Land Capability Assessment

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Ballarat North Precinct Structure Plan
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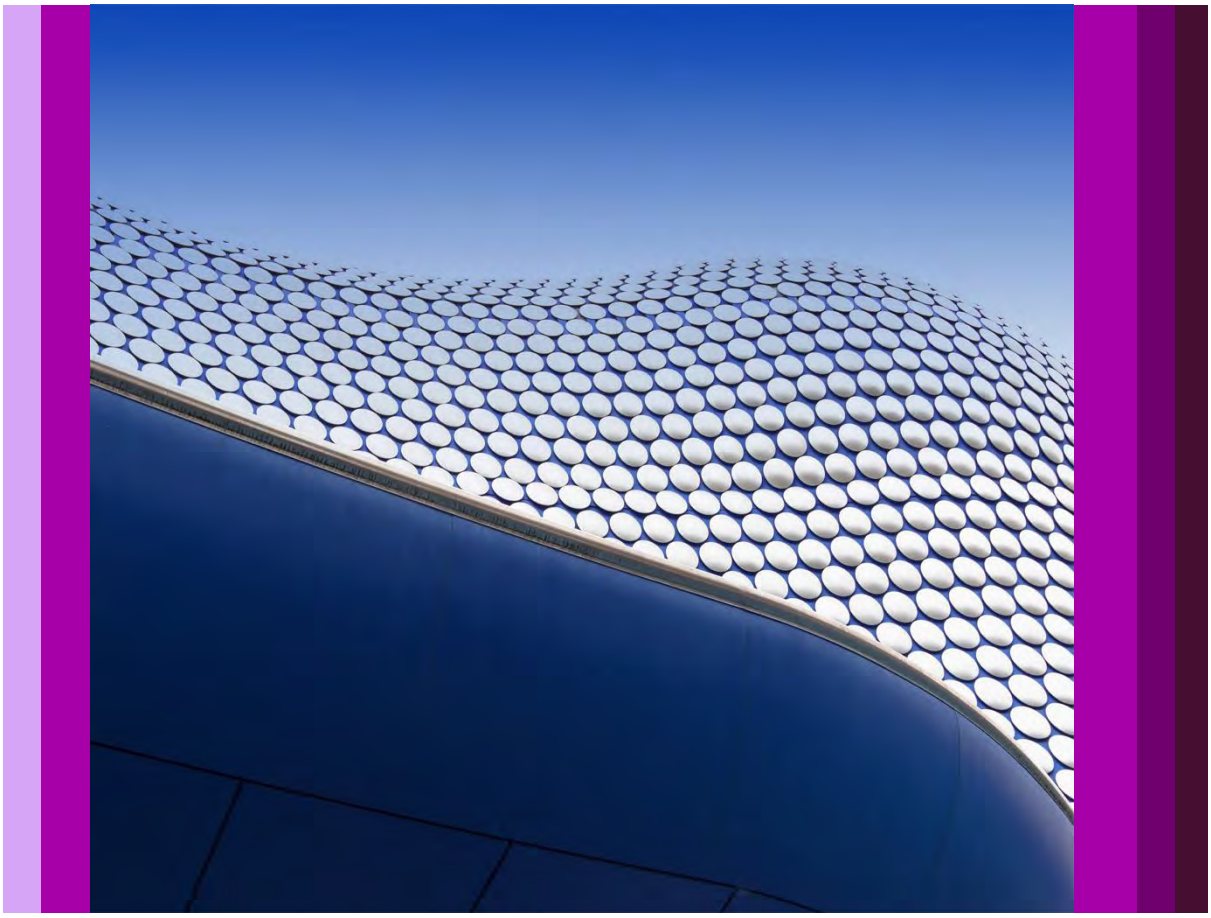

Land Capability Assessment

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Executive summary

Background and objectives

Jacobs Group (Australia) Pty Ltd (Jacobs) was commissioned by the Victorian Planning Authority (VPA) to undertake a Land Capability Assessment (LCA) for Ballarat North Precinct Structure Plan (Ballarat North PSP) area, hereafter referred to as either 'Ballarat North' or 'the study area' or 'the Site'. The Site comprises of two land masses – a 561-ha "core area" and a 271-ha "expanded area" north of Cummins Road. The inclusion of the 'expanded area' in the final PSP is yet to be confirmed by VPA, but for the purposes of this assessment it has been included.

Primarily, the LCA study aims to identify potential environmental constraints relevant to the proposed future development (residential land use addressing the rapid growth rate and increasing the actual number of developable lands / properties) of Ballarat North. This includes considerations such as the potential for the presence of land contamination as well as constraints relating to hydrology, groundwater, geology and geomorphology. Establishing the environmental conditions will be based on a combination of a desktop review and field site inspection within the boundaries of the Ballarat North PSP. Both stages will consider the areas of potential sodic/dispersive soils, potential soil and/or groundwater contamination, geotechnical and hydrological variables.

Scope of works

The following scope of work has been completed as part of this LCA:

- Stage 1 – A desktop assessment stage comprised the gathering of relevant information (including the use of Lotsearch Reports and various literature sources) to identify potential sources of contamination, hydrogeological, hydrological, geomorphological, and geotechnical conditions across the Ballarat North PSP area.
- Stage 2 – A site inspection at selected properties within the Ballarat North PSP area to further support site-specific and precinct-wide observations made as part of the Stage 1 desktop assessment. This site inspection focused primarily on the potential for contamination.

Key conclusions

Based on the information gathered during the Stage 1 and Stage 2 assessments, the following conclusions can be made concerning Ballarat North PSP:

Contamination

- Thirteen properties within Ballarat North PSP area were identified as presenting a high potential for contamination:
  - Property numbers 70, 71, 72, and 73 which according to the landowner, since they have been aware in late 2022 through a self-sponsored Preliminary Site Assessment (PSI) that these parcels would need environmental clean-up activities. Jacobs understands that the landowner plans to implement remediation activities in early 2024.
  - Property 77 which is an asphalt services company. Based on the current site use, Jacobs has determined that there is a potential for activities at the property to result in contamination.
  - Property numbers 90, 91, 92, 98, 99,100, 101, and 102 which encompasses the inferred lateral extent of the closed landfill (former Wendouree Tip) at the southern portion of the Site.
- Eleven properties within Ballarat North PSP area were identified as presenting a medium potential for contamination:

- Property number 5 which had indications of presence of metal piles including stockpiles of cut trees and soil and a potential presence of a stock dip.
- Property numbers 31 and 32 (under the same ownership) which had numerous sand spoil mounds / stockpiles dating back two decades. Upon inspection, it was evident that spoil mounds / stockpiles included fill material, including metal, brick and ceramic fragments, gravel and timber.
- Property number 43 where farm operation were assessed as presenting a medium potential for contamination on the basis of previous assessment which identified activities generating waste (carcass burials, fuel spills from routine refilling of farm machineries, rubbish/burning of rubbish, etc).
- Property numbers 56 and 57 (under the same ownership) which had indications of presence of what appears to be stockpiles of scrap metals and mounds of other unidentified materials around the southern portion of these two properties. It is noted that the remainder of these properties has been assessed as no potential for contamination.
- Property numbers 88 and 89 which are sandwiched between Property 77 (asphalt company) and the former Wendouree Tip – both locations with a high potential for contamination.
- Property number 93 which is adjacent to the extents of the former Wendouree Tip.
- Property numbers 96 on account of the fact that this parcel is located generally downgradient from adjacent parcels with a high potential for contamination (parcels 71, 72 and 73).
- Property numbers 74 for which an EAO has been applied historically and remains in place. Jacobs notes that this particular EAO also remains in place across part of properties 75 and 97. However, it is understood that the activities that originally gave rise to this EAO did not occur at these two properties, and on this basis properties 75 and 97 have been assessed as presenting no potential for contamination (and on this basis the extent of the EAO may be modified to exclude these properties).

- The remaining properties (80 out of the total 104) within the Ballarat North PSP study area were identified as presenting a no potential for contamination. This number represents the mostly agricultural / farm land properties and parcels such as Miners Rest Recreation Reserve and Wyndholm Park.
- Based on the information described in this report, there does not appear to be any significant constraints from a site contamination perspective which would render the land unsuitable for proposed future sensitive land use (i.e. residential with supportive commercial). The exception to this is likely to be for area of the former Wendouree Tip where future sensitive land uses may not be able to be practicably realised. However, there are specific properties within the Ballarat North PSP study area that have been assessed as presenting a 'high' and 'medium' potential for contamination. Further assessment at these properties may be required in order to better characterise the nature of contamination and identify how contamination (if identified) can be managed as part of the future development activities.

Geotechnical

Based on the available information, the following conclusions can be made from a geotechnical perspective:

- The study area is predominantly underlaid by the Quaternary-Tertiary aged Newer Volcanic Group, generally comprising high plasticity residual clay overlying basalt rock, typically variably weathered. The limited historical borehole information indicates the soil cover is generally between 1m and 5m. High plasticity clays are typically expansive leading to large ground movements and can be problematic during earthworks due to their characteristics.
- Basalt cobbles and boulders (commonly referred to as floaters or core stones) are often present within the residual soil and extremely weathered basalt.
- Compressible soils are likely to be encountered around creeks and rivers where Quaternary Age alluvial deposits have been mapped.

- Based on the published information, the Lancefieldian-aged Castlemaine Group, comprising marine sandstone, mudstone and black shale, is expected to be present in the eastern side of the project area. However, no historical borehole information is available to confirm the presence of this unit.
- Several historical boreholes have been identified within the study area. However, there is a lack of detailed and recent intrusive geotechnical data covering the whole study area, especially in the north-east corner of the site.
- Several historical mining shafts are recorded within the south-east part of the study area. However, the level of accuracy of the historical records is unknown, and additional shafts could be present in the area. The presence of shafts presents a serious geotechnical hazard as any construction works over the disused shaft pose a potential for cave ins and ground collapse.
- The study area contains a volcanic eruption point (Mount Rowan) that is subject of a Significant Landscape Overlay in the relevant planning scheme. Therefore, any future developments would require a permit application and a site-specific ground investigation which would need to include a slope stability assessment.
- Two areas subject to the Erosion Management Overlay are present in this section, associated with surface watercourses (Burrumbeet Creek) and scoria deposits (Mount Rowan). Therefore, any future developments in these areas would require a permit application.
- The project area is mapped as having a Low to Very Low landslip susceptibility. During the site walkover in 2023, possible signs of instability – minor translational slides with approximately less than 1m soil exposed in the scarp- were observed on the steep slopes of Mount Rowan.
- Dispersive soils are likely to be present within the study area, as indicated by mapped soil types and supported by the results of limited geotechnical laboratory testing. Dispersive soils may cause slope instability and trafficability issues in addition to instability of structures and earthworks in the long term e.g. piping failures if reused without treatment. The likelihood for encountering reactive soils is high, which are prone to shrink-swell behaviour.

Hydrogeology

Based on the regional and local hydrogeological information, the local water table is expected to be relatively shallow across parts of the site and hosted in the fractured rock Upper Tertiary/Quaternary Basalts and the alluvial Quaternary Aquifer, where present, and in the Upper Tertiary Aquifer (fluvial) aquifer where it outcrops.

Across the precinct area, the following issues require consideration in the planning and design of any development:

- Shallow depth to groundwater is likely to occur over large portions of the precinct area. The shallow water table may cause groundwater inflow to excavations and may impact site drainage (i.e. cause waterlogging).
- There may be areas that have poor sub-soil drainage and are susceptible to waterlogging.
- Site-specific groundwater impact assessments will be required for works within or near to groundwater receptors (groundwater dependent ecosystems (GDEs) and nearby registered bores) depending on location, footprint, and extent of works within the subsurface/water table.
- Similar to above, potential dewatering induced reductions to baseflow of surface water systems would require assessment and consideration.
- Groundwater dewatering or extraction associated with development has the potential to reduce discharge to nearby surface water features and/or terrestrial GDEs, which could potentially have a negative impact on the ecological health of local groundwater receptors.

- Existing off-site bores used for water supply (typical use is stock, domestic and irrigation) require consideration in terms of location, existence, condition, and current license to prevent unacceptable impacts during construction. Some existing bores are located close to the precinct area. For instance, bore 60758, used for domestic and irrigation, is only 12 m west of the precinct area.
- The potential brackish nature of the groundwater may require careful monitoring if dewatering or extraction is required, particularly for the consideration of the disposal of water.
- Opportunities for the potential use of extracted groundwater include dust suppression during construction, and garden watering, and irrigation of parks and ovals following development. However, the expected range of salinity is likely to vary and depending on the salinity of the groundwater, it may need to be mixed with potable water to improve the quality for the intended purpose.
- Potential groundwater contamination, if identified.
- Consideration of groundwater aggressivity effects on structures (e.g. concrete piles).
- Consideration of dewatering impacting ground movement and acid sulfate soils (if relevant).

Hydrology

This desktop due diligence study has identified that the Ballarat North PSP area falls within a floodplain exposed to riverine flooding. Future development in the area has the potential to influence existing overland flow paths in addition to impacting the project area drainage strategy, floodplain storage, land imperviousness, and the associated flood risk. As such, it is expected that future development across the site will require several further studies that were included in the recommendations.

Geomorphology

The Ballarat Nort PSP Area is located on soils that have formed from weathering of local Newer Volcanic Group Basalt rock. Topsoils typically have better structural stability, but subsoils may be sodic/dispersive and susceptible to erosion, particularly in instances where the topsoil is removed or if there are drainage works, which then result in rainfall and runoff making contact with and eroding these soils.

Recommendations

Jacobs understand that the target future land use of the Ballarat North PSP area will be primarily for residential development to address the rapid growth rate of Ballarat and increase the actual number of developable lands / properties. As support to the future residential communities, some commercial and institutional development will also be needed to foster the growth of a self-sufficient community. This assessment has been completed based on the initial intended use of the area as mentioned above and this is the primary context in which recommendations are presented below. The following further works are recommended:

1. Completion of Preliminary Risk Screening Assessment (PRSA) or proceeding directly to an audit per Table 3: Recommended approach to assessing potentially contaminated land (PPN30) for properties identified as “medium” and “high” potential for contamination. Properties 70, 71, 72, 73, 77, 90, 91, 92, 98, 99, 100, 101, and 102 were categorised as a high potential for contamination as part of this assessment. This relates the presence of known contamination arising from historical mine-related activities or because they represent what is inferred to be the location of the former Wendouree Tip (except for Property 77 which is considered under current industrial land use). On the other hand, properties 5, 31, 32, 43, 56, 57, 74, 88, 89, 93 and 96 were categorised as medium potential for contamination as part of this assessment. This relates to the presence of stock dip, stockpiles of imported fill, soil, and other materials such as metal scraps and various waste materials, and close proximity to properties with high potential for contamination (EAO sites and extents of former Wendouree Tip). The completion of a PRSA will determine whether an environmental audit is required for these properties (medium potential for

contamination). For those properties with high potential for contamination, the completion of a PRSA or audit options applies, and it is recommended to proceed directly to an environmental audit.

2. In relation to the former Wendouree Tip (the inferred extent of which is believed to include land parcels 90, 91, 92, 98, 99,100, 101, and 102), it is recommended that a landfill gas risk assessment is completed. Jacobs understand that Ballarat City Council owns the land and intends to complete this assessment, although the timing for this cannot be confirmed at this stage. In addition, Jacobs notes that (consistent with EPA Publication 1642 – Assessing Planning Proposals in the Buffer of a Landfill and the Draft EPA Publication 1950 – Land buffer guideline) potential risk relating to landfill gas should also be considered for all properties that fall within a 500m buffer distance from the landfill. This estimated buffer distance is presented in Figure 7 1. Potential risks relating to landfill gas originating from the former Wendouree Tip should be assessed on a parcel-by-parcel basis through the completion of a landfill gas risk assessment. The requirement to perform a landfill gas risk assessment should be included as a planning permit condition applied to relevant land parcels within the buffer distance, specifically land parcels 62, 63, 64, 65, 66, 67, 68, 69, 70, 76, 77, 78, 79, 80, 81,82, 83, 84, 85, 86, 87, 88, 89, 93, 94, 95, 96,103 and 104.

3. It is recommended that future developers establish an appropriate Construction Environment Management Plan (CEMP) for implementation during development works. This should include provision for the appropriate management of unexpected finds as well as other features or infrastructure that may be present that have the potential to cause contamination. The CEMP should be prepared by a suitably qualified professional and should consider the appropriate management of activities such as waste disposal, post-removal validation, and below-ground septic systems identification and removal.

4. Once the future development plans are confirmed, a site-specific ground investigation, comprising soil and rock sampling, and geotechnical laboratory testing should be undertaken in general accordance with Australian Standard AS 1726 to support the future development of each site within the project area. This will lead to the determination of the ground conditions, site classification, potential design constraints, and geotechnical design parameters for the proposed development at the site.

5. The potential for the presence of mining related shafts presents a potential geotechnical hazard. A total of seven shafts within the south-eastern part of the Ballarat North PSP area have been identified (refer the Ballarat Goldfield District Online Map (2019) which is discussed in Section 7.2.2 and Lotsearch report LS048897 in Appendix B). Construction works over disused shafts, adits or underground workings pose a potential for cave ins and ground collapse. It is recommended that requests as to the status of these shafts and associated mine infrastructure (including extent of underground mining) are made by the future developer as part of their due diligence process to the current landowner(s) in order to identify any further information that may be able to confirm specific location of these shafts and whether they have been capped and/or backfilled. It is also recommended that site specific geophysical survey be undertaken in the areas where historical mining activity is recorded in order to locate potentially abandoned shafts. Where mine shafts are identified, then a site-specific geotechnical investigation should be undertaken, including a mine shaft remedial assessment (if not already available). A mine shaft remedial assessment will provide remedial options including suitable mitigation methods for suspected mine shafts and associated geotechnical risks at each site. It should address health and safety liabilities from each site arising from historical workings and mine shafts including 'make-safe' options.

6. Subject to approved access (and possibly suitable bore depths), existing investigation/observation bores in the vicinity of the precinct area identified as active can be used to verify groundwater conditions based on the potential risk of proposed land use affecting groundwater. Groundwater hydraulic testing (slug tests) may also be undertaken to determine aquifer hydraulic conductivity. This assumes existing wells are in a suitable condition for such an assessment. Due to the lack of groundwater investigation or observation bores over most of the precinct area, the installation and development of new monitoring bores is also likely to be required to confirm the local groundwater level and quality presented in this desktop assessment.

7. It is recommended that further site investigation, sampling, laboratory analysis and characterisation of soils is undertaken to confirm their erodibility and develop a plan to stabilise the soils (options include chemical treatment of soils, careful staging of works). The scope of this work would be similar to the Sodic Soils Assessment previously completed by Jacobs for Melton East, Parwan and Parwan Employment Precincts. We recommend a gridded program is adopted for collection of soil samples, with one sampling site per 10 hectares[1]. In previous Sodic Soil Assessments completed for VPA we have typically cored to 1.5 m, sampled topsoil and subsoil at each location and then at a selection of boreholes sampled at deeper increments (up to 1.5 m depth). We think a similar strategy would be appropriate in Ballarat North.

8. A geomorphological assessment of waterways is recommended to assess their current condition and how this is likely to change with future development. The scope of this assessment should be agreed with authority responsible for commissioning this assessment (Victorian Planning Authority or Ballarat City Council). The outcomes of this work would inform further design and development of the drainage services scheme.

Table ES-1 below summarises the recommended technical studies and their respective timings.

[1] Final decision on grid density should be made by VPA. Grid density should be chosen to provide suitable representation of topography, geomorphology/soils and future land use.

Table ES-1. Summary of technical studies

Recommendation number	Purpose	Technical study	Timing	Responsibility
1	Assess the nature and extent of potential contamination at properties assessed as representing a medium potential for contamination (properties 5, 31, 32, 43, 56, 57, 74, 88, 89, 93 and 96).	Preliminary Risk Screening Assessment (PRSA) followed by Environmental Audit (if required based on outcome of PRSA)	After the gazettal of the Planning Scheme Amendment. PRSA (and environmental audit if required) to be completed prior to the proposed sensitive use (or buildings / works associated with establishing that use) commencing	Future land developer
	Assess the nature and extent of potential contamination at properties assessed as representing a high potential for contamination (properties 70, 71, 72, 73, 77, 90, 91, 92, 98, 99, 100, 101, and 102).	Environmental Audit	After the gazettal of the Planning Scheme Amendment. Environmental audit to be completed prior to the proposed sensitive use (or buildings / works associated with establishing that use) commencing	Future land developer

Recommendation number	Purpose	Technical study	Timing	Responsibility
2	Assess the potential risk to sensitive receptors associated with landfill gas from the former Wendouree Tip (properties 90, 91, 92, 98, 99,100, 101, and 102).	Landfill Gas Risk Assessment for all properties that fall within the extent of the former landfill	At the earliest opportunity (timing cannot be confirmed at this point).	Ballarat City Council
	Assess the potential risk to sensitive receptors associated with landfill gas from the former Wendouree Tip. This assessment should consider landfill gas risks beyond the extent of the former landfill, but within the 500m buffer distance from the edge of the landfill. Jacobs understands this to be relevant to properties 53, 54, 55, 56, 62, 63, 64, 65, 66, 67, 68, 69, 70, 76, 77, 78, 79, 80, 81,82, 83, 84, 85, 86, 87, 88, 89, 93, 94, 95, 96,103 and 104.	Landfill Gas Risk Assessment for all properties that fall within the 500m buffer distance of the former landfill (but beyond the extent of the former landfill)	The assessment should be on a parcel-by-parcel basis during future site development	Future land developer
3	Plan for the classification, disposal and post-removal validation (if required) of various stockpiles and dumped materials/wastes located onsite. In addition, plan for the identification, removal and post-removal validation of below-ground septic systems that may be present at rural residential properties and farm residences where unexpected finds may occur during future development.	Construction Environment Management Plan (CEMP) for all properties that would undergo construction-related activities.	The development and implementation of the CEMP should be undertaken on a site-by-site basis during future site development.	Future land developer
4	Assess the site-specific ground conditions in order to classify the site and determine the potential design constraints. With these data real estate developers	Geotechnical Site Investigations	The conduct of the Geotechnical Site Investigations should be done on	Future land developer

Recommendation number	Purpose	Technical study	Timing	Responsibility
	should be able to determine appropriate geotechnical design parameters for their proposed development.		a site-by-site basis during future development as part of the building permit application process.	
5	Assess potential geotechnical hazards prior to construction in areas where mine shafts were previously identified. Construction works over disused shafts, adits or underground workings pose a potential for cave-ins and ground collapse.	Due Diligence activities by prospective land purchasers, Geophysical Surveys, Site-specific Geotechnical Studies, and Mine Shaft Remedial Assessment for areas with historical mine shafts.	These technical studies should be undertaken on a site-by-site basis as part of the permit application process associated with future development of individual land parcels.	Future land developer
6	Assess groundwater levels and other groundwater-related parameters such as groundwater quality and hydraulic conductivity to inform of the potential risk of future development activities to groundwater.	Geotechnical and Groundwater Investigations which include the installation and development of new groundwater monitoring wells and conduct of Groundwater hydraulic testing (slug tests).	These tasks should be undertaken on a site-by-site basis during design / planning phase.	Future land developer
7	Assessment / characterisation of soils to confirm presence of sodic soils. The scope of this work would be similar to the Sodic Soils Assessment previously	Sodic Soils Assessment	This task should be undertaken across the precinct area as part of the	VPA or future land developer

Recommendation number	Purpose	Technical study	Timing	Responsibility
	completed by Jacobs for Melton East, Merrifield North, Parwan and Parwan Employment Precincts.		planning stage for the PSP. The outcomes of this work will assist in providing strategic advice on issues relating to sodic soils and how to manage these with future development.	
8	Assess the current condition of the waterways and how would future development scenarios impact the hydrology and hydraulics within Ballarat North PSP.	Geomorphological Assessment of waterways	This task should be undertaken across the precinct area as part of the planning stage for the PSP. The outcomes of this work will assist in providing strategic advice on issues relating to the stability of waterways and how to manage these with future development.	Ballarat City Council or Victorian Planning Authority

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Appendices

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Figures

Acronyms and abbreviations

AASS	Actual Acid Sulfate Soils
ACM	Asbestos containing material
ANZCC	Australian and New Zealand Environment and Conservation Council
ANZG	Australian and New Zealand Guidelines
BAO	Buffer Area Overlay
BLTGOI	Ballarat Long-Term Growth Options Investigation
BNWRP	Ballarat North Water Reclamation Plant
BNWTP	Ballarat North Wastewater Treatment Plant
CASS	Coastal Acid Sulfate Soils
CEMP	Construction Environmental Management Plan
CMA	Catchment Management Authority
COPC	Contaminants of Potential Concern
DCCEEW	Department of Climate Change, Energy, the Environment and Water (Commonwealth)
DELWP	Department of Environment, Land, Water and Planning
EAO	Environmental Audit Overlay
EIIA	Extractive Industries Interest Area
EPA	Environmental Protection Authority
EMO	Erosion Management Overlay
EPAV	Environmental Protection Authority Victoria
ESA	Environmental Site Assessment
ESO	Environmental Significance Overlay
GDE	Groundwater Dependent Ecosystem
GHCMA	Glenelg Hopkins Catchment Management Authority
GIA	Greenfield Investigation Area
GQRUZ	Groundwater Quality Restricted Use Zones
LCA	Land Capability Assessment
LDRZ	Low Density Residential Zone
LGRA	Landfill Gas Risk Assessment
LOPC	Loss of Primary Containment

LSIO	Land Subject to Inundation Overlay
NEPC	National Environment Protection Council
NEPM	National Environment Protection Measure
PASS	Potential Acid Sulfate Soils
PACM	Presumed Asbestos Containing Material
PCRZ	Public Conservation and Resource Zone
PFAS	Per- and Polyfluorinated Substances
PPN30	Planning Practice Note 30
PRSA	Preliminary Risk Screening Assessment
PSP	Precinct Structure Plan
SLO	Significant Landscape Overlay
SMO	Salinity Management Overlay
SMOs	Site Management Orders
SUZ1	Special Use Zone – Schedule 1
TDA	Total Dissolved Solids
UXO	Unexploded Ordnance
VPA	Victorian Planning Authority

1. Introduction

1.1 Background and objectives

Jacobs Group (Australia) Pty Ltd (Jacobs) was commissioned by the Victorian Planning Authority (VPA) to undertake a desktop review and assessment of the hydrogeological, hydrological, geomorphological, geotechnical and ecological environmental settings of the Ballarat North Precinct Structure Plan (Ballarat North PSP) area, hereafter referred to as either 'Ballarat North' or 'the study area' or 'the Site'. This assessment is termed a Land Capability Assessment (LCA).

This assessment aims to identify potential environmental constraints relevant to the proposed future development of Ballarat North. This includes considerations such as the potential for the presence of land contamination (resulting from current / historical land uses within and / or adjacent to the Ballarat North) as well as constraints relating to hydrology, groundwater, geology/geomorphology, buffers and amenities, and ecology. Establishing the environmental conditions will be based on a combination of a desktop review and field site inspection within the boundaries of the Ballarat North PSP. Both stages will consider the areas of potential sodic/dispersive soils, potential soil and/or groundwater contamination, geotechnical and hydrological variables, and existing land uses that may have the potential to cause adverse amenities. The LCA study will also assess, in general high-level terms, ecological constraints, buffers, and adverse amenity risks. There will be no sampling that will be conducted at this stage and will include the above-mentioned process.

The 'core area' of the Ballarat North PSP area has an area of 561 ha, while the 'expanded area' currently has an area of 271 ha. This study considered the entire 832 ha and no distinction has been made between the 'core area' and the 'expanded area' when assessing these areas – they have both been included when reference is made to the broader Ballarat North PSP area. Jacobs has applied the same assessment methodologies for both areas with the knowledge that the long-term plan for the Ballarat North PSP area is to allow for residential development to address the rapid growth rate of Ballarat and increase the actual number of developable lands / properties.

1.2 Scope of works

The following scope of work has been completed as part of this LCA:

- Stage 1 – A desktop assessment stage comprised the gathering of relevant information (including the use of Lotsearch Reports and various literature sources) to identify potential sources of contamination, hydrogeological, hydrological, geomorphological, and geotechnical conditions across the Ballarat North PSP area, including the assessment of potential for ecological, buffers and adverse amenity risks
- Stage 2 – A site inspection at selected properties within the Ballarat North PSP area to further support site-specific and precinct-wide observations made as part of the Stage 1 desktop assessment. This site inspection focused primarily on the potential for contamination.

The approach and findings of the assessment, together with supporting information, are documented within this report.

2. Regulatory framework

2.1 Relevant legislation and policies

2.1.1 Planning and Environment Act 1987 (Vic)

The *Planning and Environment Act 1987* regulates the use and development of land in Victoria. The Act sets out the framework and procedures for preparing and amending planning schemes, obtaining planning permits, settling disputes, enforcing compliance with planning schemes, and other administrative procedures. The Act requires planning authorities to *'take into account any significant effects which it considers the scheme or amendment might have on the environment or which it considers the environment might have on any use or development envisaged in the scheme or amendment.'*

Each planning scheme is prepared in accordance with the Victoria Planning Provisions (VPPs), which serve as a state-wide document framing a consistent and coordinated structure and content for all Victorian planning schemes. If Ballarat North is subject to the Ballarat Planning Scheme, then any proposed use and development must be in accordance with the planning scheme. Once the planning process is completed, this will primarily allow for residential development within Ballarat North PSP, which will be supplemented by non-residential components to foster the growth of a self-sufficient community. These non-residential components and supporting land uses will include commercial retail areas, new educational facilities, and protection and enhancement of important PSP features such as Burrumbeet Creek, the Ballarat Town Commons, and Mount Rowan.

The Environmental Significance Overlay – Schedule 2 & 4 (ESO2 & ESO4), Floodway Overlay (FO), Specific Controls Overlay (SCO1), Bushfire Management Overlay (BMO), Design and Development Overlay – Schedule 18 (DDO18), Significant Landscape Overlay (SLO), Erosion Management Overlay (EMO) and Environmental Audit Overlay (EAO) are applicable to the areas within Ballarat North PSP. These overlays will need to be considered when undertaking future development within the Precinct. Additionally, other planning overlays that are in effect at the buffer zone should also be considered in the overall planning to influence environmental, development and built form outcomes.

In accordance with Section 12(2)(a) of the *Planning and Environment Act 1987*, when preparing a planning scheme or amendment, planning authorities must consider Ministerial Directions. *Ministerial Direction No. 1 – Potentially Contaminated Land* requires that planning authorities ensure the environmental conditions of land intended for a sensitive use, agriculture or public open space are, or will be, suitable for that use. Depending on the planning process to be followed, this is generally done through the preparation of an environmental site assessment and audit.

In addition, in accordance with Sections 12(2)(b) and 60(1)(e) of the Planning and Environment Act 1987, planning and responsible authorities must consider: *"any significant effects that the scheme or amendment might have on the environment or that the environment might have on any use or development envisaged in the scheme or amendment."*

2.1.2 Environment Protection and Biodiversity Conservation Act 1999

The Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) provides for the listing of nationally threatened species, threatened ecological communities and key threatening processes. It provides the legal framework to protect and manage nine matters of national environmental significance (MNES): world heritage properties; national heritage places; wetlands of international importance (Ramsar); listed threatened species and communities; listed migratory species; Commonwealth marine areas; the Great Barrier Reef Marine Park; nuclear actions; and water resources, in relation to coal seam gas and large coal mining development.

Any project not covered by an approved strategic assessment that is likely to have a significant impact on MNES is required to be referred to the Commonwealth Minister for Environment via the Department of Climate Change, Energy, the Environment and Water (DCCEEW) for a decision on whether the project is a 'controlled action' requiring assessment and approval under the EPBC Act.

2.1.3 Water Act 1989 (Vic)

The Water Act 1989 provides the legal framework for water management and use across Victoria, including the issuing and allocation of water entitlements and the provision of water services by state-owned water corporations and Catchment Management Authorities (CMAs). CMAs are provided with regional waterway, floodplain, drainage and environmental water reserve management powers under the Water Act 1989.

2.1.4 Ministerial Direction No. 1 – Potentially Contaminated Land

Where the land is to be rezoned, *Ministerial Direction No. 1 – Potentially Contaminated Land* requires planning authorities, when preparing planning scheme amendments, to ensure that the environmental conditions of land intended for a sensitive use, agriculture or public open space are, or will be, suitable for that use.

If the land is potentially contaminated and a sensitive use is proposed, Direction No. 1 provides that a planning authority must ensure the land's suitability through an environmental audit.

In this Direction, potentially contaminated land means land:

- Used or known to have been used for industry or mining;
- Used or known to have been used for the storage of chemicals, gas, waste or liquid fuel (other than minor above-ground storage that is ancillary to another use of the land); or
- Where a known past or present activity or event (occurring on or off the land) may have caused contamination on the land.

When approving a planning permit that permits potentially contaminated land for a sensitive use (including a residential site or a children's playground), the responsible authority must:

- Satisfy itself whether or not the land, or parts of the land, are potentially contaminated;
- Where it has determined that the land is not potentially contaminated, state the determination in the amendment Explanatory Report; and
- Where it has determined the land, or parts of the land, are potentially contaminated, must state the determination in the amendment Explanatory Report and satisfy itself that the environmental conditions of that land are or will be suitable for that use.

2.1.5 Ministerial Direction No. 19

Ministerial Direction No. 19 came into effect on 18 October 2018. It requires planning authorities to seek early advice from the EPA when undertaking strategic planning processes and preparing planning scheme amendments that may significantly impact Victoria's environment, amenity and/or human health due to pollution and waste. The explanatory report for an amendment must include a statement of how the proposed amendment addresses the views of the EPA.

The Ministerial Requirement for information is issued under Section 12(1)(f) of the *Planning and Environment Act 1987*. It requires planning authorities to give the Minister for Planning the following information when applying for authorisation to prepare an amendment under sections 8A or 8B of the *Planning and Environment Act 1987*, or preparing an amendment under section 9 of the *Planning and Environment Act 1987*:

- "The written views of EPA, including any supporting information and reports"
- "a written explanation of how the proposed amendment addresses any issues or matters raised by the EPA"

2.1.6 Planning Practice Note 30

Planning Practice Note 30 (PPN30) was published by the Department of Environment, Land, Water and Planning (DELWP) in July 2021. The purpose of the practice note is to provide guidance for planners and applicants on:

- How to identify potentially contaminated land
- The appropriate level of assessment of contamination that should be conducted in different circumstances
- The appropriate provisions in planning scheme amendments
- Appropriate conditions on planning permits

A list of the land uses that have the potential to contaminate land (categorised as high or medium) is provided in Table 2 of PPN30. This is not an exhaustive list but does include several land uses / activities relevant to rural residential areas, such as those associated with the Ballarat North PSP area. Potentially contaminated land is defined in *Ministerial Direction No. 1 – Potentially Contaminated Land* (refer Section 2.1.4) and it is this definition that has been adopted for the Jacobs assessment. In instances where land is evaluated by Jacobs as part of this assessment as not meeting the definition of potentially contaminated land (per *Ministerial Direction No. 1 – Potentially Contaminated Land*), Jacobs has defined this land as 'not potentially contaminated'. It is important to note that categorising land as either 'potentially contaminated' or 'not potentially contaminated' (per *Ministerial Direction No. 1 – Potentially Contaminated Land*) is based on how land is used, or known to have been used and Jacobs has established this through the methodology described in Section 3. Importantly, it should be noted that categorisation provided by Jacobs in this report is not a definitive categorisation – it is a categorisation that is based on the review of available data by Jacobs at the time of the assessment and the application of professional judgement as to the potential for contamination. In particular, for properties that are categorised as 'no potential for contamination' it is possible that potentially contaminated uses or activities could have occurred at a property, but such uses or activities may not able to be identified based on the scope of this assessment and the information available to Jacobs at the time of this assessment has been performed.

The practice note also presents an assessment matrix in Table 3 that outlines recommended approaches towards assessing potentially contaminated land under different planning proposals. An extract from Table 3 is presented below.

It is noted that in some circumstances it may be difficult or inappropriate to undertake either the Preliminary Risk Screening Assessment (PRSA) or the environmental audit at the time of the planning scheme amendment. One such example presented in PPN30 would be when 'the rezoning relates to a large strategic planning exercise or involve multiple sites in separate ownership'. In such circumstances it is acceptable to defer the requirements (to complete a PRSA and / or environmental audit) until after the planning scheme amendment. This can be achieved through the application of an Environmental Audit Overlay (EAO). The completion of the PRSA and / or environmental audit would then be completed prior to development of the land.

Where an EAO has been applied to a parcel of land, this indicates that a decision has been made that the land is potentially contaminated and may not be suitable for a sensitive use without further assessment and / or remediation. The EAO requires that an environmental audit be undertaken, or a PRSA to determine the need for an environmental audit. All buildings and works associated with a sensitive use (unless the works pose a negligible risk, for example where soil is not disturbed during the works) will trigger the need to undertake either the PRSA or the environmental audit (as appropriate).

In the context of Ballarat North, it is noted that the future proposed land use would comprise predominantly residential areas with supportive commercial areas as well as new educational facilities that aims to enhance growth and development of a residential community. Therefore, as per Table 3 of PPN30, the outcomes of the assessment for each land parcel would be aligned with the proposed predominant future land use across the Ballarat North PSP (residential with commercial land use from a land contamination potential perspective), namely:

- Conduct an environmental audit (for parcels with high potential for contamination)
- Conduct a PRSA to determine the need for an environmental audit (for parcels with medium potential for contamination)

Picture 2-1. Recommended approach to assessing potentially contaminated land

Extract of Table 3 from PPN 30

Planning Proposal		Potential for Contamination	
		High	Medium
Uses defined in *Ministerial Direction No. 1*, the EAO, and clause 13.04-1S			
• Sensitive uses: Residential use, childcare centre, kindergarten, pre-school centre, primary school, even if ancillary to another use. • Children's playground • Secondary school	New use, or buildings and works associated with a new use	A	B
	Buildings and works associated with an existing use	B	B
Other land use			
Open space Agriculture Retail or office Industry or warehouse	New use, or buildings and works associated with a new or existing use	C	D

	Planning Scheme Amendment	Planning Permit Application
A	PRSA or audit option applies Proceeding directly to an audit is recommended.	PRSA or audit option applies Proceeding directly to an audit is recommended.
B	PRSA or audit option applies PRSA to determine need for audit is recommended.	PRSA or audit option applies PRSA to determine need for audit is recommended.
C	PSI to inform need for audit is recommended	PSI to inform need for audit is recommended
D	Planning authority to document consideration of potential for contamination to impact proposal	Responsible authority to document consideration of potential for contamination to impact proposal

Note: Where land is used for more than one purpose, the most sensitive land use should be used to inform the approach to determining if an audit is required.

2.1.7 Environment Protection Act 2017 (Vic)

The Environment Protection Act 2017 (as amended by the Environment Protection Amendment Act 2018) and its subordinate legislation came into effect on 1 July 2021.

The legislation enhances the protection of Victoria's environment and human health through a more proportionate, risk-based environment protection framework that includes:

- A preventative approach through a general environmental duty.

- A tiered system of EPA permissions to support risk-based and proportionate regulatory oversight.
- Significant reforms to contaminated land and waste management.
- Increased maximum penalties.
- Requirements for more environmental information to be publicly available.
- Modernising and strengthening EPA's compliance and enforcement powers.

Similar to the (now repealed) Environment Protection Act 1970 that it replaces, the Environment Protection Act 2017 provides for environmental audits, which are used to provide an authoritative opinion on the suitability of potentially contaminated land for future use and forms an integral part of the land use planning and approval process. However, the Environment Protection Act 2017 also incorporates a new process – the Preliminary Risk Screening Assessment (PRSA), administered by EPA Victoria.

PRSAs do not replace Environmental Audits – they are used to establish whether there is a need for an Environmental Audit, and if so, the scope of the Environmental Audit. Importantly, the PRSA does not make a conclusion on the suitability of a site for its existing or proposed future use – this remains the outcome of an Environmental Audit. Only EPA-accredited contaminated land auditors can perform PRSAs. Environmental consultants may be involved in the PRSA process through preparing assessment reports that are considered by the auditor in the PRSA. A PRSA is expected to follow an assessment process consistent with that of the Preliminary Site Investigation (PSI) outlined in the National Environment Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013) and may include targeted / limited sampling.

The environmental audit system under the 2017 Act is also administered by EPA Victoria. An Environmental Audit of a site involves the appointment of an EPA accredited auditor to undertake an independent assessment of the environmental condition of a site and provide an opinion regarding the site's suitability for feasible or proposed end uses. A range of information including a site history assessment and results of relevant soil and groundwater testing undertaken are evaluated by the auditor when forming such an opinion. When an environmental audit is conducted specifically for land use planning purposes, the scope of the audit must identify the proposed use of the site. Where an audit assesses the use or proposed use of the site, an auditor must include a statement regarding the suitability of the site. The auditor will make one of the following three statements:

- The site is suitable for the purposes specified in the statement; or
- The site is suitable for the purposes specified in the statement if the recommendations made in the statement are complied with; or
- The site is not suitable for the purposes specified in the statement at the time the statement was prepared.

2.2 Guidelines and standards for assessment of contaminated land

2.2.1 National Environment Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013)

The NEPM is the national guideline for assessing contaminated sites and was prepared by the National Environment Protection Council (NEPC). The NEPM document ensures there is a nationally consistent approach to the assessment of contamination. The NEPM provides guidance on the methods of site contamination assessment, environmental and health-based investigation levels for soil and groundwater contaminants, human and environmental health risk assessment, and reporting requirements.

2.2.2 Australian and New Zealand guidelines for fresh and marine water quality

The Australian and New Zealand Guidelines for Fresh and Marine Water Quality published in 2018 by Australian and New Zealand Governments and Australian State and Territory Governments (ANZG) provide a nationally consistent framework for water quality management. The ANZG establish water quality trigger values for the protection of a range of environmental values for water resources, such as drinking water, recreation, and ecological values.

The ANZG (2018) replaced the previous guidelines published in 2000 (commonly referred to as the ANZECC 2000 guidelines) and have been adopted as the most contemporary guidelines when considering the new Environment Reference Standard. However, it should be noted that in many cases the ANZG did not make substantial revision to the content of the ANZECC 2000 guidelines. This is particularly true for most toxicant guideline values and guidelines values for primary industries and aquaculture.

2.2.3 Environment Reference Standards

The Environment Reference Standard came into effect on 1st July 2021 (alongside the Environment Protection Act 2017) and sets out the environmental values of the ambient air, ambient sound, land and water environments that are sought to be achieved or maintained in Victoria and standards to support those values. Environmental values are the uses, attributes, and functions of the environment that Victorians value.

Standards for the environmental values are comprised of objectives for supporting different uses of the environment and indicators that can be measured to determine whether those objectives are being met. The indicators and objectives provide a basis for assessment and reporting on environmental conditions in Victoria.

2.2.4 Australian Standard AS1726-2017: Geotechnical Site Investigations

Australian Standard AS1726 sets out minimum requirements for a geotechnical site investigation, as a component in the engineering design, construction, commissioning, and operation of civil engineering and building works.

The standard specifies considerations affecting the design and construction of works which must be made in a geotechnical site investigation. Assessment of these factors enables the identification of field and laboratory work to obtain the geotechnical data required to facilitate the engineering design and construction of the project. The standard provides guidance on suitable field and laboratory examination and testing of geotechnical materials and outlines a system of material classification.

The applications of this Standard include assessment of natural or filled ground, new construction, maintenance of existing facilities, the evaluation of post construction performance and the assessment of failure.

2.3 Guidelines and standards for surface water

2.3.1 Australian Rainfall and Runoff (2019)

Australian Rainfall and Runoff (ARR) is a national guideline document, data and software suite that is used for the estimation of design flood characteristics in Australia.

The Australian Rainfall and Runoff guide to flood estimation is accompanied by several public data resources including:

- Bureau of Meteorology – Rainfall Data System 2016: www.bom.gov.au/water/designRainfalls/revised-ifd/

- ARR Data Hub: http://data.arr-software.org/

With nationwide applicability, balancing the varied climates of Australia, the information and the approaches presented in Australian Rainfall and Runoff are essential for policy decisions and projects involving:

- Infrastructure such as roads, rail, airports, bridges, dams, stormwater and sewer systems;
- Town planning;
- Mining;
- Developing flood management plans for urban and rural communities;
- Flood warnings and flood emergency management;
- Operation of regulated river systems; and
- Prediction of extreme flood levels.

2.3.2 Guidelines for Development in Flood Affected Areas (DEECA, previously DELWP, 2019)

The Guidelines for Development in Flood Affected Areas provide an assessment framework and method to assist decisions on development in flood affected areas. The methods and objectives of the Guidelines results in development outcomes that respond to the flood risk.

The purpose of the guidelines is to provide a clear, consistent and transparent process for managing land use and development in flood affected areas in Victoria. They are intended to be used with the land use planning and development system, and are comprised of three parts:

- **Part One** introduces the guidelines, plus basic information on flood risk management and climate change.
- **Part Two** contains information on the regulatory framework used in decision-making. It examines key legislation and the roles and responsibilities of the key agencies that are affected by the legislation. The administrative processes for preparing, assessing and reviewing planning permits are also explained.
- **Part Three** provides the methodology used by floodplain management authorities when assessing development proposals referred to them. This is achieved by considering four objectives:
  - Safety
  - Flood damage
  - Off-site impacts
  - Waterway and floodplain protection.

This results in development outcomes that respond appropriately to the flood risk. Sometimes this means no development is appropriate.

2.3.3 Glenelg Hopkins Catchment Management Authority Flood Modelling Guidelines and Specifications (August 2021)

The purpose of this document is to provide the Service Provider with an indication of the minimum requirements and technical specifications for projects being carried out for the Flood Mapping and Mitigation team. The four objectives highlighted in the document for new developments are:

- Flooding problems must not be transferred from one location to another.
- New developments must provide safe access to all lots during floods ranging in magnitude up to the 1% AEP event.

- Development must maintain existing environmental values and where possible, result in net environmental benefit.
- Climate change considerations must be factored into modelling where applicable.

This document is relevant for flood mapping studies within the Glenelg Hopkins Catchment Management Authority area.

2.3.4 Burrumbeet Creek Catchment Local Floodplain Development Plan (2015)

Burrumbeet creek catchment local floodplain development plan is an incorporated document within clause 81 of the Ballarat Planning Scheme, pursuant to Section 6(2)(j) of the Planning and Environment Act 1987.

The plan establishes criteria for buildings, works and subdivision and provides a performance-based approach to the assessment of applications for all land affected by the Land Subject to Inundation Overlay (LSIO) and Floodway Overlay (FO) upstream of Lake Burrumbeet in the Ballarat Planning Scheme. The plan also specifies the required documentation for planning permit applications that fall within FO and LSIO of the Ballarat Planning Scheme.

3. Methodology

3.1 General assessment approach

3.1.1 Stage 1 Assessment

A Stage 1 assessment (also referred to as a Phase 1 Environmental Site Assessment (ESA)) is typically undertaken to establish site conditions, historical site uses and practices. The focus of such assessments it typically related to the potential for site contamination, but other environmental aspects have been considered, as described earlier in this report. As part of this Stage 1 assessment, the following sources of information have been reviewed:

- Previous reports;
- EPA Victoria information searches including:
  - Priority sites register;
  - Environmental Audit Reports Online Portal;
  - Groundwater Quality Restricted Use Zones (GQRUZ) Map;
  - Environmental Audit Overlay (EAO);
  - EPA Licensed sites; and
  - EPA landfill register.
- Topographical maps;
- State bore records on the DELWP Water Measurement Information System;
- Geological maps;
- Planning schemes;
- Historical aerial photographs;
- Hydrogeological maps;
- Potential acid sulfate soils (PASS) probability maps; and
- Energy Safe Victoria cathodic protection system database.

The Stage 1 assessment seeks to identify if possible:

- Potential source(s) of on and off-site contamination;
- Pathways and receptors of contamination; and
- Areas of environmental concern (contamination, hydrogeological and geotechnical) which will form the basis of subsequent assessments at the site.

A qualitative assessment has been undertaken as part of the Stage 1 assessment using a traffic light system which uses colour-coding to classify each land parcel within the Ballarat North PSP area as low, medium, or high potential for contamination. The outcomes of the risk assessment are subsequently used to confirm the need for Stage 2 assessment for each Ballarat North PSP area (see below).

3.1.2 Stage 2 Assessment

For this particular investigation, the site inspection works are referred to as a Stage 2 assessment. The site inspections undertaken included visual observations at selected properties across the Ballarat North PSP area

(where land access was permitted by landowners) in order to confirm findings from the Stage 1 assessment and confirm the final potential for contamination relating to each property.

Based on the findings of the site inspections, further works may be required for some Ballarat North PSP areas to assess the suitability for proposed future use. These further works are outlined in the conclusions and recommendations section of this report.

While the completion of these further works does not form part of this scope of work, Section 3.1.3 and Section 3.1.4 below provide an overview of the typical objectives/outcomes of such works.

3.1.3 Stage 3 Assessment (not included in this scope of works)

The Stage 3 intrusive site investigation may be undertaken to characterise the site with respect to contamination, hydrogeology, and geotechnical conditions. Note that this stage of site investigation is usually referred to as a Phase 2 ESA. With respect to each of the abovementioned disciplines, the following works may be undertaken as part of a Stage 3 assessment:

- **A contamination assessment** will typically assess the level (if any) of contamination present on site, establish the lateral and vertical distribution of contamination and identify the source(s) of on-site and off-site contamination. Prior to undertaking any intrusive soil and/or groundwater investigation, a Sampling and Analysis Plan (SAP) is generally prepared. The SAP defines the intended sampling locations and the contaminants which will be tested for, based on the site characteristics as determined in a Phase 1 ESA.
- **A geotechnical assessment** will typically seek to obtain information on the sub-surface conditions at the site through a geotechnical site investigation comprising of a series of boreholes and/or test pits and laboratory testing. Field and laboratory test data is used to develop a site ground model describing the soil and/or rock profiles and the variability across the site. A geotechnical assessment would generally include advice on site classification and allowable bearing capacity for shallow foundation design, and comments regarding excavations, foundation systems, pavement design and other items relevant to the proposed development.
- **A hydrogeological assessment** will typically include determination of groundwater level elevations based on observations made in groundwater bores installed for the project. Assessment of aquifer hydraulic conductivity can be undertaken through slug or pumping tests to inform estimates of potential groundwater inflow rates to excavations for below-ground infrastructure, and to inform potential groundwater level drawdown impact assessments. Groundwater quality samples can be collected to inform disposal options and various assessments.

3.1.4 Remediation (not included in this scope of works)

If significant contamination is identified at a site, to a level where the beneficial uses of land, surface water or groundwater are at risk or precluded, remediation of the identified contamination may be required in order to allow for a particular land use to continue or commence in future.

4. Precinct description

General information relating to the Ballarat North PSP area is presented in Table 4-1 below. Refer to Figure 1 for Site location map and Figure 2 for Site layout plan found in Appendix A.

Table 4-1. Overview of Ballarat North PSP area

Summary of precinct description details

Item	Details
Location / Address	The Ballarat North PSP area is located approximately eight kilometres from the Ballarat Central Business District, Ballarat City, Victoria 3350.
Extent (Approximate)	North-western extent at 37.476716°S ,143.806693°E South-western extent at 37.506302°S, 143.806031°E North-eastern extent at 37.501604°S 143.845490°E South-eastern extent at 37.518810°S, 143.841785°E
Site Area (ha)	The actual PSP boundary has not yet been confirmed. The site area includes the core area and the expanded area. At the time of this report, it is yet to be determined whether the expanded area will be included in the PSP. Notable features found within the assessed PSP area include Mount Rowan, Burrumbeet Creek, Ballarat North Wastewater Treatment Plant, former Wendouree Tip, Ballarat Town Commons, Equine precinct, Miners Rest and Macarthur Park Wetlands, agricultural pastures, and patches of established vegetation.
Local Council	City of Ballarat
Zoning	The entire "core area" has been rezoned to Urban Growth Zone (UGZ) while the "expanded area" is currently classified as Farming Zone (FZ).
Zoning of Surrounding Land	▪ Rural Living Zone (RLZ) ▪ Transport Zone 2 - Principal Road Network (TRZ2) ▪ General Residential Zone - Schedule 1 (GRZ1) ▪ Public Use Zone - Service and Utility (PUZ1) ▪ Special Use Zone - Schedule 13 (SUZ13) ▪ Farming Zone (FZ) ▪ Industrial 1 Zone (IN1Z) ▪ Mixed Use Zone (MUZ) ▪ Public Park and Recreation Zone (PPRZ) ▪ Special Use Zone - Schedule 7 (SUZ7) ▪ Public Use Zone – Education (PUZ2) ▪ Industrial 3 Zone (IN3Z) ▪ Special Use Zone - Schedule 14 (SUZ14) ▪ Special Use Zone - Schedule 6 (SUZ6) ▪ Transport Zone 1 - State Transport INFRASTRUCTURE (TRZ1)
Overlays	The following overlays apply to Ballarat North PSP area : ▪ Erosion Management Overlay (EMO) ▪ Environmental Audit Overlay (EAO) ▪ Environmental Significance Overlay – Schedule 2 (ESO2)

Item	Details
	▪ Floodway Overlay (FO) ▪ Specific Controls Overlay (SCO1) ▪ Bushfire Management Overlay (BMO) ▪ Environmental Significance Overlay – Schedule 4 (ESO4) ▪ Design and Development Overlay – Schedule 18 (DDO18) ▪ Significant Landscape Overlay (SLO) ▪ Land Subject to Inundation Overlay (LSIO)
Extractive Industry Investigation Areas (EIIAs)	Based on DEECA Earth Resources (GeoVic) database, there is one EIIAs within the Ballarat North PSP area, namely EIIA 884066, which intersects a small portion of the northern extent of the PSP area. Mapping is available via: ▪ https://earthresources.vic.gov.au/projects/extractive-industry-priority-project-list. According to Appendix 1 of Geological Survey Victoria Technical Record 1997/3, EIIAs – Ballarat Supply Area (areas within a 30 kms radius of Ballarat), there were 20 work authorities issued at the time of reporting in June of 1997 mostly for the extractive industry operations of sand/gravel, basalt, and clay/shale.
Ramsar	There are no Ramsar sites located within the Ballarat North PSP area. In addition, the same observation is true outside of the PSP's boundaries (1000-m buffer area).
Site Layout	The Ballarat North PSP area is an irregularly shaped polygon landmass bounded by Sharpes Road, Garland Road, and Raglan Street to the north, sections of Western Freeway to the south, Howe Street and Waterford Drive to the west, and sections of Gillies Road and Midland Highway to the east. The Ballarat North PSP area also adjoins the Central Highlands Water wastewater treatment plant (also known as Ballarat North Water Reclamation Plant), which is located to the south, adjacent to the Western Freeway. It is partially intersected by an Extractive Industry Interest Area (EIIA) to the northeast of the site, adjacent to the Gillies Road boundary and it is in proximity to the Ballarat airport which is located approximately 3 km to its southwest. In addition, the Ballarat-Maryborough Railway line is located within the 1000-m buffer zone. The highest elevation is located at Mt. Rowan at approximately 500 m.
Current Land Uses	Land use in the Ballarat North PSP area is mostly residential and commercial with decades-long history of agriculture and mines-related land use.
Proposed Land Uses	The Ballarat North PSP area has been identified as an area to be developed primarily for use as a residential area, supplemented by non-residential components to foster the growth of a self-sufficient community. The non-residential components will include but is not limited to retail areas, new educational facilities, and protection and enhancement of Burrumbeet Creek, the Ballarat Town Commons and Mount Rowan.
Surrounding Land Uses	The Ballarat North PSP area is surrounded by the following land uses: ▪ North – Low-density residential and commercial area including vacant agricultural lots ▪ West – Medium to high density residential and commercial area including some vacant agricultural lots. The Burrumbeet Creek Corridor is prominent at the western boundary. ▪ South – Medium to high density residential and commercial area including some industrial entities such as the Ballarat North Water Reclamation Plant and the 8.2 MW Solar Farm of McCain Foods.

Item	Details
	▪ East – Low-density residential and commercial area including vacant agricultural lots. At the north-eastern portion lies Mount Rowan and within the 100-m buffer area is Ballarat-Maryborough Railway line.

5. Environmental setting

Information on the general environmental setting of the Ballarat North PSP area is outlined in the following sections.

5.1 Regional geology

According to the Resources Victoria GeoVic online 1:50,000 Seamless Map Victoria, the study area is predominantly underlain by igneous rock units of the Newer Volcanic Group which comprises basalt (Neo) and scoria (Nes) characterised by widespread lava inundation from several local eruption centres e.g. Mount Rowan. The igneous rock units are variably weathered and are capped by variable thickness of residual soil. Quaternary-aged alluvial deposits (Qa1) and colluvial (Qc1) deposits are present around watercourses that are incised into outcropping igneous rock units. Swamp and lake deposits (Qm1) are recorded in the far north-west corner of the study area.

The predominant basement bedrock unit for the area is the Lancefieldian-aged Castlemaine Group (Qcl), that underlies the Newer Volcanic Group and is mapped at the surface in the far eastern part of the study area. Tertiary to Quaternary aged colluvial deposits (Nc1) are present on slopes and at the base of the Castlemaine Group hills.

The geological units in the vicinity of the study area extracted from the map are summarised in Table 5-1 below and shown in Figure 5-1.

Table 5-1. Summary of the geological units within the study area in accordance with 1:50,000 Seamless Map Victoria

Geological Unit	Symbol	Geologic history	Description
Quaternary	Qm1	Swamp and lake deposits	Carbonaceous mud, silt, clay, minor peat
	Qa1	Alluvium	Gravel, sand, silt: variably sorted and rounded
	Qc1	Colluvium	Diamictite, gravel, sand, silt, clay, rubble: sorting variable, usually poor; generally poorly rounded; clasts locally sourced; includes channel deposits with better rounding and sorting
Quaternary-Tertiary		Newer Volcanic Group	Basalt flows and scoria deposits
	Nc1	Incised Colluvium	Gravel, sand, silt and clay, containing clasts of sandstone, slate and vein quartz from bedrock
Ordovician	Ocl	Castlemaine Group - Lancefieldian	Marine sandstone, mudstone, black shale and minor granule quartz conglomerate

Note:

The geological units identified in the GeoVic online database align generally with the historical Geological Survey of Victoria maps, specifically the Ballarat (1:50,000 scale, 1996) and Creswick (1:50,000 scale, 2000) maps.

