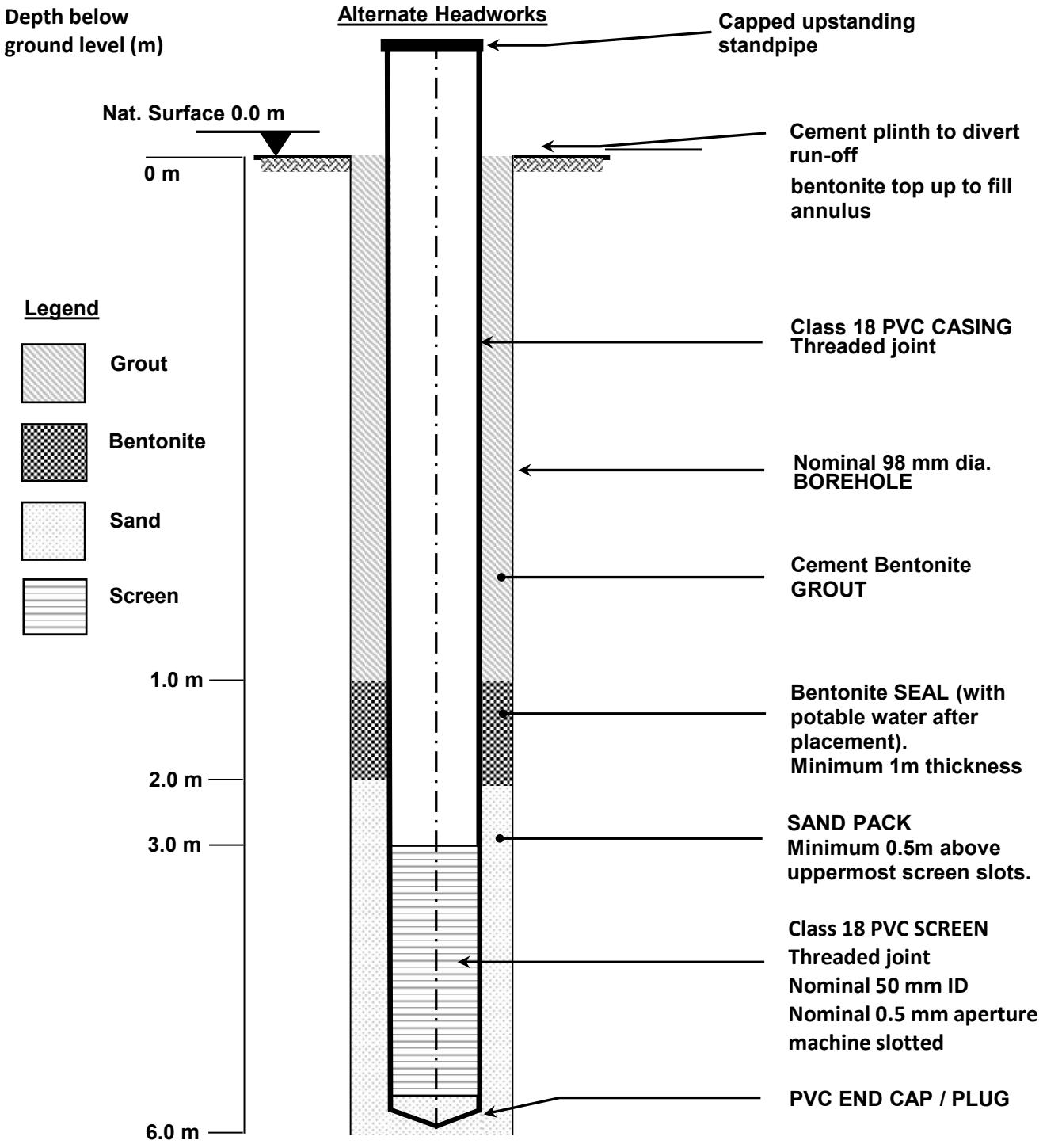

GHD CLIENTS | PEOPLE | PERFORMANCE

Beveridge Northwest Land Development
Geotechnical Site Investigations - Stage 1
Standpipe Diagram - BH01 (not to scale)

scale: | NTS | date: 20/08/2019

job no. | 31 / 34596
report no. | -
Rev no. | A

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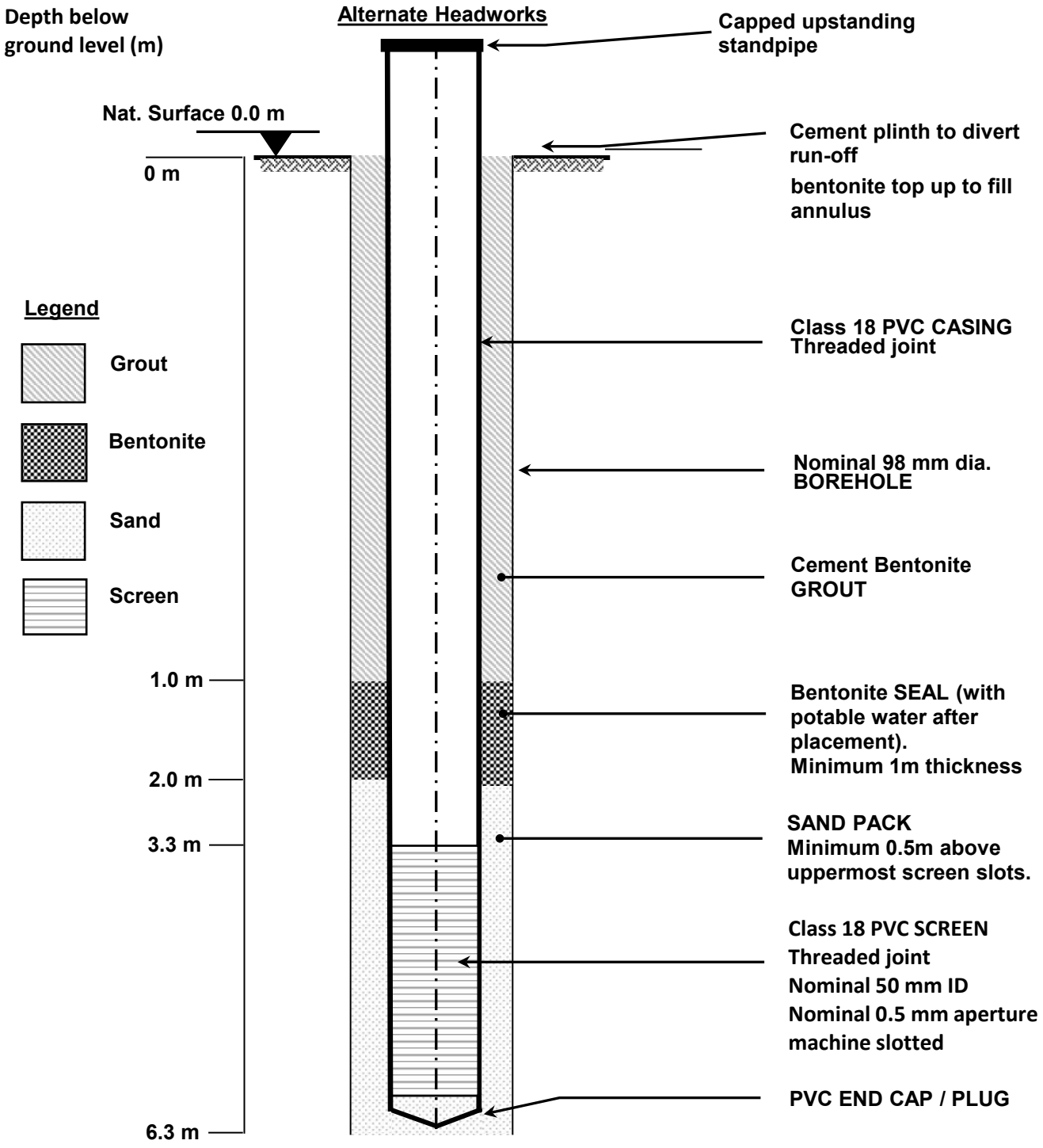

GHD CLIENTS | PEOPLE | PERFORMANCE

Beveridge Northwest Land Development
Geotechnical Site Investigations - Stage 1
Standpipe Diagram - BH04 (not to scale)

scale: | NTS | date: 20/08/2019

job no. | 31 / 34596
report no. | -
Rev no. | A

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Beveridge Northwest Land Development
Geotechnical Site Investigations - Stage 1
Core Photography - BH01

Job Number 31 / 34596
Date 03/07/2019

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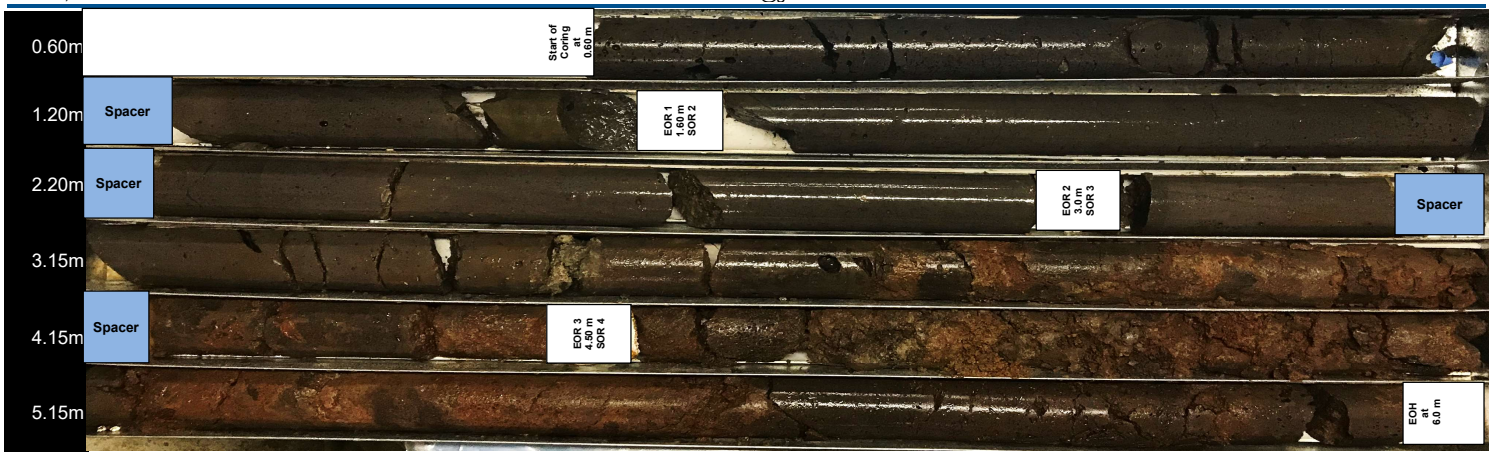

Beveridge Northwest Land Development
Geotechnical Site Investigations - Stage 1
Core Photography - BH02

Job Number 31 / 34596
Date 05/07/2019

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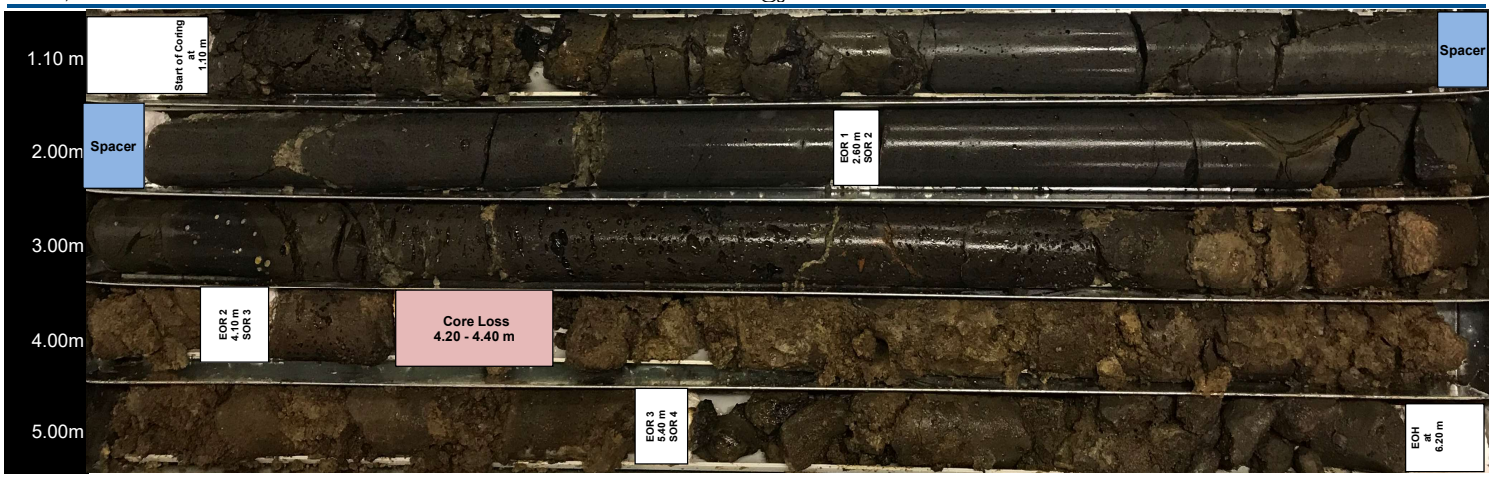

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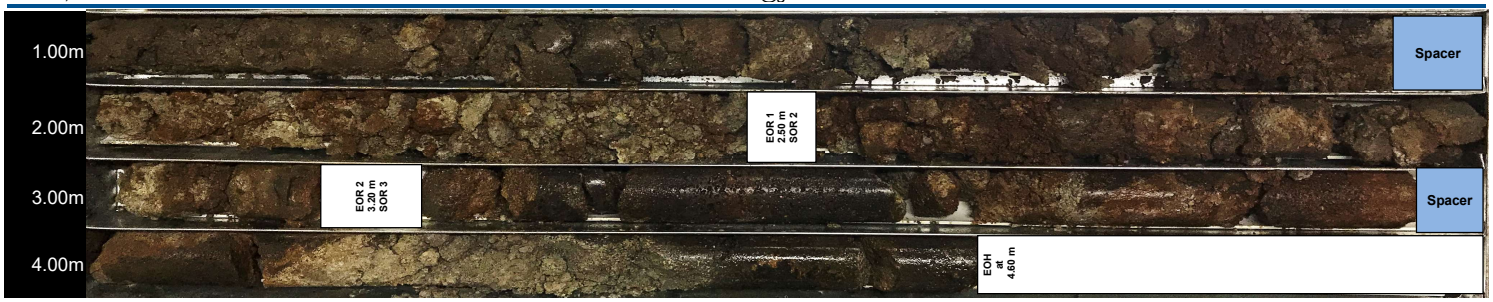
Beveridge Northwest Land Development
Geotechnical Site Investigations - Stage 1
Core Photography - BH03

Job Number 31 / 34596
Date 05/07/2019



Beveridge Northwest Land Development
Geotechnical Site Investigations - Stage 1
Core Photography - BH07

Job Number 31 / 34596
Date 06/07/2019

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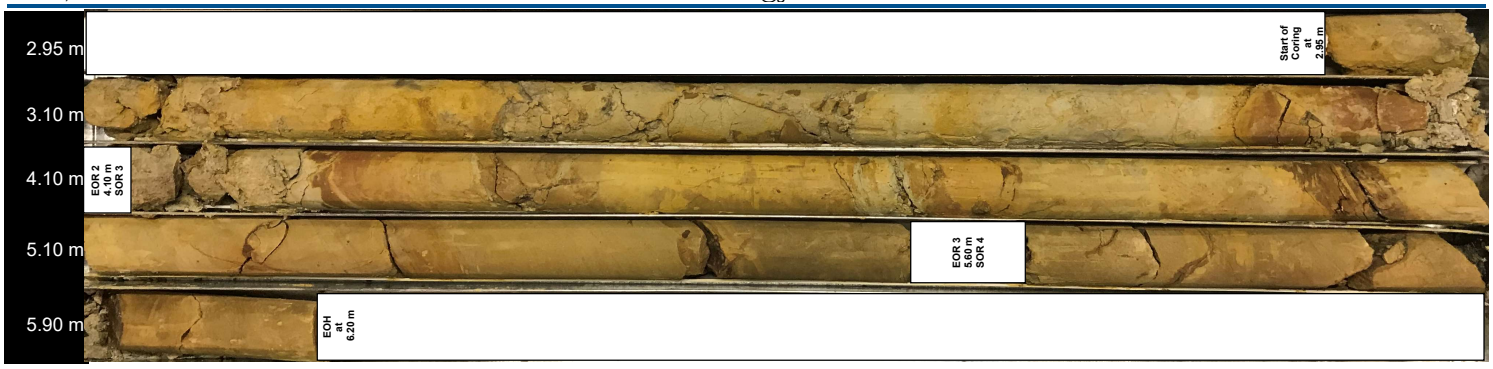

Beveridge Northwest Land Development
Geotechnical Site Investigations - Stage 1
Core Photography - BH08

Job Number 31 / 34596
Date 06/07/2019

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Beveridge Northwest Land Development
Geotechnical Site Investigation - Stage 1
Core Photography - BH09

Job Number 31 / 34596
Date 06/07/2019

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Appendix C – Laboratory Results and Certificates

LABORATORY TESTING

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GENERAL

Samples extracted during the fieldwork stage of a site investigation may be “disturbed” or “undisturbed” (as generally indicated on the test hole logs) depending upon the nature and purpose of the sample as well as the method of extraction, transportation, extrusion and testing. This aspect should be taken into account when assessing test results, which must of necessity, reflect the effects of such disturbance.

All soil properties (as measured by laboratory testing) exhibit inherent variability and thus a certain statistical number of tests is required in order to predict an average property with any degree of confidence. The site variability of soil strata, future changes in moisture and other conditions and the discrete sampling positions must also be considered when assessing the representative nature of the laboratory programme.

Certain laboratory test results provide interpreted soil properties as derived by conventional mathematical procedures. The applicability of such properties to engineering design must be assessed with due regard to the site, sample condition, procedure and project in hand.

TESTING

Laboratory testing is normally carried out in accordance with Australian Standard AS 1289 as amended, or in NSW, Roads and Maritime Services (RMS) standards when specified. The routine Australian Standard tests are as follows:

Moisture Content	AS1289 2.1.1	
Liquid Limit	AS1289 3.1.1	collectively known as Atterberg Limits
Plastic Limit	AS1289 3.2.1	
Plasticity Index	AS1289 3.3.1	
Linear Shrinkage	AS1289 3.4.1	
Particle Density	AS1289 3.5.1	
Particle Size Distribution	AS1289 3.6.1, 3.6.2 and 3.6.3	
Emerson Class Number	AS1289 3.8.1	collectively, Dispersive Classification
Percent Dispersion	AS1289 3.8.2	
Pinhole Dispersion Classification	AS1289 3.8.3	
Hole Erosion (HE)	GHD Method	
No Erosion Filter (NEF)	GHD Method	
Organic Matter	AS1289 4.1.1	
Sulphate Content	AS1289 4.2.1	
pH Value	AS1289 4.3.1	
Resistivity	AS1289 4.4.1	
Standard Compaction	AS1289 5.1.1	
Modified Compaction	AS1289 5.2.1	
Dry Density Ratio	AS1289 5.4.1	
Minimum Density	AS1289 5.5.1	
Density Index	AS1289 5.6.1	
California Bearing Ratio	AS1289 6.1.1 and 6.1.2	
Shear Box	AS1289 6.2.2	
Undrained Triaxial Shear	AS1289 6.4.1 and 6.4.2	
One Dimensional Consolidation	AS1289 6.6.1	
Permeability Testing	AS1289 6.7.1, 6.7.2 and 6.7.3	

Where tests are used which are not covered by appropriate standard procedures, details are given in the report.

LABORATORIES

Our Australian laboratories are NATA accredited to AS ISO / IEC17025 for the listed tests.

The oedometer, triaxial and shear box equipment are fully automated for continuous operation using computer controlled data acquisition, processing and plotting systems.

Ref: DS5.5.2 Issue 0 Date: 05/10/2018

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web: www.ghd.com.au/ghdgeotechnics
Tel: (03) 5136 5900
Fax: (03) 5136 5999

Aggregate/Soil Test Report

Report No: TRA1901075
Issue No: 1
This report replaces all previous issues of report no 'TRA1901075'.

Client: Yarra Valley Water

Project: Hazelwynde Stage 1

Accredited for compliance with ISO / IEC 17025 - Testing

NATA Accredited Laboratory Number: 4092

Approved Signatory: Wayne Burge (Laboratory Operations Manager)

Date of Issue: 30/07/2019

Sample Details

GHD Sample No	TRA19-0801-01
Sampled By	Sampled by GHD
Location	Beveridge, Victoria
BH / TP No.	BH04
Depth (m)	1.0m
Soil Description	CLAY trace Sand (CI)

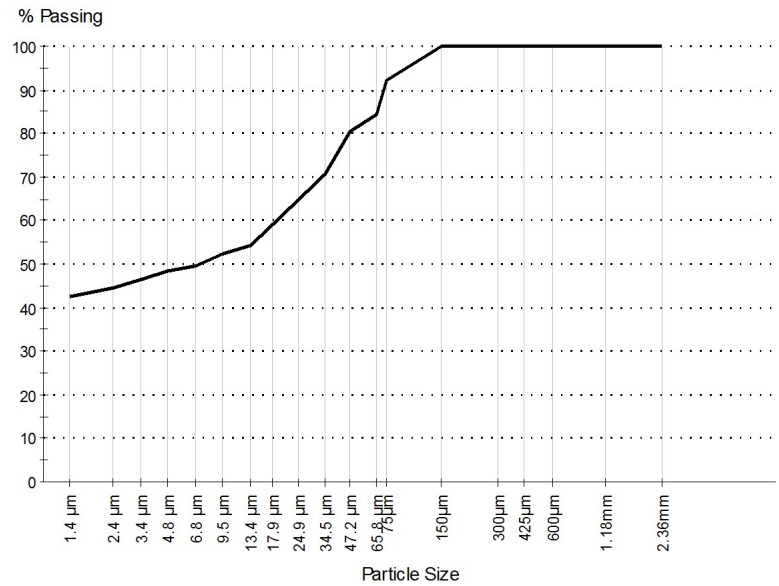
Other Test Results

Description	Method	Result	Limits
Moisture Content (%)	AS 1289.2.1.1	18.3	
Date Tested		24/07/2019	
Sample History	AS 1289.1.1	Oven-dried	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	12.5	
Mould Length (mm)		249.9	

Particle Size Distribution

AS 1289.3.6.3

Drying by: Oven
Date Tested: 30/07/2019



Particle Size	% Passing	Limits
2.36mm	100	
1.18mm	100	
600µm	100	
425µm	100	
300µm	100	
150µm	100	
75µm	92	
65.8 µm	84	
47.2 µm	80	
34.5 µm	71	
24.9 µm	65	
17.9 µm	59	
13.4 µm	54	
9.5 µm	52	
6.8 µm	50	
4.8 µm	49	
3.4 µm	47	
2.4 µm	45	
1.4 µm	43	

Comments

An Assumed SC of 2.65 t/m3 used for Hydrometer Analysis

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Fax: (03) 5136 5999

Aggregate/Soil Test Report

Report No: TRA1901075
Issue No: 1
This report replaces all previous issues of report no 'TRA1901075'.

Client: Yarra Valley Water

Project: Hazelwynde Stage 1

Accredited for compliance with ISO / IEC 17025 - Testing

NATA Accredited Laboratory Number: 4092

Approved Signatory: Wayne Burge (Laboratory Operations Manager)

Date of Issue: 30/07/2019

Other Test Results

Description	Method	Result	Limits
Crumbling		No	
Curling		Yes	
Cracking		No	
Liquid Limit (%)	AS 1289.3.1.2	42	
Method		One Point	
Plastic Limit (%)	AS 1289.3.2.1	15	
Plasticity Index (%)	AS 1289.3.3.1	27	
	AS 1289.3.1.2, AS 1289.3.2.1, AS 1289.3.3.1, AS 1289.3.4.1		
Dispersion Method	AS 1289.3.6.3	Mechanical stirrer	
Emerson Class Number	AS 1289.3.8.1	1	
Soil Description			
Type of Water		Distilled	
Temperature of Water (°C)		18.5	
Date Tested		29/07/2019	

Comments

An Assumed SC of 2.65 t/m3 used for Hydrometer Analysis

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Aggregate/Soil Test Report

Report No: TRA1901076
Issue No: 1
This report replaces all previous issues of report no 'TRA1901076'.

Client: Yarra Valley Water

Project: Hazelwynde Stage 1

Accredited for compliance with ISO / IEC 17025 - Testing

NATA Accredited Laboratory Number: 4092

Approved Signatory: Wayne Burge (Laboratory Operations Manager)

Date of Issue: 30/07/2019

Sample Details

GHD Sample No	TRA19-0801-02
Sampled By	Sampled by GHD
Location	Beveridge, Victoria
BH / TP No.	BH04
Depth (m)	3.0m

Test Results

Description	Method	Result	Limits
Moisture Content (%)	AS 1289.2.1.1	18.4	
Date Tested		24/07/2019	
Sample History	AS 1289.1.1	Oven-dried	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	14.5	
Mould Length (mm)		249.5	
Crumbling		No	
Curling		Yes	
Cracking		No	
Liquid Limit (%)	AS 1289.3.1.2	49	
Method		One Point	
Plastic Limit (%)	AS 1289.3.2.1	17	
Plasticity Index (%)	AS 1289.3.3.1	32	
	AS 1289.3.1.2, AS 1289.3.2.1, AS 1289.3.3.1, AS 1289.3.4.1		
Emerson Class Number	AS 1289.3.8.1	1	
Soil Description			
Type of Water		Distilled	
Temperature of Water (°C)		18.5	
Date Tested		29/07/2019	

Comments

N/A

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Aggregate/Soil Test Report

Report No: TRA1901077
Issue No: 1
This report replaces all previous issues of report no 'TRA1901077'.

Client: Yarra Valley Water

Project: Hazelwynde Stage 1

Accredited for compliance with ISO / IEC 17025 - Testing

NATA Accredited Laboratory Number: 4092

Approved Signatory: Wayne Burge (Laboratory Operations Manager)

Date of Issue: 30/07/2019

Sample Details

GHD Sample No	TRA19-0801-03
Sampled By	Sampled by GHD
Location	Beveridge, Victoria
BH / TP No.	BH04
Depth (m)	6.0m

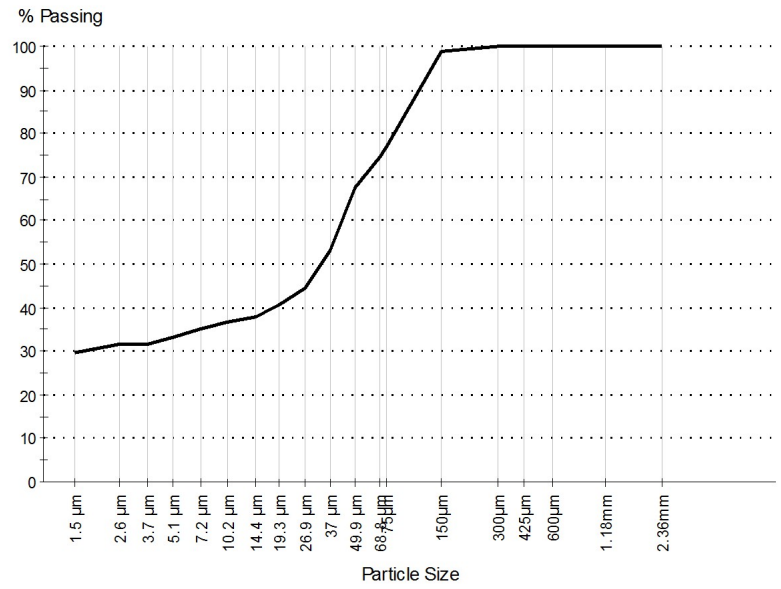
Other Test Results

Description	Method	Result	Limits
Avg Particle Density - passing 2.36mm (g/cm³)	AS 1289.3.5.1	2.61	
Temperature - passing 2.36mm (°C)		19	
Avg Particle Density - retained 2.36mm (g/cm³)			
Temperature - retained 2.36mm (°C)			
Soil Particle Density (g/cm³)			
Date Tested		30/07/2019	

Particle Size Distribution

AS 1289.3.6.3

Drying by: Oven
Date Tested: 30/07/2019



Particle Size	% Passing	Limits
2.36mm	100	
1.18mm	100	
600µm	100	
425µm	100	
300µm	100	
150µm	99	
75µm	77	
68.8 µm	75	
49.9 µm	67	
37.0 µm	53	
26.9 µm	44	
19.3 µm	41	
14.4 µm	38	
10.2 µm	37	
7.2 µm	35	
5.1 µm	33	
3.7 µm	32	
2.6 µm	32	
1.5 µm	30	

Comments

N/A

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Aggregate/Soil Test Report

Report No: TRA1901077
Issue No: 1
This report replaces all previous issues of report no 'TRA1901077'.

Client: Yarra Valley Water

Project: Hazelwynde Stage 1

Accredited for compliance with ISO / IEC 17025 - Testing

NATA Accredited Laboratory Number: 4092

Approved Signatory: Wayne Burge (Laboratory Operations Manager)

Date of Issue: 30/07/2019

Other Test Results

Description	Method	Result	Limits
Dispersion Method	AS 1289.3.6.3	Mechanical stirrer	

Comments

N/A

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Aggregate/Soil Test Report

Report No: TRA1901078
Issue No: 1
This report replaces all previous issues of report no 'TRA1901078'.

Client: Yarra Valley Water

Project: Hazelwynde Stage 1

Accredited for compliance with ISO / IEC 17025 - Testing

NATA Accredited Laboratory Number: 4092

Approved Signatory: Wayne Burge (Laboratory Operations Manager)

Date of Issue: 30/07/2019

Sample Details

GHD Sample No	TRA19-0801-04
Sampled By	Sampled by GHD
Location	Beveridge, Victoria
BH / TP No.	BH05
Depth (m)	1.0m
Soil Description	CLAY trace Sand (CH)

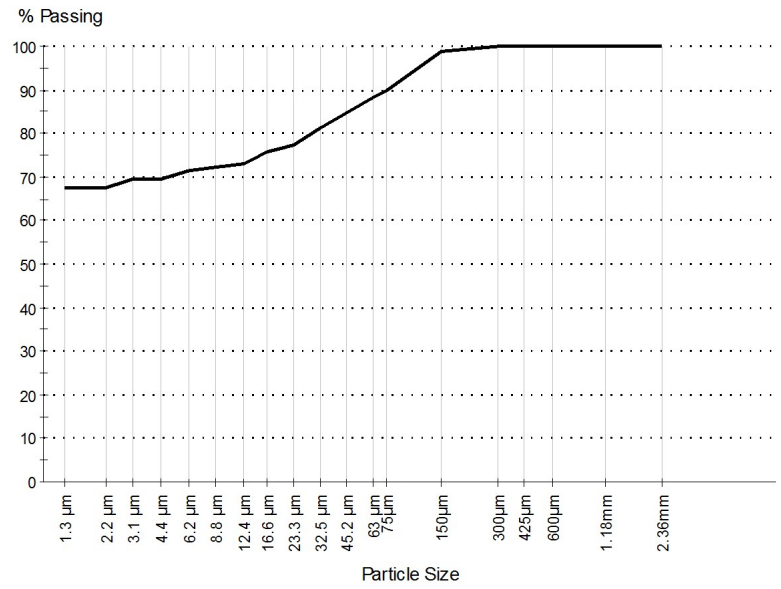
Other Test Results

Description	Method	Result	Limits
Moisture Content (%)	AS 1289.2.1.1	26.7	
Date Tested		24/07/2019	
Sample History	AS 1289.1.1	Oven-dried	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	19.0	
Mould Length (mm)		250.08	

Particle Size Distribution

AS 1289.3.6.3

Drying by: Oven
Date Tested: 30/07/2019



Particle Size	% Passing	Limits
2.36mm	100	
1.18mm	100	
600µm	100	
425µm	100	
300µm	100	
150µm	99	
75µm	90	
63.0 µm	88	
45.2 µm	85	
32.5 µm	81	
23.3 µm	77	
16.6 µm	76	
12.4 µm	73	
8.8 µm	72	
6.2 µm	71	
4.4 µm	70	
3.1 µm	70	
2.2 µm	68	
1.3 µm	68	

Comments

An Assumed SC of 2.65 t/m3 used for Hydrometer Analysis

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Aggregate/Soil Test Report

Report No: TRA1901078
Issue No: 1
This report replaces all previous issues of report no 'TRA1901078'.

Client: Yarra Valley Water

Project: Hazelwynde Stage 1

Accredited for compliance with ISO / IEC 17025 - Testing

NATA Accredited Laboratory Number: 4092

Approved Signatory: Wayne Burge (Laboratory Operations Manager)

Date of Issue: 30/07/2019

Other Test Results

Description	Method	Result	Limits
Crumbling		No	
Curling		Yes	
Cracking		No	
Liquid Limit (%)	AS 1289.3.1.2	75	
Method		One Point	
Plastic Limit (%)	AS 1289.3.2.1	20	
Plasticity Index (%)	AS 1289.3.3.1	55	
	AS 1289.3.1.2, AS 1289.3.2.1, AS 1289.3.3.1, AS 1289.3.4.1		
Dispersion Method	AS 1289.3.6.3	Mechanical stirrer	
Emerson Class Number	AS 1289.3.8.1	1	
Soil Description			
Type of Water		Distilled	
Temperature of Water (°C)		18.5	
Date Tested		29/07/2019	

Comments

An Assumed SC of 2.65 t/m3 used for Hydrometer Analysis

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Aggregate/Soil Test Report

Report No: TRA1901079
Issue No: 1
This report replaces all previous issues of report no 'TRA1901079'.

Client: Yarra Valley Water

Project: Hazelwynde Stage 1

Accredited for compliance with ISO / IEC 17025 - Testing

NATA Accredited Laboratory Number: 4092

Approved Signatory: Wayne Burge (Laboratory Operations Manager)

Date of Issue: 30/07/2019

Sample Details

GHD Sample No	TRA19-0801-05
Sampled By	Sampled by GHD
Location	Beveridge, Victoria
BH / TP No.	BH05
Depth (m)	2.0m

Test Results

Description	Method	Result	Limits
Moisture Content (%)	AS 1289.2.1.1	24.1	
Date Tested		24/07/2019	
Sample History	AS 1289.1.1	Oven-dried	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	18.0	
Mould Length (mm)		254.09	
Crumbling		No	
Curling		Yes	
Cracking		No	
Liquid Limit (%)	AS 1289.3.1.2	64	
Method		One Point	
Plastic Limit (%)	AS 1289.3.2.1	19	
Plasticity Index (%)	AS 1289.3.3.1	45	
	AS 1289.3.1.2, AS 1289.3.2.1, AS 1289.3.3.1, AS 1289.3.4.1		
Emerson Class Number	AS 1289.3.8.1	1	
Soil Description			
Type of Water		Distilled	
Temperature of Water (°C)		18.5	
Date Tested		29/07/2019	

Comments

N/A

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Aggregate/Soil Test Report

Report No: TRA1901080
Issue No: 1
This report replaces all previous issues of report no 'TRA1901080'.

Client: Yarra Valley Water

Project: Hazelwynde Stage 1

Accredited for compliance with ISO / IEC 17025 - Testing

NATA Accredited Laboratory Number: 4092

Approved Signatory: Wayne Burge (Laboratory Operations Manager)

Date of Issue: 30/07/2019

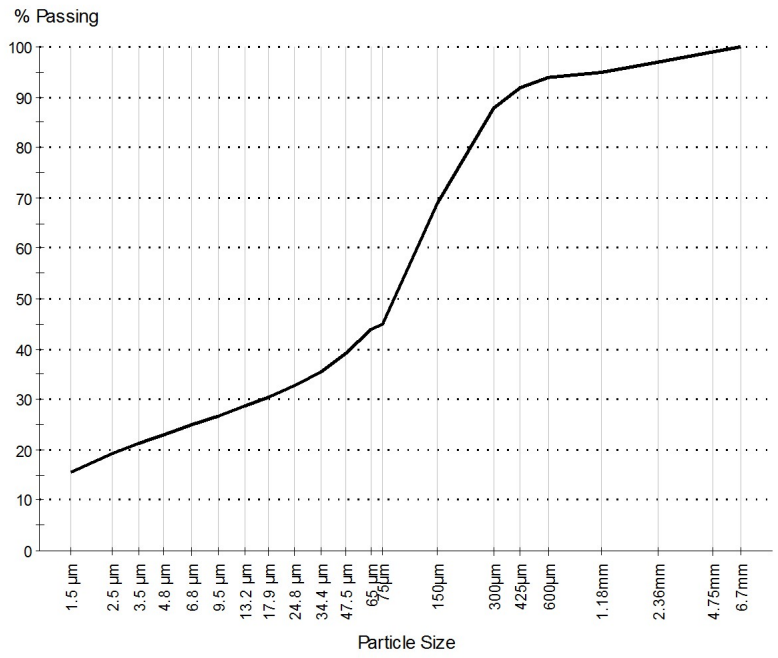
Sample Details

GHD Sample No	TRA19-0801-06
Sampled By	Sampled by GHD
Location	Beveridge, Victoria
BH / TP No.	BH05
Depth (m)	4.0m

Other Test Results

Description	Method	Result	Limits
	AS 1289.3.6.3		
Dispersion Method		Mechanical stirrer	

Particle Size Distribution



Method: AS 1289.3.6.3
Drying by: Oven
Date Tested: 30/07/2019

Particle Size	% Passing	Limits
6.7mm	100	
4.75mm	99	
2.36mm	97	
1.18mm	95	
600µm	94	
425µm	92	
300µm	88	
150µm	69	
75µm	45	
65.0 µm	44	
47.5 µm	39	
34.4 µm	35	
24.8 µm	33	
17.9 µm	31	
13.2 µm	29	
9.5 µm	27	
6.8 µm	25	
4.8 µm	23	
3.5 µm	21	
2.5 µm	19	
1.5 µm	16	

Comments

An Assumed SC of 2.65 t/m3 used for Hydrometer Analysis

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Aggregate/Soil Test Report

Report No: TRA1901081
Issue No: 1
This report replaces all previous issues of report no 'TRA1901081'.