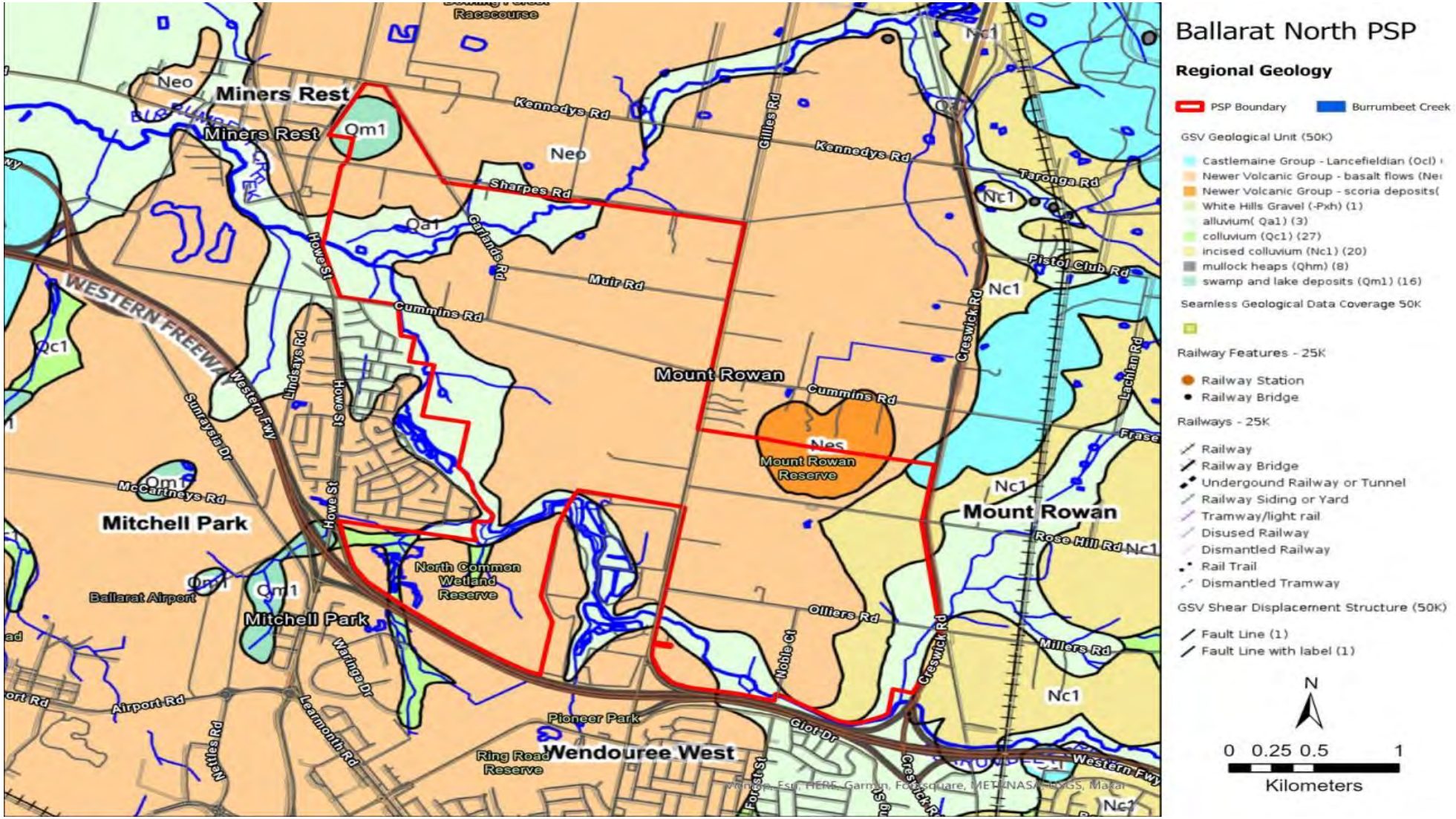

Figure 5-1. Extract of 1:50,000 Seamless Map Victoria

5.2 Topography

According to the Victorian government's public 10 metre resolution dataset as shown in Figure 5-5, the study area exhibits a gently undulating terrain. The natural ground surface on the eastern side of Gillies Road slopes gradually from 440 meters Australian Height Datum (m AHD) in the southern region near Burrumbeet Creek to 480 m AHD in the northern area at the base of Mount Rowan. From there, the elevation sharply rises to 510 m AHD at the summit of Mount Rowan. Additionally, the site features irregular elevations and depressions along its west-to-east axis. The land gently slopes from the west, near Burrumbeet Creek, towards Mount Rowan, and then gradually descends from the middle of the site towards the east, near the Midland Highway.

5.3 Regional acid sulfate soils

Based on the October 2023 Lotsearch report, a copy of which is presented in Appendix B (referencing the Atlas of Australian Acid Sulfate Soils), the probability of occurrence of acid soil sulfate within the Ballarat North PSP area is extremely low (defined as a 1% to 5% chance occurrence in small, localised areas).

5.4 Regional hydrology

5.4.1 Overview of regional hydrology

The Ballarat North PSP area is within the catchment area managed by the Glenelg Hopkins Catchment Management Authority (GHCMA). The relevant service providers for this area include Central Highlands Water as the urban water corporation, and Southern Rural Water as the rural water corporation.

The main hydrological feature near the Ballarat North PSP area is a waterway called Burrumbeet Creek which drains to Lake Burrumbeet approximately 25 km downstream of the site. North-Central Highlands CMA and Corangamite CMA are adjacent to the Burrumbeet Creek catchment; however, they do not overlap with the site footprint (Figure 5-2).

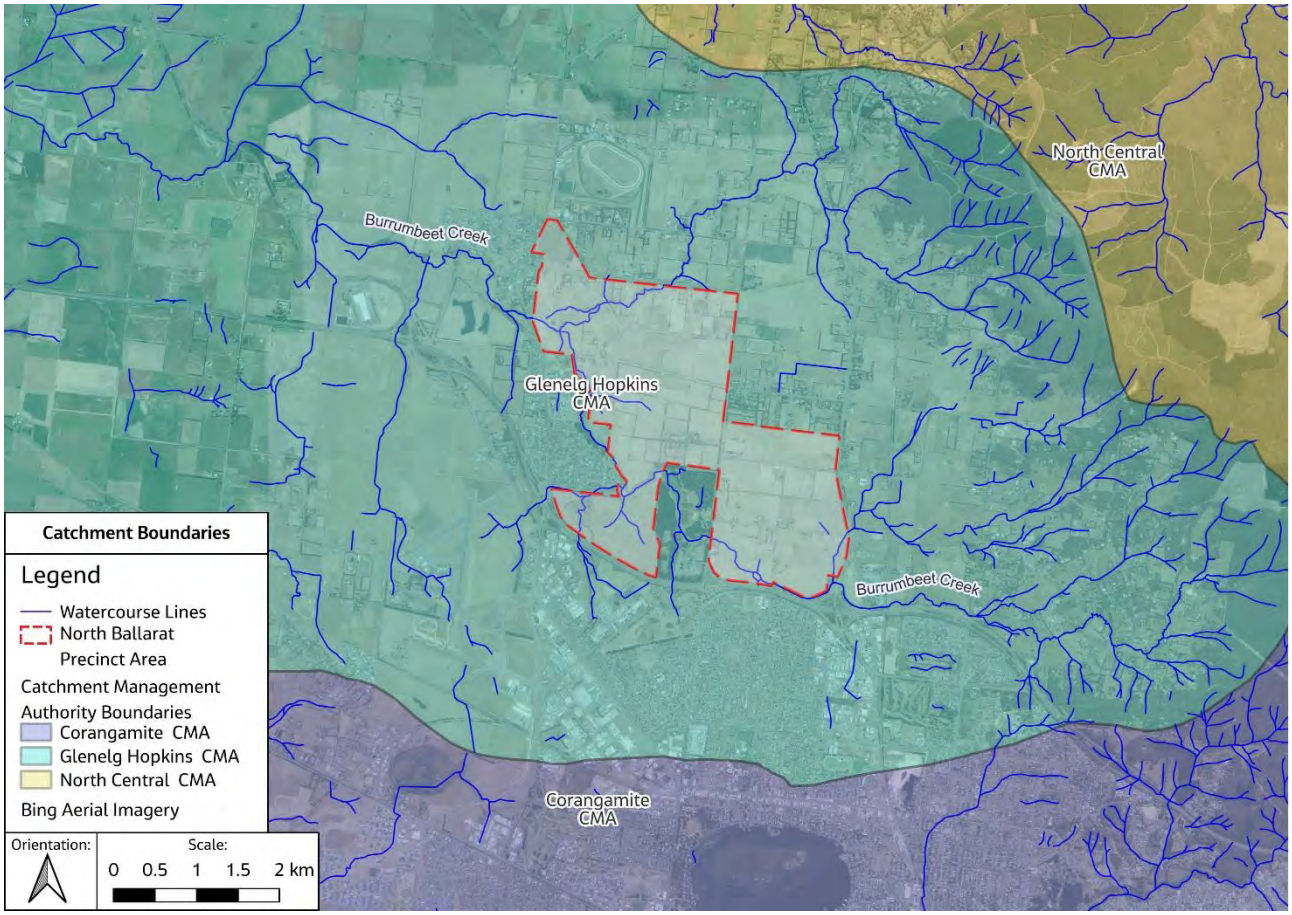

Figure 5-2. Catchment management authority boundaries near North Ballarat Precinct area

Publicly available drainage asset information from the City of Ballarat indicates that there is limited drainage infrastructure within the site.

Therefore, under existing conditions overland flow paths govern the movement of water through the site.

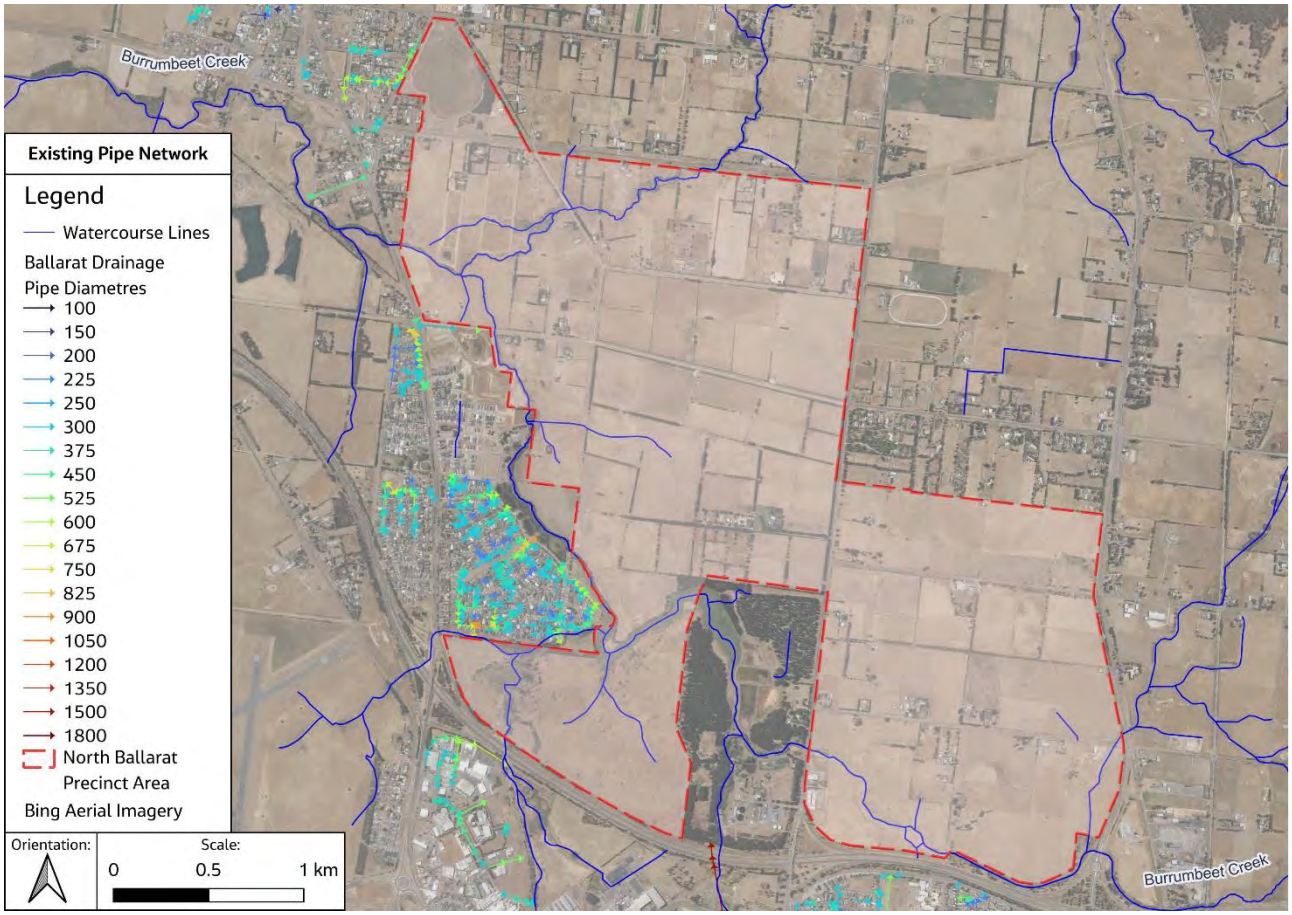

Figure 5-3. Existing council pipe network

5.4.2 Flooding overlays and flood extents

Flooding overlays and flood extents for the Ballarat North Precinct were available through the Planning Scheme, and the GHCMA Flood Portal. The studies and overlays which were reviewed to understand potential flood risk include:

- Burrumbeet Flood Investigation (Water Technology, 2013)
- Land Subject to Inundation Overlay (LSIO)
- Flood Overlay (FO)

The sources for these studies and overlays are provided in Section 6.4.

Results for the 1% Annual Exceedance Probability (AEP) event shows that the Burrumbeet Creek catchment drains through the Ballarat North PSP area, and that parts of the Ballarat North PSP area are at risk of inundation from riverine flooding (Figure 5-4).The results of the riverine flood study do not inform the level of risk of local stormwater flooding throughout the site.

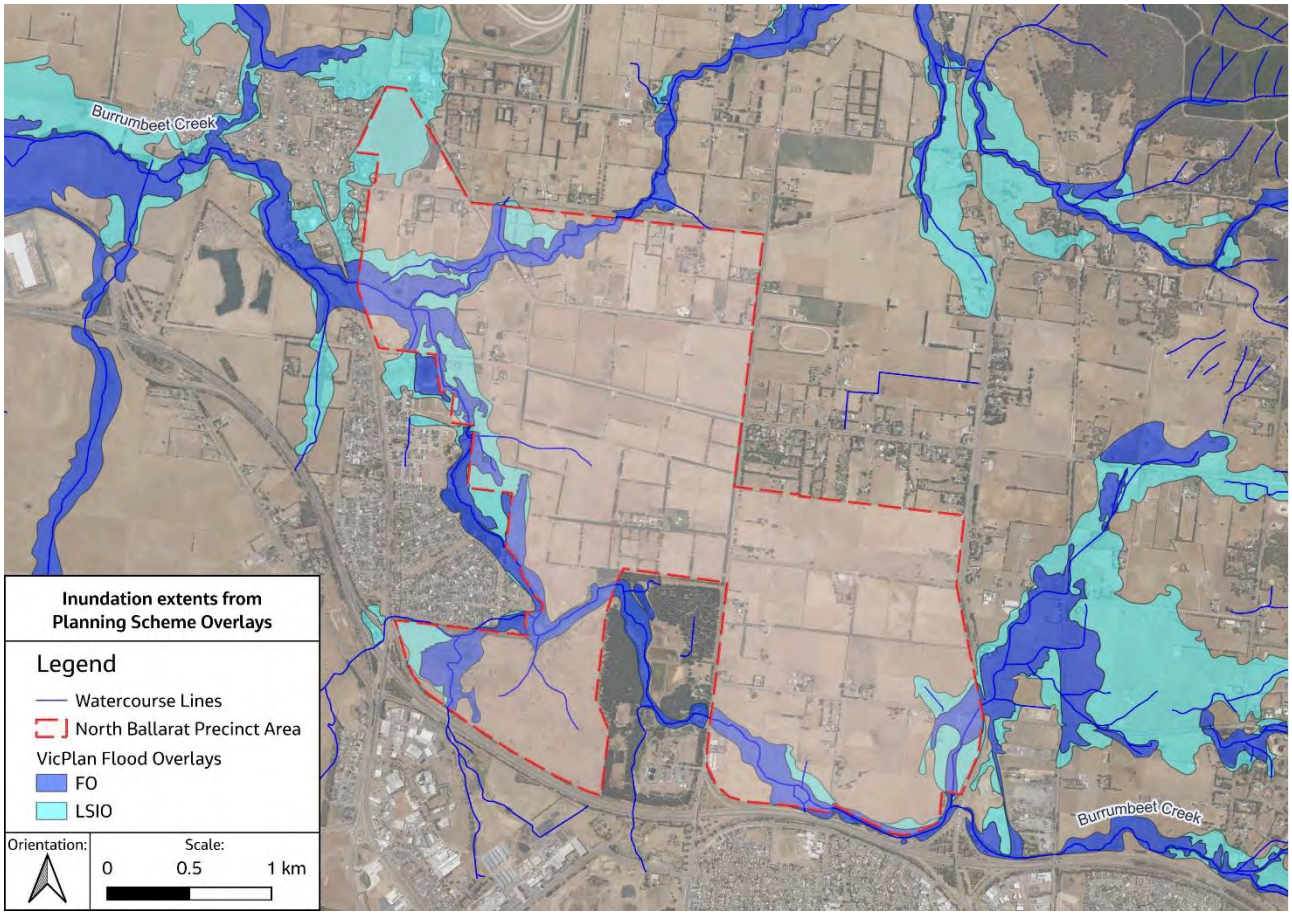

Figure 5-4. Planning scheme flooding overlays

5.4.3 Catchment topography and flow regime

The land in the vicinity of the Ballarat North PSP area generally slopes East to West with local overland flow paths draining to Burrumbeet Creek. Figure 5-5 shows the local topography and watercourse lines.

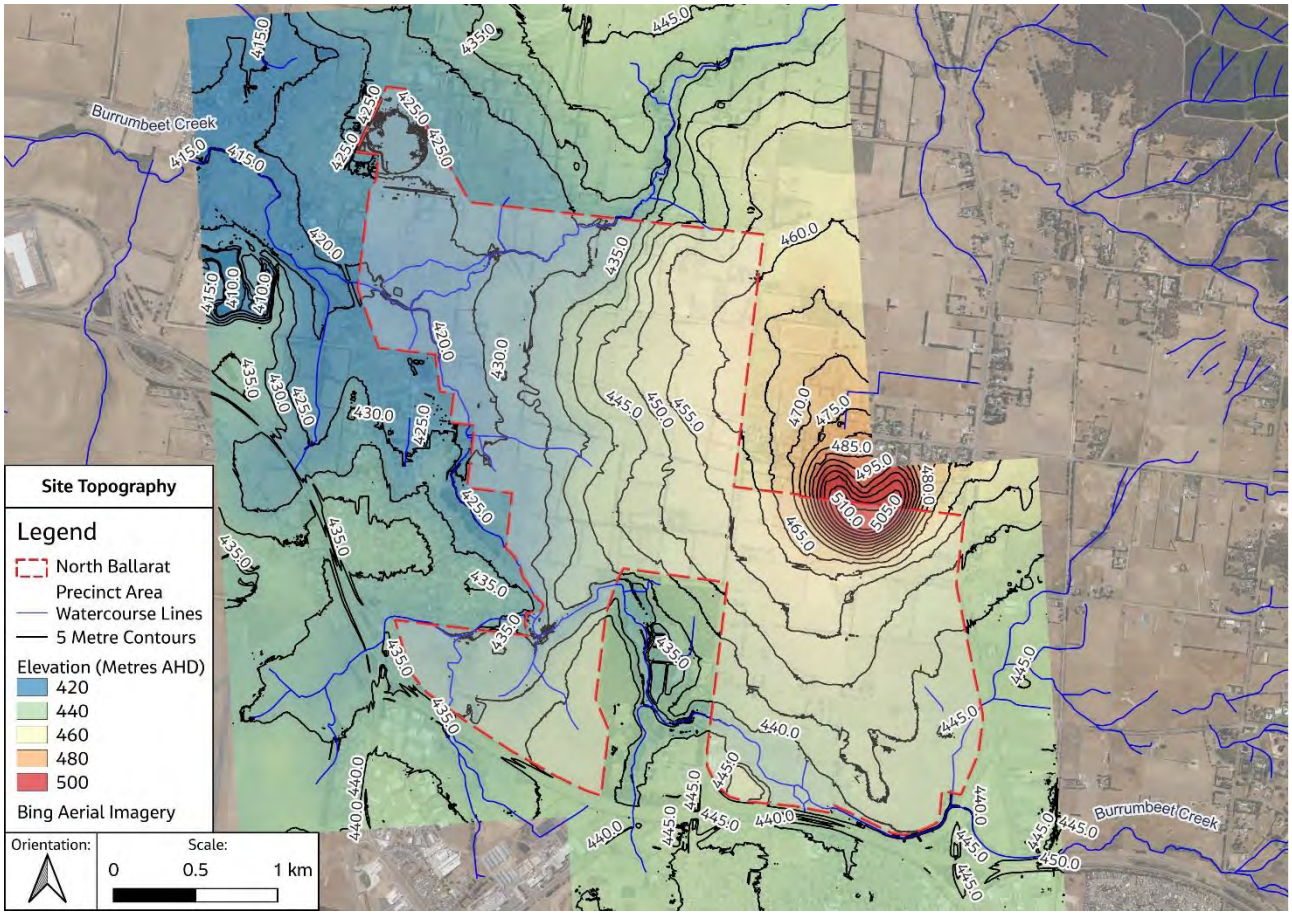

Figure 5-5. Local topography from the Victorian government's public 10-metre resolution dataset (Regional Towns - Ballarat LiDAR 2019)

The City of Ballarat has made some information publicly available which shows the location of the local drainage network. This dataset shows that minimal drainage infrastructure is present within the North Ballarat Precinct area. However, proposed assets including pipes and detention basins are being planned to the west and south of the Ballarat North PSP area.

The drainage assessment report which contains details on proposed drainage assets is in draft and the time of submitting this report, therefore assessment of the flow regime is limited to existing flow paths only for this report. The existing area is mostly rural, and it is likely that overland flow paths dominate the current flow regime. Figure 5-6 shows the current overland flow paths along with site contours, local drainage asset locations, and waterways.

Future development in the area has the potential to influence existing overland flow paths in addition to impacting the project area drainage strategy and imperviousness. Proposed changes to local overland flow paths as a result of new development within the site must not block existing flow paths or impact flow conveyance.

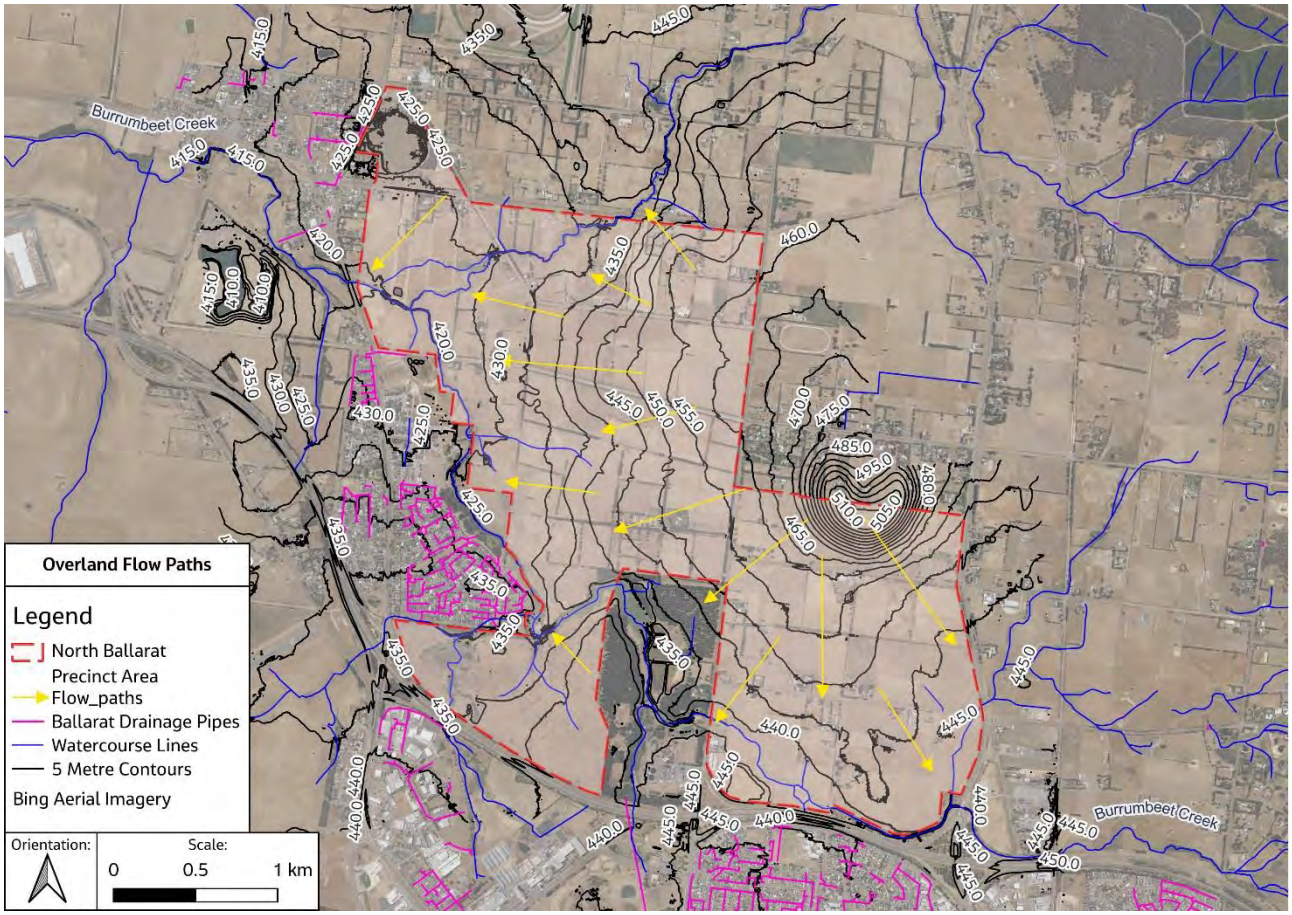

Figure 5-6. Overland flow paths and contours for the Ballarat North PSP area

5.4.4 Assumptions and limitations of due diligence desktop study

This assessment was carried out based on limited available data and information including but not limited to aerial imagery, public topography data, public asset information, local flood studies, flooding overlays, and VicPlan overlays. A summary of the available studies and information reviewed for this desktop due diligence assessment is provided in Section 6.4.

The following assumptions and limitations apply to this desktop due diligence assessment:

- Feature survey has not been provided or undertaken for this assessment
- Public data referenced in this assessment has not been quality controlled
- Drainage data available at the time of this assessment was in draft and not appropriate to produce conclusions on the underground flow paths in the vicinity of the Ballarat North PSP area.
- Flow paths are based on existing contours pre-development.

Information provided on future drainage and development is in draft and high level in nature. Therefore, this desktop due diligence assessment is unable to provide details of the development impacts on the flood storage, flow path, land imperviousness, access safety and hazard, freeboard of the buildings, and drainage strategy. High level comparison of the flood extent represented in the draft report demonstrated fair alignment with the flood extent shown in flood overlays and LSIO. This extent is based on riverine flooding and does not represent the behaviour of local catchments.

Obtaining and assessing more detailed data such as survey data; additional flood study reports, maps, and models; and a site visit may lead to different conclusions in assessing the regional hydrology.

5.5 Regional geomorphology

The Ballarat North PSP area covers a volcanic landscape. The geomorphology and topography have been influenced by volcanic eruptions, lava flows and incision of lava by Burrumbeet Creek. More recently with agricultural development it is expected that the topography and drainage patters have been altered as a result of land levelling, drainage works, farm dams and stream diversions. No site of geological or geomorphological significance are known to exist in the Precinct[2].

The geomorphology of the precinct is described with reference to the Geomorphology of Victoria dataset. A map of the geomorphology units is presented in Figure 5-7 with a summary provided in Table 5-2.. The project area sits within three geomorphological units:

Unit 2.1.6 – Eruption points and volcanic plains of the Western Uplands, Dissected Uplands

This geomorphological unit comprises the newer volcanic basalt landscapes of the Western Uplands with Mt Rowan featuring as a local volcanic eruption point and surrounding larval plains. A swamp is located in the north west corner of the precinct. The basalt plains tend to have heavy clay soils (Vertosols and Sodosols).

Unit 2.1.7 – Terraces and floodplains of the Western Uplands, Dissected Uplands

This geomorphological unit features the terraces and floodplains of the Western Uplands which have formed as the drainage network has incised into the surrounding volcanic landscape. A range of soil types are associated with this geomorphological unit (Sodosols, Vertosols, Dermosols, Tenosols and Hydrosols).

Burrumbeet Creek is the main waterway through the project area. A number of constructed wetlands are present along the creek, some of which are associated with the treatment of water at Ballarat North Wastewater Treatment Plant. Constructed wetlands are also located adjacent to the creek within the vicinity of Waterford Drive. Burrumbeet Creek receives effluent discharge from the treatment plant.

A review of aerial imagery indicates that Burrumbeet Creek has been subject to historical drainage and stream diversions. Stream diversions are present within the vicinity of the storage ponds at Ballarat North Wastewater Treatment Plant and potentially also in the section adjacent to Waterford Drive.

Unit 6.1.5 – Terraces and floodplains of the Western Plains, Volcanic Plains

This geomorphological unit is present in the south western part of the precinct area. The unit comprises the terraces and floodplains of the Western Plains. A range of soil types are associated with this geomorphological unit (Vertosols, Sodosols and Dermosols).

Burrumbeet Creek traverses this geomorphological unit, the form of which appears to have been altered through drainage works and stream diversions.

[2] https://vro.agriculture.vic.gov.au/dpi/vro/coranregn.nsf/pages/cor_sites_sig

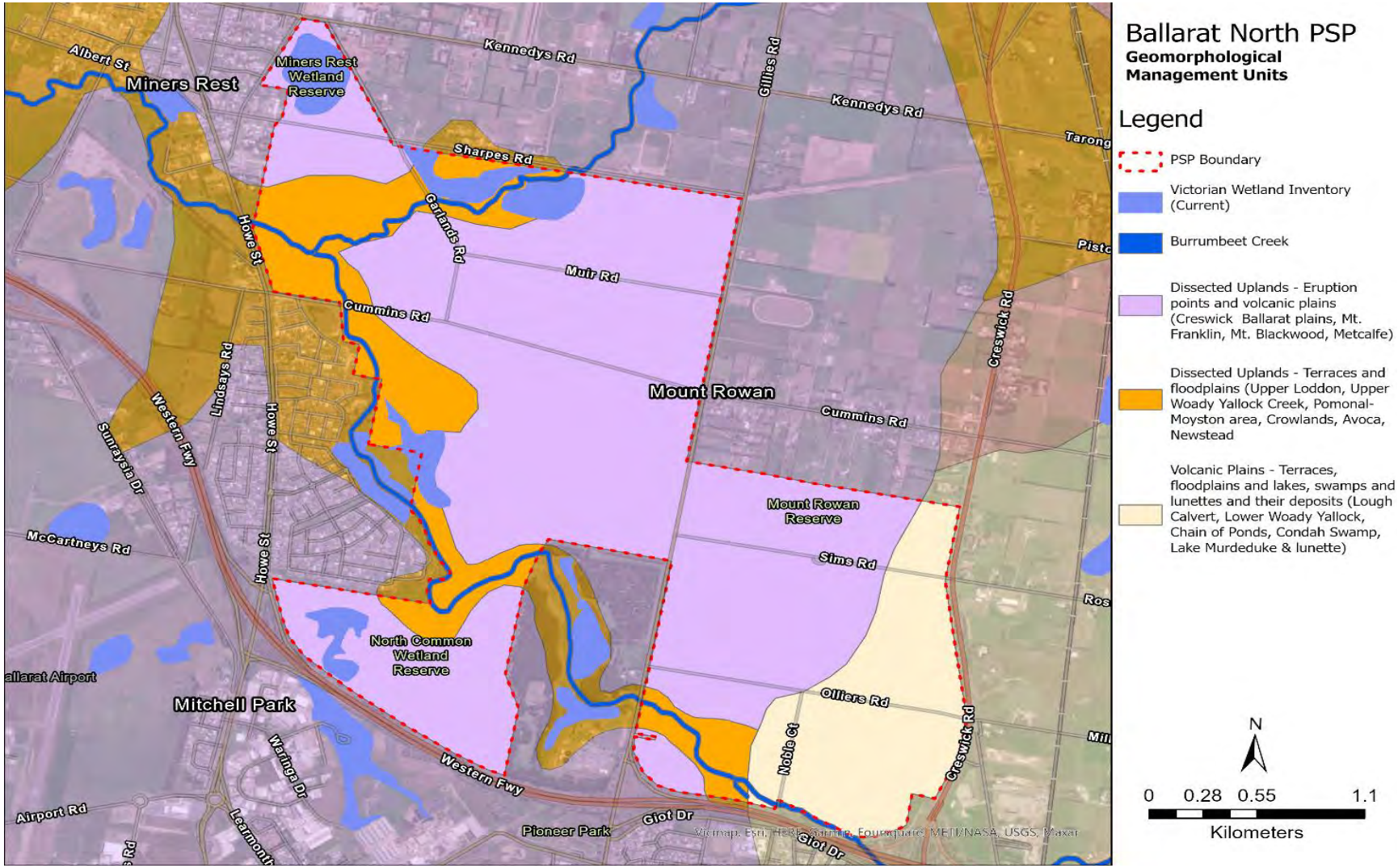

Figure 5-7. Geomorphology management units of the study area

Table 5-2. Characteristics of geomorphology management units

Unit ID	Description	Lithology	Erosion susceptibility				Associated soil types
			Sheet/Rill	Gully	Landslip	Wind	
2.1.6	Eruption points and volcanic plains of the Western Uplands, Dissected Uplands	Basalt	Moderate	Low	Low	Low	Cracking clays soils (Vertosols) and sodic brown, yellow and grey texture contrast soils (Sodosols).
2.1.7	Terraces and floodplains of the Western Uplands, Dissected Uplands	Alluvium	Low	Moderate	Very Low	Low	Range from texture contrast, generally sodic (Sodosols) to gradational earths and occasional clay (Vertosols, Dermosols) and sandy soils (Tenosols). Some soils may be waterlogged prone for at least 3 months of the year (Hydrosols).
6.1.5	Terraces and floodplains of the Western Plains, Volcanic Plains	Alluvium	Low	Moderate	Low	Low	Black and grey self-mulching and cracking clays (Vertosols), black (and some red) sodic texture contrast (Sodosols) and dark loam soils (Dermosols)

Information on soil types in the precinct has been derived from regional (Baxter and Robinson, 2001; Maher and Martin, 1987; Robinson et. al 2003) and state wide mapping[3]. Across the precinct soils have been classified according to the Australian Soil Classification as mostly Brown Chromosols and Red Dermosols, with some smaller areas of Grey Vertosols and Brown Sodosols. A map of the soil types is presented in Figure 5-8 with a summary provided in Table 5-3.

Chromosols and Sodosols have strong texture contrasts between the surface A horizon and the subsoil horizons. The subsoil of Sodosols are sodic whilst Chromosols are generally non sodic. Regardless of sodicity, we have found based on studies completed elsewhere in the Melton East Precinct that both soil types are dispersive (Jacobs, 2023a). Further analysis of Vertosol and Dermosol soil types in Merrifield North, Parwan Precinct and Parwan Employment Precinct also showed that these have dispersive characteristics (Jacobs 2023b, 2023c, 2023d).

Sodic and dispersive soils are susceptible to problems of waterlogging and erosion as a result of their physical structure and chemical composition. Dispersion degrades soil structure, which is more frequently a problem with subsoil horizons that are often relatively impermeable and become prone to gullying and tunnel erosion.

[3] Victorian Soil type mapping - Dataset - Victorian Government Data Directory

This erosion risk is increased in circumstances where the surface soil has been removed and the subsoils are then exposed.

There is increasing awareness that urban development in areas that have these geologies and soil types is an issue both in the construction phase and in the ongoing management of waterways. During the construction phase of development, vegetation is cleared and surface soils may be removed, exposing subsoils to rainfall. Erosion risks are potentially heightened along incised drains and connecting streams, as the amount of runoff to these waterways is increased as a result of increased stormwater runoff from impervious areas (roads, roofs). There is also more pressure on existing streams to drain water from their catchment areas (Duncan et al 2014; Jacobs 2016, 2019).

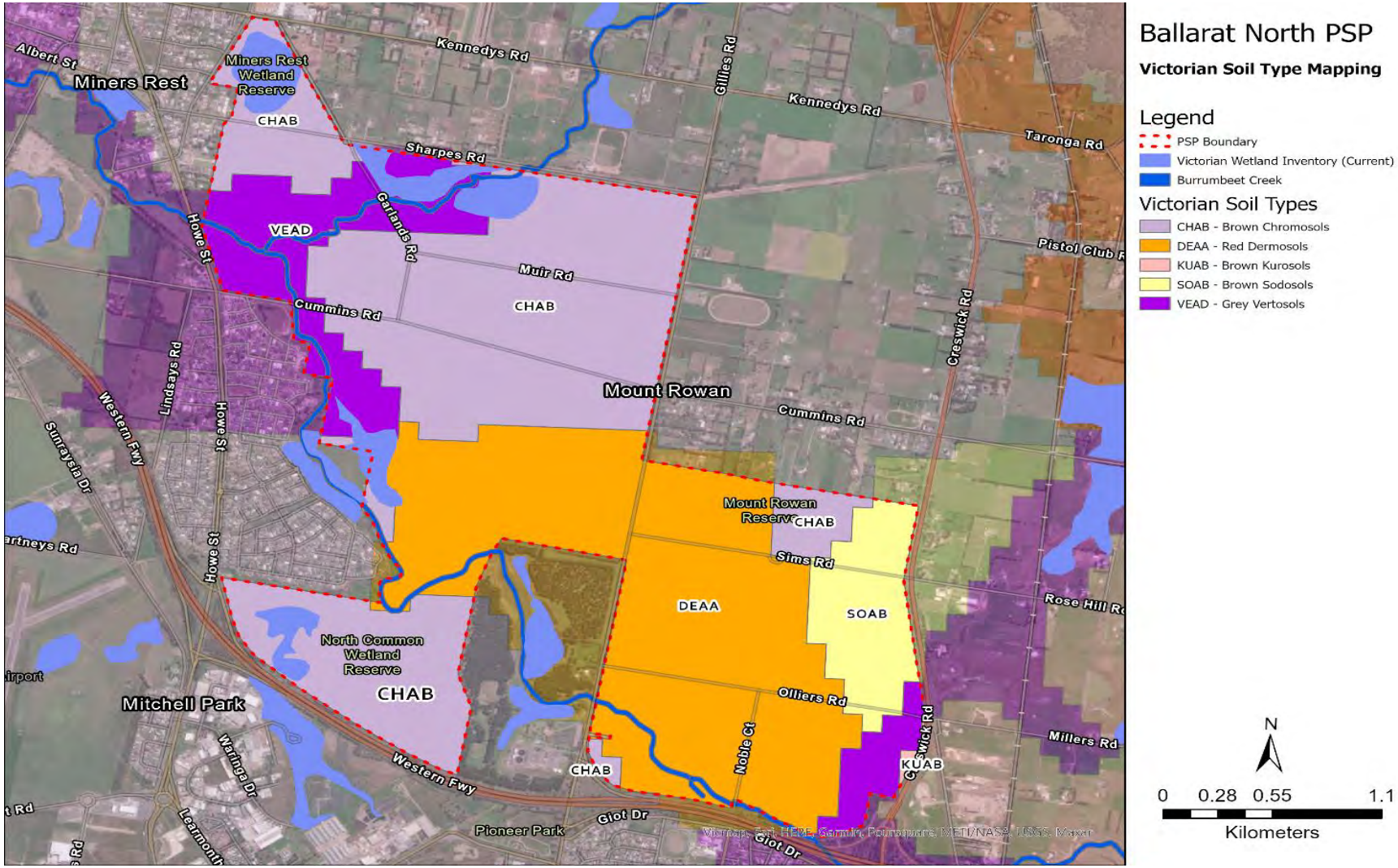

Figure 5-8. Soil types across the study area

Table 5-3. Description of soil types

Soil type	Description
Brown Chromosols	Chromosols are soils that have strong texture contrast between the surface (A) horizons and the clay subsoil (B) horizons. The subsoil is also not strongly acid i.e. pH is greater than 5.5 in water. Chromosols are most common on sedimentary plains and rises. Chromosols also occur in some areas on basalt and volcanic ash/scoria deposits, where they often have dark subsoils.
Red Dermosols	Dermosols are soils lacking strong texture contrast between surface (A) horizons and the upper subsoil (B21) horizon. The subsoil also displays reasonable soil structure development i.e. moderate to strong pedality.
Grey Vertosols	Vertosols are clay soils that display significant shrinking and swelling during wetting and drying cycles i.e. display vertic characteristics. They exhibit strong cracking when dry and at depth have slickensides and/or lenticular peds. Due to the strongly vertic nature of these soils, gilgai i.e. 'crabholey' microrelief is common. Vertosols are most extensive on basalt plains and rises as well as on some alluvial plains, swamps and lunettes. Grey Vertosols can occur throughout the basalt plains and often have self-mulching surfaces, although more coarsely structured surface soils also occur. Subsoils are often sodic and can be calcareous at depth, often with visible free lime, both soft and as calcareous nodules.
Brown Sodosols	Sodosols are soils that have strong texture contrast between the surface (A) horizons and the clay subsoil (B) horizons. The subsoil is sodic not strongly acid i.e. pH is greater than 5.5 in water. Sodosols are common on basalt plains and rises. Subsoils of Sodosols often display a strong shrinking and swelling characteristic i.e. vertic, and the subsurface horizons can be ferric i.e. contain significant amounts of ferruginous nodules 'buckshot'. The sodic subsoils often disperse and are usually dense and coarsely structured.

5.6 Regional and local hydrogeology

5.6.1 Overview of regional hydrogeology

The precinct area is characterised by three main aquifer units. These are summarised below with reference to the Victorian Aquifer Framework (VAF) (GHD, 2012) and shown in a conceptual hydrogeological cross section in Figure 5-9 below.

Quaternary Alluvium Aquifer (QA – 100) is present near Burrumbeet Creek where it traverses through the precinct area's northern parcels, and around the south-eastern margins of the precinct area. The alluvium is mapped as up to about 400 m wide where it traverses through the precinct area's northern parcels. In the southeast, it extends into the precinct area by about 50 m to 600 m. Seamless Geology mapping within Visualising Victoria's Groundwater (FedUni, 2015) describes the alluvium as comprising silt, sand and gravel. GHD (2012) indicates that the alluvium is thin and typically less than 6 m thick. Groundwater is conceptualised to flow through the pore spaces between the grains of the alluvium. Where it occurs across the precinct area, this unit is likely to typically host the water table. However, as shown in Figure 5-9, there may be exceptions in areas with relatively high ground levels, where the water table may be below the unit.

Upper Tertiary Aquifer (fluvial) (UTAF – 105) outcrops adjacent to the Quaternary Alluvium Aquifer near Burrumbeet Creek where it traverses through the precinct area's northern parcels. The outcropped extent is mapped up to about 500 m wide. GHD (2012) indicates that the aquifer materials comprise fluvial gravel, sand and silt. Where the unit outcrops within the precinct area, the unit is likely to host the water table.

Where the unit does not outcrop within the precinct area, it is present west of near Gillies Road, and underlies the Upper Tertiary/Quaternary Basalt (UTB – 101). It has variable thickness and is up to about 40 m thick. It is underlain by Cretaceous and Palaeozoic Basement (BSE – 114), which is not relevant to the precinct due to its depth.

Upper Tertiary/Quaternary Basalts (UTB – 101) underlie the QA - 100 and outcrop where the QA – 100 is absent and where the UTAF – 105 does not outcrop. UTB – 101 is a fractured rock aquifer in the basalt flows and stony rises of the Newer Volcanics. Groundwater flow in this aquifer is primarily controlled by the size, spacing and interconnectivity of fractures and joints and as such, flow is known to be highly variable. It forms a major regional and local aquifer. GHD (2012) indicates that the UTB – 101 has variable thickness in the precinct area and is up to about 70 m thick. Near the QA – 100 and where the UTAF – 105 outcrops, it is thinner and about 3 m to 5 m thick. It is underlain by UTAF – 105 in the west and by BSE – 114 in the east. This unit is expected to host the water table where it is encountered at the surface.

FedUni (2015) state-wide depth-to-water table mapping (Figure 5-10) indicates that the water table depth is generally 10 to 20 mbgl in the central precinct area, grading to <5 mbgl in the southeast and northwest. There is an isolated area east of Gilles Road where the water table is mapped at >50 mbgl.

The primary recharge mechanism for the local aquifers is conceptualised to be via diffuse rainfall and surface infiltration. Locally, shallow groundwater is likely to contribute baseflow to surface water features and is also expected to be discharging via evapotranspiration in these areas where the water table is shallow and less than a few metres below ground surface.

Contours of the FedUni (2015) water table surface indicate that shallow groundwater system flow is generally to the west in the precinct area. Local groundwater levels and flow directions are discussed in Section 0.

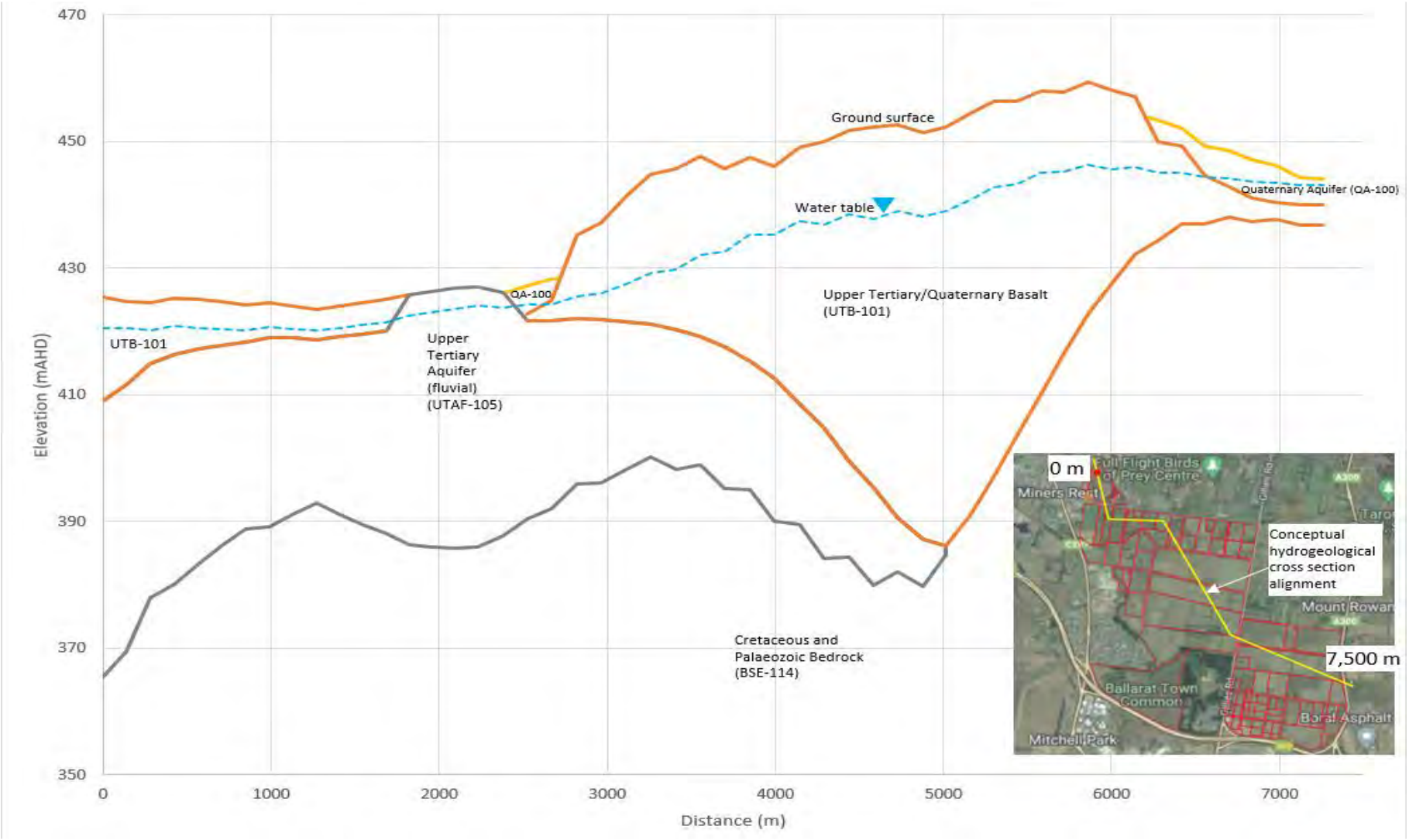

Figure 5-9. Conceptual hydrogeological cross section (data sources: GHD, 2012 and FedUni, 2015)

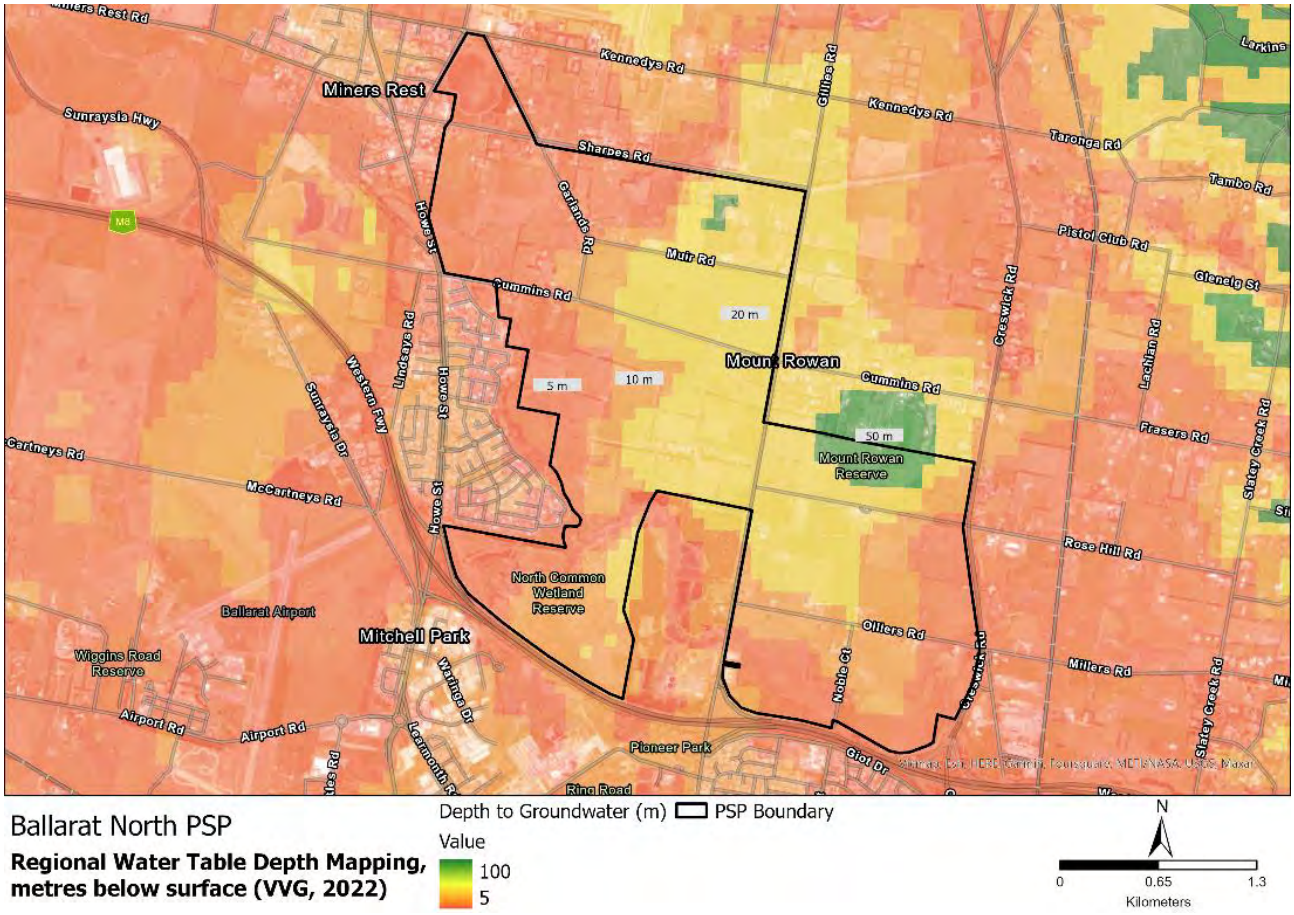

Figure 5-10. Water table depth mapping (FedUni, 2015)

5.6.2 Groundwater-dependent ecosystems

A review of the Atlas of Groundwater Dependent Ecosystems (GDEs) (BoM, 2012) was conducted to identify potential GDEs within the precinct area. The GDE Atlas serves as a national inventory of known and potential GDEs categorised by their degree of reliance on groundwater. The Atlas indicates whether the source data is derived from national or regional studies. National-scale analysis combines GIS data and a set of criteria by which potential GDEs are determined. Regional data sources are generally more detailed studies conducted by state or regional bodies utilising various methodologies, including conceptual models, satellite imagery and field work verification (BoM, 2012). The two types of potential GDEs from the BoM Atlas which are relevant to the precinct area are outlined below:

- Aquatic: defined as ecosystems reliant on surficial expression of groundwater and include surface water ecosystems with a surface-groundwater interaction. Examples include wetlands, springs, and rivers.
- Terrestrial: defined as ecosystems which depend on a subsurface supply of groundwater. These commonly occur as vegetation ecosystems.

The Atlas indicates that the following potential GDEs are present within the precinct area.

Aquatic (Figure 5-11**):**

- The reach of Burrumbeet Creek which traverses near the western precinct boundary is characterised as high potential for GDE and was defined based on national assessment.
- The reach of Burrumbeet Creek in the north of the precinct area, which is a tributary of the reach described above, is characterised as moderate potential for GDE and was defined based on national assessment.

- The majority of the precinct area's most northern parcel (in-between Garlands Road and Raglan Street) has an area of moderate potential for GDE. The potential GDE is characterised as a wetland and was defined based on regional studies. The wetland has a length and width of about 500 m and 350 m, respectively.
- There are four separate tracts of unclassified potential GDEs, all characterised as wetland within the precinct area, and located near two different parts of Burrumbeet Creek. These potential GDEs were defined based on regional studies. The tracts range in area from about 3.1 ha to 8.6 ha.

Terrestrial (Figure 5-12**):**

- There are numerous tracts of moderate and high potential GDEs characterised as 'Plains Grassy Woodland' scattered over the precinct area, the most significant in footprint is a group located near the section of Burrumbeet Creek close to the North Common Wetland Reserve. These potential GDEs were defined based on national assessment.
- There are eight tracts of low potential GDEs characterised as 'Plains Grassy Woodland' scattered within or encroaching into the precinct area. These potential GDEs were defined based on national assessment. The area of each tract within the site or the portion that encroaches into the site is relatively small and generally less than about 2,500 m^2.

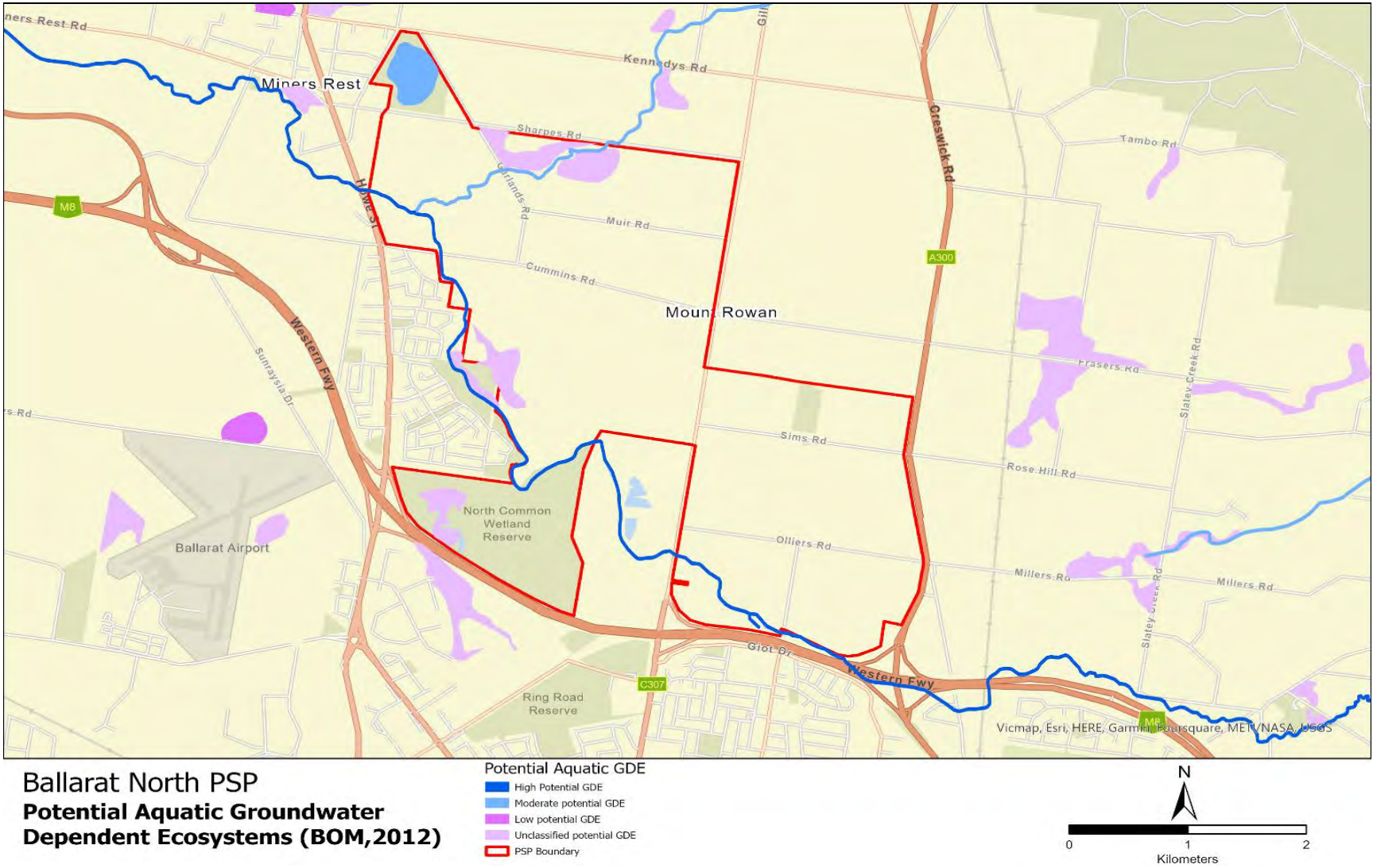

Figure 5-11. Potential aquatic GDEs (BoM, 2012)

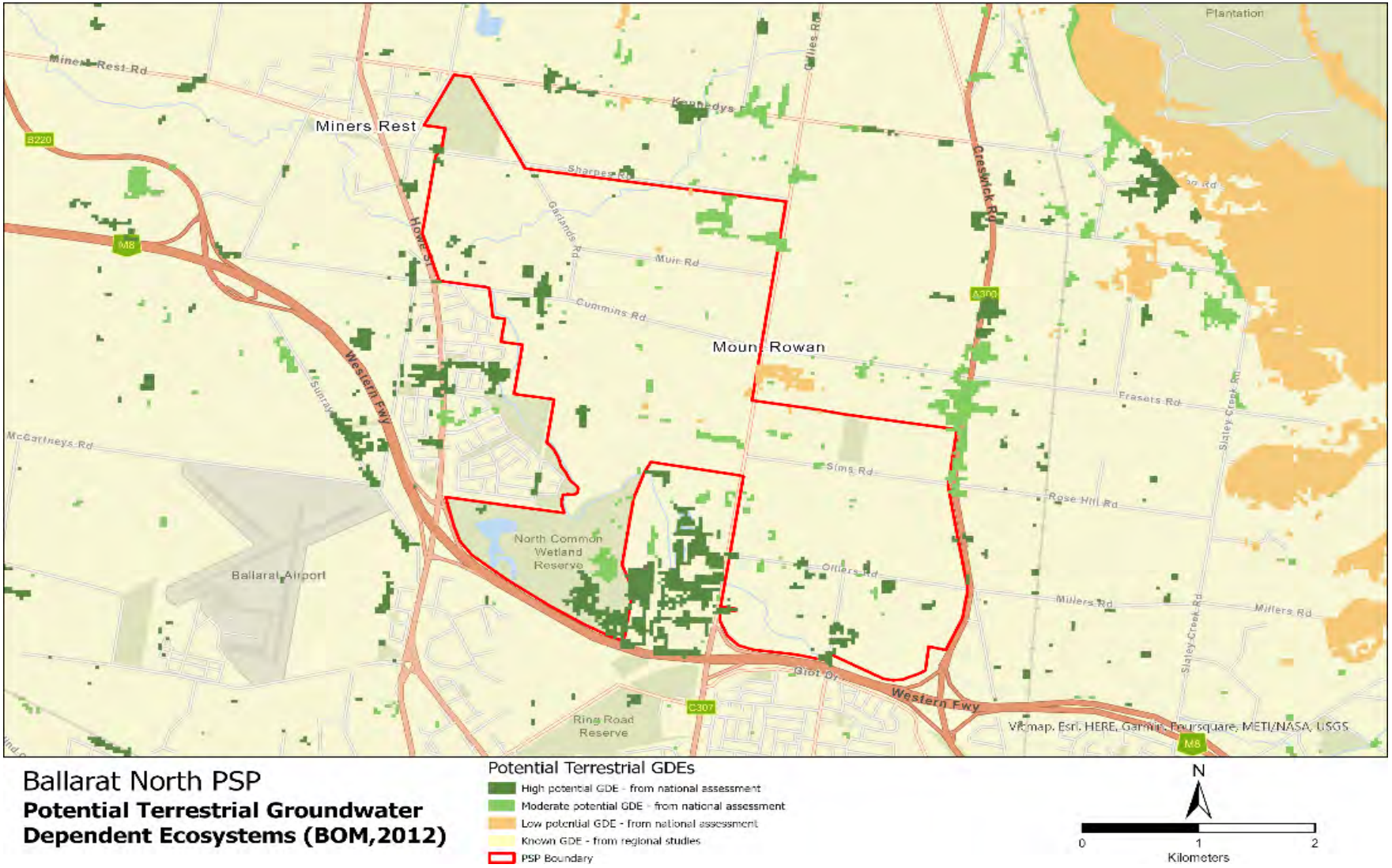

Figure 5-12. Potential terrestrial GDEs (BoM, 2012)

5.6.3 Groundwater users

The BoM's (2023) Australian Groundwater Explorer indicates there are 211 registered bores (Figure 5-13) within 2 km of the precinct area, of which 33 are within the precinct area. Bore use types are summarised in Table 5-4. In Table 5-4, domestic, irrigation and stock are lumped into a single use category to reduce the number of categories and simplify the categorisation. This is because the raw data included mixed use types of 'domestic/stock', 'domestic/irrigation' and 'domestic, irrigation and stock'.

Table 5-4. Registered bore (BoM, 2023) use types

Use	Bore quantity
Exploration and monitoring	90
Domestic, irrigation and stock	61
Unknown	52
Irrigation	6
Industrial	2

The mean, median, 75th percentile and maximum bore depth is 35 m, 15 m, 61 m and 151 m, respectively. Thus, the bores are generally relatively shallow.

Only four of the bores have groundwater level data (BoM, 2023), two of which are either within the precinct area or within 20 m of the precinct area boundary. These groundwater level data are discussed in Section 0.

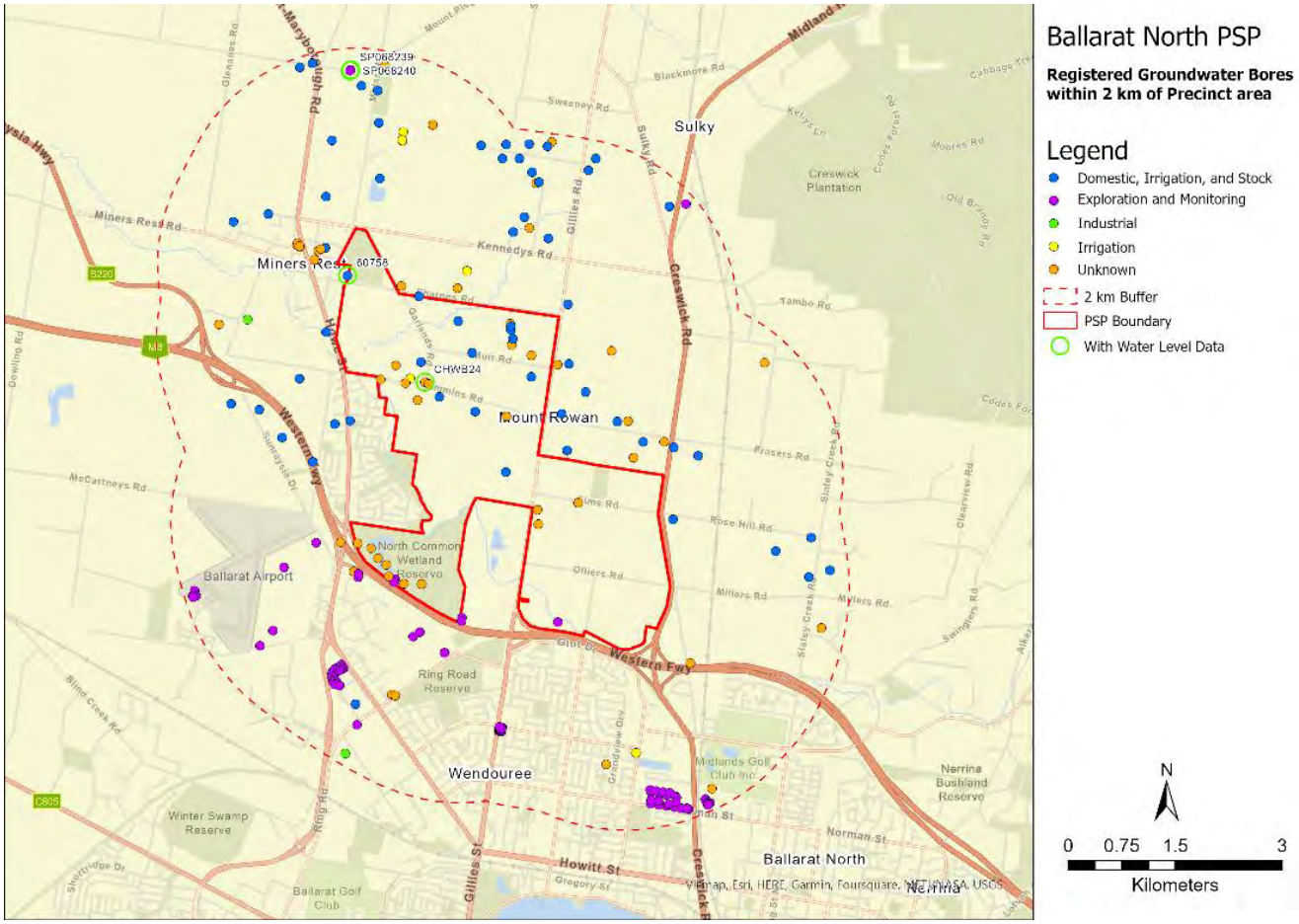

Figure 5-13. Registered bores within 2 km of precinct (data source: BoM, 2023)

5.6.4 Regional groundwater quality

Regional groundwater salinity mapping (Figure 5-14) indicates that groundwater salinity within the precinct area is either in the range of 1,000 to 3,500 mg/L or 3,500 mg/L to 7,000 mg/L (DELWP, 2014).

The environmental value of groundwater is categorised into segments based on geographical areas with corresponding salinity ranges, defined in the Environmental Reference Standard (ERS) (EPA, 2022). The ERS defines environmental values as 'uses, attributes and functions of the environment that Victorians value'. Based on the lower regional groundwater salinity mapping range applicable to the precinct area of 1,000 mg/L to 3,500 mg/L, the most conservative relevant groundwater segment is A2 (601 mg/L to 1,200 mg/L). Under this segment, the following environmental values require protection (EPA, 2022):

- Water dependent ecosystems and species
- Potable water supply
- Potable mineral water supply
- Agriculture and irrigation (irrigation)
- Agriculture and irrigation (stock watering)
- Industrial and commercial use
- Water-based recreation
- Traditional Owner cultural values
- Buildings and structures
- Geothermal properties

A state-wide Salinity Management Overlay (SMO) (DELWP, 2017) has been developed to:

- Identify areas subject to saline groundwater discharge or high groundwater recharge.
- Ensure development is compatible with site capability and the retention of vegetation and comply with the objectives of any salinity management plan for the area.
- Prevent damage to buildings and infrastructure from saline discharge and high-water table.

Planning data has been reviewed and no SMO is identified in the precinct area.

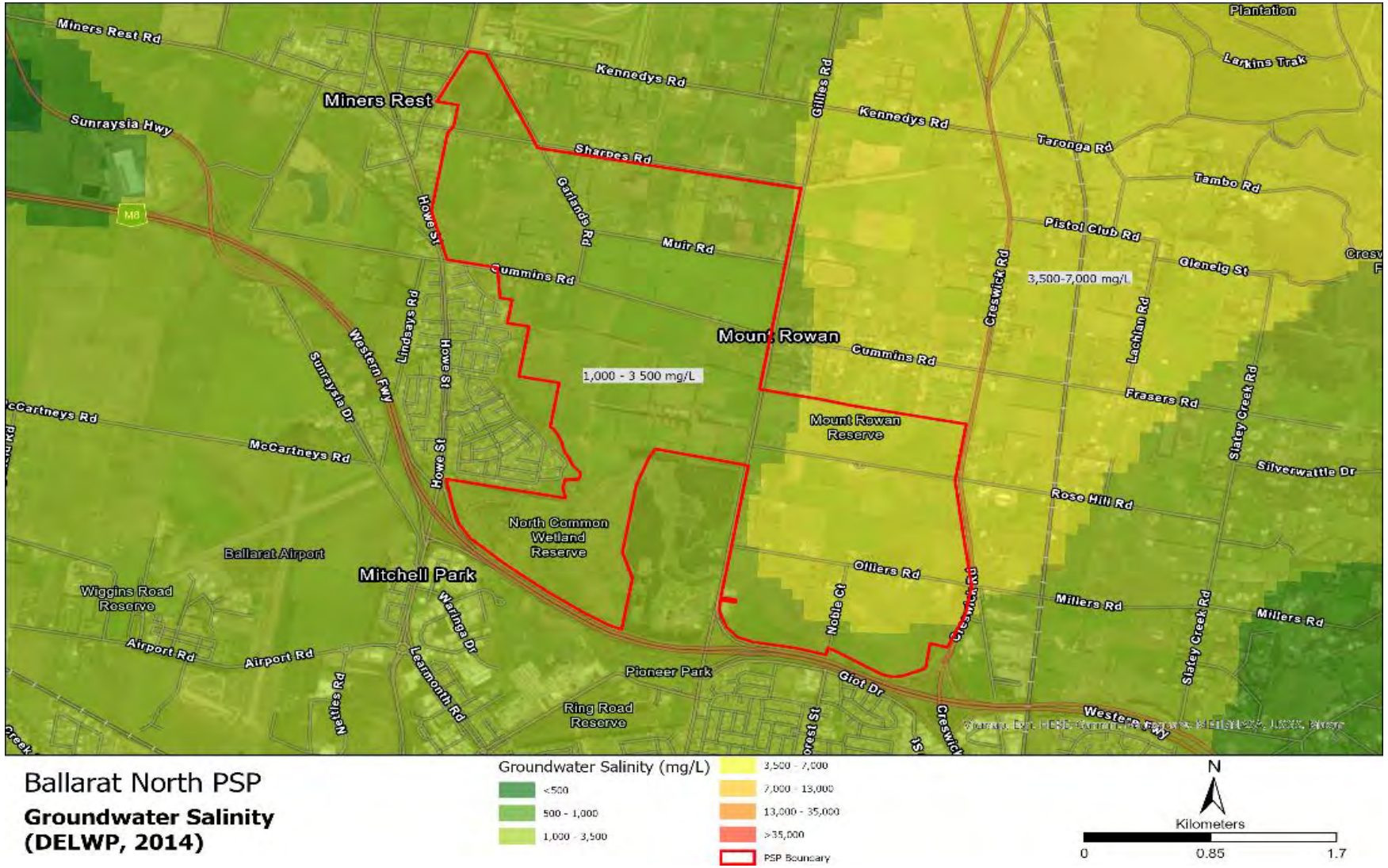

Figure 5-14. Regional groundwater salinity (DELWP, 2014)

5.6.5 Local groundwater quality

Local groundwater salinity was assessed by reviewing the salinity concentrations for bores within 2 km of the precinct area which the BoM (2023) indicated had salinity data. The salinity concentrations were taken from FedUni (2015). Time series salinity data were not reviewed.

A total of 22 bores (Table 5-5) had salinity data. Salinity statistics are summarised in the same table. The salinity concentrations are typically less than indicated by the regional salinity mapping (Section 5.6.4). Five bores had a concentration within the range of 1,000 mg to 3,500 mg/L which the regional mapping indicated was applicable for the west and south of the precinct area, and the maximum value of 3,103 mg/L was below the range of 3,500 mg/L to 7,000 mg/L that the regional mapping indicated for the east of the precinct area.

Based on the median and mean salinity concentrations of 620 mg/L and 845 mg/L, respectively, the groundwater segment is A2 (601 mg/L to 1,200 mg/L TDS) and aligns with the segment that was adopted based on regional salinity mapping.

It is noted that individual bore hydrostratigraphy was not reviewed in relation to the salinity concentrations. However, the majority of bores with salinity values are assumed to be sourcing groundwater from the basalt, based on surface geological mapping and the bore locations.

Table 5-5. Local groundwater salinity statistical summary (data source: FedUni, 2015)

Statistic	Salinity (mg/L) or quantity
Total number of samples that statistics are based on	22 [quantity]
Minimum	125
5th percentile	368
25th percentile	454
Median (average)	620
Mean (average)	845
75th percentile	679
95th percentile	2,258
Maximum	3,103
Total number of samples with salinity >1,000 mg/L	5 [quantity]

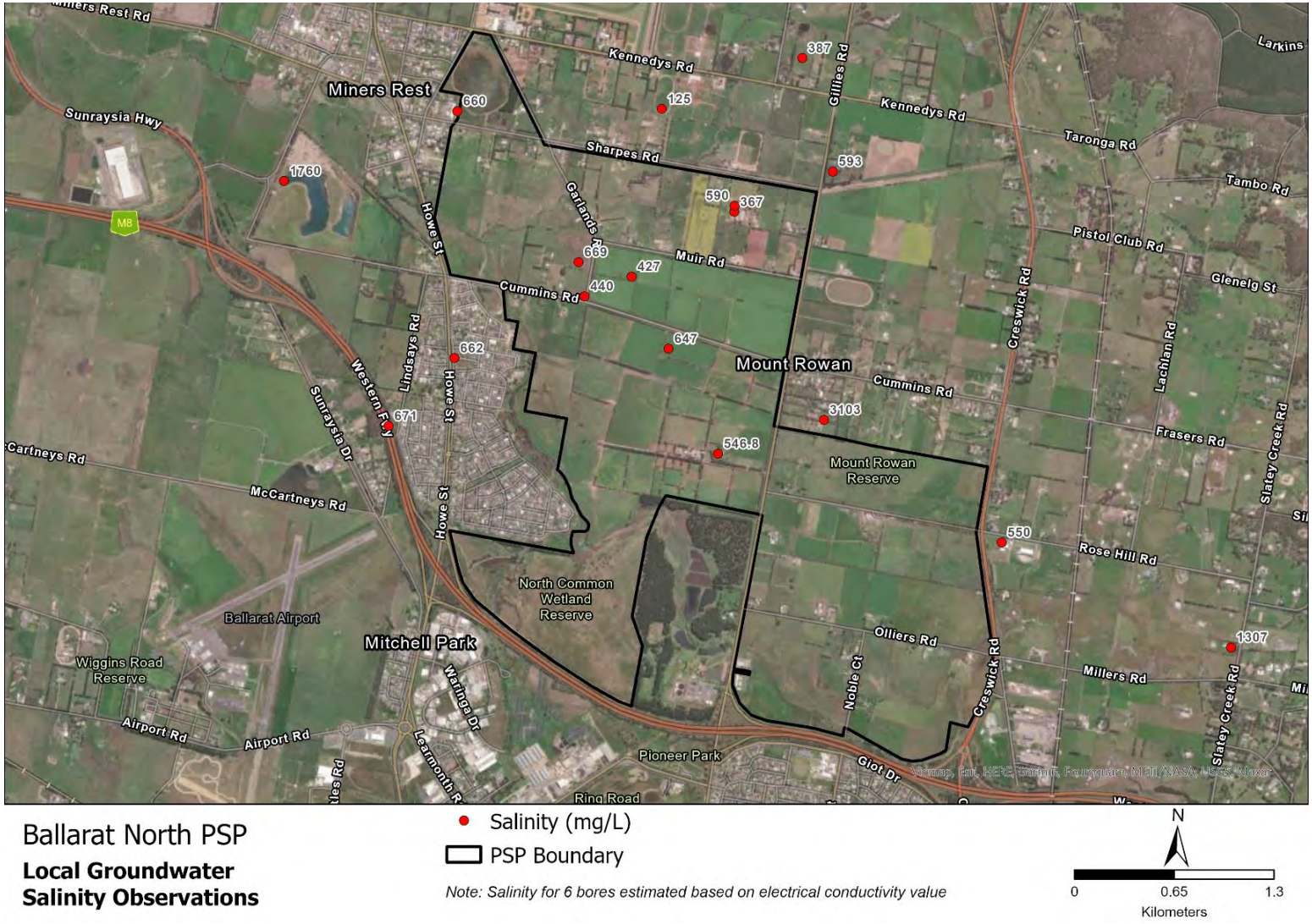

Figure 5-15. Local groundwater salinity (data source: FedUni, 2015)

5.6.6 Local groundwater levels and flow directions

As discussed in Section 1.1.1 and shown in Figure 5-13, only four of the bores have groundwater level data (BoM, 2023), two of which are either within the precinct area or within 20 m of the precinct area boundary. The remaining two bores are located within about 15 m of each other and are located about 1.75 km north of the precinct area. The data is considered too sparse to enable characterisation of local groundwater flow directions in the precinct area.

Hydrographs for the four bores with water level data (bores, SP068239, SP068240, 60758 and CHWB24) are shown in the datum of m AHD and mbgl in Figure 5-16 and Figure 5-17, respectively. The figures include bore depth.

Aside from bore 60758, which has a depth of 30 m, the other bores are significantly deeper than the groundwater systems the project is likely to directly interact with. Their depths are 85 mbgl, 90 mbgl and 107 mbgl and therefore are associated with groundwater systems significantly below the water table. There is a significant vertical hydraulic gradient between bore SP068239 and bore SP068240, which are only 15 m apart.

There is substantial water level variation in the bores and the causes of the water level trends are unknown.

Bore 60758 groundwater depth ranges from 5 mbgl to 9 mbgl. At this location the FedUni (2015) state-wide depth-to-water table mapping indicates a depth to water of less than 5 mbgl.

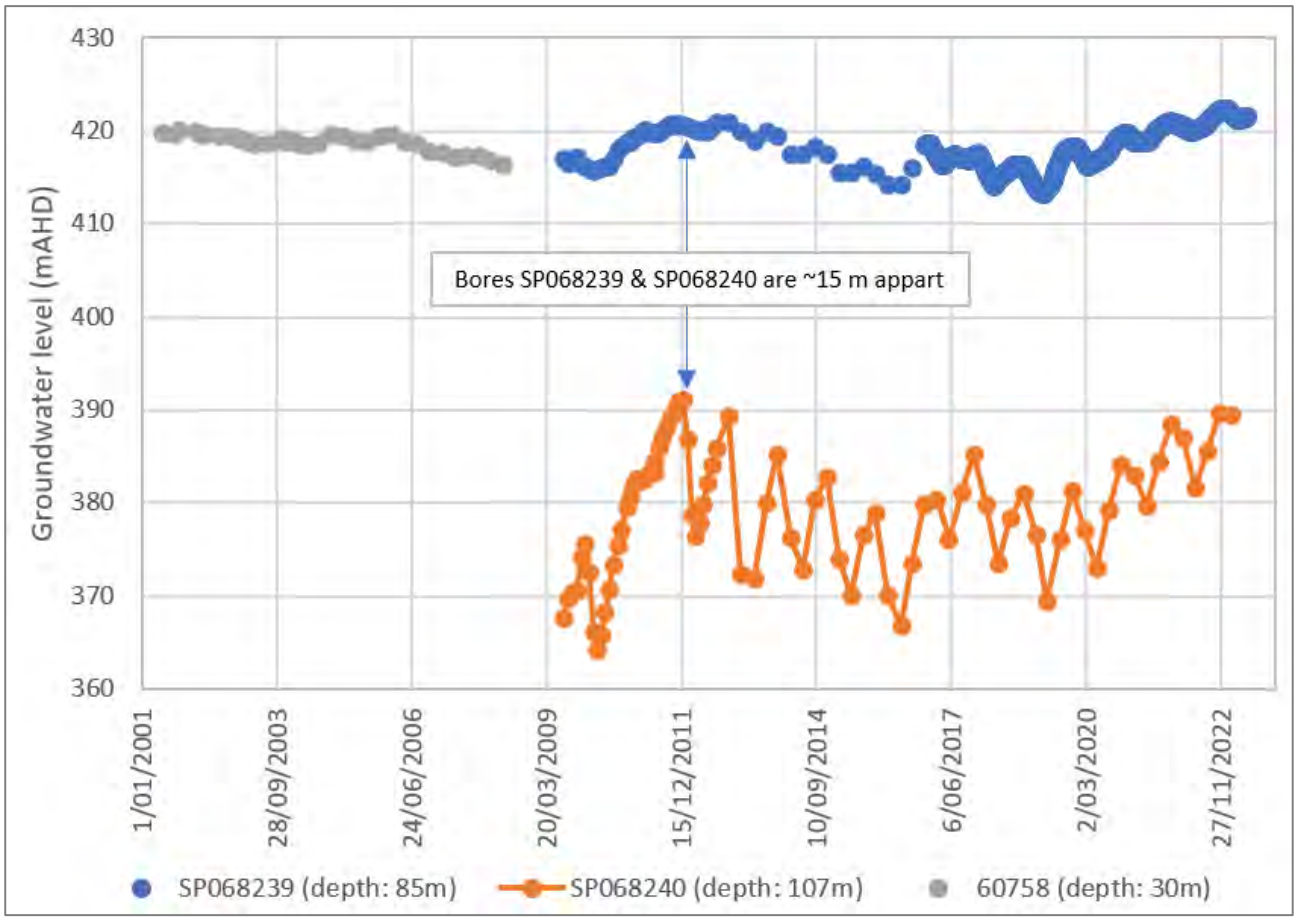

Figure 5-16. Groundwater level hydrographs, datum m AHD (data source: BoM, 2023)

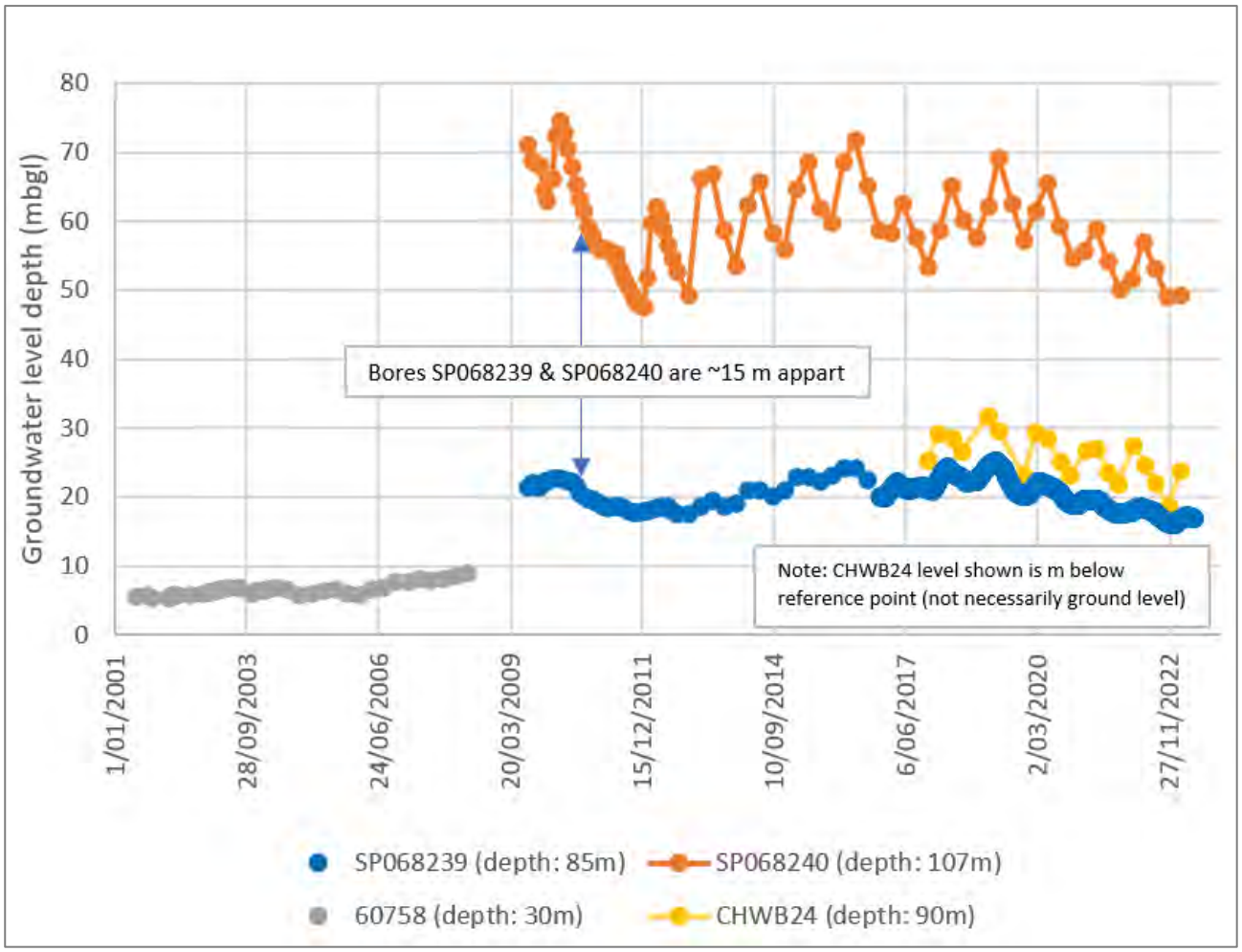

Figure 5-17. Groundwater level hydrographs, datum mbgl (data source: BoM, 2023)

5.7 Future land use

The Ballarat North area is located within the Ballarat Local Government Area (LGA) and is subject to the Ballarat Planning Scheme. The project area is adjacent to the Western Freeway to the south and immediately north-east of the Ballarat Airport. It is approximately 5 km north of the Ballarat town centre.

A further relevant strategy includes the Ballarat Rural Land Use Strategy which applies to all rural land within the City of Ballarat LGA. The Ballarat Rural Land Use Strategy sets out to create a long-term vision for Ballarat's rural areas and provides for the following:

- A strategy to manage land use and development in rural areas.
- Guidance for the application of planning scheme provisions, including planning policy and permitting controls for subdivision, dwellings, protection of agricultural land from non-farming uses and recognition of important natural values in accordance with the vision adopted by Ballarat City Council.

As stated in the strategy, the Rural Land Use Strategy does not review individual development proposals on rural zoned land and instead assists in guiding Council in managing land use and development in its rural areas. The strategy is implemented through the planning scheme. This is significant as the expanded area remains within the farming zone, therefore this policy applies to this land and must be considered before the land is converted to UGZ by the VPA.

6. Information review

This section summarises the various sources of information, records, and reports reviewed as part of Stage 1 of the Land Capability Assessment.

6.1 Certificate of Title information

The list of land uses for the Ballarat North PSP area were reviewed to help confirm historical and current land uses. This information is provided in Appendix B as part of the Lotsearch report commissioned by Jacobs for this assessment. A review of the list revealed that majority of the land within the PSP area had been used for agricultural-related purposes such as cropping and livestock for many decades.

In addition, mining activities were noted within the Ballarat North PSP area and within its buffer zone since the 1800s. Outside of the PSP boundaries, a mix of residential and commercial land uses were prevalent on the east, south and north-west boundaries, while on the south-western boundary, industrial entities were noted including the presence of Ballarat Airport.

6.2 Historical aerial imagery

Aerial photographs from 1934 to 2023 were reviewed for land use changes. Observations are summarised in the table below. Copies of aerial photographs are provided in the Lotsearch report provided in Appendix B.

Table 6-1. Summary of review of historical aerial imagery for Ballarat North

Table presenting a summary of observations based on the review of available current and historical aerial imagery across the Ballarat North PSP area.

Year	Description	Source
1934	**On-Site:** Vacant agricultural land with a few residential properties. All major Roads such as Sharpes Road, Garlands Road, and Cummins Road are evident. **Off-Site:** Vacant agricultural land with a few to several residential areas sparsely distributed. Howe Street and Muir Road are also established.	Vicmap through Lotsearch
1961	**On-Site:** No notable changes were observed since 1934 except for the apparent disappearance of a small number of residential properties. **Off-Site:** No notable changes were observed since 1934 except for a new road that is under construction at the southern portion of the site.	Vicmap through Lotsearch
1970/1972	**On-Site:** No notable changes were observed since 1961 except for the vegetative growth adjacent Miners Rest Recreational Reserve, a few land cultivation activities and construction of a few residential properties. **Off-Site:** Ponds starting to appear in the vicinity of what now represents the Ballarat North Wastewater Treatment / Water Reclamation Plant. There is an increase in number of structures such as new residential houses and commercial buildings.	Vicmap through Lotsearch
1981	**On-Site:** No notable changes were observed since 1970/1972 except for a few new residential properties and land development activities and some land cultivation activities.	Vicmap through Lotsearch

Year	Description	Source
	Off-Site: The McCain Foods facility and other commercial establishments were constructed south of Ballarat North Wastewater Treatment / Water Reclamation Plant. There was an increase in the number of residential houses at the western side adjacent Howe Street. Some land development activities and land cultivation activities were also observed.	
1989	**On-Site:** Changes observed in some agricultural lots and new structures/buildings were constructed. Vegetative growth adjacent Miners Rest Recreational Reserve seemed to have disappeared. No satellite image available for other parts of the PSP. **Off-Site:** Additional residential houses were built on both sides of Raglan Street and Howe Street. Some agricultural lands that appeared to undergone soil cultivation. No satellite image available for other parts of the PSP area.	Vicmap through Lotsearch
1990	**On-Site:** No notable changes were observed since 1981 except for the observed increase in land cultivation activities. **Off-Site:** Expansion of the McCain Foods facility was observed. Additional residential properties as well as commercial structures/buildings were also constructed. Soil cultivation across some of the agricultural land was noted.	Vicmap through Lotsearch
2011	**On-Site:** Vegetative growth adjacent Miners Rest Recreational Reserve re-emerged. No other notable changes were observed since1990 except for a few residential and commercial structures/buildings that have been constructed. **Off-Site:** Additional residential properties were built on both sides of Raglan Street and Howe Street. Some new residential properties & commercial structures at the northern western, and southern off-site areas were constructed. Furthermore, additional structures associated with the Ballarat North Wastewater Treatment / Water Reclamation Plant were constructed. Warehouses for McCain Foods as well as some commercial establishments were also constructed.	Vicmap through Lotsearch
2015	**On-Site:** No notable changes were observed since 2011 except for some new residential and commercial buildings that were constructed. **Off-Site:** No notable changes were observed since 2011 except for additional structures/buildings that were constructed.	Vicmap through Lotsearch
2017	**On-Site:** No notable changes were observed since 2015 except for some land development and land cultivation activities. **Off-Site:** No notable changes were observed since 2015 except for additional structures/buildings that were constructed.	Vicmap through Lotsearch
2019	**On-Site:** No notable changes were observed since 2017. **Off-Site:** No notable changes were observed since 2017 except for a few additional structures/buildings that were constructed.	Vicmap through Lotsearch

Year	Description	Source
2022	**On-Site:** No notable changes were observed since 2019 except for one or two houses that have been demolished. No notable changes were observed since 2019 except for some land cultivation activities. **Off-Site:** No notable changes were observed since 2019 except for additional structures/buildings that were constructed mostly north of at Ballarat Town Commons and some additional residential dwellings and commercial structures built in the east and south of the site.	Vicmap through Lotsearch
2023	**On-Site:** No notable changes were observed since 2022. **Off-Site:** No notable changes were observed since 2022.	Google Earth Pro®

In summary, the review of the historical aerial imagery from 1934 to 2022 indicated that majority of the land that comprised the Ballarat North PSP area is originally agricultural land. Change in land use has led to the development of mixed residential-commercial area in a few locations within the PSP area.

6.3 EPA Victoria records

6.3.1 Priority sites register, site management orders, & pollution notices

Based on EPA Victoria's Priority Sites Register, there are no EPA Priority Sites within the Ballarat North PSP area. However, there is one off-site location listed that is within 1km of the PSP boundary. A summary is provided in Table 6-2 below.

Table 6-2. Summary of EPA Victoria priority sites

Summary Table of EPA Victoria Priority Site located within the Ballarat North PSP boundary.

Notice number	Address	Suburb / municipality	Issue	Distance & direction
EAN-00003633-1	Ballarat Airport, Mitchell Park, Ballarat, Victoria, 3355	Ballarat	Accidental spill/leak (non-industrial site). Requires assessment and/or clean up	411 m West

Based on EPA Victoria's register of site management orders (SMO), there are currently no SMOs for Ballarat North PSP area including those located within 1km of the PSP area boundary.

Table 6-3 below lists the recipients of former EPA Victoria Priority Sites and Other Pollution Notices within the Site up to the 1 km radius from the PAP area boundary. Notice numbers 90001913, 90011357, NO1912, NO4662, NO4674, and NO8038 are all related to the Ballarat Airport. The dates of issue (1991, 2005, 2009, 2013) of the notices corresponds to the historical account as mentioned in the August. 2022 BlueSphere Environmental Report entitled: Environmental Audit of the Risk of Harm from Contaminated Land, Waste or Pollution - Field Air Ballarat - Environmental Audit ID: 8003103 relating to the above off-site EPA Priority Site.

In addition, Notice Numbers IGN-00003913, IMPN-00003735, IMPN-00003740, and REV-IMPN-00003739 pertain to McCain Foods (Australia) Pty Ltd.'s previous pollution notices. It was unclear what kind of environmental issues this location was cited for in 2022 and 2023. Other notices include the following:

- Notice number 90007792 is a Pollution Abatement Notice that pertains to Ballarat Town Common; We understand based on correspondence between VPA, EPA Victoria and City of Ballarat that this notice has now been revoked.
- Notice number 90007899 is a clean-up notice for a company called Anthony Broadbent; & Notice number 90003757 is a Pollution Abatement Notice that pertains to a company called Coronet Laundry.

Table 6-3. Former EPA Victoria priority sites and other pollution notices

Summary table of previous EPA Victoria Priority Sites and other Pollution Notices located within the Ballarat North PSP boundary and within the 1 km buffer zone.

Notice number	Notice type	Company	Address	Suburb	Status	Issue	Date issued	Distance & direction
90007792	Pollution Abatement Notice	SPI R2\PP2542 [Miners Rest]	Ballarat Town Common Council property # 2012137 City of Ballarat	Miners Rest	Previous Pollution Notice. It is understood that this PAN now been revoked.	Unknown	16/05/2017	0 m Onsite
IGN-00003913	Information Gathering Notice	McCain Foods (Aust) Pty Ltd	Ring Road	Wendouree	Previous Pollution Notice	Unknown	01/02/2023	91 m Southwest
IMPN-00003735	Improvement Notice	McCain Foods (Aust) Pty Ltd	Ring Road	Wendouree	Previous Pollution Notice	Unknown	21/12/2022	91 m Southwest
IMPN-00003740	Improvement Notice	McCain Foods (Aust) Pty Ltd	Ring Road	Wendouree	Previous Pollution Notice	Unknown	21/12/2022	91 m southwest
REV-IMPN-00003739	Improvement Notice	McCain Foods (Aust) Pty Ltd	Ring Road	Wendouree	Previous Pollution Notice	Unknown	21/12/2022	91 m Southwest
90007899	Clean Up Notice	Anthony Broadbent [Miners Rest]	201-203 Howe St., Miners Rest VIC 3352	Miners Rest	Previous Pollution Notice	Unknown	10/08/2017	343 m Northwest
90001913	Previous Priority Notice	Unknown	Volume 6747 Folio 250	Ballarat	Previous Priority Notice	Current Industrial Site. Requires assessment and/or clean up.	30/09/2009	411 m West

Notice number	Notice type	Company	Address	Suburb	Status	Issue	Date issued	Distance & direction
90011357	Previous Priority Notice	Unknown	Volume 6747 Folio 250	Ballarat	Current Pollution Notice	Current Industrial Site. Requires assessment and/or clean up.	Unknown	411 m West
NO1912	62A(1)	Field Air (Ballarat) P/L	Ballarat Aerodrome Volume 6747 Folio 250	Ballarat	Legacy EPA Database Pollution Notice	Unknown	14/02/1991	411 m West
NO4662	62A(1)	Field Air (Ballarat) P/L	Ballarat Aerodrome Volume 6747 Folio 250	Ballarat	Legacy EPA Database Pollution Notice	Unknown	01/04/2005	411 m West
NO4674	62A(1)	Field Air (Ballarat) P/L	Ballarat Aerodrome Volume 6747 Folio 250	Ballarat	Legacy EPA Database Pollution Notice	Current Industrial Site, Requires assessment and/or clean up.	27/04/2005	411 m West
NO8038	62A(1)	Field Air (Ballarat) P/L	Ballarat Aerodrome Volume 6747 Folio 250	Ballarat	Legacy EPA Database Pollution Notice	Current Industrial Site, Requires assessment and/or clean up.	30/09/2009	411 m West

Notice number	Notice type	Company	Address	Suburb	Status	Issue	Date issued	Distance & direction
90003757	Pollution Abatement Notice	Coronet laundry	21 Coronet St	Wendouree	Previous Pollution Notice	Unknown	13/06/2013	856 m Southeast

6.3.2 Permissions, licenced activities and works approvals

The EPA Victoria classifies three tiers of permissions based on the level of risk to human health and the environment, namely:

- Licences for high-risk prescribed activities;
- Permits for medium risk prescribed activities; &
- Registrations for low risk prescribed activities.

The following list represents the EPA register of permissions records with active status that exist within the Ballarat North PSP area including those found within the 1km of the PSP area boundary.

Table 6-4. Summary of EPA register of permissions

Permission ID	Permission type	Activity	Premise address	Issue date	Expiry date	Distance & direction
OL000071980	Operating Licence (any other case)	A03 (Sewage treatment)	Gillies Rd, Ballarat North 3352	01/07/2008	31/12/9999	0 m South
P000111697	Permit	A14 (Wastewater supply or use)	1059 Ring Road Mitchell Park 3355	25/02/2015	31/12/9999	91 m South West
P000112660	Permit	A14 (Wastewater supply or use)	1059 Ring Road Mitchell Park 3355	10/04/2015	31/12/9999	91 m South West
DL000107264	Development Licence	H02 (Bitumen or asphalt batching)	5 Yarramie Ct Mitchell Park 3355	02/09/2014	31/12/9999	292 m South West
R000302506	Registration	A13c (Waste and resource recovery - small)	67 Old Midland Highway, Mount Rowan 3352	02/01/2022	01/01/2027	401 m South East
R000302506	Registration	A13c (Waste and resource recovery - small)	3 Grand Junction Drive, Miners Rest, 3352	07/01/2023	06/01/2028	538 m West
R000300667	Registration	A13c (Waste and resource recovery - small)	5 Coronet Street Wendouree 3355	03/08/2021	03/08/2026	873 m South East
R000301319	Registration	A13c (Waste and resource	5 Coronet Street	28/09/2021	27/09/2026	873 m South East

Permission ID	Permission type	Activity	Premise address	Issue date	Expiry date	Distance & direction
		recovery - small)	Wendouree 3355			
R000303566	Registration	A07b (Organic waste processing - small)	3355, Australia	27/05/2022	26/05/2027	Unknown

There are no records of any EPA-licensed activities within the Ballarat North PSP area. However, beyond the Ballarat North PSP area boundary, current and former licensed sites were recorded. The details are summarised in Table 6-5 below.

Table 6-5. Summary of current and former EPA licences activities (beyond the Ballarat North PSP area boundary)

Transaction no. / type	Licence no.	Licence type	Organisation	Address	Activities	Distance & direction
3032904	74422	Amalgamated licence	Central Highlands Region Water Corporation	Gillies St., Ballarat North, VIC 3352	A03 Sewerage Treatment	0 m South
	EI26168#2	Unknown	Ace Scrap Metal & Steel Co. Pty Ltd	5-7 Coronet St., Wendouree VIC 3355	A01 Prescribed Industrial Waste Management	873 m South East

In relation to EPA works approval, there is one entity – Western Victoria Asphalt Pty Ltd currently approved by EPA. The details are summarised in Table 6-6.

Table 6-6. Summary of EPA works approval

Transaction no	Status	Organisation	Premises address	Scheduled categories	Distance (m)	Direction
1001432	Approved/ Issued	Western Victoria Asphalt Pty Ltd [Mitchell Park]	5 Yarramie CT, Mitchell Park VIC 3355	H02 Bitumen Asphalt Batching Works	292	South West

6.3.3 Environmental audit sites

Based on EPA Victoria website, Lotsearch reports, and Victoria Unearthed, the Ballarat North Wastewater Treatment / Water Reclamation Plant located immediately south of the Site's boundary is under 53V Audit category. There are no properties within the Site that is under environmental audits at this time.

Table 6-7. Summary of EPA environmental audit sites

CARMS no	Transaction no	Site address	Suburb	Date complete	Audit category	Distance (m) & direction
78778-1	8006904	Sewerage Farm, 29 Gillies Road	Miners Rest	8/15/2021	53V Audit recommendations	0 m South

6.3.4 Preliminary Risk Screening Assessments (PRSA)

There are no PRSA sites within Ballarat North PSP area, nor within the 1km buffer distance of the PSP area boundary.

6.3.5 Groundwater quality restricted use zones (GQRUZ)

Restricted use zones are not present within the Ballarat North PSP area, nor within 1km of the PSP area boundary.

6.4 Surface water information

The information used to assess the regional hydrology of the North Ballarat Precinct area was retrieved from a combination of publicly available information, and information provided by VPA. Table 6-8 summarises the information reviewed during the regional hydrology assessment.

Table 6-8. Summary of information reviewed in hydrology desktop due diligence assessment

Item	Data type	Source
Burrumbeet Flood Investigation (Water Technology, 2013)	Flooding Report	Provided by the client.
Ballarat Long Term Growth Options Investigation (Hansen partnership, 2018)	Options Assessment Report	Provided by the client.
DRAFT Ballarat North PSP - IWM Opportunities and Drainage Assessment Report (Arup, pending)	Draft Report	Provided by the client.
Land Subject to Inundation Overlay (LSIO)	Planning Overlay.	Retrieved online from VicPlan website
Flood Overlay (FO)	Planning Overlay.	Retrieved online from VicPlan website
Vicmap Hydro Watercourse Lines	Spatial data: Streamlines for rivers, small streams, channels, and open drains.	Retrieved online from National Map website. Author and dataset custodian: Victorian State Government.
City of Ballarat Drainage Pipes	Spatial data: Drainage asset locations.	Retrieved online from National Map website. Author and dataset custodian: City of Ballarat
City of Ballarat Drainage Pits	Spatial data: Drainage asset locations.	Retrieved online from National Map website. Author

Item	Data type	Source
		and dataset custodian: City of Ballarat
Digital Elevation Model with 10m Resolution (Victorian Government)	Digital Elevation Model: Topography derived from LiDAR surveyed in 2019.	Retrieved online from ELVIS (Elevation Information System) website. Author and dataset custodian: Victorian government
Metromap Capital Cities Latest Aerial Imagery	Aerial imagery: Used as a sense check of public imagery such as Bing Satellite imagery to current site conditions	Internal resource available for Jacobs to consult through a corporate license.
Bing Satellite Imagery	Aerial imagery: Publicly available dataset. Date last updated in the GAEP area is unknown, however imagery shows the site conditions to be comparable with what is shown in the project aerial imagery. This dataset was considered acceptable for use in mapping to contextualise other spatial data.	Publicly available. Author and dataset custodian: Microsoft.

6.5 Waste management facilities and landfills

The former Wendouree tip is the only historical landfill in EPA Victoria's landfill register. Details are included Table 6-9 below.

Table 6-9. Summary of landfills found within Ballarat North PSP

Landfill Register No	Site	Address	Operating status	Year of closure	Waste type	Distance (m) and direction
10038	Former Wendouree Tip	corner Gilles Road North and Western Freeway	Closed	1983	Putrescible waste, Solid inert waste	On-site

Outside of the Site's boundary, a lone entity is classified as a legacy EPA prescribed industrial waste treater, disposer and permitted transporter. Details are included in Table 6-10 below.

Table 6-10. Summary of legacy EPA-prescribed industrial waste

Map ID	Company name	Address	Operating status as a transporter	EPA list status	Distance (m)	Direction
1206	Henderson Haulage Pty Ltd	61 Old Midland Highway, Mt. Rowan	Active	Current EPA List	340	South East

With regards to wastes and resource recovery, there are no recycling facilities within Ballarat North PSP. However there is a metal recycling entity within 1km of the PSP boundary with details below:

Table 6-11. Waste and resource recovery facility outside Ballarat North PSP

Map ID	Site name	Address	Category	Sub-category	Distance (m)	Direction
65	OneSteel Recycling (trading as Ace Scrap metal & Steel)	7 Coronet St, Wendouree, Victoria	Commercial and Industrial (C&I)	C&I Recovery	873	South East

Review of the National Waste Management Site Database (as reflected in Lotsearch Reports) indicates no known waste management sites either within the PSP, or within the 1km buffer distance from the PSP boundary. It is noted that this database does not identify the facilities identified in Table 6-9, Table 6-10 or Table 6-11.

6.6 PFAS investigation and management programs

There are no current EPA PFAS site investigations within the PSP area or within 1km of the PSP area boundary. In addition, there are no Defence PFAS Investigation or Management sites, nor Airservices Australia National PFAS Management Program sites within the Ballarat North PSP area or within 1km of the PSP area boundary.

6.7 Former gasworks and liquid fuel facilities

There are no former gasworks and liquid fuel within the PSP area or within 1km of the PSP area boundary.

6.8 Defence sites and unexploded ordnance (UXO)

Based on Lotsearch Reports (Appendix B), within the Site's assigned dataset buffer for UXO of 2 km from its boundaries, there is a area previously assessed by the Department of Defence for the potential presence of unexploded ordnance. See Table 6-12 below for details.

Table 6-12. Defence sites and UXO outside Ballarat North PSP boundaries

Site ID	Location name	Category	Area description	Distance (m)	Direction
330	Ballarat	Other	This site was proposed as a Rifle Range and Grenade Range, but no evidence has been identified of its actual use.	1924	West

6.9 Other reviewed reports

In addition to information obtained from publicly available sources, the following environment reports related to Ballarat North PSP area and surrounds were also provided to Jacobs by VPA and reviewed in relation to land contamination potential as well as drainage assessment.

1. Submissions Summary. Ballarat Growth Areas Review. (SD Planning, April 2021) – This report is essentially related to the 1100 plus pages Ballarat Long Term Growth Options Investigation Report by Hansen partnership, et. al. The aspects of planning, environmental, economic, physical, and community infrastructure constraints and opportunities were evaluated for the four nominated growth areas. The report findings mentioned that the Northern (which is half of this Ballarat North PSP study area), and Western Growth Investigation Areas (GIA) were identified as the Council's preferred greenfield growth areas which were deemed capable of accommodating Ballarat's expected growth and housing demand up to year 2040. The key issues mentioned were constraints of sites, need for additional growth, and

support for well-planned and sequenced development. It also concluded that the other work that will need to be undertaken during PSP formation to further refine boundaries of new growth areas such as Ballarat North shall be supported through investigations such as adverse amenities and buffers, bushfire and cultural heritage extents, open space and connectivity, roads and upgrades, and landscape values.

2. Environmental Audit of the Risk of Harm from Contaminated Land, Waste or Pollution – Field Air Ballarat. Environmental Audit ID: 8003103 (BlueSphere Environmental, August 2022). This report is a culmination of various environmental assessments and auditing history since early 2000s. The nature and extent of continuing risk of harm emanates from the contaminated land (including groundwater) that exists within the Ballarat Airport primarily due to the release of contaminated wastewater many years ago. Based on the environmental audit report, recommendations have been provided to minimise the risk of harm due to the occurrence of pollution and the presence of contaminated land at the Ballarat Airport. The report also mentioned that the current condition of the land was assessed to be suitable for ongoing commercial/industrial use but subject to compliance with recommendations. Lastly, the audit report recommended a GQRUZ to be put in place for the affected areas and a routine groundwater monitoring was required. The environmental audit was completed on 22 August 2022.

3. Historical Information Review Ballarat West Employment Zone (Senversa, Aug. 2013) – This report summarises the historical information related to Ballarat West Employment Zone (BWEZ), a 438-ha area which is almost immediately adjacent to the Ballarat North PSP area on its south-western side. The objectives of the Historical Information Review were to assess historic and current uses of BWEZ to identify potential sources and areas of contamination and assess the potential risks and restrictions contamination may pose on the future development and use of BWEZ. The Ballarat Airport *per se* was not assessed, however its potential for contaminating the BWEZ was included in the findings. The report mentioned that based on the current and historical land use at the airport, groundwater contamination associated with storage and use of petroleum, aviation gas, pesticides, herbicides and fungicides may be present at and down hydraulic gradient of the airport. In addition, due to Central Highlands Water (Ballarat North Wastewater Treatment Plant) using bottom section of aquifer, groundwater contamination derived from the airport in upper section may not have been assessed.

4. Preliminary Site Investigation: Wyndholm Park, Miners Rest, Vic (Atma Environmental, May 2022) – This report pertains to the approximately 217 ha land mass centrally located within Ballarat North PSP area. The subject property is occupied by Wyndholm Park Pty Ltd which provides horse breeding and associated equine services (weaning, mare management, rehabilitation, foaling, etc.). The farm also runs several hundred sheep to help manage the paddocks. Based on the findings, there are several areas of potential environmental concern (having a ‘medium’ or ‘high’ potential for contamination which require further investigation) such as Farm Operations Area (Mech Shed, ASTs and UST), Creek-side Area (burn pile and hard wastes), ‘New’ Burning Area (brush), carcass burials area, locations of former buildings, and fencing material burial. Review of environmental records revealed that Wyndholm Park have no existing or previous EPA Notices, not subject to an environmental audit overlay and is not within 500 m of a current or former landfill.

5. Extractive Industry Interest Areas (EIIA) – Ballarat Supply Area (Geological Survey of Victoria, June 1997). According to this technical record, an EIIA is a designation applied to a land that has been identified to likely contain stone resources of sufficient quantity and quality to support a commercial extractive industry operation. At the Ballarat Supply Area or BSA (an EIIA covering up to 30 kms radius from the centre of Ballarat), there were 20 work authorities issued at the time of reporting in June of 1997 mostly for the extractive industry operations of sand/gravel, basalt, and clay/shale but none were applied to the Ballarat North PSP. This study reiterates that identified EIIAs shall be used by local councils for consideration in long-term strategic planning for their municipalities. Further review of the DEECA Earth Resources (GeoVic) database identified that there is one EIIAs within the Ballarat North PSP area, namely EIIA 884066, which intersects a small portion of the northern extent of the PSP area. Mapping is available via: https://resources.vic.gov.au/projects/extractive-industry-priority-project-list.

6. Preliminary Site Investigation: 43 Olliers Road, 45 Olliers Road, & 35 Noble Court, Mount Rowan, Victoria (Atma Environmental, December 2022). This report was commissioned by the Dennis Family Corporation Pty Ltd as part of its pre-purchase due diligence. The real property subjected to the preliminary site investigation (PSI) has a total hectarage of 23.1965 ha. At the time of the assessment, the site is not under an environmental audit overlay and does not appear in any publicly available databases related to environmental contamination. Evidence of potential land contamination include small burn area north-east and mine waste in the south-east corner of the site, solid metal wastes across the site, possible asbestos near the old residence, and chemical storage shed of fertilisers and herbicides. In addition, there was an area to the south of the site where sheep hides were exposed to the air and some old blood observed on the ground. The study also confirmed the presence of mine tailings during desktop review. Referencing PPN30, the site was classified as an industry with land use likely in the "medium" or "high" potential for contamination thus considered as "potentially contaminated land" defined under Environmental Protection Act 2017.

7. Soil Testing Addendum – 43 and 45 Olliers Road, 35 Noble Court, Mount Rowan, Victoria (Atma Environmental, December 2022). This is the follow-up task after the PSI study. The first soil sample GS01 was analysed for a suite of 17 metals, pH, cyanide, and cation exchange capacity while the second soil sample GS02 was analysed for total recoverable hydrocarbons (TRH), benzene toluene ethylbenzene xylenes naphthalene or BTEXN, polycyclic aromatic hydrocarbons (PAH), organochlorine pesticides (OCP), and 8 metals. Results for both GS01 and GS02 revealed that all parameters tested resulted below the adopted ecological and human health-based screening levels for residential land use. Furthermore, GS01 can be generally considered fill materials, however GS02 falls within the range of Category C due to elevated zinc levels. The report recommends that further investigation be conducted to adequately characterise the soil.

7. Site characterisation

7.1 Site contamination assessment

Jacobs evaluated each parcel of land within the boundary of the Ballarat North PSP area as part of the desktop study (Stage 1 assessment). The purpose of this evaluation was to establish current and historical land uses, and then decide on the potential for those activities to contaminate the land. This evaluation was guided by comparing the current and/or historical land uses with those presented in Table 2 of Planning Practice Note 30 (PPN30) (DELWLP, 2021). Table 2 of PPN30 defines the potential for different land uses to contaminate land as either 'high' or 'medium'. Jacobs has applied professional judgement when evaluating land uses and the resultant contamination potential. For this assessment, Jacobs has determined that any land uses that are not clearly defined as either a 'high' or 'medium' potential for contamination in PPN30 are considered as representing 'no potential for contamination' (unless determined otherwise based on professional judgement). This would apply to properties where highly localised areas of interest are identified (i.e. septic tanks, or farm buildings with only minor to small volume chemical storage) or those properties where no evidence of potentially contaminative activities has been identified (i.e. open paddocks with no history of intensive agriculture, buildings, or structures present).

Jacobs conducted site reconnaissance (Stage 2 assessment) on November 16, 17, and 24, 2023. Prior to the fieldwork, Jacobs provided VPA with a list of candidate sites and Jacobs sought concurrence thereafter. Only those properties that had signed the Consent to Access Land form were shortlisted for a site visit. The final list included eleven candidate sites. Jacobs then contacted the respective landowners via email and phone calls to coordinate the planned site visits. In the end, only ten out of eleven properties were visited by the Jacobs site reconnaissance team - Property 58 was not visited due to access constraints during the time of conducting the site visits.

Common land uses are discussed below as well as general comments relating to the Ballarat North PSP area and surrounding land use.

7.1.1 General precinct-wide observations

7.1.1.1 Agricultural land use

Most of the land forming Ballarat North PSP area has been used for agricultural-related purposes for many decades based on publicly available and client-provided data, historical aerial imagery from 1934 to 2023, and Lotsearch reports. Activities such as livestock farming (cattle and sheep), cropping, silage production and hay farming, and horse breeding and associated equine services such as horse agistment were reported and observed. Contaminants of potential concern (COPC) associated with these activities typically include heavy metals (from stock dipping), pesticides, herbicides, and fungicides as well as potential nutrients (from manure, slurry application, and other fertilisers) and biological contaminants (from animal burial). There are also a few rural residential land uses observed within the Ballarat North PSP area which indicates the potential presence of septic tank systems for on-property sewerage treatment (in the absence of a reticulated sewerage system across the PSP area). Since these septic systems are located underground, these can be difficult to identify during the site reconnaissance. In this regard, the COPC can include biological contaminants (i.e., bacteria and viruses) and nutrients (elevated nitrogen and phosphorus) associated with potential leakages from septic tank systems.

General agricultural land use and rural septic tank systems especially in sparsely distributed residential areas are generally considered to present a "low" potential to contaminate the land. Appendix D presents the summary of potential for contamination for each parcel within Ballarat North PSP area.

7.1.1.2 Farm residences and associated buildings

The farm residences within the Site are generally found at the northern portion albeit few. There are also a few of these located in the central and south-eastern area of the PSP area. These farm residences and associated buildings such as farm sheds are typically utilised for the storage of farm machinery (both operational and non-operational), farm implements, vehicles, and many other miscellaneous items. Buildings and structures may also include fuel storage areas for refuelling farm machinery (commonly in the form of above-ground storage tanks or ASTs) as well as storage areas for items such as agricultural chemicals (pesticides, herbicides, fungicides, etc.). In addition, hydraulic oils, lubricants, solvents, and brake fluids are also stored onsite as operational necessities and for the maintenance of these machineries.

The contamination scenario most likely to occur in consideration of the above set-up include potential spill-to-ground and/or spill-to-water body (for areas in close proximity to Burrumbeet Creek) of petroleum hydrocarbons (fuels and lubricants) and other chemicals from routine re-fuelling of farm machinery / equipment and general maintenance activities. However, the scenario of loss of primary containment (LOPC) of stock agricultural chemicals and hydrocarbons may also impact upon soils and surface water. Given that such chemicals are typically stored in small volumes, the extent of impact is likely to be highly localised for soil, however if in the case of spill-to-water body, there would be mobility of COPC to a larger area.

Based on the site reconnaissance conducted on 24 November 2023, there were a couple of old residential buildings dating back ~1970s that were observed south of Olliers Road (Property 73) where asbestos fragments were found on the ground as well as remnants of the dilapidated building where likely Asbestos-containing materials (ACM) sheets have been used as a construction material. Asbestos was commonly used as a building material with several applications in Australia as early as the 1880s (although more frequently in the mid to late 1900s). According to Asbestos Safety and Eradication Agency, approximately one third of all homes in Australia contain asbestos products, especially if a house was built before 1990, it is likely that it would have some ACM. The Australian Government banned Asbestos on 31st December 2003. While asbestos presents a limited potential risk while it remains in the bonded matrix (i.e. as bonded asbestos cement sheeting in roofing, pipe lagging, insulation, and tile adhesives), free fibres can present a higher potential risk through inhalation. Mobilisation of asbestos fibres can occur through several processes including (but not limited to) abrasion, breaking, sanding and cutting of asbestos-containing materials. Asbestos is also likely to be encountered in building materials during demolition of old buildings and sites were buried or imported waste has been reported.

7.1.1.3 Imported fill, fly tipped waste and stockpiled material

The existence of imported fill in an area can be challenging to identify without undertaking intrusive investigations, particularly in areas that are heavily vegetated. Fill materials are most likely to be found in locations where previous or on-going construction/development works are being undertaken. During the site reconnaissance, stockpiles of soil and gravelly materials were observed in at least two locations (Properties 31 and 32) within Ballarat North PSP area.

Various kinds of wastes can also be generated and deposited onsite. -The type and volume of wastes depends on the activities and processes being performed in the area. In addition, illegal dumping of wastes and importation of wastes (albeit the latter is less common as it typically requires EPA approval) may also occur. During the site reconnaissance, stockpiles of miscellaneous materials were photo-documented on at least 10 locations (Properties 5, 9, 20, 31, 31, 56, 69, 71, 72, and 73).

Contaminants of potential concern associated with fill material, fly-tipped waste and stockpiled materials can vary significantly depending on their source and the time at which they were deposited. Since such information is rarely available, specific contaminants of potential concern often cannot be adequately identified without laboratory analysis (although visual and olfactory observations can provide limited information). However, the most encountered contaminant groups include total petroleum hydrocarbons (TPH), polycyclic aromatic hydrocarbons (PAHs), heavy metals and ACM.

7.1.1.4 Surrounding land uses

Off-site locations immediately outside of the Ballarat North PSP boundary were also considered during the Stage 1 assessment to identify any potentially contaminating land uses that may impact the future uses of land within the Ballarat North PSP area. Off-site sources identified in the vicinity of the Ballarat North PSP areas are summarised in Table 7-2.