Client: Yarra Valley Water

Project: Hazelwynde Stage 1

Accredited for compliance with ISO / IEC 17025 - Testing

NATA Accredited Laboratory Number: 4092

Approved Signatory: Wayne Burge (Laboratory Operations Manager)

Date of Issue: 30/07/2019

Sample Details

GHD Sample No	TRA19-0801-07
Sampled By	Sampled by GHD
Location	Beveridge, Victoria
BH / TP No.	BH06
Depth (m)	1.0m

Test Results

Description	Method	Result	Limits
Moisture Content (%)	AS 1289.2.1.1	19.7	
Date Tested		24/07/2019	
Sample History	AS 1289.1.1	Oven-dried	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	14.5	
Mould Length (mm)		249.82	
Crumbling		No	
Curling		No	
Cracking		Yes	
Liquid Limit (%)	AS 1289.3.1.2	58	
Method		One Point	
Plastic Limit (%)	AS 1289.3.2.1	19	
Plasticity Index (%)	AS 1289.3.3.1	39	
	AS 1289.3.1.2, AS 1289.3.2.1, AS 1289.3.3.1, AS 1289.3.4.1		
Emerson Class Number	AS 1289.3.8.1	1	
Soil Description			
Type of Water		Distilled	
Temperature of Water (°C)		18.5	
Date Tested		29/07/2019	

Comments

N/A

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Aggregate/Soil Test Report

Report No: TRA1901082
Issue No: 1
This report replaces all previous issues of report no 'TRA1901082'.

Client: Yarra Valley Water

Project: Hazelwynde Stage 1

Accredited for compliance with ISO / IEC 17025 - Testing

NATA Accredited Laboratory Number: 4092

Approved Signatory: Wayne Burge (Laboratory Operations Manager)

Date of Issue: 30/07/2019

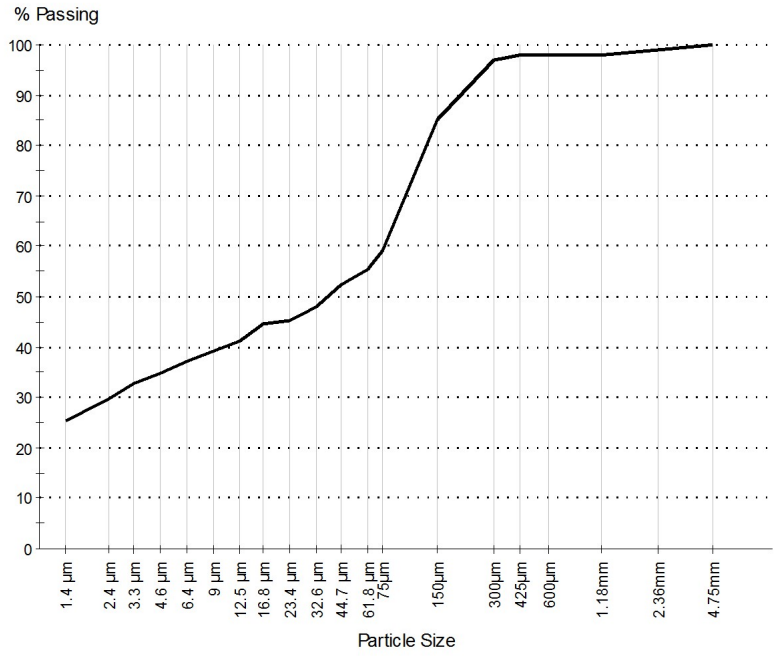
Sample Details

GHD Sample No	TRA19-0801-08
Sampled By	Sampled by GHD
Location	Beveridge, Victoria
BH / TP No.	BH06
Depth (m)	4.0m
Soil Description	Sandy CLAY (CL)

Other Test Results

Description	Method	Result	Limits
Moisture Content (%)	AS 1289.2.1.1	11.9	
Date Tested		24/07/2019	
Sample History	AS 1289.1.1	Oven-dried	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	9.0	
Mould Length (mm)		249.55	
Crumbling		No	
Curling		No	
Cracking		No	
Liquid Limit (%)	AS 1289.3.1.2	31	
Method		One Point	

Particle Size Distribution



Method: AS 1289.3.6.3
Drying by: Oven
Date Tested: 30/07/2019

Particle Size	% Passing	Limits
4.75mm	100	
2.36mm	99	
1.18mm	98	
600µm	98	
425µm	98	
300µm	97	
150µm	85	
75µm	59	
61.8 µm	55	
44.7 µm	52	
32.6 µm	48	
23.4 µm	45	
16.8 µm	45	
12.5 µm	41	
9.0 µm	39	
6.4 µm	37	
4.6 µm	35	
3.3 µm	33	
2.4 µm	30	
1.4 µm	25	

Comments

An Assumed SC of 2.65 t/m3 used for Hydrometer Analysis

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Aggregate/Soil Test Report

Report No: TRA1901082
Issue No: 1
This report replaces all previous issues of report no 'TRA1901082'.

Client: Yarra Valley Water

Project: Hazelwynde Stage 1

Accredited for compliance with ISO / IEC 17025 - Testing

NATA Accredited Laboratory Number: 4092

Approved Signatory: Wayne Burge (Laboratory Operations Manager)

Date of Issue: 30/07/2019

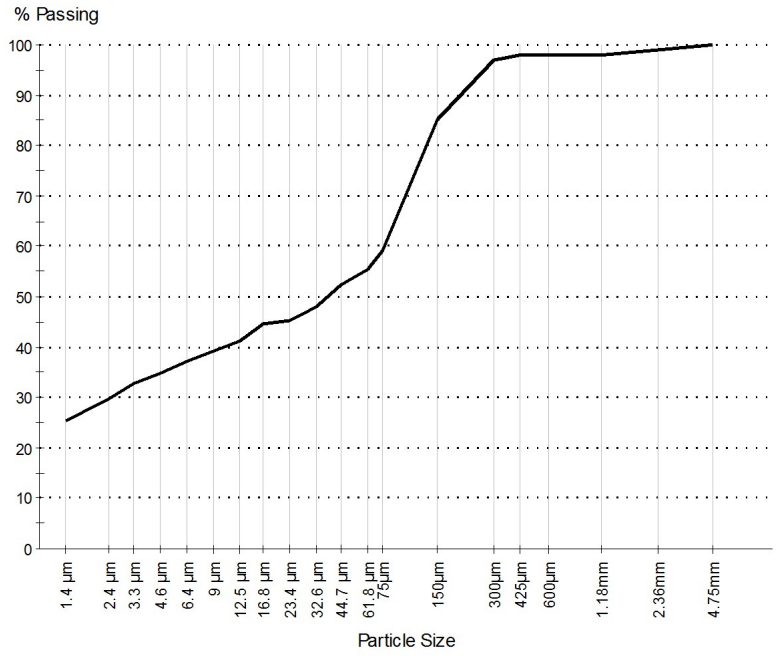
Sample Details

GHD Sample No	TRA19-0801-08
Sampled By	Sampled by GHD
Location	Beveridge, Victoria
BH / TP No.	BH06
Depth (m)	4.0m
Soil Description	Sandy CLAY (CL)

Other Test Results

Description	Method	Result	Limits
Plastic Limit (%)	AS 1289.3.2.1	14	
Plasticity Index (%)	AS 1289.3.3.1	17	
	AS 1289.3.1.2, AS 1289.3.2.1, AS 1289.3.3.1, AS 1289.3.4.1		
	AS 1289.3.6.3		
Dispersion Method		Mechanical stirrer	
Emerson Class Number	AS 1289.3.8.1	1	
Soil Description			
Type of Water		Distilled	
Temperature of Water (°C)		18.5	
Date Tested		29/07/2019	

Particle Size Distribution



Method: AS 1289.3.6.3
Drying by: Oven
Date Tested: 30/07/2019

Particle Size	% Passing	Limits
4.75mm	100	
2.36mm	99	
1.18mm	98	
600µm	98	
425µm	98	
300µm	97	
150µm	85	
75µm	59	
61.8 µm	55	
44.7 µm	52	
32.6 µm	48	
23.4 µm	45	
16.8 µm	45	
12.5 µm	41	
9.0 µm	39	
6.4 µm	37	
4.6 µm	35	
3.3 µm	33	
2.4 µm	30	
1.4 µm	25	

Comments

An Assumed SC of 2.65 t/m3 used for Hydrometer Analysis

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Aggregate/Soil Test Report

Report No: TRA1901083
Issue No: 1
This report replaces all previous issues of report no 'TRA1901083'.

Client: Yarra Valley Water

Project: Hazelwynde Stage 1

Accredited for compliance with ISO / IEC 17025 - Testing

NATA Accredited Laboratory Number: 4092

Approved Signatory: Wayne Burge (Laboratory Operations Manager)

Date of Issue: 30/07/2019

Sample Details

GHD Sample No	TRA19-0801-09
Sampled By	Sampled by GHD
Location	Beveridge, Victoria
BH / TP No.	BH07
Depth (m)	1.0m
Soil Description	CLAY trace Sand (CH)

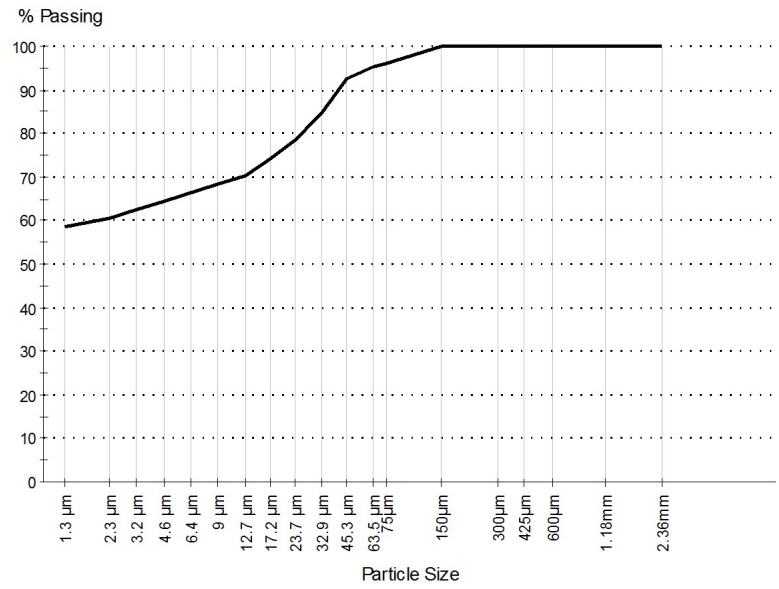
Other Test Results

Description	Method	Result	Limits
Moisture Content (%)	AS 1289.2.1.1	26.9	
Date Tested		24/07/2019	
Sample History	AS 1289.1.1	Oven-dried	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	18.0	
Mould Length (mm)		250.08	

Particle Size Distribution

AS 1289.3.6.3

Drying by: Oven
Date Tested: 30/07/2019



Particle Size	% Passing	Limits
2.36mm	100	
1.18mm	100	
600µm	100	
425µm	100	
300µm	100	
150µm	100	
75µm	96	
63.5 µm	95	
45.3 µm	93	
32.9 µm	85	
23.7 µm	79	
17.2 µm	74	
12.7 µm	70	
9.0 µm	68	
6.4 µm	66	
4.6 µm	64	
3.2 µm	63	
2.3 µm	61	
1.3 µm	59	

Comments

An Assumed SC of 2.65 t/m3 used for Hydrometer Analysis

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Aggregate/Soil Test Report

Report No: TRA1901083
Issue No: 1
This report replaces all previous issues of report no 'TRA1901083'.

Client: Yarra Valley Water

Project: Hazelwynde Stage 1

Accredited for compliance with ISO / IEC 17025 - Testing

NATA Accredited Laboratory Number: 4092

Approved Signatory: Wayne Burge (Laboratory Operations Manager)

Date of Issue: 30/07/2019

Other Test Results

Description	Method	Result	Limits
Crumbling		No	
Curling		No	
Cracking		Yes	
Liquid Limit (%)	AS 1289.3.1.2	75	
Method		One Point	
Plastic Limit (%)	AS 1289.3.2.1	21	
Plasticity Index (%)	AS 1289.3.3.1	54	
	AS 1289.3.1.2, AS 1289.3.2.1, AS 1289.3.3.1, AS 1289.3.4.1		
Dispersion Method	AS 1289.3.6.3	Mechanical stirrer	
Emerson Class Number	AS 1289.3.8.1	1	
Soil Description			
Type of Water		Distilled	
Temperature of Water (°C)		18.5	
Date Tested		29/07/2019	

Comments

An Assumed SC of 2.65 t/m3 used for Hydrometer Analysis

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Aggregate/Soil Test Report

Report No: TRA1901084
Issue No: 1
This report replaces all previous issues of report no 'TRA1901084'.

Client: Yarra Valley Water

Project: Hazelwynde Stage 1

Accredited for compliance with ISO / IEC 17025 - Testing

NATA Accredited Laboratory Number: 4092

Approved Signatory: Wayne Burge (Laboratory Operations Manager)

Date of Issue: 30/07/2019

Sample Details

GHD Sample No	TRA19-0801-10
Sampled By	Sampled by GHD
Location	Beveridge, Victoria
BH / TP No.	BH07
Depth (m)	2.5m

Test Results

Description	Method	Result	Limits
Moisture Content (%)	AS 1289.2.1.1	16.7	
Date Tested		24/07/2019	
Sample History	AS 1289.1.1		
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	8.0	
Mould Length (mm)		250	
Crumbling		No	
Curling		No	
Cracking		Yes	
Liquid Limit (%)	AS 1289.3.1.2	34	
Method		One Point	
Plastic Limit (%)	AS 1289.3.2.1	13	
Plasticity Index (%)	AS 1289.3.3.1	21	
	AS 1289.3.1.2, AS 1289.3.2.1, AS 1289.3.3.1, AS 1289.3.4.1		
Emerson Class Number	AS 1289.3.8.1	1	
Soil Description			
Type of Water		Distilled	
Temperature of Water (°C)		18.5	
Date Tested		29/07/2019	

Comments

N/A

Traralgon Laboratory
5 Church Street
Traralgon Vic 3844
email: mwlmail@ghd.com.au
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Tel: (03) 5136 5900
Fax: (03) 5136 5999

Aggregate/Soil Test Report

Report No: TRA1901085
Issue No: 1
This report replaces all previous issues of report no 'TRA1901085'.

Client: Yarra Valley Water

Project: Hazelwynde Stage 1

Accredited for compliance with ISO / IEC 17025 - Testing

NATA Accredited Laboratory Number: 4092

Approved Signatory: Wayne Burge (Laboratory Operations Manager)

Date of Issue: 31/07/2019

Sample Details

GHD Sample No	TRA19-0801-11
Sampled By	Sampled by GHD
Location	Beveridge, Victoria
BH / TP No.	BH09
Depth (m)	1.0m

Test Results

Description	Method	Result	Limits
Moisture Content (%)	AS 1289.2.1.1	28.7	
Date Tested		24/07/2019	
Sample History	AS 1289.1.1		
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	19.5	
Mould Length (mm)		249.6	
Crumbling		No	
Curling		Yes	
Cracking		Yes	
Liquid Limit (%)	AS 1289.3.1.2	70	
Method		One Point	
Plastic Limit (%)	AS 1289.3.2.1	19	
Plasticity Index (%)	AS 1289.3.3.1	51	
	AS 1289.3.1.2, AS 1289.3.2.1, AS 1289.3.3.1, AS 1289.3.4.1		
Emerson Class Number	AS 1289.3.8.1	1	
Soil Description			
Type of Water		Distilled	
Temperature of Water (°C)		20.0	
Date Tested		29/07/2019	

Comments

N/A

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Traralgon Vic 3844
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web: www.ghd.com.au/ghdgeotechnics
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Aggregate/Soil Test Report

Report No: TRA1901086
Issue No: 1
This report replaces all previous issues of report no 'TRA1901086'.

Client: Yarra Valley Water

Project: Hazelwynde Stage 1

Accredited for compliance with ISO / IEC 17025 - Testing

NATA Accredited Laboratory Number: 4092

Approved Signatory: Wayne Burge (Laboratory Operations Manager)

Date of Issue: 31/07/2019

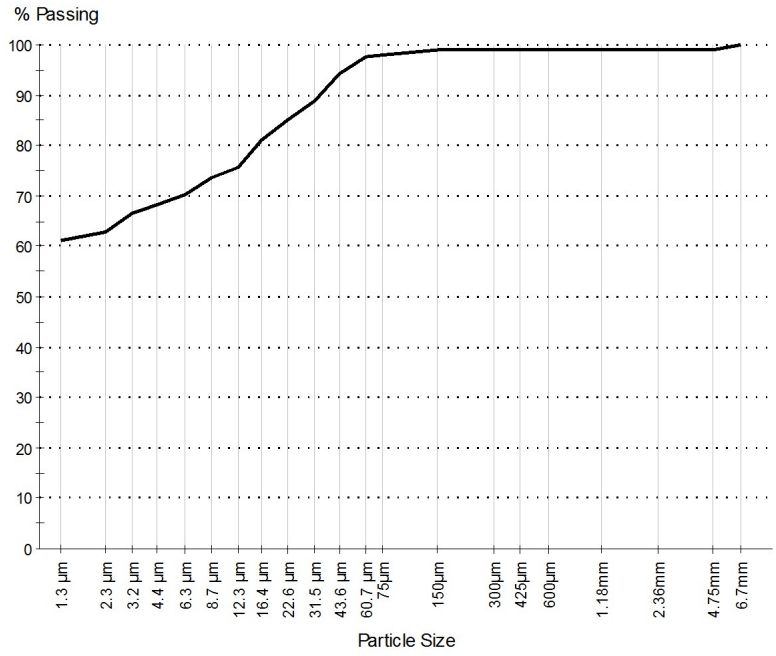
Sample Details

GHD Sample No	TRA19-0801-12
Sampled By	Sampled by GHD
Location	Beveridge, Victoria
BH / TP No.	BH09
Depth (m)	2.0m
Soil Description	CLAY trace Sand (CH)

Other Test Results

Description	Method	Result	Limits
Moisture Content (%)	AS 1289.2.1.1	32.1	
Date Tested		24/07/2019	
Sample History	AS 1289.1.1		
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	20.0	
Mould Length (mm)		250.1	
Crumbling		No	
Curling		Yes	
Cracking		No	
Liquid Limit (%)	AS 1289.3.1.2	80	
Method		One Point	

Particle Size Distribution



Method: AS 1289.3.6.3
Drying by: Oven
Date Tested: 30/07/2019

Particle Size	% Passing	Limits
6.7mm	100	
4.75mm	99	
2.36mm	99	
1.18mm	99	
600µm	99	
425µm	99	
300µm	99	
150µm	99	
75µm	98	
60.7 µm	98	
43.6 µm	94	
31.5 µm	89	
22.6 µm	85	
16.4 µm	81	
12.3 µm	76	
8.7 µm	74	
6.3 µm	70	
4.4 µm	68	
3.2 µm	67	
2.3 µm	63	
1.3 µm	61	

Comments

An Assumed SC of 2.65 t/m3 used for Hydrometer Analysis

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Fax: (03) 5136 5999

Aggregate/Soil Test Report

Report No: TRA1901086
Issue No: 1
This report replaces all previous issues of report no 'TRA1901086'.

Client: Yarra Valley Water

Project: Hazelwynde Stage 1

Accredited for compliance with ISO / IEC 17025 - Testing

NATA Accredited Laboratory Number: 4092

Approved Signatory: Wayne Burge (Laboratory Operations Manager)

Date of Issue: 31/07/2019

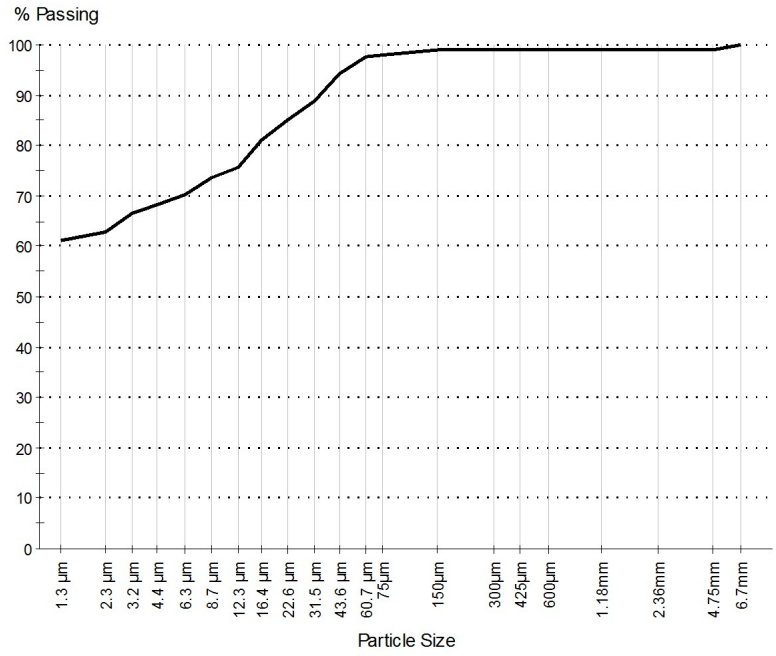
Sample Details

GHD Sample No	TRA19-0801-12
Sampled By	Sampled by GHD
Location	Beveridge, Victoria
BH / TP No.	BH09
Depth (m)	2.0m
Soil Description	CLAY trace Sand (CH)

Other Test Results

Description	Method	Result	Limits
Plastic Limit (%)	AS 1289.3.2.1	20	
Plasticity Index (%)	AS 1289.3.3.1	60	
	AS 1289.3.1.2, AS 1289.3.2.1, AS 1289.3.3.1, AS 1289.3.4.1		
	AS 1289.3.6.3		
Dispersion Method		Mechanical stirrer	
Emerson Class Number	AS 1289.3.8.1	1	
Soil Description			
Type of Water		distilled	
Temperature of Water (°C)		18.5	
Date Tested		29/07/2019	

Particle Size Distribution



Method: AS 1289.3.6.3
Drying by: Oven
Date Tested: 30/07/2019

Particle Size	% Passing	Limits
6.7mm	100	
4.75mm	99	
2.36mm	99	
1.18mm	99	
600µm	99	
425µm	99	
300µm	99	
150µm	99	
75µm	98	
60.7 µm	98	
43.6 µm	94	
31.5 µm	89	
22.6 µm	85	
16.4 µm	81	
12.3 µm	76	
8.7 µm	74	
6.3 µm	70	
4.4 µm	68	
3.2 µm	67	
2.3 µm	63	
1.3 µm	61	

Comments

An Assumed SC of 2.65 t/m3 used for Hydrometer Analysis

Bamford Rock Testing Services

239 Arden Street, North Melbourne, Vic 3051 Australia
Telephone : (03) 9329 2818 email : tests@bamfordrocks.com.au ABN : 78 167 341 693

NATA Accredited Facility No. 19523 Accredited for compliance with ISO/IEC 17025 - Testing

ACCREDITED FOR TECHNICAL COMPETENCE

REPORT 827
ON
ROCK TESTING

(BRTS JOB NUMBER 827)

Client : GHD Pty Ltd

Project : Beveridge North West Land Development Project – Beveridge, 3064

Reference : 31-34596

14th August, 2019

BRTS
Bamford Rock Testing Services

UNIAXIAL COMPRESSIVE STRENGTH
AS 4133.4.2.1

NATA Accredited Facility No. 19523
239 Arden St, North Melbourne VIC 3051
Ph: (03) 9329 2818

Client	GHD Pty Ltd	**Reference**	31-34596
Project	Beveridge North West Land Development Project		
Location	Beveridge, 3064		

Report no	**C005-1997**
Sample no	**B19-1997**
Client No.	**C005**
Date	14-Aug-19
Date Tested	13-Aug-19
Tested by	JC
Checked by	RD

Sample location / identification						**Sample Number**	UCS1	
Sample Description	Basalt - SW-FR		Borehole	BH01	Depth (m)	1.25	-	1.45
Failure Mode	AX							

SAMPLE DETAILS			TESTING DETAILS					
Diameter	51.67	mm	**Rate of Deformation**	0.030	mm/min	**Bulk Density**	2679	**kg/m^3**
Length	129.87	mm	**Rate of Loading**	42.93	kPa/s	**Dry Density**	-	**kg/m^3**
L/D Ratio	2.51		**Test Duration**	25 Min 14 Sec		Axial Load @ Failure	136.24	kN

Testing Machine: MATEST CYBER-PLUS EVOLUTION 3MN

TEST RESULTS

	UCS	**64.98**	**MPa**
Young's modulus E (Mid-third)		ND	**GPa**
	Poisson's ratio (v)	ND	
	Moisture Content	**As Received**	

Sample Storage Comments

Sample was left wrapped in plastic, as received, until removed for specimen preparation.
Prepared specimen was placed in a sealed plastic bag, until tested.

Failure Mode Legend

AX	Simple axial cleavage	**RS**	Rock substance
SS	Simple shear	**BEDDING**	Bedding
MS	Multiple shear	**DEFECT**	Defect
MAX	Multiple axial cleavage		
MFR	Multiple fracture		
DIS	Disintegrated		

Before Test

After Test

References

Failure Mode: AS 4133.4.3.2- 2013
Moisture Content: AS 4133.1.1.1 - 2005

Approved by :

Dr. W. E. Bamford Dr. D. Palamakumbure

NATA ACCREDITED FOR TECHNICAL COMPETENCE

BRTS
Bamford Rock Testing Services

239 ARDEN STREET, NORTH MELBOURNE, 3051 AUSTRALIA
NATA Accredited Facility No. 19523

NATA
ACCREDITED FOR TECHNICAL COMPETENCE

Test Request No. : 827
Date: 1 August 2019
Client: GHD Pty Ltd
Project: Beveridge North West Land Development Project
Location: Beveridge, 3064
Reference: 31-34596

AS 4133.4.1

AXIAL POINT LOAD STRENGTH INDEX

BRTS Sample Number	Client's Sample Number	Lithology - Weathering Class	Borehole	Depth from (m)	Depth to (m)	Is(50) (MPa)	Indentation Hardness Index (IHI) (kN/mm)	*Failure Mode*
B19-1998	PLT7	Basalt - SW-FR	BH01	1.45	1.55	**3.52**	0.52	*1*
B19-1999	PLT8	Basalt - HW	BH01	4.07	4.12	**1.87**	0.23	*1*
B19-2000	PLT6	Basalt - FR	BH02	2.53	2.6	**2.20**	0.30	*4*
B19-2001	PLT5	Basalt - HW	BH02	5.3	5.4	**1.63**	0.22	*1*
B19-2002	PLT4	Basalt - HW	BH03	3.43	3.48	**1.19**	0.18	*1*
B19-2003	PLT9	Siltstone - HW-MW	BH07	4.25	4.37	**0.98**	0.14	*4*
B19-2004	PLT3	Basalt - SW	BH08	1.2	1.3	**5.77**	0.78	*1*
B19-2005	PLT1	Basalt - SW	BH09	3.1	3.2	**4.39**	0.57	*1*
B19-2006	PLT2	Basalt - FR	BH09	4	4.1	**4.94**	0.61	*1*
B19-2010	PLT10	Siltstone - HW-MW	BH07	5.45	5.6	**0.68**	0.10	*1*

Failure Mode: 1. Fracture through rock substance, not influenced by weak planes 2. Fracture along bedding
3. Fracture influenced by pre-existing plane, microfracture, vein, chemical alteration 4. Chip or partial failure 5. Did not fail


B19-1998
PLT7
Basalt
SW-FR
BH01
1.45
Control Patches
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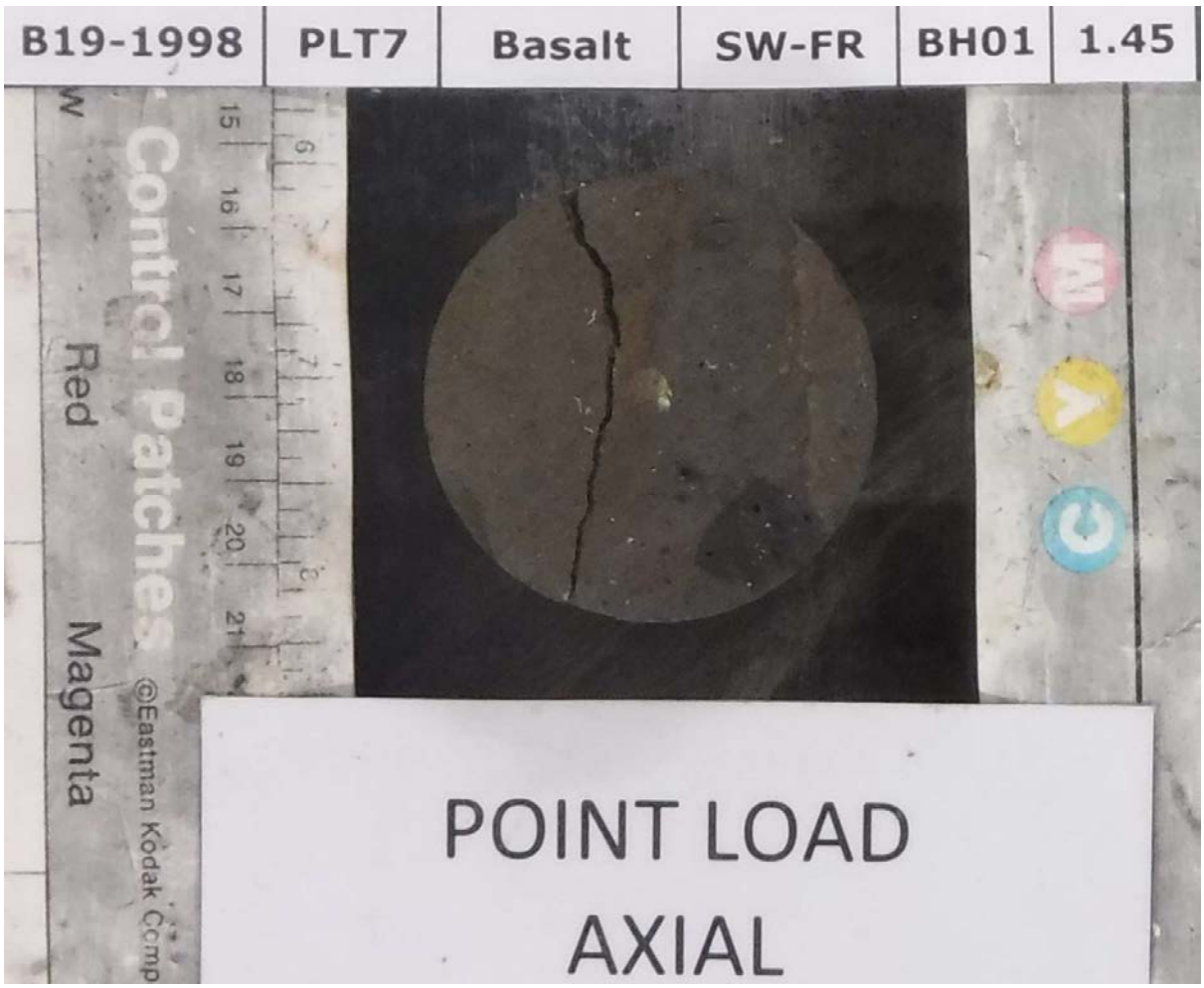
Red
Magenta
POINT LOAD
AXIAL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PLT7
Basalt
SW-FR
BH01
1.45
Control Patches
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AXIAL


B19-1999
PLT8
Basalt
HW
BH01
4.07
Control Patches
Red
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B19-1999
PLT8
Basalt
HW
BH01
4.07
Control Patches
Red
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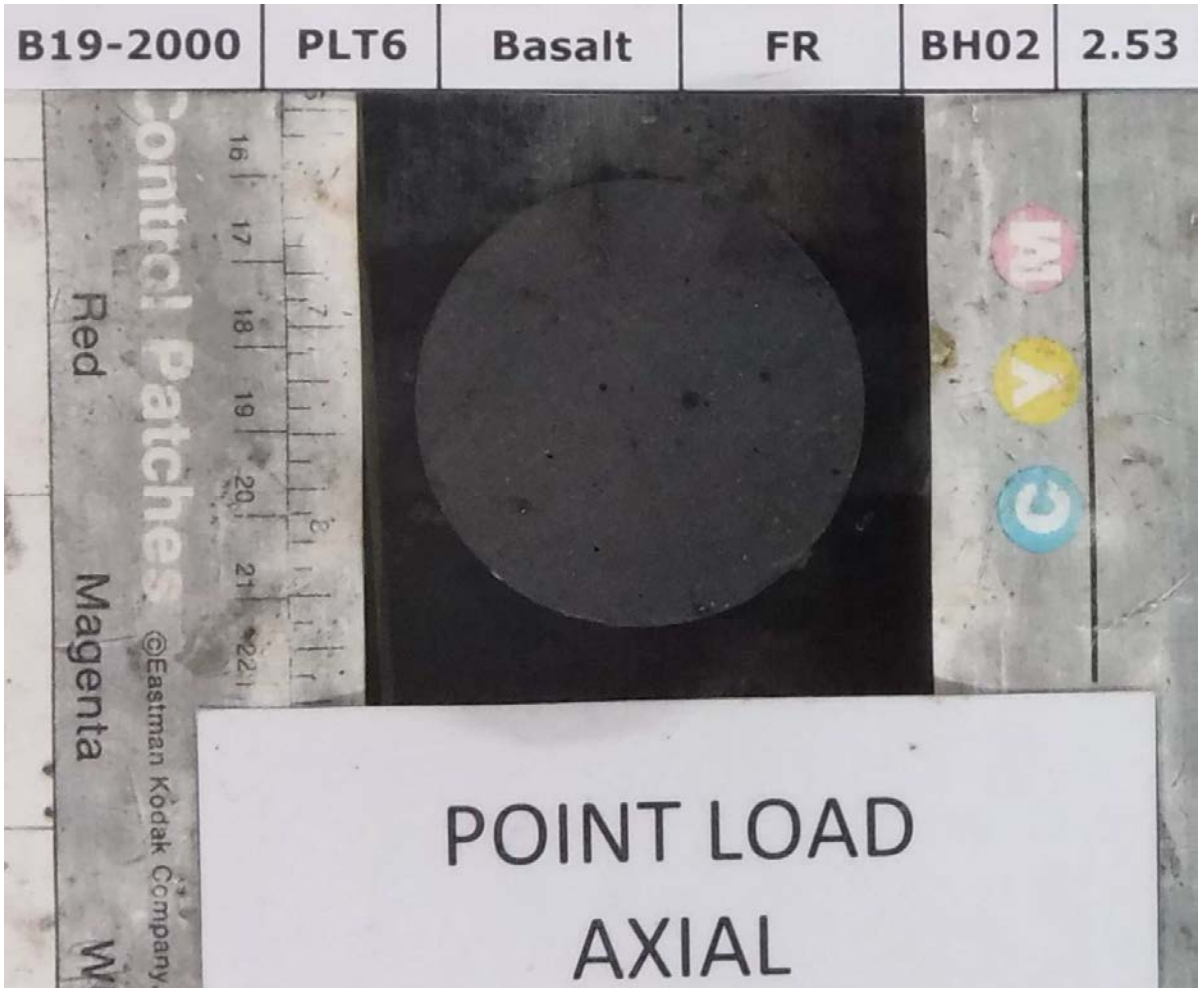
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PLT6
Basalt
FR
BH02
2.53
Control Patches
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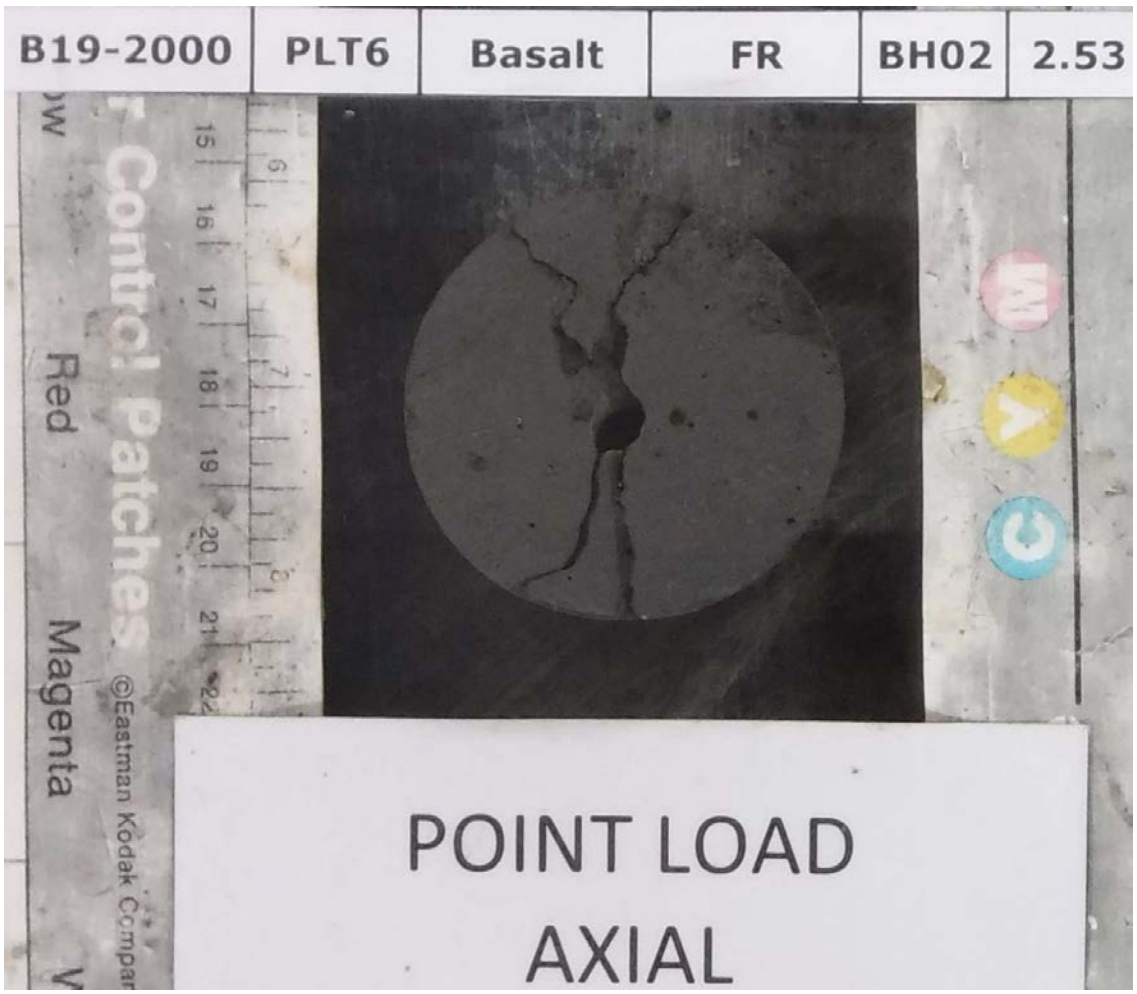
Magenta
POINT LOAD
AXIAL