The sites located outside of the Ballarat North PSP areas that present the highest potential for contamination that could impact upon the study area include:

- Ballarat Airport is located approximately 411 m southwest from Ballarat North PSP boundary. Historically it was a former EPA Victoria Priority Sites and recipient of Other Pollution Notices. The leak was attributed to an event in early 1989 wherein an accidental release of pesticide-contaminated wastewater from Field Air (Ballarat) Pty Ltd operations resulted in overland flow of wastewater which led to the death of a number of sheep on adjacent land. The agricultural aerial spraying activities from the Ballarat Aerodrome uses a wide range of agricultural chemicals including insecticides and herbicides. Wastewater generated in the process were contaminated with these pesticides and when one absorption line fractured, the wastewater flowed overland in the southerly direction towards a tributary of the Burrumbeet Creek.
- McCain Foods is a potato processing plant located ~91 m southwest from Ballarat North PSP boundary. Previously, it was the recipient of at least four pollution notices. It was unclear what kind of environmental issues this location was cited for in 2022 and 2023. In 2021, an 8.2 MW Solar Farm became operational as McCain Foods' renewable energy system. The installation is adjacent south of Ballarat Town Commons.
- Ballarat North Wastewater Treatment Plant / Water Reclamation Plant also known as the Central Highlands Water wastewater treatment plant is located immediately south from the Site boundary and located immediately north of Western Freeway. Per Lotsearch reports, this facility is under 53V Audit category.

The remaining off-site properties comprised of agricultural areas, medium-to-high density rural residences, small to medium scale commercial entities, a few industrial entities and reserve lands / crown lands.

7.1.2 Site characterisation

During the Site reconnaissance on November 16, 17, and 24, 2023, selected locations were visited, property owners were interviewed, and relevant features of interest at the properties were photo documented.

In general, the Site is a mostly greenfield land. Residential areas are sparsely distributed. The land use is largely agriculture-based such as cropping, silage production, and livestock rearing and grazing. Historically, mining activities were conducted at the Site, as such, mine wastes and tailings were present in selected areas. In addition, a closed landfill (former Wendouree Tip) is located at the southern portion of the Site. Such impacts from these mine-related sources as well as from closed landfills are likely to be localised. On this basis, most of the properties within Ballarat North PSP area were generally allocated a no potential for contamination, unless otherwise noted in Appendix D.

In relation to the former Wendouree Tip, little information is available for this site, which (based on current aerial images and interpretation of surface landform) appears to extend across several individual properties. This former tip accounts for eight of the 14 properties designated with a high potential for contamination, and several other adjacent properties designated medium potential for contamination. These properties are owned by Ballarat City Council. Historical aerial images do not cover this part of the PSP area, and no historic reports are available that would confirm the precise lateral extent of the site.

Jacobs understands that the landfill accepted putrescible waste during its operations (we understand operation of the landfill ceased in the 1980s). As such, the landfill has the potential to generate landfill gas. In accordance with EPA Publication 1642 – Assessing Planning Proposals in the Buffer of a Landfill and the Draft EPA Publication 1950 - Land buffer guideline, consideration has been given to the appropriate application of a buffer distance around this closed landfill and associated further assessment, specifically

focussed on understanding and managing potential risks relating to the migration of landfill gas. The following Figure 7-1 presents Jacobs estimation of the applicable landfill buffer (500m) based on the inferred extent of the landfill (informed by site features, general landform and current aerial imagery). Specific recommendations relating to the management of potential landfill gas at land parcels within the applicable buffer (and the former landfill itself) are presented in Section 10.

Figure 7-1. Estimation of applicable 500m closed landfill buffer (landfill gas)

The potential sources of on-site contamination identified during the Stage 1 and 2 assessments are presented in Appendix D and depicted in Figure 3 in Appendix A. The overall summary of numbers of "no potential for contamination" "medium potential for contamination" and "high potential for contamination" ranked sites are also presented in Appendix D. Examples of observed surface waste material and other features/observations of interest are presented in Picture 7-1 and Picture 7-2.

Table 7-1. Summary of on-site characterisation – potential for contamination

Table summarising the contamination potential for sites within the Ballarat North PSP area, based on the land uses with the potential to contaminate land presented in Table 2 of Planning Practice Note 30 (DELWP, 2021). The proposed further assessment is based on the approach presented in Table 3 of PPN30, assuming sensitive future land use.

No of sites	Contamination potential	Recommended further action
13	High	PRSA or audit option applies. Proceeding directly to an audit is recommended.
14	Medium	PRSA or audit option applies. PRSA to determine need for audit is recommended.

No of sites	Contamination potential	Recommended further action
51	No potential for contamination	No further action required – General Environmental Duty applies
26	No potential for contamination	Within the 500m buffer distance from the former Wendouree ti. Landfill gas assessment recommended. p

Table 7-2. Summary of off-site characterisation – potential for contamination

Table summarising the contamination potential for sites within the vicinity of the Ballarat North PSP area, based on the land uses with the potential to contaminate land presented in Table 2 of Planning Practice Note 30 (DELWP, 2021). This includes a qualitative evaluation of the potential impact on sites within the Ballarat North PSP area.

Address	Land use	Contamination potential	Potential impact on properties within Ballarat North
29 Gillies Rd, Miners Rest VIC 3352	Ballarat North Wastewater Treatment Plant (BNWTP)	Low	Located adjacent east of Properties 44 and 45 & located adjacent west of eight additional parcels of Ballarat North PSP, the Ballarat North Wastewater Treatment /Water Reclamation Plant of Central Highlands Region Water Corporation was previously an Environmental Audit Point / Environmental Audit Area as designated by EPA Victoria with CARMS No. 78778-1 and under 53V Audit recommendations. Looking at the entire Ballarat North PSP, the groundwater flow varies, however it is anticipated generally westerly over the majority of its area. For example, in the very south eastern corner of the site, there may be a southerly element to the groundwater flow direction. Although sandwiched between eastern and western land masses of Ballarat North PSP, it is unlikely that contamination relating to the operations of this facility will materially impact upon the Ballarat North PSP's land parcels (from a contamination perspective) noting that the regional groundwater flow at the south-eastern corner is generally south-southeast while at the south-western corner, groundwater flow direction is generally south-west. However, for parcels further south of Ballarat Town Commons, the groundwater flow has an element going north-west.
Mitchell Park, Ballarat, VIC 3355	Ballarat Airport	Low	Located 411 m west of the Ballarat North PSP, The Ballarat Airport, also referred to as Ballarat Aerodrome, is currently in the EPA Priority Sites Register. The nature and extent of continuing risk of harm emanates from the contaminated land (including groundwater) that exists within the Ballarat Airport primarily due to the release of contaminated wastewater many years ago. Based on the environmental audit report, recommendations have been provided to minimise the risk of harm due to the occurrence of pollution and the presence of contaminated land at the Ballarat Airport. The report also mentioned that the current condition of the land was assessed to be suitable for ongoing commercial/industrial use but subject to compliance with recommendations. Lastly, the audit report recommended a GQRUZ to be put in place for the affected areas and a routine groundwater monitoring was required. The environmental audit was completed on 22 August 2022. Based on all available data, it is unlikely that the parcels of

Address	Land use	Contamination potential	Potential impact on properties within Ballarat North
			Ballarat North would be affected by the residual risk that Ballarat Airport poses on the environment.
1059 Ring Road, Mitchell Park, VIC, 3355	McCain Foods	Low	McCain Foods is a potato processing plant located 91 m southwest from Ballarat North PSP boundary. Previously, it was the recipient of at least four pollution notices from EPA Victoria. It was unclear what kind of environmental issues this facility was cited for in 2022 and 2023. McCain Foods is considered large manufacturing facility with its own wastewater treatment facility, overall waste generation per year potential, presence of above-ground storage tanks and warehouses, etc. Despite its relatively close proximity to the Site, potential adverse impacts to Ballarat North PSP are considered low due to the nature of operations of the facility (not a high-risk site from a potential for contamination standpoint).

Picture 7-1. Site inspection – selective photographs

Selected photographs that illustrate common observations relating to the land use across Ballarat North PSP area. ***Top left.*** Livestock such as cattle, sheep, and horses graze in the vast grasslands of Ballarat North. ***Top right.*** The topography of most of the sites are generally flat and the ground is typically covered with grass <1 m tall. In the background is Mt. Rowan (outside of site boundary). ***Bottom left.*** Residential home typically has stockpile of assorted things at the back of the houses and/ or sheds which would include tyres, old machinery, dilapidated tools, rubbish, etc. ***Bottom right.*** Sand and soil stockpiles from a property that previous owned a sand retail business. It was noted that some of the stockpiles contain a mixture of other particles other than sand.

Picture 7-2. Site inspection – selective photographs

Selected photographs that illustrate common observations relating to the land use across Ballarat North PSP area. ***Top left.*** PACM (presumed asbestos containing material) was identified on the ground around a dilapidated shed/aviary. ***Top right.*** Scorched earth within a grassland area showed a recent open burning activity featuring PVC pipes. ***Bottom left.*** Suspected former waste stockpiling area with remnant of anthropogenic wastes (plastics, bricks, PACM). ***Bottom right.*** Historical mine tailings stockpile is covered with <1 m tall grass in a generally well vegetated area.

7.2 Geotechnical assessment

7.2.1 Available geotechnical information

Historical geotechnical investigation data was obtained from information provided by VPA and publicly available sources. This information is summarised in Table 7-3 below. Very limited laboratory testing data is available and has been summarised in Section 7.2.1.1.

It should be noted that the reliability of the historical data varies:

- Recent geotechnical investigations performed in accordance with relevant Australian Standards are generally considered higher quality and to be more reliable.
- Some of the historical data was undertaken using different logging standards and practices, and whilst it still provides valuable information it is generally considered less reliable.
- Judgement should be utilised regarding the use of historical data for geotechnical interpretation. Jacobs has made an initial assessment of the borehole reliability using the guidance in, "A Simple Method of Estimating Ground Model Reliability for Linear Infrastructure Projects" (Paul, 2019).

Although very limited historical investigation data is available, they are generally in agreement with the published geological data and provide an indication of the ground conditions to be expected across the study area. Please refer to Section 8.2.1 for further information.

Table 7-3. Relevant geotechnical reports and logs from historical investigations

Source	Year	Reference	Project/ title	Summary of content and relevance	Relevant location IDs	Reliability
Ground Science Pty Ltd (Ground Science)	2022	G4749.1 AA	Geotechnical Investigation 171 Gillies Road, Miners Rest	Factual report containing the results of a geotechnical investigation undertaken for the proposed residential development located at 171 Gillies Road in Miners Rest, Victoria (the site). Please refer to Section 7.2.2.1 for details	TP1 to TP74	Recent geotechnical data considered generally reliable.
Earth Resources Database	1890-1977	N/A	N/A	Various boreholes located within the project area. Majority of the boreholes do not contain any lithological or stratigraphical information. Please refer to Lotsearch report LS048897 in Appendix B for details.	306443, 306444, 306445, 306446, 306447, 306448, 306449, 60729, 60730, 60736	Lacking reliability around standards and quality assurance. Minimal information available, stratigraphy considered generally reliable; data only used for conceptual understanding of geological setting.
DELWP WMIS	1890-2000	N/A	N/A	Various boreholes located within the project area. Majority of the boreholes do not contain any lithological or stratigraphical information. For details, please refer to Lotsearch report LS048897 in Appendix B.	143294, 306443, 306444, 306445, 306446, 306447, 306448, 306449, 60729, 60730, 60734, 60736, 60737, 60739, 60751, 60752, 60753, 60754, 60755, WRK043217, WRK963844, WRK967908, WRK968856, WRK975599, WRK975789, WRK976682, WRK976715, WRK979894, WRK980330, WRK982171, WRK990316, WRK990317, WRK992457	The available information lacks reliability around standards and quality assurance. Stratigraphy considered generally reliable; data only used for conceptual understanding of geological setting.

Source	Year	Reference	Project/ title	Summary of content and relevance	Relevant location IDs	Reliability
Federation University	N/A	N/A	N/A	Various boreholes located within the project area. Majority of the boreholes do not contain any lithological or stratigraphical information. For details, please refer to Lotsearch report LS048897 in Appendix B.	143294, 306443, 306444, 306445, 306446, 306447, 306448, 306449, 60729, 60730, 60734, 60736, 60737, 60739, 60751, 60752, 60753, 60754, 60755, S9018846/1, S9021310/1,S9021962/1, S9026812/1,S9026990/1, S9027619/1,S9027634/1, S9030098/1,S9030433/1, S9031758/1,S9037476/1, S9037476/2,S9038873/1	The available information lacks reliability around standards and quality assurance. Stratigraphy considered generally reliable; data only used for conceptual understanding of geological setting

7.2.1.1 Ground Science 2022 ground investigation (GI)

Ground Science Pty Ltd (Ground Science) has previously undertaken a geotechnical investigation in 2022 for the proposed residential development located at 171 Gillies Road in Miners Rest, Victoria, which is within the proposed study area.

The field investigation comprised 74No. test pits to a target depth of between 1.5 m and 5.0 m below surface levels, using a tracked excavator. The plan showing the test pits locations in shown in Figure 7-2 below.

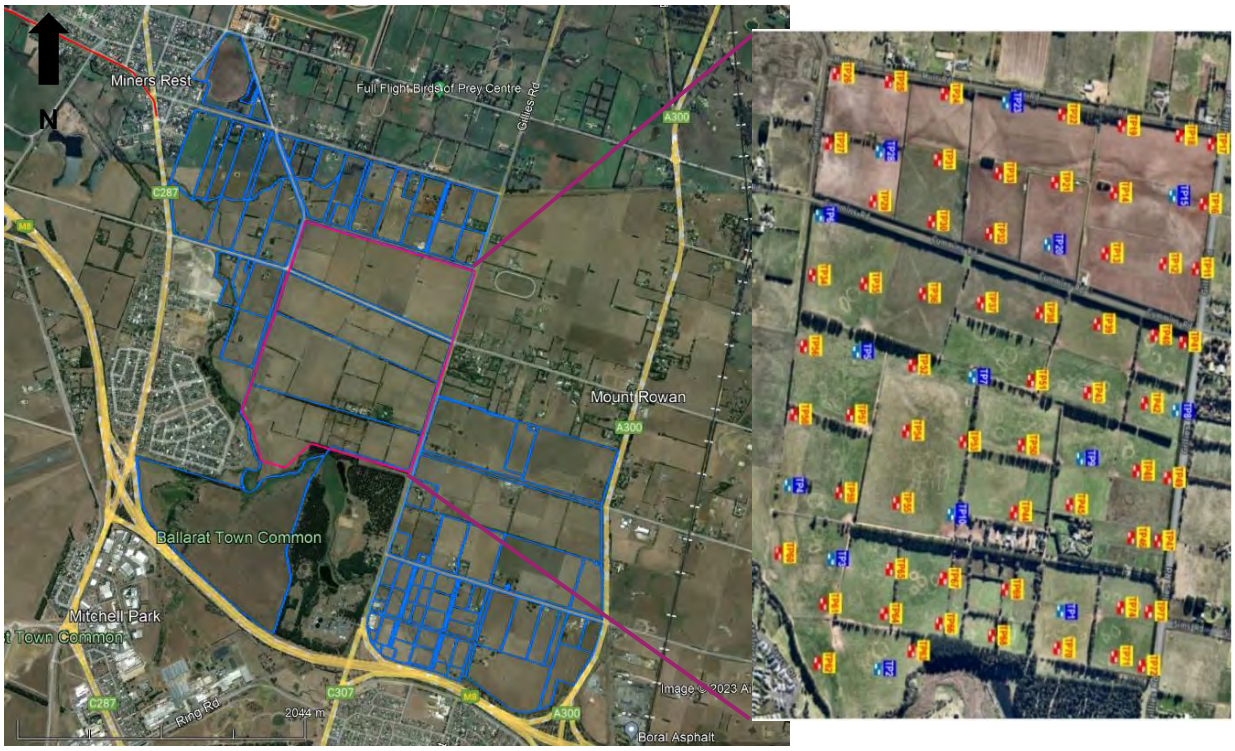

Figure 7-2. Indicative locations of test pits (extract from Ground Science 2022 GI, not to scale) site boundary outline shown in purple

The subsurface soils encountered during the investigation were generally distinguished into 3 geological units, summarised as follows:

Table 7-4. Summary of Ground Science 2022 ground profile by unit

Unit	Name	Type / Profile	Base depth (mbgl)	Thickness (m)	Description
1	Topsoil		0.0 to 0.4	0.3 to 0.4	The Unit 1 topsoil material generally comprised silty clay, low to medium plasticity, brown with sand, rootlets/organics, firm to stiff consistency with moisture typically dry to moist. Occasionally the surface material was recovered as inferred fill (possibly disturbed material /dressed soil) comprising silt with sand/rootlets.
2		Residual Soil	0.7 to 5.6	0.7 to >5.6	Unit 2 Residual 'Newer Volcanic Group' soil deposits were found to underlie the Unit 1 topsoil material at all test pit locations. The Unit 2 soils were typically

Unit	Name	Type / Profile	Base depth (mbgl)	Thickness (m)	Description
	Newer Volcanic Group				recovered as silty clay or clay, medium to high plasticity, red mottled brown, with traces of sand and gravel, stiff to hard consistency and dry to moist. Basalt cobbles were noted within this deposit. Some material variations were observed, including sandy silt of low plasticity, recovered at some locations (possibly alluvial deposits) and in some locations, the Unit 2 soils were recovered as gravelly clay. Penetration refusal was encountered at several locations within this soil unit.
3		Extremely Weathered (EW) Basalt			Unit 3 EW Basalt was encountered at most locations before the test pits were terminated or the excavator refused. The Unit 3 EW Basalt was generally recovered as clayey gravel, gravel or sandy gravel. The excavator was generally able to excavate these deposits to a certain depth before refusal was encountered.

The findings of the investigation are consistent with the published information, which indicates that the site is underlain predominantly by Quaternary aged Newer Volcanic Group, with possible alluvial deposits in proximity to the Burrumbeet Creek.

Groundwater was not encountered during the investigation. It should however be noted that groundwater levels can vary seasonally and with changes to drainage conditions.

Limited laboratory testing was undertaken on residual soils to assess the engineering characteristics. The summary is as follows:

- Moisture Content undertaken on 8 No. samples gave values between 14.0% and 33.1%;
- Atterberg Limits testing undertaken on 10 No. samples showed the material to be clay of low to high plasticity but generally of medium to high plasticity. The Liquid Limit and Plasticity Index values indicates the material has a low to high swell potential but predominantly medium to high;
- 4 day Soaked Californian Bering Ratio (CBR) tests were undertaken on 8No. samples giving values between 3% and 25%, with higher values attributed to an increase in sand and/or gravel within the sample;
- The CBR percentage swell test values ranged from 0.0% to 2.5%, indicating high variations in the swell potential (low to high);
- One sample recorded Emerson Class of 4 and pinhole dispersion classification of ND2, which indicates the sample tested is slightly to non-dispersive. A second sample returned Emerson Class 1 and pinhole dispersion classification of D2, which indicates the sample tested is highly dispersive.

7.2.2 Historical mining activity

The first discovery of gold near Ballarat in 1851 was associated with areas of historical mining activity. The Ballarat Goldfield District Online Map (2019) identifies several shafts for alluvial gold mines within the south-east part of the study area, please see Table 7-5 and Figure 7-3 below. The Lotsearch report LS048897 in

Appendix B identifies the same mine shaft locations expect Site ID 377395. No further details, for example size and depth of the shafts, are provided.

Deep leads are ancient gold-bearing creeks and rivers buried beneath the ground and the presence of these leads indicate a higher potential of historical mining activity in the surrounding area. An inferred deep lead is shown traversing the proposed project area which may have been subject to mining (refer to Table 7-5 below).

Table 7-5. Summary of shafts identified within the project area

Name	Site ID	Mining method	Mine depth (m)	Deposit category	Date mining activity finished
United Suburban Co.	379660	Shaft	57.9	Alluvial Gold	01/04/1870
Great Northern Junction Co.	377395	Shaft	106.68	Alluvial Gold	12/06/1869
Northern Junction Co.	378691	Shaft	91.44	Alluvial Gold	n/a
Quick and Co.	379483	Shaft	n/a	Alluvial Gold	n/a
Mount Rowan Co. No. 1 Shaft	378847	Shaft	141.7	Alluvial Gold	31/12/1887
Mount Rowan Co. No. 2 Shaft	378848	Shaft	28.4	Alluvial Gold	31/04/1885
Mount Rowan Co.	378807	Shaft	n/a	Alluvial Gold	n/a

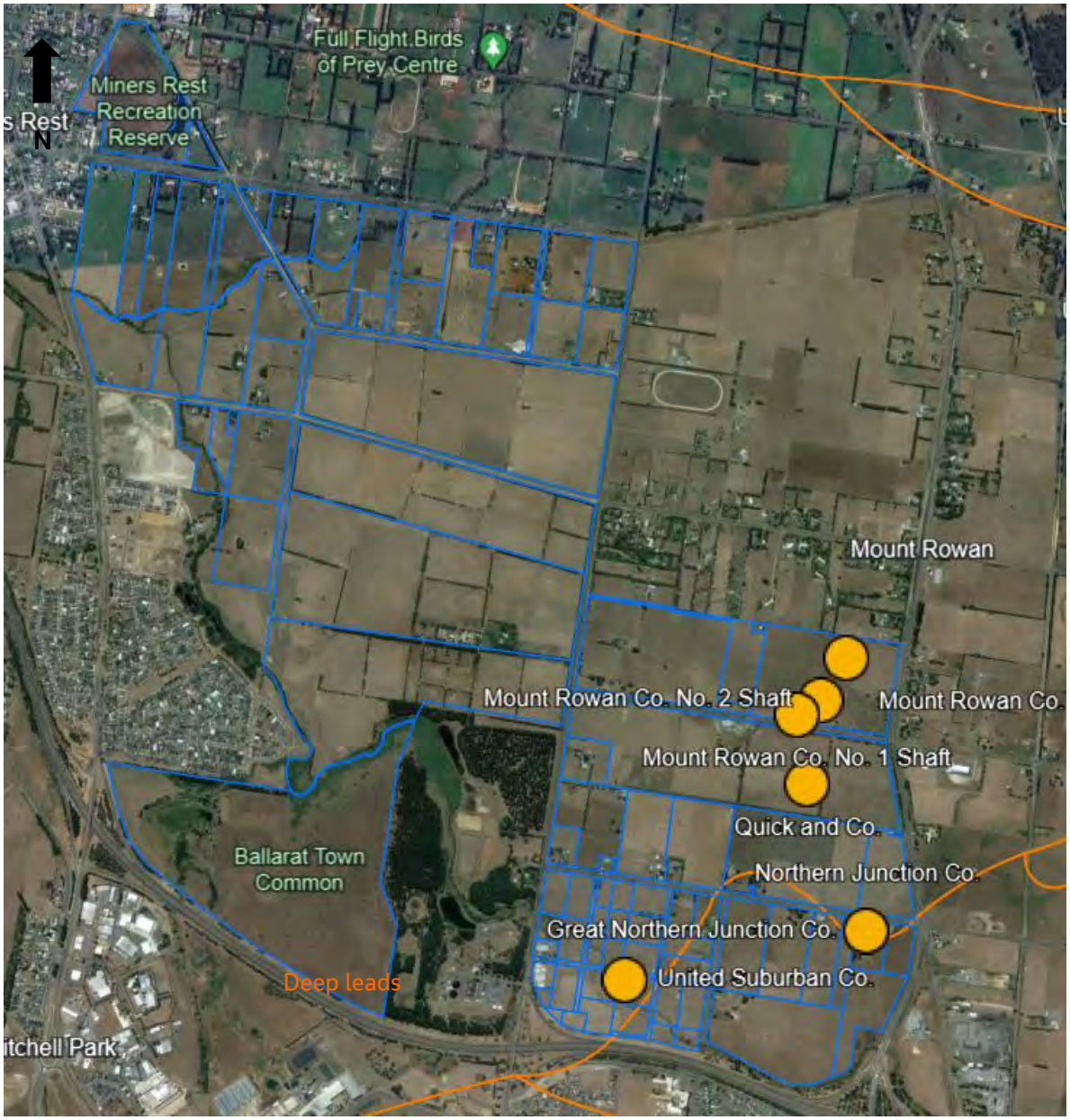

Figure 7-3. Extract of Ballarat Goldfield District Online Map showing the shafts identified within the study area (2019). Copyright © The State of Victoria, Department of Environment, Land, Water & Planning 2019, Copyright © The State of Victoria, Department of Economic Development, Jobs, Transport and Resources 2019, Copyright © K.C. Richards 2019

7.2.3 Sites of geological significance

No sites of geological significance, as determined by the Geological Society of Australia (GSA), are present at or close to the study area (DEECA, 2023d).

The project area includes a Significant Landscape Overlay (SLO) area, which is associated with an eruption point (Mount Rowan). The purpose of this SLO area is to "*to implement the Municipal Planning Strategy and the Planning Policy Framework, to identify significant landscapes and to conserve and enhance the character of significant landscapes*" (DEECA, 2023e). The SLO area within the project area is shown in Figure 7-4.

7.2.4 Erosion and land stability

Mapped geomorphological units, accessed from the Geomorphology of Victoria dataset and based on the Victorian Geomorphology Framework (VGF), are summarised in Table 5-2 (Please refer to Section 5.5).

The Geomorphology of Victoria dataset also indicates susceptibility to gully and wind erosion, and susceptibility to landslide for each of the geomorphological units which are also indicated in Table 5-2..

Gully erosion susceptibility is generally mapped as low to moderate, predominantly low. However, the low-lying area containing the Burrumbeet Creek and an area in the south-east corner of the study area, associated with terraces and floodplains of the Western Plains, is mapped as moderate.

Residual soils of the Newer Volcanic Group and alluvial soils within the study area may be susceptible to gully erosion during flooding or high rainfall events, especially where soils may have been exposed by construction works. Also, as noted in Section 7.2.5, sodic soils and residual soils of the Newer Volcanic Group are susceptible to dispersion which may lead to tunnel and gully erosion, and removal of topsoil may result in increased susceptibility to gully erosion in areas mapped as very low and low.

No observations of localised soil erosion were made during the site walkover in November 2023.

As shown in Table 5-2, the project area is mapped as having a Low to Very Low landslip susceptibility. Localised landslips may occur in areas of steep slopes, such as Mount Rowan Reserve (refer to Figure 5-6 for the contour map and overland flow paths for the Ballarat North PSP area). During the site walkover in 2023, possible signs of instability – minor translational slides with approximately less than 1m soil exposed in the scarp- were observed. This was a roadside observation, so the nature of ground movement may be different upon closer inspection.

Small areas within the study area are subject to an Erosion Management Overlay (EMO). The purpose of the EMO is to "*protect areas prone to erosion, landslip or other land degradation processes, by minimising land disturbance and inappropriate development*" (DEECA, 2023c). The areas subject to the overlay are associated with surface watercourse (Burrumbeet Creek) and an area mapped as the geological unit scoria (Nes) which are positive relief features that represent eruption centre locations. No evidence of active erosion was observed during the site walkover in November 2023. The extents of the EMO within the project area are illustrated in Figure 7-4 below.

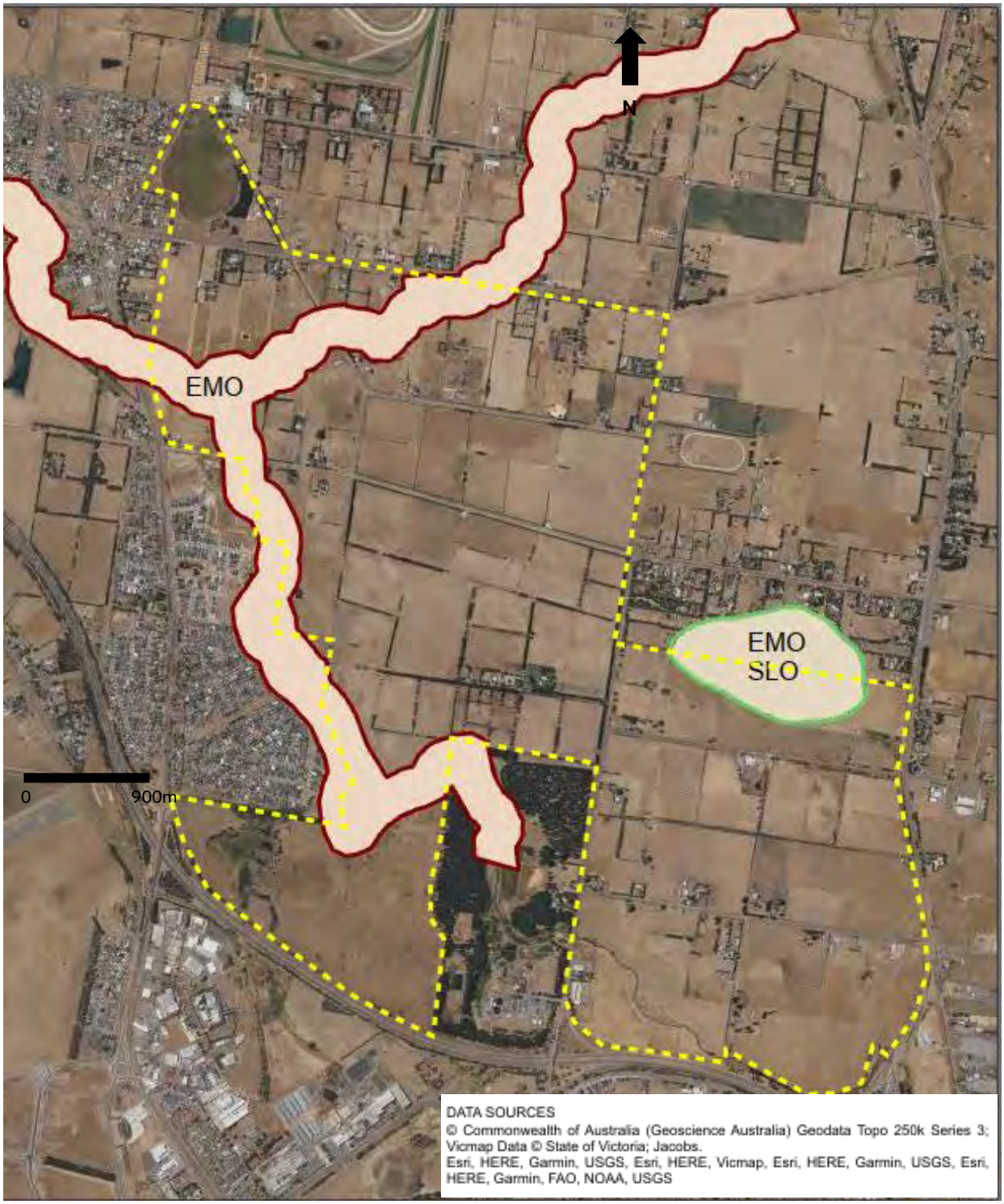

Figure 7-4. The extents of EMO and SLO within the study area (DEECA, 2023)

7.2.5 Dispersive soils

A summary of the mapped soil types within the project area is presented in Table 5-3 and is illustrated in Figure 5-8 (please refer to Section 5.5).

Mapped soil comprises predominantly Chromosols and Dermosols, with minor areas of Vertosols and Sodosols. Description of these soil types is provided in Section 5.5.

Sodosols typically feature increasing levels of soil sodicity with depth. The presence of Sodosols (sodic soils) within the project area is important as the clay portion of the soil is sensitive to dispersion. Soil dispersion is the process of clay particles separating from one another upon wetting, resulting in structural decline of the soil and often leading to gullying and tunnel erosion. The risk of dispersion increases for sodic soils where the overlying topsoil is removed or if surface runoff is poorly managed.

Very limited Emerson Class and pinhole dispersion testing was undertaken as part of the Ground Science 2022 GI. Two soil samples of the Newer Volcanics residual soil were tested. One sample, from the area mapped as Dermosols, recorded Emerson Class of 4 and pinhole dispersion classification of ND2, which indicates the sample tested is slightly to non-dispersive. The second sample, collected from the area mapped as Chromosols, returned Emerson Class 1 and pinhole dispersion classification of D2, which indicates the sample tested is highly dispersive.

7.2.6 Reactive soils

The likelihood for encountering reactive soils within the study area is considered high.

The mapped soil types (refer to Figure 5-8 in Section 5.5) indicate that small areas of Vertosols associated with alluvial deposits are present within the study area. This soil type is associated with clay-rich soils that shrink and swell in response to moisture change are known to be susceptible to cracking and slickensides leading to differential settlements across a structure's footprint. Slickensided surfaces where encountered will reduce the soil strength.

There is also large areas of Dermosols and Chromosols associated with the Newer Volcanics Group. Although Sodosols are not always necessarily associated with large shrink-swell movements, the Newer Volcanics residual soils are known to be highly to extremely reactive and susceptible to large surface movements as a result of changes in moisture content.

Atterberg Limit testing was undertaken on soil samples as part of the Ground Science 2022 GI within the residual soil of the Newer Volcanic Group. These samples recorded plasticity index (PI) between 16% and 53% which indicates the residual soil in this area display low to high soil reactivity, but predominantly medium to high reactivity (Holtz & Gibbs, 1956 & Seed et al. 1962). The percentage swell test values ranged from 0.0% to 2.5%, indicating high variations in the swell potential (low to high).

7.2.7 Compressible soils

Soft, compressible soils that may potentially be saturated are likely to be encountered around creeks and rivers, predominantly around Burrumbeet Creek. This likelihood is high where alluvial deposits (Qa1) have been mapped as shown in Figure 7-4.

The presence of uncontrolled fill and alluvial deposits where present across the project site with a shallow water table will likely result in high total and differential settlements due to any additional loads associated with site specific development, likely resulting in unacceptable ground movement.

7.2.8 Saline soils

Saline soil is a result of the accumulation of salt within the soil. Saline soils do occur naturally (primary salinity). However, European settlement in South- East Australia has expanded their occurrence as secondary salinity (Agriculture Victoria, 2020b).

The replacement of perennial native vegetation with annual crops and pastures, and the use of irrigation have both resulted in changes to the water balance resulting in a rising water table. If the water is sufficiently saline salt can accumulate in soil just below the ground surface, or on the surface itself. An accumulation of salt at the surface can kill off protective vegetation and leave the bare soil surface vulnerable to erosion, and can impact earthworks (e.g., soil reuse) (Agriculture Victoria, 2020b). Areas of saline soils can also display

elevated concentrations of chlorides and sulfates, that may cause corrosion of concrete and steel structures, as described in Section 6.4 of the Australian Standard Piling - Design and installation (AS 2159-2009).

A review of the Victorian Salinity Provinces (Agriculture Victoria, 2020a) indicates that the project area is located within the Burrumbeet salinity province. Salinity Provinces (SPs) provide a framework for describing land and water (both surface and groundwater) salinity in Victoria. These are specific geographic areas where the landscape setting and physical processes contributing to salinity are similar, and where salinity management options are also similar. Each salinity province contains discrete salinity impacted areas where there is a concentration or higher incidence of land and/or water salinisation. None of these areas are shown to be within the project area.

No obvious signs of salt scalding or salinity indicator species were observed during the site walkover in November 2023.

A summary of the Burrumbeet salinity province is shown below in Table 7-6 below.

Table 7-6. Summary of salinity provinces within the study area (Agriculture Victoria, 2020a)

Salinity province	Catchment management region	Priority status[1]	Province area (ha)	Recorded soil salinity area[2] (ha)	Salinity area description
Burrumbeet	Glenelg Hopkins	Low	50,040	61	A number of small salinity discharge sites are scattered within the area, mainly adjacent to and along drainage lines.

1. High priority provinces:
   (a) Include (or intersect) the boundaries of significant environmental or cultural assets, high value infrastructure (including urban development), and/or priority biodiversity areas.
   (b) Contain significant salinity occurrences that pose a threat to land productivity, catchment health, downstream assets or water users, and/or high value infrastructure.
   (c) Have reasonable prospects for successful salinity management interventions or treatment options that are considered feasible from both 'practicality' and 'return on investment' points of view.
   Salinity Provinces that do not meet the above criteria are classified as Low priority
2. Comprises the total geographic area that has been mapped as having, or showing symptoms of, dryland soil salinity at some time (past or present). Retrieved from http://vro.agriculture.vic.gov.au/dpi/vro/vrosite.nsf/pages/lwm_salinity-provinces. (Agriculture Victoria, 2020a)

7.3 Hydrogeological assessment

Based on the regional and local hydrogeological information presented in Section 5.6.1, a summary hydrogeological conceptual model is outlined below. A figure presenting water table depth across the Ballarat North PSP area is presented in Figure 5-10.

- There are three main groundwater systems relevant to the precinct:
  - Quaternary Alluvium Aquifer (QA – 100) and Upper Tertiary Aquifer (fluvial) (UTAF – 105): QA – 100 is present near Burrumbeet Creek where it traverses through the precinct area's northern parcels, and around the south-eastern margins of the precinct area. UTAF – 105 outcrops adjacent to the QA – 100 near Burrumbeet Creek where it traverses through the precinct area's northern parcels. UTAF – 105 is also present beyond where it outcrops but is not particularly relevant to the precinct because in these areas it underlies Upper Tertiary/Quaternary Basalts (UTB – 101) and due to depth, is unlikely to directly interact with the precinct.
  - The QA – 100 material is characterised as silt, sand and gravel and the UTAF – 105 material is characterised as fluvial gravel, sand and silt.

  - Where the QA – 100 unit occurs across the precinct area, it is likely to typically host the water table. Where the UTAF – 105 unit outcrops within the precinct area, the unit is likely to host the water table.
  - The QA – 100 is relatively thin and less than 6 m thick. The UTAF – 105 has variable thickness and is up to about 40 m thick.
  - Groundwater is conceptualised to flow through the pore spaces between the grains of the QA – 100 and UTAF – 105 material.
  - Upper Tertiary/Quaternary Basalts (UTB – 101) underlie the QA - 100 and outcrop where the QA – 100 is absent and where the UTAF – 105 doesn't outcrop. UTB – 101 is a fractured rock aquifer in the basalt flows and stony rises of the Newer Volcanic Group. Groundwater flow in this aquifer is primarily controlled by the size, spacing and interconnectivity of fractures and joints and as such, flow is known to be highly variable. It forms a major regional and local aquifer. The aquifer has variable thickness in the precinct area and is up to about 70 m thick. Near the QA – 100 and where the UTAF – 105 outcrops, it is thinner and about 3 m to 5 m thick. It is underlain by UTAF – 105 in the west and by Cretaceous and Palaeozoic Bedrock (BSE – 114) in the east. The UTB – 101) unit is expected to host the water table where it is encountered at the surface.

- The water table depth is conceptualised to be generally 10 to 20 mbgl in the central precinct area, grading to shallower than 5 mbgl in the southeast and northwest. There may be areas where the water table is deeper than 20 mbgl, likely in areas with relatively high ground levels.
- The primary recharge mechanism for the local aquifers is conceptualised to be via diffuse rainfall and surface infiltration. Locally, shallow groundwater is likely to contribute baseflow to surface water features and is also expected to be discharging via evapotranspiration in these areas where the water table is shallow (less than a few metres below ground).
- Shallow groundwater system flow is expected to generally be in a westward direction in the precinct area.
- State-wide groundwater salinity mapping indicates that groundwater salinity within the precinct area is either in the range of 1,000 to 3,500 mg/L or 3,500 mg/L to 7,000 mg/L (DELWP, 2014). The median and mean salinity concentrations of bores within 2 km of the precinct area was 620 mg/L and 845 mg/L, respectively. Accordingly, the groundwater segment is A2 (601 mg/L to 1,200 mg/L).
- Potential GDEs are present within the precinct area:
  - Burrumbeet Creek is a potential aquatic GDE. The majority of the precinct area's most northern parcel is potential GDE wetland. There are additional tracts of potential GDE wetlands near two different parts of Burrumbeet Creek.
  - There are numerous tracts of potential GDEs characterised as 'Plains Grassy Woodland' scattered over the precinct area.
- There are existing registered groundwater supply bores within the precinct area and beyond. The predominant use type is exploration and monitoring or domestic, irrigation and stock. The existing bores are relatively shallow with a mean and median depth of 35 m and 15 m, respectively.

In terms of land suitability, proposed works will need to be planned, constructed, and managed considering the groundwater conditions expected and the environmental value of the groundwater resource. Further details regarding specific recommendations for the appropriate management of groundwater conditions during development are provided in Section 8.3.

7.4 Hydrology assessment

Based on the regional hydrology information presented in Section 5.4, the North Ballarat PSP area is characterised as being at risk of inundation and development around Burrumbeet Creek will be encroaching on a floodplain. The risk of inundation arises from riverine flooding, but more information is required to determine whether the site is also at risk of flooding from local catchment. The flood model used to produce

the existing LSIO and FO planning overlays was developed in 2013 (Water Technology, 2013), and revised modelling is recommended to assess the impact of future development in line with the current Glenelg Hopkins CMA guidelines and standards.

The site is mostly rural with overland flow paths governing the flow regime. However, planned drainage information for the area is currently in draft and new drainage asset information may impact this conclusion. The drainage report (Arup, pending) recommends that the drainage mitigation features (i.e., drainage basins) take place outside of the 1% AEP riverine inundation extent.

Future development may impact on the flood storage, flow path, land imperviousness, access safety and hazard, freeboard of the buildings, and drainage strategy. Flooding considerations and general design criteria will be applicable to the North Ballarat Precinct area and are outlined in Section 8.4.

Since the area is in the upstream part of the Burrumbeet Creek catchment, the area could be exposed to flash flooding where warning time would be limited. This must be considered this when planning construction to ensure safe work environment.

It is recommended that an assessment take place to understand the potential effects of development on local catchment runoff and to ensure that flow conveyance throughout the site is not compromised. Jacobs notes that VPA will be preparing a separate drainage and flooding assessment as part of the PSP process. This should include:

- Ensuring that safety and hazard criteria are met and addressed where required.
- Understanding the duration of the flooding and whether there could be ponding areas. It is important to ensure that the length of inundation is not increased as a result of future development.
- Confirm that the proposed drainage scheme accounts for additional runoff due to land use changes within the development area.

8. Development opportunities & constraints

8.1 Land contamination

The following issues require consideration in the planning and design of any development and may be assessed through further contamination investigation:

Based on the information described in this report, there does not appear to be any significant constraints from a site contamination perspective which would render the land unsuitable for proposed future residential development. The exception to this is likely to be for area of the former Wendouree Tip where future sensitive land uses may not be able to be practicably realised (identified in the bullet points below). However, there are specific properties within the Ballarat North PSP area that have been assessed as presenting a 'high' potential for contamination (including the properties that fall within the inferred lateral extent of the former landfill). Further assessment at these properties may be required in order to better characterise the nature of contamination and identify how contamination (if identified) can be managed as part of the future development activities.

These properties include (refer to Figure 8-1 below and Figure 3 in Appendix A):

- Property numbers 70, 71, 72, and 73 which according to the landowner, since they have been aware in late 2022 through a self-sponsored Preliminary Site Assessment (PSI) that these parcels would need environmental clean-up activities. Jacobs understands that the landowner plans to implement remediation activities in 2024. Jacobs notes that the completion of the PSI, and the indication that remediation is to be performed at these properties does not negate the need for the completion of an environmental audit in order to assess the suitability of the land for potentially sensitive future uses.
- Property 77 which is an asphalt services company. Based on the current site use, Jacobs has determined that there is a potential for activities at the property to result in contamination; and
- Property numbers 90, 91, 92, 98, 99,100, 101, and 102 which encompasses the inferred lateral extent of the closed landfill (former Wendouree Tip) at the southern portion of the Site.

In accordance with PPN30 and based on the future proposed sensitive land use that is being considered for Ballarat North PSP area (residential land use), PPN30 recommends that properties representing a 'high' potential for contamination proceed to an environmental audit. As discussed in Section 2.1.6, PPN30 states that when 'the rezoning relates to a large strategic planning exercise or involve multiple sites in separate ownership' it is acceptable to defer the requirements (to complete the environmental audit) until after the planning scheme amendment. This is achieved through the application of an EAO. The future developer will then need to meet the environmental audit requirement (i.e. obtain the environmental audit statement) which will be a condition in the planning permit (triggered by the EAO) prior to the proposed sensitive use (or buildings / works associated with establishing that use) commencing.

In addition to the above, the following properties were categorised as 'medium' potential for contamination:

- Property number 5 which had indications of presence of metal piles including stockpiles of cut trees and soil and a potential presence of a stock dip;
- Property numbers 31 and 32 (under the same ownership) which had numerous sand spoil mounds / stockpiles dating back two decades. Upon inspection, it was evident that spoil mounds / stockpiles included fill material, including metal, brick and ceramic fragments, gravel and timber;
- Property number 43 where farm operation were assessed as presenting a medium potential for contamination on the basis of previous assessment which identified activities generating waste (carcass burials, fuel spills from routine refilling of farm machineries, rubbish/burning of rubbish, etc);
- Property numbers 56 and 57 (under the same ownership) which had indications of presence of what appears to be stockpiles of scrap metals and mounds of other unidentified materials;

- Property numbers 88 and 89 which are sandwiched between Property 77 (asphalt company) and the former Wendouree Tip – both locations with a high potential for contamination;
- Property number 93 which is adjacent to the extents of the former Wendouree Tip; and
- Property number 96 on account of the fact that this parcel is located downgradient adjacent parcels with a high potential for contamination (specifically parcels 71, 72 and 73).
- Property numbers 74 for which an EAO has been applied historically and remains in place. As previously described, while the current EAO also extends across adjacent properties 75 and 97 these have been assessed as presenting no potential for contamination since the activities that originally gave rise to the application of the EAO are understood not to have occurred at properties 75 and 97.

Details of these observations are included in Appendix D. In accordance with PPN30 and based on the future proposed sensitive land use that is being considered for Ballarat North (residential land use), for properties where the potential for contamination is considered to be 'medium', a PRSA is recommended in order to determine the need for and environmental audit. As discussed in Section 2.1.6, PPN30 states that when 'the rezoning relates to a large strategic planning exercise or involve multiple sites in separate ownership' it is acceptable to defer the requirements (to complete the PRSA and / or environmental audit) until after the planning scheme amendment. This is achieved through the application of an EAO. The future developer will then need to meet the PRSA requirement (and any subsequent environmental audit as recommended as an outcome of the PRSA) which will be a condition in the planning permit (triggered by the EAO) prior to the proposed sensitive use (or buildings / works associated with establishing that use) commencing.

The former Wendouree Tip (land owned by Ballarat City Council) has been identified as several parcels of land (8 in total) that represent a 'high' potential for contamination. On this basis, an environmental audit is required that would include consideration of potential risks associated with landfill gas. Jacobs notes that potential risks associated with the lateral migration of landfill gas should also be considered for adjacent parcels of land beyond the lateral extent of the former landfill. In accordance with EPA Publication 1642 – Assessing Planning Proposals in the Buffer of a Landfill and the Draft EPA Publication 1950 - Land buffer guideline, Jacobs recommends that a 500m closed landfill buffer is applied, within which further assessment of potential risk (and therefore development constraints) associated with landfill gas are considered. To this end, Jacobs recommends that a planning permit condition is included for all land parcels that fall within the 500m buffer that a landfill gas risk assessment be undertaken by the future land developer. This assessment should inform the potential requirement for landfill gas mitigation to be incorporated as part of future land development. Jacobs understands that Ballarat City Council (owner of the land parcels that represent the extent of the former landfill) intends to complete a landfill gas risk assessment. Figure 7-1 presents Jacobs estimation of the applicable landfill buffer (500m) based on the inferred extent of the landfill (informed by site features, general landform and current aerial imagery). Specific recommendations relating to the management of potential landfill gas at land parcels within the applicable buffer (and the former landfill itself) are presented in Section 10.

In addition to the properties that have been identified above as presenting either a 'high' or 'medium' potential for contamination, it is likely that localised or discrete areas of contamination may be identified elsewhere across the Ballarat North PSP area. It is likely that these can be cost-effectively managed or remediated as part of the site development process. For example:

- Septic tank systems associated with the farm residences are likely present within the Ballarat North PSP area, albeit sparsely distributed, have the potential to cause localised subsurface contamination. As such, it is recommended that any septic tank system should be identified, excavated and validated as part of future site development activities.
- Miscellaneous stockpiles and areas where discarded materials/equipment on the ground surface were observed at some of the properties. These stockpiles, which include residual mine wastes, mullock heaps, tailings, sand, gravel, soil, imported fill, green wastes (timber from cut trees) and assorted rubbish (scrap metals from broken down / dilapidated vehicles and farm equipment) may not be suitable to remain on site under the future land use scenario, in which case they should be identified and removed to a suitably

licensed disposal facility, and the areas that they were located appropriately validated. This may be undertaken as part of future site development activities.

It is anticipated that minor management activities such as the above could be controlled during development through the implementation of a robust Construction Environmental Management Plan (CEMP) with suitable provisions for the management of unexpected finds. Where necessary, the developer should seek the advice of a suitably qualified environmental professional.

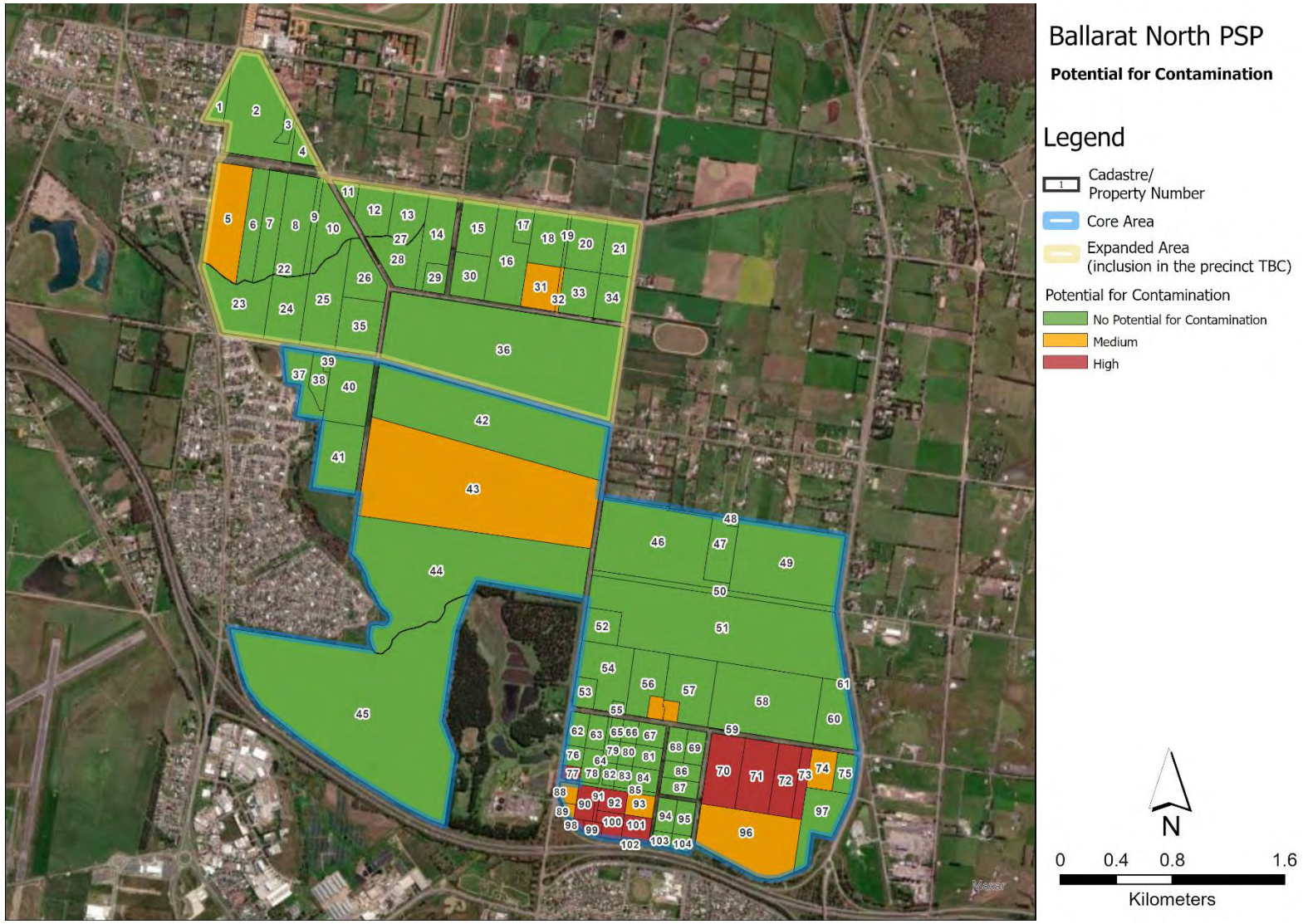

Figure 8-1. Assessment of potential for contamination

8.2 Geotechnical consideration

The following issues require consideration in the planning and design of any development and should be assessed through a detailed geotechnical site and laboratory investigation.

8.2.1 Ground conditions

From the desktop review carried out, the study area is predominantly underlaid by the Newer Volcanic Group Formation. The weathering profile of the basalt is highly variable and typically comprises high plasticity residual clay and extremely weathered basalt with occasional rock floaters (in the form of cobbles and boulders), overlying the highly to moderately weathered basalt. Jointing within the basalt rock mass can be variable, and depth to basalt and thickness of basalt can be highly variable over relatively short horizontal distances.

Historical boreholes and test pits identified within the study area containing lithological or stratigraphical information, as shown in Figure 8-2, encountered the Newer Volcanic Group, which is consistent with the published geological information.

The generalised summary of the ground profile is provided in Table 7-4. The variability of the ground conditions is demonstrated by the range of thickness of the residual soil and extremely weathered Basalt profile across the Groundscience (2022) site as follows:

- In the northern part of the study area, the soil profile was recorded to be between 1.2 and 5.6 m
- In the south-west corner the soil cover was recorded to be between 0.9 m and 3.7 m
- In the central part, the soil cover was recorded to be between 0.7 m and more than 5.0 m

In the Ballarat region, the thickness of the basalt flows in the project area are recorded to be more than 40 m. However, the strength and weathering grade of basalt is unknown.

Alluvial deposits were not encountered during the historical ground investigations and are likely to be present around watercourses with colluvial deposits likely to be present around watercourses, on slopes and at the base of the hills.

Based on the published information, the Lancefieldian-age Castlemaine Group, comprising marine sandstone, mudstone and black shale, is expected to be present in the eastern side of the study area. However, no historical borehole information is available to confirm the presence of this unit.

Although a number of historical boreholes have been identified within the study area, there is a lack of detailed and recent intrusive geotechnical data covering the whole study area, especially in the north-east corner of the site.

Figure 8-2. Historical boreholes and test pits identified within the study area containing lithological or stratigraphical information (Groundscience 2022 site area shown in purple)

8.2.2 Historical and current mining activity

The presence of mining related shafts presents a serious geotechnical hazard as any construction works over disused shafts, adits or underground workings pose a potential for cave ins and ground collapse.

The Ballarat Goldfield District Online Map (2019) and Lotsearch report LS048897 in Appendix B identifies 7No. shafts within the south-east part of the study area (please refer to Section 7.2.2). However, the level of accuracy of the historical records is unknown, and additional shafts could be present in the area.

Currently there is no information to indicate mine closure and decommissioning of any shafts e.g. capping and/or backfilling of the shaft. It is recommended that requests as to the status of these shafts and associated mine infrastructure (including extent of underground mining) are made by the future developer as part of their due diligence process to the current landowner(s) in order to identify any further information that may be able to confirm specific location of these shafts and whether they have been capped and/or backfilled. It is also recommended that site specific geophysical survey be undertaken in the areas where historical mining activity is recorded in order to locate potentially abandoned shafts. Where mine shafts are identified, then a site-specific geotechnical investigation should be undertaken, including a mine shaft remediation assessment (if not already available). A mine shaft remediation assessment will provide remedial options including suitable mitigation methods for suspected mine shafts and associated geotechnical risks at each site. It should address health and safety liabilities from each site arising from historical workings and mine shafts

including 'make-safe' options. The design and implementation of an appropriate survey should be performed by a suitably qualified specialist. Further details regarding this specific recommendation is provided in Section 10.

8.2.3 Sites of geological significance

The study area includes a SLO area, which is associated with an eruption point (Mount Rowan), please refer to Figure 7-4**.** This area is not listed as a geologically significant feature, however there is a permit application requirement to develop or carry out works in this area.

8.2.4 Dispersive soil and soil erosion

Residual soils derived from the Newer Volcanic Group typically display dispersive properties. During construction these materials may erode, and the condition of the material may deteriorate quickly if disturbed or exposed. The presence of dispersive soil may also cause instability of structures and earthworks in the long term e.g. piping failures.

In-situ dispersive soils are also prone to waterlogging that can impact the surrounding environment if not properly managed. Re-use of soil prone to dispersion for earthworks may also need to be managed as the soil may be susceptible to erosion and gullying, impacting earthworks integrity and leading to sedimentation of waterways and adjacent land.

During any construction activities in the area where dispersive soils are identified, surface runoff may need to manage and the area of excavation to exposed soil limited, avoiding wash out of dispersive soil. Dispersive soil may need to be improved by application of either lime or other additives where the dispersive soils are encountered.

Failure to put control measures into place to control erosion during construction and to re-instate areas (with sufficient time allowance for establishment of grass) where soil has been exposed may result in loss of soil material from disturbed areas and sedimentation of waterways and adjacent land.

Any temporary or permanent batter slopes which expose dispersive soils will likely require face protection to prevent erosion and fall out from the face e.g. surface drainage control and face treatment. A geotechnical engineer/engineering geologist should assess the stability of any slopes and provide guidance as to measure needed for the site-specific situation.

The very limited laboratory testing indicates that dispersive soil is present within the study area. It is recommended that sufficient soil samples should be obtained during the geotechnical investigation to confirm the dispersive properties of soil, particularly in areas where Sodosols and Chromosols are mapped.

Small areas within the study area, as identified in Figure 7-4, are subject to an EMO. As such, there is a planning permit requirement before any construction works, including earthworks and tree removal, can be carried out.

8.2.5 Soil reactivity

Residual soils derived from the Newer Volcanic Group are known to be reactive, experience variable volumetric change properties and can contribute to seasonal ground movement of pavements and shallow foundations due to natural soil moisture changes. This can lead to reduced trafficability, erosion and soil instability impacting land use and assets.

The limited laboratory testing data (Groundscience, 2022) indicates that reactive soil is present within the project study area. It is recommended that sufficient soil samples should be obtained during any future geotechnical investigation to confirm the reactivity of soil.

Laboratory testing, including soil classification and shrinkage index of the soil, can provide an indication of the sensitivity of in-situ material to changes in moisture content to inform the tolerances which should be allowed for during design. Site Classification in accordance with AS2870-2011 Residential Slabs and Footings should be undertaken to assess the characteristic surface movement for the site specifically being assessed within the project study area.

Where reactive soil is present, depending on the shrink swell properties and structure sensitivity to ground movements, the soil may need to be removed and replaced. Adequate drainage of the finished ground surface and surrounding areas to manage surface water runoff can also effectively minimise the impact of characteristic surface movements due to reactive soils.

Without treatment, e.g., cement and/or lime stabilisation, reactive soils may be unsuitable for re-use as fill material in accordance to AS 3798—2007 Guidelines on Earthworks for commercial and residential developments and may require disposal off site subject to EPA Victoria requirements.

8.2.6 Compressible soil

Soft, compressible and potentially saturated soils may be encountered around watercourses, particularly where recent alluvial sediments have been mapped along the Burrumbeet Creek. Excavation, vehicle movement and construction of structures in these locations have the potential to result in settlement and/or land instability due to inadequate bearing capacity of soils during construction.

In addition, soft, compressible material may be unsuitable for re-use for fill material without treatment and may require disposal off site.

8.3 Hydrogeology

The following issues require consideration in the planning and design of any development and may be assessed through further hydrogeological investigation:

- Site-specific groundwater impact assessments will be required for works within or near groundwater receptors (potential GDEs and registered bores used for water supply) depending on location, footprint, and extent of works within the subsurface/water table.
- Due to the potential shallow water table across parts of the site, construction may be difficult during wet months, particularly as some of the site is of low-lying elevation. Where ground is saturated during construction/excavation, waterlogged soils may become difficult to traverse.
- Dewatering during construction may be required if excavations encounter the water table (expected to be within 5 m of ground surface across significant parts of precinct area). The magnitude of groundwater inflow into excavations cannot currently be assessed with confidence; however, provided only shallow infrastructure construction is proposed, a sump and pump type arrangement may provide satisfactory management of groundwater locally.
- Works requiring dewatering will need a site-specific assessment before and during any excavation to prevent impacts to groundwater receptors (GDEs and existing bores used for water supply). This will include, as a minimum, an analytical assessment of the extent of groundwater level drawdown to achieve dry conditions in excavations, and whether the drawdown cone of depression will intersect groundwater receptors. If potential impacts are identified, consideration of the proposed construction method and scheduling to minimise or eliminate impacts is required. If there is high uncertainty, or if impacts cannot be mitigated through design and scheduling, field investigations will be required to assess groundwater levels, quality, and aquifer properties. A field monitoring program will need to be designed and implemented during construction to ensure assessment objectives are achieved. The requirements for this assessment should be determined on a site-by-site basis by the future site developer at the time of future development.

- Similar to above, potential dewatering induced reductions to baseflow of surface water systems would require assessment and consideration.
- Consideration of dewatering impacting ground movement and ASS, if relevant.
- Consideration of disposal options for extracted groundwater will be required. Disposal of groundwater should be in accordance with the requirements of relevant authorities and permits obtained. Groundwater quality could influence the dewatering disposal method or mean that water requires treatment prior to discharge.
- Opportunities for the potential use of extracted groundwater include dust suppression during construction, and garden watering and irrigation of parks and ovals following development (provided groundwater low in salinity is encountered). Salt tolerance limits vary for different plants and animals, so it is advisable to assess which salinity range would be acceptable for the intended use. Based on the expected salinity of the groundwater, it may need to be supplemented by or mixed with potable water to improve the quality for the intended purpose.
- Groundwater quality should be considered in relation to structure design and durability.
- Potential groundwater contamination, if identified.
- Consideration of groundwater aggressivity effects on structures (e.g. concrete piles).

8.4 Hydrology

Flooding considerations and design criteria will constrain future development given that significant portions of the Ballarat North PSP area are at risk of inundation from riverine flooding. At the time of this desktop due diligence study, details on specific land use changes in the Ballarat North PSP area were not available. The considerations and design criteria identified are general in nature and relate to the broad future proposed commercial / industrial land use across the precinct.

Potential considerations and design criteria for future development are not limited to items listed in this section. Early engagement and consultation with local water authorities and stakeholders will be critical to understand the full list of considerations and design criteria applicable to specific land use changes.

8.4.1 Flooding considerations

Flood risk will need to be managed when planning and implementing future development in the Ballarat North PSP area. General guidance for managing flood risk in new developments includes but is not limited to:

- Flood Flow: Works or structures should not affect floodwater flow capacity. This ensures that existing flood levels are not made worse by alterations to the flow characteristics of a floodplain or overland flow path.
- Flood Storage: Works or structures should not reduce floodwater storage capacity. This prevents higher flood levels that may occur if the available storage volume is reduced.
- Freeboard: Works or structures should not reduce minimum freeboard. This ensures there is no adverse impact on existing property and infrastructure.
- Site Safety Requirements: Works or structures should not create new hazards or increase existing hazard. Development will not be allowed where the depth and flow of floodwaters would create new hazard or increase existing hazards.
- Access Safety Requirements: Access safety requirements should be taken into account. Development cannot be allowed in circumstances where the depth and flow of floodwater affecting access to the property is hazardous.
- Climate change requirements: Floodplain impacts of works or structures must be considered, consistent with the approach specified in ARR 2019, for the following climate change scenarios:

- Increase in rainfall intensity
- Sea-level rise

8.4.2 Flooding design criteria

The desired key outcome for development within a flood prone area is to ensure the proposed design does not adversely impact (increase) flood risk to people and properties. Appropriate flood mitigation measures must be included in the design so that there is no significant increase in flood risk outside the land of the project and minor adverse flood impacts are located where there are no sensitive receptors. The primary design criteria outlined in the Guidelines for Development in Flood Affected Areas (DEECA, previously DELWP, 2019), which must be considered in the design stage include:

- To ensure that the proposed design does not adversely impact the existing flow regime, including overland flow paths for extreme storm conditions.
- Access/Site Safety: To review the flood modelling results against the safety criteria of local guidelines during a 1% AEP event
- Freeboard: If related, set the floor elevations of the new buildings at 300 mm (for stormwater overland flow paths) or 600 mm (for developments near a watercourse) above the 1% flood level.
- To demonstrate that no additional flows would be discharged from the site as a result of the proposed works (overland and underground)

As stated earlier, an early engagement and consultation with local flood authorities and stakeholders will be critical to understand the full list of flood management criteria and the associated drainage strategy and to ensure there is no further restriction/constrains for development.

8.4.3 Additional constraints

In addition to the general flooding considerations and design criteria provided, state planning controls apply to areas within the Ballarat North PSP area. The Land Subject to Inundation Overlay (LSIO) associated with the flooding extent from Burrumbeet Creek covers a significant proportion of the south-west boundary of the site.

Under the LSIO, a permit is required to construct a building or carry out any temporary (constructions sites) or permanent works, and to subdivide land. In addition to this, any temporary or permanent works at or near waterways may require the appropriate planning approvals. Therefore, additional investigations in consultation with the relevant Catchment Management Authority will be required. In summary, Jacobs recommends that the relevant requirements and legislations applicable to the development in question (including flooding requirements, details regarding the application process for planning permits, construction permits, and/or building permits) be confirmed through consultation with local planning authorities and stakeholders as requirements can vary according to project locality. Two important stakeholders to include in this consultation are the Glenelg Hopkins CMA and the Ballarat City Council.

8.5 Geomorphology

The Precinct is located on soils that have formed from weathering of local Newer Volcanic Group Basalt rock. They may have characteristics that are similar to sodic/dispersive soils that previously been assessed by Jacobs in other Precincts (Melton East, Merrifield North, Parwan and Parwan Employment).

Topsoils are generally expected to have better structural stability, but subsoils have the potential to be sodic/dispersive and susceptible to erosion, particularly in instances where the topsoil is removed or if there are drainage works, which then result in rainfall and runoff making contact with and eroding these soils. Development in these areas may require very careful planning, staging of works to minimise disturbance and possible remediation of soils to enhance their stability.

With proposed urban development there will be a significant change in runoff to waterways – which in turn will heighten erosion risks. It is expected that with development of drainage services scheme Ballarat City Council will want further advice as to how future development and the drainage services scheme can be prepared so as manage erosion risks and provide appropriate for protection to waterways, including wetlands that are present in the Precinct.

9. Conclusions

9.1 Contamination

Based on the information gathered during the Stage 1 and Stage 2 assessments, the following conclusions can be made concerning Ballarat North PSP:

- Thirteen properties within Ballarat North PSP area were identified as presenting a high potential for contamination:
  - Property numbers 70, 71, 72, and 73 which according to the landowner, since they have been aware in late 2022 through a self-sponsored Preliminary Site Assessment (PSI) that these parcels would need environmental clean-up activities. Jacobs understands that the landowner plans to implement remediation activities in early 2024.
  - Property 77 which is an asphalt services company. Based on the current site use, Jacobs has determined that there is a potential for activities at the property to result in contamination.
  - Property numbers 90, 91, 92, 98, 99,100, 101, and 102 which encompasses the inferred lateral extent of the closed landfill (former Wendouree Tip) at the southern portion of the Site.
- Eleven properties within Ballarat North PSP area were identified as presenting a medium potential for contamination:
  - Property number 5 which had indications of presence of metal piles including stockpiles of cut trees and soil and a potential presence of a stock dip.
  - Property numbers 31 and 32 (under the same ownership) which had numerous sand spoil mounds / stockpiles dating back two decades. Upon inspection, it was evident that spoil mounds / stockpiles included fill material, including metal, brick and ceramic fragments, gravel and timber.
  - Property number 43 where farm operation were assessed as presenting a medium potential for contamination on the basis of previous assessment which identified activities generating waste (carcass burials, fuel spills from routine refilling of farm machineries, rubbish/burning of rubbish, etc).
  - Property numbers 56 and 57 (under the same ownership) which had indications of presence of what appears to be stockpiles of scrap metals and mounds of other unidentified materials around the southern portion of these two properties (the remainder of these properties has been assessed as no potential for contamination).
  - Property numbers 88 and 89 which are sandwiched between Property 77 (asphalt company) and the former Wendouree Tip – both locations with a high potential for contamination.
  - Property number 93 which is adjacent to the extents of the former Wendouree Tip.
  - Property number 96 on account of the fact that this parcel is located downgradient adjacent parcels with a high potential for contamination (specifically parcels 71, 72 and 73).
  - Property numbers 74 for which an EAO has been applied historically and remains in place. Jacobs notes that this particular EAO also remains in place across part of properties 75 and 97. However, it is understood that the activities that originally gave rise to this EAO did not occur at these two properties, and on this basis properties 75 and 97 have been assessed as presenting no potential for contamination.
- The remaining properties (80 out of the total 104) within the Ballarat North PSP study area were identified as presenting a no potential for contamination. This number represents the mostly agricultural / farm land properties and parcels such as Miners Rest Recreation Reserve and Wyndholm Park.
- The off-site land uses that were identified within 1km of the Ballarat North PSP study area that were identified for review based on their potential to contaminate land include:

- Ballarat North Wastewater Treatment Plant (BNWTP) – This site has been subject to an Environmental Audit (CARMS No. 78778-1). Anticipated groundwater flow direction in the areas is anticipated to be generally westerly over the majority of the PSP area, although in the south-eastern corner of the PSP area there may be a southerly element to the groundwater flow direction. Although sandwiched between eastern and western land masses of Ballarat North PSP area, it is unlikely that contamination relating to the operations of this facility will materially impact upon the Ballarat North PSP area land parcels (from a contamination perspective). This was assessed as presenting a low potential to present contamination risk to Ballarat North study area.
- Ballarat Airport - The continuing risk of harm emanates from the contaminated land (including groundwater) that exists within the Ballarat Airport primarily due to the release of contaminated wastewater in the 1980s. Based on the environmental audit report, recommendations have been provided to minimise the risk of harm due to the occurrence of pollution and the presence of contaminated land at the Ballarat Airport. The report also mentioned that the current condition of the land was assessed to be suitable for ongoing commercial/industrial use but subject to compliance with recommendations. Lastly, the audit report recommended a GQRUZ to be put in place for the affected areas and a routine groundwater monitoring was required. The environmental audit was completed on 22 August 2022. Based on all available data, it is unlikely that the parcels of Ballarat North would be affected by the residual risk that Ballarat Airport poses on the environment. This was assessed as presenting a low potential to present contamination risk to Ballarat North study area.
- McCain Foods – This entity was the recipient of at least four pollution notices from EPA Victoria in recent years. It was unclear what kind of environmental issues this facility was cited for in 2022 and 2023. McCain Foods is considered large manufacturing facility with its own wastewater treatment facility, overall waste generation per year potential, presence of above-ground storage tanks and warehouses, etc. Despite its relatively close proximity to the Site, potential adverse impacts to Ballarat North PSP are considered low due to the nature of operations of the facility (not a site with a high potential for contamination).

- Based on the information described in this report, there does not appear to be any significant constraints from a site contamination perspective which would render the land unsuitable for proposed future sensitive land use (i.e. residential with supportive commercial). The exception to this is likely to be for area of the former Wendouree Tip where future sensitive land uses may not be able to be practicably realised. However, there are specific properties within the Ballarat North PSP study area that have been assessed as presenting a 'high' and 'medium' potential for contamination. Further assessment at these properties may be required in order to better characterise the nature of contamination and identify how contamination (if identified) can be managed as part of the future development activities. More specifically, as per PPN30:
  - For properties where the potential for contamination is considered to be 'high', an environmental audit is required.
  - For properties where the potential for contamination is considered to be 'medium', a PRSA is required. This PRSA will determine whether an environmental audit is then subsequently required.

  As discussed in Section 2.1.6, PPN30 states that when 'the rezoning relates to a large strategic planning exercise or involve multiple sites in separate ownership' it is acceptable to defer the requirements (to complete the PRSA and / or environmental audit) until after the planning scheme amendment. This is achieved through the application of an EAO, which is the approach that is recommended as part of this study. The future developer would need to meet the PRSA and / environmental audit requirement, which will be a condition in the planning permit (triggered by the EAO) prior to the proposed sensitive use (or buildings / works associated with establishing that use) commencing.
- Consideration of potential risks relating to landfill gas (from the former Wendouree Tip, owned by Ballarat City Council) should be considered as part of future development. More specifically, land parcels within 500m of the former Wendouree Tip should be the subject of a landfill gas risk assessment by the future land developer. This assessment should inform the potential requirement for landfill gas

mitigation to be incorporated as part of future land development. Jacobs understands that Ballarat City Council (owner of the land parcels that represent the extent of the former landfill) intends to complete a landfill gas risk assessment. The inferred lateral extent of the former landfill is presented in Figure 7-1, including the 500m buffer within which Jacobs recommends landfill gas risk assessments are performed. It is recommended that this requirement is included as a planning permit condition.

- Localised or discrete areas of contamination may be identified elsewhere across Ballarat North PSP area. It is likely that these can be cost-effectively managed or remediated as part of the site development process. It is anticipated that minor management activities could be controlled during development through the implementation of a robust Construction Environmental Management Plan (CEMP) with suitable provisions for the management of unexpected finds. Where necessary, the developer should seek the advice of a suitably qualified environmental professional.

9.2 Geotechnical

Based on the available information, the following conclusions can be made:

- The study area is predominantly underlaid by the Quaternary-Tertiary aged Newer Volcanic Group, generally comprising high plasticity residual clay overlying basalt rock, typically variably weathered. The limited historical borehole information indicates the soil cover is generally between 1m and 5m. High plasticity clays are typically expansive leading to large ground movements and can be problematic during earthworks due to their characteristics.
- Basalt cobbles and boulders (commonly referred to as floaters or core stones) are often present within the residual soil and extremely weathered basalt. Core stones pose higher levels of risk for foundations with the potential to found on a core stone rather than basalt flow. Basalt can be difficult to excavate where encountered within proposed footing and/or basement excavation footprints. Extremely weathered basalt or fresher material which is high strength with wide discontinuity spacing may require the use of specialist excavators and hydraulic breakers including rock hammers.
- Although not encountered during the historical ground investigations, alluvial deposits are mapped and likely to be present around watercourses and colluvial deposits are mapped and likely to be present around watercourses and on slopes and at the base of the hills. These units are likely to be soft compressible soils which should be confirmed by site specific geotechnical investigation.
- Compressible soils are likely to be encountered around creeks and rivers where Quaternary Age alluvial deposits have been mapped. The potential for total and differential settlement associated with compressible soils and uncontrolled fill should be assessed for the site specifically being assessed within the project study area. Soft and compressible soils are problematic and typically require treatment to improve their characteristics prior to development or reuse. With respect to reuse of compressible materials as controlled fill, this should be assessed against AS3798-2007.
- Based on the published information, the Lancefieldian-aged Castlemaine Group, comprising marine sandstone, mudstone and black shale, is expected to be present in the eastern side of the project area. However, no historical borehole information is available to confirm the presence of this unit.
- Several historical boreholes have been identified within the study area. However, there is a lack of detailed and recent intrusive geotechnical data covering the whole study area, especially in the north-east corner of the site.
- Several historical mining shafts are recorded within the south-east part of the study area. However, the level of accuracy of the historical records is unknown, and additional shafts could be present in the area. The presence of shafts presents a serious geotechnical hazard as any construction works over the disused shaft pose a potential for cave ins and ground collapse.
- The study area contains a volcanic eruption point (Mount Rowan) that is subject the SLO in the relevant planning scheme. Therefore, any future developments would require a permit application and a site-specific ground investigation which would need to include a slope stability assessment.

- Two areas subject to the Erosion Management Overlay are present in this section, associated with surface watercourses (Burrumbeet Creek) and scoria deposits (Mount Rowan). Therefore, any future developments in these areas would require a permit application.
- The project area is mapped as having a Low to Very Low landslip susceptibility. During the site walkover in 2023, possible signs of instability – minor translational slides with approximately less than 1m soil exposed in the scarp- were observed on the steep slopes of Mount Rowan. Should the development impact this area, further investigations may be required to determine the nature of the potential risk.
- Dispersive soils are likely to be present within the study area, as indicated by mapped soil types and supported by the results of limited geotechnical laboratory testing. Dispersive soils may cause slope instability and trafficability issues in addition to instability of structures and earthworks in the long term e.g. piping failures if reused without treatment. With respect to reuse of dispersive materials as controlled fill, this should be assessed against AS3798-2007.
- The likelihood for encountering reactive soils is high, which are prone to shrink-swell behaviour. Site Classification in accordance with AS2870-2011 Residential Slabs and Footings should be undertaken to assess the characteristic surface movement for the site specifically being assessed within the project study area.
- A review of the Victorian Salinity Provinces indicates that the project area is located within the Burrumbeet salinity province. No salinity impacted areas are shown to be within the project area and no obvious signs of soil salinity were observed within the study area during the site walkover in November 2023.

To support the future development of the site, a site-specific geotechnical ground investigations should be undertaken, in general accordance with Australian Standard AS 1726 with the aim to provide the following information:

- Identify the presence of any disused shafts and adits within the project area.
- Obtain a sufficient level of geotechnical information across the whole project area, including the underlying soil profile including thickness of superficial topsoil/fill/natural soils materials and depth to rock, and their geotechnical characteristics;
- Undertake geotechnical laboratory testing to assess the characteristics of the soil/rock materials and soil/groundwater geo-chemistry;
- Reporting of the investigation works (for subsequent determination of a relevant site classification).

9.3 Hydrogeology

Based on the regional and local hydrogeological information, the local water table is expected to be relatively shallow across parts of the site and hosted in the fractured rock Upper Tertiary/Quaternary Basalts and the alluvial Quaternary Aquifer, where present, and in the Upper Tertiary Aquifer (fluvial) aquifer where it outcrops.

Across the precinct area, the following issues require consideration in the planning and design of any development:

- Shallow depth to groundwater is likely to occur over large portions of the precinct area. The shallow water table may cause groundwater inflow to excavations and may impact site drainage (i.e. cause waterlogging).
- There may be areas that have poor sub-soil drainage and are susceptible to waterlogging.
- Site-specific groundwater impact assessments will be required for works within or near to groundwater receptors (GDEs and nearby registered bores) depending on location, footprint, and extent of works within the subsurface/water table.

- Similar to above, potential dewatering induced reductions to baseflow of surface water systems would require assessment and consideration.
- Groundwater dewatering or extraction associated with development has the potential to reduce discharge to nearby surface water features and/or terrestrial GDEs, which could potentially have a negative impact on the ecological health of local groundwater receptors.
- Existing off-site bores used for water supply (typical use is stock, domestic and irrigation) require consideration in terms of location, existence, condition, and current license to prevent unacceptable impacts during construction. Some existing bores are located close to the precinct area. For instance, bore 60758, used for domestic and irrigation, is only 12 m west of the precinct area.
- The potential brackish nature of the groundwater may require careful monitoring if dewatering or extraction is required, particularly for the consideration of the disposal of water.
- Opportunities for the potential use of extracted groundwater include dust suppression during construction, and garden watering, and irrigation of parks and ovals following development. However, the expected range of salinity is likely to vary and depending on the salinity of the groundwater, it may need to be mixed with potable water to improve the quality for the intended purpose.
- Potential groundwater contamination, if identified.
- Consideration of groundwater aggressivity effects on structures (e.g. concrete piles).
- Consideration of dewatering impacting ground movement and ASS, if relevant.

It is recommended that a field investigation be undertaken on a site-by-site basis by the future developer at the time of development to confirm depth to groundwater, groundwater quality and aquifer properties (including hydraulic conductivity). This may include:

- Sampling of existing bores (if active and accessible) for groundwater level and quality, and hydraulic conductivity testing; and
- Drilling and construction of new monitoring bores for ongoing observation, to assess groundwater level and quality, and monitor for seasonal variations (if required).

Groundwater field investigations are expected to become a high priority where excavations are anticipated to intersect the water table. For large or deep excavations, groundwater investigations can be used to inform the quantity, quality, and impact of dewatering.

9.4 Hydrology

This desktop due diligence study has identified that the Ballarat North PSP area falls within a floodplain exposed to riverine flooding. Future development in the area has the potential to influence existing overland flow paths in addition to impacting the project area drainage strategy, floodplain storage, land imperviousness, and the associated flood risk.

As such, it is expected that future development across the site will require:

- A detailed flood modelling and flood study. VPA will be responsible for demonstrating to the local flood authority that the future development design meets relevant flooding criteria. The requirements for meeting relevant flooding criteria should be determined through consultation with the local flooding authority. For this project area, Glenelg Hopkins Catchment Management Authority is the CMA, and the local council is the Ballarat City Council. Both stakeholders should be consulted to determine their requirements for flooding assessments of new developments.
- It is expected that the project will fully address the design flooding impacts that may occur as a result of future development. The future development may cause flood-related impacts, including flow obstruction and alterations to flow conveyance or loss of floodplain storage. These effects may result in

increased flood depths and levels (afflux), changes in flow velocity, modifications to the safety and hazard profile, or the discharge of additional flow from the site, both overland and underground.

- Early consultation and liaison with flood authorities to understand design criteria/expectations and future drainage schemes (refer to item 1),
- A construction permit from the relevant flood authorities and discuss working adjacent to an open channel and/or within LSIO/flooding extent and the required setback or the appropriate flood risk management strategies.

This report recommends that early consultation with flood authorities including The Glenelg Hopkins Catchment Management Authority be prioritised when planning future development. Jacobs notes that such engagement is already underway as part of a separate drainage and flooding assessment that VPA has commissioned for Ballarat North PSP. However, VPA should ensure that flood impact assessment as a result of the project, including flood hydrology and hydraulic analysis, and flood risk mitigation requirements are also discussed.

9.5 Geomorphology

The Precinct is located on soils that have formed from weathering of local Newer Volcanic Group Basalt rock. Topsoils typically have better structural stability, but subsoils may be sodic/dispersive and susceptible to erosion, particularly in instances where the topsoil is removed or if there are drainage works, which then result in rainfall and runoff making contact with and eroding these soils.

10. Recommendations

We understand that the target future land use of the Ballarat North PSP area will be primarily for residential development to address the rapid growth rate of Ballarat and increase the actual number of developable lands / properties. As support to the future residential communities, some commercial and institutional development will also be needed to foster the growth of a self-sufficient community. This assessment has been completed based on the initial intended use of the area as mentioned above and this is the primary context in which recommendations are presented below. The following further works are recommended, including recommended timings:

1. Completion of Preliminary Risk Screening Assessment (PRSA) or proceeding directly to an audit per Table 3: Recommended approach to assessing potentially contaminated land (PPN30) for properties identified as "medium" and "high" potential for contamination. Properties 70, 71, 72, 73, 77, 90, 91, 92, 98, 99, 100, 101, and 102 were categorised as a high potential for contamination as part of this assessment. This relates the presence of known contamination arising from historical mine-related activities or because they represent what is inferred to be the location of the former Wendouree Tip (except for Property 77 which is considered under current industrial land use). On the other hand, Properties 5, 31, 32, 43, 56, 57, 74, 88, 89, 93 and 96 were categorised as medium potential for contamination as part of this assessment. This relates to the presence of stock dip, stockpiles of imported fill, soil, and other materials such as metal scraps and various waste materials, and close proximity to properties with high potential for contamination (EAO sites and extents of former Wendouree Tip). The completion of a PRSA will determine whether an environmental audit is required for these properties (medium potential for contamination). For those properties with high potential for contamination, the completion of a PRSA or audit options applies, and it is recommended to proceed directly to an environmental audit. *Timing: It is recommended that the PRSAs and audits at these properties be completed after the gazettal of the Planning Scheme Amendment. This should be implemented as a permit application requirement in the planning scheme ordinance. Ordinarily environmental audit system requirements (i.e. completion of the PRSA and / or environmental audit) must be met at the time of the amendment unless the planning authority determines that compliance with this requirement is 'difficult or inappropriate'. An example of a situation provided in PPN30 included instances where the rezoning relates to a large strategic planning exercise or involves multiple sites in separate ownership. This scenario is consistent with the PSP planning process that is currently underway, and on this basis Jacobs believes the deferral of the requirements of the environmental audit system until after the gazettal of the Planning Scheme Amendment is justified.*

2. In relation to the former Wendouree Tip (the inferred extent of which is believed to include land parcels 90, 91, 92, 98, 99,100, 101, and 102), it is recommended that a landfill gas risk assessment is completed Jacobs understand that Ballarat City Council owns the land and intends to complete this assessment, although the timing for this cannot be confirmed at this stage. In addition, Jacobs notes that (consistent with EPA Publication 1642 – Assessing Planning Proposals in the Buffer of a Landfill and the Draft EPA Publication 1950 – Land buffer guideline) potential risk relating to landfill gas should also be considered for all properties that fall within a 500m buffer distance from the landfill. This estimated buffer distance is presented in Figure 7-1. Potential risks relating to landfill gas originating from the former Wendouree Tip should be assessed on a parcel-by-parcel basis through the completion of a landfill gas risk assessment. The requirement to perform a landfill gas risk assessment should be included as a planning permit condition applied to relevant land parcels within the buffer distance, specifically land parcels 53, 54, 55, 56, 62, 63, 64, 65, 66, 67, 68, 69, 70, 76, 77, 78, 79, 80, 81,82, 83, 84, 85, 86, 87, 88, 89, 93, 94, 95, 96,103 and 104. *Timing: The completion of the landfill gas risk assessment across the area of the former Wendouree Tip should be completed at the earliest opportunity, and in parallel with the PSP planning activities being performed by VPA. This would allow the findings of this assessment to be considered by VPA and future developers within the 500m buffer distance. Jacobs notes that Ballarat City Council intends to complete this assessment although specific timing is unknown. In relation to the completion of landfill gas risk assessments for land parcels that fall within the 500m buffer from the landfill (but not part of the former landfill itself), these should be completed on a parcel-by-parcel basis during future site development.*

3. It is recommended that future developers establish an appropriate Construction Environment Management Plan (CEMP) for implementation during development works. This should include provision for the appropriate management of unexpected finds as well as other features or infrastructure that may be present that have the potential to cause contamination. The CEMP should be prepared by a suitably qualified professional and should consider the appropriate management of activities such as:

    a. The classification, disposal and post-removal validation (if required) of various stockpiles and dumped materials/wastes that were observed at some locations across Ballarat North PSP area. It is noted that sampling of some stockpiles of soil observed may indicate that the material is suitable for re-use as part of future development and as such removal may not be required in all instances.

    b. The identification, removal and post-removal validation of below-ground septic systems that may be present at rural residential properties and farm residences. These should be identified and removed if located.

    Timing: This task (development and implementation of the CEPM) should be undertaken on a site-by-site basis during future site development.

4. Once the future development plans are confirmed, a site-specific ground investigation, comprising soil and rock sampling, and geotechnical laboratory testing should be undertaken in general accordance with Australian Standard AS 1726 to support the future development of each site within the project area. This will lead to the determination of the ground conditions, site classification, potential design constraints, and geotechnical design parameters for the proposed development at the site. *Timing: This task should be undertaken on a site-by-site basis during future development as part of the building permit application process.*

5. The potential for the presence of mining related shafts presents a potential geotechnical hazard. A total of seven shafts within the south-eastern part of the Ballarat North PSP area have been identified (refer the Ballarat Goldfield District Online Map (2019) which is discussed in Section 7.2.2 and LotSearch report LS048897 in Appendix B). Construction works over disused shafts, adits or underground workings pose a potential for cave ins and ground collapse. It is recommended that requests as to the status of these shafts and associated mine infrastructure (including extent of underground mining) are made by the future developer as part of their due diligence process to the current landowner(s) in order to identify any further information that may be able to confirm specific location of these shafts and whether they have been capped and/or backfilled. It is also recommended that site specific geophysical survey be undertaken in the areas where historical mining activity is recorded in order to locate potentially abandoned shafts. Where mine shafts are identified, then a site-specific geotechnical investigation should be undertaken, including a mine shaft remediation assessment (if not already available). A mine shaft remediation assessment will provide remedial options including suitable mitigation methods for suspected mine shafts and associated geotechnical risks at each site. It should address health and safety liabilities from each site arising from historical workings and mine shafts including 'make-safe' options. The design and implementation of an appropriate survey to locate potentially abandoned shafts should be performed by a suitably qualified specialist. *Timing: This task should be undertaken by the future developer on a site-by-site basis as part of the permit application process associated with future development of individual land parcels.*

6. Subject to approved access (and possibly suitable bore depths), existing investigation/observation bores in the vicinity of the precinct area identified as active can be used to verify groundwater conditions based on the potential risk of proposed land use affecting groundwater. Groundwater hydraulic testing (slug tests) may also be undertaken to determine aquifer hydraulic conductivity. This assumes existing wells are in a suitable condition for such an assessment. Due to the lack of groundwater investigation or observation bores over most of the precinct area, the installation and development of new monitoring bores is also likely to be required to confirm the local groundwater level and quality presented in this desktop assessment. *Timing: This task should be undertaken on a site-by-site basis during design to inform potential risk to groundwater. Alternatively, groundwater investigations can be undertaken*

concurrently with geotechnical investigations by installing observation bores to measure groundwater level, quality, and aquifer hydraulic conductivity.

7. It is recommended that further site investigation, sampling, laboratory analysis and characterisation of soils is undertaken to confirm their erodibility and develop a plan to stabilise the soils (options include chemical treatment of soils, careful staging of works). The scope of this work would be similar to the Sodic Soils Assessment previously completed by Jacobs for Melton East, Merrifield North, Parwan and Parwan Employment Precincts. We recommend a gridded program is adopted for collection of soil samples, with one sampling site per 10 hectares[4]. In previous Sodic Soil Assessments completed for VPA we have typically cored to 1.5 m, sampled topsoil and subsoil at each location and then at a selection of boreholes sampled at deeper increments (up to 1.5 m depth). We think a similar strategy would be appropriate in Ballarat North. In addition, further investigation of sodic/dispersive soils is recommended to inform PSP planning with respect to land use layout and how to manage any identified erosion risks that are associated with sodic/dispersive soils. These studies are also recommended to inform the development of drainage service schemes, (DSS) and more broadly the citing and design of any infrastructure assets. The standard approach has been to undertake a Sodic Soils Assessment. Jacobs have undertaken these assessments for nine precinct areas, this work completed for Victorian Planning Authority. Issues of sodic/dispersive soils, their management and how PSP and DSS has considered are matters that have been raised in Planning Panels – completion of Sodic Soils Assessment is therefore recommended as input to PSP planning so that these matters can be addressed and responded to in any future panel hearing. *Timing: This task should be undertaken by VPA across the precinct area as part of the planning stage for the PSP (if the outcomes of this work would be considered beneficial in providing strategic advice on issues relating to sodic soils and how to manage these with future development). Alternately, this task could be performed on a parcel-by-parcel basis at the time of future development by the future site developer.*

8. A geomorphological assessment of waterways is recommended to assess their current condition and how this is likely to change with future development. The scope of this assessment should be agreed with authority responsible for commissioning this assessment (Victorian Planning Authority or Ballarat City Council). The outcomes of this work would inform further design and development of the drainage services scheme.. *Timing: This task should be undertaken across the precinct area as part of the planning stage for the PSP. The outcomes of this work will assist in providing strategic advice on issues relating to the stability of waterways and how to manage these with future development.*

[4] Final decision on grid density should be made by VPA. Grid density should be chosen to provide suitable representation of topography, geomorphology/soils and future land use.

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Appendix A. Figures

The following figures are presented below:

Figure 1. Site Locality Plan

Ballarat North PSP

Miners Rest Wetland Reserve
Kennedys Road
Bones Lane
Sharpes Road
Nelson Street
Howe Street
Garlands Road
Expanded Area (inclusion in the precinct TBC)
Muir Road
Cummins Road
Gillies Road
A300
Mount Rowan
Lindsays Road
Western Freeway
Waterford Drive
Ballarat North PSP Core Area
C307
Mount Rowan Reserve
Sims Road
North Common Wetland Reserve
Ballarat North Wastewater Treatment Plant
Olliers Road
Noble Court
Midland Highway
Mitchell Park
Pioneer Park
Giot Drive
McCain Foods
Learmonth Road
Ring Road Reserve
Ballarat Link Road
Nettles Road

PSP Boundary
Core Area
Expanded Area (inclusion in the precinct TBC)

Jacobs

N

0 0.2 0.4 0.6 0.8
Kilometers

Figure 2. Site Layout Plan

Ballarat North PSP

PSP Boundary

1 Parcels / Lot Number

Core Area

Expanded Area (inclusion in the precinct TBC)

Jacobs

N

0 0.2 0.4 0.6 0.8

Kilometers

Figure 3. Potential for Contamination Ballarat North PSP

Core Area

Expanded Area (inclusion in the precinct TBC)

1 Cadastre/ Property Number

Potential for Contamination

No Potential for Contamination

Medium

High

Jacobs

N

0 0.2 0.4 0.6 0.8

Kilometers

Appendix B. Lotsearch reports

LOTSEARCH

LOTSEARCH ENVIRO LITE

Date: 09 Oct 2023 17:05:50

Reference: LS048897 EL

Address: Ballarat North, Ballarat City, VIC 3350

Dataset Listing

Datasets contained within this report, detailing their source and data currency:

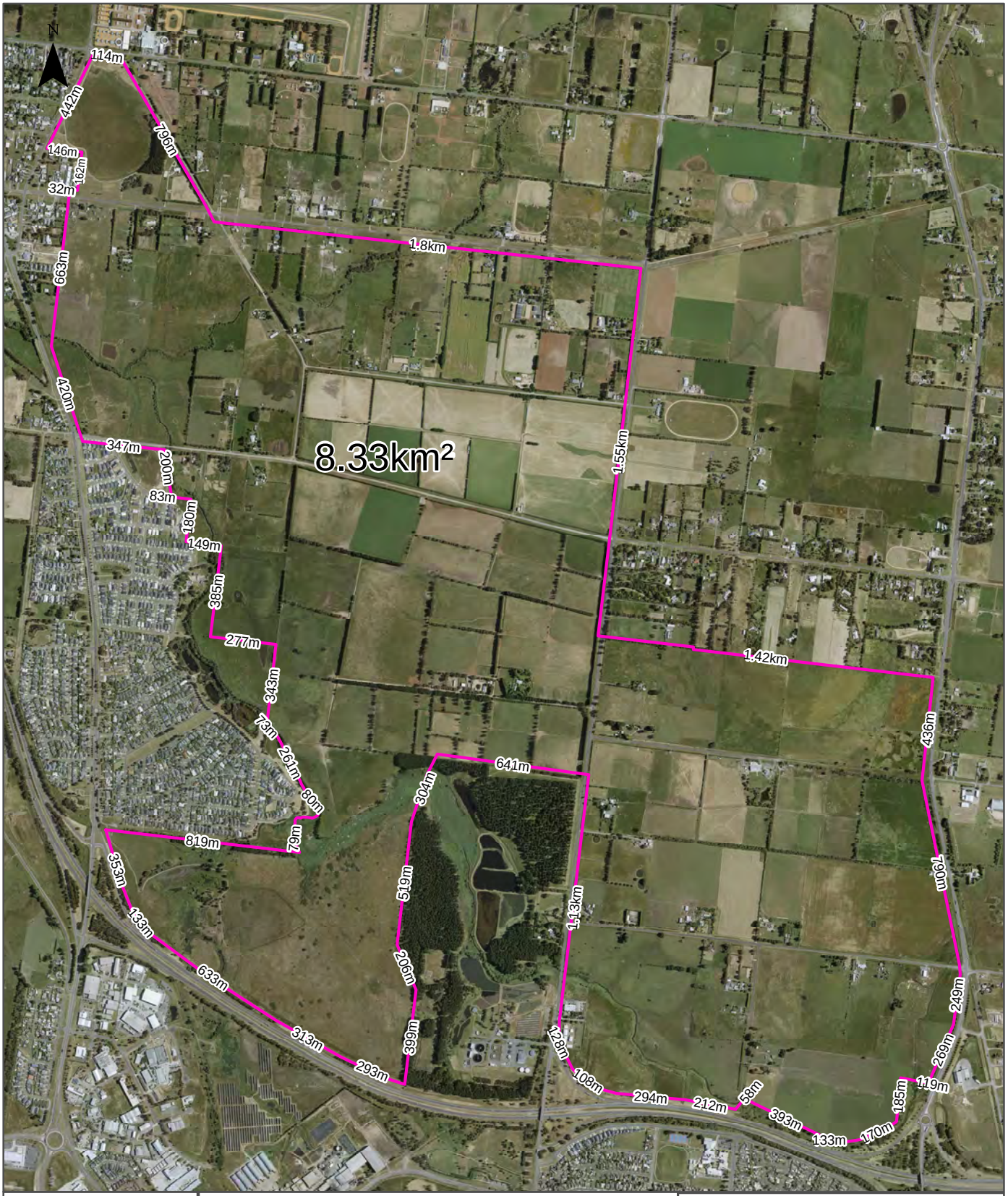
Dataset Name	Custodian	Supply Date	Currency Date	Update Frequency	Dataset Buffer (m)	No. Features On-site	No. Features within 100m	No. Features within Buffer
Topographic and Cadastre data	State Government Victoria - Department of Environment, Land, Water & Planning	13/09/2023	13/09/2023	Monthly	-	-	-	-
Current EPA Priority Sites	Environment Protection Authority (Vic)	18/08/2023	01/08/2023	Monthly	1000m	0	0	1
EPA Site Management Orders	Victoria EPA	27/09/2023	29/08/2023	Monthly	1000m	0	0	0
Former EPA Priority Sites & other Remedial Notices	Environment Protection Authority (Vic)	02/05/2023	21/02/2023	Monthly	1000m	1	5	13
EPA PFAS Site Investigations	Environment Protection Authority (Vic)	18/09/2023	30/05/2023	Monthly	2000m	0	0	0
Defence PFAS Investigation & Management Program - Investigation Sites	Department of Defence	16/08/2023	16/08/2023	Monthly	2000m	0	0	0
Defence PFAS Investigation & Management Program - Management Sites	Department of Defence	16/08/2023	16/08/2023	Monthly	2000m	0	0	0
Airservices Australia National PFAS Management Program	Airservices Australia	18/08/2023	18/08/2023	Monthly	2000m	0	0	0
Defence Controlled Areas	Department of Defence	08/06/2023	08/06/2023	Quarterly	2000m	0	0	0
Defence 3 Year Regional Contamination Investigation Program	Department of Defence	16/06/2023	02/09/2022	Quarterly	2000m	0	0	0
National Unexploded Ordnance (UXO)	Department of Defence	08/06/2023	08/06/2023	Quarterly	2000m	0	0	1
EPA Preliminary Risk Screening Assessments	Environment Protection Authority (Vic)	18/09/2023	15/11/2022	Monthly	1000m	0	0	0
EPA Environmental Audit Reports	Environment Protection Authority Victoria	19/05/2023	24/02/2023	Monthly	1000m	0	1	1
EPA Groundwater Zones with Restricted Uses	Environment Protection Authority (Vic)	28/07/2023	28/07/2023	Monthly	1000m	0	0	0
EPA Register of Permissions	Environment Protection Authority (Vic)	26/06/2023	26/06/2023	Monthly	1000m	0	4	9
Legacy EPA Licensed Activities	Environment Protection Authority (Vic)	19/07/2022	22/07/2021	Monthly	1000m	0	1	2
Legacy EPA Works Approvals	Environment Protection Authority (Vic)	13/12/2022	13/12/2022	Monthly	1000m	0	0	1
National Waste Management Facilities Database	Geoscience Australia	26/05/2022	07/03/2017	Annually	1000m	0	0	0
Statewide Waste and Resource Recovery Infrastructure Plan Facilities	State Government Victoria - Department of Sustainability	27/11/2014	31/12/2012	None planned	1000m	0	0	1
Legacy EPA Prescribed Industrial Waste	Environment Protection Authority (Vic)	12/08/2020	12/08/2020	Quarterly	1000m	0	0	1
EPA Victorian Landfill Register	Environment Protection Authority (Vic)	10/05/2023	16/03/2023	Quarterly	1000m	1	1	1
Former Gasworks	Various historical sources collated by Lotsearch	15/08/2017	15/08/2017	Not required	1000m	0	0	0
National Liquid Fuel Facilities	Geoscience Australia	20/09/2023	07/09/2020	Annually	1000m	0	0	0
Historical Business Directories (Premise & Intersection Matches)	Hardie Grant; Sands & McDougall, State Library Victoria			Not required	150m	0	0	1
Historical Business Directories (Road & Area Matches)	Hardie Grant; Sands & McDougall, State Library Victoria			Not required	150m	-	4	7
Historical Business Directory Dry Cleaners & Motor Garages/Service Stations (Premise & Intersection Matches)	Hardie Grant; Sands & McDougall, State Library Victoria			Not required	500m	0	0	0
Historical Business Directory Dry Cleaners & Motor Garages/Service Stations (Road & Area Matches)	Hardie Grant; Sands & McDougall, State Library Victoria			Not required	500m	-	0	2
Features of Interest	State Government Victoria - Department of Environment, Land, Water & Planning	18/10/2022	18/10/2022	Quarterly	1000m	9	16	103

Dataset Name	Custodian	Supply Date	Currency Date	Update Frequency	Dataset Buffer (m)	No. Features On-site	No. Features within 100m	No. Features within Buffer
Hydrogeology Map of Australia	Commonwealth of Australia (Geoscience Australia)	08/10/2014	17/03/2000	As required	1000m	1	1	1
Groundwater Salinity	State Government Victoria - Department of Environment, Land, Water & Planning	14/08/2015	29/08/2012	Unknown	0m	2	-	-
Depth to Watertable	State Government Victoria - Department of Environment, Land, Water & Planning	14/08/2015	29/08/2012	Unknown	0m	5	-	-
Surface Elevation	State Government Victoria - Department of Environment, Land, Water & Planning	14/08/2015	23/09/2013	Unknown	0m	1	-	-
Basement Elevation	State Government Victoria - Department of Environment, Land, Water & Planning	14/08/2015	23/09/2013	Unknown	0m	1	-	-
Groundwater Boreholes WMIS	State Government Victoria - Department of Environment, Land, Water & Planning	27/07/2023	27/07/2023	Quarterly	2000m	33	37	116
Groundwater Boreholes Earth Resources Database	State Government Victoria - Department of Economic Development, Jobs, Transport and Resources	19/12/2022	17/02/2010	Annually	2000m	9	10	32
Groundwater Boreholes Fed Uni	Federation University Australia	21/12/2017	07/01/2014	As required	2000m	32	36	105
Historical Mining Activity - Shafts	State Government Victoria - Department of Economic Development, Jobs, Transport and Resources	05/09/2023	21/06/2023	Annually	1000m	6	6	21
Geological Units 1:50,000	State Government Victoria - Department of Economic Development, Jobs, Transport and Resources	13/01/2015	24/06/2014	Unknown	1000m	7	7	7
Geological Structures 1:50,000	State Government Victoria - Department of Economic Development, Jobs, Transport and Resources	13/01/2015	24/06/2014	Unknown	1000m	0	0	0
Dykes and Marker Beds 50k	State Government Victoria - Department of Economic Development, Jobs, Transport and Resources	13/01/2015	24/06/2014	Unknown	1000m	0	0	0
Shear zones 250k	State Government Victoria - Department of Economic Development, Jobs, Transport and Resources	13/01/2015	24/06/2014	Unknown	1000m	0	0	0
Atlas of Australian Soils	ABARES	19/05/2017	17/02/2011	As required	1000m	3	3	3
Victorian Soil Type Mapping	State Government Victoria - Department of Economic Development, Jobs, Transport and Resources	24/08/2017	21/03/2016	Unknown	1000m	5	5	6
Atlas of Australian Acid Sulfate Soils	CSIRO	19/01/2017	21/02/2013	As required	1000m	1	1	1
Coastal Acid Sulfate Soils	State Government Victoria - Department of Economic Development, Jobs, Transport and Resources	28/03/2017	30/03/2011	None planned	1000m	0	0	0
Planning Scheme Zones	State Government Victoria - Department of Environment, Land, Water & Planning	09/08/2023	26/07/2023	Monthly	1000m	3	15	51
Planning Scheme Overlay	State Government Victoria - Department of Environment, Land, Water & Planning	09/08/2023	26/07/2023	Monthly	1000m	10	18	41
Commonwealth Heritage List	Australian Government Department of Agriculture, Water and the Environment	03/06/2022	13/04/2022	Annually	1000m	0	0	0
National Heritage List	Australian Government Department of Agriculture, Water and the Environment	03/06/2022	13/04/2022	Annually	1000m	0	0	0
Victorian Heritage Register	State Government Victoria - Department of Environment, Land, Water & Planning	14/06/2023	14/06/2023	Quarterly	1000m	0	0	1
Cultural Heritage Sensitivity	State Government Victoria - Department of Premier and Cabinet	18/10/2022	18/10/2022	Quarterly	1000m	15	16	24
Bushfire Prone Area	State Government Victoria - Department of Transport, Planning and Local Infrastructure	18/10/2022	17/08/2022	Quarterly	1000m	1	1	1
Fire History	State Government Victoria - Department of Environment, Land, Water & Planning	16/02/2023	10/01/2023	Quarterly	1000m	2	2	4
Flood - 1 in 100 Year Modelled Flood Extent	State Government Victoria - Department of Environment, Land, Water & Planning	19/10/2022	22/06/2022	Quarterly	1000m	1	1	1
Victorian Coastal Inundation Sea Level Rise	State Government Victoria - Department of Environment, Land, Water & Planning	10/04/2018	24/10/2017	Unknown	1000m	0	0	0
Native Vegetation (Modelled 2005 Ecological Vegetation Classes)	State Government Victoria - Department of Environment, Land, Water & Planning	13/01/2015	31/12/2005	None planned	1000m	2	2	3
Ramsar Wetland Areas in Victoria	State Government Victoria - Department of Environment, Land, Water & Planning	09/05/2023	01/11/2022	Annually	1000m	0	0	0
Groundwater Dependent Ecosystems Atlas	Bureau of Meteorology	05/06/2023	01/06/2023	Annually	1000m	10	11	12

Dataset Name	Custodian	Supply Date	Currency Date	Update Frequency	Dataset Buffer (m)	No. Features On-site	No. Features within 100m	No. Features within Buffer
Inflow Dependent Ecosystems Likelihood	Bureau of Meteorology	05/06/2023	01/06/2023	Annually	1000m	22	24	31

Site Diagram

Ballarat North, Ballarat City, VIC 3350



Legend

- Site Boundary
- Internal Parcel Boundaries

Total Area: 8.33km²

Total Perimeter: 19.61km

Scale: 0 100 200 400 600 800 1,000 Meters

Data Source Aerial Imagery:
© Aerometrex Pty Ltd

Coordinate System:
GDA 1994 MGA Zone 55

Date: 09 October 2023

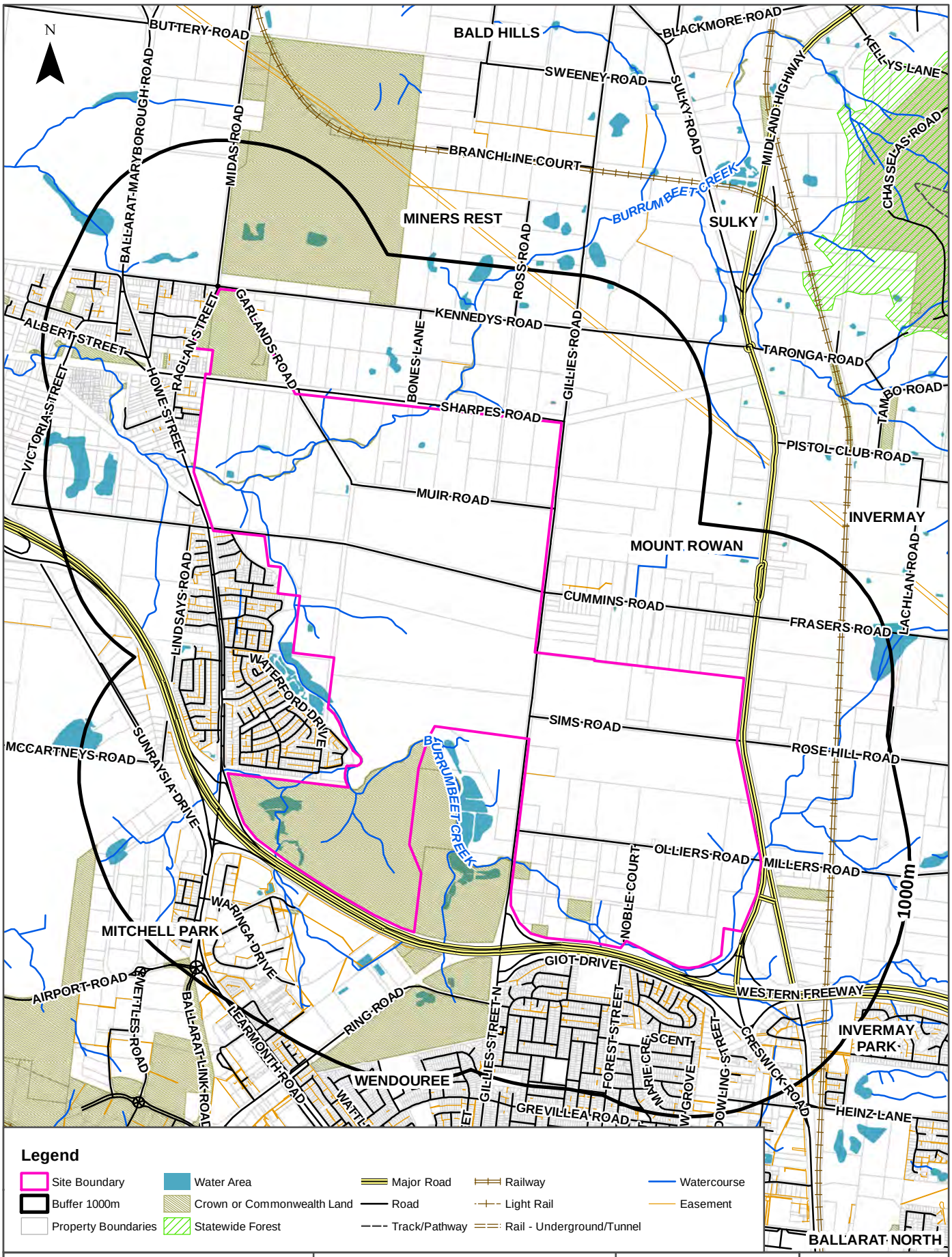
Disclaimers:

Measurements are approximate only and may have been simplified or smaller lengths removed for readability.

Parcels that make up a small percentage of the total site area have not been labelled for increased legibility.

Topographic Data

Ballarat North, Ballarat City, VIC 3350



Legend

Site Boundary	Water Area	Major Road	Railway	Watercourse
Buffer 1000m	Crown or Commonwealth Land	Road	Light Rail	Easement
Property Boundaries	Statewide Forest	Track/Pathway	Rail - Underground/Tunnel	

Scale: 0 100 200 400 600 800 1,000 1,200 1,400 1,600 1,800 Meters

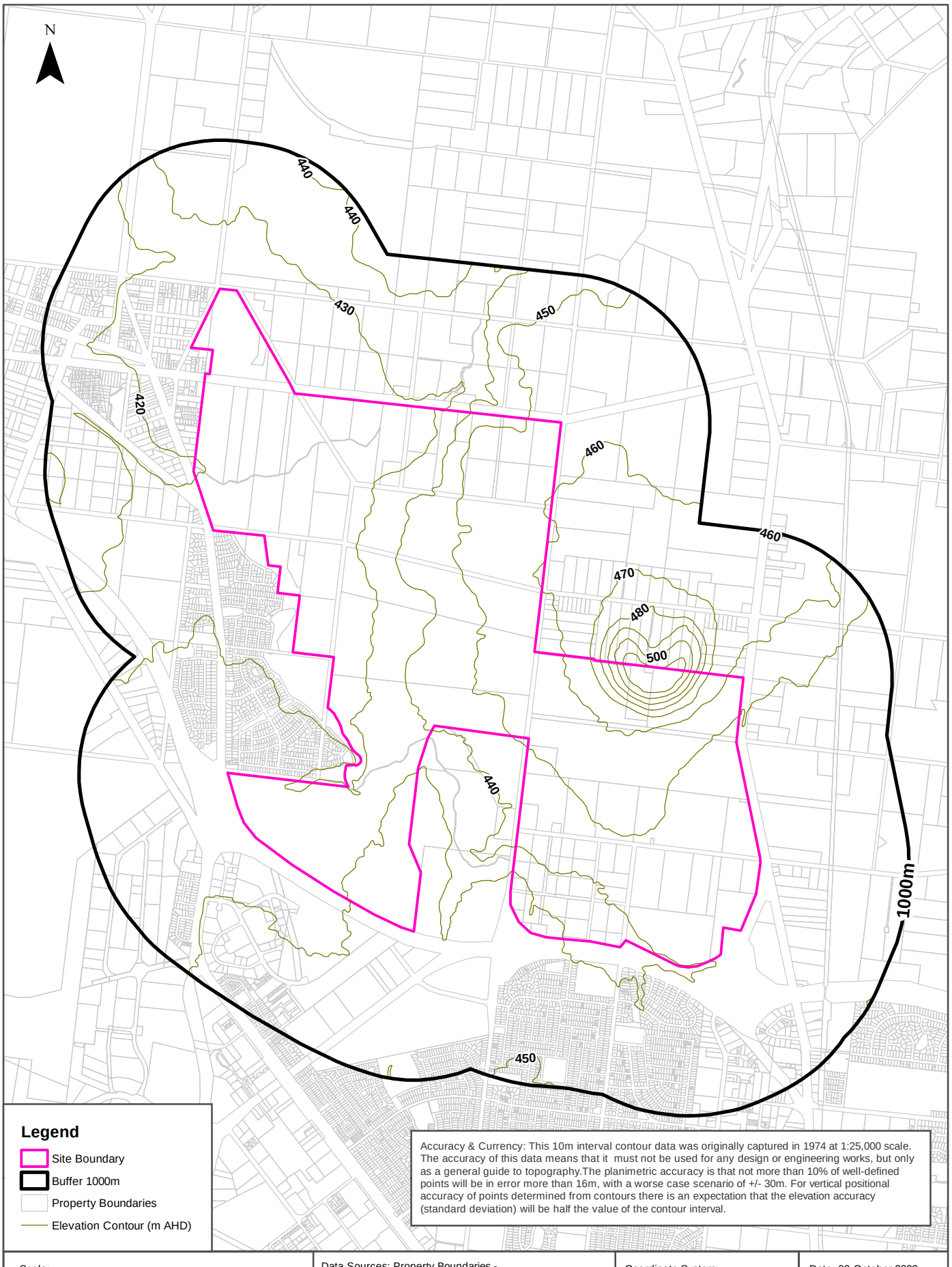
Data Sources: Property Boundaries - State Government Victoria - Department of Environment, Land, Water & Planning

Coordinate System: GDA 1994 MGA Zone 55

Date: 09 October 2023

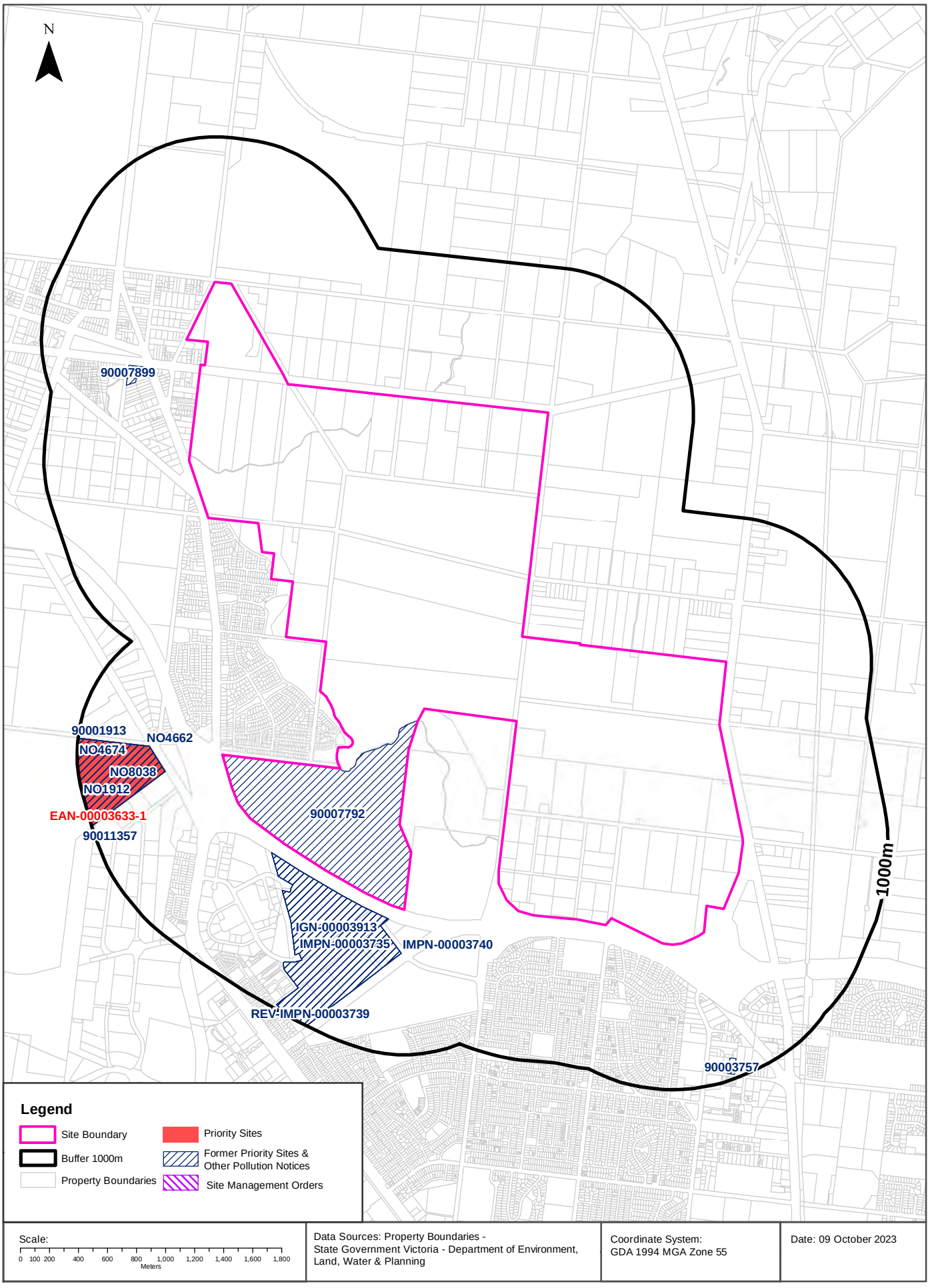
Elevation Contours (m AHD)

Ballarat North, Ballarat City, VIC 3350



EPA Records - Priority Sites, Site Management Orders & Pollution Notices

Ballarat North, Ballarat City, VIC 3350



EPA Priority Sites, Site Management Orders & Pollution Notices

Ballarat North, Ballarat City, VIC 3350

Current EPA Priority Sites Register

Sites on the current EPA priority sites register that exist within the dataset buffer:

Notice No	Address	Suburb	Issue	Loc Conf	Dist (m)	Direction
EAN-00003633-1	Ballarat Airport, Mitchell Park, Ballarat, Victoria, 3355, Australia	Ballarat	Accidental spill/leak (non-industrial site). Requires assessment and/or clean up	Premise Match	411m	West

Site Management Orders Custodian: State Government Victoria - Environment Protection Authority (EPA)

Site Management Orders

Sites within the dataset buffer that have been issued a Site Managment Orders:

Order Id	Issue Date	Address	Title	Suburb	Company	Status	Loc Conf	Dist (m)	Dir
N/A	No records in buffer								

Site Management Orders Data Custodian: State Government Victoria - Environment Protection Authority (EPA)

Former EPA Priority Sites & Other Pollution Notices

Sites within the dataset buffer that have been issued a Pollution Notice:
Note. Due to pollution notices being revoked and removed from published lists this is not an exhaustive list of all past pollution notices.