B19-2000
PLT6
Basalt
FR
BH02
2.53
Control Patches
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Magenta
POINT LOAD
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B19-2001
PLT5
Basalt
HW
BH02
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B19-2001
PLT5
Basalt
HW
BH02
5.3
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B19-2002
PLT4
Basalt
HW
BH03
3.43
Control Patches
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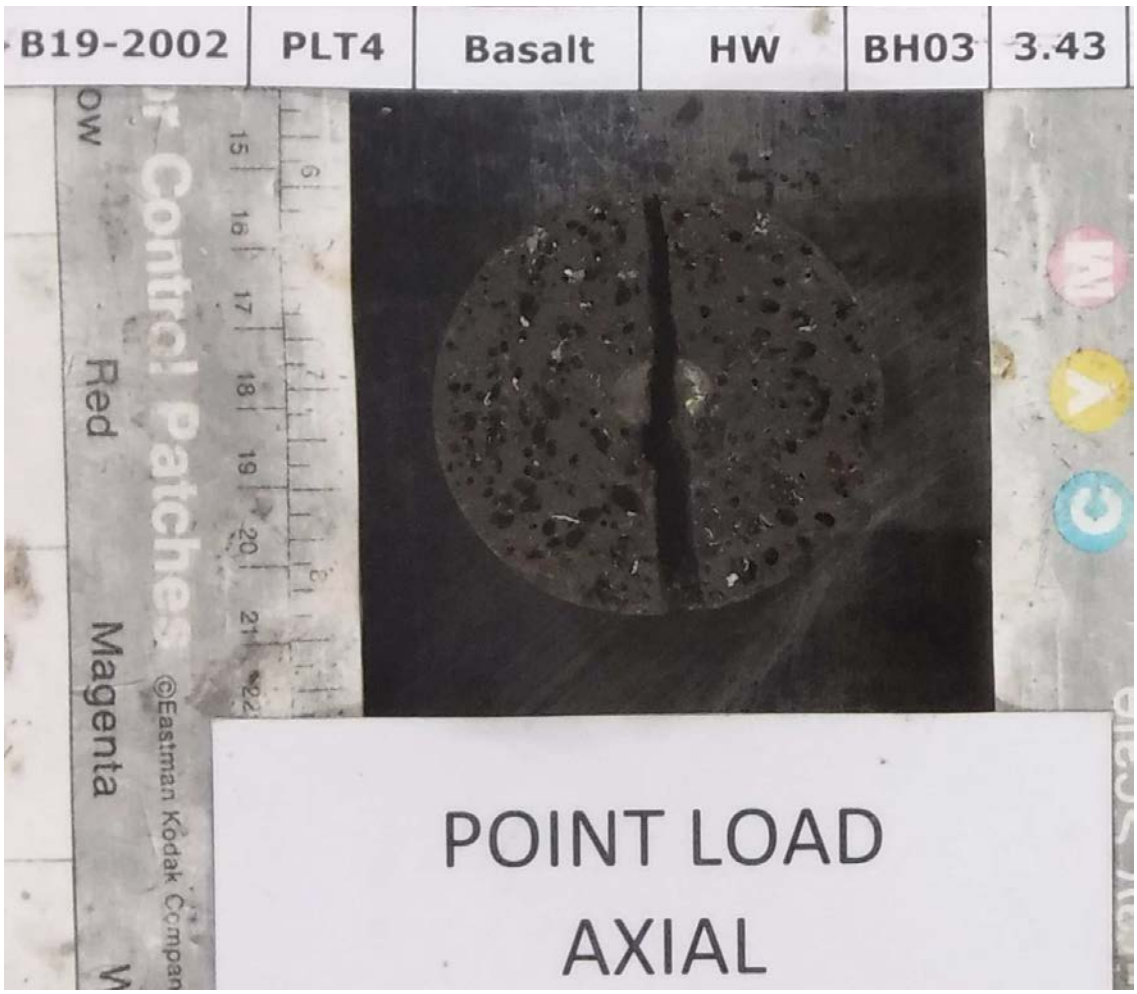
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PLT4
Basalt
HW
BH03
3.43
Red
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AXIAL


B19-2003
PLT9
Siltstone
HW-MW
BH07
4.25
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Magenta
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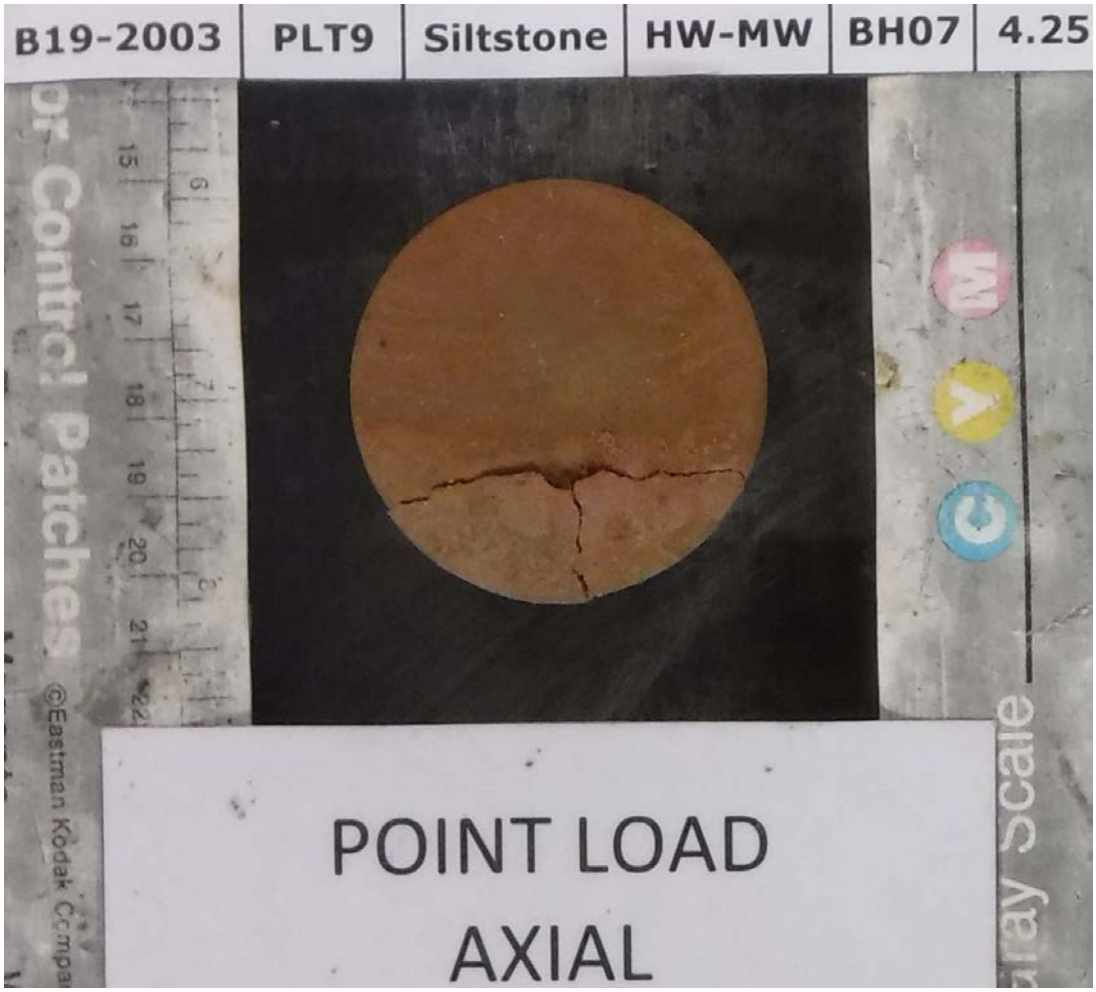
B19-2003
PLT9
Siltstone
HW-MW
BH07
4.25
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B19-2004
PLT3
Basalt
SW
BH08
1.2
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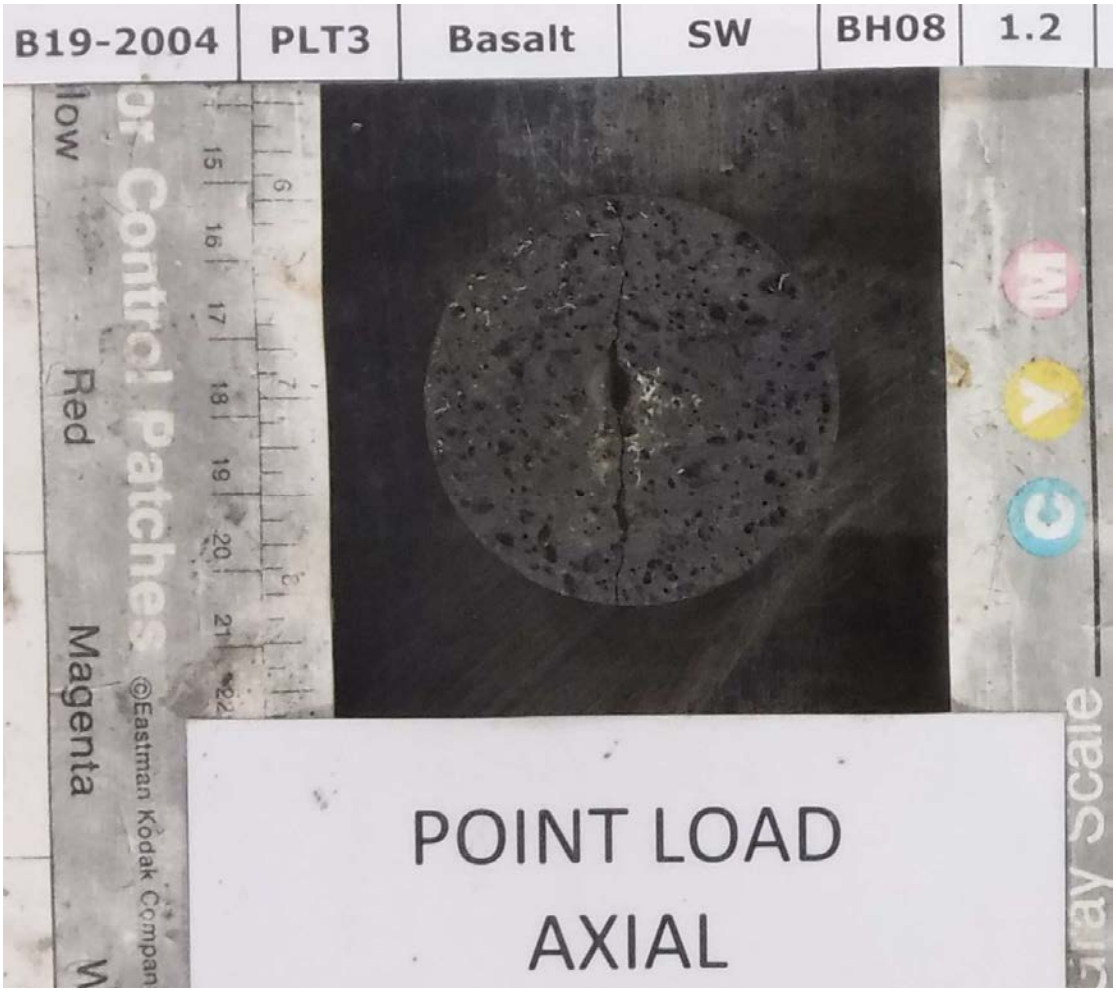
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Basalt
SW
BH08
1.2
Control Patches
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B19-2005
PLT1
Basalt
SW
BH09
3.1
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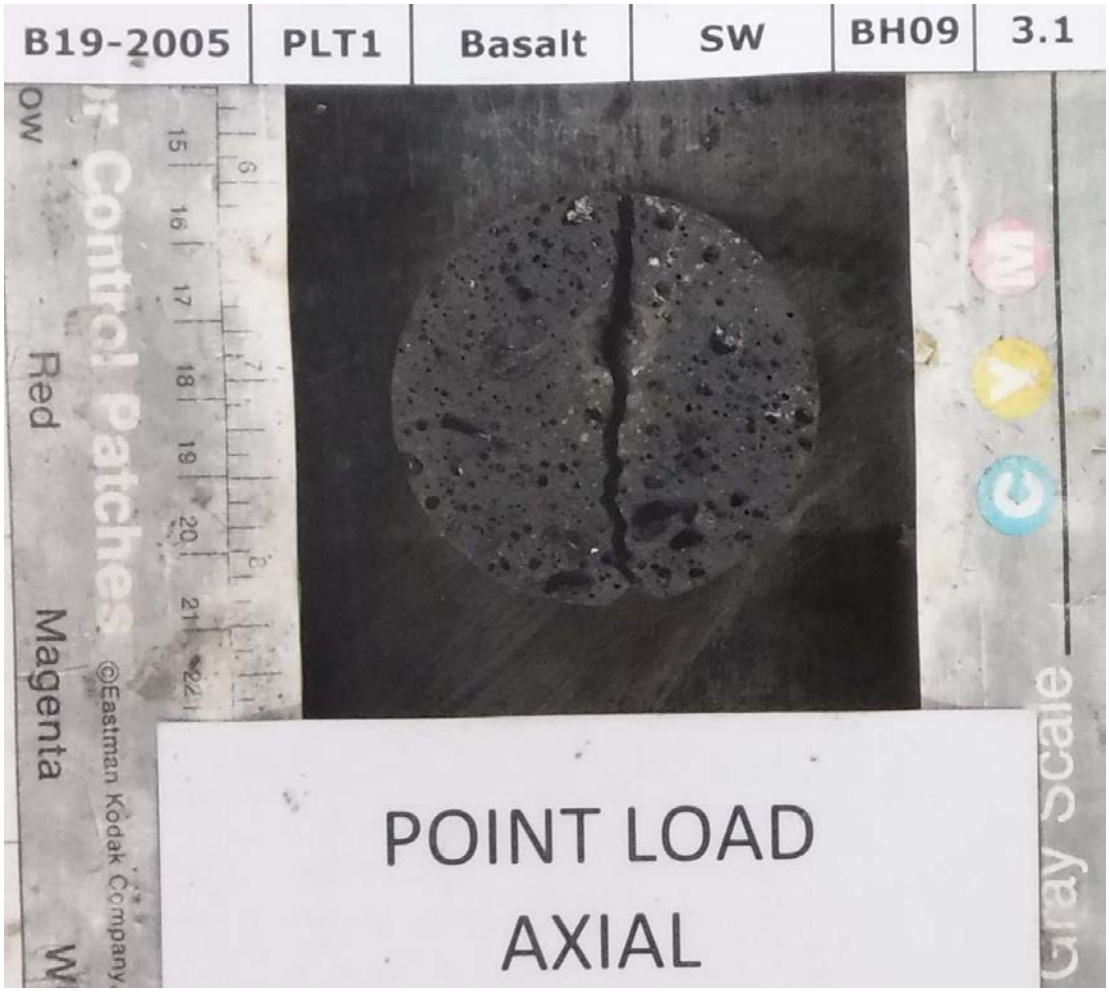
B19-2005
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BH09
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Gray Scale
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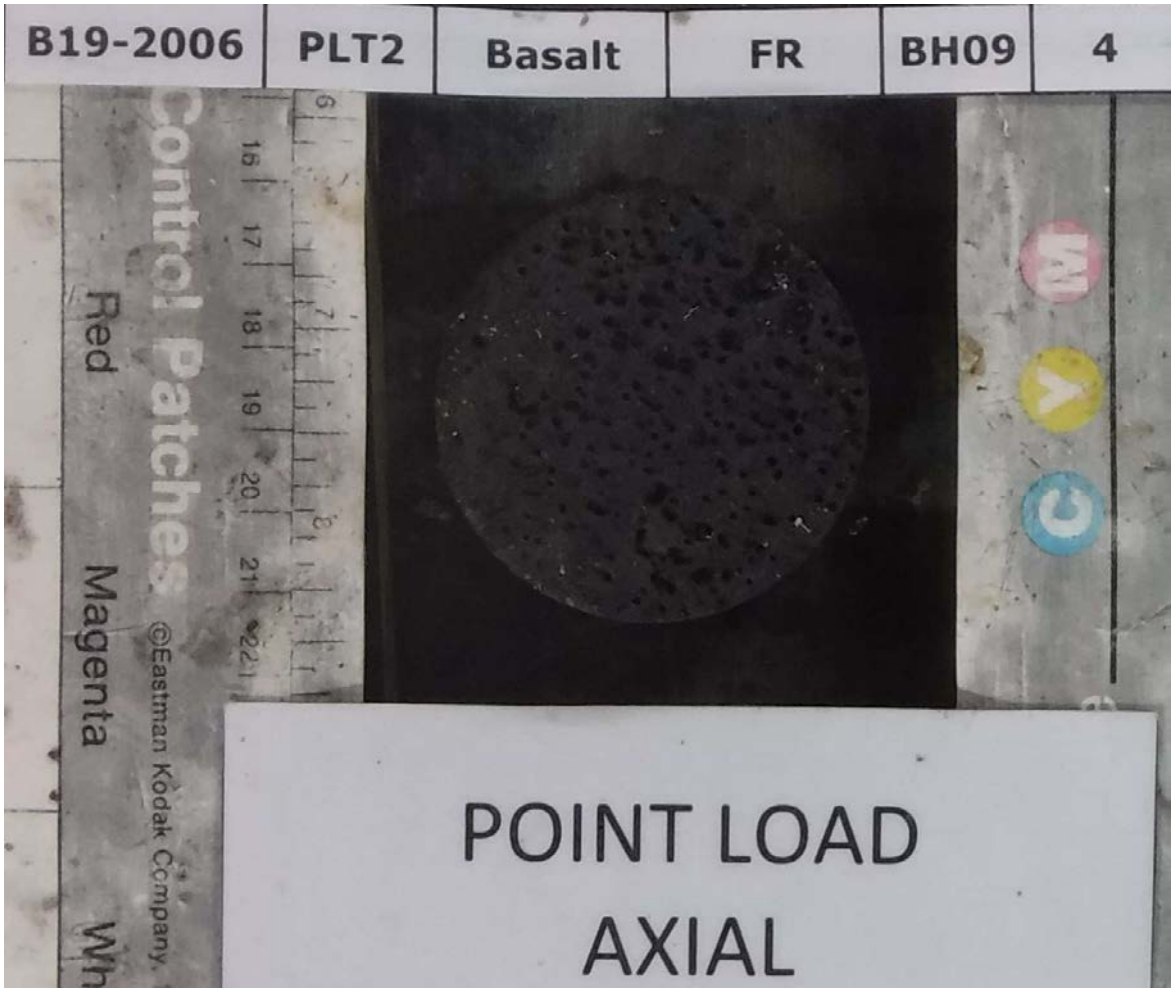
AXIAL


B19-2006
PLT2
Basalt
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BH09
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B19-2006
PLT2
Basalt
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BH09
4
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B19-2010
PLT10
Siltstone
HW-MW
BH07
5.45
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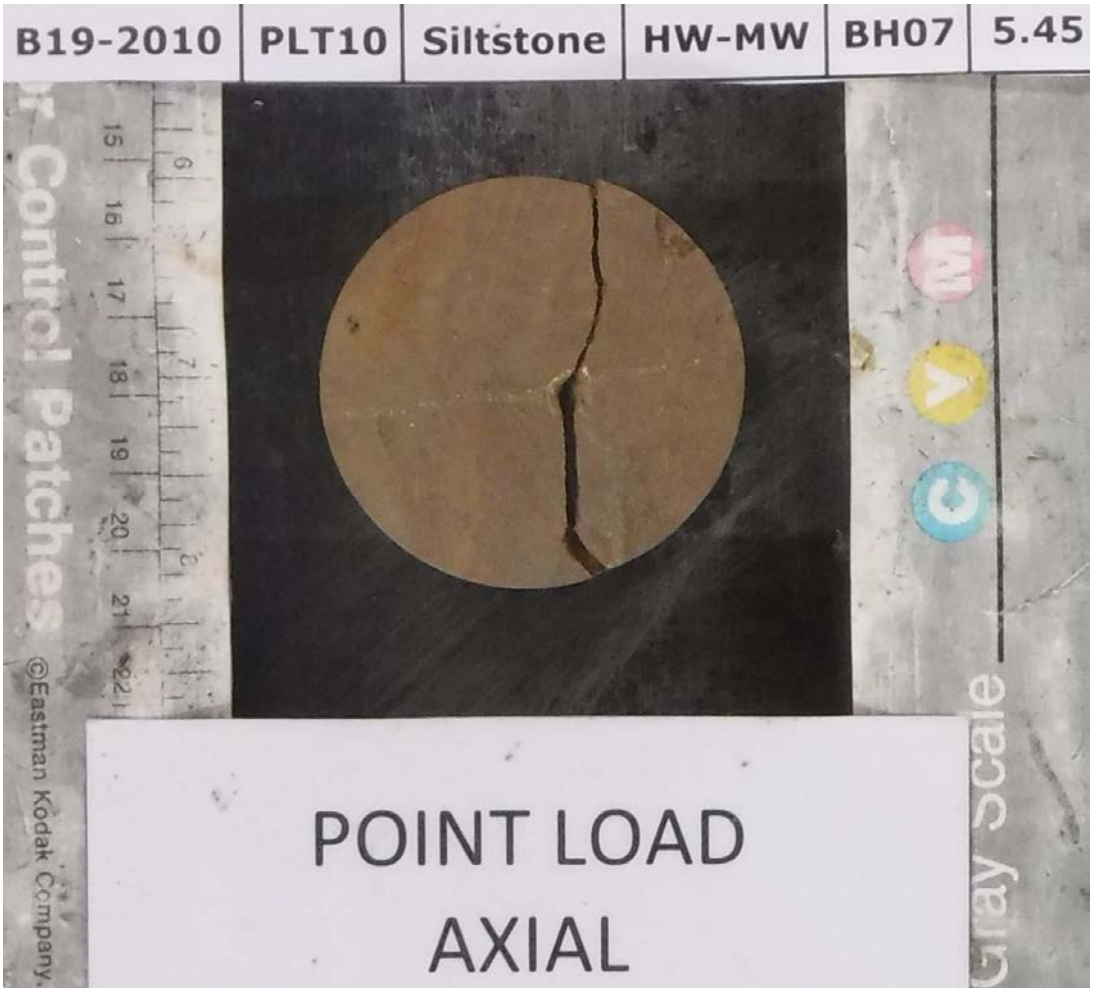
B19-2010
PLT10
Siltstone
HW-MW
BH07
5.45
Control Patches
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AXIAL

GHD

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3134596-51640/https://projects.ghd.com/oc/Victoria/hazelwyndelanddevelo/Delivery/Documents/3134596-REP-01-Geotechnical Factual Report (Repaired).docx

Document Status

Revision	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
A	E Fifield / M Lazzaro	M Lazzaro / C Johnson		R Mickelson		22.08.19

www.ghd.com

Memo

Transport & Traffic Solutions Pty Ltd
3 Prentice Street
Brunswick VIC 3056

To:	Ms. Victoria Cook, Project Manager – Hazelwynde, Yarra Valley Water
From:	Mr. Michael Marsicovetere, Director, Transport &Traffic Solutions Pty Ltd
cc:	
Date:	3 October 2019
Re:	Beveridge North West Precinct Structure Plan & Transport Modelling Review

Comments:

As requested, please find our comments below with regard to our review of the Transport Modelling Reports prepared by GTA dated 10 December 2018 and 5 August 2014 and the Beveridge North West (BNW) Precinct Structure Plan (PSP) dated August 201.

GTA Strategic Transport Modelling Assessment

1. Section 2.2.5 Proposed Internal Road Network Layout

   Figures 2.3 to 2.6 of the GTA report shows a north-south aligned key local access street through the Hilltop Reserve that connects to the land holding north of Hadfield Road, and a staggered T-intersection on Patterson Road south of Hadfield Road (South of Spring Hill Reserve). Where-as the PSP Street Network Plan (SNP) shows that there is no north-south aligned key local access street connection through the Hilltop Reserve, and a four leg intersection south of Hadfield Street.

   Further the SNP shows a proposed east-west aligned Connector Street connecting Old Sydney Road to the WNS Arterial Road just north of Camerons Lane. Where-as Figures 2.3 to 2.6 of the GTA report do not show this connector street.

   This inconsistency in the road network layout will have an impact on the future year traffic volumes recorded on both the WNS Arterial Road and Patterson Road and the adjacent key arterial road intersections. It is therefore recommended that the road network layout used in the 2031 & 2046 VITM Models be updated to match the SNP to ensure that the future road network and intersections are planned and designed appropriately.

2. Section 4.3.3 Land Use Refinements

   a. A graphical illustration of the proposed 2031 and 2046 land use yields is provided in Figure 4.7 and 4.8. The northern zones of these figures show population and employment in an area mostly designated as Reserve and Regional Open Space.

      We request that Figure 4.7 and 4.8 be updated to show the PSP SNP under the proposed zone structure and that a more detailed land use summary be provided for analysis and checking purposes similar to Figure 5.5 and Table 5.1 of the 2014 GTA report.

   b. Comparing the 2046 BNW PSP Land Use Summary as detailed in Table 5.1 of the 2014 GTA report to Table 4.1 of the 2018 GTA report, it is noted that the number of dwelling, jobs, and enrolments have increased by 4,579 dwellings (9,421 dwellings vs 14,000 dwellings), 483 jobs (1,267 jobs vs 1,750 jobs) and 1,498 enrolments (3,302 enrolments vs 4,700 enrolments).

      Further, referring to *Table 4: Housing Density* and *Table 8: Anticipated Employment creation within Precinct* of the PSP, it is noted that the total number of dwellings and jobs has now increased to 16,286 dwellings and 3,019 jobs respectively. Based on

this increase in the total number of dwellings and jobs, it is expected that the number of enrolments will also increase.

Refer Table 1 below for a comparison of the land use summary (dwellings, jobs and enrolments) between the respective GTA Reports and the PSP.

Table 1: 2046 Land Use Summary Comparison

Land Use	Document Source		
	2014 GTA Report	**2018 GTA Report**	**PSP 2019**
Dwellings	9,421	14,000	16,286
Jobs	1,267	1,750	3,019
Enrolments	3,302	4,700	*5,500(estimated)*

As can be seen from Table 1 above, since the 2014 GTA Report the number of dwellings, jobs and enrolments has increased by 6,685 dwellings, 1,752 jobs, and 2,200 (estimated) enrolments. This proposed change in land use will have a major impact on the 2031 & 2046 VITM Model outputs.

Confirmation is required as to why there has been such a large increase in the proposed land use since the 2014 GTA Transport Report, and if the proposed PSP land use is achievable?

Further if the proposed PSP land use is achievable, then the 2031 & 2046 VITM Models should be updated to ensure that the future road network and intersections are planned and designed appropriately.

c. The PSP Transport Model refer *Table 4.1: BNW PSP Land Use Summary (2031 and 2046)* of the 2018 GTA report has been built on the basis that by 2031 approximately 75% of the PSP area will be developed. At 10,500 dwellings, this equates to be a delivery rate of approximately 1,050 dwellings per annum between 2021 to 2031.

   Further by 2046 (15 Years later) the remaining 25% (3,500 dwellings) will be delivered. This works out to be a delivery rate of approximately 233 dwellings per annum between 2031 to 2046.

   Based on our discussion, it is expected that the BNW Precinct will achieve a development delivery rate of approximately 500 to 600 dwellings per annum over the life of the project.

   Based on this expected development delivery rate it is recommended that the land use summary as detailed in Table 4.1 of the 2018 GTA Report for the year 2031 and the 2031 VITM Model be updated to reflect this change as it will have a major impact on the 2031 VITM Model output. The updating of the model will also ensure that the 2031 road network and intersections are planned and designed appropriately.

d. Figure 4.7 and Figure 4.8 of the 2018 GTA Report shows that the growth in land use is proportional over the entire PSP area. This should be updated to reflect the expected development pattern, which will commence from the south (Cameron's Lane) and work its way up to the north towards Hadfield Road i.e. by 2031 the southern area of the PSP will be fully developed, then by 2046 the northern area of the PSP including the proposed road connections to Hadfield Road will be fully developed.

Based on this expected development pattern it is recommended that the land use yield by zones as detailed in Figure 4.7 of the 2018 GTA Report for the year 2031 and the 2031 VITM Model be updated to reflect this development pattern. The updating of the model will also ensure that the 2031 road network and intersections are planned and designed appropriately.

3. Section 4.4.1 Travel Demand Analysis

   It is noted that the mode share as detailed in Table 4.2 of the 2018 GTA Report has been frozen between 2031 and 2046. Based on historical travel patterns it is expected that over time, the percentage of trips undertaken by Public Transport will increase due to external factors such as increase in congestion on the road network, improved public transport reliability and accessibility, increase in petrol costs etc.

   Consideration should be given to increasing the percentage of trips undertaken by Public Transport in the year 2046 when compared to the year 2031.

4. Section 4.4.2 Network Performance Analysis

   a. *Table 4.6 Summary of Ultimate Daily Volumes on Key Roads (2046)* should be expanded to include the WNS Arterial Road and Patterson Road south of Hadfield Street and the Hume Freeway and the Camerons Lane interchange on and off ramps for analysis purposes.

   b. Page 15 of the 2018 GTA Report states that, "*the capacity afforded on some roads in the northern sections of the PSP, such as the WNS Arterial Road and Patterson Road could be reduced and still perform at acceptable operating conditions. Further investigation of the usage of the allocated road space should be undertaken through the PSP design process, including consideration of road management within local town centres and through school precincts as well as their role in supporting the Hume Freeway. This could be understanding the appropriate and best use of road space in the form of lane management, parking management and Public Transport Priority*".

      Referring to the 2046 Volume Plots provided in Appendix B of the report, it is noted that the proposed continuation of Patterson Road north of the Mixed Use area can be downgraded to a Connector Street standard from a Secondary Arterial Road standard.

      Alternatively, if Patterson Road in this location is built as a four lane divided secondary arterial road, then the extra lanes could be utilised for PT priority.

      Therefore, the future use/ management of Patterson Road and the WNS Arterial Road should be discussed/ negotiated with the VPA prior to finalising the BNW PSP and in particular the SNP including proposed road cross sections.

   c. Referring to the 2031 and 2046 VITM Volume Plots and Select Link Analysis Plots, it is noted that the main reason for the Patterson Road classification as a four lane divided secondary arterial road is due to mixing of the Local Town Centre (LTC) traffic with the Patterson Road through traffic.

      It is our opinion that by creating a more permeable road network to the Town Centre from Camerons Lane via the provision of a separate access point (signalised T-intersection located approximately 200 metres east of Camerons lane/ Patterson Road intersection) will result in a better outcome for the PSP as it will separate the LTC traffic from the Patterson Road through traffic and improve:

      i. The operational performance of both Camerons Road and Patterson Road and their intersection resulting in reduced congestion and travel times, and

      ii. Public Transport travel times.

It would also provide the opportunity to implement PT priority on Paterson Road adjacent to the LTC.

d. It is noted that the WNS Arterial Road has been modelled as a four lane divided arterial road in the 2031 VITM Model, whilst the traffic volumes estimated on this road (refer to the GTA Model Outputs) justify a two lane two-way road (interim arrangement). It is also noted that Table 4.1: Precinct Infrastructure Plan of the BNW PSP identifies that the WNS Arterial Road be constructed as a two lane two-way road (interim arrangement).

   Further as detailed in Items 2 c. & d. above, due to the expected development delivery rate and development pattern, the traffic volume on WNS Arterial Road is expected to be a lot less than the current 2031 VITM Model results.

   Therefore, it is recommended that the 2031 VITM model be updated to show the WNS Arterial Road as a two lane road.

e. Referring to the AM and PM 2031 volume/ capacity ratio plots, the southbound and northbound traffic volumes on the Northern Highway and the northbound PM traffic volume on the Hume Freeway are over capacity. These results show that an extra lane is required on both the Northern Highway and Hume Freeway.

   Further, the provision of an extra lane on these roads is expected to reduce the future year traffic volumes on BNW PSP road network.

   It is also noted that the upgrade of the Northern Highway from a two lane road to a four lane road has also been identified in the Wallan Structure Plan (March 2015). Refer Section 5.3 of the Wallan Structure Plan for more details.

   Therefore, it is recommended that the 2031 & 2046 VITM Model be updated to include an extra lane in both directions on both the Northern Highway and Hume Freeway.

5. <u>Section 4.6 Northern Highway On-Ramp Scenario</u>

   a. A review of the 2031 and 2046 Volume plots in Appendix D shows that the traffic volume on the WNS Arterial Road (80km/h Speed Limit) has increased by 7,500 vpd & 8,500 vpd respectively when compared to the Appendix B traffic volume plots where WNS Arterial Road has a speed limit equivalent to 60km/h.

      This increase in traffic volume is considered to be high when taking into account that the Northern Highway (80km/h) will be upgraded to include an extra lane in each direction in 2031 and the Hume Freeway (110km/h) will be upgraded to include an extra lane in each direction in 2046. Basically, the travel time savings due to the increase in the posted speed limit along the WNS Arterial Road from 60km/h to 80km/h which has interrupted flow facilities is considered to be marginal when compared to the Hume Freeway uninterrupted flow route. Therefore, it is expected that the traffic volume increase along the WNS Arterial Road route will also be marginal.

      Confirmation is required as to why there is such an increase in the traffic volume on the WNS Arterial Road?

   b. The Transport Model for this scenario shows the need for additional traffic lanes on the Northern Highway and Camerons Lane east of Patterson Road in the year 2031 and additional traffic lanes on the Hume Freeway in the year 2046.

      Does the proposed SNP take into account that additional traffic lanes will be provided on both the Northern Highway and Hume Freeway?

Beveridge North West PSP

6. Plan 2 – Precinct Features

   It is noted that a Proposed Quarry (WA1473) is located in the north-eastern corner of the PSP east of Patterson Road and south of Hadfield Road. Referring to Plan 3 – Future Urban Structure the same area is highlighted as residential/ landscape values.

   Confirmation is required as to which land use is proposed in this location? If the quarry is proposed, then further details are required on how access will be provided to the quarry from the future Arterial Road network. From a safety and operational perspective access to the quarry should be provided from either, Hadfield Road, the Northern Highway or the Hume Freeway.

   Further taking into account that the quarry will have buffer to the future residential land uses in this area, be in operation for the long term (+20 years) and require rehabilitation once operations are ceased, combined with not knowing what this land will be used for after the site is rehabilitated, it is recommended that the land use summary used in the 2031 & 2046 VITM Model be updated to include the Quarry use. The updating of the VITM Model will ensure that the road network and intersections are planned and designed appropriately.

7. Section 2.1 Vision

   The PSP identifies that the Precinct will have "*an efficient connection to the Hume Freeway via the future construction of the Camerons Lane Interchange and will be supported by a series of local arterial roads that can accommodate high frequency public transport*".

   Referring to *Section 4.1 Precinct Infrastructure Plan*, the Camerons Lane Interchange is identified as a VicRoads led project which is to be delivered in the short to medium term. We are seeking feedback from the Department of Transport (VicRoads) on the status of the planning, design and construction of the freeway interchange including any proposal to the upgrade the Northern Highway and Hume Freeway as per the GTA Transport Modelling scenario. We will provide you with a further update once feedback is received from VicRoads.

   With regard to the "*local arterial roads that can accommodate high frequency public transport*" we assume this statement refers to the committed Principal Public Transport Network (PPTN) as detailed on the "North Growth Corridor Plan" (NGCP). Referring to both the NGCP and *Plan 10 Public Transport and Path Network* of the PSP, we note that provision for the PPTN has not been made within the BNW PSP arterial road network apart from identifying the arterial roads as bus capable roads. Further, there is no other reference to high frequency public transport services with the PSP document.

   Confirmation is required as to what this statement refers to i.e. is the intention to make Patterson Road a high frequency public transport route as per the GTA statement in their transport modelling report (refer item 4 b. above).

8. Section 2.3 Precinct Land Use Budget

   Plan 4 – Land Use Budget and Table 1: Precinct Land Use Budget identifies the total area within the PSP required for transport infrastructure.

   Confirmation is required as to how these areas have been calculated to ensure that an adequate allowance has been made?

9. Plan 10 - Street Network

   a. The two proposed north-south aligned secondary arterial roads located along the northern boundary of the site are located within 700 metres of each other. Typically, Secondary Arterial Roads are located on a 1.6km grid network.

Further based on the 2046 daily traffic volumes, Patterson Road north and south of Hadfield Road can be downgraded to a connector street standard.

It is recommended that prior to settling on PSP SNP, the land use summary for both the 2031 & 2046 VITM models (refer item 2 above) should be confirmed and the models re-run if changes are agreed to ensure that the future road network and intersections are planned and designed appropriately.

b. Consideration should be given to straightening the WNS Arterial Road to avoid the multiple horizontal short curves proposed along its alignment. Depending on the radius of these horizontal curves, and the future speed limit of this road superelevation may be required through some of the proposed signalised intersections.

   Further, there is a section of the WNS Arterial Road which may have a longitudinal grade of around 5% which is close to the desirable maximum for an arterial road.

c. Consideration should be given to making the following street network changes. Refer also Figure 1 below for proposed changes in the same number format as the comments below.