Notice No	Notice Type	Company	Address	Suburb	Status	Issue	Date Issued	Loc Conf	Dist	Dir
90007792	Pollution Abatement Notice	SPI R2\PP2542 [MINERS REST]	Ballarat Town Common Council property # 2012137City of Ballart	MINERS REST	Previous Pollution Notice		16/05/2017	Premise Match	0m	On-site
IGN-00003913	Information Gathering Notice	MCCAIN FOODS (AUST) PTY LTD	Ring RD	WENDOUREE	Previous Pollution Notice		01/02/2023	Premise Match	91m	South West
IMPN-00003735	Improvement Notice	MCCAIN FOODS (AUST) PTY LTD	Ring RD	WENDOUREE	Previous Pollution Notice		21/12/2022	Premise Match	91m	South West
IMPN-00003740	Improvement Notice	MCCAIN FOODS (AUST) PTY LTD	Ring RD	WENDOUREE	Previous Pollution Notice		21/12/2022	Premise Match	91m	South West
REV-IMPN-00003739	Improvement Notice	MCCAIN FOODS (AUST) PTY LTD	Ring RD	WENDOUREE	Previous Pollution Notice		21/12/2022	Premise Match	91m	South West
90007899	Clean Up Notice	Anthony BROADBENT [MINERS REST]	201-203 HOWE ST MINERS REST VIC 3352	MINERS REST	Previous Pollution Notice		10/08/2017	Premise Match	343m	North West
90001913	Previous Priority Notice		Volume 6747 Folio 250	BALLARAT	Previous Priority Notice	Current Industrial Site. Requires assessment and/or clean up.	30/09/2009	Premise Match	411m	West

Notice No	Notice Type	Company	Address	Suburb	Status	Issue	Date Issued	Loc Conf	Dist	Dir
90011357	Previous Priority Notice		Volume 6747 Folio 250	BALLARAT	Current Pollution Notice	Current Industrial Site. Requires assessment and/or clean up.		Premise Match	411m	West
NO1912	62A(1)	FIELD AIR (BALLARAT) P/L	BALLARAT AERODROME VOLUME 6747 FOLIO 250	BALLARAT	Legacy EPA Database Pollution Notice		14/02/1991	Premise Match	411m	West
NO4662	62A(1)	FIELD AIR (BALLARAT) P/L	BALLARAT AERODROME VOLUME 6747 FOLIO 250	BALLARAT	Legacy EPA Database Pollution Notice		01/04/2005	Premise Match	411m	West
NO4674	62A(1)	FIELD AIR (BALLARAT) P/L	BALLARAT AERODROME VOLUME 6747 FOLIO 250	BALLARAT	Legacy EPA Database Pollution Notice	Current Industrial Site, Requires assessment and/or clean up.	27/04/2005	Premise Match	411m	West
NO8038	62A(1)	FIELD AIR (BALLARAT) P/L	BALLARAT AERODROME VOLUME 6747 FOLIO 250	BALLARAT	Legacy EPA Database Pollution Notice	Current Industrial Site, Requires assessment and/or clean up.	30/09/2009	Premise Match	411m	West
90003757	Pollution Abatement Notice	Coronet laundry	21 CORONET ST	WENDOUREE	Previous Pollution Notice		13/06/2013	Premise Match	856m	South East

Pollution Notice Data Custodian: State Government Victoria - Environment Protection Authority (EPA)

PFAS Investigation & Management Programs

Ballarat North, Ballarat City, VIC 3350

EPA PFAS Site Investigations

Sites being investigated by the EPA for PFAS contamination within the dataset buffer:

Map ID	Site Name	Address	Location Confidence	Distance	Direction
N/A	No records in buffer				

EPA PFAS Site Investigations Data Custodian: State Government Victoria - Environment Protection Authority (EPA)

Defence PFAS Investigation & Management Program Investigation Sites

Sites being investigated by the Department of Defence for PFAS contamination within the dataset buffer:

Map ID	Base Name	Address	Location Confidence	Distance	Direction
N/A	No records in buffer				

Defence PFAS Investigation & Management Program Data Custodian: Department of Defence, Australian Government

Defence PFAS Investigation & Management Program Management Sites

Sites being managed by the Department of Defence for PFAS contamination within the dataset buffer:

Map ID	Base Name	Address	Location Confidence	Distance	Direction
N/A	No records in buffer				

Defence PFAS Investigation & Management Program Data Custodian: Department of Defence, Australian Government

Airservices Australia National PFAS Management Program

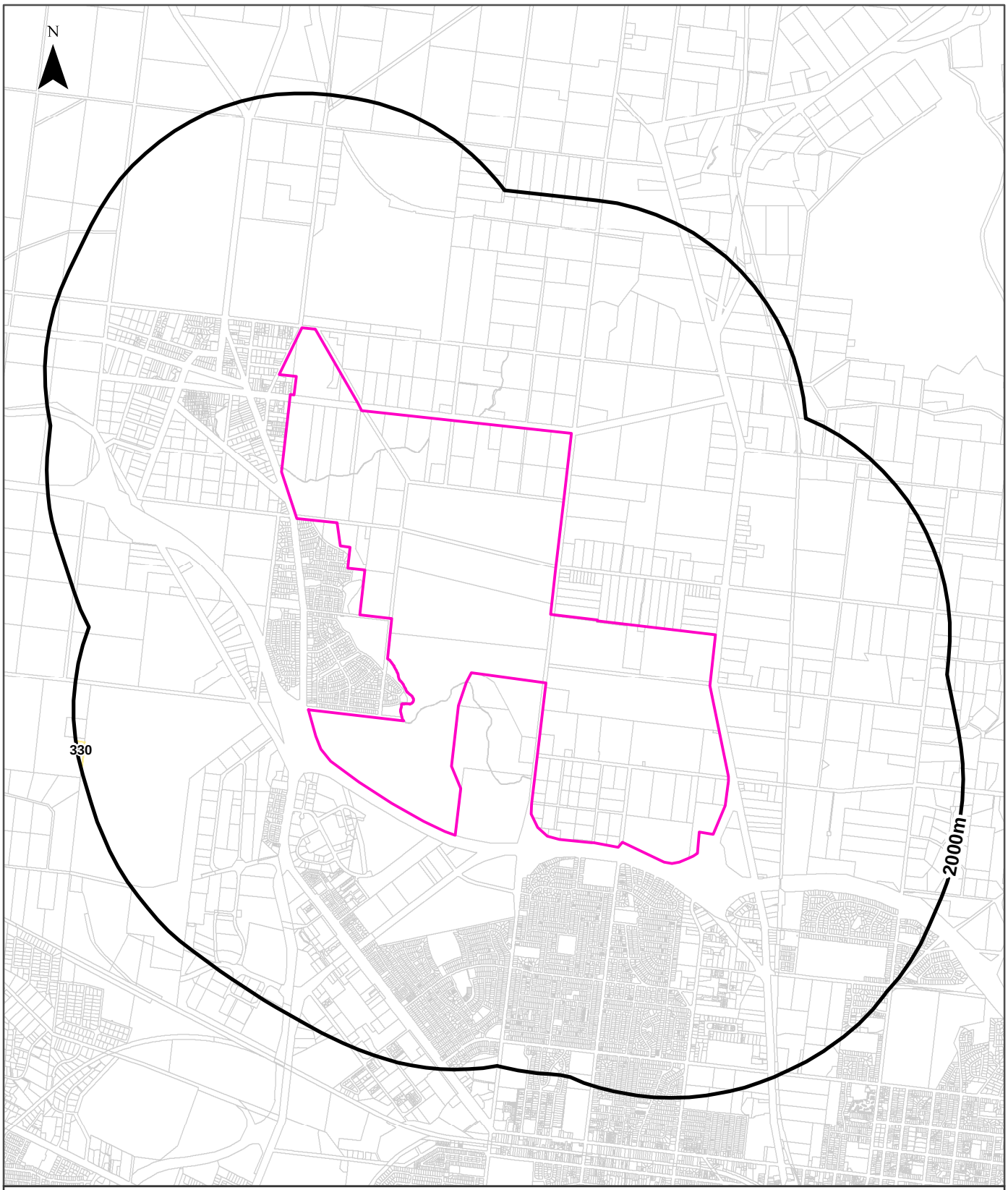
Sites being investigated or managed by Airservices Australia for PFAS contamination within the dataset buffer:

Map ID	Site Name	Impacts	Location Confidence	Distance	Direction
N/A	No records in buffer				

Airservices Australia National PFAS Management Program Data Custodian: Airservices Australia

Defence Sites and Unexploded Ordnance

Ballarat North, Ballarat City, VIC 3350



Legend

- Site Boundary
- Buffer 2000m
- Property Boundaries

DCA

- Defence Controlled Area

Defence 3 Year RCIP

- Known Contamination
- No Known Contamination

UXO

- Substantial Potential
- Slight Potential
- Remote Potential
- Sea Dumping of Depth Charges
- Information
- Other
- Other Sea Dumping Sites

Scale:	Data Sources: Property Boundaries - State Government Victoria - Department of Environment, Land, Water & Planning	Coordinate System: GDA 1994 MGA Zone 55	Date: 09 October 2023

0 200 400 800 1,200 1,600 Meters

Defence Sites and Unexploded Ordnance

Ballarat North, Ballarat City, VIC 3350

Defence Controlled Areas (DCA)

Defence Controlled Areas provided by the Department of Defence within the dataset buffer:

Site ID	Location Name	Loc Conf	Dist	Dir
N/A	No records in buffer			

Defence Controlled Areas, Data Custodian: Department of Defence, Australian Government

Defence 3 Year Regional Contamination Investigation Program (RCIP)

Sites which have been assessed as part of the Defence 3 Year Regional Contamination Investigation Program within the dataset buffer:

Property ID	Base Name	Address	Known Contamination	Loc Conf	Dist	Dir
N/A	No records in buffer					

Defence 3 Year Regional Contamination Investigation Program, Data Custodian: Department of Defence, Australian Government

National Unexploded Ordnance (UXO)

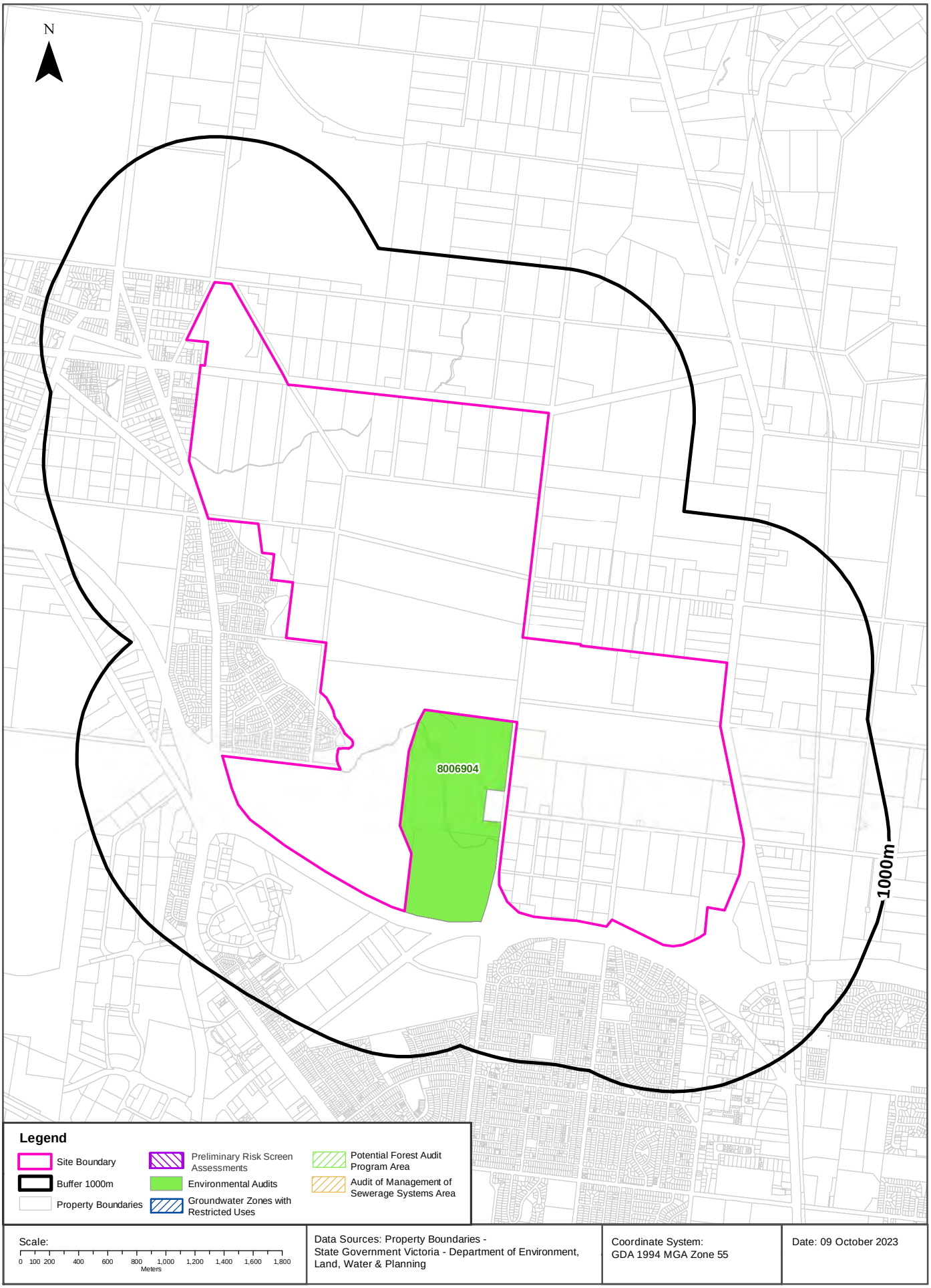
Sites which have been assessed by the Department of Defence for the potential presence of unexploded ordnance within the dataset buffer:

Site ID	Location Name	Category	Area Description	Additional Information	Commonwealth	Loc Conf	Dist	Dir
330	Ballarat	Other	This site was proposed as a Rifle Range and Grenade Range, but no evidence has been identified of its actual use.		Not Commonwealth Land	As Supplied	1924m	West

National Unexploded Ordnance (UXO), Data Custodian: Department of Defence, Australian Government

EPA Records - Preliminary Risk Screen Assessments, Audit Reports & GQRUZ

Ballarat North, Ballarat City, VIC 3350



EPA Records

Ballarat North, Ballarat City, VIC 3350

EPA Preliminary Risk Screen Assessments

EPA Prelinimary Risk Screen Assessment records that exist within the dataset buffer:

PRSA ID	Site Address	Completion Date	Attachment A	Attachment B	Attachment C	Loc Conf	Distance	Direction
N/A		No records in buffer						

Environmental Audit Data Custodian: State Government Victoria - Environment Protection Authority (EPA)

EPA Environmental Audits

EPA environmental audit records that exist within the dataset buffer:
Note. Please click on CARMS No. to activate a hyperlink to online documentation. If link does not work, documentation may still be accessible via the EPA Interaction Portal.

Transaction No	CARMS No	Site	Address	Suburb	Date Complete	Audit Category	Loc Conf	Distance	Direction
8006904	78778-1	SEWERAGE FARM 29 GILLIES RD	SEWERAGE FARM 29 GILLIES RD	MINERS REST	15/08/2021	53V Audit recommendations	Premise Match	0m	South

Environmental Audit Data Custodian: State Government Victoria - Environment Protection Authority (EPA)

EPA Records

Ballarat North, Ballarat City, VIC 3350

EPA Groundwater Zones with Restricted Uses

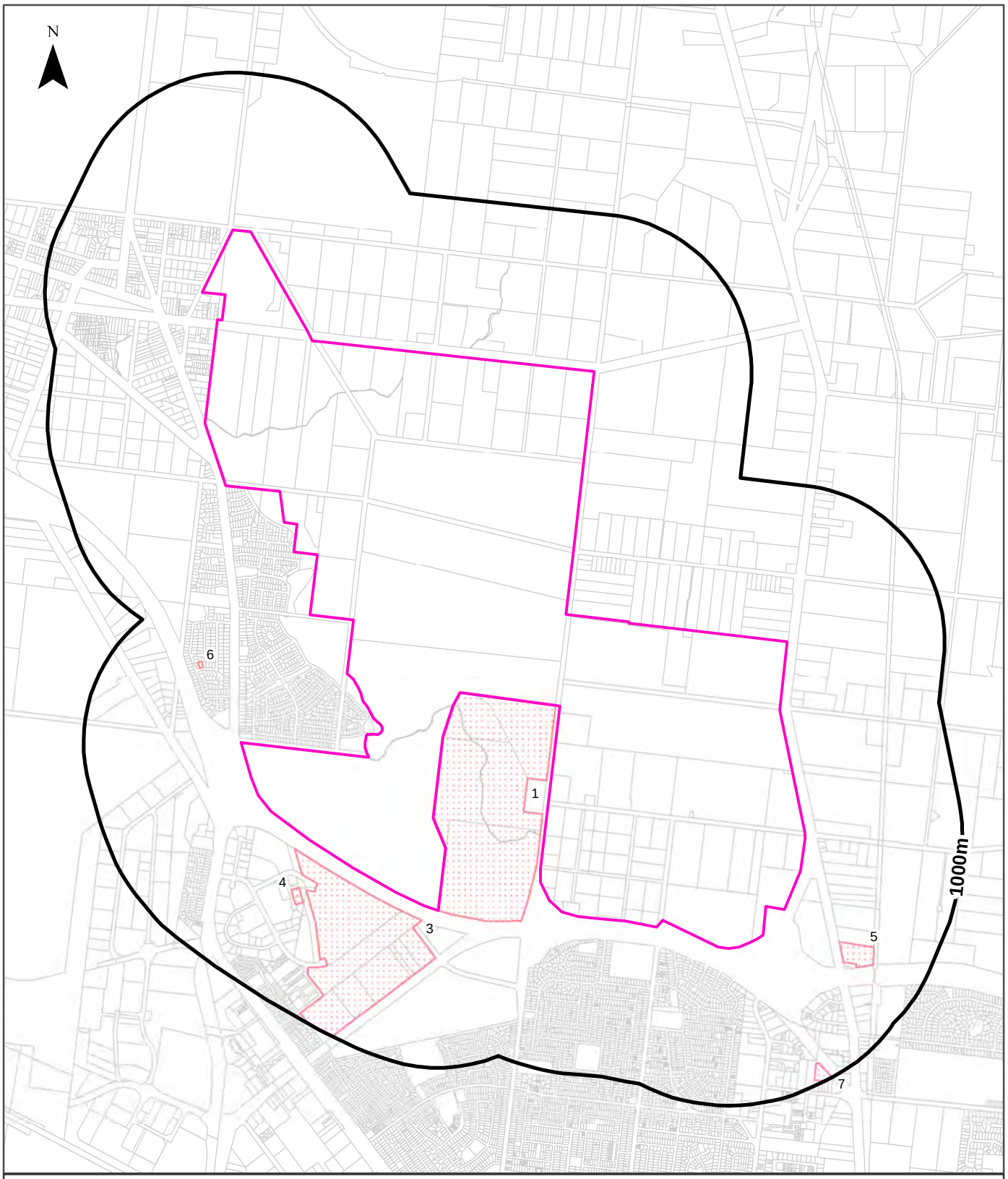
EPA GQRUZ records that exist within the dataset buffer:
Note. Please click on CARMS No. to activate a hyperlink to online documentation.

CARMS No	EPA Id	Site History	Site Address	Restricted Uses	Status	Loc Conf	Distance	Direction
N/A	No records in buffer							

Environmental GQRUZ Data Custodian: State Government Victoria - Environment Protection Authority (EPA)

EPA Activities - Register of Permissions

Ballarat North, Ballarat City, VIC 3350



Legend

- Site Boundary
- Register of Permissions Record
- Buffer 1000m
- Property Boundaries

Scale:	Data Sources: Property Boundaries - State Government Victoria - Department of Environment, Land, Water & Planning	Coordinate System: GDA 1994 MGA Zone 55	Date: 09 October 2023

0 100 200 400 600 800 1,000 1,200 1,400 1,600 1,800 Meters

EPA Activities

Ballarat North, Ballarat City, VIC 3350

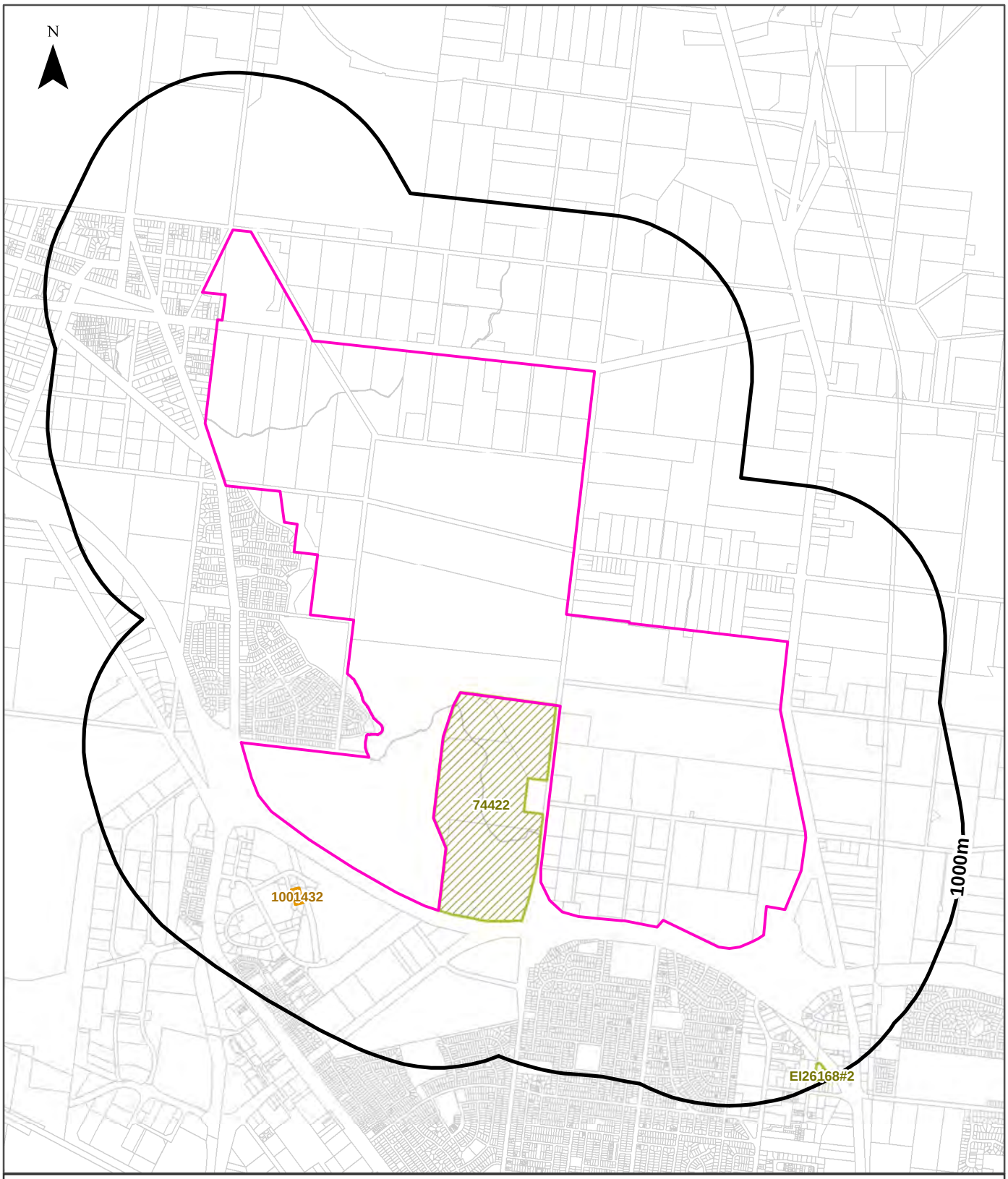
EPA Activites - Register of Permissions

EPA Register of Permissions records that exist within the dataset buffer:
Note - Records with the following activities have been excluded:
- L05 (Operation of events outside of hours or extended operations)
- L06 (Conducting more than six outdoor concerts)

Map ID	Permission ID	Permission Type	Activity	Premise Address	Status	Issue Date	Expiry Date	Doc Link	Loc Conf	Dist (m)	Dir
1	OL000071980	Operating Licence (any other case)	A03 (Sewage treatment)	Gillies Rd, BALLARAT NORTH, VIC, 3352, AU	Active	01/07/2008	31/12/9999	Link	Premise Match	0m	South
3	P000111697	Permit	A14 (Wastewater supply or use)	1059 Ring Road Mitchell Park 3355	Active	25/02/2015	31/12/9999		Premise Match	91m	South West
	P000112660	Permit	A14 (Wastewater supply or use)	1059 Ring Road Mitchell Park 3355	Active	10/04/2015	31/12/9999		Premise Match	91m	South West
4	DL000107264	Developme nt Licence	H02 (Bitumen or asphalt batching)	5 Yarramie Ct Mitchell Park VIC 3355 AU	Active	02/09/2014	31/12/9999	Link	Premise Match	292m	South West
5	R000302506	Registration	A13c (Waste and resource recovery - small)	67 Old Midland Highway, Mount Rowan, Victoria, 3352, Australia	Active	02/01/2022	01/01/2027	Link	Premise Match	401m	South East
6	R000305200	Registration	A13c (Waste and resource recovery - small)	3 Grand Junction Drive, Miners Rest, Victoria, 3352, Australia	Active	07/01/2023	06/01/2028	Link	Premise Match	538m	West
7	R000300667	Registration	A13c (Waste and resource recovery - small)	5 Coronet Street Wendouree 3355	Active	03/08/2021	03/08/2026	Link	Premise Match	873m	South East
	R000301319	Registration	A13c (Waste and resource recovery - small)	5 Coronet Street Wendouree 3355	Active	28/09/2021	27/09/2026	Link	Premise Match	873m	South East
	R000303566	Registration	A07b (Organic waste processing - small)	3355, Australia	Active	27/05/2022	26/05/2027	Link	Suburb Match		

EPA Records - Legacy Licensed Activities & Works Approvals

Ballarat North, Ballarat City, VIC 3350



Legend

- Site Boundary
- Buffer 1000m
- Property Boundaries
- Legacy Licensed Activities
- Legacy Works Approvals

Scale:	Data Sources:	Coordinate System:	Date:
0 100 200 400 600 800 1,000 1,200 1,400 1,600 1,800 Meters	Property Boundaries - State Government Victoria - Department of Environment, Land, Water & Planning	GDA 1994 MGA Zone 55	09 October 2023

EPA Activities

Ballarat North, Ballarat City, VIC 3350

Legacy EPA Licensed Activities

Activities licensed under the repealed *Environment Protection Act 1970 (Vic.)* within the dataset buffer:

Trans No	Licence No	Licence Type	Organisation	Premise Ref	Premise Address 1	Premise Address 2	Activities	Loc Conf	Dist (m)	Direction
3032904	74422	Amalgamated licence	CENTRAL HIGHLANDS REGION WATER CORPORATION	71980	GILLIES ST	BALLARAT NORTH VIC 3352	A03 Sewage Treatment	Premise Match	0m	South
	EI26168#2		ACE SCRAP METAL & STEEL CO PTY LTD		5-7 CORONET ST	WENDOUREE VIC 3355	A01 Prescribed Industrial Waste Management	Premise Match	873m	South East

Legacy Activity Data Custodian: State Government Victoria - Environment Protection Authority (EPA)

Legacy EPA Works Approvals

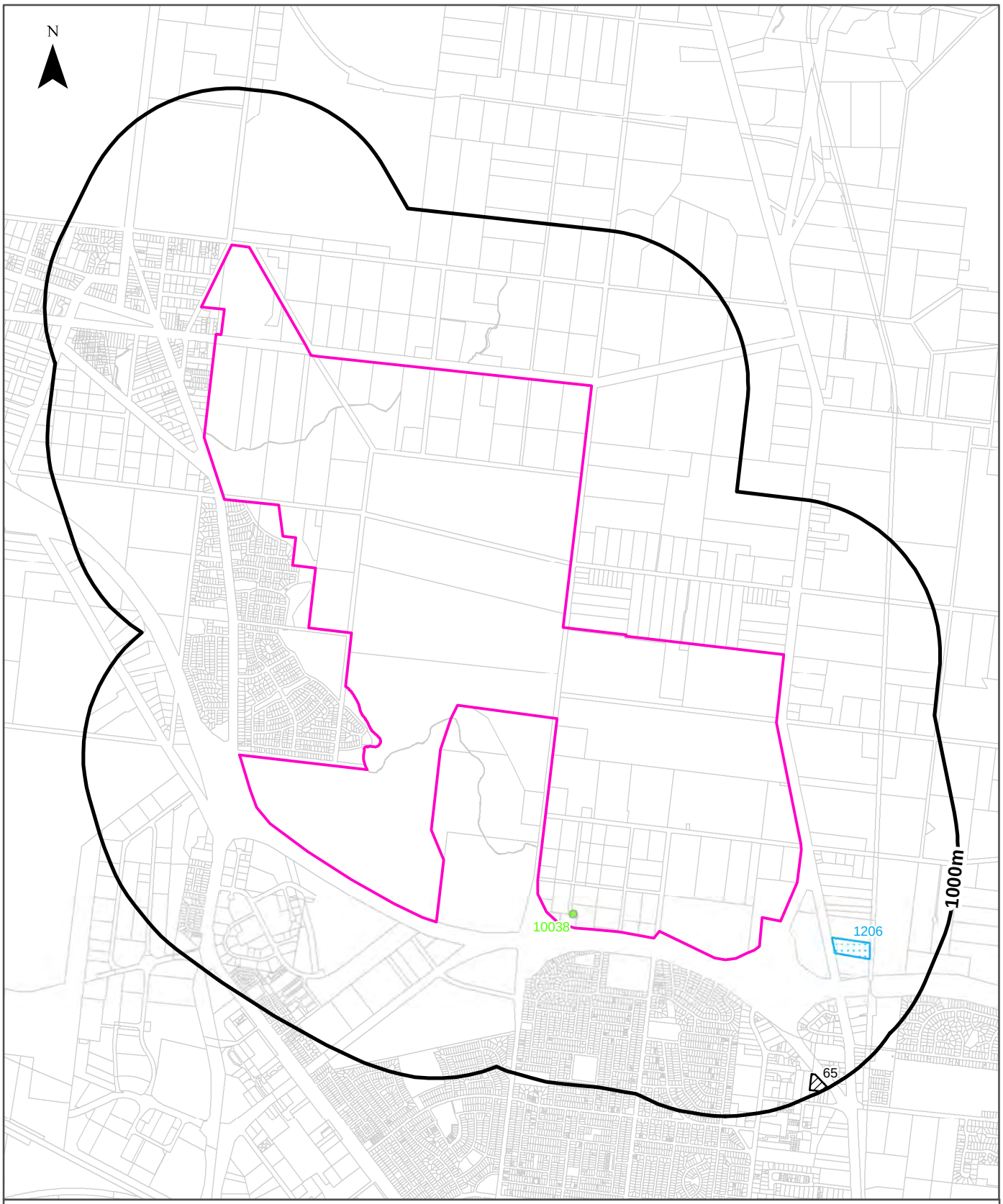
Works approvals licensed under the repealed *Environment Protection Act 1970 (Vic.)* within the dataset buffer:

Transaction No	Status	Approval No	Organisation	Premise Address	Suburb	Scheduled Categories	Loc Conf	Dist (m)	Direction
1001432	Approved/ Issued	107264	WESTERN VICTORIA ASPHALT PTY LTD [MITCHELL PARK]	5 YARRAMIE CT MITCHELL PARK VIC 3355	MITCHELL PARK	H02 Bitumen Asphalt Batching Works	Premise Match	292m	South West

Legacy Works Approvals Data Custodian: State Government Victoria - Environment Protection Authority (EPA)

Waste Management Facilities and Landfills

Ballarat North, Ballarat City, VIC 3350



Site Boundary
ReportBuffer
Property Boundary
National Waste Management Site
Statewide Waste and Resource Recovery Infrastructure Plan Facility
Legacy EPA Prescribed Industrial Waste Site
EPA Victorian Landfill Register
Area identified as Former Waste Disposal Site

Scale:
0 100 200 400 600 800 1,000 1,200 1,400 1,600 1,800
Meters

Data Sources: Property Boundaries - State Government Victoria - Department of Environment, Land, Water & Planning

Coordinate System: GDA 1994 MGA Zone 55

Date: 09 October 2023

Waste Management Facilities & Landfills

Ballarat North, Ballarat City, VIC 3350

National Waste Management Site Database

Sites on the National Waste Management Site Database within the dataset buffer:

Site Id	Owner	Name	Address	Suburb	Class	Landfill	Reprocess	Transfer	Comments	Loc Conf	Dist (m)	Direction
N/A	No records in buffer											

Waste Management Facilities Data Source: Australian Government Geoscience Australia

Statewide Waste and Resource Recovery Infrastructure Plan Facilities

Statewide Waste and Resource Recovery Infrastructure Plan Facilities within the dataset buffer:

Map Id	Owner	Site Name	Address	Suburb	Category	Sub Category	Loc Conf	Distance	Direction
65		Onesteel Recycling (trading as Ace Scrap metal & Steel)	7 Coronet St	Wendouree	Commercial & Industrial	C&I Recovery	Premise Match	873m	South East

SWRRIPF Data Source: State Government Victoria - Department of Sustainability

Legacy EPA Prescribed Industrial Waste

EPA Prescribed Industrial Waste treaters, disposers and permitted transporters under the repealed *Environment Protection Act 1970 (Vic.)* within the dataset buffer:

Map Id	Company Name	Address	Suburb	Treatment /Disposal	Transport	Accredited Agent	EPA List Status	Loc Conf	Dist (m)	Dir
1206	HENDERSON HAULAGE PTY LTD	61 OLD MIDLAND HWY	MOUNT ROWAN VIC 3352	No	Yes	No	Current EPA List	Premise Match	340m	South East

Legacy Prescribed Industrial Waste Data Source: State Government Victoria - Environment Protection Authority (EPA)

Waste Management Facilities & Landfills

Ballarat North, Ballarat City, VIC 3350

EPA Victorian Landfill Register

EPA Victorian Landfill Register sites within the dataset buffer:

Landfill Register No.	Site	Address	Operating Status	Est. Year Of Closure	Waste type	Loc Conf	Dist (m)	Direction
10038	Cnr Gilles Road North and Western Freeway	Lot 1 Noble Court, Mount Rowan, VIC, 3352	Closed	1983	Putrescible waste, Solid inert waste	As Supplied	0m	On-site

EPA Victorian Landfill Register Data Source: State Government Victoria - Environment Protection Authority (EPA)

Former Gasworks and Liquid Fuel Facilities

Ballarat North, Ballarat City, VIC 3350

Former Gasworks

Former Gasworks identified from various historical sources within the dataset buffer:
Note - As this is a dataset collated from various historical sources, it is not an exhaustive list of all former Gasworks

Map Id	Site Name	Date Opened	Year Closed	Location Confidence	Distance	Direction
N/A	No records in buffer					

Former Gasworks Data Source: Collated from various historical sources

National Liquid Fuel Facilities

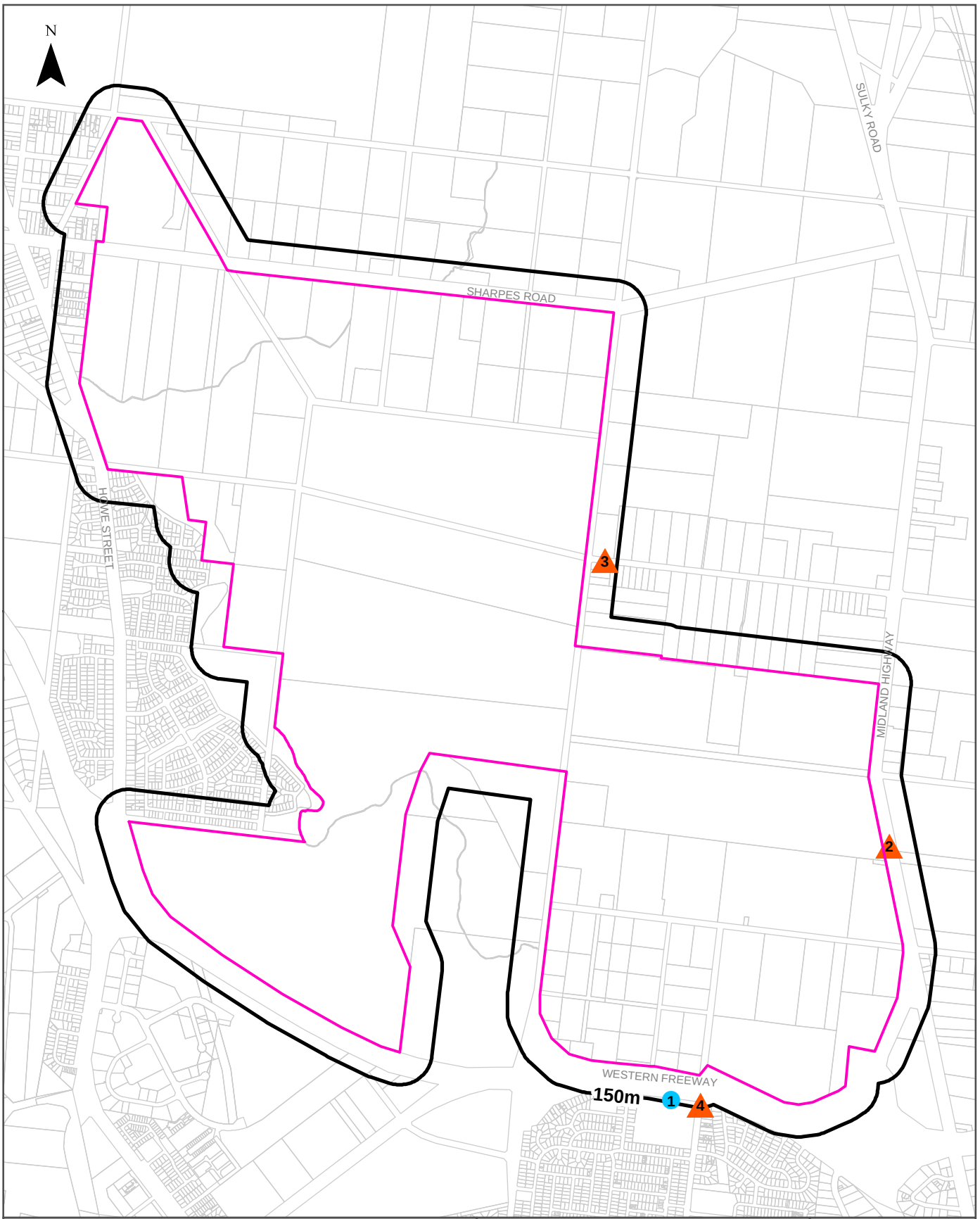
National Liquid Fuel Facilties within the dataset buffer:

Map Id	Owner	Name	Address	Suburb	Class	Operational Status	Operator	Revision Date	Loc Conf	Dist (m)	Direction
N/A	No records in buffer										

National Liquid Fuel Facilities Data Source: Geoscience Australia

Historical Business Directories

Ballarat North, Ballarat City, VIC 3350



Legend

- Site Boundary
- Buffer 150m
- Property Boundary
- Business directory records mapped to a specific premise
- Business directory records mapped to a road intersection
- Business directory records mapped to a road corridor
- Business directory records mapped to a general area

Scale: 0 340 680 1,020 1,360 Meters

Coordinate System: GDA 1994 MGA Zone 55

Date: 09 October 2023

Historical Business Directories

Ballarat North, Ballarat City, VIC 3350

Business Directory Records 1905-1991
Premise or Road Intersection Matches

Universal Business Directory and Sands & McDougall Directory records, from years 1991, 1980, 1970, 1960, 1950, 1945, 1925 & 1905, mapped to a premise or road intersection within the dataset buffer:

Map Id	Business Activity	Premise	Ref No.	Year	Location Confidence	Distance to Property Boundary or Road Intersection	Direction
1	Schools &/Or Colleges - Private &/Or Public	Wendouree High/Technical School., Forest St. Wendouree. 3355	78033	1991	Premise Match	123m	South East

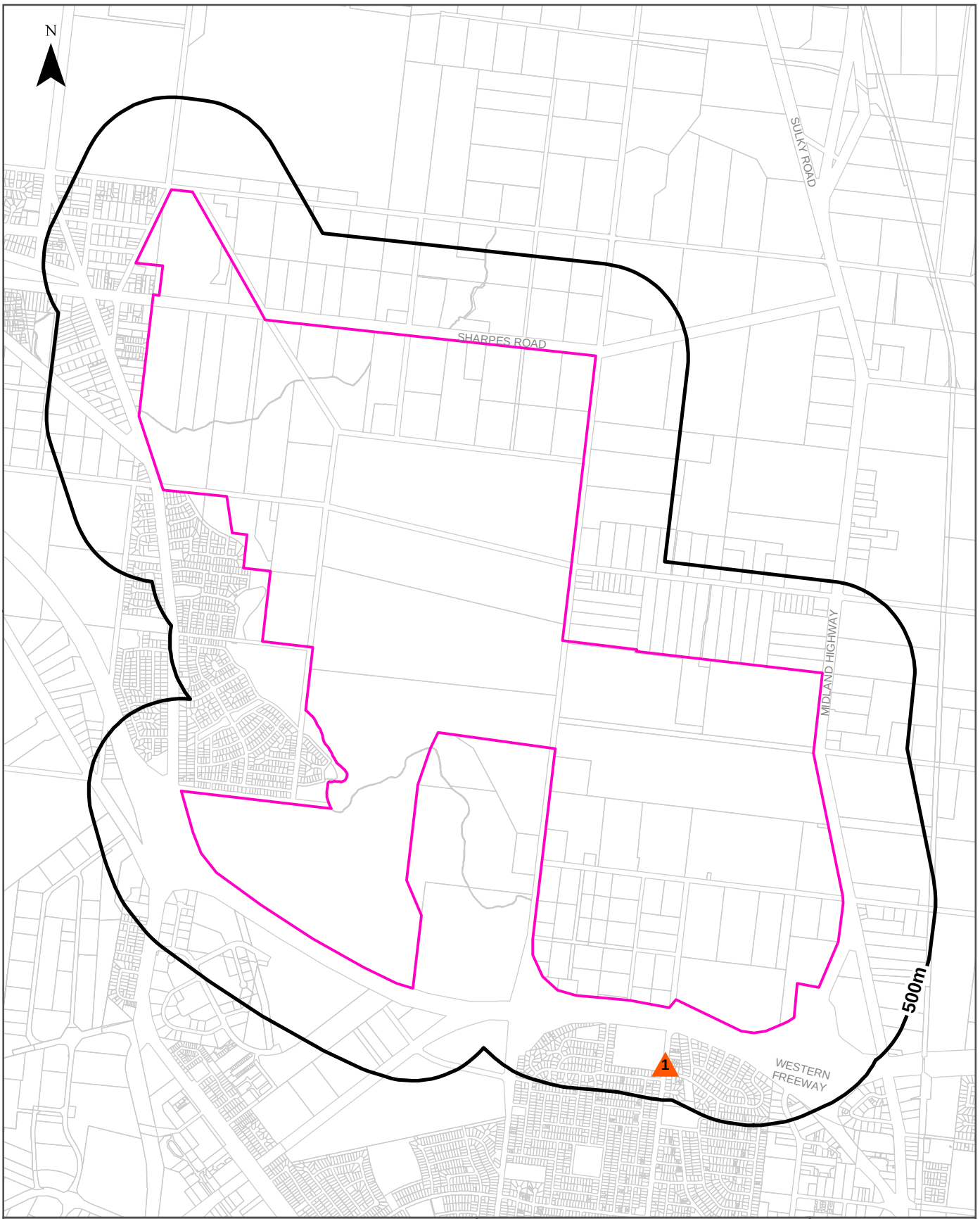
Business Directory Records 1905-1991
Road or Area Matches

Universal Business Directory and Sands & McDougall Directory records, from years 1991, 1980, 1970, 1960, 1950, 1945, 1925 & 1905, mapped to a road or an area, within the dataset buffer. Records are mapped to the road when a building number is not supplied, cannot be found, or the road has been renumbered since the directory was published:

Map Id	Business Activity	Premise	Ref No.	Year	Location Confidence	Distance to Road Corridor or Area
2	Fork Lift Truck Hirers	Vagg. K. R. & K. J. Forklifts., Creswick Rd. Mount Rowan. 3352	75855	1991	Road Match	0m
	Fork Lift Truck Mfrs. &/Or Imps. &/Or Dists.	Vagg. K. R. & K. J. Forklifts., Creswick Rd. Mount Rowan. 3352	75857	1991	Road Match	0m
	Fork Lift Truck Service, Maintenance &/Or Repairs	Vagg. K. R. & K. J. Forklifts., Creswick Rd. Mount Rowan. 3352	75860	1991	Road Match	0m
3	BUILDERS & BUILDING CONTRACTORS	Colbourne. W. H., Cummings Rd Mt Rowan Ballarat	7466	1970	Road Match	31m
4	Motor Garages &/Or Engineers &/Or Service Stations	Wendouree Motors Pty.Ltd. Forest St. Ballarat, 3350	67880	1980	Road Match	123m
	Motor Car &/Or Truck Dealers - New &/Or Used	Wendouree Motors, Forest St. Ballarat, 3350	67816	1980	Road Match	123m
	Motor Garages &/Or Engineers &/Or Service Stations	Wendouree Motors. Forest St. Ballarat, 3350	67881	1980	Road Match	123m

Dry Cleaners, Motor Garages & Service Stations

Ballarat North, Ballarat City, VIC 3350



Legend

- Site Boundary
- Buffer 500m
- Property Boundary
- Business directory records mapped to a specific premise
- Business directory records mapped to a road intersection
- Business directory records mapped to a road corridor
- Business directory records mapped to a general area

Scale: 0 400 800 1,200 1,600 Meters

Coordinate System: GDA 1994 MGA Zone 55

Date: 09 October 2023

Historical Business Directories

Ballarat North, Ballarat City, VIC 3350

Dry Cleaners, Motor Garages & Service Stations Premise or Road Intersection Matches

Dry Cleaners, Motor Garages & Service Stations from Sands & McDougall's Directories and UBD Business Directories, mapped to a premise or road intersection within the dataset buffer.

Map Id	Business Activity	Premise	Ref No.	Year	Location Confidence	Distance to Property Boundary or Road Intersection	Direction
N/A	No records in buffer						

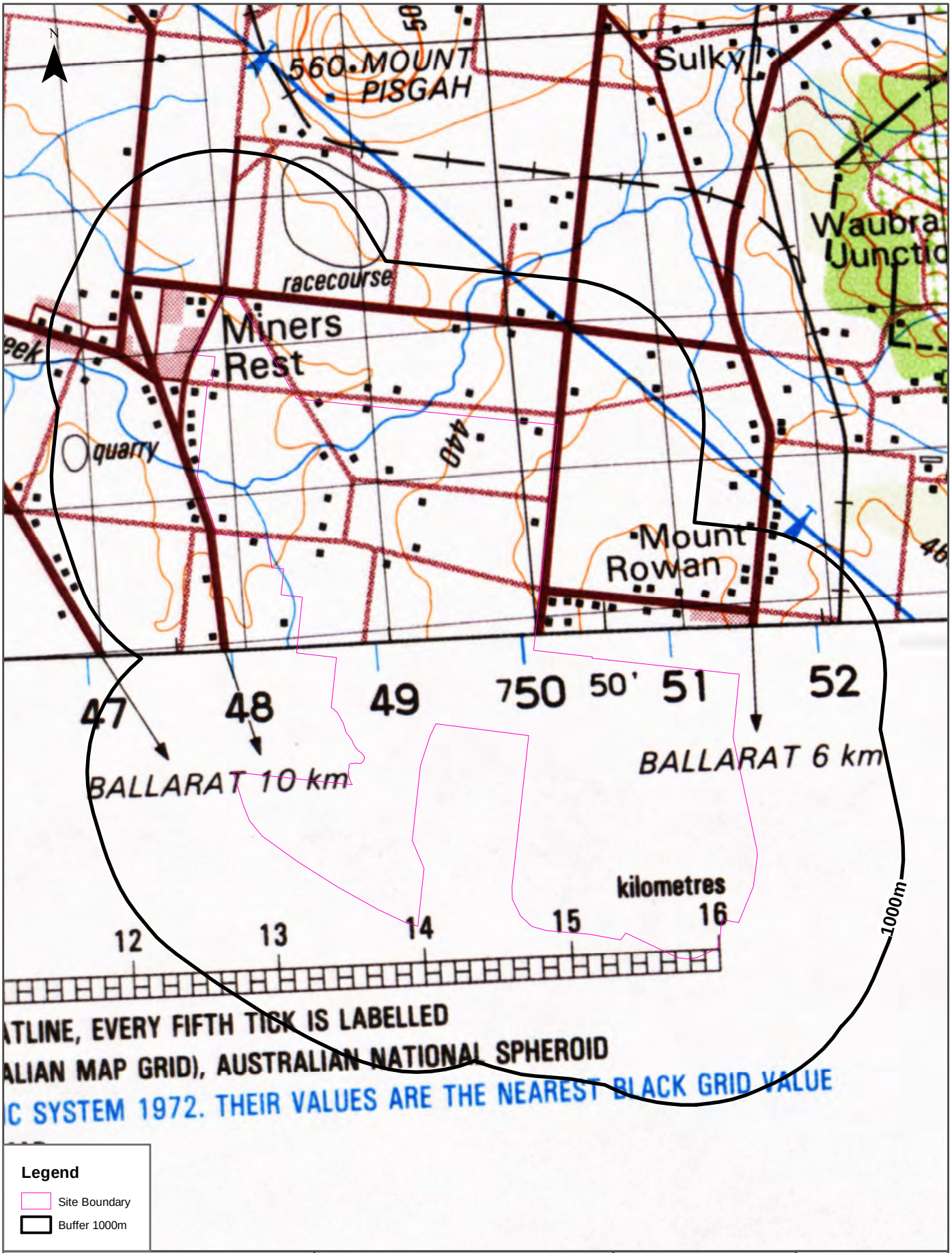
Dry Cleaners, Motor Garages & Service Stations Road or Area Matches

Dry Cleaners, Motor Garages & Service Stations from UBD Business Directories and Sands & McDougall's Directories, mapped to a road or an area within the dataset buffer. Records are mapped to the road when a building number is not supplied, cannot be found, or the road has been renumbered since the directory was published.

Map Id	Business Activity	Premise	Ref No.	Year	Location Confidence	Distance to Road Corridor or Area
1	Motor Garages &/Or Engineers &/Or Service Stations	Wendouree Motors Pty.Ltd. Forest St. Ballarat, 3350	67880	1980	Road Match	123m
	Motor Garages &/Or Engineers &/Or Service Stations	Wendouree Motors. Forest St. Ballarat, 3350	67881	1980	Road Match	123m

Historical Map 1984

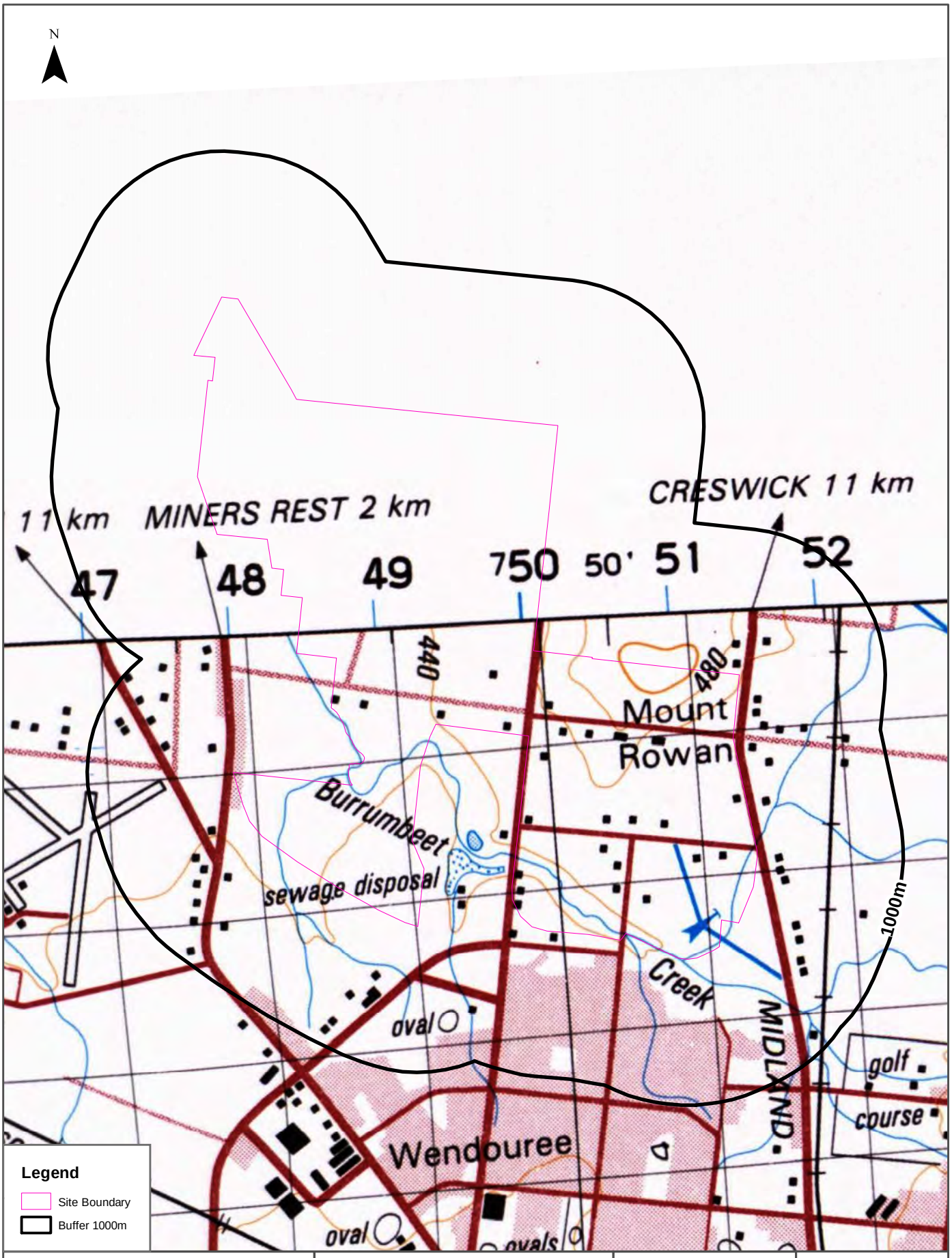
Ballarat North, Ballarat City, VIC 3350



Scale: 0 410 820 1,230 1,640 Meters	Data Sources: NATMAP 1:100,000 Topographic Maps Geoscience Australia	Coordinate System: GDA 1994 MGA Zone 55	Date: 06 October 2023

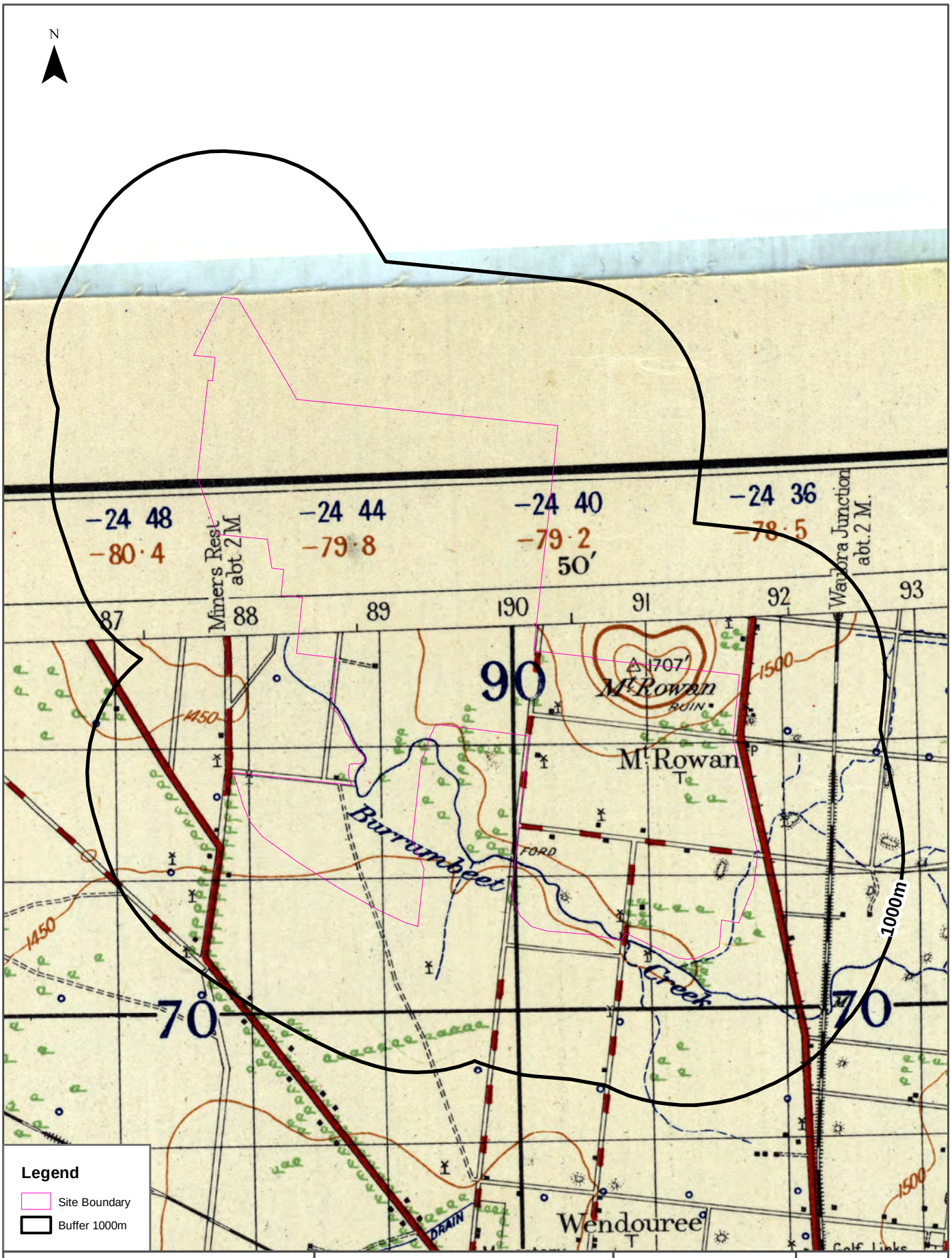
Historical Map 1984

Ballarat North, Ballarat City, VIC 3350



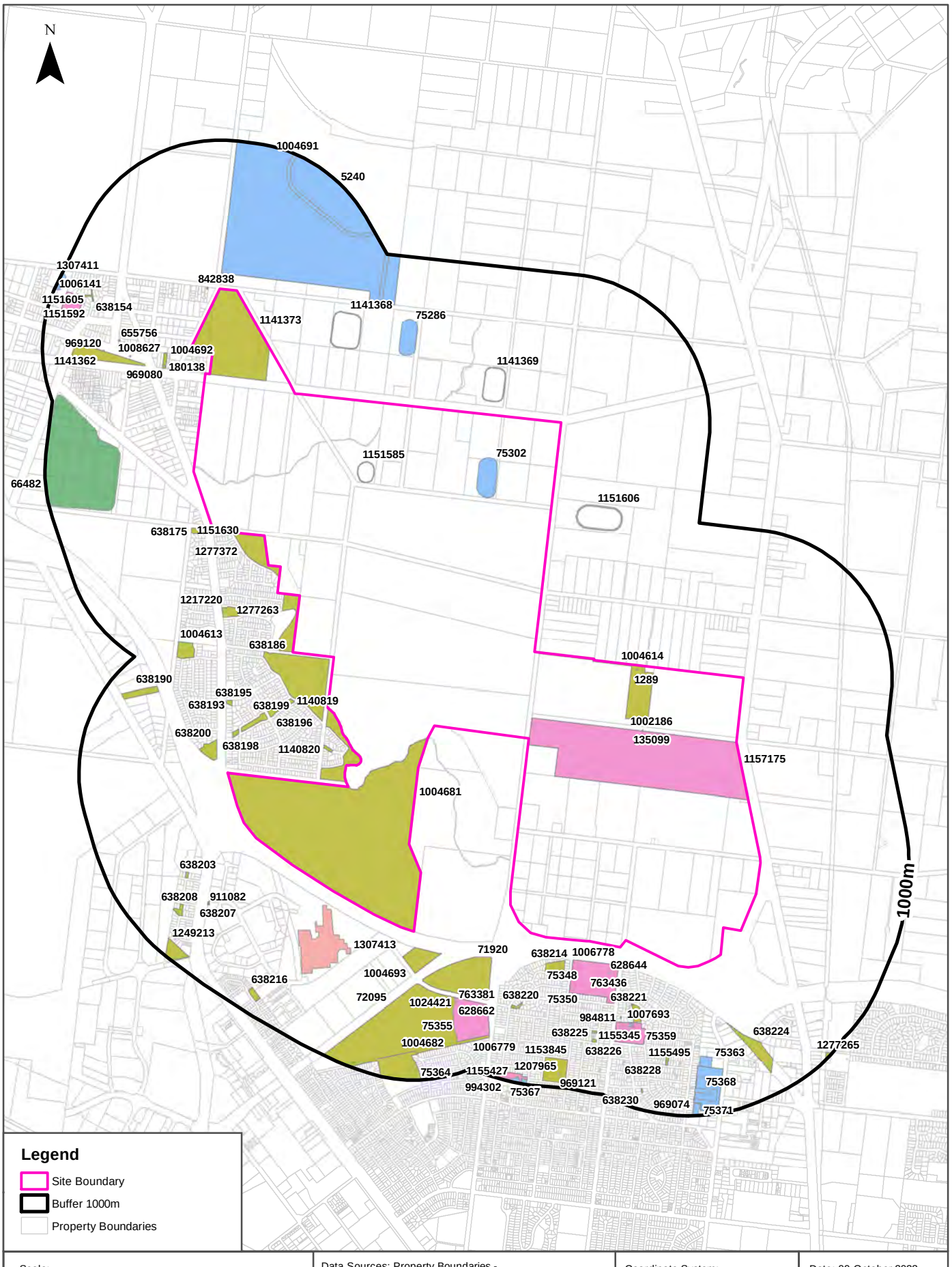
Historical Map c.1936

Ballarat North, Ballarat City, VIC 3350



Features of Interest

Ballarat North, Ballarat City, VIC 3350



Features of Interest

Ballarat North, Ballarat City, VIC 3350

Features of Interest

Features of Interest within the dataset buffer:

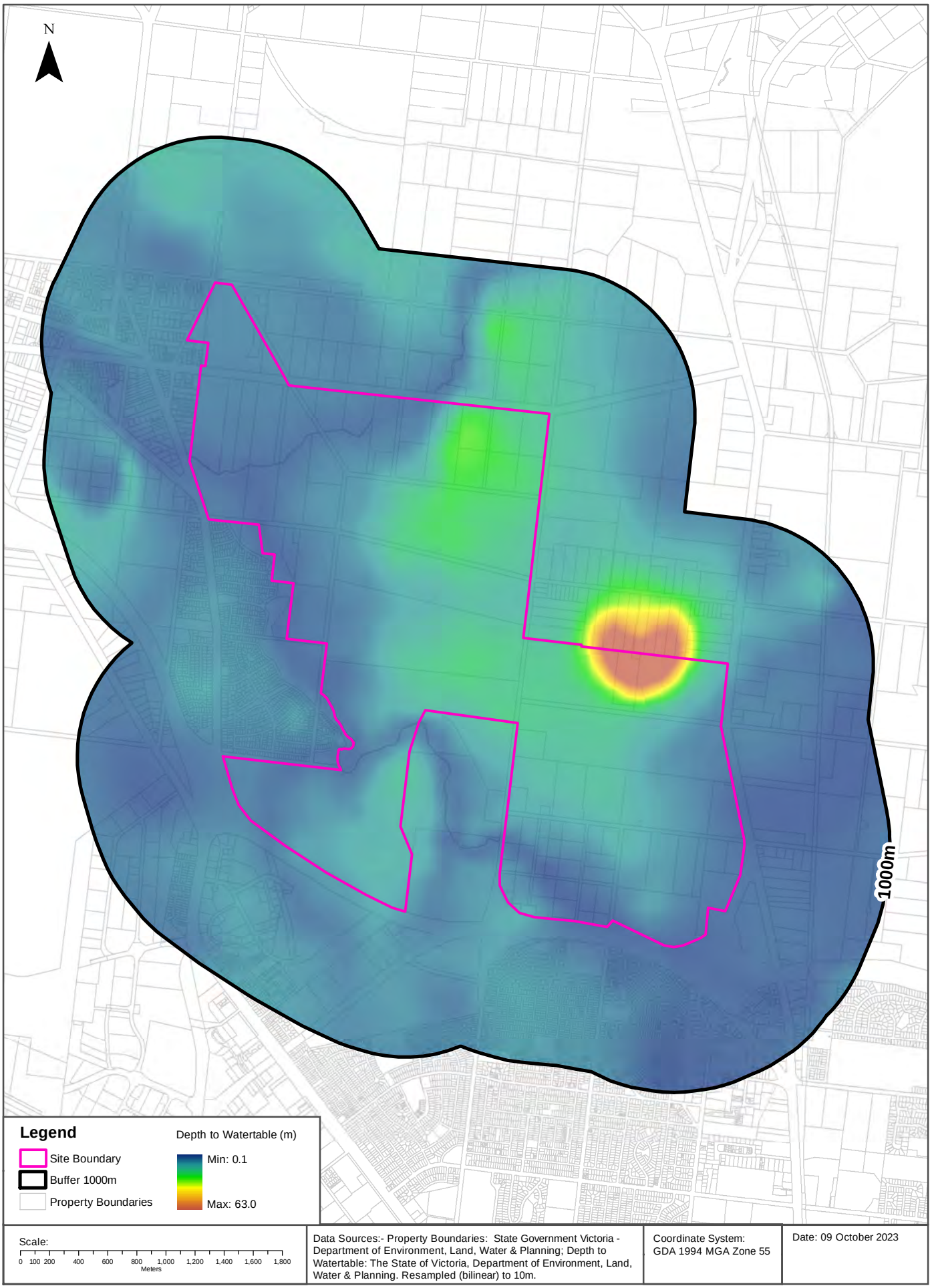
Feature Id	Feature Type	Feature Sub Type	Name	Distance	Direction
1004681	reserve	park	North Common Wetland Reserve	0m	On-site
1157175	education centre	education complex		0m	On-site
1141373	reserve	park	Miners Rest Wetland Reserve	0m	On-site
1004614	reserve	park	Mount Rowan Reserve	0m	On-site
75302	sport facility	sports ground		0m	On-site
1151585	sport facility	training track		0m	On-site
1289	control point	survey monument		0m	On-site
135099	education centre	primary/secondary school	Ballarat Grammar	0m	On-site
1002186	education centre	primary/secondary school	Ballarat Grammar - Ballarat Grammar Mount Rowan Campus	0m	On-site
1277372	reserve	park		0m	North West
1140819	reserve	park		0m	South West
1277263	reserve	park		0m	West
638186	reserve	park	Macarthur Park Wetlands	20m	West
638175	reserve	park	Cummins Road Reserve	57m	North West
842838	communication service	telephone exchange	Miners Rest Telephone Exchange	74m	North West
1141369	sport facility	training track		91m	North
1307413	power facility	solar power station		102m	South West
5240	sport facility	racecourse	Dowling Forest Racecourse	105m	North
1004693	reserve	park	Waldie Park	106m	South
638200	reserve	park	Sunraysia Heights Reserve	118m	West
1140820	reserve	park		121m	South West
1006778	education centre	education complex		123m	South
1151630	recreational resource	playground		124m	North West
638214	reserve	park	Ealing Avenue Reserve	145m	South
75348	sport facility	basketball court		147m	South
1004692	reserve	park	Miners Rest Hall Reserve	167m	North West
1151606	sport facility	training track		169m	North East
628644	education centre	secondary school	Mount Rowan Secondary College - Mount Rowan Campus	181m	South East
763436	education centre	secondary school	Mount Rowan Secondary College	181m	South East
75350	sport facility	sports ground		197m	South
180138	community venue	hall	Miners Rest Hall	215m	North West

Feature Id	Feature Type	Feature Sub Type	Name	Distance	Direction
638196	reserve	park		231m	West
638198	reserve	park		241m	West
1217220	reserve	park		253m	West
638199	reserve	park	Malahide Drive Median Strip Reserve	284m	West
71920	reserve	park	Pioneer Park	306m	South
75286	sport facility	sports ground		334m	North
969080	reserve	park	Miners Rest Reserve	334m	North West
1141368	sport facility	training track		336m	North
72095	reserve	park	Ring Road Reserve	354m	South
638221	reserve	park	Rowan View Park	366m	South East
1008627	landmark	monument	Miners Rest War Memorial	410m	North West
638224	reserve	park		424m	South East
638195	reserve	park		451m	West
1006779	education centre	education complex		453m	South
1007693	education centre	education complex		454m	South East
638220	reserve	park	Langstaffe Drive Reserve	462m	South
984811	care facility	child care	Rowan View Preschool	466m	South East
1155426	sport facility	sports ground		478m	South East
655756	emergency facility	fire station	Miners Rest Fire Station	480m	North West
1155345	sport facility	sports ground		487m	South East
638193	reserve	park	Macarthur Park Boulevard Reserve	492m	West
638203	reserve	park	Winifred Street Park	501m	South West
66482	excavation site	mine		503m	North West
75359	sport facility	sports complex		503m	South East
638207	reserve	park		527m	South West
1155493	recreational resource	playground		529m	South East
911082	communication service	telephone exchange		544m	South West
628662	education centre	primary/secondary school	Yuille Park P-8 Community College - Yuille Campus	550m	South
763381	education centre	primary/secondary school	Yuille Park P-8 Community College	550m	South
1024421	education centre	primary/secondary school	Yuille Park P-8 Community College - Young Parents Campus	550m	South
638225	reserve	park	Carpenter Street Reserve	583m	South
969120	recreational resource	playground		584m	North West
628170	education centre	special school	Forest Street Primary School - Forest Street Deaf Facility	586m	South East
628269	education centre	primary school	Forest Street Primary School	586m	South East
765428	education centre	primary school	Forest Street Primary School	593m	South East
638228	reserve	park	John Street Reserve	598m	South East
75363	sport facility	tennis court		600m	South East

Feature Id	Feature Type	Feature Sub Type	Name	Distance	Direction
1141362	sport facility	sports ground		619m	North West
638226	reserve	park	Carpenter Street Playground	641m	South
1155495	recreational resource	playground		642m	South East
75355	sport facility	sports ground		646m	South
638208	reserve	park	Caldwell Street Park	663m	South West
1004613	reserve	park	Sunraysia Heights Neighbourhhod Park	663m	West
969074	sport facility	sports complex	Hollioake Park	669m	South East
1004691	sport facility	horse racetrack		683m	North
638190	reserve	park		716m	West
638154	reserve	park	James Court Reserve	728m	North West
75368	sport facility	tennis court		739m	South East
1009967	care facility	child care	Miners Rest Kindergarten	782m	North West
1006141	education centre	education complex		791m	North West
1151584	sport facility	sports ground		797m	North West
1151592	sport facility	sports ground		799m	North West
1004682	reserve	park	Wendouree West Recreation Reserve	802m	South
1153845	reserve	park	Montgomery Street Reserve	804m	South
1151605	sport facility	tennis court		814m	North West
1151631	recreational resource	playground		836m	North West
638216	reserve	park	Waltham Drive Reserve	840m	South West
1151637	recreational resource	playground		863m	North West
638230	reserve	park	Harrow Street Reserve	866m	South
75364	sport facility	sports complex		886m	South
1249213	reserve	park		893m	South West
140730	education centre	primary school	Miners Rest Primary School	897m	North West
969121	recreational resource	playground		908m	South
75371	sport facility	bowling green	Webbcona Bowls Club	919m	South East
1207965	education centre	education complex		940m	South
1307411	sport facility	sports ground		951m	North West
1277265	reserve	park		962m	South East
75367	sport facility	sports ground		965m	South
1957	sport facility	netball court		970m	South
1155427	sport facility	sports ground		982m	South
994302	care facility	child care	Ymca Ballarat - Our Lady Help Of Christians Oshc	988m	South
1155537	recreational resource	playground		995m	South

Depth to Watertable

Ballarat North, Ballarat City, VIC 3350



Hydrogeology & Groundwater

Ballarat North, Ballarat City, VIC 3350

Hydrogeology

Description of aquifers within the dataset buffer:

Description	Distance	Direction
Fractured or fissured, extensive highly productive aquifers	0m	On-site

Hydrogeology Map of Australia: Commonwealth of Australia (Geoscience Australia)

Groundwater Salinity

On-site Groundwater Salinity:

Groundwater Salinity	Percent Of Site Area
1,000 - 3,500 mg/l	75
3,500 - 7,000 mg/l	25

Depth to Watertable

On-site Depth to Watertable:

Depth to Watertable	Percent Of Site Area
Less than 5 metres	40
10 to 20 metres	33
5 to 10 metres	23
Greater than 50 metres	1
20 to 50 metres	1

Surface Elevation

Approximate on-site Surface Elevation:

Surface Elevation
419 AHDm to 516 AHDm

Basement Elevation

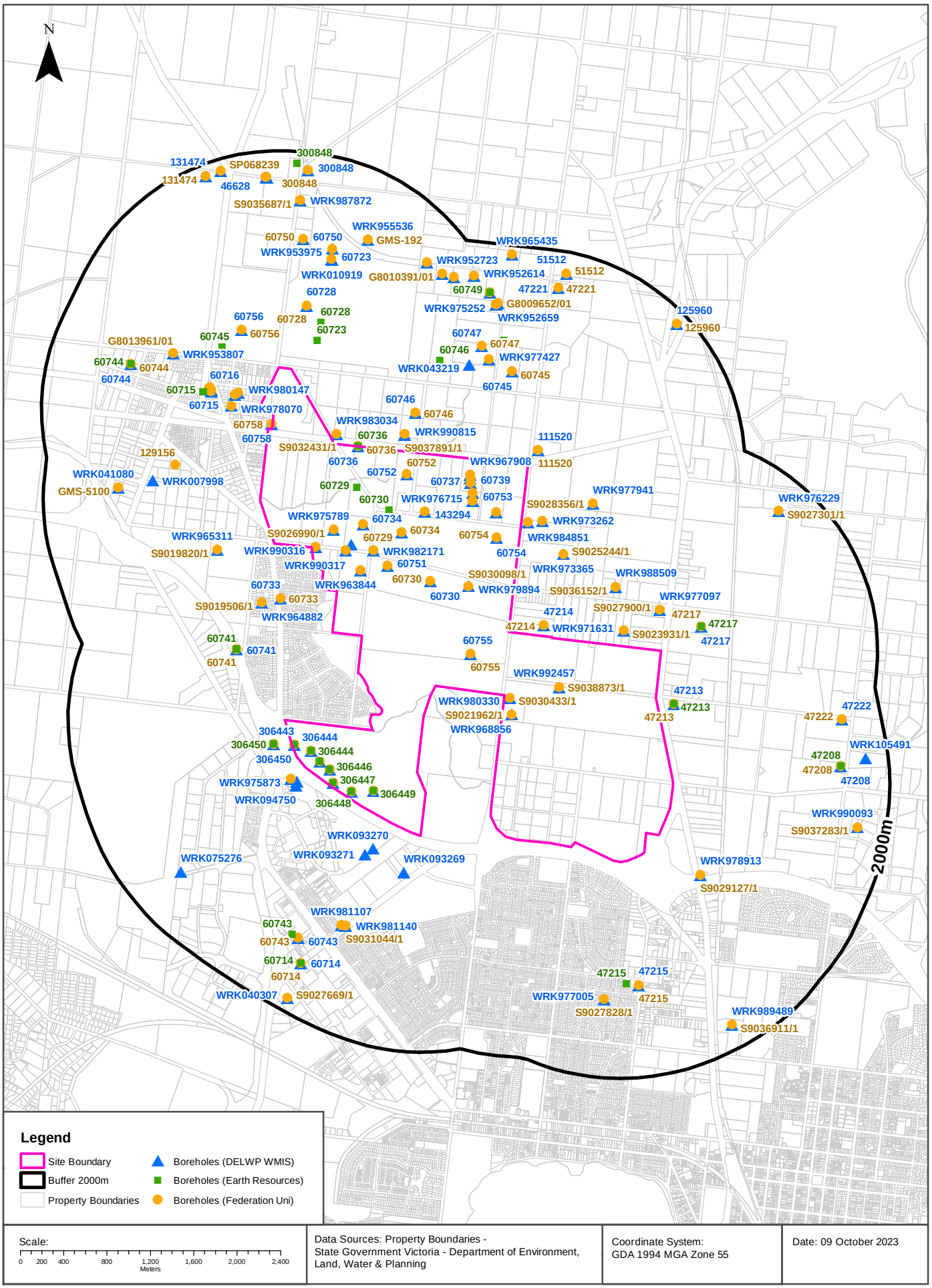
Approximate on-site Basement Elevation:

Basement Elevation - Basement Rocks comprise Lower Palaeozoic basement rocks that form the highlands and the crystalline basement; and Mesozoic rocks of the Otway and Gippsland basins both outcropping and subsurface
317 AHDm to 454 AHDm

Groundwater Data Custodian: State Government Victoria - Dept of Environment, Land, Water & Planning

Groundwater Boreholes

Ballarat North, Ballarat City, VIC 3350



Groundwater Boreholes

Ballarat North, Ballarat City, VIC 3350

Boreholes (DELWP WMIS)

Boreholes from the Department of Environment, Land, Water & Planning's Water Measurement Information System, within the dataset buffer:

Bore Id	Use Type	Drillers Log	Construction	Latest Water Levels	Geology	Completed Date	Dist (m)	Dir
143294	Domestic, Stock	0.00m-4.00m CLAY 4.00m-5.50m BLUE BASALT 5.50m-9.00m CLAY 9.00m-24.00m BLUE BASALT 24.00m-32.00m SOFT BASALT 32.00m-42.00m HARD BASALT	-0.50m-42.00m INNER LINING - CASING = Pvc 20.00m-33.00m INNER LINING - SCREEN = Pvc 0.00m-0.50m OUTER LINING - GRAVEL = Cement 20.00m-0.00m OUTER LINING - GRAVEL = Seal			23/03/2000	0m	On-site
306443	Non Groundwater					31/12/1890	0m	On-site
306444	Non Groundwater					31/12/1890	0m	On-site
306445	Non Groundwater					31/12/1890	0m	On-site
306446	Non Groundwater					31/12/1890	0m	On-site
306447	Non Groundwater					31/12/1890	0m	On-site
306448	Non Groundwater					31/12/1890	0m	On-site
306449	Non Groundwater					31/12/1890	0m	On-site
60729	Domestic, Stock	0.00m-0.30m TOP SOIL 0.30m-1.83m RED CLAY 1.83m-2.44m BROWN CLAY 2.44m-4.88m BASALT (GREY) 4.88m-5.49m SANDY YELLOW CLAY 5.49m-6.40m BASALT (GREY) 6.40m-8.53m SANDY YELLOW CLAY 8.53m-15.54m BASALT (HONEYCOMB) 26.52m-32.91m BASALT (HARD) 32.91m-26.52m BASALT (SOFT GREY)	0.00m-12.50m INNER LINING - CASING = Not Known 0.00m-32.91m INNER LINING - SCREEN = Not Known		0.00m-32.91m	26/09/1972	0m	On-site
60730	Stock	0.00m-0.23m TOPSOIL 0.23m-5.56m CLAY 5.56m-18.29m CLAY AND RUBBLE 18.29m-25.30m BASALT 25.30m-26.21m CLAY AND RUBBLE 26.21m-32.92m SOFT BASALT WITH CLAY	0.00m-3.05m INNER LINING - CASING = Not Known 0.00m-32.92m INNER LINING - CASING = Pvc			26/01/1973	0m	On-site
60734	Domestic, Stock	0.00m-1.00m TOP RED VOLCANIC SOIL 1.00m-5.00m VOLCANIC CLAYS 5.00m-38.00m BASALT 38.00m-39.00m GREY CLAY	0.00m-6.00m INNER LINING - CASING = Galvanised Iron 20.11m-38.10m INNER LINING - SCREEN = Galvanised Iron		20.11m-38.10m	13/01/1976	0m	On-site
60736	Domestic	0.00m-0.30m TOP SOIL 0.30m-1.20m BUCKSHOT 1.20m-35.30m GREY BASALT	0.00m-13.40m INNER LINING - CASING = Pvc 32.80m-35.30m INNER LINING - SCREEN = Pvc		32.80m-35.30m	27/08/1977	0m	On-site
60737	Domestic, Stock	0.00m-1.00m TOP RED VOLCANIC SOIL 1.00m-4.00m VOLCANIC CLAY 4.00m-39.00m BASALT 39.00m-40.00m VOLCANIC CLAY	0.00m-6.00m INNER LINING - CASING = Pvc 6.00m-40.00m INNER LINING - SCREEN = Pvc		6.00m-40.00m Basalt	01/04/1978	0m	On-site
60739	Domestic, Stock	0.00m-0.30m TOP SOIL 0.30m-3.60m RED CLAY 3.60m-4.80m BROWN CLAY 4.80m-27.70m BASALT 27.70m-32.50m VOLCANIC CLAY 32.50m-37.10m BASALT 37.10m-39.00m CLAY	0.00m-26.80m INNER LINING - CASING = Pvc 26.80m-39.00m INNER LINING - SCREEN = Pvc		26.80m-39.00m Basalt	07/11/1978	0m	On-site
60751	Stock					01/01/1988	0m	On-site
60752	Domestic					01/01/1988	0m	On-site
60753	Domestic, Stock					01/01/1988	0m	On-site

Bore Id	Use Type	Drillers Log	Construction	Latest Water Levels	Geology	Completed Date	Dist (m)	Dir
60754	Domestic					01/01/1988	0m	On-site
60755	Domestic, Stock	0.00m-1.00m TOP SOIL 1.00m-30.00m CLAY 30.00m-36.00m BASALT 36.00m-40.00m CLAY 40.00m-60.00m LOOSE ROCK	-0.30m-49.00m INNER LINING - CASING = Pvc 49.00m-52.00m INNER LINING - SCREEN = Pvc 52.00m-60.00m INNER LINING - CASING = Pvc		49.00m-52.00m Basalt	10/01/1991	0m	On-site
WRK043217	Irrigation						0m	On-site
WRK963844							0m	On-site
WRK967908							0m	On-site
WRK968856							0m	On-site
WRK975599							0m	On-site
WRK975789							0m	On-site
WRK976682							0m	On-site
WRK976715							0m	On-site
WRK979894							0m	On-site
WRK980330							0m	On-site
WRK982171							0m	On-site
WRK990316							0m	On-site
WRK990317							0m	On-site
WRK992457							0m	On-site
60758	Domestic & Stock, Irrigation	0.00m-2.50m BROWN CLAY & EARTH 2.50m-7.00m BLUE BASALT 7.00m-9.50m PUGGY BROWN CREAM CLAY 9.50m-20.00m HARD BLUE BASALT 20.00m-30.00m FRACTURED BLUE BASALT	-0.30m-19.00m INNER LINING - CASING = Pvc 20.00m-27.00m INNER LINING - SCREEN = Pvc 12.00m-0.00m OUTER LINING - GRAVEL = Seal	Date/time: 2008-04-23 1200 Quality: 47 WLMP: 9.27m DBNS: 9.13m RWL: 416.36 mAHD	20.00m-27.00m	31/05/1991	7m	North West
WRK983034							61m	North West
WRK984851							62m	North East
47214	Domestic	0.00m-4.50m BROWN EARTH AND STIFF BROWN CLAY 4.50m-21.00m FRACTURED AND BRITTLE BLUE BASALT 21.00m-30.00m HARD BLUE BASALT 30.00m-33.00m SITFF BLUE CLAY 33.00m-39.00m HARD BLUE BASALT 39.00m-45.00m FRACTURED BLUE BASALT 45.00m-55.00m MEDIUM-HARD BLUE BASALT 55.00m-56.00m VERY SOFT BRITTLE BLACK BASALT 56.00m-60.00m SANDY YELLOW MUDSTONE	0.00m-38.00m INNER LINING - CASING = Pvc 38.00m-40.00m INNER LINING - SCREEN = Pvc 40.00m-56.00m INNER LINING - CASING = Pvc 56.00m-58.00m INNER LINING - SCREEN = Pvc		38.00m-40.00m Basalt 56.00m-58.00m Mudstone	11/03/1986	96m	East
WRK971631							143m	East
WRK094748	Investigation	0.00m-1.90m CLAY 1.90m-4.00m BASALT	0.00m-1.00m INNER LINING - CASING = Pvc 1.00m-4.00m INNER LINING - SCREEN = Pvc 0.00m-0.30m OUTER LINING - GRAVEL = Cement 0.30m-0.80m OUTER LINING - GRAVEL = Bentonite 0.80m-4.00m OUTER LINING - GRAVEL = Gravel			04/07/2016	150m	South West

Bore Id	Use Type	Drillers Log	Construction	Latest Water Levels	Geology	Completed Date	Dist (m)	Dir
WRK094749	Investigation	0.00m-1.90m CLAY 1.90m-4.00m BASALT	0.00m-1.00m INNER LINING - CASING = Pvc 1.00m-4.00m INNER LINING - SCREEN = Pvc 0.00m-0.30m OUTER LINING - GRAVEL = Cement 0.30m-0.80m OUTER LINING - GRAVEL = Bentonite 0.80m-4.00m OUTER LINING - GRAVEL = Gravel			04/07/2016	150m	South West
47213	Domestic, Stock	0.00m-0.30m GREY LOAM AND BUCKSHOT 0.30m-3.50m STIFF GREY AND ORANGE CLAY 3.50m-6.90m LOOSE GRANULAR CREAM CLAY 6.90m-10.50m YELLOW AND GREY CLAY 10.50m-13.50m BROWN DECAYED BASALT 13.50m-27.00m HARD BLUE BASALT 27.00m-0.00m LIGHT BLUE CLAY	0.00m-8.00m INNER LINING - CASING = Pvc 8.00m-27.00m INNER LINING - SCREEN = Pvc		8.00m-27.00m	29/11/1982	151m	East
WRK990815							154m	North
306450	Non Groundwater					31/12/1890	160m	South West
111520	Domestic, Stock	0.00m-1.00m TOP SOIL & CLAY 1.00m-3.00m CLAY 3.00m-32.00m BASALT 32.00m-34.00m CLAY 34.00m-52.00m BASALT	-0.30m-37.00m INNER LINING - CASING = Pvc 37.00m-52.00m INNER LINING - SCREEN = Pvc		37.00m-52.00m Basalt	09/12/1991	165m	North East
WRK975873							171m	South West
WRK094750	Investigation	0.00m-2.20m CLAY 2.20m-5.50m BASALT	0.00m-1.00m INNER LINING - CASING = Pvc 1.00m-5.50m INNER LINING - SCREEN = Pvc 0.00m-0.30m OUTER LINING - GRAVEL = Cement 0.30m-0.80m OUTER LINING - GRAVEL = Bentonite 0.80m-5.50m OUTER LINING - GRAVEL = Gravel			04/07/2016	183m	South West
WRK973262	Domestic & Stock, Irrigation	18.00m-47.00m HARD FRACTURED	0.30m-30.00m INNER LINING - CASING = Pvc 30.00m-47.00m INNER LINING - SLOT = Pvc			08/04/2006	193m	North East
WRK980147							237m	North West
WRK978070							252m	North West
WRK978355							254m	North West
WRK093270	Observation	0.00m-1.00m FILL 1.00m-1.60m CLAY 1.60m-13.50m ROCK/WEATHERED	0.00m-12.00m INNER LINING - CASING = Pvc 12.00m-13.50m INNER LINING - SCREEN = Pvc 0.00m-10.00m OUTER LINING - GRAVEL = Cement 10.00m-10.50m OUTER LINING - GRAVEL = Bentonite 10.50m-13.50m OUTER LINING - GRAVEL = Gravel			11/04/2016	289m	South
60746	Irrigation	0.00m-1.50m RICH RED EARTH 1.50m-4.00m STIFF BROWN CLAY 4.00m-8.00m BROWN CLAY AND VOLCANIC RUBBLE 8.00m-16.00m SOFT RED HONEYCOMB ROCK (WATER) 16.00m-61.80m HARD BLUE BASALT WITH ISOLATED FRACTURES 61.80m-62.50m FRACTURED BROWN BASALT (WATER) 62.50m-65.00m HARD BLUE BASALT 65.00m-65.50m SOFT BLACK BASALT RUBBLE	0.00m-7.80m INNER LINING - CASING = Pvc 7.80m-11.50m INNER LINING - CASING = Pvc 11.50m-65.50m INNER LINING - SCREEN = Pvc 10.50m-0.00m OUTER LINING - GRAVEL = Seal		11.50m-65.50m Basalt	22/09/1983	362m	North
WRK093271	Observation	0.00m-5.00m CLAY 5.00m-15.00m ROCk/WEATHERED	0.00m-13.00m INNER LINING - CASING = Pvc 13.00m-15.00m INNER LINING - SCREEN = Pvc 0.00m-12.00m OUTER LINING - GRAVEL = Cement 12.00m-12.50m OUTER LINING - GRAVEL = Bentonite 12.50m-15.00m OUTER LINING - GRAVEL = Gravel			11/04/2016	371m	South West
WRK977097							371m	East

Bore Id	Use Type	Drillers Log	Construction	Latest Water Levels	Geology	Completed Date	Dist (m)	Dir
WRK093269	Observation	0.00m-7.50m CLAY 7.50m-10.00m ROCK/WEATHERED	0.00m-8.00m INNER LINING - CASING = Pvc 8.00m-10.00m INNER LINING - SCREEN = Pvc 0.00m-6.50m OUTER LINING - GRAVEL = Cement 6.50m-7.50m OUTER LINING - GRAVEL = Bentonite 7.50m-10.00m OUTER LINING - GRAVEL = Gravel			11/04/2016	372m	South
60733	Domestic, Stock	0.00m-1.50m TOP SOIL 1.50m-12.19m GREY BASALT 12.19m-12.80m SALAMANDER 12.80m-37.79m GREY BASALT 37.79m-38.10m BROWN CLAY	0.00m-38.10m INNER LINING - CASING = Pvc 36.00m-38.10m INNER LINING - SCREEN = Pvc		36.00m-38.10m	19/04/1975	386m	West
WRK973365	Domestic & Stock		0.20m-48.00m INNER LINING - CASING = Pvc 0.50m-2.00m OUTER LINING - GRAVEL = Bentonite 2.00m-2.30m OUTER LINING - GRAVEL = Seal 45.00m-45.30m OUTER LINING - GRAVEL = Seal			24/05/2006	419m	North East
47217	Domestic	0.00m-1.00m TOP SOIL 1.00m-2.00m CLAY 2.00m-18.00m SCORIA AND CLAY 18.00m-49.00m BASALT	0.00m-33.00m INNER LINING - CASING = Pvc 33.00m-36.00m INNER LINING - SCREEN = Pvc		33.00m-36.00m Basalt	01/10/1984	437m	East
60718	Not Known					29/02/1960	464m	North West
60715	Not Known					03/08/1954	470m	North West
60719	Not Known					15/02/1960	470m	North West
60716	Not Known					24/12/1957	486m	North West
60756	Stock					01/01/1988	488m	North West
60720	Not Known					31/12/1960	491m	North West
60717	Not Known					09/01/1958	498m	North West
WRK965311	Domestic & Stock	0.00m-3.00m VOLCANIC TOP SOIL & CLAY 3.00m-21.00m BLUESTONE 21.00m-24.00m WEATHERED BASALT 24.00m-62.00m BLUESTONE	0.00m-38.00m INNER LINING - CASING = Pvc 38.00m-62.00m INNER LINING - SLOT = Pvc 0.00m-4.00m OUTER LINING - GRAVEL = Cement 4.00m-5.00m OUTER LINING - GRAVEL = Bentonite 5.00m-5.40m OUTER LINING - GRAVEL = Packer			07/05/2004	518m	West
WRK978913							530m	South East
WRK988509							536m	East
WRK964882	Domestic & Stock	0.00m-1.50m TOP SOIL & CLAY 1.50m-30.00m BLUESTONE 30.00m-36.00m CLAY 36.00m-62.00m HARD BLUESTONE	0.00m-50.00m INNER LINING - CASING = Pvc 50.00m-62.00m INNER LINING - SLOT = Pvc			04/04/2004	557m	West
60728	Domestic, Irrigation, Stock	0.00m-0.91m VOLCANIC RED SOIL 0.91m-2.74m VOLCANIC SOIL AND RUBBLE 2.74m-10.36m WEATHERED BASALT 10.36m-21.94m BLACK BASALT 21.94m-22.55m RED WATER WAX AND BASALT 22.55m-30.17m BLACK BASALT 30.17m-34.44m BROWN BASALT 34.44m-35.66m WEATHERED BASALT 35.66m-39.93m BLUESTONE 39.93m-41.45m WEATHERED BASALT 41.45m-43.59m BLUESTONE 43.59m-45.41m HARD FRACTURED BASALT 45.41m-51.21m BROWN BASALT 51.21m-55.17m GREY BASALT 55.17m-56.99m BLUESTONE 56.99m-58.52m HARD BLACK BASALT 58.52m-74.90m HARD BLUESTONE	0.00m-5.84m INNER LINING - CASING = Not Known			01/03/1972	599m	North West
WRK977941							638m	North East
60741	Domestic	0.00m-0.30m TOP SOIL 0.30m-2.40m CLAY 2.40m-13.00m SALAMANDER (HARD) 13.00m-47.00m GREY BASALT 47.00m-47.30m CLAY BLACK				18/09/1980	789m	West

Bore Id	Use Type	Drillers Log	Construction	Latest Water Levels	Geology	Completed Date	Dist (m)	Dir
60745	Domestic, Stock	0.00m-0.30m SOFT CHOCOLATE SOIL 0.30m-2.00m SOFT RED-GREY MOTTLED CLAY 2.00m-4.80m STIFF BLUE CLAY 4.80m-6.60m HARD BLUE BASALT 6.60m-7.30m SOFT BROWN CLAY 7.30m-10.50m HARD BLUE BASALT 10.50m-12.00m HARD BRIGHT RED CLAY 12.00m-14.00m SOFT BROKEN BROWN BASALT 14.00m-33.00m HARD BLUE BASALT	0.00m-12.00m INNER LINING - CASING = Pvc 12.00m-15.00m INNER LINING - SCREEN = Pvc 15.00m-18.00m INNER LINING - CASING = Pvc 12.00m-0.00m OUTER LINING - GRAVEL = Seal		12.00m-15.00m Basalt	20/09/1983	841m	North
WRK043219	Domestic & Stock, Irrigation		0.00m-51.00m OUTER LINING - GRAVEL = Packer			04/04/2003	859m	North
WRK977427							928m	North
WRK953807	Domestic & Stock						935m	North West
WRK007998	Industrial					21/03/2012	1006 m	North West
WRK981140							1037 m	South
60747	Domestic, Stock	0.00m-1.90m BROWN VOLCANIC EARTH 1.90m-6.00m HARD BLUE BASALT 6.00m-7.00m SOFT RED CLAY 7.00m-14.00m SOFT BROKEN BROWN AND BLUE BASALT 14.00m-35.00m HARD BLUE BASALT 35.00m-38.00m LIGHT GREY PUGGY CLAY AND BLACK BASALT RUBBLE	0.00m-15.00m INNER LINING - CASING = Pvc 15.00m-38.00m INNER LINING - SCREEN = Pvc		15.00m-38.00m Basalt	17/01/1984	1040 m	North
WRK981107							1052 m	South
WRK010919	Irrigation	0.00m-1.30m SOIL top and clay 1.30m-99.00m BASALT 99.00m-100.00m CLAY	0.00m-74.00m INNER LINING - CASING = UPVC class 12 74.00m-100.00m INNER LINING - SLOT = Slotted Pvc 0.00m-6.50m OUTER LINING - GRAVEL = Cement 6.50m-9.00m OUTER LINING - GRAVEL = Bentonite 9.00m-9.40m OUTER LINING - GRAVEL = Seal 9.40m-9.80m OUTER LINING - GRAVEL = Seal		74.00m-100.00m Basalt	01/08/2009	1073 m	North
60723	Irrigation					31/12/1968	1077 m	North
47215	Irrigation	0.00m-1.00m TOP SOIL 1.00m-7.00m CLAY AND BASALT 7.00m-9.00m VOLCANIC ASH 9.00m-12.00m BASALT	0.00m-9.00m INNER LINING - CASING = Pvc 9.00m-11.50m INNER LINING - SCREEN = Pvc 11.50m-12.00m INNER LINING - CASING = Pvc		9.00m-11.50m Basalt	30/06/1984	1151 m	South East
WRK953975	Irrigation						1170 m	North
60750	Domestic	0.00m-3.00m BROWN EARTH & RED STIFF CLAY 3.00m-25.00m MED-HD BL BAS ALTERNATING WITH SCORIA LAYERS 25.00m-40.00m HARD BLUE BASALT 40.00m-52.00m BRITTLE FRACTURED BLUE BASALT 52.00m-53.00m LOOSE WHITE CLAY 53.00m-60.00m FRACTURED BLUE BASALT	0.00m-42.00m INNER LINING - CASING = Pvc 42.00m-58.00m INNER LINING - SCREEN = Pvc 58.00m-60.00m INNER LINING - CASING = Pvc		42.00m-58.00m Basalt	22/02/1988	1199 m	North
60744	Domestic, Stock	0.00m-3.00m MUDSTONE 3.00m-6.00m BROKEN ROCK 6.00m-18.00m BASALT 18.00m-24.00m HONEYCOMB	0.00m-6.00m INNER LINING - CASING = Pvc 6.00m-24.00m INNER LINING - SCREEN = Pvc		6.00m-24.00m Basalt	06/02/1983	1250 m	North West
WRK977005							1278 m	South
WRK041080						01/07/1970	1313 m	North West
60743	Domestic	0.00m-0.30m BLACK EARTH 0.30m-4.50m VERY STIFF GREY CLAY 4.50m-5.00m LOOSE RED AND YELLOW CLAY 5.00m-6.20m SOFT DECAYED BROWN BASALT 6.20m-33.00m BLUE BASALT WITH ISOLATED SOFT LAYERS	0.00m-7.50m INNER LINING - CASING = Pvc 7.50m-33.00m INNER LINING - SCREEN = Pvc		7.50m-33.00m Basalt	30/10/1982	1348 m	South West
WRK955536						01/01/1950	1386 m	North

Bore Id	Use Type	Drillers Log	Construction	Latest Water Levels	Geology	Completed Date	Dist (m)	Dir
WRK975252							1439 m	North
WRK952659	Domestic & Stock						1454 m	North
WRK075276	Observation	0.00m-4.00m CLAY 4.00m-66.00m BASALT	0.00m-48.00m INNER LINING - CASING = Pvc 48.00m-54.00m INNER LINING - SCREEN = Pvc 0.00m-46.00m OUTER LINING - GRAVEL = Cement 46.00m-47.00m OUTER LINING - GRAVEL = Bentonite 47.00m-60.00m OUTER LINING - GRAVEL = Seal			25/08/2013	1500 m	South West
60714	Groundwater Investigation					31/12/1941	1538 m	South West
60749	Stock	0.00m-1.00m TOP SOIL 1.00m-2.00m CLAY 2.00m-21.00m BASALT 21.00m-22.00m CLAY 22.00m-42.50m BASALT 42.50m-43.00m SILTY CLAY	0.00m-25.70m INNER LINING - CASING = Pvc 25.70m-43.00m INNER LINING - SCREEN = Pvc		25.70m-43.00m Basalt	20/08/1983	1544 m	North
WRK987872	Domestic & Stock	0.00m-1.00m top soil 1.00m-3.00m clay brown 3.00m-4.00m grey clay 4.00m-11.00m brown clay 11.00m-37.00m basalt 37.00m-39.00m brown clay 39.00m-43.00m blue bassalt 43.00m-53.00m basalt 53.00m-56.00m basalt red 56.00m-61.00m blue basalt	0.50m-53.00m INNER LINING - CASING = Pvc 0.00m-25.00m OUTER LINING - GRAVEL = Cement			07/08/2009	1553 m	North
47208	Domestic	0.00m-1.00m TOP GREY SOIL 1.00m-17.00m MOTTLE CLAY 17.00m-31.00m SOFT SANDSTONE 31.00m-39.00m HARD SANDSTONEAND QUARTZ	0.00m-20.00m INNER LINING - CASING = Pvc 20.00m-39.00m INNER LINING - SCREEN = Pvc		20.00m-39.00m Sandstone	01/04/1978	1556 m	East
WRK952723	Domestic & Stock	0.00m-3.00m TOP SOIL & CLAY 3.00m-17.00m BLUESTONE 17.00m-34.00m BASALT 34.00m-80.77m HARD BLUESTONE	0.10m-55.00m INNER LINING - CASING = Pvc 55.00m-80.77m INNER LINING - SLOT = Pvc		55.00m-80.77m Basalt	24/03/2004	1588 m	North
47222	Domestic, Stock					01/01/1988	1644 m	East
WRK952934	Domestic & Stock	0.00m-3.00m TOP SOIL & SUB SOIL 3.00m-7.00m CLAY 7.00m-30.00m BLUE STONE 30.00m-33.00m CLAY 33.00m-69.00m BROWN BASHET	0.30m-48.00m INNER LINING - CASING = Pvc 48.00m-69.00m INNER LINING - SLOT = Pvc		48.00m-69.00m Basalt	21/04/2005	1647 m	North
WRK953939	Domestic & Stock	0.00m-3.00m volcanic topsoil & subsoil 3.00m-18.00m brown basalt 18.00m-34.00m bluestone 34.00m-40.00m clay 40.00m-62.00m bluestone	0.30m-47.00m INNER LINING - CASING = Pvc 47.00m-62.00m INNER LINING - SLOT = Pvc		47.00m-62.00m Basalt	04/07/2005	1648 m	North
47221	Domestic, Stock	0.00m-1.00m TOP SOIL & CLAY 1.00m-14.00m CLAY 14.00m-46.00m SLATE & SANDSTONE	-0.30m-39.00m INNER LINING - CASING = Pvc 39.00m-42.00m INNER LINING - SCREEN = Pvc 42.00m-46.00m INNER LINING - CASING = Pvc		39.00m-42.00m Sandstone	13/01/1991	1655 m	North
WRK952614	Domestic & Stock						1681 m	North
WRK976229							1685 m	East
WRK990093							1737 m	South East
SP068239	Observation, State Observation Network	0.00m-3.00m Clay 3.00m-50.00m Basalt 50.00m-54.00m Clay 54.00m-78.00m Basalt 78.00m-85.00m Clay	0.00m-56.43m INNER LINING - CASING = Pvc Class 12 56.43m-59.25m INNER LINING - SCREEN = Pvc Class 12 59.25m-60.34m INNER LINING - CASING = Pvc Class 12 0.00m-10.00m OUTER LINING - GRAVEL = Cement 29.00m-33.00m OUTER LINING - GRAVEL = Bentonite 33.00m-60.00m OUTER LINING - GRAVEL = Gravel 60.00m-65.00m OUTER LINING - GRAVEL = Bentonite	Date/time: 2022-08-17 0743 Quality: 43 WLMP: 18.49m DBNS: 17.54m RWL: 421.06 mAHD	56.43m-59.25m Basalt	07/07/2009	1758 m	North

Bore Id	Use Type	Drillers Log	Construction	Latest Water Levels	Geology	Completed Date	Dist (m)	Dir
SP068240	Observation, State Observation Network	0.00m-3.00m Clay 3.00m-50.00m Basalt 50.00m-54.00m Clay 54.00m-78.00m Basalt 78.00m-85.00m Clay 85.00m-105.00m Deep Leed 105.00m-107.00m Claystone	0.00m-79.00m INNER LINING - CASING = Pvc Class 12 79.00m-96.07m INNER LINING - CASING = Pvc Class 12 96.07m-101.75m INNER LINING - SCREEN = Pvc Class 12 101.75m-107.00m INNER LINING - CASING = Pvc Class 12 0.00m-78.00m OUTER LINING - GRAVEL = Cement 78.00m-80.00m OUTER LINING - GRAVEL = Bentonite	Date/time: 2023-05-19 1024 Quality: 43 WLMP: 59.80m DBNS: 58.87m RWL: 379.90 mAHD	96.07m-101.75m Gravel	12/07/2009	1760 m	North West
WRK989489							1781 m	South East
WRK105491	Domestic & Stock	0.00m-1.00m Top Soil 1.00m-32.00m CLAYSTONE 32.00m-56.00m Yellow 56.00m-92.00m GREY	0.00m-36.00m INNER LINING - CASING = UPVC class 12 36.00m-70.00m INNER LINING - CASING = UPVC class 12 70.00m-90.00m INNER LINING - SLOT = UPVC class 12 90.00m-92.00m INNER LINING - CASING = UPVC class 12 0.10m-6.00m OUTER LINING - GRAVEL = Cement 6.00m-9.50m OUTER LINING - GRAVEL = Bentonite 9.50m-10.00m OUTER LINING - GRAVEL = Seal			01/05/2018	1791 m	East
51512	Stock					01/01/1970	1802 m	North
300848	Non Groundwater					21/11/1887	1837 m	North
WRK040307	Industrial	0.00m-2.50m STIFF GRAY CLAY 2.50m-21.00m FIRM BLUE BASSALT 21.00m-22.00m SOFT RED BASSALT 22.00m-57.00m MEDIUM HARD BLUE BASALT 57.00m-58.00m BLUE CLAY 58.00m-63.00m MEDIUM BLIE BASALT 63.00m-70.00m BLUE CLAY 70.00m-73.00m MEDIUM SAND	3.00m-72.00m INNER LINING - CASING = Pvc 0.00m-3.00m OUTER LINING - GRAVEL = Bentonite 3.00m-3.50m OUTER LINING - GRAVEL = Seal			31/01/2007	1876 m	South West
125960	Groundwater Investigation	0.00m-1.00m LIGHT CLAY, SMALL ROCKS 1.00m-13.00m HEAVY BROWN CLAY SOME ROCK 13.00m-16.00m CLAY - DARK BROWN DAMP - WET	-0.30m-13.50m INNER LINING - CASING = Pvc Class 9 13.50m-16.00m INNER LINING - SCREEN = Pvc Class 9 12.50m-13.50m OUTER LINING - GRAVEL = Bentonite 13.50m-16.00m OUTER LINING - GRAVEL = Gravel			02/05/1995	1890 m	North East
131474	Domestic, Stock	0.00m-2.00m RED CLAY 2.00m-20.00m HARD BLUE BASALT 20.00m-40.00m FRACTURED BLUE BASALT 40.00m-80.00m HARD BLUE BASALT 80.00m-90.00m WHITE PIPE CLAY	-0.30m-2.00m INNER LINING - CASING = Steel 2.00m-90.00m INNER LINING - SCREEN = Steel		2.00m-90.00m Basalt	10/09/1997	1891 m	North West
46628	Domestic & Stock	0.00m-3.60m SOFT BLUE-BROWN VOLCANIC CLAY 3.60m-27.00m FIRM BLUE BASALT 27.00m-37.00m FRACTURED BLUE BASALT 37.00m-50.00m HARD BLUE BASALT 50.00m-61.00m MEDIUM-HARD BLUE BASALT	-0.30m-45.00m INNER LINING - CASING = Pvc 27.00m-55.00m INNER LINING - SCREEN = Pvc		27.00m-55.00m	16/02/1991	1893 m	North West
WRK965435							1915 m	North

Groundwater Boreholes

Ballarat North, Ballarat City, VIC 3350

Boreholes (Earth Resources Database)

Boreholes from the Earth Resources dataset, within the dataset buffer:

Bore Id	Bore Type	Company	Usage	Method	Status	Drill Date	Depth	Elevation	Accuracy (m)	Dist (m)	Dir
306443		Department of Manufacturing & Industry Development				31/12/1890	115.98		300	0m	On-site
306444		Department of Manufacturing & Industry Development				31/12/1890	106.68		300	0m	On-site
306445		Department of Manufacturing & Industry Development				31/12/1890	113.08		300	0m	On-site
306446		Department of Manufacturing & Industry Development				31/12/1890	101.19		300	0m	On-site
306447		Department of Manufacturing & Industry Development				31/12/1890	80.77		300	0m	On-site
306448		Department of Manufacturing & Industry Development				31/12/1890	91.69		300	0m	On-site
306449		Department of Manufacturing & Industry Development				31/12/1890	65.84		300	0m	On-site
60729		Private Individual/Corporation	Domestic & Stock water supply			26/09/1972	39.01		300	0m	On-site
60730		Private Individual/Corporation	Stock/Poultry water supply			26/01/1973	32.92		300	0m	On-site
60736		Private Individual/Corporation	Domestic water supply	Rotary (diamond/drag bit)		27/08/1977	35.36		300	0m	North West
47213		Private Individual/Corporation		Percussion (cable)	Abandoned	29/11/1982	27.00		100	150m	East
306450		Department of Manufacturing & Industry Development				31/12/1890	133.50		300	161m	South West
60723		Private Individual/Corporation				31/12/1968	69.19		300	349m	North West
47217		Private Individual/Corporation	Domestic water supply	Air Percussion/Air Rotary		01/10/1984	49.00		100	436m	East
60728		Private Individual/Corporation	Fire fighting/Sports/general			31/03/1972	71.93		300	502m	North West
60715		Private Individual/Corporation				03/08/1954	18.29	420.00	100	536m	North West
60716		Private Individual/Corporation				24/12/1957	38.10	420.00	100	536m	North West
60717		Private Individual/Corporation				09/01/1958	18.29	420.00	100	536m	North West

Bore Id	Bore Type	Company	Usage	Method	Status	Drill Date	Depth	Elevation	Accuracy (m)	Dist (m)	Dir
60718		Private Individual/Corporation				28/02/1960	30.48	420.00	100	536m	North West
60719		Private Individual/Corporation				15/02/1960	23.47	420.00	100	536m	North West
60720		Department of Education, Victoria				31/12/1960	15.24	420.00	100	536m	North West
60745		Private Individual/Corporation	Domestic & Stock water supply	Air Percussion/Air Rotary		20/09/1983	33.00		100	554m	North West
60741		Private Individual/Corporation	Domestic water supply	Rotary (diamond/drag bit)		18/09/1980	47.30		300	790m	West
60746		Private Individual/Corporation	Irrigation	Air Percussion/Air Rotary		22/09/1983	65.50		100	868m	North
60747		Private Individual/Corporation	Domestic water supply	Air Percussion/Air Rotary		17/01/1984	38.00		100	1118m	North
47215		Private Individual/Corporation	Public/town water supply	Air Percussion/Air Rotary		30/06/1984	12.00		100	1127 m	South East
60744		Private Individual/Corporation	Domestic water supply	Air Percussion/Air Rotary		06/02/1983	24.00		100	1251 m	North West
60743		Private Individual/Corporation	Domestic water supply	Air Percussion/Air Rotary		30/10/1982	33.00		100	1347 m	South West
60714		Department of Manufacturing & Industry Development	Groundwater Investigation			31/12/1941	152.40		300	1539 m	South West
60749		Private Individual/Corporation	Stock/Poultry water supply	Air Percussion/Air Rotary		20/08/1983	43.00		100	1545 m	North
47208		Private Individual/Corporation	Domestic water supply	Air Percussion/Air Rotary		30/04/1978	39.00		300	1554 m	East
300848		Department of Manufacturing & Industry Development		Rotary (diamond/drag bit)		21/11/1887	150.90	450.49	100	1887 m	North

Boreholes (Federation University)

Boreholes from the Federation University Australia dataset, within the dataset buffer:

Bore Id	Authority	Type	Uses	Initial TD	Log	Dist (m)	Dir
143294		Groundwater	Domestic Stock		D: 0.000m-4.000m Clay D: 4.000m-5.500m Blue Basalt D: 5.500m-9.000m Clay D: 9.000m-24.000m Blue Basalt D: 24.000m-32.000m Soft Basalt D: 32.000m-42.000m Hard Basalt	0m	On-site

Bore Id	Authority	Type	Uses	Initial TD	Log	Dist (m)	Dir
306443			Non Groundwater		D: 0.000m-0.900m Surface D: 0.900m-7.800m Honeycomb Rock D: 7.800m-9.000m Soft Rock D: 9.000m-37.300m Blue Rock D: 37.300m-44.500m Grey Rock D: 44.500m-45.700m Dark Clay D: 45.700m-52.400m Grey Clay D: 52.400m-55.800m Dark And Grey Clay D: 55.800m-60.700m Grey Clay D: 60.700m-71.300m Honeycomb Rock D: 71.300m-74.100m Burnt Honeycomb Rock D: 74.100m-81.100m Grey Rock (More Solid) D: 81.100m-82.300m Red Clay D: 82.300m-83.200m White Clay D: 83.200m-83.500m Grey Clay D: 83.500m-89.300m Honeycomb Rock D: 89.300m-93.700m Grey Rock D: 93.700m-97.300m Blue And Honeycomb Rock D: 97.300m-100.100m Clay D: 100.100m-101.900m Hard Blue Basaltic Rock D: 101.900m-111.300m Clay D: 111.300m-114.500m Clay And Loose Gravel D: 114.500m-116.000m Blue Slate	0m	On-site
306444			Non Groundwater		D: 0.000m-3.700m Surface Soil D: 3.700m-5.500m Very Broken Honeycomb Rock D: 5.500m-9.700m Brown Honeycomb And Grey Rock D: 9.700m-15.200m Honeycomb And Grey Rock D: 15.200m-16.900m Grey Basaltic Clay D: 16.900m-20.700m Grey Honeycomb Rock D: 20.700m-22.000m Red And Blue Clay D: 22.000m-29.700m Very Jointy Rock D: 29.700m-32.500m Hard Rock D: 32.500m-39.900m Hard Grey Rock D: 39.900m-48.300m Hard Blue Rock D: 48.300m-49.400m Red Clay D: 49.400m-54.000m Brown And Red Clays D: 54.000m-58.700m Coloured Clay D: 58.700m-60.700m Rock D: 60.700m-63.100m Honeycomb Rock D: 63.100m-75.700m Grey And Honeycomb Rock D: 75.700m-80.900m Soft Rock D: 80.900m-89.600m Grey Rock D: 89.600m-93.300m Blue Rock D: 93.300m-96.800m Gravelly Clay D: 96.800m-100.600m Coloured Clays And Wash D: 100.600m-104.700m Bottom D: 104.700m-106.700m Grey Sandstone	0m	On-site
306445			Non Groundwater		D: 0.000m-2.400m Surface Soil D: 2.400m-5.200m Brown Honeycomb Rock D: 5.200m-8.800m Honeycomb And Grey Rock D: 8.800m-11.400m Very Hard Broken Blue Rock D: 11.400m-16.600m Blue Rock And Honeycomb D: 16.600m-19.400m Blue Rock D: 19.400m-21.800m Honeycomb Rock D: 21.800m-25.800m Red Honeycomb Rock D: 25.800m-27.600m Red Clay D: 27.600m-32.300m Grey Rock D: 32.300m-45.900m Blue Rock D: 45.900m-47.100m Honeycomb Rock D: 47.100m-50.800m Dark Clay D: 50.800m-52.700m White Clay D: 52.700m-55.600m Blue Clay D: 55.600m-56.900m Black Clay D: 56.900m-57.800m White Clay D: 57.800m-60.500m Honeycomb Rock D: 60.500m-68.000m Honeycomb And Grey Rock D: 68.000m-71.300m Blue Rock D: 71.300m-79.300m Honeycomb Rock D: 79.300m-81.100m Rotten Rock D: 81.100m-83.500m Clay D: 83.500m-86.400m Honeycomb Rock D: 86.400m-89.500m Blue Rock D: 89.500m-92.200m Honeycomb Rock D: 92.200m-95.000m Blue Rock And Rotten Rock D: 95.000m-97.600m Very Hard Blue Rock D: 97.600m-106.100m Brown Clay D: 106.100m-106.700m Like Mullocky Reef D: 106.700m-113.100m Pipeclay And Brown Reef	0m	On-site

Bore Id	Authority	Type	Uses	Initial TD	Log	Dist (m)	Dir
306446			Non Groundwater		D: 0.000m-1.200m Surface Soil D: 1.200m-4.900m Broken Honeycomb And Blue Rock D: 4.900m-5.800m Blue Rock D: 5.800m-17.400m Honeycomb And Blue Rock D: 17.400m-23.500m Honeycomb Rock D: 23.500m-27.100m Honeycomb (Very Broken) D: 27.100m-32.300m Very Rotten Rock D: 32.300m-35.400m Red And Brown Clay D: 35.400m-39.300m Grey Rock D: 39.300m-44.500m Grey Rock And Honeycomb D: 44.500m-48.800m Hard Blue Rock D: 48.800m-59.700m Coloured Clays D: 59.700m-63.800m Honeycomb Rock D: 63.800m-67.000m Very Hard, Rough, Honeycomb Rock D: 67.000m-67.600m Hard Rock D: 67.600m-69.700m Honeycomb And Grey Rock D: 69.700m-70.300m Hard Honeycomb Rock D: 70.300m-77.600m Grey Rock And Honeycomb D: 77.600m-82.000m Grey Rock D: 82.000m-84.500m Clay D: 84.500m-94.300m Honeycomb And Grey Rock D: 94.300m-95.600m Dark Clay, Intermixed With Gravel D: 95.600m-96.000m Light Clay D: 96.000m-101.200m Brown Reef-Bottom	0m	On-site
306447			Non Groundwater		D: 0.000m-1.200m Surface Soil D: 1.200m-5.800m Honeycomb Rock Boulders D: 5.800m-8.800m Grey Honeycomb Rock D: 8.800m-11.900m Grey Rock D: 11.900m-49.500m Hard Blue Rock D: 49.500m-60.400m Coloured Clays D: 60.400m-62.800m Light-Green Clay, Intermixed With Quartz D: 62.800m-63.400m Green Clay D: 63.400m-67.200m Honeycomb And Grey Rock D: 67.200m-69.200m Clay D: 69.200m-74.100m Reef D: 74.100m-80.800m Sandstone Reef	0m	On-site
306448			Non Groundwater		D: 0.000m-0.900m Surface Soil D: 0.900m-3.400m Rock Boulders D: 3.400m-6.600m Red Clay D: 6.600m-14.600m Honeycomb And Grey Rock D: 14.600m-20.800m Grey Honeycomb Rock D: 20.800m-29.000m Solid Grey Rock D: 29.000m-53.000m Blue Rock D: 53.000m-64.600m Various Coloured Clays D: 64.600m-66.800m Green Clay, Mixed With Quartz D: 66.800m-77.200m Honeycomb And Grey Rock D: 77.200m-79.500m Dark And Red Clay D: 79.500m-80.000m Dark Clayey Wash D: 80.000m-91.700m Brown Reef	0m	On-site
306449			Non Groundwater		D: 0.000m-1.100m Surface Soil D: 1.100m-2.100m Rock Boulders D: 2.100m-4.900m Clay D: 4.900m-13.000m Grey Honeycomb Rock D: 13.000m-27.500m Blue Rock D: 27.500m-51.200m Very Hard Blue Rock D: 51.200m-57.900m Various Coloured Clays D: 57.900m-65.800m Brown Sandstone-Bottom	0m	On-site
60729		Groundwater	Domestic Stock		D: 0.000m-0.300m Top Soil D: 0.300m-1.800m Red Clay D: 1.800m-2.400m Brown Clay D: 2.400m-4.900m Basalt (Grey) D: 4.900m-5.500m Sandy Yellow Clay D: 5.500m-6.400m Basalt (Grey) D: 6.400m-8.500m Sandy Yellow Clay D: 8.500m-15.500m Basalt (Honeycomb) D: 26.500m-32.900m Basalt (Hard) D: 32.900m-26.500m Basalt (Soft Grey)	0m	On-site
60730		Groundwater	Stock		D: 0.000m-0.200m Topsoil D: 0.200m-5.600m Clay D: 5.600m-18.300m Clay And Rubble D: 18.300m-25.300m Basalt D: 25.300m-26.200m Clay And Rubble D: 26.200m-32.900m Soft Basalt With Clay	0m	On-site
60734		Groundwater	Domestic Stock		D: 0.000m-1.000m Top Red Volcanic Soil D: 1.000m-5.000m Volcanic Clays D: 5.000m-38.000m Basalt D: 38.000m-39.000m Grey Clay	0m	On-site
60736		Groundwater	Domestic		D: 0.000m-0.300m Top Soil D: 0.300m-1.200m Buckshot D: 1.200m-35.300m Grey Basalt	0m	On-site