   - Provide a more direct east-west Connector Street network. This will reduce travel distance/ times in particular for PT and cyclists on the connector street.
   - The north-south aligned connector street located on the west side of the drainage reserve should be shifted away from the drainage reserve to a avoid a four leg connector street/ connector street intersection (controlled by a roundabout) where it intersects the east-west aligned connector streets. As the connector streets are designated bus routes the area required to construct the roundabout may impact the bride crossing and therefore require the unnecessary widening of the bridge structure.
   - The east-west aligned connector street through the Town Centre should be shifted north to straighten the proposed bridge alignment over the channel and to provide a larger angle between the western road leg and northern road leg if the north-south aligned connector street is not relocated as per item ii. above. This larger angle is also critical for the design of the roundabout.
   - The north-south aligned connector street located to the west of the Hume Freeway should be relocated west to provide adequate separation to the freeway interchange including the interchange embankment. It will also help avoid this road being used as a bypass of the Town Centre due to the longer travel distance.
   - Relocate east-west aligned connector street as indicated to provide more separation between intersections and a more direct route to the TC for PT and cyclists.
   - A signalised intersection should be provided within the LTC to improve pedestrian accessibility between the LTC and School/ Community site.
   - As per comment 4 c. above provide a second access point into the LTC via a signalised T-intersection to separate the LTC traffic from the Patterson Road through traffic.

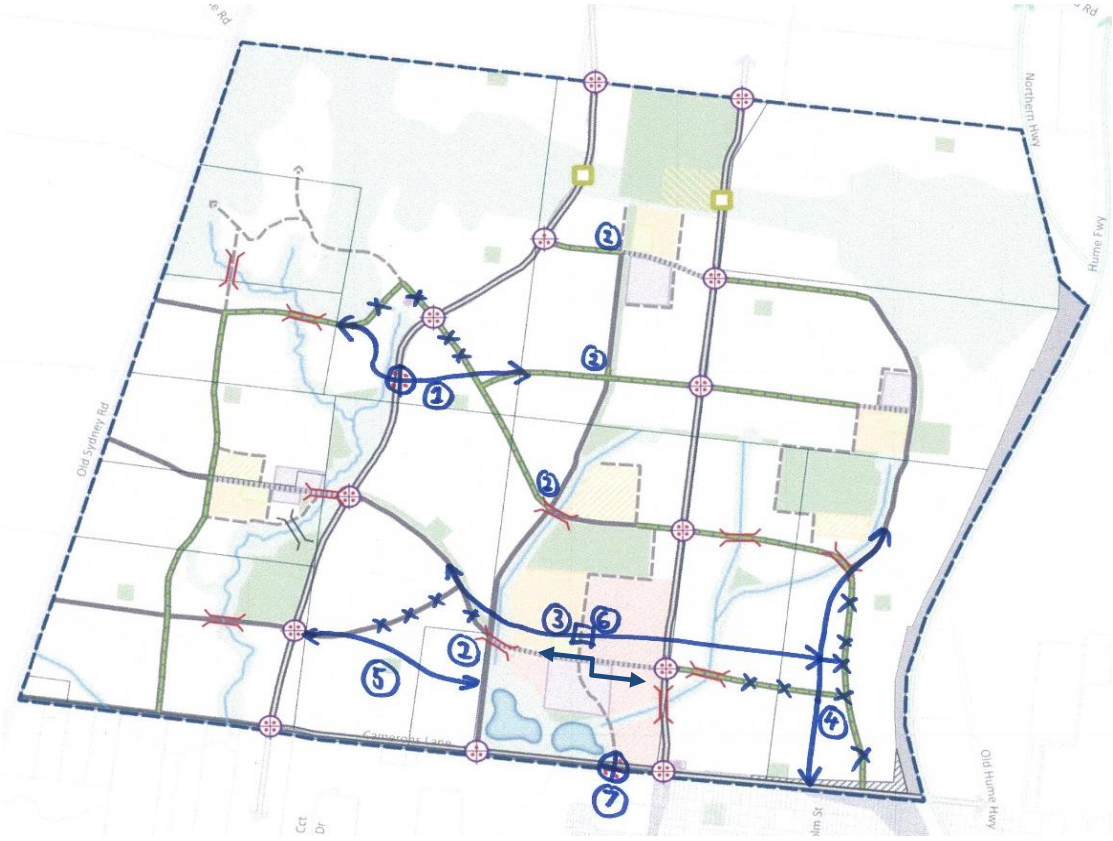

Figure 1: Proposed Street Network Modifications

10. Appendix 4.1 Precinct Infrastructure Plan (PIP)
    a. Intersection No. IN-07 (WNS Arterial Road/ Connector Street Intersection) is to be constructed to the ultimate layout. Clarification as to why this intersection is to be constructed to its ultimate layout is required.
    b. The apportionment of cost varies from 50% to 75% for the upgrade of road project RD-01 and intersection projects IN-01, IN-03, IN-08, and IN-09. Clarification for this varied apportionment cost is required.
11. Appendix 4.5 Street Cross Sections
    a. Old Sydney Road –
        - Is not included in the Precinct Boundary therefore who is responsible for this road upgrade including the 4.0m Unsealed Trail.
        - No allowance has been made for parking on the carriageway if lots are proposed to front Old Sydney Road.
    b. Arterial Road –
        - Clarification as to why 2.0 metres of the shared path is located within the arterial road road reserve under VicRoads management and 1.0 metre of the shared path is located within the service road road reserve under Council management?

12. Infrastructure Contributions Plan

    It is noted that the Infrastructure Contributions Plan (ICP) has not been provided for review. It is recommended that the ICP be provided during the PSP consultation process to gain an understanding of the estimated costs and apportionment of the proposed transport projects as detailed in the PIP.

13. Road & Intersection Concept Plans

    It is recommended that interim and ultimate year concept plans of the arterial road and intersection projects be prepared prior to the finalisation of the PSP. Further the intersection concept plans should be based on a SIDRA analysis of the intersection turning movement volumes to be taken from the final agreed 2031 and 2046 VITM models.

    The provision of these concept plans will provide certainty on the road and intersection layouts and help streamline the responsible authority's approvals process during the planning and design phase of the project.

I would be happy to meet with yourself to discuss each point in more detail if required.

Should you have any queries please do not hesitate to contact me on 0437 682 170.

Yours sincerely,

Michael Marsicovetere
Director
Transport & Traffic Solutions Pty Ltd

Hazelwynde – Lot 2 & 8 Camerons Lane, Beveridge
Engineering Servicing Report

For

YARRA VALLEY WATER

04th October 2019

Contents

Prepared by:	Brent Gleeson
Checked by:	Ray Verratti
Version:	4
Date:	05th October 2019
Project Ref:	17123

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1. EXECUTIVE SUMMARY

This servicing report has been compiled by Verve Projects, to provide an overview of the anticipated servicing arrangements associated with the future development of Lot 2 & 8, Camerons Lane – Beveridge.

The subject sites are located within the Beveridge North West PSP, which covers an area of approximately 1,259 hectares across 15 separate properties. The subject PSP is currently at Council and State Agency consultation stage.

A land use budget has been prepared by Mesh Planning for Lot 2 & 8, which combined total a gross area of 740.4 hectares. Mesh Planning have estimated a total net developable (NDA) of 463.7 hectares.

The total residential lot yield has been assumed as 6551 dwellings, based on 15 dwellings per NDA (hectares). Refer to Table 1 below for land budget breakdown for the subject site.

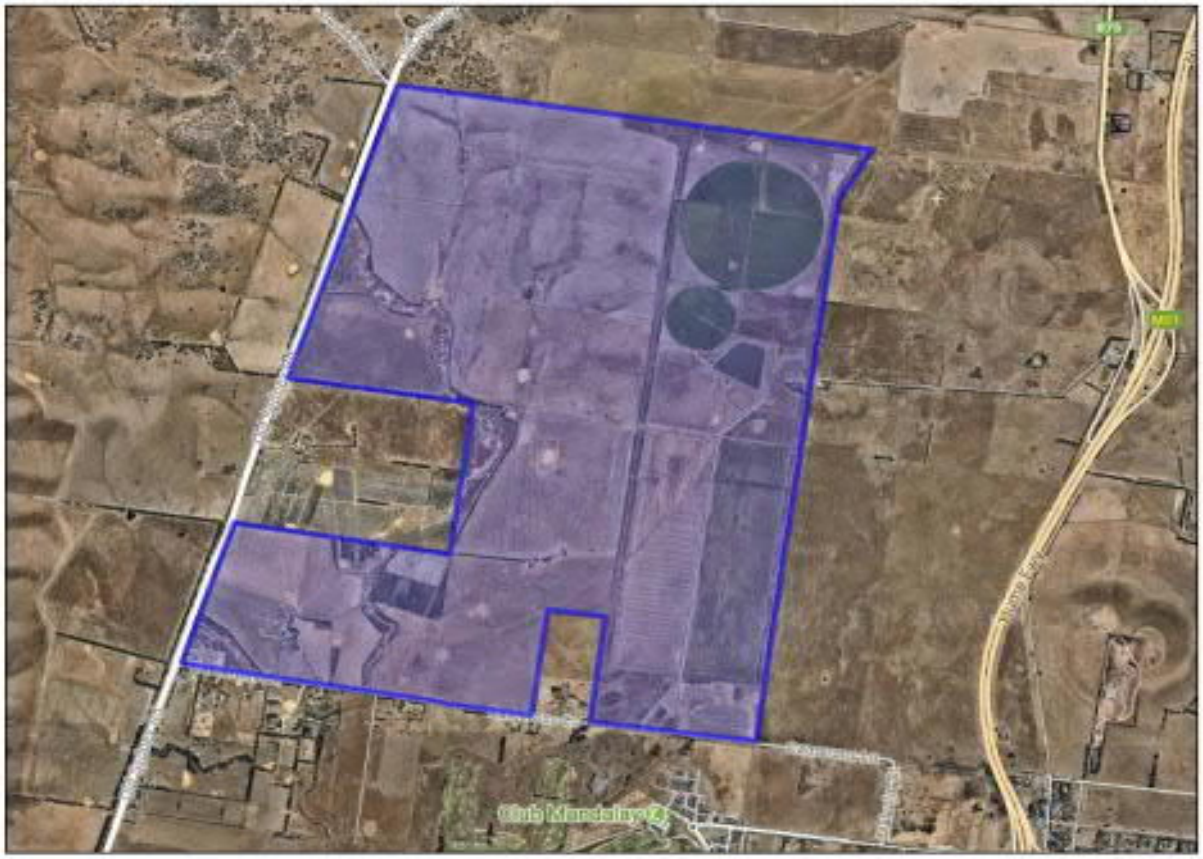


Figure 1: Property Location – 180 Camerons Lane, Beveridge

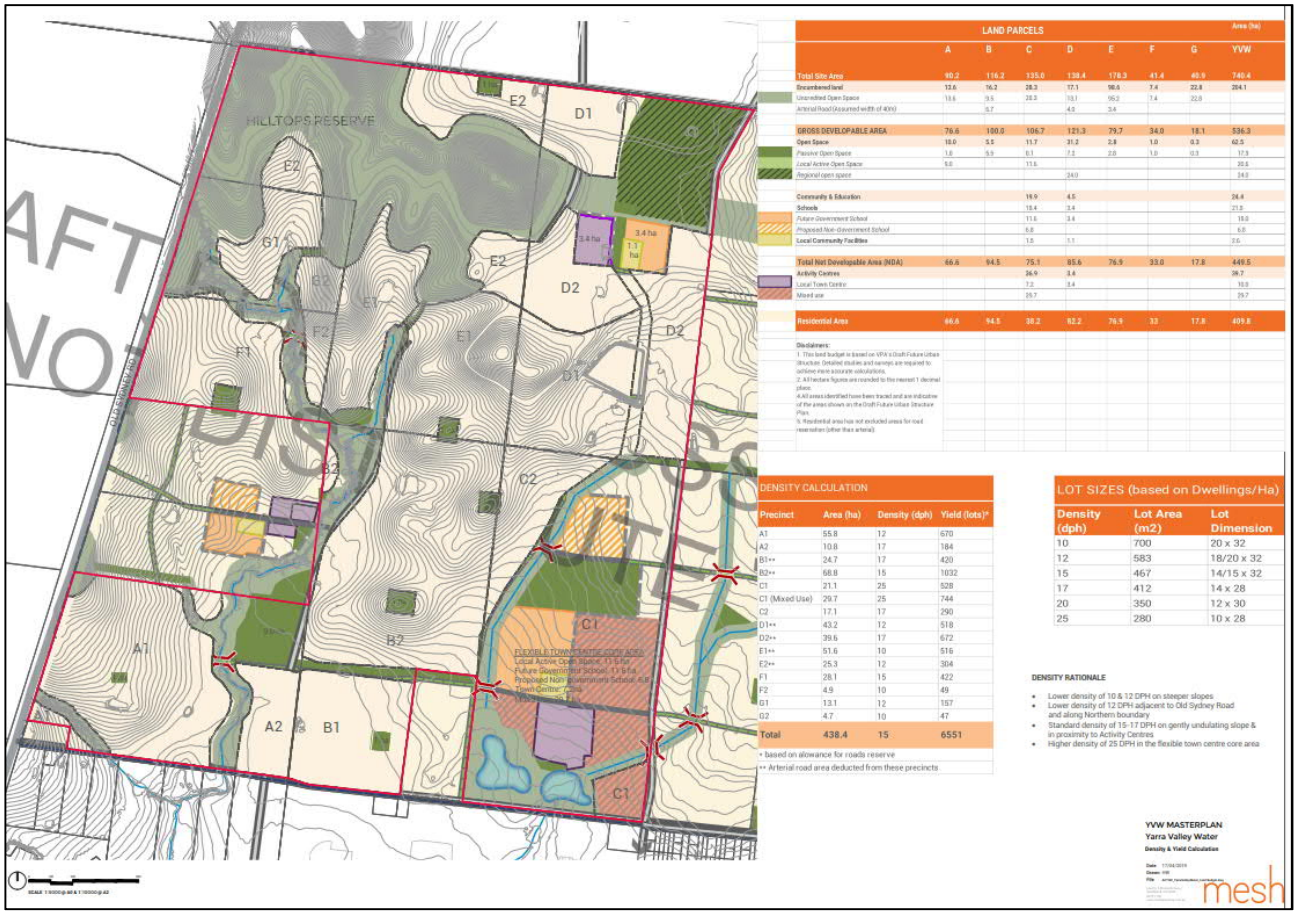


Table 1: Mesh Planning – Land Budget

2. INTRODUCTION

2.1. Site Location and Topography

The subject site(s) are located at 180 Cameron's Lane, Beveridge.

The sites are bound by Cameron's Lane to the south, and Old Sydney Road on the western boundary.

The property is approximately 740ha in total, and the natural topography indicates fall generally from north to south and toward Kalkallo Creek. The northern portion of the property's contours indicated fall towards the north eastern property boundary.

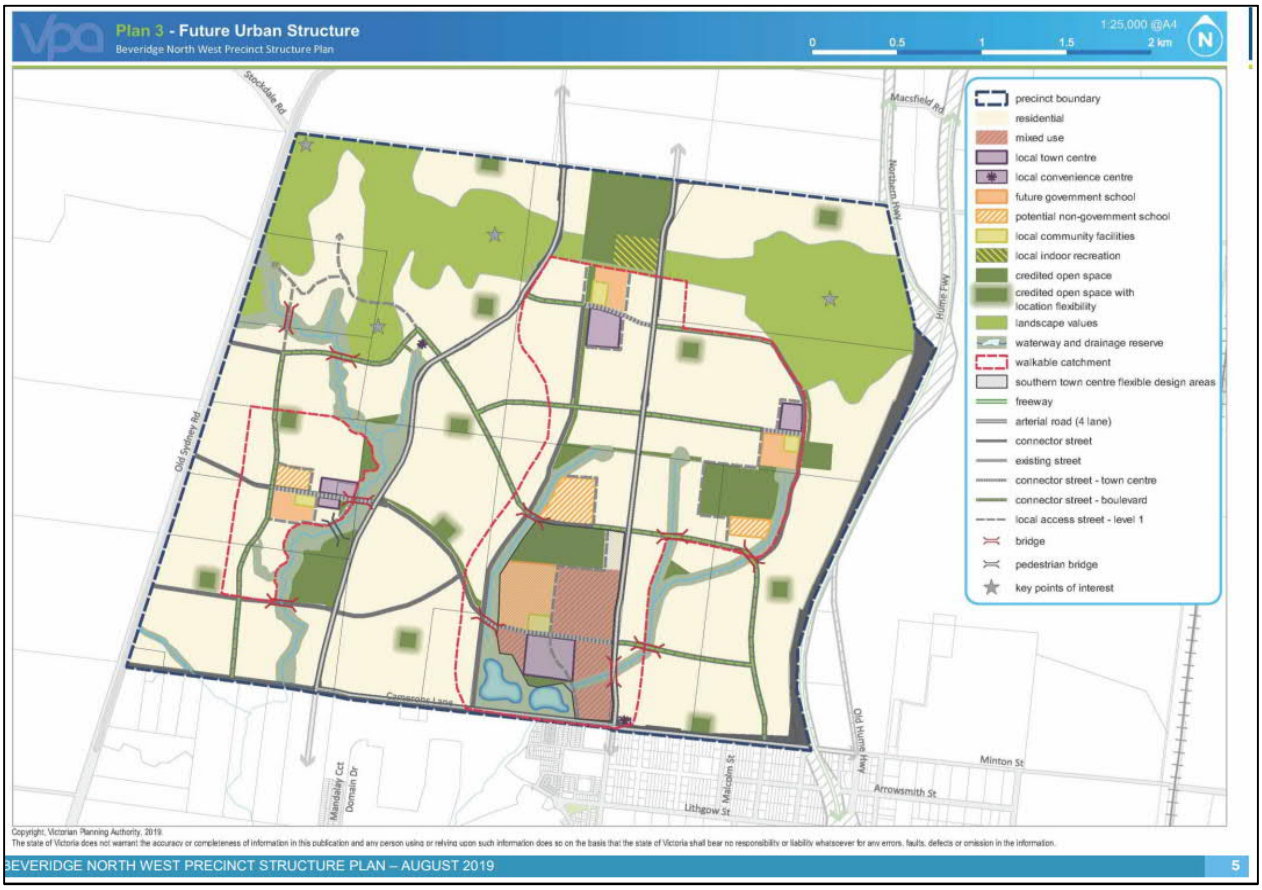


Figure 2 – Draft Future Urban Structure Plan

2.2. Authority Table

The following table summarises the responsible Authorities for infrastructure delivery to the future development;

SERVICE	RESPONSIBLE AUTHORITY
Camerons Lane	Shire of Mitchell
Hume Hwy & Camerons Lane Interchange	VicRoads / Shire of Mitchell
Main Stormwater Drainage	Melbourne Water Corporation
Sewer Reticulation	Yarra Valley Water
Water/Recycled Water Supply	Yarra Valley Water
Electricity Supply	Ausnet Services Pty Ltd
Gas Supply	APA Group Pty Ltd
Telecommunications	NBN Co.

Table 2 – List of respective authorities

3. SERVICES

3.1. Roads

VicRoads & Shire of Mitchell are the responsible authority for Camerons Lane. Internal roads created inside the development boundary will vest with Shire of Mitchell.

Development of the Camerons Lane/Hume Freeway Interchange is a key and critical major project unlocking road access to the developments front door on Camerons Lane. Provisions for a diamond interchange and freeway overpass are in planning as part of the Beveridge Central PSP. Delivery of this state infrastructure project will dictate timing for development commencement, unless alternate interim access arrangements can be arranged. Refer below (Figure 2) for functional layout of the proposed interchange.

In addition to the above, Camerons Lane will require upgrade to an arterial standard road with kerb & channel and formalised piped underground drainage. The Beveridge North West PSP on exhibition proposes a 34m road reserve width with construction of the first carriageway as part of the Infrastructure Contribution Plan.

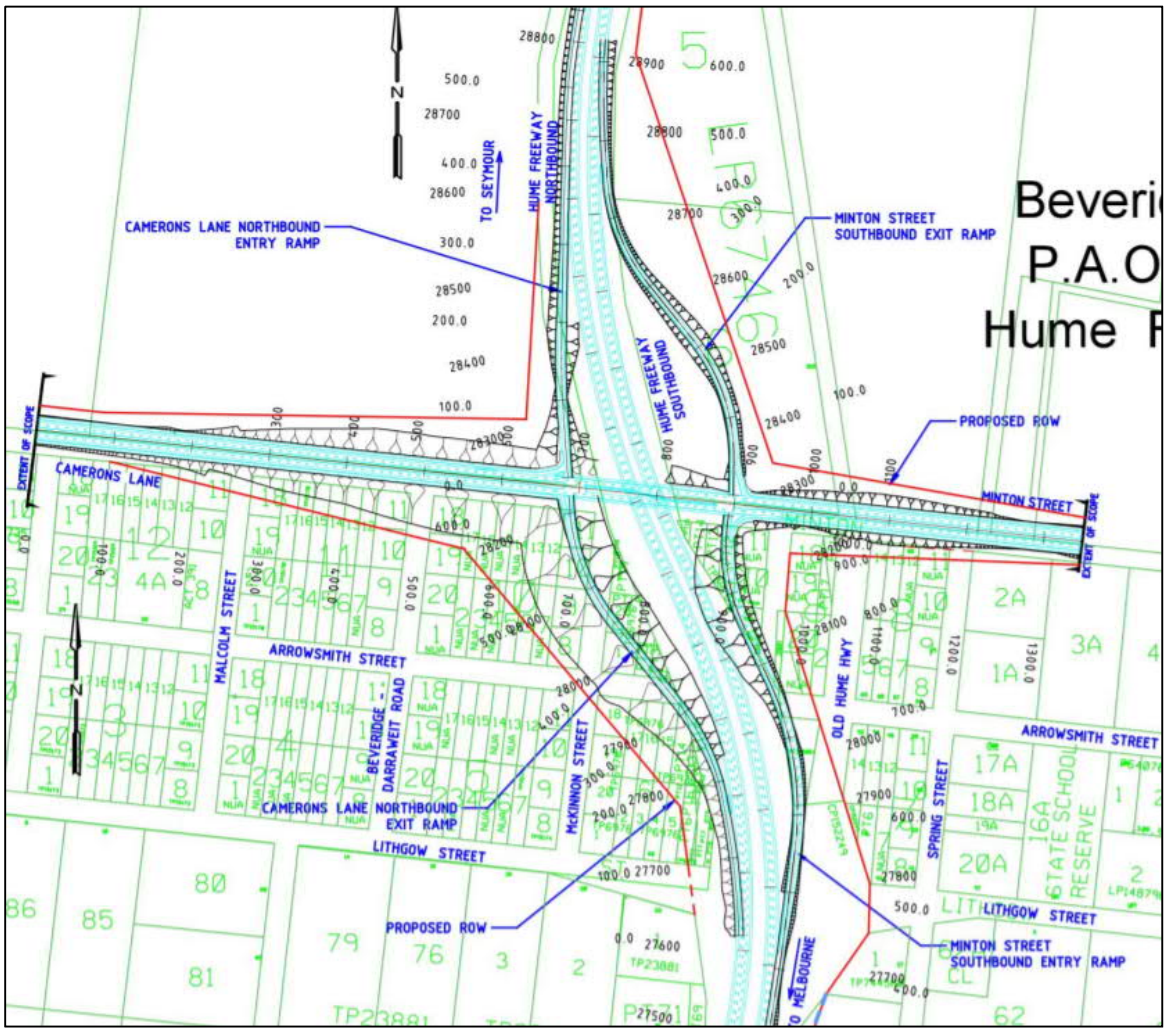


Figure 3: Future Camerons Lane & Hume Freeway Interchange

The draft urban structure plan highlights (2) major arterial roads (E-14) from Camerons Lane to Hadfield Road reservation and beyond to facilitate connectivity with future development to the north. These primary arterials propose 34m wide road reservations with construction of the first carriageway in the Infrastructure Contribution Plan.

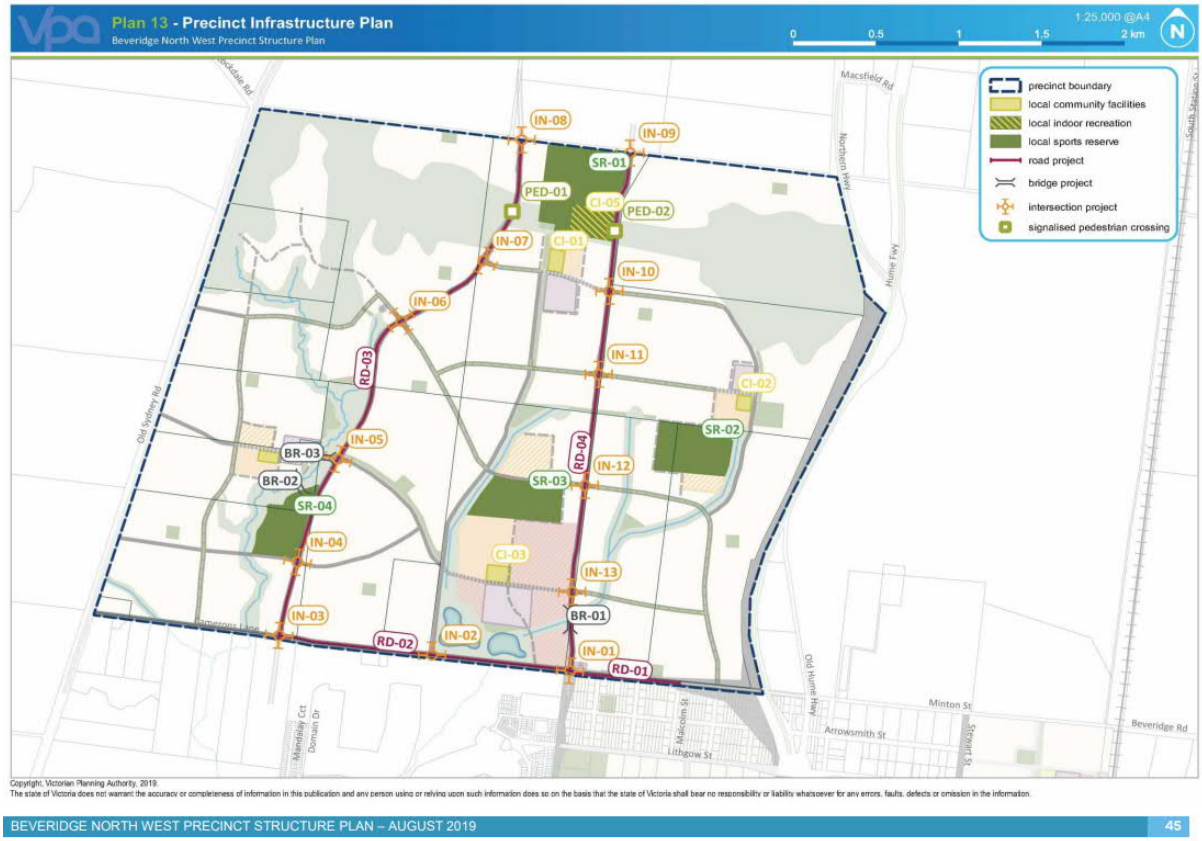


Figure 4: Future Proposed Road Network

Internal road networks within the development boundary, will develop from these main arterial connectors as part of the staged subdivision development including bridge/culvert crossings of Kalkallo Creek and other identified waterways.

The internal road reserves created as part of the subdivision process will need to be designed in accordance with VPA and Shire of Mitchell's standards and design guidelines. These road reserves will include provisions for landscape, pedestrian access, parking and services to each allotment.

Further submissions to the VPA by Yarra Valley Water are planned in relation to the alignment and location of RD03 & RD04.

3.2. Stormwater Drainage

Melbourne Water Corporation and Shire of Mitchell are the responsible authorities for stormwater drainage management. The subject land is covered by designated Melbourne Water drainage schemes namely, Kalkallo Creek (Ref: 6550) and Taylors Creek (6531).

Kalkallo Creek DS

Kalkallo Creek DS covers approximately 665ha of the properties total catchment area of 740ha. In the existing condition, open earth channels/waterways and dams manage stormwater from the contributing catchment to a series of culvert crossings at Camerons Lane. The main waterway is Kalkallo Creek which traverses the site from the western boundary at Old Sydney Road to Camerons Lane (approximately 3.4km in length internal to site).

In the development condition, the draft Beveridge North West structure plan has made provision for the development of the Kalkallo Creek drainage reserve consistent with the drainage scheme. Melbourne Water have also considered a wetland and retarding basin on Property ID 117 (refer below). This future asset has been considered in Mesh Planning's overall land budget.

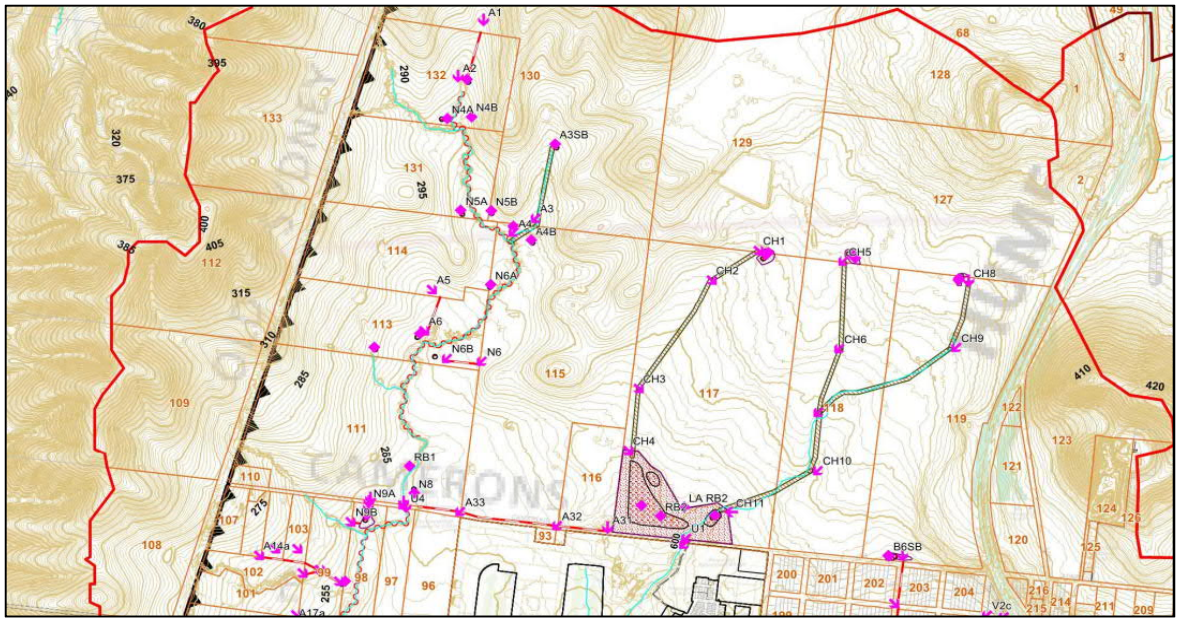


Figure 5: Kalkallo Creek – Drainage Scheme

Taylors Creek Drainage Scheme

Taylors Creek DS addresses the northern end of Lot 2 & 8. In the existing condition, informal open earth channels and dams on abutting land holdings, capture and convey approximately 75ha of the subject site(s) gross land area.

In the development condition, Melbourne Water's drainage scheme contemplates the formalisation of these existing channels to convey developed flows to a central retarding basin and wetland abutting Northern Highway. In the event development requires their construction, landowner access agreements will be required from adjoining properties immediately north of Lot 2 & 8 to facilitate their construction.

Refer below extract from Melbourne Waters Taylors Creek drainage scheme depicting the proposed waterway/channels and central RB/Wetland.

Figure 6: Taylors Creek – Drainage Scheme

General:

Drainage contributions will apply to these properties at the time of development application, to facilitate implementation of identified scheme assets. Reimbursements will apply in line with Melbourne Water

Applicable drainage scheme rates as per Kalkallo Creek Drainage Scheme, as at 4th October 2019 ($/ha) are below based on Residential development (300 – 600m2):

Hydraulic Contributions:	$83,583
Water Quality Contributions:	$49,982

Applicable drainage scheme rates as per Taylors Creek Drainage Scheme, as at 4th October 2019 ($/ha) are below based on Residential development (300 – 600m2):

Hydraulic Contributions:	$93,573
Water Quality Contributions:	$TBC

Subdivision design will need to consider freeboard requirements for proposed allotment levels i.e. 600mm above the applicable Q100 flood level. Overland flow will be conveyed within the proposed road network to appropriate discharge locations in accordance with Melbourne Water and Shire of Mitchell requirements.

Further submissions to the VPA by Yarra Valley Water are planned in relation to alternate hydraulic scheme strategies and water sensitive initiatives options for the subject sites.

3.3. Sewer Reticulation

Yarra Valley Water is the responsible authority for sewer reticulation within the Beveridge North West PSP.

The Lockerbie Branch sewer (YVW Primavera ID PSGW0290) provides the initial outfall for the subject sites southern catchment. YVW have estimated completion of this asset in 2022. To access this branch sewer, a pump station and rising main will be required at Camerons Lane.

The rising mains alignment will head east along Camerons Lane, crossing the future interchange at Hume Highway to meet this branch sewer near the intersection of Minton Street and the Melbourne to Sydney Rail Link. The cost for these works are fully developable funded.

Internal branch sewers will be required as development progresses north from Camerons Lane. These reimbursable branch sewers are identified by YVW as follows;

- Kalkallo Creek North (PSGW0079) - approximately 935m of 300mm diameter gravity sewer
- Hazelwynde (PSGW0211) - approximately 2,296m of 300 & 375mm diameter gravity sewer
- Hazelwynde West BS (PSGW0232) - approximately 787m of 300 & 375mm diameter gravity sewer
- Kalkallo Creek – Stage 3 (PSGW0289) - approximately 735m of 300 & 375mm diameter gravity sewer

Refer below extract from YVW's planned asset map for location of the above-mentioned planned sewer assets.

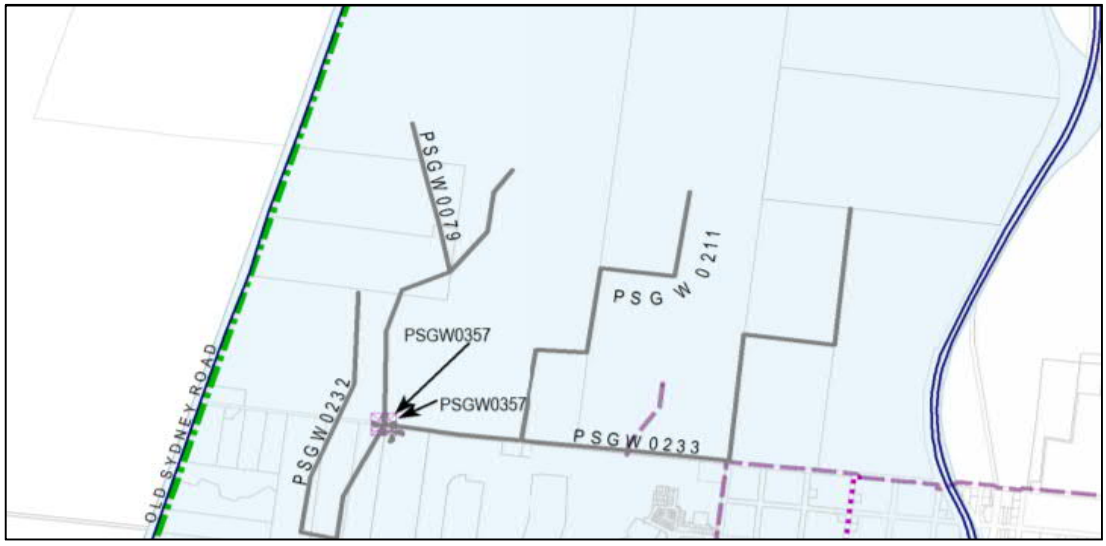


Figure 7: Beveridge Planned Sewer Assets (Southern Catchment)

Planned future assets for the northern catchment, include Rowes Lane Branch Sewer and Pump Station (refer below).

YVW has suggested however that development of the northern catchment, ahead of the planned installation dates for these permanent assets, will require a temporary pump station and rising main back to Wallan. The cost for these temporary assets would be fully funded by the developer.

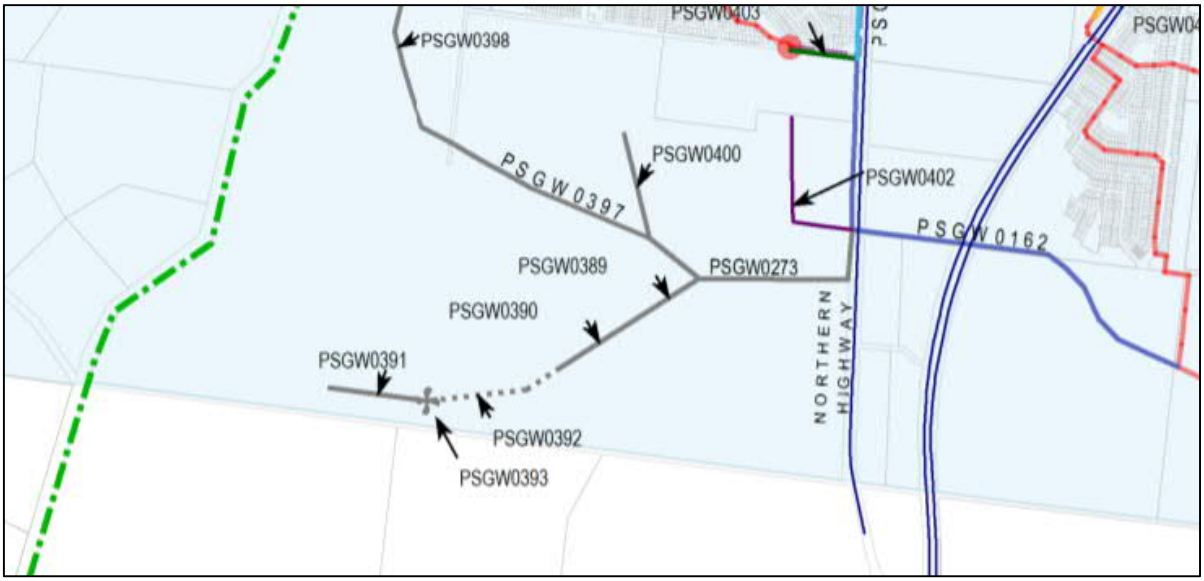


Figure 8: Wallan Planned Sewer Assets (Northern Catchment)

General:

Internal reticulation within the development will include sewers within road reserves and rear allotments easements to service each allotment created. Access to rear sewer easements will require careful consideration in the early master-planning stages. Engagement with YVW is recommend ensuring suitable access is available for future maintenance requirements.

3.4. Water Supply

3.4.1. Potable Water

Yarra Valley Water is the responsible authority for potable water reticulation within the subject site.

The site is split into two distinct catchments based on the RL 285.0m contour. The initial 500 lots will be serviced via the Hazelwynde South Main which will require extension by agreement with YVW along Camerons Lane. This proposed asset is 375mm in diameter and will attract reimbursement from YVW.

Once this threshold is reached, a second source of supply is required from Mandalay Estate. This asset is a proposed 225mm diameter main and is identified as Mandalay Internal Loop Main S2 (PWGW0532).

3.4.2. Recycled Water

Yarra Valley Water is the responsible authority for potable water reticulation within the subject site.

Existing Non-Drinking Water (NDW) assets reside within the Camerons Lane road reserve. Extension west along Camerons Lane to the future intersection with E-14 is envisaged to supply the initial stages of development.

The proposed extension along Camerons Lane is identified as Hazelwynde South Main PWGW0407 and is a 300mm diameter asset. Internal to site, the Hazelwynde South Loop Main (225mm diameter) and the Hazelwynde North Main Link (225mm diameter) assets will require consideration as part of staged subdivision development.

As per potable water advice above, the site is split into two distinct catchments based on the RL 285.0m contour.

Appended to this report is the current preliminary servicing advice from Yarra Valley Water.

3.5. Electricity Supply

Ausnet Services are the responsible authority for electrical supply for the subject sites.

Camerons Lane in the existing condition has a single phase 22kV HV overhead powerline along the southern side of this existing road reserve. This same powerline has single phase LV powerlines supplying existing properties to the south of Camerons Lane, via single phase pole mounted substations.

Old Sydney Road also has single phase 22kV/ 66kV HV overhead powerlines along on the eastern side of the road reserve for approximately 800m from the intersection with Camerons Lane. At this point, the 22kV overhead line deviates to the western verge of this road reserve. The 66kV overhead line continues north along Old Sydney Road beyond the developments western boundary.

To utilise these existing overhead powerlines in both Camerons Lane and Old Sydney Road, augmentation is required to increase the capacity to three (3) phase, increase the size of conductors and introduce new overhead powerlines. The costs to augment these lines will be developed funded.

As part of the subdivision process and early stage master-planning, kiosk reserves will be required throughout the development in line with Ausnet Services standard servicing requirements of (5.8m x 8.0m reserves) for a 500kVA substation. Based on the estimate lot yield of 7,418 lots, an estimated (65) kiosks should be allowed within the development boundary.

Appended to this report is the current preliminary servicing advice from Murtec Consulting.

3.6. Gas Supply

APA Group is the responsible authority for the gas supply within the site.

APA has existing gas infrastructure within reasonable proximity to the property boundary.

Supply would be accessible to the site via standard supply agreement with APA. Internal reticulation (63mm diameter mains) will be located within road reserves created as part of the subdivision process.

3.7. Telecommunications

Fibre to the home (FTTH) could be provided by NBN as part of the national rollout program. A review of the current roll out map, shows that fixed line services are available at Wallan to the north of the subject land.

At the time of this report, potential external costs to bring optic fibre to the sites boundary via NBN direct are unknown.

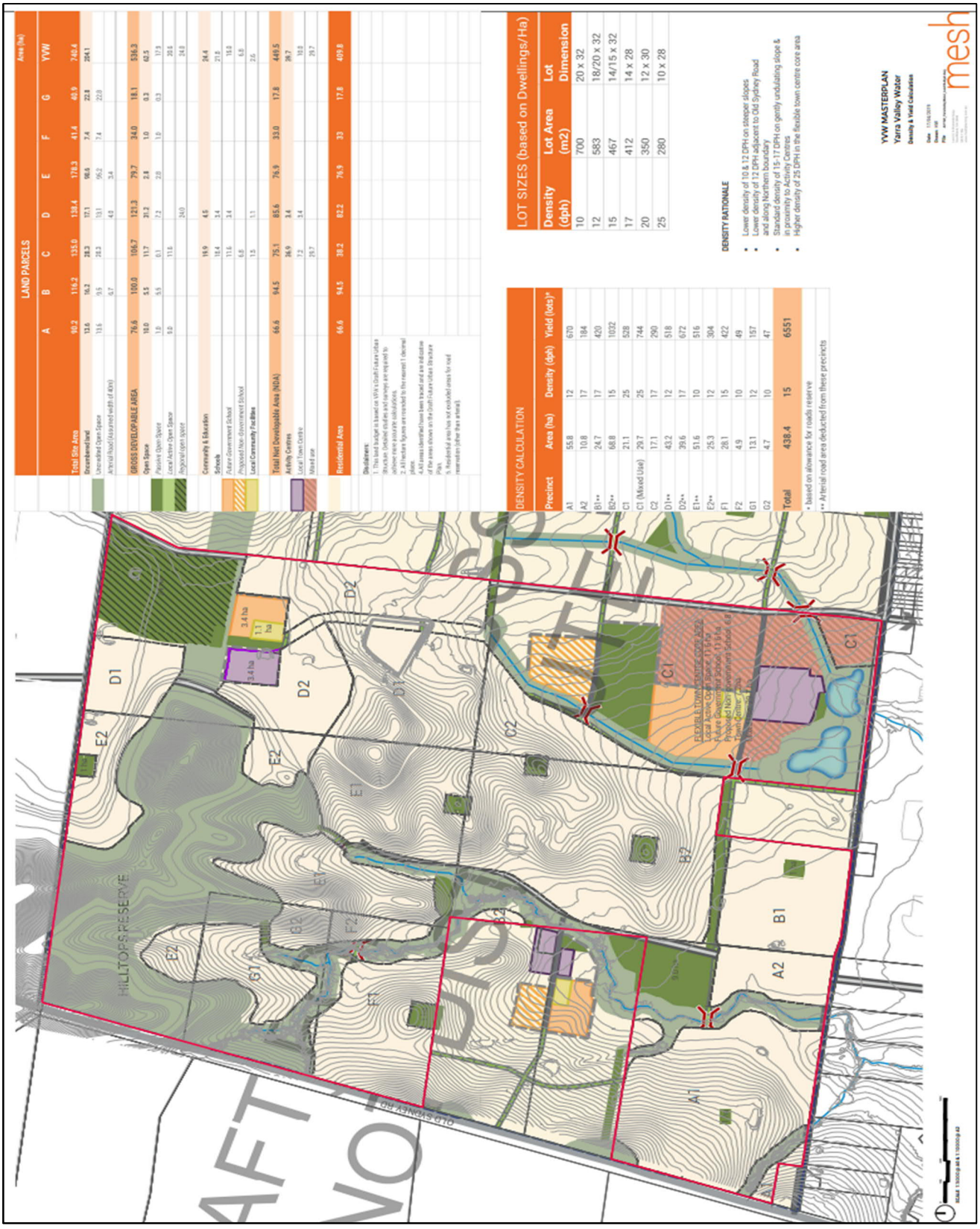
Mandalay Estate to the immediate south of the subject land, has utilised Opticomm to supply FTTH. Given the size of this development, discussions with Opticomm would most likely provide a viable alternative to NBN direct.

4. CONCLUSION

The site is not constrained to development by required services that are within reasonable proximity to existing site boundaries or that cannot be extended by agreement with the relevant agency.

The main development constraint is the timing and funding for the Camerons Lane/Hume Freeway Interchange, unless alternate interim access arrangement can be identified. At the time of this report, the timing and funding arrangements for this state infrastructure project are unknown.

5. Appendix A – Mesh Planning Land Budget



6. Appendix B – Melbourne Water Servicing Advice

5 December 2017

Brent Gleeson
Verve Projects Pty Ltd
173 Burke Road
Glen Iris VIC 3146

Dear Brent,

Proposal: Pre-development advice
Site location: 180 Camerons Lane, Beveridge
Melbourne Water reference: MWA-1039733
Date received: 29/11/17
Development Services Scheme: Kalkallo Creek Development Services Scheme

Thank you for your application requesting pre-development information for the above mentioned property. The following development advice is applicable to the property:

Drainage Agreement

Prior to the issue of a Statement of Compliance, the Owner will need to enter into and comply with an agreement with Melbourne Water Corporation, under the Water Act 1989, for the provision of drainage works and the acceptance of surface and storm water from the subject land directly or indirectly into Melbourne Water's drainage system. The agreement may include the following components.

Drainage Contributions

A drainage agreement usually includes the payment of drainage contributions, where a property is being developed. These contributions are used to recover the cost of constructing drainage works such as:

- Main drains, retarding basins, waterway improvements and flood mitigation works (Hydraulic)
- Wetlands and WSUD elements (stormwater quality)

The contributions are based on the increased load to the drainage system created by the development.

The site in question is located within Melbourne Water's Kalkallo Creek Development Services Scheme. Melbourne Water advises that the current residential contribution rates are:

- **$131,098/Ha, comprising of a hydraulic charge of $82,039/Ha and a stormwater quality charge of $49,059/Ha**

The stormwater quality charge can be reduced or removed by on-site treatment works, in-line with Melbourne Water's 'Stormwater Quality Offset Policy'. Please see the 'Stormwater Quality' section below.

It should be noted that contribution rates are subject to periodical review and hence the future contribution rate may be higher than the current provided here. For registered users, two months' notice of any change in rates, is provided via email and on the Planning and Building page on Melbourne Water's website. Contributions payable will be calculated upon receipt of an application for '*Conditions of Agreement for the Provision of Drainage Facilities*' and a formal plan of subdivision.

Stormwater Quality

The Urban Stormwater Best Practice Environmental Management Guidelines require that runoff from all new developments (including redevelopments) are treated to comply with the following targets:

- 80% Total Suspended Solids reduction
- 45% Total Phosphorus reduction
- 45% Total Nitrogen reduction

SWQ performance (targets) is assessed by using specialist software. Usually the Model for Urban Stormwater Improvement Conceptualisation (MUSIC) is used for large developments and a web-based calculator (STORM) is used for small developments. Please refer to the end of the document for links to Melbourne Water's guidelines for the use of MUSIC.

Non-compliance with best practice objectives will require the payment of the stormwater quality component of the drainage contributions. This money will help fund stormwater quality works, elsewhere in the catchment.

Drainage Scheme Works

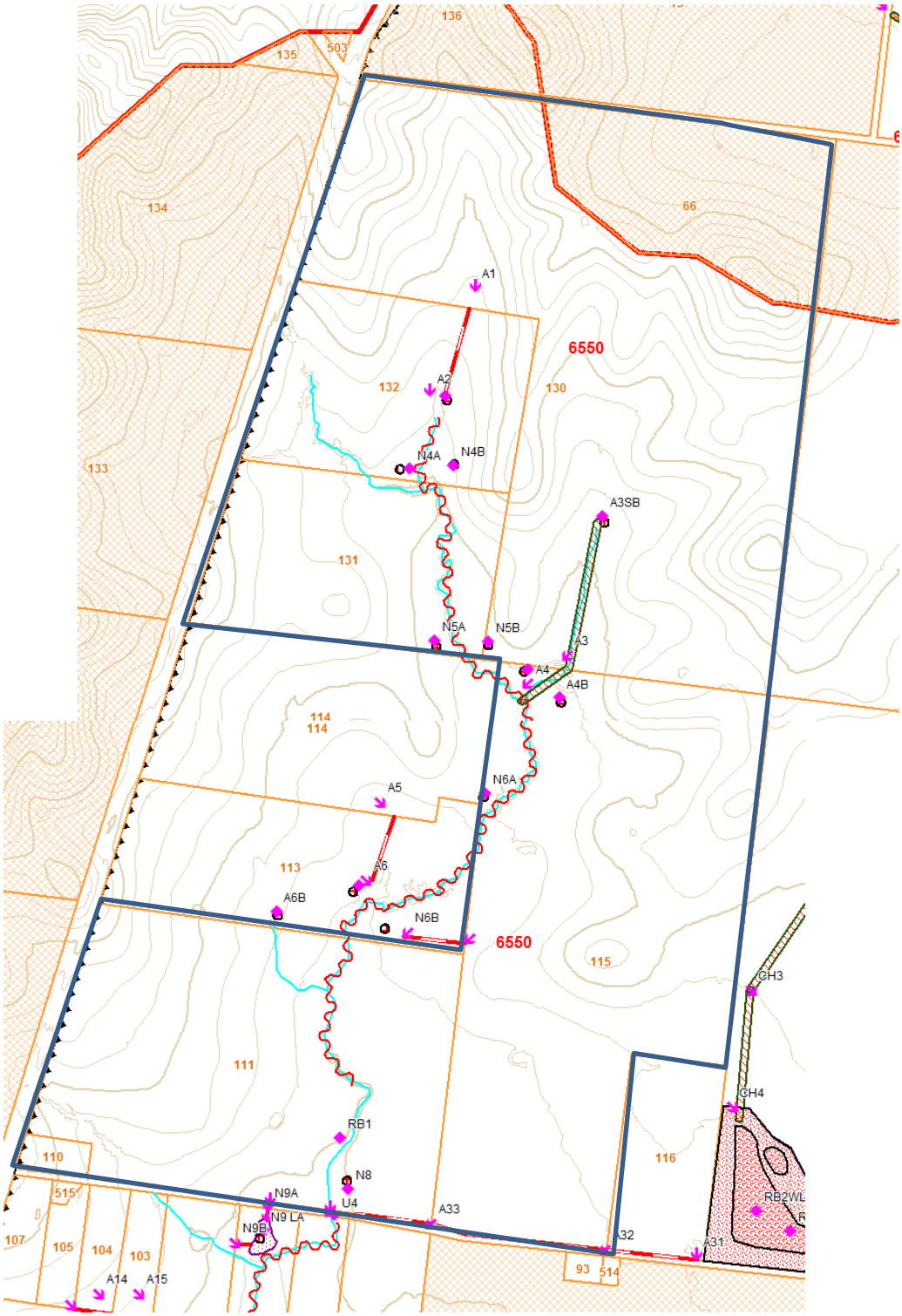
A drainage agreement usually requires the construction of permanent works in conjunction with the development as outlined by the appropriate development services scheme. A review of the Kalkallo Creek Development Services Scheme has identified that there are permanent Melbourne Water works to be constructed on this property.

Such works may require that several surveys be undertaken to determine the most efficient and environmentally friendly design outcomes. These may include, but are not limited to, a Flora & Fauna assessment and an Archaeological investigation, which would all guide the most appropriate design. Design approval from Melbourne Water and any other relevant authorities will be required prior to commencement of the drainage works.

Please refer to the attached plans for a layout of the proposed works and any overland flow paths, which must be catered for by the development. The following table details the expected drainage works and design criteria for their sizing.

Node Ref.	**Length (m)**	**Comments/Ownership**
A1-A2	270	Melbourne Water - 5 year pipe
A2SB		Council - Sediment trap
A2-A4-A6-RB1		Melbourne Water – Ex Creek stabilisation works.
A3SB		Council - Sediment trap
A3SB-A3-A4		Melbourne Water – Q100 Waterway corridor
N4B & N4B & N5A & N5B & A4A & A4B & N6A		Council – Sediment Trap
N6-N6B	205	Melbourne Water - 5 year pipe
N6B & N8		Melbourne Water – Sediment Trap
A32-A33-A34-U4	740	Council - 5 year pipe
N10-N9A	20	Council - 5 year Culvert
N9A-N9	25	Council - 5 year pipe
N9		Council – Sediment Trap
N9LA		Land Acquisition

Please be advised that this information may be refined and/or modified upon any application for a drainage offer/agreement.


136
135
503
134
66
A1
6550
132
A2
130
N4A
N4B
133
A3SB
131
N5A
N5B
A3
A4
A4B
114
114
A5
N6A
113
A6
A6B
N6B
6550
115
GH3
111
GH4
RB1
110
116
N8
515
N9A
U4
A33
N9 LA
N9B
107
105
104
103
A32
A31
A14
A15
93
514

Specific Property Advice

- A detailed Stormwater management strategy (SWMS) will be required prior to an issue of a planning permit. The strategy must include a catchment analysis and demonstrate an appropriate drainage solution that will not adversely affect any downstream properties.

- To achieve appropriate outfall for this development, temporary works will be/may be required as part of the drainage agreement. If the development proceeds out of sequence then the developer will need to fund the costs of these temporary works.

- The developer must negotiate any temporary works with the downstream landowner(s) to obtain a free draining outfall solution through their property/ies. Approval must be granted and forwarded to Melbourne Water before construction of the drainage works commences.

- Melbourne Water requires evidence demonstrating that appropriate interim drainage solutions (eg. retardation and sediment control) have been implemented to mitigate the risk to downstream landowners. Council acceptance of any temporary drainage infrastructure should be forwarded to Melbourne Water.

- Currently no Flooding information is available.

- Melbourne Water requires the submission of appropriate information demonstrating how the existing flood levels on other properties will not be increased or adversely impacted. If this is by means of a cut-fill balance, appropriate modelling must be submitted for review and acceptance by Melbourne Water.

- All new lots are to be filled to a minimum of 300mm above the 1 in 100 year flood level associated with an existing or proposed Melbourne Water pipeline and major overland flow path; and 600mm above the 1 in 100 year flood level associated with any Melbourne Water retarding basin, waterway, wetland; whichever is greater.

- All development adjacent/near a waterway must follow **Melbourne Water Waterway Corridors Guidelines**, extent of the waterway is subject to change upon further investigation of the site.

Overland Flow Paths

Melbourne Water expects that upon any application for certification of any subdivision plan associated with the property, due consideration will be given to the alignment of roads and reserves with any adjoining estates, to ensure continuity and provide uninterrupted conveyance of overland flows. These overland flow paths will need to be designed in accordance with the safety criteria outlined in the Standards and Specifications section on the Planning and Building of Melbourne Water's website.

Before starting any works, a separate application, direct to Melbourne Water, must be made for any new or modified storm water connection to Melbourne Water's drains or watercourses. Before accepting an application, evidence must be provided demonstrating that Council has considered that it is not feasible to connect to the local drainage system.

Water Sensitive Urban Design

WSUD is a design process that enables localised collection and treatment of stormwater runoff. Melbourne Water acknowledges the potential for water sensitive urban design to be incorporated into the development to enable sustainable management of stormwater across the property and to compliment the social and environmental values of the area.

Melbourne Water recommends that initiatives such as sediment ponds, bio-filtration systems, grassed swales, grey water re-use, rainwater tanks and porous soils be considered in the design of the development. Stormwater runoff from paved areas can also be a valuable resource for irrigating trees, grassed areas and landscaped garden beds.

Offer Application

Prior to any application for an offer of drainage contributions, Melbourne Water requests that you forward a **drainage strategy demonstrating** that the proposed drainage plan for the property coincides with the intent of Melbourne Water's Kalkallo Creek Development Services Scheme and the local Precinct Structure Plan, if relevant.

The following information should be included within the strategy:

- General site information
- Options for the proposed drainage of the property
- Consideration for Water Sensitive Urban Design

Melbourne Water look forward to further discussion on the above and advises that this information is preliminary and forms no contractual agreement between your company and Melbourne Water.

Advice Links
For further information on Melbourne Water's role in planning please refer to the following links:

- **Contribution Rates:** http://melbournewater.com.au/Planning-and-building/schemes/contribution/Pages/scheme-contribution-rates-calculator.aspx

- **Drainage Schemes:** http://melbournewater.com.au/Planning-and-building/schemes/map/Pages/Drainage-schemes.aspx

- **Water Sensitive Urban Design -** http://melbournewater.com.au/Planning-and-building/Stormwater-management/Pages/Stormwater-management.aspx

- **Reducing Water Quality Contributions/Stormwater Offset Rate review -** http://melbournewater.com.au/Planning-and-building/schemes/offset/Pages/What-are-stormwater-quality-offsets.aspx

- **Overland Flow Paths** (These overland flow paths will need to be designed in accordance with the safety criteria outlined in the Standards and Specifications section of Melbourne Water's Planning and Building

website found on www.melbournewater.com.au

- **Working near or Connection to MW assets -** http://melbournewater.com.au/Planning-and-building/Working-around-mains-drains-and-waterways/Pages/Working-around-mains.aspx

- **Stormwater Quality:** The Urban Stormwater Best Practice Environmental Management Guidelines require that runoff from all new developments (including redevelopments) be treated to comply with the following, 'Best Practice' standards criteria: Removal of 80% of the suspended solid annual load, 45% of total phosphorus and 45% of total nitrogen annual loads. http://www.publish.csiro.au/issue/3822.htm

Disclaimers:
The feasibility information provided in this email is conceptual/indicative only and must be used in conjunction with an informed catchment analysis when undertaking the detailed design.

Under the QA process the Consultant is required to perform their own informed catchment analysis and calculations for the design of scheme assets which reflects the actual development and on ground conditions. As a part of the functional design process your calculations, assumptions, models and catchment analysis are to be submitted for our acceptance/records.

Please note that as schemes develop and Melbourne Water receives additional information, the conceptual/indicative advice you have been provided as part of the feasibility request may now be outdated. Under the QA process it is the responsibility of the consultant to certify that all information provided to Melbourne Water is correct having completed their own detailed catchment analysis.

Melbourne Water reserves the right to alter any or all of the information provide in this letter.

Please do not hesitate to contact me if you have further enquires on 9679 7981 or via email mayank.khanna@melbournewater.com.au.

Yours sincerely,

Mayank Khanna
Urban Growth Services

Melbourne Water ABN 81 945 386 953
990 La Trobe Street Docklands VIC 3008
PO Box 4342 Melbourne VIC 3001 Australia
T 131 722 F +61 (0) 3 9679 7099
melbournewater.com.au

7. Appendix C – Yarra Valley Water Servicing Advice

3 January 2018

Verve Projects

Attn: Brent Gleeson

Application ID: 294883

Property Address: 180 Camerons Lane, Beveridge

Preliminary Servicing Advice

The following information is preliminary servicing advice and does not constitute an offer.

This advice lapses within 3 months of the date of this letter.

This preliminary servicing advice is based on the information provided in your enquiry.

This advice may no longer be valid if there are any changes to the information provided.

This advice succeeds any prior written or verbal advice provided by Yarra Valley Water.

If you have any enquiries, please e-mail us at easyACCESS@yvw.com.au or visit our website https://www.yvw.com.au/help-advice/develop-build for further information. Alternatively, you can contact us on 1300 651 511.

Yours sincerely,

John Maudsley
Divisional Manager, Development Services

Water Advice:

This Preliminary Service Advice, hereafter referred to as 'advice', is based on information provided within the developer's application. This advice may no longer be valid if information provided by the developer changes.

The following information is preliminary servicing advice and does not constitute an offer. This advice expires within 3 months of date of letter / advice to customer.

This advice succeeds any prior written or verbal advice provided by YVW. The designer should clarify any discrepancies between this and previous advice with YVW.

GENERAL

The Beveridge North West PSP will be serviced by two drinking and two non-drinking water zones. For both drinking and non-drinking water the area south of the 285m contour line will be on the Beveridge PR Zone, TWL 320m (note drinking TWL currently 330m), and north of the contour line will be serviced by the Mt Fraser Zone, TWL 370m. The Mt Fraser Zone will not be operational until reservoirs at the Mt Fraser Tank Site and appropriate transfer pipelines have been constructed.

The southern section of the PSP in the Beveridge PR Zone requires significantly less infrastructure to begin development. The northern section in the future Mt Fraser Zone requires extensive works not planned until post 2025+.

The design of all mains DN225 and greater, or as specifically noted in this offer, are to be submitted to the Land Development Engineer, Asset Creation, for the approval of the Manager Water Growth Planning and the Manager Water Operations.

All mains DN375 and greater are strictly non tapping mains (even if parallel duplicate mains are not shown on the plans provided), and shall be isolated from tapping mains via valving as per clause 6.2.5.2. All valves on mains larger than DN375 shall be metal wedge, including offtake valves.

The Manager Water Operations shall be notified 7 days prior to any work on or adjacent to existing mains DN300 or greater.

This advice is given for servicing of superlots only. If the superlots are further subdivided then additional conditions may apply. Any further assets to be constructed will be at the expense of the developer.

YVW requires that key asset Drinking Water and Non-Drinking Water mains are located on either side of major road reserves. The design of the services within the developments major roads must allow for this requirement and up to two additional reticulation rider mains along the road (drinking and non-drinking water reticulation mains on each side of road).

Choose Tap Initiative

As part of this development Yarra Valley Water would like to offer the opportunity to feature our bespoke Choose Tap water refill stations. Water refill stations are permanent installations providing public access to water for drinking or filling of personal receptacles. The provision of water refill stations are funded by Yarra Valley Water under the Choose Tap program. For more information, please contact choosetap@yvw.com.au

Southern Section (Elevation <285m)

Drinking and non-drinking water can be provided to the southern section now. Development can progress up to the 285m contour provided that 1) Once 500 lots are reached off a single source, a second source of supply is constructed and 2) The total lots to be developed in the Beveridge-Wallan area is less than 4,000.

Asset requirements are outlined in the drinking and non-drinking servicing advice sections of this document.

Northern Section (Elevation >285m)

Infrastructure for drinking and non-drinking supply to this area is currently planned for post 2025+. This forms the future Mt Fraser Zone and the following assets are required to supply it with water (see strategy plans attached to this document):

Drinking Water:

1. Bald Hill Drinking Water Reservoir
2. Bald Hill North WPS
3. Mt Fraser Inlet Main (Bald Hill WPS – Mt Fraser Reservoir)
4. Mt Fraser Drinking Reservoir
5. Northern Hwy to Beveridge Main
6. Hazelwynde Central and North Mains
7. Gilbo Land Main

Non-Drinking Water:

1. Mt Fraser Non-drinking Water Reservoir
2. Mt Fraser Outlet Main
3. Hazelwynde Link Main
4. Hazelwynde Main

DRINKING WATER (DW) ADVICE

Please refer to the attached charts for pressure and flow information for assessment of general services. The information provided is for the point marked 'A' on the attached Water Supply Concept Plan, for a Peak Summer Day event.

The pressure of drinking water supply may change in future. Refer to additional charts for ultimate state pressure and flow information. The development area may be subject to operational changes in the future as development proceeds, and pressures measured in the field might not reflect the future regime. The development should be designed to suit both the current and future operating regimes.

A separate development deed must be applied for to undertake these works."

Drinking Water Advice – Southern Section

No drinking water supply is currently available for the subject land.

Drinking water supply for the subject land requires:

- The extension of various distribution mains to and through future development of the land;
- Installation of internal reticulation mains.

Refer to attached Drinking Water Infrastructure strategy plans for the Beveridge North West PSP area. These plans show the preliminary location for the key assets planned to service this area, including transfer and distribution mains and pumping stations.

Development of subject land requires the construction of assets as described in the table below.

Key Assets Required

	Asset	Description	Construct Method/Timing
1	DN375 Hazelwynde South Main Main PWGW0319	approximately 2950m @ DN375 main along Lithgow St, Malcolm St and Camerons Lane .	YVW design and construct main. Progressive timing as required by development. Current planned construction for Waterplan 4 (post 2025+) (To be confirmed)
2	DN225 Mandalay Internal Loop Main Stage 2 PWGW0532	approximately 1000m @ DN225 main along Mandalay Circuit . Additional link from the loop main the Hazelwynde South Main required.	YVW design and construct main. Progressive timing as required by development. Current planned construction for Waterplan 3 (2017/18) (To be confirmed)

Note that the above details of these drinking water assets are preliminary at this stage and are subject to confirmation at design stage.

The key assets along Lithgow St, Malcolm St and Camerons Lane are deemed to be Shared Infrastructure under the ESC Development Pricing Guidelines and as such under current policy will be provided by YVW however the developer may be required to meet a bring forward cost at a rate determined from the planned construction year.

The developer will be required to install drinking water reticulation assets at the developer's cost.

YVW will need to provide upgrades as required by development progression to key drinking water assets to maintain zone supplies.

Distribution and reticulation mains provided for any development of the subject land must integrate with surrounding development.

YVW requires that key asset Drinking Water and Non-Drinking Water mains are located on either side of major road reserves. The design of the services within the developments major roads must allow for this requirement and up to two additional reticulation rider mains along the road (Drinking and Non-Drinking water reticulation mains on each side of road).

The Beveridge-Wallan area is solely supplied by the M656 Drinking Water Transfer Main which is pumped from Kalkallo WPS610 to Pretty Sally Reservoir WRS610. To ensure security of supply it is determined that a maximum of 4,000 more lots can be developed in the Beveridge-Wallan area which rely on this main for Drinking water supply. The distribution of these 4,000 lots is dependent on the rate and location of development only. Any single development which reaches 500 lots off a single source of supply will be required to construct additional infrastructure to provide dual directions of supply into the development. In order to develop more than 4,000 lots in this area key infrastructure is required that is not scheduled for construction until post 2025+, bring forward costs will apply.

NON-DRINKING WATER (NDW) ADVICE

Yarra Valley Water has mandated non-drinking water for residential use in this area.

Please note mandatory inspections of non-drinking water plumbing for each dwelling/lot will be required for this development should it proceed.

The developer is not authorised to construct any cross connections between non-drinking water mains and drinking water mains unless specifically directed through YVW advice.

Non-Drinking Water Advice – Southern Section

No non-drinking water supply is currently available for the subject land.

Non-Drinking water distribution mains are constructed to part way along Camerons Lane and can be extended to supply the area with non-drinking water when available.

Non-drinking water supply for the subject land requires:

· The extension of various transfer and distribution mains to and through future development of the land;

· Provision of pressure reducing stations; and

· Installation of internal reticulation mains.

Refer to attached Non-Drinking Water Infrastructure strategy plans for the Beveridge - Wallan area. These plans show the preliminary location for the key assets planned to service this area, including transfer and distribution mains and pumping stations. Estimated timing for the key assets is shown on the plans but will be dependent on development timing.

Development of subject land requires the construction of assets as described in the table below.

Key Assets Required

	Asset	Description	Construct Method/Timing
1	DN300 Hazelwynde South Main PWGW0407	approximately 1200m @ DN300 main along Camerons Lane.	YVW design and construct main. Progressive timing as required by development. Current planned construction for 2017/18
2	DN225 Mandalay Internal Loop Main Stage 1 PWGW0256	approximately 1000m @ DN225 main along Mandalay Cct.	YVW design and construct main. Progressive timing as required by development. Current planned construction for 2017/18

Note that the above details of these drinking assets are preliminary at this stage and are subject to confirmation at design stage.

The key assets along Camerons Lane are deemed to be Shared Infrastructure under the ESC Development Pricing Guidelines and as such under current policy will be provided by YVW however the developer may be required to meet a bring forward cost at a rate determined from the planned construction year.

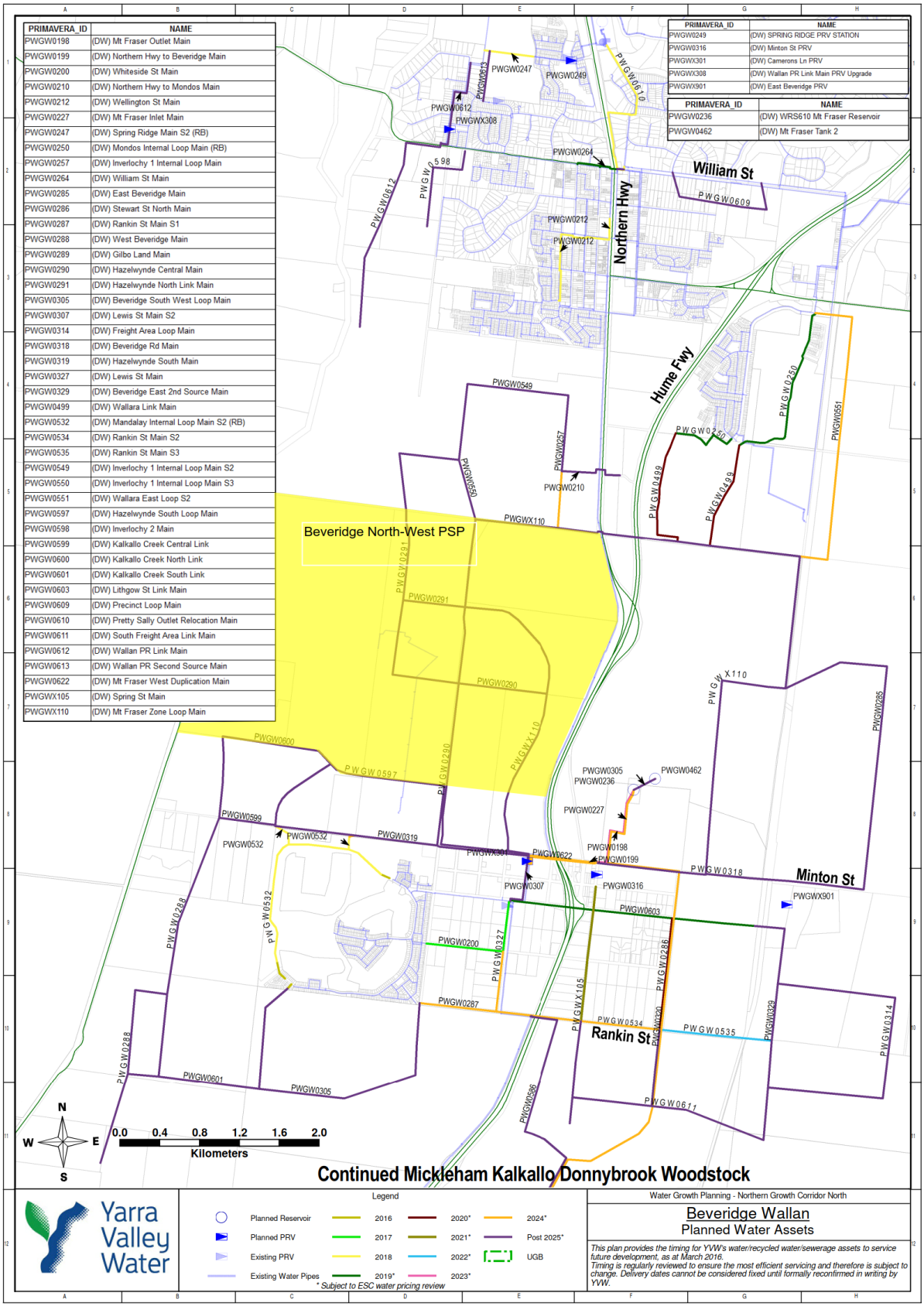
The developer will be required to install non-drinking water reticulation assets at the developer's cost.

Distribution and reticulation mains provided for any development of the subject land must integrate with surrounding development.

Temporary Drinking Water Cross Connection

Temporary cross connection not applicable.

YVW is responsible for the preparation of an Environmental Management Plan (EMP), covering the provision of non-drinking water to this development. The developer must ensure that proposed designs comply with the requirements in the EPA Guidelines for Dual Pipe Water Recycling Schemes – Health and Environmental Risk Management (Publication 1015), and in particular adherence to the regulations applicable to dual pipe developments. The developer may contact the Water Quality Specialist, Asoka Jayaratne on (03) 9872 1398 for clarifications of these requirements prior to the scheme design.

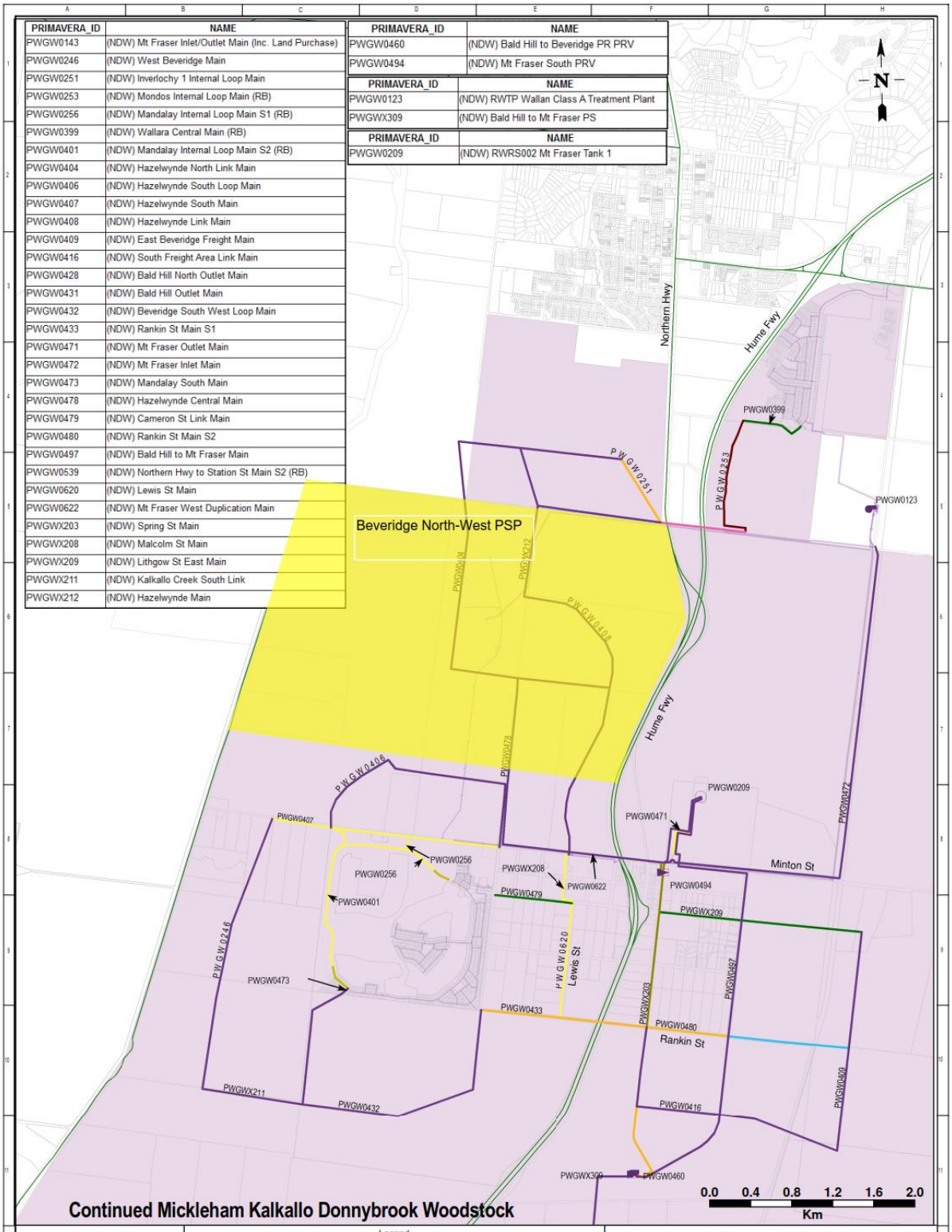

PRIMAVERA_ID | NAME
PWGW0198 | (DW) Mt Fraser Outlet Main
PWGW0199 | (DW) Northern Hwy to Beveridge Main
PWGW0200 | (DW) Whiteside St Main
PWGW0210 | (DW) Northern Hwy to Mondos Main
PWGW0212 | (DW) Wellington St Main
PWGW0227 | (DW) Mt Fraser Inlet Main
PWGW0247 | (DW) Spring Ridge Main S2 (RB)
PWGW0250 | (DW) Mondos Internal Loop Main (RB)
PWGW0257 | (DW) Inverlochy 1 Internal Loop Main
PWGW0264 | (DW) William St Main
PWGW0285 | (DW) East Beveridge Main
PWGW0286 | (DW) Stewart St North Main
PWGW0287 | (DW) Rankin St Main S1
PWGW0288 | (DW) West Beveridge Main
PWGW0289 | (DW) Gilbo Land Main
PWGW0290 | (DW) Hazelwynde Central Main
PWGW0291 | (DW) Hazelwynde North Link Main
PWGW0305 | (DW) Beveridge South West Loop Main
PWGW0307 | (DW) Lewis St Main S2
PWGW0314 | (DW) Freight Area Loop Main
PWGW0318 | (DW) Beveridge Rd Main
PWGW0319 | (DW) Hazelwynde South Main
PWGW0327 | (DW) Lewis St Main
PWGW0329 | (DW) Beveridge East 2nd Source Main
PWGW0499 | (DW) Wallara Link Main
PWGW0532 | (DW) Mandalay Internal Loop Main S2 (RB)
PWGW0534 | (DW) Rankin St Main S2
PWGW0535 | (DW) Rankin St Main S3
PWGW0549 | (DW) Inverlochy 1 Internal Loop Main S2
PWGW0550 | (DW) Inverlochy 1 Internal Loop Main S3
PWGW0551 | (DW) Wallara East Loop S2
PWGW0597 | (DW) Hazelwynde South Loop Main
PWGW0598 | (DW) Inverlochy 2 Main
PWGW0599 | (DW) Kalkallo Creek Central Link
PWGW0600 | (DW) Kalkallo Creek North Link
PWGW0601 | (DW) Kalkallo Creek South Link
PWGW0603 | (DW) Lithgow St Link Main
PWGW0609 | (DW) Precinct Loop Main
PWGW0610 | (DW) Pretty Sally Outlet Relocation Main
PWGW0611 | (DW) South Freight Area Link Main
PWGW0612 | (DW) Wallan PR Link Main
PWGW0613 | (DW) Wallan PR Second Source Main
PWGW0622 | (DW) Mt Fraser West Duplication Main
PWGWX105 | (DW) Spring St Main
PWGWX110 | (DW) Mt Fraser Zone Loop Main
PRIMAVERA_ID | NAME
PWGW0249 | (DW) SPRING RIDGE PRV STATION
PWGW0316 | (DW) Minton St PRV
PWGWX301 | (DW) Camerons Ln PRV
PWGWX308 | (DW) Wallan PR Link Main PRV Upgrade
PWGWX901 | (DW) East Beveridge PRV
PRIMAVERA_ID | NAME
PWGW0236 | (DW) WRS610 Mt Fraser Reservoir
PWGW0462 | (DW) Mt Fraser Tank 2
Beveridge North-West PSP
William St
Northern Hwy
Hume Fwy
Minton St
Rankin St
Continued Mickleham Kalkallo Donnybrook Woodstock
N
W
E
S
0.0 0.4 0.8 1.2 1.6 2.0
Kilometers
Yarra Valley Water
Legend
Planned Reservoir
Planned PRV
Existing PRV
Existing Water Pipes
2016
2017
2018
2019*
2020*
2021*
2022*
2023*
2024*
Post 2025*
UGB
* Subject to ESC water pricing review
Water Growth Planning - Northern Growth Corridor North
Beveridge Wallan
Planned Water Assets
This plan provides the timing for YVW's water/recycled water/sewerage assets to service future development, as at March 2016.
Timing is regularly reviewed to ensure the most efficient servicing and therefore is subject to change. Delivery dates cannot be considered fixed until formally reconfirmed in writing by YVW.

PRIMAVERA_ID	NAME
PWGW0143	(NDW) Mt Fraser Inlet/Outlet Main (Inc. Land Purchase)
PWGW0246	(NDW) West Beveridge Main
PWGW0251	(NDW) Inverlochy 1 Internal Loop Main
PWGW0253	(NDW) Mondos Internal Loop Main (RB)
PWGW0256	(NDW) Mandalay Internal Loop Main S1 (RB)
PWGW0399	(NDW) Wallara Central Main (RB)
PWGW0401	(NDW) Mandalay Internal Loop Main S2 (RB)
PWGW0404	(NDW) Hazelwynde North Link Main
PWGW0406	(NDW) Hazelwynde South Loop Main
PWGW0407	(NDW) Hazelwynde South Main
PWGW0408	(NDW) Hazelwynde Link Main
PWGW0409	(NDW) East Beveridge Freight Main
PWGW0416	(NDW) South Freight Area Link Main
PWGW0428	(NDW) Bald Hill North Outlet Main
PWGW0431	(NDW) Bald Hill Outlet Main
PWGW0432	(NDW) Beveridge South West Loop Main
PWGW0433	(NDW) Rankin St Main S1
PWGW0471	(NDW) Mt Fraser Outlet Main
PWGW0472	(NDW) Mt Fraser Inlet Main
PWGW0473	(NDW) Mandalay South Main
PWGW0478	(NDW) Hazelwynde Central Main
PWGW0479	(NDW) Cameron St Link Main
PWGW0480	(NDW) Rankin St Main S2
PWGW0497	(NDW) Bald Hill to Mt Fraser Main
PWGW0539	(NDW) Northern Hwy to Station St Main S2 (RB)
PWGW0620	(NDW) Lewis St Main
PWGW0622	(NDW) Mt Fraser West Duplication Main
PWGWX203	(NDW) Spring St Main
PWGWX208	(NDW) Malcolm St Main
PWGWX209	(NDW) Lithgow St East Main
PWGWX211	(NDW) Kalkallo Creek South Link
PWGWX212	(NDW) Hazelwynde Main

PRIMAVERA_ID	NAME
PWGW0460	(NDW) Bald Hill to Beveridge PR PRV
PWGW0494	(NDW) Mt Fraser South PRV

PRIMAVERA_ID	NAME
PWGW0123	(NDW) RWTP Wallan Class A Treatment Plant
PWGWX309	(NDW) Bald Hill to Mt Fraser PS

PRIMAVERA_ID	NAME
PWGW0209	(NDW) RWRS002 Mt Fraser Tank 1



Yarra Valley Water

Legend

2016 2017 2018 2019* 2020* 2021* 2022* 2023* 2024* Post 2025* Existing NDW Pipes Mandated NDW Area

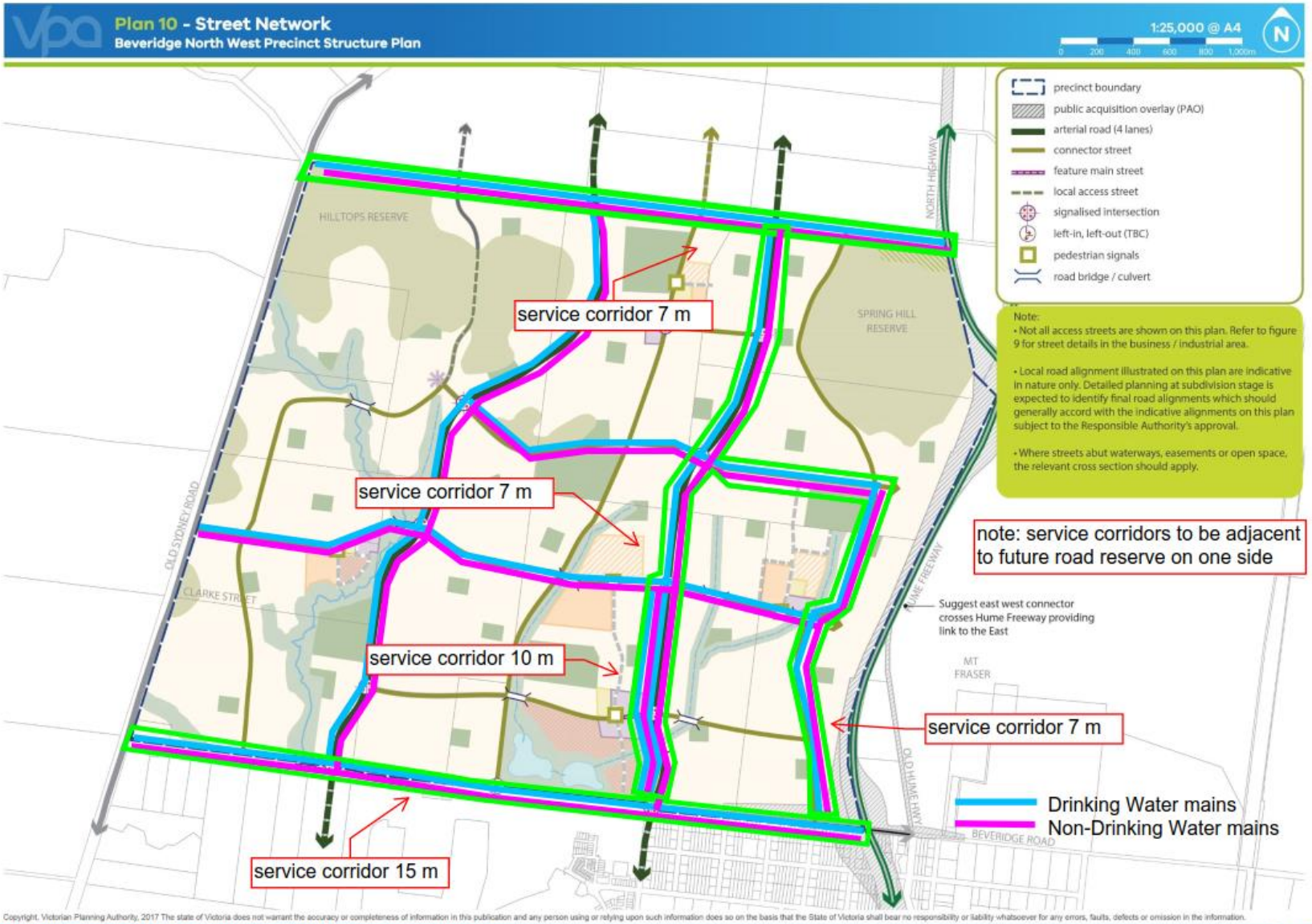
Planned Reservoir Planned Pump Station Planned PRV

* Subject to ESC water pricing review

Water Growth Planning - Northern Growth Corridor North

Beveridge Wallan
Planned NDW Assets

This plan provides the timing for YVW's water/non-drinking water/sewerage assets to service future development, as at March 2016.
Timing is regularly reviewed to ensure the most efficient servicing and therefore is subject to change. Delivery dates cannot be considered fixed until formally reconfirmed in writing by YVW.



Sewer Advice:

General

- This **preliminary servicing advice** ("advice") is based on the information provided within the developer's Application and will no longer be valid if the information provided by the developer changes subsequent to this Application.
- This **advice** does not constitute an offer and lapses within 3 months of the date of this letter.
- This advice succeeds any prior written or verbal advice provided by Yarra Valley Water.

Design Standards

- Unless otherwise instructed all works shall be designed in accordance with WSA 02-2014-3.1 Sewerage Code of Australia, Melbourne Retail Water Agencies - Version 2.
- The designer should note that WSA 02-2014-3.1 Clause 1.2.7 requires the designer to undertake the necessary design and produce Design Drawings to comply with Yarra Valley Water's concept and/or strategy plan and design parameters.

Generic Technical Requirements

General

- Upon accepting an Offer the Developer is required to inspect the connecting maintenance structure (i.e. maintenance hole, maintenance chamber, or maintenance shaft) and make an assessment of suitability for connection with regards to access and structural integrity. Any structural defects which the Developer believes will preclude connection must be immediately reported to Yarra Valley Water for rectification. If connection to the maintenance structure is not possible because of other physical constraints, including but not limited to the arrangement of ladders and/or other existing connections, the Developer will have to fully fund construction of a new and/or additional maintenance structure as the case may be.

Location

- Sewers shall be located in accordance with WSA 02-2014-3.1 Clause 5.2.4
- Sewers shall only be located along the rear boundary of private lots where reasonable access to the sewer is maintained, as defined in WSA 02-2014-3.1 Clause 5.2.4.3.
- For sewers proposed to be located along the rear boundary of private lots, a Plan of Subdivision showing building envelopes must be submitted with the sewer design drawings to verify that access requirements can be met.
- Where compliance with access requirements cannot be verified at the design stage, the sewer must be located in public or road reserve. Yarra Valley Water may offer dispensation to this requirement where only a small portion of allotments do not meet access requirements.
- Maintenance holes shall not be located in the rear of private property without reasonable access, unless they are required to accommodate lateral reticulation sewers at the end of a pod of lots in accordance with MRWA Standard MRWA-S-108.
- Notwithstanding any other requirements, sewers servicing industrial /commercial allotments shall be located in the road reserve.
- Construction of works through other properties requires permission from the relevant land owners.

- Unless noted otherwise, internal sewers must be extended to the development's upstream boundary and be designed and constructed to control upstream catchments.
- All sewer constructed within private property will require the creation of an easement in Yarra Valley Water's favour. Easements shall be designed in accordance with WSA 02-2014-3.1 Clause 5.2.8 (Easements). Surveyed verification of planned easement offset from sewer shall be submitted to YVW for approval.
- All buildings / dwellings constructed within private property must comply with YVW's Build Over Easement (BOE) Conditions. The Developer must apply for conditions before building a structure or conducting works (earthworks) within an easement, or in close proximity to a Yarra Valley Water asset.
- Sewers and maintenance structures adjacent to structures such as buildings and retaining walls shall be located clear of the "zone of influence" of the structure's foundations to ensure that the stability of the structure is maintained, excessive loads are not imposed on the sewer and maintenance access is not restricted. Refer WSA 02-2014-3.1 Clause 5.4.4 (Clearance from structures).

Pipe Sizing

- Pipe size and grade shall be such as to contain the design flow without exceeding the specified maximum velocity and to achieve a self-cleansing velocity at peak dry weather flow at least once per day.
- Average dry weather flows from commercial/industrial development expected to be in excess of 0.125 litres per second per hectare are not permitted without additional approval.
- Irrespective of other requirements, for maintenance purposes the minimum sizes of property connection and reticulation sewers shall be not less than those shown in WSA 02-2014-3.1 Table 5.5 and shown below.

TABLE 5.5

MINIMUM PIPE SIZES FOR RETICULATION AND PROPERTY CONNECTION SEWERS

Sewer	Minimum size DN
Property connection sewers servicing single or two occupancy residential lots	100
Reticulation sewers servicing >3 residential lots Property connection sewer servicing commercial and industrial lots	150
Reticulation sewer servicing commercial and industrial lots and other lots where large flows may be expected	225

Property Connection

- All property branches not used must be cut and sealed with a screw cap.
- Multi-unit development sites (i.e. Owners Corporations) comprising up to 30 units (equivalent tenements) may connect directly to a sewer without having to connect via a maintenance structure.
- Irrespective of other requirements, any new connections to sewers >4.1 metres deep must into a maintenance structure. If the connection cannot be made to an existing maintenance structure then a new maintenance structure will need to be constructed on the existing sewer.

Major Works

The following major infrastructure is required to service this development;

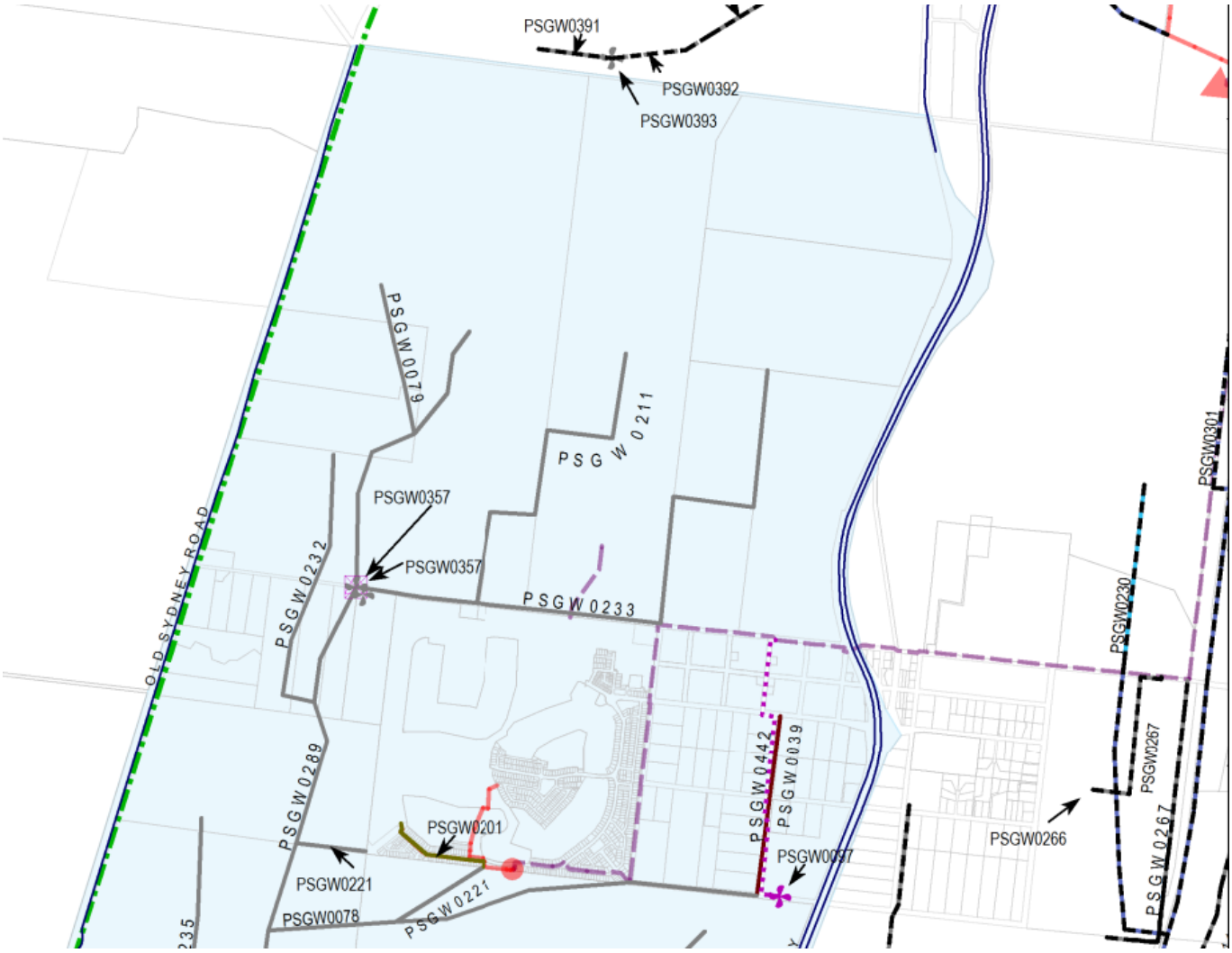
Asset	Design	Build	Fund
PSGW0211 Hazelwynde Branch Sewer	TBC	TBC	Bring-forward costs apply
PSGW0233 Beveridge North Branch Sewer *(Temporary discharge to Hazelwynde SPS, Ultimate discharge to Kalkallo Main Sewer)*	TBC	TBC	Bring-forward costs apply
PSGW0289 Kalkallo Main Sewer – Stage 3 *(Ultimate outlet)*	YVW	YVW	Bring-forward costs apply
PSGW0026 Kalkallo Main Sewer – Stage 2 *(Ultimate outlet)*	YVW	YVW	Bring-forward costs apply
PSGW0357 Hazelwynde SPS, Rising Main and Emergency Storage *(Temporary outlet discharging to Lockerbie Main Sewer)*	YVW	YVW	Developer Funded

The above works are generally indicated on the attached plan. Note that sewer alignments are indicative only.

- Temporary servicing strategies such as eduction will be considered if it is efficient to do so and the timing of permanent works is not consistent with development rates.

Privately-owned Pump Stations

Yarra Valley Water only allows the use of privately-owned pump stations to service fixtures below the finished surface level of the allotment (e.g. basements and basement car parks). The pump station must discharge to the internal gravity plumbing prior to the 27A connection point (i.e. the interface point where the private gravity plumbing connects to the Yarra Valley Water property branch).


PSGW0391
PSGW0392
PSGW0393
PSGW0079
PSGW0211
PSGW0357
PSGW0357
PSGW0232
PSGW0233
OLD SYDNEY ROAD
PSGW0301
PSGW0230
PSGW0289
PSGW0442
PSGW0039
PSGW0267
PSGW0266
PSGW0267
PSGW0201
PSGW0097
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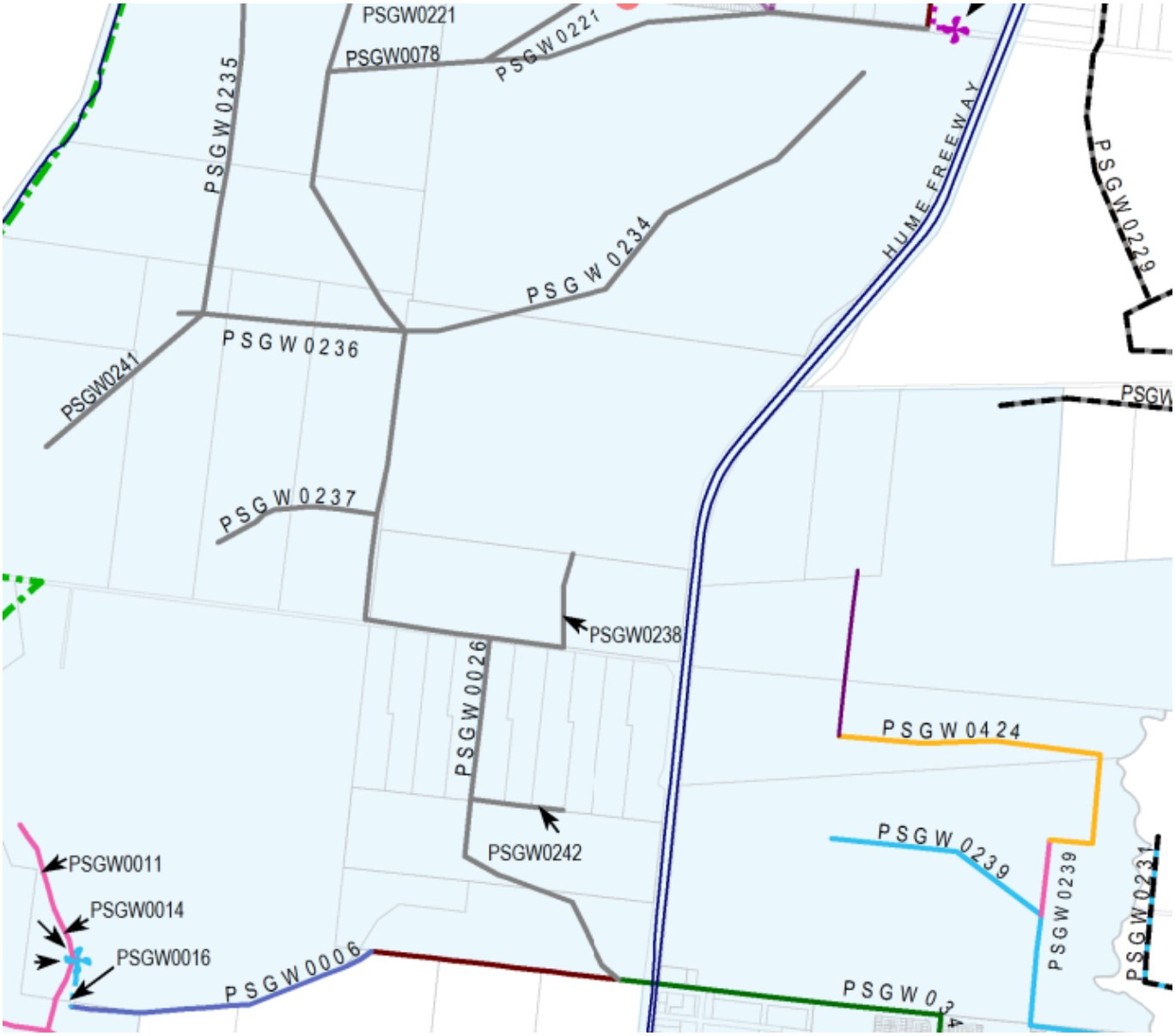

Build Over Easement / Within Close Proximity to YVW Assets:
Please ensure all necessary clearances are maintained from YVW assets. Click here to view the Build Over Easement Guidelines, these should be taken into consideration in the design stage of the development.

Application Forms:
To receive an offer from YVW, you will need to submit an application to us - click here to submit an online application.

Fees Advice:
Application Fees, Products & Services, and New Customer Contributions may be applicable to this development. Click here to view the current fees and charges.

8. Appendix D – Murtec Consulting Electrical Advice

HAZELWYNDE – BEVERIDGE ELECTRICAL SERVICING

General Site Conditions

- Proposed to be a residential development with a town centre / mixed use
    - Early predictions indicate approximately 7,500 residential lots
- The development site is bordered by
    - North – Existing land (undeveloped)
    - East – Existing Land (undeveloped)
    - South – Camerons Lane
    - West – Old Sydney Rd
- There is an existing Urban Residential Development (URD) on the south side of Camerons Lane called Mandalay Estate. Mandalay Estate is yet to connect to Camerons Lane and is accessed currently via Lithgow Street.
    - Ultimately it will connect to Camerons Lane.
- Site falls under Mitchell Shire Council
- Site falls under AusNet Services Pty Ltd requirements
- Site can be serviced by NBN Co.
- Initially planning indicates that the development will commence from Camerons Lane.

Electrical considerations

Incoming 22kV High Voltage (HV) Supply

The primary requirement from an electrical supply is the ability to bring 3 phase HV electrical supply to the site. Following are a few key points

Camerons Lane

- There is a single phase HV overhead power line along the southern side of Camerons Lane.
    - This power line also has some single phase Low Voltage (LV) power lines supplying existing premises to the south of Camerons Lane via single phase overhead pole substations.
    - The 22kV HV overhead conductor is of a small nature and will require augmentation.
    - To utilise this 22kV HV overhead power line to supply the development it will require augmentation to
        - Increase the capacity to three phase
        - Increase the size of the conductors
        - Additional overhead power poles will need to be designed into the existing overhead line.
        - All costs to augment the existing overhead powerline to bring adequate three phase 22kV HV supply to the development will be developer funded.

- As the overhead line is on the south side of Camerons Lane it will not affect any entry roads into the development.

Old Sydney Rd

- There is a single phase 22kV HV / 66kV HV overhead power line along the eastern side of Old Sydney Rd for the first 800m of the development frontage, north of Camerons Lane
- At this point the
    - 22kV HV overhead line deviates to the west side and continues north along the frontage of the development
    - 66kV HV overhead line continues along the eastern side along the frontage of the development
- The 22kV HV overhead conductor is of a small nature and will require augmentation.
    - To utilise this 22kV HV overhead power line to supply the development it will require augmentation to
        - Increase the capacity to three phase
        - Increase the size of the conductors
        - Additional overhead power poles will need to be designed into the existing overhead line.
        - All costs to augment the existing overhead powerline to bring adequate three phase 22kV HV supply to the development will be developer funded.
- Consideration also needs to be given to the location of the entry roads into the development to avoid new and existing locations for the 66kV overhead power pole locations.
    - 66kV overhead powerlines are an important feeder for AusNet Services Pty Ltd and can be expensive to relocate.

Mandalay Estate

- This is a URD development currently in construction on the south side of Camerons Lane.
- It is yet to connect to Camerons Lane.
- This development is currently supplied with three phase 22kV HV from an overhead powerline in Lewis Street. At the end of Lewis Street the 22kV HV is converted to underground and runs down Lithgow Street to supply the internal kiosk substations of Mandalay Estate
- Mandalay Estate development plans also show provision of three phase 22kV HV underground electrical assets in Ambrosia Way. This location is currently approximately 150m from Camerons Lane. It is fully expected that as Mandalay Estate develops to Camerons Lane that this three phase 22kV underground conductor will be brought out to Camerons Lane.

Existing three phase 22kV HV conductor with direct access to the development

- The nearest existing 22kV overhead conductor is in Lewis Street near the intersection with Lithgow Street
- The nearest existing 22kV underground conductor is in Lithgow Street at the intersection with Malcom Street

Options

- Early indications are that the proposed development for Hazelwynde is in the order of 5 years.
- According to this timeline we fully expect Mandalay Estate to extend to Camerons Lane with three phase 22kV HV supply.
    - Hazelwynde would then need to extend this three phase 22kV HV, via overhead or underground, to the initial stage of the development.
    - This works will be developer funded

- If Hazelwynde development progresses before Mandalay Estate connects to Camerons Lane then the only option is to extend the three phase 22kV HV powerline from the intersection of Malcom Street and Lithgow Street
    - North along Malcom Street
    - West along Camerons Lane

  To the initial stage of the development.
    - This can be completed via overhead or underground supply.
    - Cost vary on a number of factors yet to be decided, however, an overhead extension will be cheaper than an underground supply.
    - These external augmentation / extension works will be developer funded.

Internal Electrical Supply

- The development will fall under AusNet Services Pty Ltd Urban Residential Development requirements.
- The developer has a minimum requirement to provide 4KVA of electrical supply to each lot.
    - It is not unreasonable that 2,000kVA will be required for the town centre / mixed use precinct. This is a conservative estimation.
- On the basis of the proposed lots (7,500kVA) we expect the development to require approx. 32MVA of electrical supply.
    - This is a substantial load.
- Early discussions should be held with AusNet Services Pty Ltd to ensure that adequate supply is available in the existing network.
    - It is our expectation that this supply is readily available due to the AusNet Kalkallo Zone Substation recently constructed in Donnybrook Rd, Mickleham.
    - Provision for feeder cables driving north into the vicinity of Hazelwynde have already been planned for
- This, however, can only be confirmed during the overall master planning phase when discussions are held with AusNet Services Pty Ltd.
- AusNet Services Pty Ltd provide supply to residential developments on the basis of the following
    - 500kVA kiosk substations (with a reserve dimension of either 5.4m (width) x 8.0m (depth) or 5.8m (width) x 8.0m (depth) depending on the type of kiosk substation.
        - This reserve needs to be in favour of AusNet Services Pty Ltd and depicted on the Plan of Subdivision (POS).
        - On the basis of the electrical supply required we expect the development to ultimately require approximately sixty five (65) kiosk substations. Primary factors which determine the number of kiosk s/stns are load and voltage drop considerations.
        - A kiosk substation will be required within stage 1 of the development.
        - For planning purposes each kiosk substation can supply approximately 125 lots depending on factors above.
        - Consideration also needs to be given to the staging plan to ensure kiosk substations are adequately placed to ensure overloading does not occur. This is completed during the Electrical Overall Masterplan Design and should include liaison with the developer to ensure kiosk substation locations meet their requirements. It should also include liaison with AusNet Services Pty Ltd, so as to ensure that their needs are met for internal reticulation as well as for broader issues such as network capacity.

- 22kV HV underground cables "snake" through the development linking up all the kiosk substations.
    - Space / clearance considerations should be factored into the design phase for roads that contain 22kV HV underground cables. This will ensure clearances to other assets is maintained and will ensure the construction / PM2 process / Statement of Compliance (SOC) is not compromised.
- Each kiosk substation runs LV cables out in a "spider web" fashion.
- To ensure voltage drop considerations are maintained each LV cable should have a maximum length of approximately 400m supplying approximately 25 customers.
- LV cables are linked between kiosk substations via electrical parallel pillars
    - These are an above ground asset and ensure reliability of the network can be maintained during outages / maintenance.
- Each lot is supplied via an electrical service pit supplied via a service cable (off the main LV backbone)
    - Service pits are located in the road reserve and become the point of supply for the lot
- For efficiencies electrical pits are to be located on the boundary between two lots minimising the number of pits and reducing
    - Construction costs for the developer
    - Maintenance issues for AusNet Services Pty Ltd
- Public Lighting cables are run out of electrical pits to supply the required public lights.
- Generally speaking public lights will need to be spaced at approximately 55-60m intervals.
    - Public Lighting designs / types will also require approval from Mitchell Shire Council.

Other factors

- The developer will receive an AusNet Services Pty Ltd rebate once each stage has received Statement of Compliance (SOC). These are calculated at the offer stage and will be detailed in the AusNet Services Pty Ltd Electrical Supply Offer. On current processes
    - All 22kV HV works are fully re-imbursed
    - An LV rebate of approx. $ 100 / lot is a good guide
        - Please note these change on a yearly basis and may not be applicable when this development commences
- AusNet Services Pty Ltd issue the electrical offer after the design is approved. A generally guide to two weeks after the design is approved.
- There are two distinct phases required under AusNet Services Pty Ltd requirements
    1. An electrical overall masterplan will be required initially
        a. This will detail proposed kiosk substation / HV & LV cable routes
        b. Once approved this will allow AusNet Services Pty Ltd to certify Plan of Subdivisions for individual stages
    2. A detailed electrical design plan for each stage.
- Due to the large number of services and conduits required adequate space needs to be considered / allowed for in the road reserve to ensure relevant clearances between electrical assets and other authorities is maintained.
- AusNet Services Pty Ltd have become more stringent in allowing conduits to be staked. Their strong preference is for all electrical assets to be laid flat / side by side. Having a trench width of 500mm -1000mm for electrical assets alone is not uncommon. AusNet Services Pty Ltd will consider allowing electrical assets to be staked when it can be demonstrated that no other options exist. This is completed during the design phase.

Beveridge North West

Precinct Structure Plan

Submission Response

October 2019





mesh

Beveridge North West

Precinct Structure Plan

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Contents

Figures

Introduction

This submission has been prepared by Mesh Planning on behalf of Yarra Valley Water (YVW).

The submission addresses a number of issues and requested changes to the exhibited Precinct Structure Plan.

The submission is accompanied by a revised Future Urban Structure that incorporates each of the requested changes that have plan based implications. Other matters such as requested changes to the document have been separately identified for ease of reference.

The submission will firstly provide information regarding the significance of the site and its potential to deliver improved urban development outcomes, secondly the needs of large scale master planned communities; thirdly explanatory material to demonstrate the importance of the revisions that have been made to the former version of the future urban structure and finally requested changes to the exhibited document and plans.

In terms of general position, it is important to state that YVW are generally supportive of the exhibited document however it is submitted that the requested changes have the potential to improve the overall performance of the structure plan area and the ability of the YVW land to deliver improved outcomes.

Context

From the outset, it must be acknowledged that preparation of the Beveridge North West Precinct Structure Plan (BNWPSP) has been subject of on-going discussion over a period of time since the PSP was first subject of non-statutory exhibition by the previous Government in late 2014.

Where formulation of the Structure Plan that was subject of non-statutory exhibition was largely closed to landowners and their representatives, during the period that has followed YVW have had the opportunity to meet with the Victorian Planning Authority (VPA) and the Mitchell Shire Council (MSC) on a number of occasions to discuss potential opportunities and aspirations for the land.

Throughout the discussions with the VPA and the MSC 3 critical points have been raised:

Firstly, the scale of the landholding:

› The YVW land is a very rare opportunity – the landholding is comprised of 7 parcels and has a total area of approximately 743ha and is owned entirely by YVW.

Secondly, the highly variable topography across the land:

› The elevation and contour of the land varies considerably from a generally flat valley in the eastern part of the land through to a series of connected hilltops in the western part of the land (see further information following).

Thirdly:

› The desire of YVW to position the land such that it can demonstrate best practice once the land is developed for urban purposes.

The strategic significance of the land in this context cannot be over stated.

In growth area planning terms there is a definite nexus between the scale of the landholding, the motivation of the landowner and the maturity of the Planning Authority. Put simply, where there is a motivated landowner that has the desire and capacity to affect change and the scale of the landholding allows a long term view to be adopted and the Planning Authority has clarity in its objectives and is willing to 'put aside' the rule book then there is a real chance that change will occur.

The relevance of these strategic advantages to formulation of the BNWPSP is that there is an opportunity to be less spatially prescriptive (provided necessary land and infrastructure is ultimately accommodated within the land) and there is an opportunity for the developer to provide much of the needed infrastructure directly thereby simplifying and de-risking the implementation process.

Subject Land

The land is irregular in shape and is bound by Camerons Lane to the south, Old Sydney Road to the west and an unconstructed road reserve to the north.

A privately owned land parcel interrupts the Camerons Lane frontage and three privately owned land parcels are located in between the frontage of the YVW land to the Old Sydney Road *(see Figure 1)*.

The YVW land is currently zoned part Urban Growth Zone, part Rural Conservation Zone and part Urban Floodway Zone.

The land is also included (in part) within the Salinity Management Overlay, the Erosion Management Overlay and the Vegetation Protect Protection Overlay *(see Figures 2&3)*. The land is also partially located within an area of Aboriginal Cultural Heritage Significance.

Figure 1 - Land parcels (Source: Mesh)

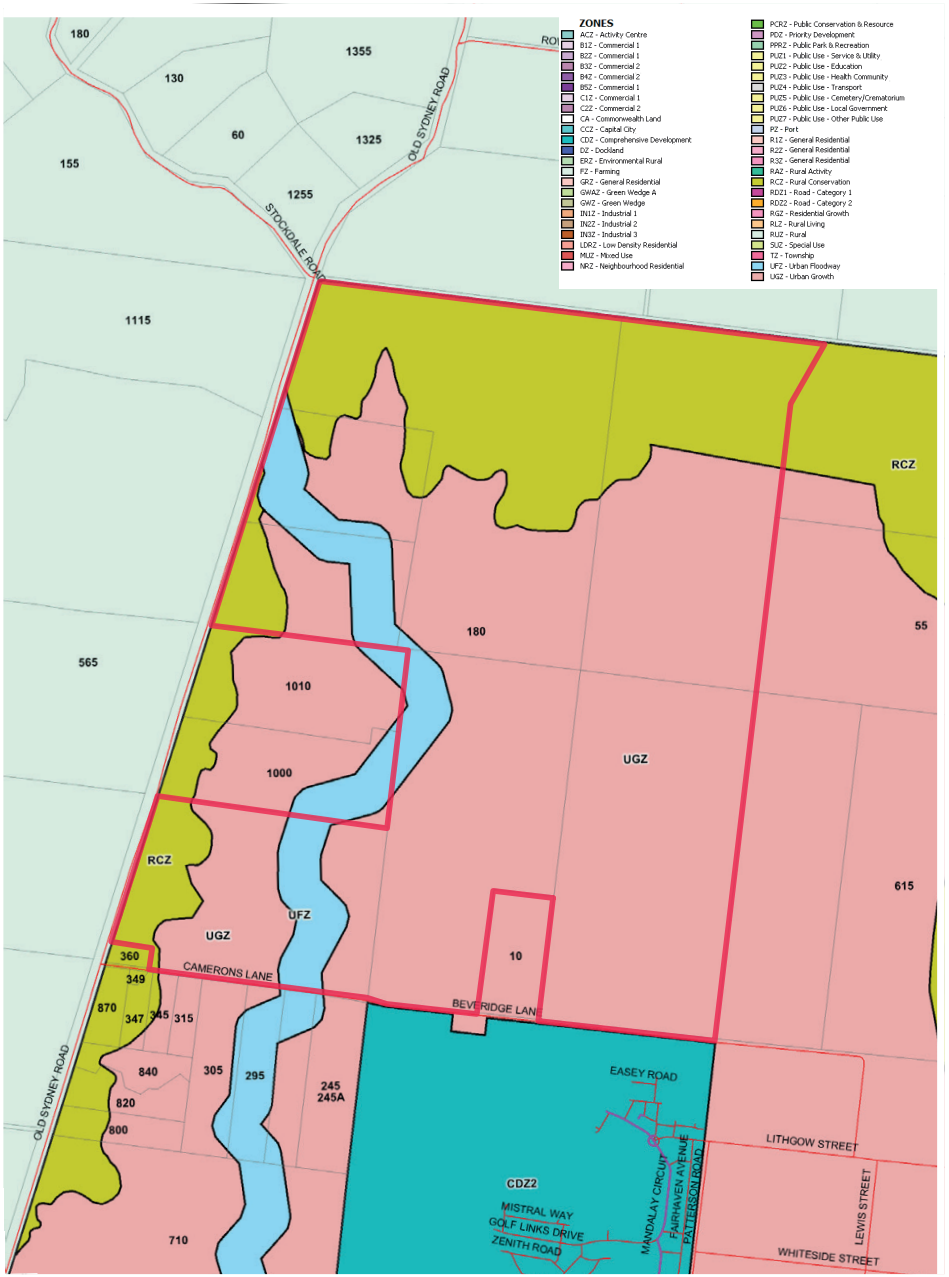


Figure 2 - Zoning Plan (Source: Mesh)

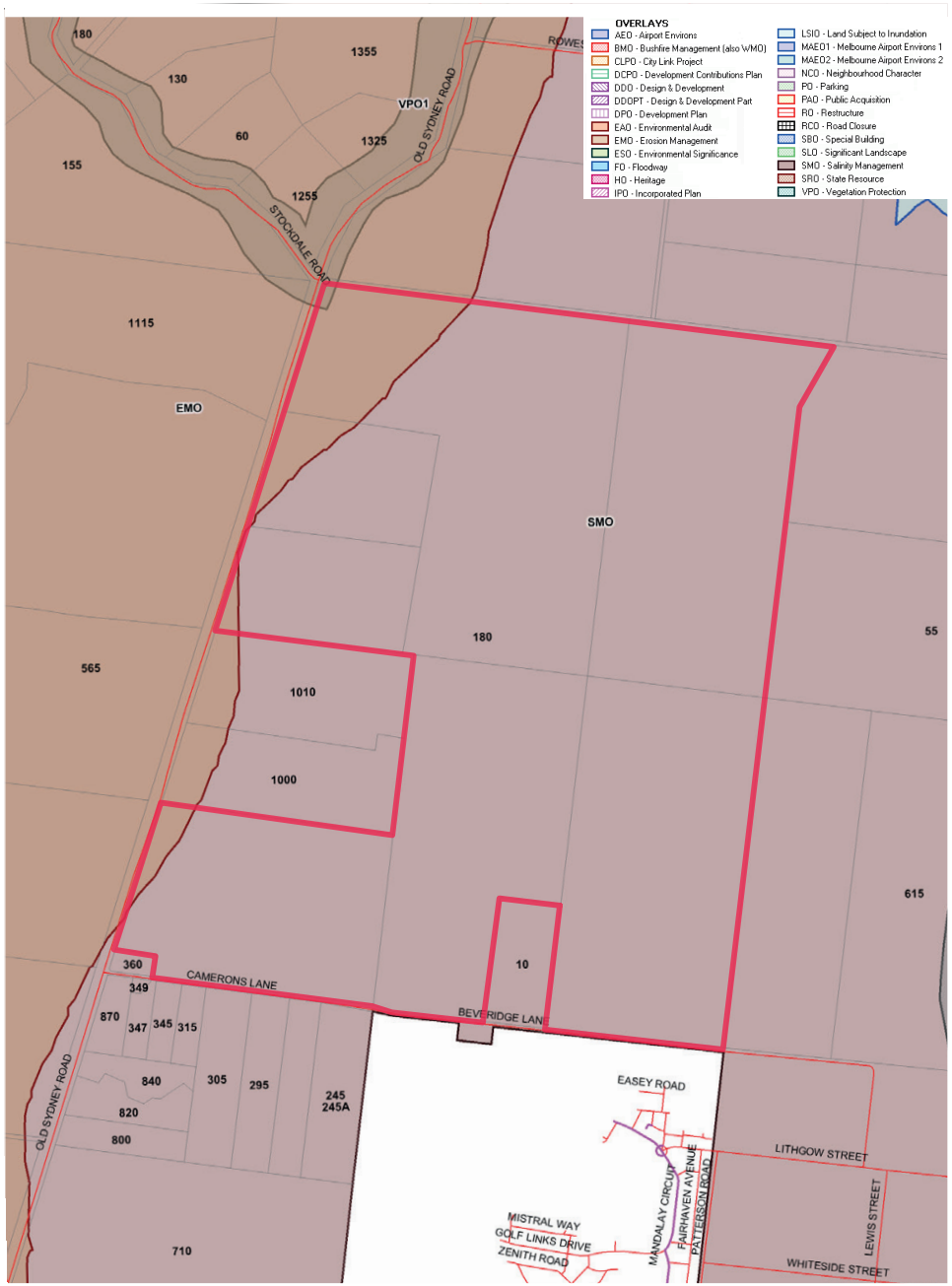


Figure 3 - Overlays Plan (Source: Mesh)

Subject Land

The land is currently being actively managed as a farm and is being partially used for spray irrigation of treated effluent from the Wallan Sewerage Treatment Plant. The site will be used for irrigation purposes until at least 2022.

The YVW is topographically diverse such that the central to eastern part of the land forms part of a broad valley which is relatively flat whereas the western part of the land is more undulating. Through the undulating part of the land there are a series of minor and more prominent high points. A waterway meanders through the western part of the land before the land rises up toward Old Sydney Road *(see Figure 4)*. The presence of the undulating landform, the watercourse and the flatter sections of the land will offer a interesting and diverse set of conditions for the master plan design response process.

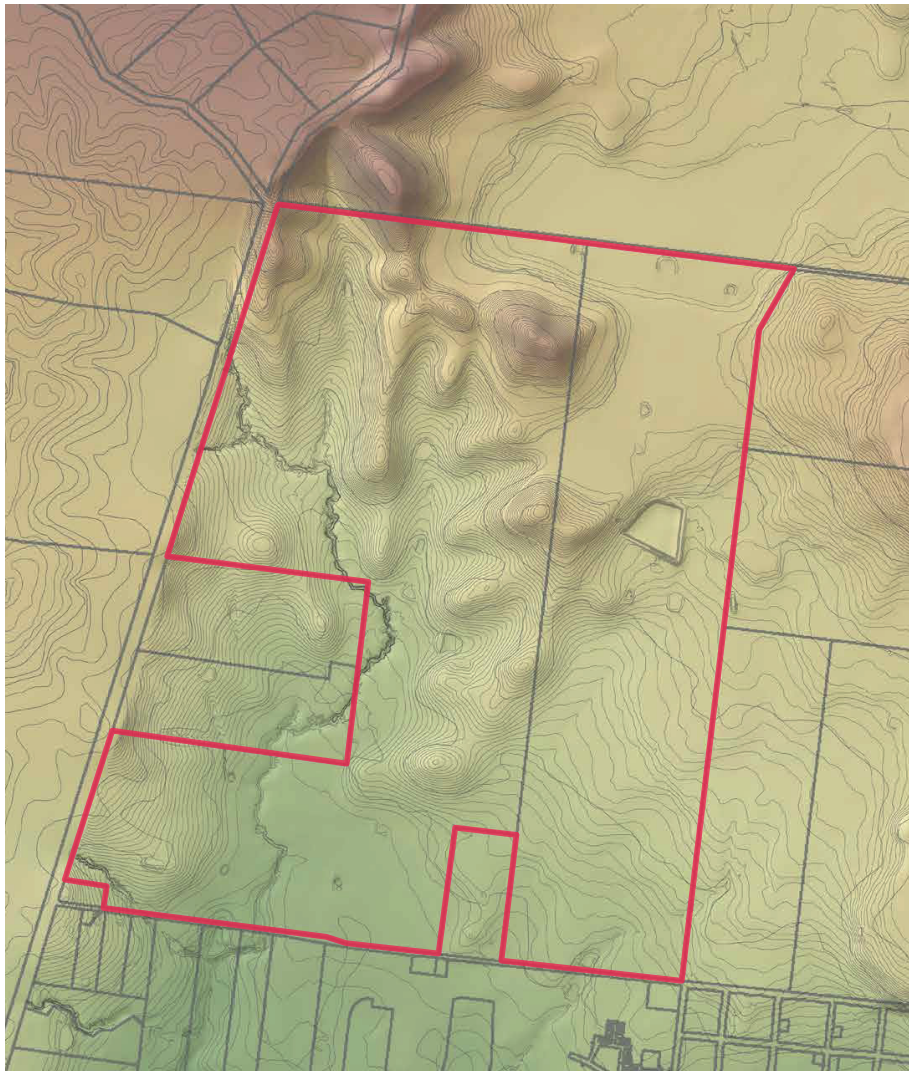


Figure 4 - Topography (Source: Mesh)

The YVW land is included within two broad drainage catchments *(see Figure 5)*.

Run off from urban development will be required to be detained and treated on site before being discharged into the waterways. Melbourne Water have confirmed that there is the ability to divert surface flows from one catchment to the other if there is a desire to detain water at a preferred location on Camerons Lane.

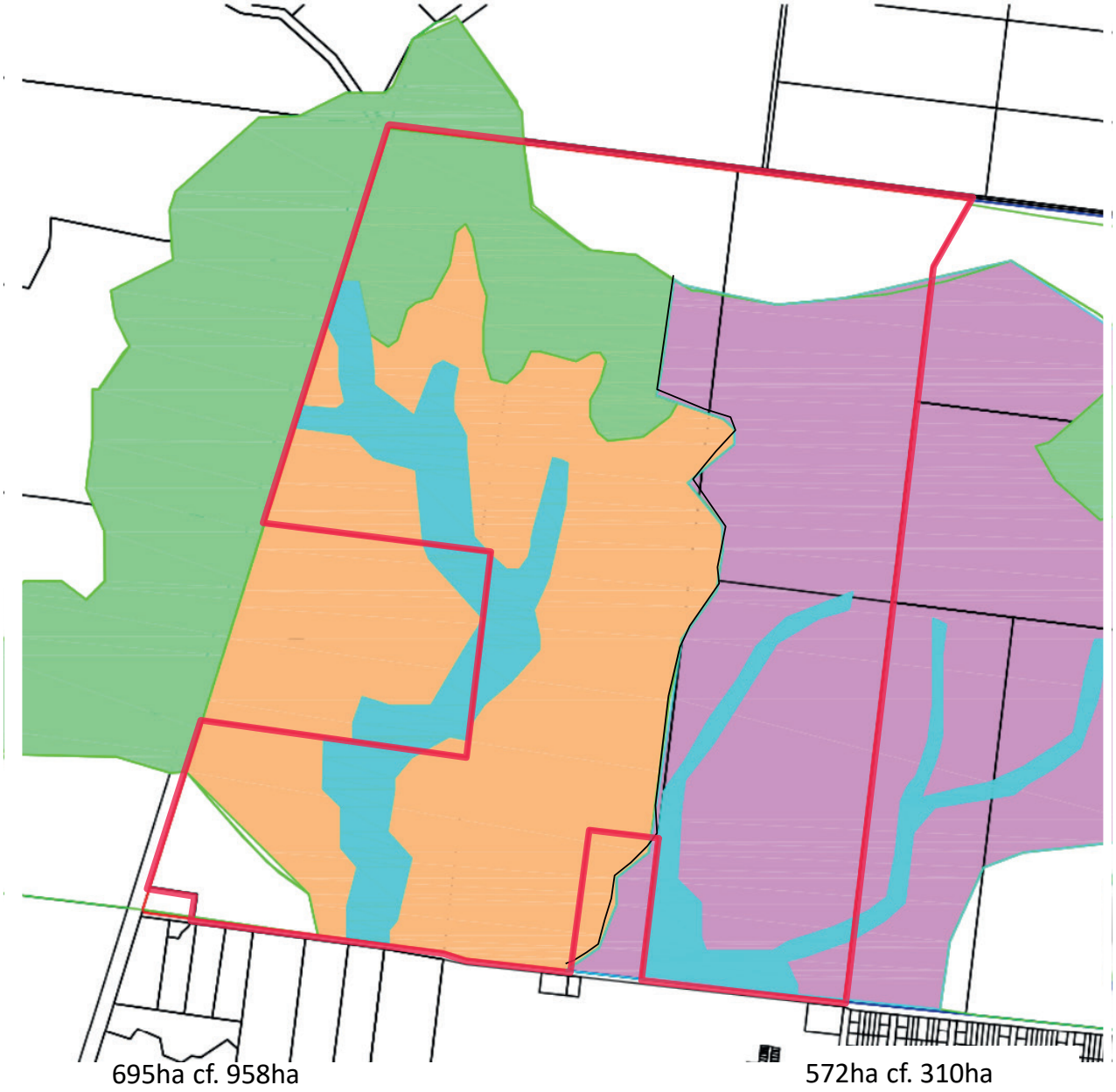


Figure 5 - Drainage Catchments (Source: Mesh)

Master Planned Communities

TYPICAL REQUIREMENTS AND DEVELOPMENT APPROACH TO DELIVERY OF MASTER PLANNED COMMUNITIES

Land holdings that have the potential to be planned and developed as master planned communities of 8-10,000 lots or 25-30,000 persons are very significant in a growth area planning context.

They are significant by virtue of their scale, development horizon, capacity to fund infrastructure (Local and State) and ability to support innovation and progress in the fields of urban development and sustainability over an extended time frame.

Central to the success of master planned communities are a set of pre-conditions that must be delivered including:

URBAN DESIGN AND SENSE OF PLACE – the master plan must embody the principles of good design and the design response must positively incorporate all of the site features and other initiatives that will collectively create identity and points of difference in the urban environment. Diversity in streetscapes and built form must also be actively encouraged to avoid sameness and repetition.

COMMUNITY – the master plan must incorporate a series of public places (including open space) and community facilities of various types. Importantly these facilities and places and other initiative to foster community development must be provided as soon as the earliest residents arrive. Higher order and local infrastructure can play a vital role in the viability and place value of town centres.

ENVIRONMENT – the master plan must incorporate a sensitive and responsible response to the site conditions and the use and conservation of natural resources. Planning for whole of water cycle management and integration with connected open space networks which also support pedestrian and bicycle access are essential. Community based energy schemes and other methods to reduce energy consumption and costs should also be investigated. Street trees and other plantings can have a significant impact on the heat island effect but only if sufficient space is made available.

EMPLOYMENT – the master plan must seek to maximize local employment generation through the designation of activity centres and other initiatives.

TRANSPORT AND ACCESS – the master plan must resolve internal and external access requirements for all modes of transport. A hierarchy of streets and roads must be defined to accommodate the various traffic requirements and the overall urban design of streets and roads must to be taken into account to balance the 'functionality' of streets with the need to achieve a positive sense of place.

HOUSING DIVERSITY – the master plan must establish the framework that can accommodate a diverse range of housing options to meet the needs of a diverse community.

MULTIPLE DEVELOPMENT FRONTS & RATE OF SALE – master planned communities require multiple development fronts that appeal to a range of housing markets and rates of sale that are sufficient to fund necessary infrastructure and to ensure that the project maintains its momentum.

CHANGE OVER TIME – master planned communities that are likely to be delivered over an extended time period need flexibility to be able to accommodate changing needs over time.

Beyond these physical conditions, master planned communities require a commitment to innovation and evolution over time.

This commitment to innovation and evolution over time must be shared by Government, other regulators and the developer/s throughout the life of the project. If a shared commitment can be reached which recognizes that the land is in single ownership, there is an opportunity to remove the need for prescription and detailed control in the applicable planning framework.

The ability of master planned communities to evolve and mature over time is a key strength that should not be underestimated.

Caroline Springs is an example in Melbourne's West where significant improvement in the fields of urban development and sustainability have been achieved over an extended time frame. Delivery of Caroline Springs is an example of a project which has redefined perceptions of the west and what can be achieved on a project of that scale.

The northern part of the northern growth corridor is fortunate to have two current broad scale projects (Merrifield and Cloverton).

The YVW land is the third project that will set new benchmarks and which will serve to lift the standard of development through Beveridge North West and up toward Wallan South. The relationship between Beveridge North West and Wallan South is particularly important in this context as it is likely that future residents in Wallan South will travel into Beveridge North West for access to service and facilities rather than relying solely on Wallan.

BNWPSP Previous Structure Plan

BEVERIDGE NORTH WEST PRECINCT STRUCTURE PLAN

A previous version of the BNWPSP was subject of non-statutory exhibition *(see Figure 6).*

In response to the identified deficiencies associated with the Draft Future Urban Structure an illustrative master plan was developed *(see Figures 7&8).*

The purpose of the illustrative master plan was to respond to the site conditions in a more positive way whilst also responding to the needs of a master planned community project.

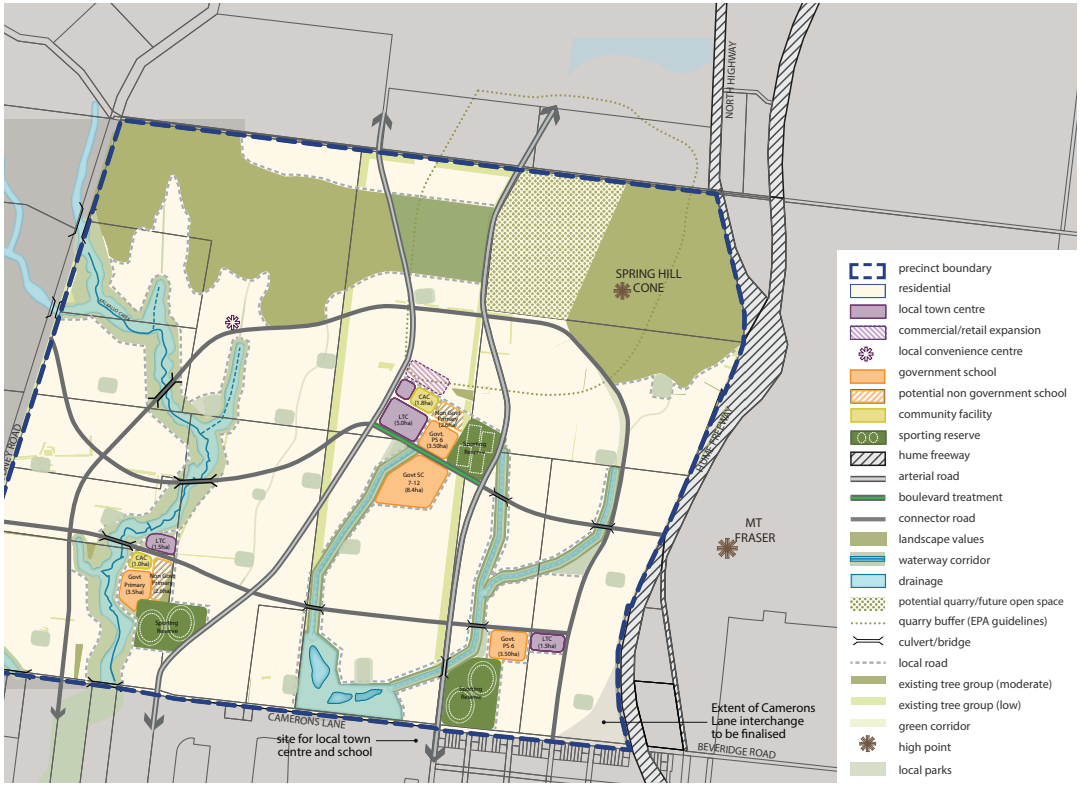


Figure 6 - Draft Beveridge North West Precinct Structure Plan (Source: Metropolitan Planning Authority)

IDENTIFIED DEFICIENCIES

Identified deficiencies associated with the previous draft structure plan included:

- Poorly positioned town centre/s
- Impact of twin north-south road alignments through the landholding with full access control
- Unresolved response to topography and lack of positive view lines
- Inappropriate number and location of crossings of the Kalkallo Creek and poorly aligned road alignments
- Poorly developed/disconnected linear links
- No sense of place
- Poorly resolved approach to high points
- Unresolved location and role of the inter-urban break

Figure 7 - Illustrative Master Plan Version without contours (Source: Mesh)

Figure 8 - Illustrative Master Plan with contours (Source: Mesh)

MAIN OPPORTUNITIES

The main opportunities and value of the illustrative master plan include:

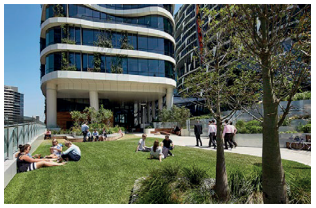
- High quality/water-based gateway for the project as anchor for the town centre and diverse housing outcomes;
- Well defined core/spine through the project that has the capacity to support a range of densities and land use outcomes with amenity benefit for the adjacent landholdings to the east to consolidate the walkable catchment to the town centre as rationale for realignment of the E14;
- Distributed community facilities;
- Multiple development fronts;
- Distributed approach to internal drainage lines with the potential to support permanent water presence;
- Distributed approach to transport network;
- Reduced impact of arterial roads;
- Well defined neighbourhoods;
- Clear rationale for realignment/re-definition of the east west non-urban break including relocation of the regional active POS;
- Ability to accommodate a range of densities and diverse housing outcomes over time;
- Attractive to a range of housing markets;
- Resolved alternative use for the quarry land;
- High value lot orientation;
- Positive view lines and sense of place;
- Connected and well distributed open space system;
- Potential for storm water re-use;
- Reduced heat island effect; and
- Connected active transport network.

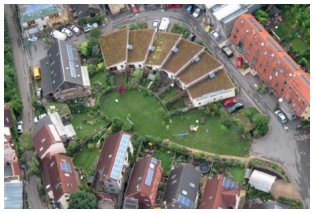
The components of the illustrative master plan are further explained with reference to the following layers *(see Figures 9-15)*.

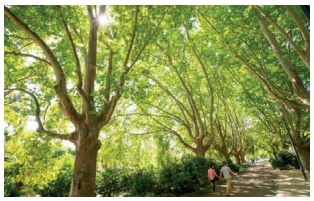
Water bodies

Water

Figure 9 - Master Plan Water (Source: Mesh)







Conservation reserve

Open Space

Open space

Figure 10 - Master Plan Open space (Source: Mesh)

Retail

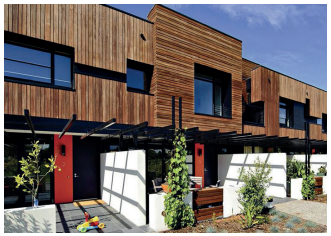
CAC

Built form

Catchments

Town/Village Centres

Figure 11 - Master Plan Town / Village Centres (Source: Mesh)



Medium Density Housing

Built form & density

Figure 12 - Master Plan Built Form and Density (Source: Mesh)

Retail

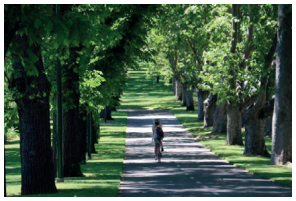
CAC

Built form

Educational

Community Facilities

Figure 13 - Master Plan Community Facilities (Source: Mesh)



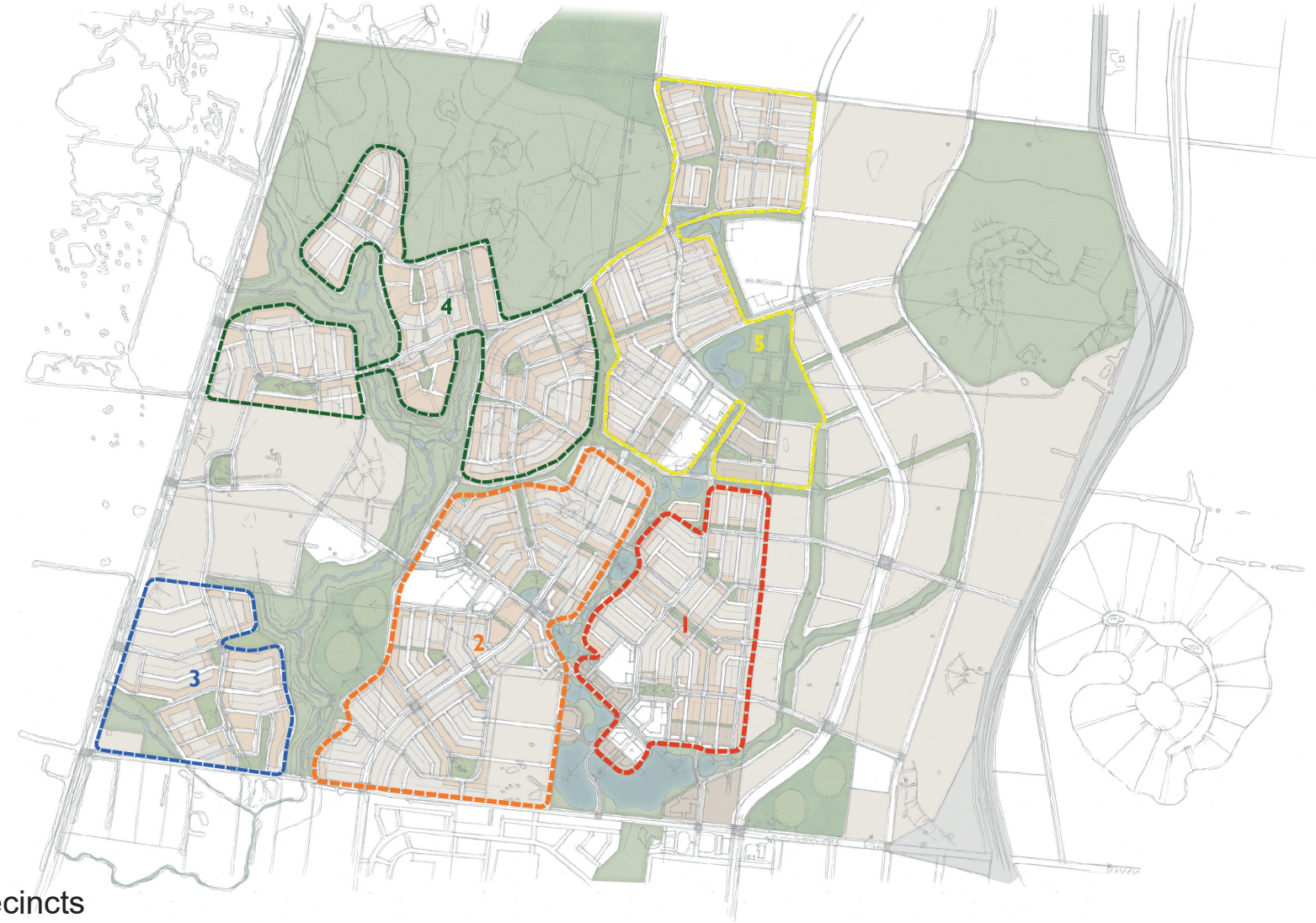
Primary Roads

Green link

Secondary Roads

Road hierarchy

Figure 14 - Master Plan Road Hierarchy (Source: Mesh)



Neighbourhoods/Precincts

Figure 15 - Master Plan Neighbourhoods / Precincts (Source: Mesh)

KEY FEATURES

Irrespective of the internal detail of the illustrative master plan, the key features of the plan that become evident in response to the site conditions are:

- The need to incorporate an offset grid road network to effectively transition from the steeper land to the flatter land;
- The need to carefully align the offset grid road network taking into account the topography and the various high points;
- The opportunity to distribute traffic along a number of north south links including Old Sydney Road;
- The opportunity to realign the extension of the E14 to the east to consolidate the town centre catchment and avoid a dead straight road alignment;
- The opportunity to create a linked open space network along the drainage lines that defines the town centre site and surrounds;
- The opportunity to collect and treat stormwater at a central point on Camerons Lane that can offer amenity and context for a town centre;
- The opportunity to design an accessible open space network along the valley floors with easier grades to support walking and cycling and to enable housing to over-look the open space;
- The opportunity to protect some of the high points with open space to offer a different experience;
- The opportunity to either downgrade one of the north south road links or realign one to intersection with the other before continuing to the north;
- The opportunity to review the boundary between development land and land that has landscape values;
- The opportunity to distribute density along the amenity spines including the drainage lines, open space and diverse streets;
- The opportunity to distribute lower order activity centres around the plan area with relatively direct connectivity to the larger central town centre;
- The need to incorporate high value local streets and waterways that can accommodate large street trees and distributed, irregular open spaces that can offset the housing; and
- The opportunity to create view lines to elevated land in the alignment of roads and open space.

Site Visit (Source: Mesh)

Exhibited Precinct Structure Plan

SIGNIFICANT IMPROVEMENTS

The exhibited BNWPSP future urban structure is a significant improvement over early versions and positively incorporates key elements of the illustrative master plan including:

- A large wetland/water treatment site on the north side of Camerons Lane;
- A town centre immediately adjoining the large wetland/water treatment site;
- A network of distributed but connected lower order town centres;
- Rationalisation of the boundary between land that has landscape significance and land that will be developed for urban purposes; and
- An offset grid of roads that have generally been aligned to respond to the topography (with some exceptions).

ISSUES TO ADDRESS

Notwithstanding these positive aspects of the exhibited plan, that are supported, there are a number of issues that need to be addressed that are set out following in relation to:

- Housing Density Requirements and Guidelines
- Sloping Land
- Landscape Values Land
- North-South Arterial Road and Internal Connector Road Alignments
- Open Space
- Town Centre Land Uses
- Potential Quarry
- Infrastructure Contributions Plan

HOUSING DENSITY REQUIREMENTS AND GUIDELINES

CONTEXT

The exhibited PSP includes required densities as set out below in Table 1.

Table 1 - Housing Density Guide

Residential Type	NDAR (HA)	DWELL / NDHA	DWELLINGS
Residential within walkable catchment (applied RGZ)	238.43	30.00	7,153
Standard residential outside walkable catchment (applied GRZ)	380.08	17.00	6,461
Residential outside walkable catchment Sensitive Interface Area A (applied GRZ)	13.00	9.50	124
Residential outside walkable catchment Sensitive Interface Area B (applied GRZ)	8.87	15.50	137
Residential outside walkable catchment Sensitive Interface Area C (applied GRZ)	130.67	9.00	1,176
Mixed use	27.98	30.00	840
Town Centre (applied CZ1)	15.81	25.00	395
Totals Residential Yield Against NDA	**814.85**	**20**	**16,286**
Anticipated population @ 2.8 persons per dwelling			45,601
Anticipated population @ 3.1 persons per dwelling			50,487

The required densities of 30 dwellings per NDHa and 17 dwellings per NDHa translate to an average lot size of 233m² and 411m² respectively.

On the YVW land, due the extensive area of land that is defined as falling within the walkable catchment of the town centre/s this translates to a required yield of 3497 dwellings at 30 dwellings per NDHa and 3571 dwellings at 17 dwellings per NDHa and a total yield of 8465 dwellings as set out in Table 2.

Table 2 - Housing Density Guide – YVW land only

Residential Type	NDAR (HA)	DWELL / NDHA	AV. LOT SIZE	DWELLINGS
Residential within walkable catchment	88.60	30.00	233M²	2658
Standard residential outside walkable catchment	210.08	17.00	422M²	3571
Residential outside walkable catchment Sensitive Interface Area A	7.30	9.50	736M²	69
Residential outside walkable catchment Sensitive Interface Area B	5.85	15.50	451M²	91
Residential outside walkable catchment Sensitive Interface Area C	106.94	9.00	777M²	962
Mixed use	27.98	30.00	233M²	839
Town Centre	11.00	25.00	280M²	275
TOTAL				**8465**

Table 3 - Density Calculation

Precinct	Area (ha)	Density (dph)	Yield (lots)*
A1	55.8	12	670
A2	10.8	17	184
B1**	24.7	17	420
B2**	68.8	15	1032
C1	21.1	25	528
C1 (Mixed use)	29.7	25	744
C2	17.1	17	290
D1**	43.2	12	518
D2**	39.6	17	672
E1**	51.6	10	516
E2**	25.3	12	304
F1	28.1	15	422
F2	4.9	10	49
G1	13.1	12	157
G2	4.7	10	47
TOTAL	**438.4**	**15**	**6551**

ISSUE

As described in part 1 of this submission, the YVW has some very complex landform conditions.

To better understand the impact of the landform on potential yield the YVW land has been broken down into a series of sub-precincts *(see Figure 16)*.

Depending on the severity of the slope a range of densities from 10 lots per ha through to 25 lots per ha have been applied – see Table 3.

Based on this analysis the YVW has the potential to support a yield of approximately 6,500 dwellings. This is approximately 1965 lots less than the yield that has been assumed within the exhibited PSP.

Delivery of the yield of approximately 6,500 dwellings will likely involve walkable mid-rise development within and surrounding the town centre in addition to distributed density along high amenity interfaces including waterways and open space links. Depending on the housing needs of households into the future, it is likely that the distributed density will take the form of terraces or town homes that is, separate small lot based dwellings. Whilst the eastern, flatter part of the land (as generally depicted by the extent of the walkable catchment) is likely to be easier to develop for small lot purposes and/or higher density development, other parts of the site in high amenity locations may also have the capacity to support delivery of smaller lots and increased densities of development.

Based on the findings of the site specific analysis there is concern that the yield that has been assumed in the exhibited PSP may be too high and there is general concern regarding the spatial direction that is contained within the PSP about where the densities must be achieved. A more flexible approach is preferred to delivery of an overall target density as opposed to prescribed spatial approach provided that an agreed overall density target is achieved.

It is also noted that the PSP requires a 10% affordable housing contribution. It is however unclear as to how a PSP can implement such a requirement in a greenfield setting. YVW request the opportunity to discuss this requirement in more detail.

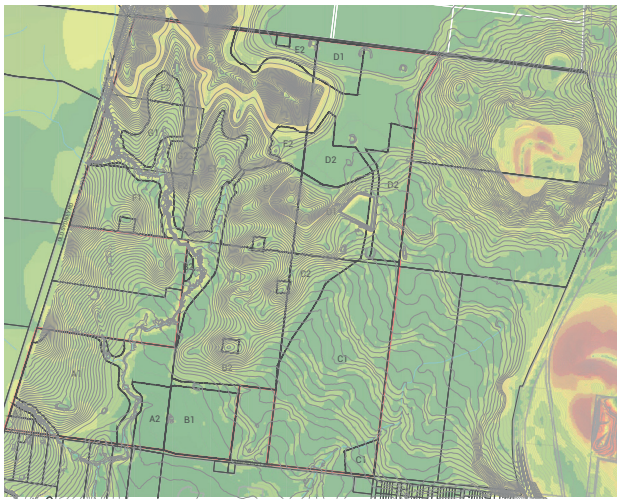


Figure 16- Yarra Valley Water Land Sub-Precincts (Source: Mesh)

REQUESTED CHANGES

It is requested that the exhibited Future Urban Structure (and the associated plans and/or the PSP) be amended to:

- Recognize that the land is in singular ownership and will be subject of a Memorandum of Understanding between the Mitchell Shire Council and the landowner;
- Retained an agreed reduced density target within the PSP;
- The walkable catchment boundary be either:
  - Removed ; or
  - Amend R3 and G15 to clarify that densities to achieve the overall yield target can be redistributed on the YVW land with the consent of the MSC.
- That the 10% affordable housing requirement be subject of further discussion.

SLOPING LAND

CONTEXT

The exhibited PSP recognizes that there are variable topographic conditions within the PSP area and specifically on the YVW land. Plan 6 depicts the slope characteristics and divides the PSP area into moderate slope (5-10%), steep slope (10-15%), very steep (15-20%) and extremely steep (greater than 20%).

In addition to identifying the location of the land that falls within each of these slope categories, the exhibited PSP also includes a requirement (R5) for subdivision and development applications for land on slope greater than 10% to respond to and address the dwelling construction methods as indicated by Figures 1, 2 & 3 and Table 5.

Table 5 specifies density requirements for three sensitive interface areas – sensitive interface areas A, B and C.

Site Visit (Source: Mesh)

ISSUE

As has been set out in this submission, it is acknowledged that the YVW land and other parts of the PSP contain variable topographic conditions.

The presence of these conditions is properly viewed as a key strategic advantage of the PSP area that has the capacity to support delivery of a development outcome that has a positive sense of place. Equally the presence of slope has the potential to support delivery of diverse housing outcomes that not only address the slope but also capture positive view lines. In the absence of design guidance to confirm the desire to use slope to generate a positive sense of place, implementation of the PSP will retreat to a conservative assessment of cut and fill as per Figures 1, 2 and 3 and implementation of the sensitive interface area outcomes set out in Table 2 of the PSP.

The Old Sydney Road interface is problematic in this regard. The exhibited PSP prescribes an average lot size of 736m² for this interface but Table 2 restricts the development outcome to a single dwelling with a minimum 10m setback to Old Sydney Road with a building height that should not exceed 1 storey above ground. Analysis of the topography on the east and west sides of Old Sydney Road *(see Figures 17)* reveals that the landform on the west side of Old Sydney Road rises sharply well above Old Sydney Road and any built form that will be delivered in the future. Taking into account the landform it is unlikely that there will be any visual impact associated with development on the east side of Old Sydney Road and there is no need to restrict development to one storey.

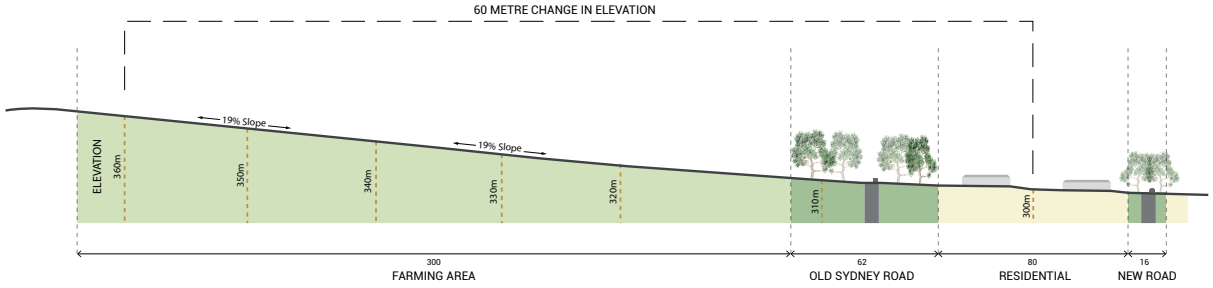


Figure 17 - Old Sydney Road Cross Section (Source: Mesh)

REQUESTED CHANGES

In order to promote positive responses to slope it is requested that:

- R5 be amended to read "Alternative responses utilizing suspended floors **or other solutions** instead of split levels will also be considered";
- Table 2 be amended to remove the restriction of a single dwelling on a lot **where a proposal for up to 2 dwellings demonstrates contemporary architectural design excellence**.
- Table 2 be amended to remove the reference to building height not exceeding 1 storey above ground.

LANDSCAPE VALUES LAND

CONTEXT

The exhibited PSP nominates a large area of land in the north west part of the YVW land as 'landscape values' land.

It is unclear how this land has been accounted for in Table 1 - Precinct Land Use Budget but it is assumed that it is recorded as **Open Space 'Other'**.

Whilst it is recognized that this land and other land to the east forms part of the non-urban break that was designed to separate the northern limit of the northern growth area from Wallan (a concept that has since lost some relevance) the exhibited PSP is silent with regard to the future ownership and maintenance of this land.

The hills as depicted as having landscape value are generally devoid of vegetation but are interesting in terms of landform. The landform in the north-west part of the YVW land is elevated and is comprised of a series of linked hilltops *(see Figure 18)*. The linked hilltops are quite flat at their peak and offer beautiful views up and down the valley from various vantage points.

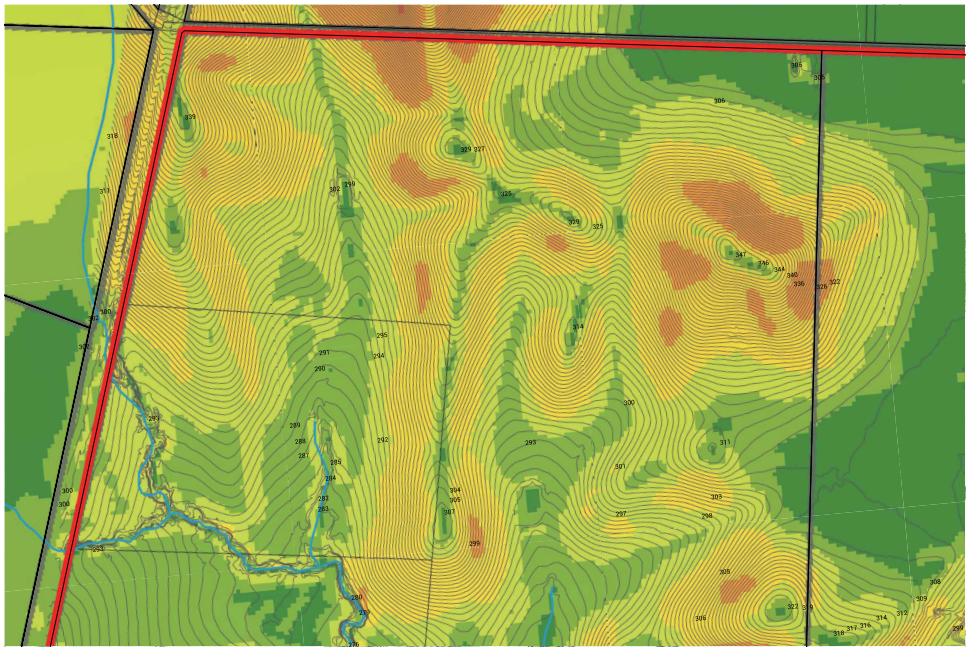


Figure 18 - Landscape Values Land Elevation and Slope (Source: Mesh)

(Source: Daily Telegraph)

(Source: ArchDaily)

ISSUE

If the intended outcome for this land is future ownership and maintenance of publicly accessible open space then YVW are supportive of this outcome (assuming that there would be an opportunity to contribute to the development of part of the land for open space purposes on a voluntary basis).

In the absence of a commitment to own and manage the land as publicly accessible open space there may be an outcome than would involve part of the land being in public ownership and part of the land being in private ownership.

Figure 19 - Old Sydney Road Topography (Source: Mesh)

A concept plan has been prepared *(see Figure 19)* which incorporates the following elements:

- A 'spine' road that links the hilltops including provision for private vehicle and walking/cycle access;
- A café/restaurant/small convention centre at a prominent high point;
- Nominated visitor points with associated open space; and
- Rural Living (5-8ha) size lots with nominated building envelopes.

The precinct could offer a visitor experience in addition to meeting a segment of the housing market that is not usually catered for in growth areas. To ensure that the dwellings are architecturally designed and contribute to the visitor experience, each of the dwellings would be required to be designed by an architect in accordance with some very specific design guidelines with review and approval by the developer.

Equally the café/restaurant/convention centre would have to be architecturally designed to ensure that it becomes a destination. The ratio of building envelope to open space would be very low and the orientation of the lots is such that they could be rear loaded, outward facing stepping down the slope in each direction as per the attached examples.

If the concept plan was of interest to Council a precinct specific infrastructure contribution could be nominated to ensure that the walking and cycle trails and visitor open spaces are embellished to an appropriate standard.

REQUESTED CHANGES

To retain the option of implementing the concept plan, or a variation thereof in consultation with the MSC and the VPA, it is requested that the PSP be amended to include a specific section in relation to the landscape values land on the YVW land to read as follows:

- The elevated land in the north western part of the YVW land has been identified as containing landscape values that are worthy of retention. This land will either be transferred into public ownership and maintained in perpetuity as publicly accessible open space or the land may be developed for a combination of public and private purposes.

If the land is developed for a combination of public and private purposes the land must contain:

- One or more publicly accessible open spaces located at key vantage points;
- A connected walking and cycle train system;
- A site for commercial activities that is located at an accessible key vantage point;
- A maximum number of 5-8ha rural living sized lots;
- Nominated building envelopes;
- Stringent design guidelines that require excellence in contemporary architecture and response to site conditions.

NORTH-SOUTH ARTERIAL ROAD AND INTERNAL CONNECTOR ROAD ALIGNMENTS

CONTEXT

The Northern Corridor Plan makes provision for two parallel arterial road links through the BNW PSP area *(see Figure 20)*.

One of the links is the extension of the E14 whilst the other is a parallel route that was included (it is assumed) to relieve pressure from the Northern Highway.

Through the process of working with the VPA and the MSC, the western route has been aligned to take into account the landform whilst still intersecting with Camerons Lane at the desired location.

The eastern route however adopts a very direct north-south alignment between Camerons Lane and Hadfield Road along the property boundary between the YVW land and the adjoining land to the east.

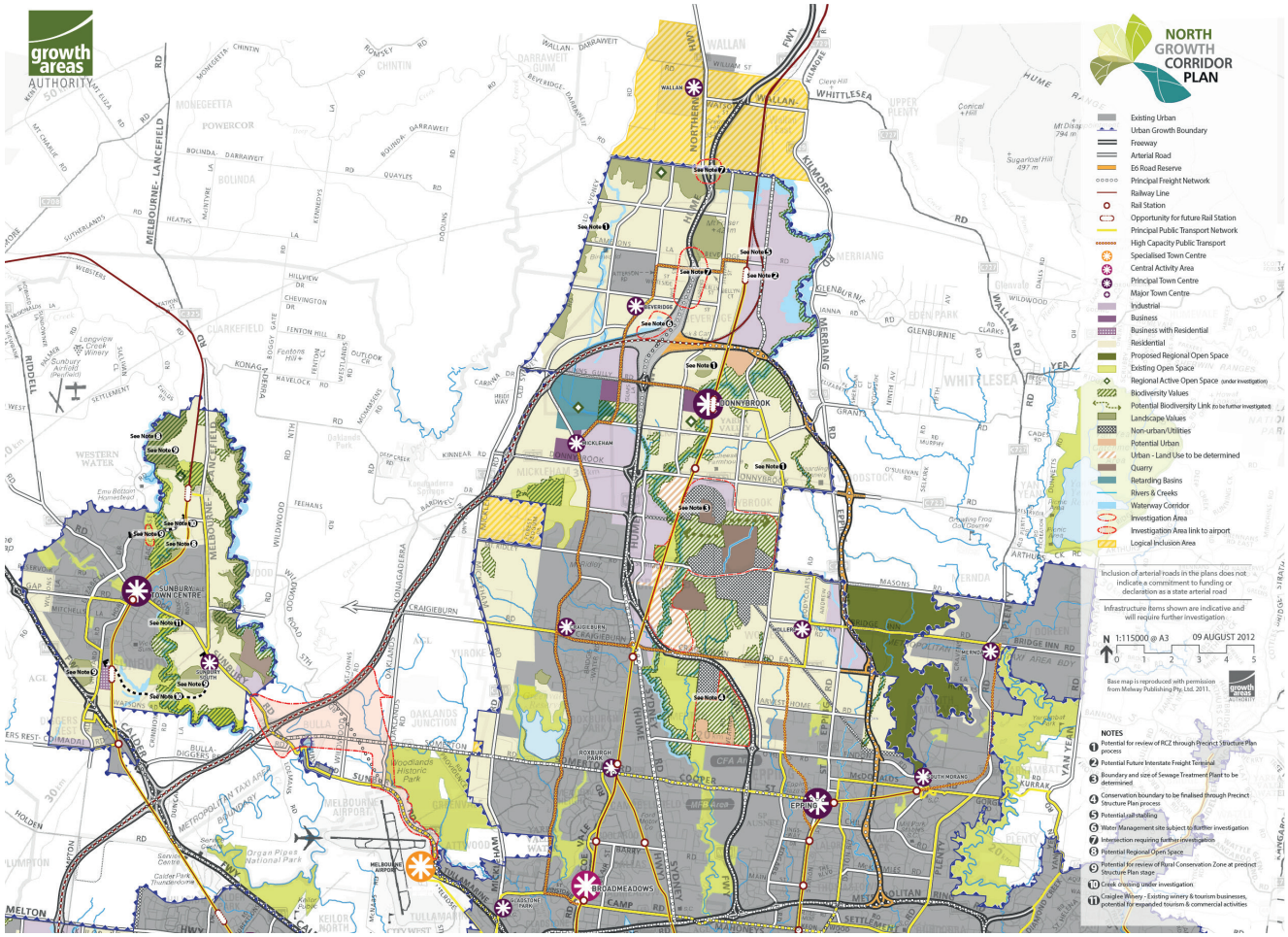


Figure 20 - North Growth Corridor Plan (Source: Growth Areas Authority)

Figure 21 - Continuous Green Loop source: Mesh

ISSUE

Where the western road has been aligned to take into account the topography, the eastern route adopts a dead straight alignment between Camerons Lane and Hadfield Road.

When viewing the PSP Future Urban Structure this alignment appears imposed and severs the eastern side of the walkable catchment of the southern town centre. Setting aside landownership boundaries, there is a significant opportunity to link the drainage lines to the west and east of the proposed town centre to create a continuous green link that will also convey water *(see Figure 21)*. The value of this continuous green link will be diminished if it is severed by a 28-31m road with access control on both sides. The place making potential of the continuous green loop is significant particularly if it is activated by diverse housing forms and other uses noting that the western section of the loop adjoins the town centre. The PSP transport network could be improved by realigning the western arterial road to the west enabling the walkable catchment of the town centre to be consolidated and avoiding the need to severe the green link *(see Figure 22)*.

In terms of impact on the adjoining landholdings it is noted that the road will be a funded ICP road and that the same number of crossings of the connector streets and drainage lines/open space links would be required if the road were to be realigned. In addition, having regard to the projected traffic volumes which are only reaching connector street volumes to the north of the southern town centre, there may be an opportunity to downgrade one or other or both of the north links or realign one to intersect with the other toward the northern end of the PSP area.

In order to maximise the value of the internal loop of open space, it is preferred to align quiet, lower order streets rather than connector streets adjacent to the open space. The exhibited version of the PSP incorporates a connector road alignment immediately adjacent the western part of the green loop where it adjoins the southern town centre and extending up to the northern town centre.

The exhibited alignment is problematic as it follows a property boundary as it approaches Camerons Lane and as it continues further to the north running parallel to the drainage line/open space link the connector road cross section of 28-31m will separate people from the amenity and it is likely that higher vehicle speeds will result. In order to overcome these issues and to provide a second gateway opportunity for the YVW land, the connector street could be realigned to the west as is generally depicted in Figure 22.

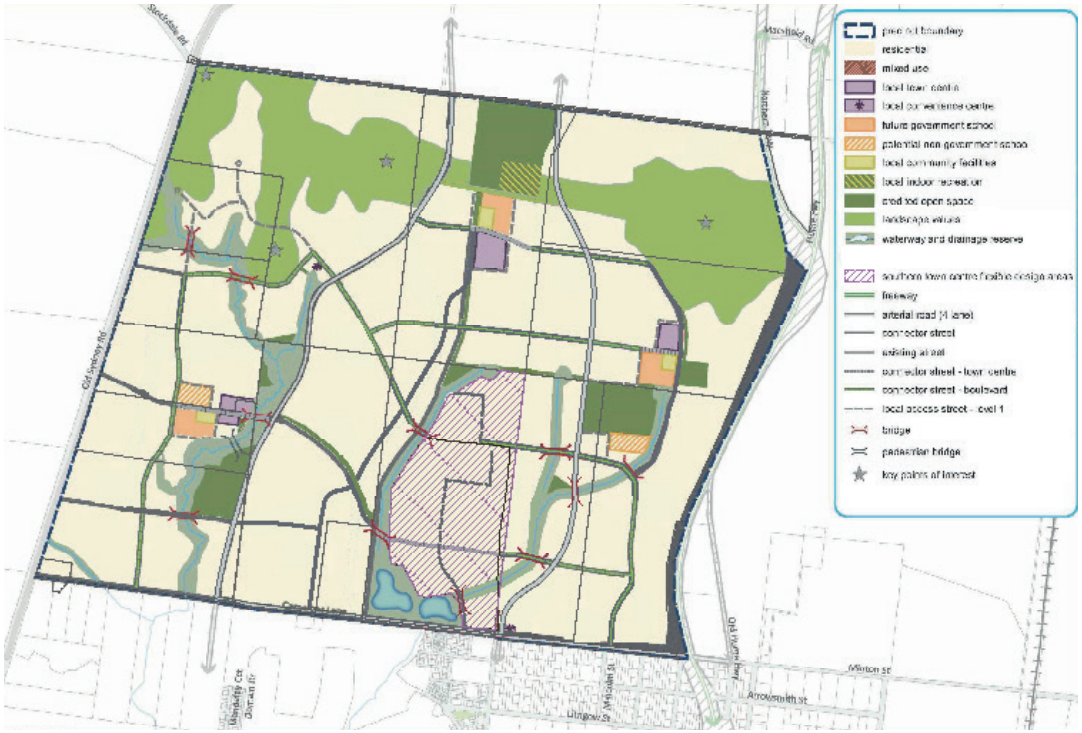


Figure 22 - Alternative Future Urban Structure (Source: Mesh)

REQUESTED CHANGES

It is requested that the exhibited Future Urban Structure (and the associated plans) be amended to:

- Realign the western arterial road in order consolidate the walkable catchment of the town centre and consolidate the value of the green line without the need for it to be crossed by an arterial road;
- Consider the opportunity to downgrade the northern part of the western arterial road and/or the eastern arterial road to connector streets; and
- Realign the western north-south connector within the YVW land such that it does not adjoin the drainage line/ open space link with a new intersection on Camerons Lane *(see Figure 22)*.

mesh

OPEN SPACE

CONTEXT

The exhibited PSP includes a land budget that nominates the precise area of each of the active and passive open spaces that are located throughout the PSP area including the YVW land – see Plan 7 and Table 10.

In recognition of the ownership status and scale of the YVW land, the PSP includes positive recognition within G28 that alternative locations and configurations may be entertained subject to some preconditions.

Figure 23 - Extract from Illustrative Master Plan (Source: Mesh)

ISSUE

Taking into account the topography of the land and the distributed density as represented in the illustrative master plan, it is likely that passive open spaces in particular will need to be irregular in shape and preferably located as part of a connected open space network rather than a number of relatively similar sized passive open spaces.

If designed as part of a linked system of passive open spaces in a combination of valleys and high points the value of the open space will be extended to activate delivery of diverse housing outcomes and the presence of the open space will promote improved health and well being by supporting walking and cycling.

Delivery of a connected open space network will also play a vital role in interrupting the predictable, standards based outcomes that lack often lack personality *(see Figure 23)*.

The explicit flexibility described above is welcome however it would be preferable on the YVW land to nominate the total **area** of the creditable open space (particularly the passive open space) that must be provided with no locations shown on the Future Urban Structure along with recognition that more open space may be provided with the agreement of the MSC.

To ensure adequate open space is provided it is noted that provision of the requisite amount of open space could be progressively managed as each of the individual titles are developed in consultation with the MSC.

REQUESTED CHANGES

It is requested that the exhibited Future Urban Structure (and the associated plans and/or the PSP) be amended to:

- Delete Table 10 and the indicative locations of the creditable open space (particularly the passive open space);
- Replace Table 10 with a Table which specifies only the **total area** of each of the types of creditable open space that must be provided;
- Include positive recognition that successful delivery of increased development densities will require a range of open spaces to be provided and that the preference is to deliver a network of linked open space of varying sizes, shapes and functions;
- Include a notation on each of the active open space concept plans that the layouts are indicative only and may be changed with the agreement of the MSC; and
- Include recognition that additional open space may be provided if supported by the MSC.

TOWN CENTRE LAND USES

CONTEXT

The southern town centre occupies a strategic location adjacent to a large wetland (approximately 20ha in area) that will require careful design to ensure that the town centre is placed based and acts as an attractor for a range of purposes.

Due to the changing nature of retailing and the location of the town centre relative to the other planned town centres, it is likely that community facilities will become important attractors and generators of activity.

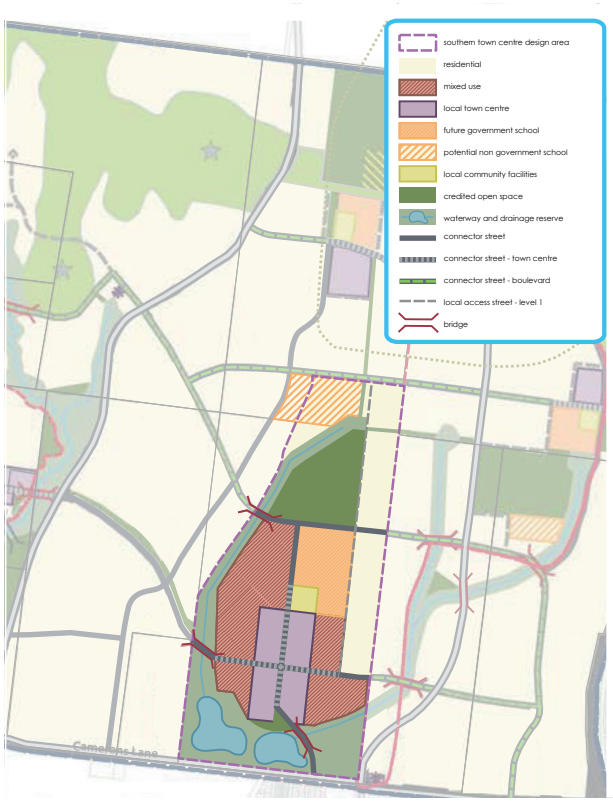


Figure 24 - Activity Centre Diagram Option 1 (Source: Mesh)

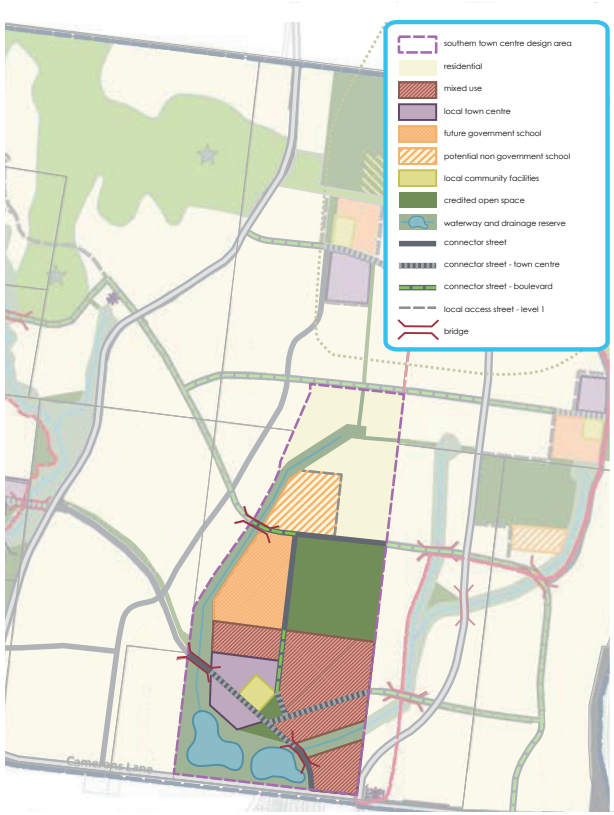


Figure 25 - Activity Centre Diagram Option 2 (Source: Mesh)

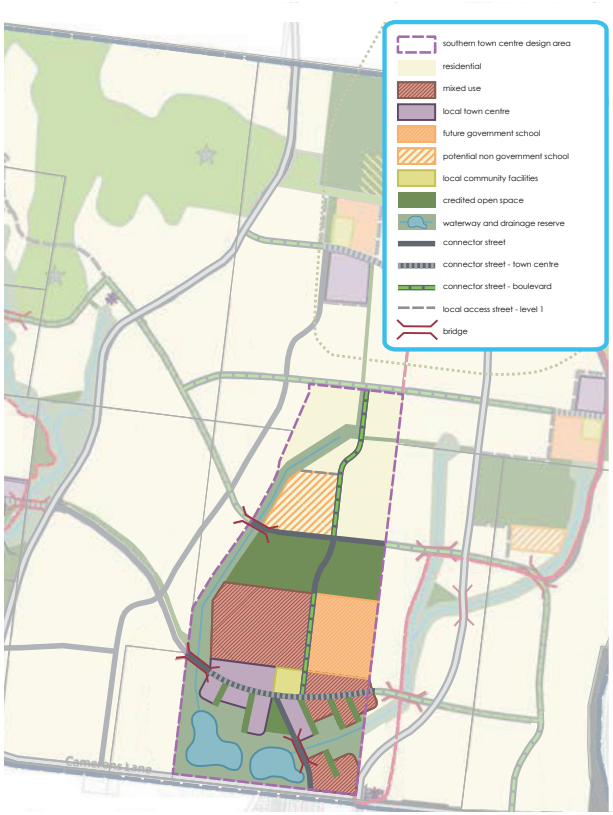


Figure 26 - Activity Centre Diagram Option 3 (Source: Mesh)

ISSUE

In order to be most effective and to ensure that the town centre is presented as a mixed use environment it will be essential for the town centre to have an urban character and quality.

Design of the town centre will take considerable time and effort including involvement with the various authorities including in partnership with the MSC. The exhibited PSP does not include a concept plan for the southern town centre but a number of specific uses are nominated that must be incorporated within the town centre. This approach has been adopted partially in response to the request for flexibility however the absence of a defined requirement for preparation of an Urban Design Framework or similar (such as a Development Plan) may not satisfy the MSC notwithstanding that it is intended that a Memorandum of Understanding will be entered into between YVW and the MSC.

In terms of the uses that are required to be delivered in the town centre it is significant that the wetland will become part of the gateway to the project but that the town centre uses will be on the north side of the wetland and as such will face south. It will be important to maximise the value of the maximum of 20% of open water that Melbourne Water will support. Three concept plans have been developed *(see Figures 24, 25 and 26)* to demonstrate the extent to which different design responses could be prepared to accommodate the various uses. It is noted in this context that a significant part of the town centre is nominated for mixed use purposes clarification is required regarding the built form and other requirements within the mixed use area.

Taking into account the time that will be required to design the town centre the preferred approach is to retain the table of required uses (but with the acknowledgement that reduced land areas may be delivered with the agreement of the relevant authorities) but delete the individual land uses from the Future Urban Structure Plan. The preferred option is accompanied by a willingness for the PSP to require an Urban Design Framework or similar master plan (such as a Development Plan) to be prepared for the town centre area *(see Figure 27)*.

The concept plans for the other town centres are acceptable at this stage but all of the concept plans should include a note that the concept plans are indicative only and that alternative design responses may be submitted with the consent of the MSC.

Figure 27 - Town Centre UDF or Development Plan area (Source: Mesh)

REQUESTED CHANGES

It is requested that the exhibited Future Urban Structure (and the associated plans and/or the PSP) be amended to:

- Delete the specific land uses from the southern town centre;
- Include a requirement for preparation of an Urban Design Framework for the southern town centre;
- Retain the table of required uses but include a specific acknowledgment that reduced land areas may be delivered with the agreement of the relevant authorities;
- Include a note on each of the town centre concept plans to the effect that the concept plans are indicative only and that alternative design responses may be submitted with the consent of the MSC.

PROPOSED QUARRY

CONTEXT

The exhibited version of the PSP notes on Plan 2 – Precinct Features a 'proposed quarry' – WA1473.

It is unclear from the exhibited material what the status of the proposed quarry is however it is important to note that the land that is subject of the proposal is nominated on the North Corridor Plan as part of the non-urban break between Beveridge and Wallan.

Whilst it is acknowledged that the concept of the non-urban break may have lost some of its relevance as a genuine 'non urban break' following inclusion of Wallan within the Urban Growth Boundary (UGB), the reason for identification of the land as a potential non-urban break was in relation to its elevation and landscape significance in the region.

The landscape significance of the subject land and the remainder of the Spring Hill cone is similarly identified in the exhibited PSP as being of landscape significance.

ISSUE

A proposed quarry, which must be assumed to have a long-term life, is in conflict with the landscape values as the extraction process will significantly alter the profile of the north-western side of the Spring Hill cone.

The proposed quarry is also considered to be incompatible with planned urban expansion between Beveridge North West and Wallan. A quarry in the location as proposed is considered to be incompatible with the uses as planned in the North Corridor Plan (as amended to include Wallan) due to:

- Direct impact of quarry buffers;
- Potential amenity impacts;
- Potential traffic impacts;
- Potential staging impacts; and
- Potential perception impacts.

Specifically with regard to the direct impacts of the quarry buffers, if a 500m buffer is assumed as per the previous proposal *(see Figure 28)*, a total area of 59.08ha of the YVW land is impacted.

This is comprised of:

- Credited Open Space – 17.19ha
- Local indoor recreation – 4.92ha
- Future Government School – 3.18ha
- Local Community Facility – 1.13ha
- Local Town Centre – 3.79ha
- Landscape Values – 2.37ha
- Residential land (30/dwell/ha) – 26.5ha (including roads)

In addition to the quarry buffer impact on the YVW land, the buffer would also impact approximately 36.9ha of the area of the adjoining landholding to the south of the proposed quarry, approximately two thirds of which is developable. Aside from rendering the land within the quarry buffer undevelopable for an indefinite period of time, it is also important to note that quarry traffic and the presence of the quarry could restrict or remove the potential to establish a northern development front on the YVW land. The potential to establish a northern development front is particularly important given the scale of the project and the potential to access sewer infrastructure on the northern boundary of the land.

Other amenity based impacts would need to be carefully considered however the potential perception impacts of living nearby to an active quarry that involves blasting and other activities should not be underestimated particularly within or adjacent to a master planned community.

Returning to the impact of the potential quarry on staging and the possibility of a northern growth front, it is noted that the non-residential land uses, including the active open space and the northern town centre would not be able to be delivered for an indefinite period of time.

REQUESTED CHANGE

It is requested that the exhibited Future Urban Structure (and the associated plans and/or the PSP) be amended to:

- Delete reference to the proposed quarry.

Figure 28 - Quarry Buffer Impact (Source: VPA)

INFRASTRUCTURE CONTRIBUTIONS PLAN

CONTEXT

Preparation of an Infrastructure Contributions Plan (ICP) is an essential part of the process of reserving and developing land for urban purposes in growth areas.

The ICP will ensure that the costs of necessary infrastructure are shared equitably. As per recent practice, the BNWPSP has been exhibited without an accompanying ICP.

To ensure there is transparency in the selection of the projects and whether there is need for a Supplementary Levy/s it would be preferable to accompany the PSP with a draft version of the ICP.

ISSUE

In addition to general transparency, early access to the ICP will allow projects to be checked etc.

In this instance due to the scale of the YVW landholdings there is the added advantage of being able to divide the ICP projects into two discreet lists – firstly infrastructure that can be funded and delivered on the YVW land (up to or equal with the ICP liability) and secondly infrastructure that can be funded and delivered on the remaining privately owned land.

By 'tagging' infrastructure projects to land in this way implementation of the ICP will be significantly simplified and de-risked.

If the projects cannot be neatly divided into two lists that align directly with the liability for each group of landholdings then any residual project/s can be divided by share of useage.

In lieu of access to a draft of the ICP, the projects in Precinct Infrastructure Plan (PIP) have been reviewed. The PIP provides little information with regard to a critical piece of infrastructure being the Camerons Lane interchange. It is not suggested that the interchange be funded via the ICP however delivery of the infrastructure is critical to enable the BNWPSP and other adjoining PSPs to be delivered.

Site Visit (Source: Mesh)

REQUESTED CHANGES

It is requested that the exhibited Future Urban Structure (and the associated plans and/or the PSP) be amended to:

- Recognize the opportunity to divide projects between the YVW land and the remaining privately owned land to simplify and de-risk implementation of the ICP.

ROAD CROSS SECTIONS

CONTEXT

The exhibited PSP includes a guideline (G56) which encourages implementation of a variety of cross sections.

ISSUE

A consistent criticism in growth areas is the sameness of street composition and the lack of street tree and other plantings.

The lack of diversity of streets is in direct contrast to older parts of Melbourne that display many examples of diverse streets. The diverse streets in the older parts of Melbourne are valued to the extent that they offset increased densities and balance the transport functionality of streets with the broader role of streets as public places – see examples of diverse streets.

Notwithstanding the general encouragement within the PSP to encourage delivery of a variety of cross sections, the PSP fails to adequately emphasise the relative importance of delivery of a range of cross sections in responding to site conditions and in creating a positive sense of place. In this context the PSP also defaults to the primary requirements being traffic with little to no recognition of the importance of diverse streets from a place making point of view.

The suite of cross sections within the PSP should be viewed as indicative only and it is noted that the standard local access street level 2 occupies a width of 20.0m has considerable potential for redesign to achieve a more balanced approach between functionality and place making.

REQUESTED CHANGES

It is requested that the exhibited Future Urban Structure (and the associated plans and/or the PSP) be amended to:

- Strengthen recognition of the relative importance of and need for delivery of a diverse range of streets as a requirement but with flexibility to design the streets at detailed design;
- Recognize the relative importance of diverse streets in off setting increased densities;
- Recognise the specific need for diverse, more urban streets within the town centre and immediate surrounds; and
- Include a notation on the typical cross sections that variations may be proposed subject to agreement by the responsible authority.

(Fitzroy, City of Yarra Source: Google Images)

(Source of above images: Google Maps)

(Source: City of Melbourne)

(Source: City of Port Phillip)

SUMMARY OF REQUESTED CHANGES

Thank you for the opportunity to comment on the exhibited BNWPSP.

This submission should be read in conjunction with other parts of the YVW submission. For ease of reference a summary of the requested changes in set out below.

It is requested that the exhibited Future Urban Structure (and the associated plans and/or the PSP) be amended to:

- Recognize that the land is in singular ownership and will be subject of a Memorandum of Understanding between the Mitchell Shire Council and the landowner;
- Retained an agreed reduced density target within the PSP;
- The walkable catchment boundary be either:
  - Removed ; or
  - Amend R3 and G15 to clarify that densities to achieve the overall yield target can be redistributed on the YVW land with the consent of the MSC;
- That the 10% affordable housing requirement be subject of further discussion;
- R5 be amended to read "Alternative responses utilizing suspended floors **or other solutions** instead of split levels will also be considered";
- Table 2 be amended to remove the restriction of a single dwelling on a lot **where a proposal for up to 2 dwellings demonstrates contemporary architectural design excellence**; and
- Table 2 be amended to remove the reference to building height not exceeding 1 storey above ground.

To retain the option of implementing the concept plan, or a variation thereof in consultation with the MSC and the VPA, it is requested that the PSP be amended to include a specific section in relation to the landscape values land on the YVW land to read as follows:

The elevated land in the north western part of the YVW land has been identified as containing landscape values that are worthy of retention. This land will either be transferred into public ownership and maintained in perpetuity as publicly accessible open space or the land may be developed for a combination of public and private purposes.

If the land is developed for a combination of public and private purposes the land must contain:

- *One or more publicly accessible open spaces located at key vantage points;*
- *A connected walking and cycle train system;*
- *A site for commercial activities that is located at an accessible key vantage point;*
- *A maximum number of 5-8ha rural living sized lots; and*
- *Nominated building envelopes;*

Stringent design guidelines that require excellence in contemporary architecture and response to site conditions.

- Realign the western arterial road in order consolidate the walkable catchment of the town centre and consolidate the value of the green line without the need for it to be crossed by an arterial road;
- Consider the opportunity to downgrade the northern part of the western arterial road and/or the eastern arterial road to connector streets;
- Realign the western north-south connector within the YVW land such that it does not adjoin the drainage line/open space link with a new intersection on Camerons Lane;
- Delete Table 10 and the indicative locations of the creditable open space (particularly the passive open space);
- Replace Table 10 with a Table which specifies only the **total area** of each of the types of creditable open space that must be provided;
- Include positive recognition that successful delivery of increased development densities will require a range of open spaces to be provided and that the preference is to deliver a network of linked open space of varying sizes, shapes and functions;
- Include a notation on each of the active open space concept plans that the layouts are indicative only and may be changed with the agreement of the MSC; and
- Include recognition that additional open space may be provided if supported by the MSC.
- Delete the specific land uses from the southern town centre;
- Include a requirement for preparation of an Urban Design Framework for the southern town centre;
- Retain the table of required uses but include a specific acknowledgement that reduced land areas may be delivered with the agreement of the relevant authorities; and
- Include a note on each of the town centre concept plans to the effect that the concept plans are indicative only and that alternative design responses may be submitted with the consent of the MSC.
- Delete reference to the proposed quarry; and
- Include explanatory text in opposition to the proposed quarry taking into account its impact on privately owned land and conflict with the urban growth objectives in the North Corridor plan and the BNWPSP.
- Recognize the opportunity to divide projects between the YVW land and the remaining privately owned land to simplify and de-risk implementation of the ICP;
- Strengthen recognition of the relative importance of and need for delivery of a diverse range of streets as a requirement but with flexibility to design the streets at detailed design;
- Recognize the relative importance of diverse streets in off setting increased densities;
- Recognise the specific need for diverse, more urban streets within the town centre and immediate surrounds; and
- Include a notation on the typical cross sections that variations may be proposed subject to agreement by the responsible authority.

YVW and Mesh welcome any opportunity to meet with the VPA and Council to discuss the requested changes particularly those relating to structural changes to the Future Urban Structure, in a workshop setting.

Finally we would request the opportunity to workshop preparation of a more positive vision statement that recognises the substance of the submission.

mesh

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