Bore Id	Authority	Type	Uses	Initial TD	Log	Dist (m)	Dir
60737	Department of Minerals and Energy (1977 - 1985)	Groundwater	Domestic Stock		D: 0.000m-1.000m Top Red Volcanic Soil D: 1.000m-4.000m Volcanic Clay D: 4.000m-39.000m Basalt D: 39.000m-40.000m Volcanic Clay	0m	On-site
60739	Department of Minerals and Energy (1977 - 1985)	Groundwater	Domestic Stock		D: 0.000m-0.300m Top Soil D: 0.300m-3.600m Red Clay D: 3.600m-4.800m Brown Clay D: 4.800m-27.700m Basalt D: 27.700m-32.500m Volcanic Clay D: 32.500m-37.100m Basalt D: 37.100m-39.000m Clay	0m	On-site
60751	Rural Water Commission / Corporation (1984 - 1995)	Groundwater	Stock			0m	On-site
60752	Rural Water Commission / Corporation (1984 - 1995)	Groundwater	Domestic			0m	On-site
60753	Rural Water Commission / Corporation (1984 - 1995)	Groundwater	Domestic Stock			0m	On-site
60754	Rural Water Commission / Corporation (1984 - 1995)	Groundwater	Domestic			0m	On-site
60755		Groundwater	Domestic Stock		D: 0.000m-1.000m Top Soil D: 1.000m-30.000m Clay D: 30.000m-36.000m Basalt D: 36.000m-40.000m Clay D: 40.000m-60.000m Loose Rock	0m	On-site
S9018846/1		Groundwater				0m	On-site
S9021310/1		Groundwater				0m	On-site
S9021962/1		Groundwater				0m	On-site
S9026812/1		Groundwater				0m	On-site
S9026990/1		Groundwater				0m	On-site
S9027619/1		Groundwater				0m	On-site
S9027634/1		Groundwater				0m	On-site
S9030098/1		Groundwater				0m	On-site
S9030433/1		Groundwater				0m	On-site
S9031758/1		Groundwater				0m	On-site
S9037476/1		Groundwater				0m	On-site
S9037476/2		Groundwater				0m	On-site
S9038873/1		Groundwater				0m	On-site
60758		Groundwater	Domestic and Stock Irrigation		D: 0.000m-2.500m Brown Clay & Earth D: 2.500m-7.000m Blue Basalt D: 7.000m-9.500m Puggy Brown Cream Clay D: 9.500m-20.000m Hard Blue Basalt D: 20.000m-30.000m Fractured Blue Basalt	7m	North West
S9032431/1		Groundwater				61m	North West
S9033607/1		Groundwater				62m	North East
47214	Rural Water Commission / Corporation (1984 - 1995)	Groundwater	Domestic		D: 0.000m-4.500m Brown Earth And Stiff Brown Clay D: 4.500m-21.000m Fractured And Brittle Blue Basalt D: 21.000m-30.000m Hard Blue Basalt D: 30.000m-33.000m Sitff Blue Clay D: 33.000m-39.000m Hard Blue Basalt D: 39.000m-45.000m Fractured Blue Basalt D: 45.000m-55.000m Medium-Hard Blue Basalt D: 55.000m-56.000m Very Soft Brittle Black Basalt D: 56.000m-60.000m Sandy Yellow Mudstone	96m	East

Bore Id	Authority	Type	Uses	Initial TD	Log	Dist (m)	Dir
S9023931/1		Groundwater				143m	East
47213		Groundwater	Domestic Stock		D: 0.000m-0.300m Grey Loam And Buckshot D: 0.300m-3.500m Stiff Grey And Orange Clay D: 3.500m-6.900m Loose Granular Cream Clay D: 6.900m-10.500m Yellow And Grey Clay D: 10.500m-13.500m Brown Decayed Basalt D: 13.500m-27.000m Hard Blue Basalt D: 27.000m-0.000m Light Blue Clay	151m	East
S9037891/1		Groundwater				154m	North
306450			Non Groundwater		D: 0.000m-11.500m Surface Soil And Clays D: 11.500m-15.500m Honeycomb Rock D: 15.500m-31.700m Grey Rock D: 31.700m-38.400m Rotten Honeycomb Rock D: 38.400m-47.400m Grey Rock D: 47.400m-62.700m Various Coloured Clays D: 62.700m-65.000m Honeycomb Rock D: 65.000m-67.400m Grey Rock D: 67.400m-70.100m Solid Blue Rock D: 70.100m-71.200m Solid Blue Rock D: 71.200m-77.700m Broken Hard Honeycomb Rock D: 77.700m-81.700m Hard Honeycomb And Solid Rock D: 81.700m-87.800m Coloured Clays D: 87.800m-93.100m Honeycomb Rock D: 93.100m-99.700m Hard Rock And Rotten Honeycomb D: 99.700m-107.400m Coloured Clays D: 107.400m-108.100m Wash D: 108.100m-124.100m Pipeclay D: 124.100m-133.500m Loose Sandstone Reef	160m	South West
111520		Groundwater	Domestic Stock		D: 0.000m-1.000m Top Soil & Clay D: 1.000m-3.000m Clay D: 3.000m-32.000m Basalt D: 32.000m-34.000m Clay D: 34.000m-52.000m Basalt	165m	North East
S9027054/1		Groundwater				171m	South West
S9025168/1		Groundwater	Domestic and Stock Irrigation		D: 18.000m-47.000m Hard Fractured	193m	North East
S9030250/1		Groundwater				237m	North West
S9028422/1		Groundwater				252m	North West
S9028647/1		Groundwater				255m	North West
60746		Groundwater	Irrigation		D: 0.000m-1.500m Rich Red Earth D: 1.500m-4.000m Stiff Brown Clay D: 4.000m-8.000m Brown Clay And Volcanic Rubble D: 8.000m-16.000m Soft Red Honeycomb Rock (Water) D: 16.000m-61.800m Hard Blue Basalt With Isolated Fractures D: 61.800m-62.500m Fractured Brown Basalt (Water) D: 62.500m-65.000m Hard Blue Basalt D: 65.000m-65.500m Soft Black Basalt Rubble	363m	North
S9027900/1		Groundwater				371m	East
60733		Groundwater	Domestic Stock		D: 0.000m-1.500m Top Soil D: 1.500m-12.200m Grey Basalt D: 12.200m-12.800m Salamander D: 12.800m-37.800m Grey Basalt D: 37.800m-38.100m Brown Clay	386m	West
S9025244/1		Groundwater	Domestic and Stock			419m	North East
47217		Groundwater	Domestic		D: 0.000m-1.000m Top Soil D: 1.000m-2.000m Clay D: 2.000m-18.000m Scoria And Clay D: 18.000m-49.000m Basalt	437m	East
60718						464m	North West
60715						470m	North West
60719						470m	North West

Bore Id	Authority	Type	Uses	Initial TD	Log	Dist (m)	Dir
60716						486m	North West
60756	Rural Water Commission / Corporation (1984 - 1995)	Groundwater	Stock			488m	North West
60720	School / Education institution					491m	North West
60717						498m	North West
S9019820/1		Groundwater	Domestic and Stock		D: 0.000m-3.000m Volcanic Top Soil & Clay D: 3.000m-21.000m Bluestone D: 21.000m-24.000m Weathered Basalt D: 24.000m-62.000m Bluestone	518m	West
S9029127/1		Groundwater				530m	South East
S9036152/1		Groundwater				536m	East
S9019506/1		Groundwater	Domestic and Stock		D: 0.000m-1.500m Top Soil & Clay D: 1.500m-30.000m Bluestone D: 30.000m-36.000m Clay D: 36.000m-62.000m Hard Bluestone	557m	West
60728		Groundwater	Domestic Stock Irrigation		D: 0.000m-0.900m Soil Volcanic Red D: 0.900m-2.700m Volcanic Soil & Rubble D: 2.700m-10.400m Weathered Basalt D: 10.400m-21.900m Black Basalt D: 21.900m-22.600m Red Water Wax & Basalt D: 22.600m-30.200m Black Basalt D: 30.200m-34.400m Brown Basalt D: 34.400m-35.700m Weathered Basalt D: 35.700m-39.900m Bluestone D: 39.900m-40.800m Weathered Basalt D: 40.800m-41.500m Weathered Basalt D: 41.500m-43.600m Bluestone D: 43.600m-45.400m Hard Fractured Basalt D: 45.400m-51.200m Brown Basalt D: 51.200m-55.200m Grey Basalt D: 55.200m-57.000m Bluestone D: 57.000m-58.500m Hard Black Basalt D: 58.500m-71.900m Hard Bluestone	599m	North West
S9028356/1		Groundwater				638m	North East
60741		Groundwater	Domestic		D: 0.000m-0.300m Top Soil D: 0.300m-2.400m Clay D: 2.400m-13.000m Salamander (Hard) D: 13.000m-47.000m Grey Basalt D: 47.000m-47.300m Clay Black	789m	West
129156		Groundwater	Industrial			816m	North West
60745		Groundwater	Domestic Stock		D: 0.000m-0.300m Soft Chocolate Soil D: 0.300m-2.000m Soft Red-Grey Mottled Clay D: 2.000m-4.800m Stiff Blue Clay D: 4.800m-6.600m Hard Blue Basalt D: 6.600m-7.300m Soft Brown Clay D: 7.300m-10.500m Hard Blue Basalt D: 10.500m-12.000m Hard Bright Red Clay D: 12.000m-14.000m Soft Broken Brown Basalt D: 14.000m-33.000m Hard Blue Basalt	841m	North
S9028165/1		Groundwater				928m	North
G8013961/01		Groundwater	Domestic and Stock			935m	North West
S9031044/1		Groundwater				1037 m	South
60747		Groundwater	Domestic Stock		D: 0.000m-1.900m Brown Volcanic Earth D: 1.900m-6.000m Hard Blue Basalt D: 6.000m-7.000m Soft Red Clay D: 7.000m-14.000m Soft Broken Brown And Blue Basalt D: 14.000m-35.000m Hard Blue Basalt D: 35.000m-38.000m Light Grey Puggy Clay And Black Basalt Rubble	1040 m	North
S9031021/1		Groundwater				1051 m	South

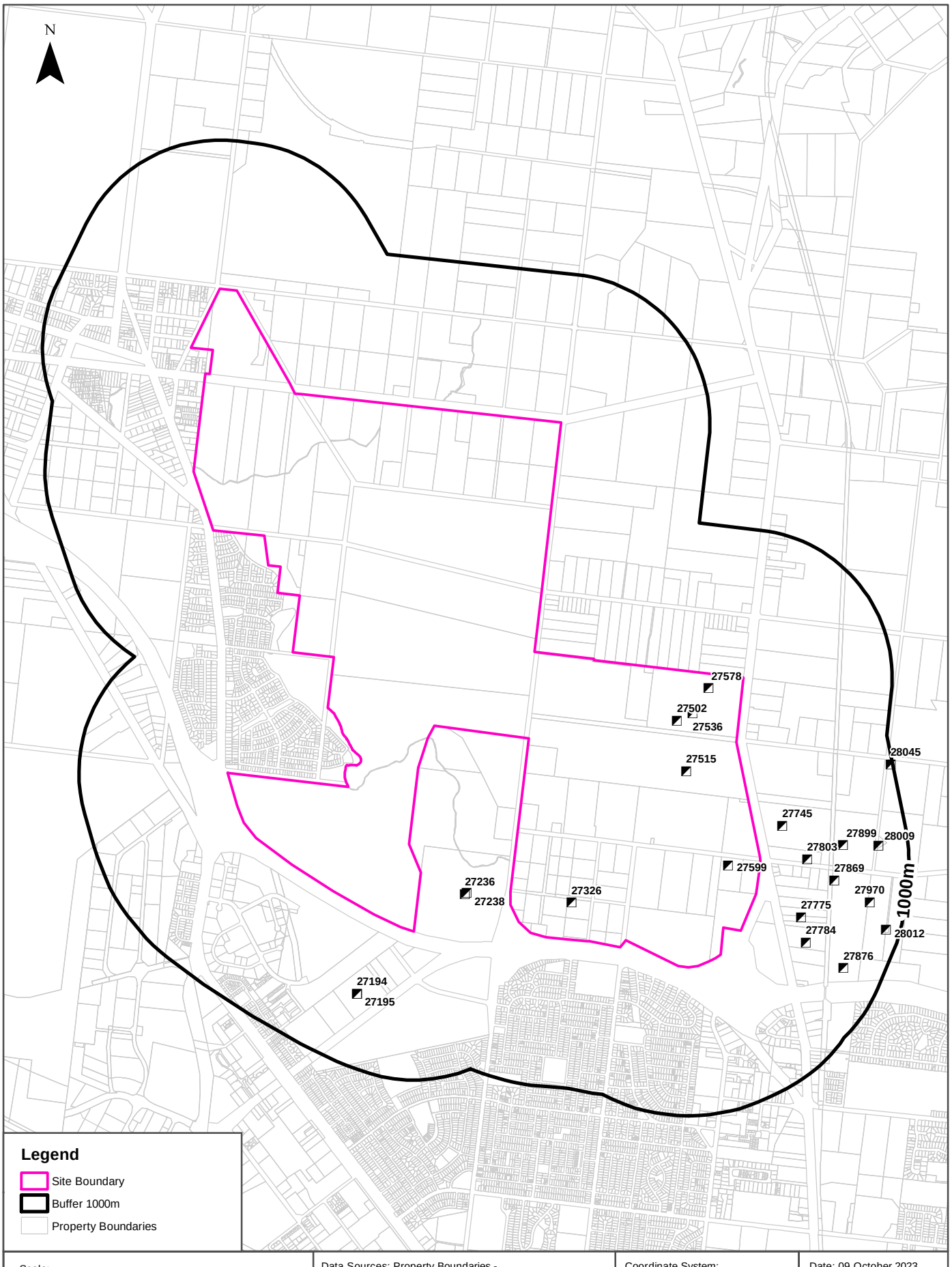
Bore Id	Authority	Type	Uses	Initial TD	Log	Dist (m)	Dir
60723		Groundwater	Irrigation			1077 m	North
47215		Groundwater	Irrigation		D: 0.000m-1.000m Top Soil D: 1.000m-7.000m Clay And Basalt D: 7.000m-9.000m Volcanic Ash D: 9.000m-12.000m Basalt	1151m	South East
G8015748/01		Groundwater	Irrigation			1170m	North
60750	Rural Water Commission / Corporation (1984 - 1995)	Groundwater	Domestic		D: 0.000m-3.000m Brown Earth & Red Stiff Clay D: 3.000m-25.000m Med-Hd Bl Bas Alternating With Scoria Layers D: 25.000m-40.000m Hard Blue Basalt D: 40.000m-52.000m Brittle Fractured Blue Basalt D: 52.000m-53.000m Loose White Clay D: 53.000m-60.000m Fractured Blue Basalt	1199m	North
60744		Groundwater	Domestic Stock		D: 0.000m-3.000m Mudstone D: 3.000m-6.000m Broken Rock D: 6.000m-9.000m Basalt D: 9.000m-18.000m Basalt D: 18.000m-21.000m Honeycomb D: 21.000m-24.000m Honeycomb	1250 m	North West
S9027828/1		Groundwater				1278 m	South
GMS-5100		Groundwater				1313 m	North West
60743		Groundwater	Domestic		D: 0.000m-0.300m Black Earth D: 0.300m-4.500m Very Stiff Grey Clay D: 4.500m-5.000m Loose Red And Yellow Clay D: 5.000m-6.200m Soft Decayed Brown Basalt D: 6.200m-33.000m Blue Basalt With Isolated Soft Layers	1347 m	South West
GMS-192		Groundwater				1386 m	North
S9026573/1		Groundwater				1439 m	North
G8009652/01		Groundwater	Domestic and Stock			1454 m	North
60714	Victorian Mines Department (1909 - 1977)	Groundwater	Groundwater Investigation		D: 0.000m-0.900m Grey Soil D: 0.900m-1.500m D: 1.500m-4.000m D: 4.000m-17.400m D: 17.400m-20.700m Stiff Red Clay D: 20.700m-32.300m Brackish Water At 36Ft, Standing Water At 42Ft	1538 m	South West
60749		Groundwater	Stock		D: 0.000m-1.000m Top Soil D: 1.000m-2.000m Clay D: 2.000m-21.000m Basalt D: 21.000m-22.000m Clay D: 22.000m-42.500m Basalt D: 42.500m-43.000m Silty Clay	1544 m	North
S9035687/1		Groundwater	Domestic and Stock		D: 0.000m-1.000m Top Soil D: 1.000m-3.000m Clay Brown D: 3.000m-4.000m Grey Clay D: 4.000m-11.000m Brown Clay D: 11.000m-37.000m Basalt D: 37.000m-39.000m Brown Clay D: 39.000m-43.000m Blue Bassalt D: 43.000m-53.000m Basalt D: 53.000m-56.000m Basalt Red D: 56.000m-61.000m Blue Basalt	1553 m	North
47208		Groundwater	Domestic		D: 0.000m-1.000m Top Grey Soil D: 1.000m-17.000m Mottle Clay D: 17.000m-31.000m Soft Sandstone D: 31.000m-39.000m Hard Sandstoneand Quartz	1556 m	East
G8009821/01		Groundwater	Domestic and Stock		D: 0.000m-3.000m Top Soil & Clay D: 3.000m-17.000m Bluestone D: 17.000m-34.000m Basalt D: 34.000m-80.800m Hard Bluestone	1588 m	North
47222	Rural Water Commission / Corporation (1984 - 1995)	Groundwater	Domestic Stock			1644 m	East

Bore Id	Authority	Type	Uses	Initial TD	Log	Dist (m)	Dir
G8010391/01		Groundwater	Domestic and Stock		D: 0.000m-3.000m Top Soil & Sub Soil D: 3.000m-7.000m Clay D: 7.000m-30.000m Blue Stone D: 30.000m-33.000m Clay D: 33.000m-69.000m Brown Bashet	1647 m	North
G8015314/01		Groundwater	Domestic and Stock		D: 0.000m-3.000m Volcanic Topsoil & Subsoil D: 3.000m-18.000m Brown Basalt D: 18.000m-34.000m Bluestone D: 34.000m-40.000m Clay D: 40.000m-62.000m Bluestone	1648 m	North
47221		Groundwater	Domestic Stock		D: 0.000m-1.000m Top Soil & Clay D: 1.000m-14.000m Clay D: 14.000m-46.000m Slate & Sandstone	1655 m	North
G8009591/01		Groundwater	Domestic and Stock			1681 m	North
S9027301/1		Groundwater				1685 m	East
S9037283/1		Groundwater				1737 m	South East
SP068240	Department of Sustainability and Environment (2003 -)	Groundwater	State Observation Network Observation		D: 0.000m-3.000m Clay D: 3.000m-50.000m Basalt D: 50.000m-54.000m Clay D: 54.000m-78.000m Basalt D: 78.000m-85.000m Clay D: 85.000m-105.000m Deep Leed D: 105.000m-107.000m Claystone	1761 m	North West
SP068239	Department of Sustainability and Environment (2003 -)	Groundwater	State Observation Network Observation		D: 0.000m-3.000m Clay D: 3.000m-50.000m Basalt D: 50.000m-54.000m Clay D: 54.000m-78.000m Basalt D: 78.000m-85.000m Clay	1762 m	North West
S9036911/1		Groundwater				1781 m	South East
51512		Groundwater	Stock			1802 m	North
300848			Non Groundwater		D: 0.000m-5.500m Surface Clay And Rotten Rock D: 5.500m-9.000m Rotten Rock D: 9.000m-15.700m Rotten And Honeycomb Rock D: 15.700m-18.300m Honeycomb And Hard Broken Rock D: 18.300m-26.300m Hard Broken Blue Rock D: 26.300m-27.000m Very Hard Blue Rock D: 27.000m-34.500m Hard Broken Blue Rock D: 34.500m-35.900m Hard Blue Rock And Basaltic Clay D: 35.900m-36.100m Clay And Honeycomb Rock D: 36.100m-41.800m Honeycomb Rock D: 41.800m-57.600m Honeycomb And Solid Grey Rock D: 57.600m-64.300m Solid Blue Rock D: 64.300m-67.600m Red Honeycomb Rock D: 67.600m-70.200m Honeycomb And Solid Blue Rock D: 70.200m-79.100m Solid Blue Rock D: 79.100m-82.700m Solid Blue And Rotten Basaltic Clay D: 82.700m-86.300m Rotten And Honeycomb Rock D: 86.300m-86.700m Rotten And Solid Blue Rock D: 86.700m-91.400m Honeycomb And Solid Blue Rock D: 91.400m-94.800m Solid Blue And Honeycomb Floating Reef D: 94.800m-96.100m Honeycomb And Solid Blue Rock D: 96.100m-113.700m Solid Blue Rock D: 113.700m-115.900m Hard Black Clay And Sand D: 115.900m-117.900m Black Clay D: 117.900m-119.400m Black Stiff Clay D: 119.400m-124.300m Black And Brown Clay D: 124.300m-135.400m Drift D: 135.400m-142.500m Drift And Boulders D: 142.500m-145.100m Boulders And Wash D: 145.100m-148.800m Wash D: 148.800m-150.900m Black Clay,Washdirt,And Pipeclay Reef	1838 m	North
S9027669/1		Groundwater	Industrial		D: 0.000m-2.500m Stiff Gray Clay D: 2.500m-21.000m Firm Blue Bassalt D: 21.000m-22.000m Soft Red Bassalt D: 22.000m-57.000m Medium Hard Blue Basalt D: 57.000m-58.000m Blue Clay D: 58.000m-63.000m Medium Blie Basalt D: 63.000m-70.000m Blue Clay D: 70.000m-73.000m Medium Sand	1875 m	South West

Bore Id	Authority	Type	Uses	Initial TD	Log	Dist (m)	Dir
125960		Groundwater	Groundwater Investigation		D: 0.000m-1.000m Light Clay D: 1.000m-13.000m Heavy Brown Clay Some Rock D: 13.000m-16.000m Clay - Dark Brown Damp - Wet	1890 m	North East
131474		Groundwater	Domestic Stock		D: 0.000m-2.000m Red Clay D: 2.000m-20.000m Hard Blue Basalt D: 20.000m-40.000m Fractured Blue Basalt D: 40.000m-80.000m Hard Blue Basalt D: 80.000m-90.000m White Pipe Clay	1891 m	North West
46628		Groundwater	Domestic and Stock		D: 0.000m-3.600m Soft Blue-Brown Volcanic Clay D: 3.600m-27.000m Firm Blue Basalt D: 27.000m-37.000m Fractured Blue Basalt D: 37.000m-50.000m Hard Blue Basalt D: 50.000m-61.000m Medium-Hard Blue Basalt	1893 m	North West
S9019870/1		Groundwater				1915 m	North

Historical Mining Activity - Shafts

Ballarat North, Ballarat City, VIC 3350



Historical Mining Activity - Shafts

Ballarat North, Ballarat City, VIC 3350

Historical Mining Activity - Shafts

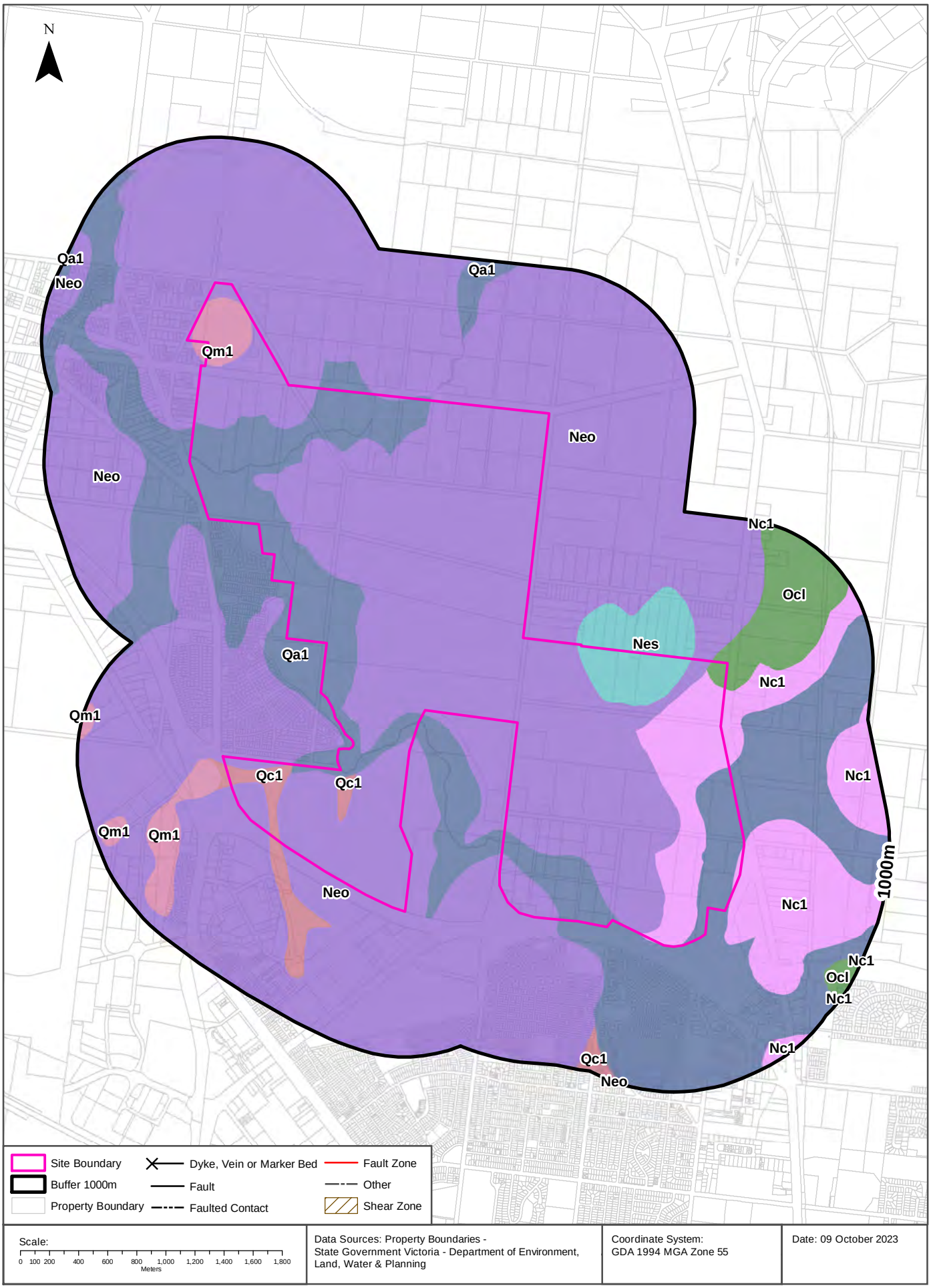
Mine Shaft Locations were collected by a variety of methods from 1869 in some areas of the state, mainly concentrating in Ballarat and Bendigo. In places a shaft may be recorded multiple times with a different source. In cases where several shaft locations are shown close together (generally with separations less than stated position errors) and they have different sources, it is possible that one shaft has been mapped several times. In cases where several shaft locations are shown close together but they have the same information source, it is possible that each shaft location represents a different shaft on the ground.

Historical Mine Shafts within the dataset buffer:

Map Id	Name	Source	Depth (m)	Collar (ft)	Fill/Cap Method	Location Desc	Location Accuracy	Distance	Direction
27326	United Suburban Co.	Digitized for Ginger					30	0m	On-site
27502	MOUNT ROWAN CO.	Digitized for Ginger					30	0m	On-site
27515	Quick and Co.	Digitized for Ginger					30	0m	On-site
27536	MOUNT ROWAN CO.	Digitized for Ginger					30	0m	On-site
27578	Mount Rowan Co.	Digitized for Ginger					30	0m	On-site
27599	NORTHERN JUNCTION CO.	Digitized for Ginger					30	0m	On-site
27745	ROSE HILL G.M.CO.	Digitized for Ginger					30	188m	South East
27238	GREAT NORTH WEST CO.	Digitized for Ginger					30	295m	South
27236	WESTERN SUBURBAN CO.	Digitized for Ginger					30	307m	South
27803	North Star Freehold G.M. Co.	Digitized for Ginger					30	316m	South East
27775	ROYAL MINT CO.	Digitized for Ginger					30	340m	South East
27784	ROYAL MINT CO.	Digitized for Ginger					30	436m	South East
27869	Hero Co.	Digitized for Ginger					30	509m	South East
27194	North City Co.	Digitized for Ginger					30	531m	South
27195	GREAT NORTH WEST CO.	Digitized for Ginger					30	531m	South
27899	New Rose Hill Co.	Digitized for Ginger					30	565m	South East
27876	Conqueror Co.	Digitized for Ginger					30	735m	South East
27970	BALLARAT EXTENSION G.M.CO.	Digitized for Ginger					30	765m	South East
28009	ROSE HILL G.M.CO.	Digitized for Ginger					30	801m	South East
28012	James Baines Co.	Digitized for Ginger					30	906m	South East
28045	NIL DESPERANDUM CO.	Digitized for Ginger					30	987m	East

Geology

Ballarat North, Ballarat City, VIC 3350



Geology

Ballarat North, Ballarat City, VIC 3350

Geological Units 1:50,000

What are the Geological Units within the dataset buffer?

Symbol	Name	Description	Geological Age	Lithology	Distance	Direction
Neo	Newer Volcanic Group - basalt flows (Neo): generic	Olivine tholeiite, quartz tholeiite, basanite, basaltic icelandite, hawaiite, mugearite, minor scoria and ash, fluvial sediments: tholeiitic to alkaline; includes sheet flows and valley flows and intercalated gravel, sand, clay	Miocene to Holocene	alkali basalt (major proportion); tholeiitic basalt (major proportion); alluvium (minor proportion); tuff (minor proportion)	0m	On-site
Qa1	alluvium(Qa1): generic	Gravel, sand, silt: variably sorted and rounded; generally unconsolidated; includes deposits of low terraces; alluvial floodplain deposits	Pleistocene to Holocene	gravel material (significant); sand (significant); silt material (significant)	0m	On-site
Nes	Newer Volcanic Group - scoria deposits(Nes): generic	Hawaiite, basanite, nephelinite, mugearite, trachybasalt, trachyandesite; scoria, ash, lapilli, agglutinated lava spatter, volcanic bombs, minor lava flows and calcareous lithic fragments: massive to moderately bedded, poorly consolidated	Miocene to Holocene	lava flow rock type (minor proportion); pyroclastic sediment (all)	0m	On-site
Qm1	swamp and lake deposits (Qm1): generic	Grey to black carbonaceous mud, silt, clay, minor peat: generally unconsolidated; rare dolomite	Pleistocene to Holocene	mud (major proportion); silt material (significant); clay lithology (significant); peat (minor proportion)	0m	On-site
Qc1	colluvium(Qc1): generic	Diamictite, gravel, sand, silt, clay, rubble: sorting variable, usually poor; generally poorly rounded; clasts locally sourced; includes channel deposits with better rounding and sorting	Pliocene to Holocene	diamictite (dominant); gravel material (significant); sand (significant); silt material (significant)	0m	On-site
Ocl	Castlemaine Group - Lancefieldian(Ocl): generic	Sandstone, mudstone, black shale and minor granule quartz conglomerate: mostly thick-bedded sandstone, coarse- to fine-grained, often graded, diffusely stratified to cross laminated, moderately to well sorted; sparsely fossiliferous with graptolites and	Lancefieldian to Lancefieldian	sandstone (significant); mudstone (significant); shale (significant); conglomerate (minor proportion)	0m	On-site
Nc1	incised colluvium (Nc1): generic	Silt, sand, gravel: generally poorly sorted and poorly rounded except within channels cut into colluvial material; dissected to variable degrees	Pliocene to Holocene	silt material (significant); sand (significant); gravel material (significant)	0m	On-site

Geology

Ballarat North, Ballarat City, VIC 3350

Geological Structures 1:50,000

What are the Geological Faults or Faulted Contacts within the dataset buffer?

Map Id	Type	Name	Contact	Positional Accuracy	Distance	Direction
N/A	No records in buffer					

What are the Dykes, Marker Beds and Veins within the dataset buffer?

Map Id	Type	Name	Description	Positional Accuracy	Distance	Direction
N/A	No records in buffer					

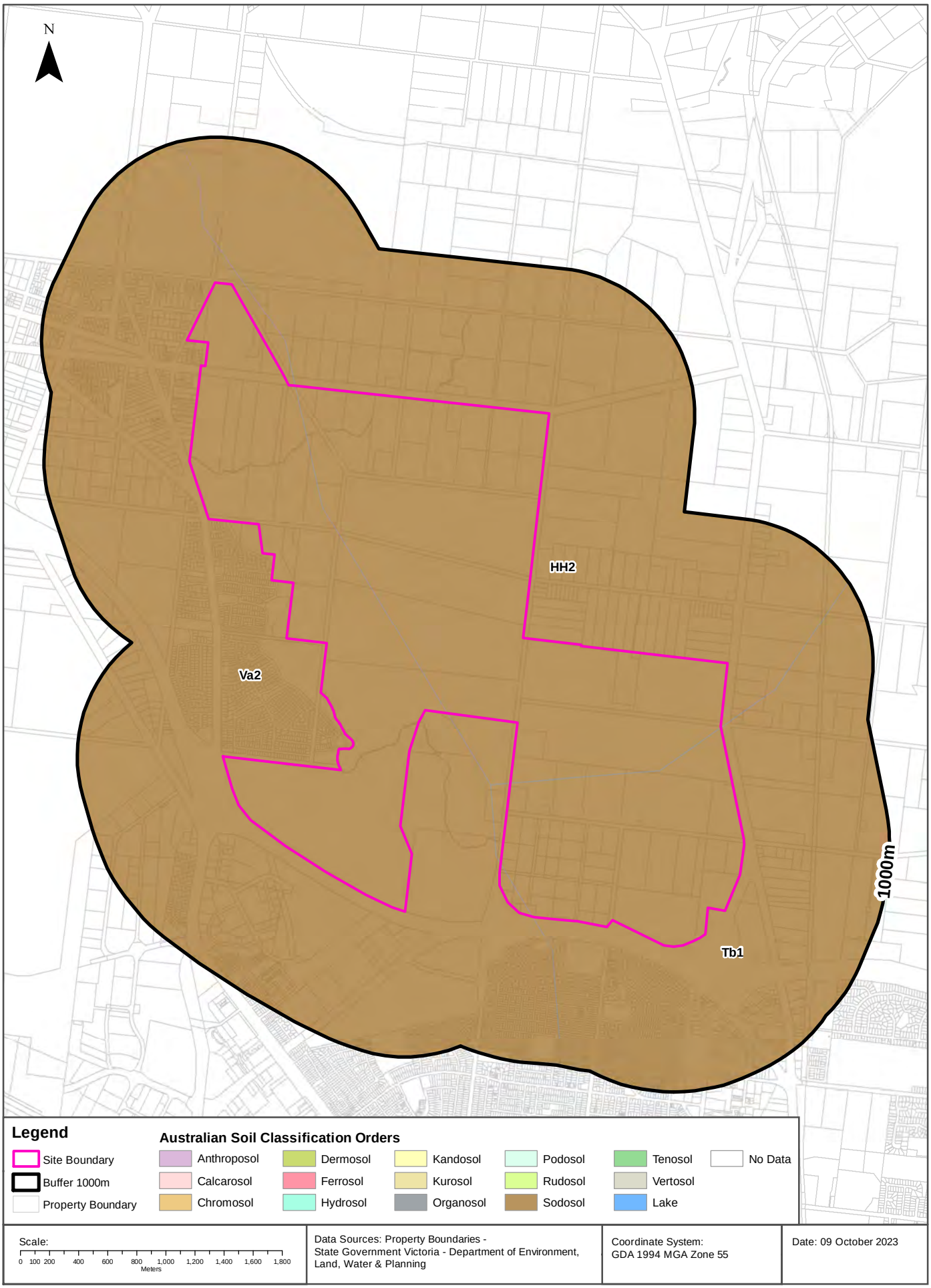
Geological Structures 1:250,000

What are the Shear Zones within the dataset buffer?

Map Id	Type	Name	Description	Positional Accuracy	Distance	Direction
N/A	No records in buffer					

Atlas of Australian Soils

Ballarat North, Ballarat City, VIC 3350



Soils

Ballarat North, Ballarat City, VIC 3350

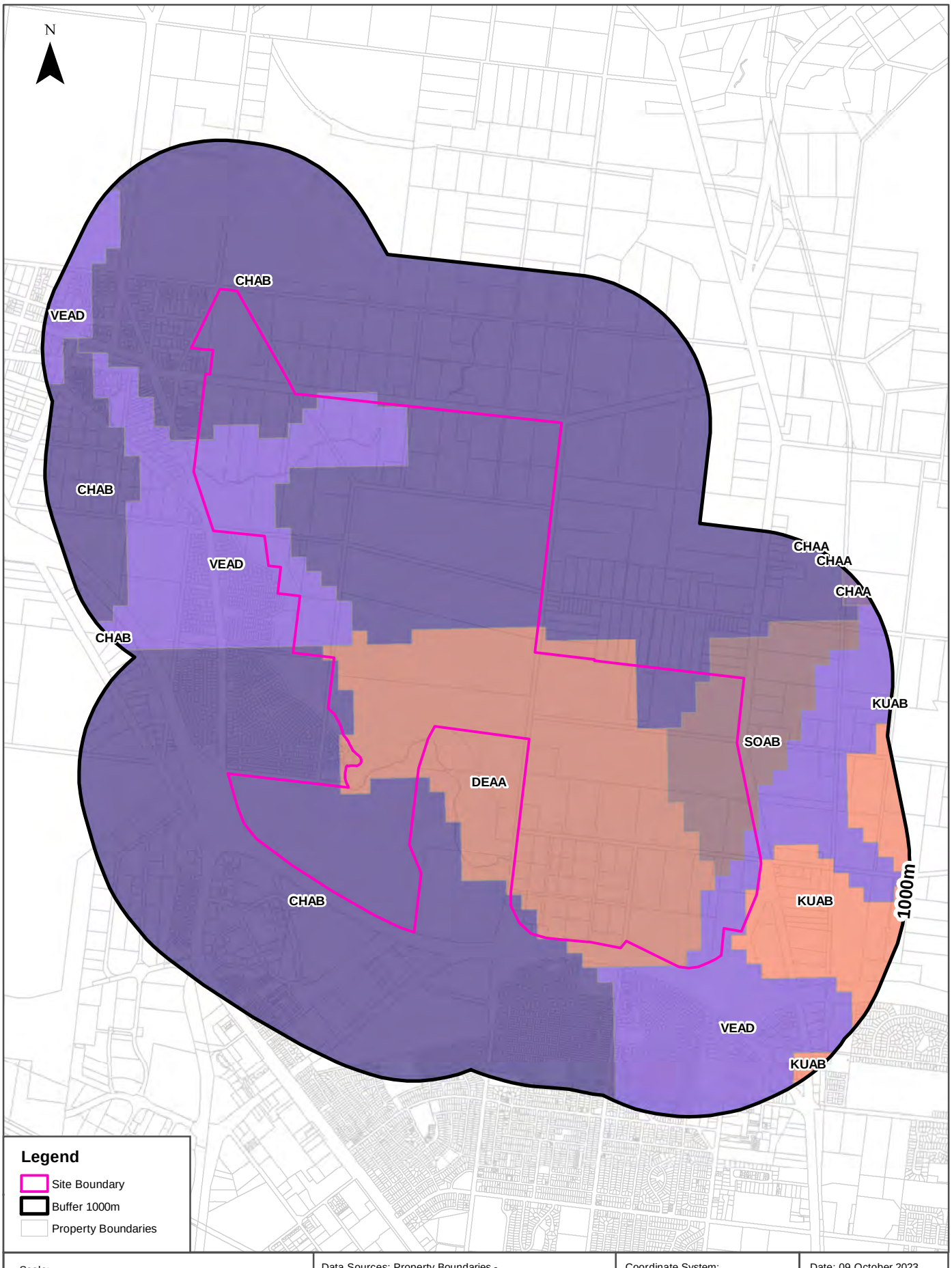
Atlas of Australian Soils

Soil mapping units and Australian Soil Classification orders within the dataset buffer:

Map Unit Code	Soil Order	Map Unit Description	Distance	Direction
HH2	Sodosol	Undulating plain with volcanic cones: plains of hard alkaline dark mottled soils (Dd2.33) in association with (Dd2.43) and (Db1.43) and smaller areas of related soils such as (Dr2.12) and (Dy3.43); small areas of cracking grey clays (Ug5.2) in lower-lying situations; ribbon development of cracking dark clays (Ug5.15) along some stream valleys; and with friable red soils (Dr4.1) and friable earths (Gn3.11) on and around volcanic cones. Ironstone gravels occur in surface horizons of some D soils.	0m	On-site
Va2	Sodosol	Plains with occasional stony rises: gilgai plains of hard alkaline and neutral yellow mottled soils (Dy3_43 and Dy3.42) in association with small areas of cracking grey clays (Ug5.2) which may be dominant locally; stony rises with shallow friable loamy soils (Um6.12, Um6.13, Um6.21, Um6.24, and Um6.41); dark cracking clays (Ug5. 16) on terraces and some floodplains along stream valleys; minor areas of (Dy3.41), (Dy3.11), (Dy5.42), and (Ug5.1) occur on the plains as well. Ironstone gravs are a common feature of surface horizons of (D) soils. Some volcanic cones occur in the Va2 area in Sheet 2 but their associated soils are not described.	0m	On-site
Tb1	Sodosol	Hills and valley plains: hills and hill slopes of hard acidic yellow mottled soils (Dy3.41 and Dy3.42) in association with hard neutral red soils (Dr2.22 and Dr2.32), shallow grey-brown sandy soils (Uc6.11), and rock outcrops; smaller localized areas of (Dy3.61), (Dy3.81), (Dy3.21), (Dy4.21), (Dr2.11), (Dr2.41), also (Gn2.74) on hills and slopes; valley plains of hard neutral or alkaline yellow mottled soils (Dy3.42 and Dy3.43) with red mottled soils (Dr3.33) and others not described but including cracking clays (Ug5.1) and (Um) soils. Soils of low-lying wet situations generally not studied but (Uf6.41) has been recorded therein. Note in the smaller areas of this unit only the dominant soils of the unit may occur therein.	0m	On-site

Victorian Soil Type Mapping

Ballarat North, Ballarat City, VIC 3350



Soils

Ballarat North, Ballarat City, VIC 3350

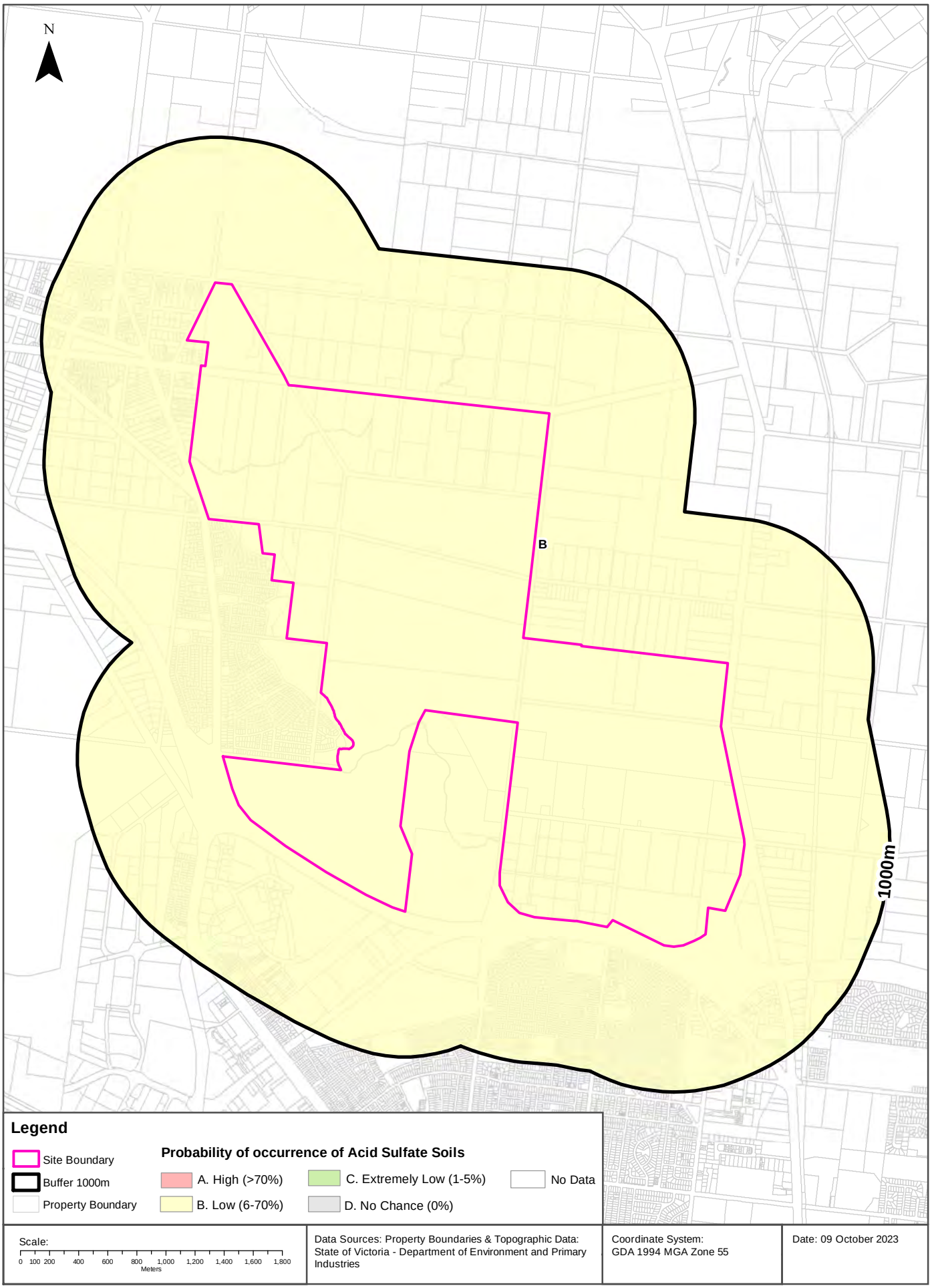
Victorian Soil Type Mapping

Victorian Soil Types within the dataset buffer:

Symbol	Description	Distance	Direction
DEAA	Red Dermosols	0m	On-site
CHAB	Brown Chromosols	0m	On-site
SOAB	Brown Sodosols	0m	On-site
VEAD	Grey Vertosols	0m	On-site
KUAB	Brown Kurosols	0m	On-site
CHAA	Red Chromosols	824m	East

Atlas of Australian Acid Sulfate Soils

Ballarat North, Ballarat City, VIC 3350



Acid Sulfate Soils

Ballarat North, Ballarat City, VIC 3350

Atlas of Australian Acid Sulfate Soils

Atlas of Australian Acid Sulfate Soil categories within the dataset buffer:

Class	Description	Distance	Direction
B	Low Probability of occurrence. 6-70% chance of occurrence.	0m	On-site

Acid Sulfate Soils

Ballarat North, Ballarat City, VIC 3350

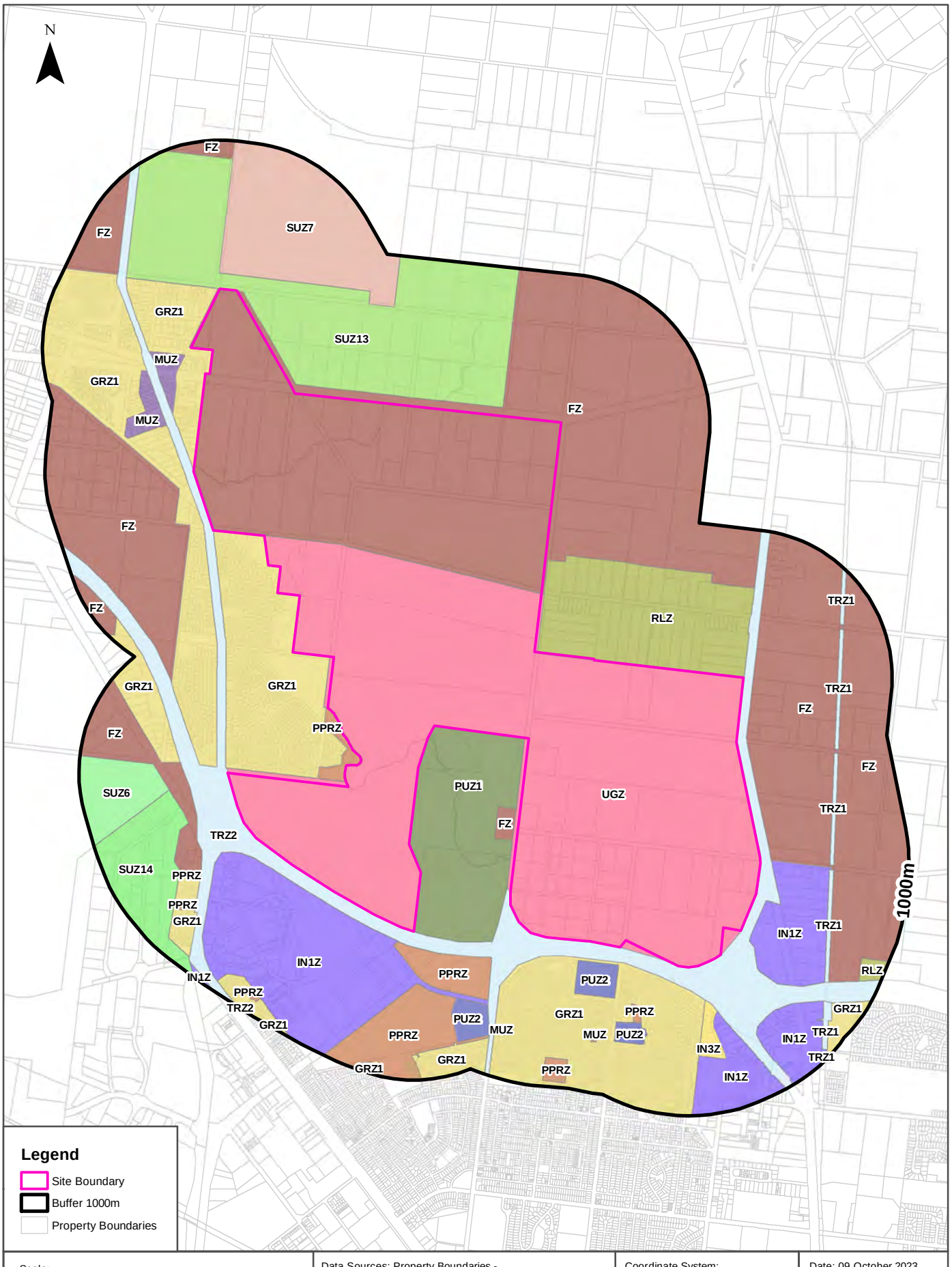
Coastal Acid Sulfate Soils

Coastal Acid Sulfate Soil types within the dataset buffer:

Coastal Acid Sulfate Soil Types	Distance	Direction
No records in buffer		

Planning Zones

Ballarat North, Ballarat City, VIC 3350



Scale: 0 100 200 400 600 800 1,000 1,200 1,400 1,600 1,800 Meters

Data Sources: Property Boundaries - State Government Victoria - Department of Environment, Land, Water & Planning

Coordinate System: GDA 1994 MGA Zone 55

Date: 09 October 2023

Planning

Ballarat North, Ballarat City, VIC 3350

Planning Zones

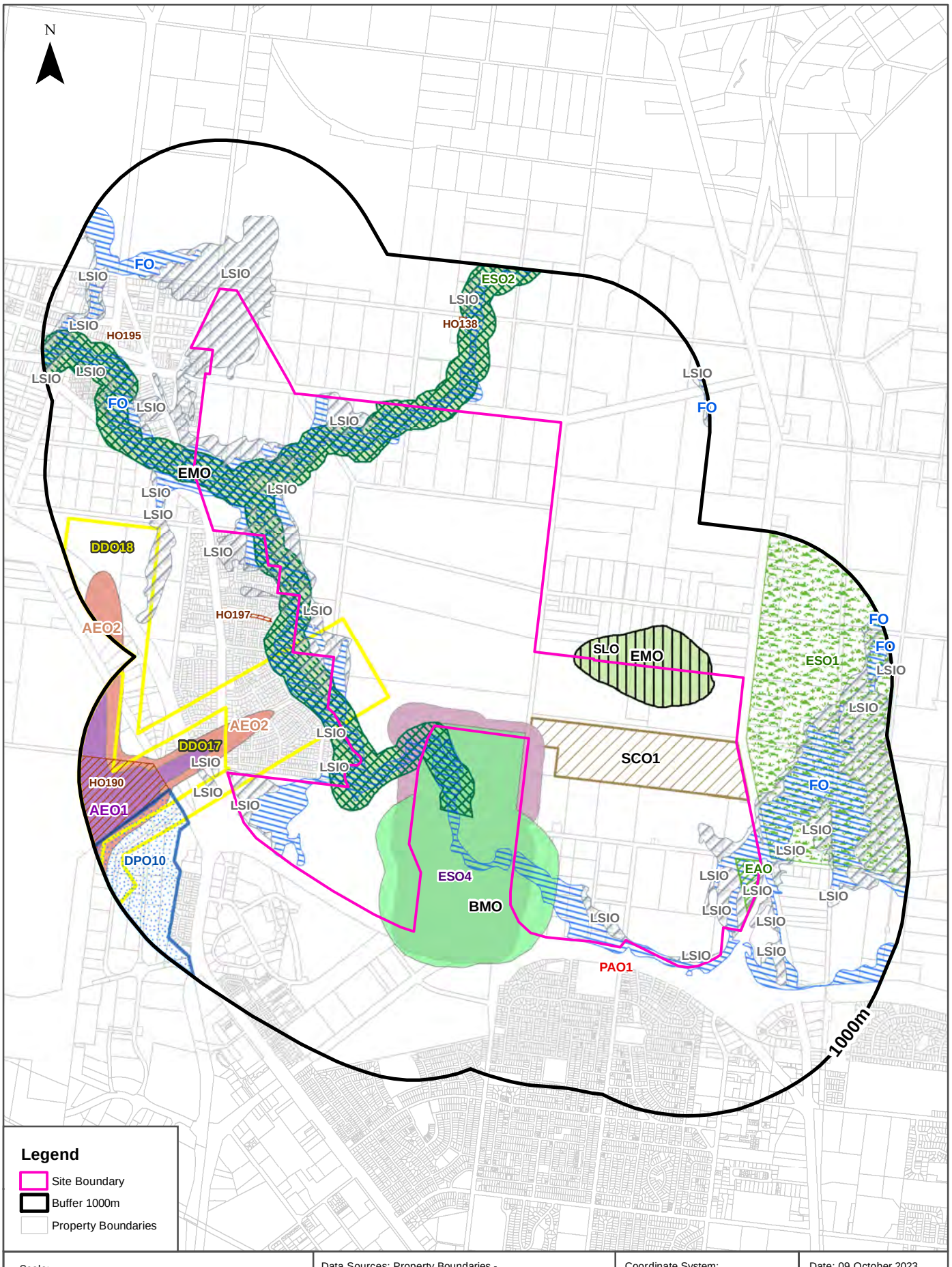
Planning zones within the dataset buffer:

Zone Code	Description	Distance	Direction
UGZ	URBAN GROWTH ZONE	0m	On-site
FZ	FARMING ZONE	0m	On-site
PPRZ	PUBLIC PARK AND RECREATION ZONE	0m	On-site
RLZ	RURAL LIVING ZONE	0m	East
TRZ2	TRANSPORT ZONE 2 - PRINCIPAL ROAD NETWORK	0m	South
GRZ1	GENERAL RESIDENTIAL ZONE - SCHEDULE 1	0m	West
PUZ1	PUBLIC USE ZONE - SERVICE AND UTILITY	0m	South
GRZ1	GENERAL RESIDENTIAL ZONE - SCHEDULE 1	0m	North West
SUZ13	SPECIAL USE ZONE - SCHEDULE 13	0m	North
GRZ1	GENERAL RESIDENTIAL ZONE - SCHEDULE 1	50m	North West
FZ	FARMING ZONE	58m	East
IN1Z	INDUSTRIAL 1 ZONE	69m	South East
MUZ	MIXED USE ZONE	69m	North West
IN1Z	INDUSTRIAL 1 ZONE	91m	South West
PPRZ	PUBLIC PARK AND RECREATION ZONE	95m	South
GRZ1	GENERAL RESIDENTIAL ZONE - SCHEDULE 1	103m	South
SUZ7	SPECIAL USE ZONE - SCHEDULE 7	105m	North
PUZ2	PUBLIC USE ZONE - EDUCATION	123m	South
FZ	FARMING ZONE	127m	North West
MUZ	MIXED USE ZONE	219m	North West
IN3Z	INDUSTRIAL 3 ZONE	233m	South East
FZ	FARMING ZONE	273m	West
GRZ1	GENERAL RESIDENTIAL ZONE - SCHEDULE 1	325m	West
IN1Z	INDUSTRIAL 1 ZONE	327m	South East
SUZ14	SPECIAL USE ZONE - SCHEDULE 14	347m	South West
PPRZ	PUBLIC PARK AND RECREATION ZONE	354m	South
PPRZ	PUBLIC PARK AND RECREATION ZONE	366m	South East
SUZ6	SPECIAL USE ZONE - SCHEDULE 6	411m	West
GRZ1	GENERAL RESIDENTIAL ZONE - SCHEDULE 1	446m	South West
PUZ2	PUBLIC USE ZONE - EDUCATION	454m	South East
TRZ1	TRANSPORT ZONE 1 - STATE TRANSPORT INFRASTRUCTURE	463m	South East
TRZ1	TRANSPORT ZONE 1 - STATE TRANSPORT INFRASTRUCTURE	463m	East

Zone Code	Description	Distance	Direction
FZ	FARMING ZONE	475m	East
PPRZ	PUBLIC PARK AND RECREATION ZONE	501m	South West
IN1Z	INDUSTRIAL 1 ZONE	513m	South East
PUZ2	PUBLIC USE ZONE - EDUCATION	528m	South
PPRZ	PUBLIC PARK AND RECREATION ZONE	583m	South
MUZ	MIXED USE ZONE	595m	South
TRZ1	TRANSPORT ZONE 1 - STATE TRANSPORT INFRASTRUCTURE	629m	East
PPRZ	PUBLIC PARK AND RECREATION ZONE	641m	South
MUZ	MIXED USE ZONE	661m	South
PPRZ	PUBLIC PARK AND RECREATION ZONE	663m	South West
TRZ1	TRANSPORT ZONE 1 - STATE TRANSPORT INFRASTRUCTURE	729m	South East
TRZ1	TRANSPORT ZONE 1 - STATE TRANSPORT INFRASTRUCTURE	739m	East
GRZ1	GENERAL RESIDENTIAL ZONE - SCHEDULE 1	758m	South
GRZ1	GENERAL RESIDENTIAL ZONE - SCHEDULE 1	781m	South East
PPRZ	PUBLIC PARK AND RECREATION ZONE	804m	South
RLZ	RURAL LIVING ZONE	817m	South East
PPRZ	PUBLIC PARK AND RECREATION ZONE	845m	South West
IN1Z	INDUSTRIAL 1 ZONE	936m	South West
TRZ1	TRANSPORT ZONE 1 - STATE TRANSPORT INFRASTRUCTURE	938m	South East

Planning Overlays

Ballarat North, Ballarat City, VIC 3350



Planning

Ballarat North, Ballarat City, VIC 3350

Planning Overlays

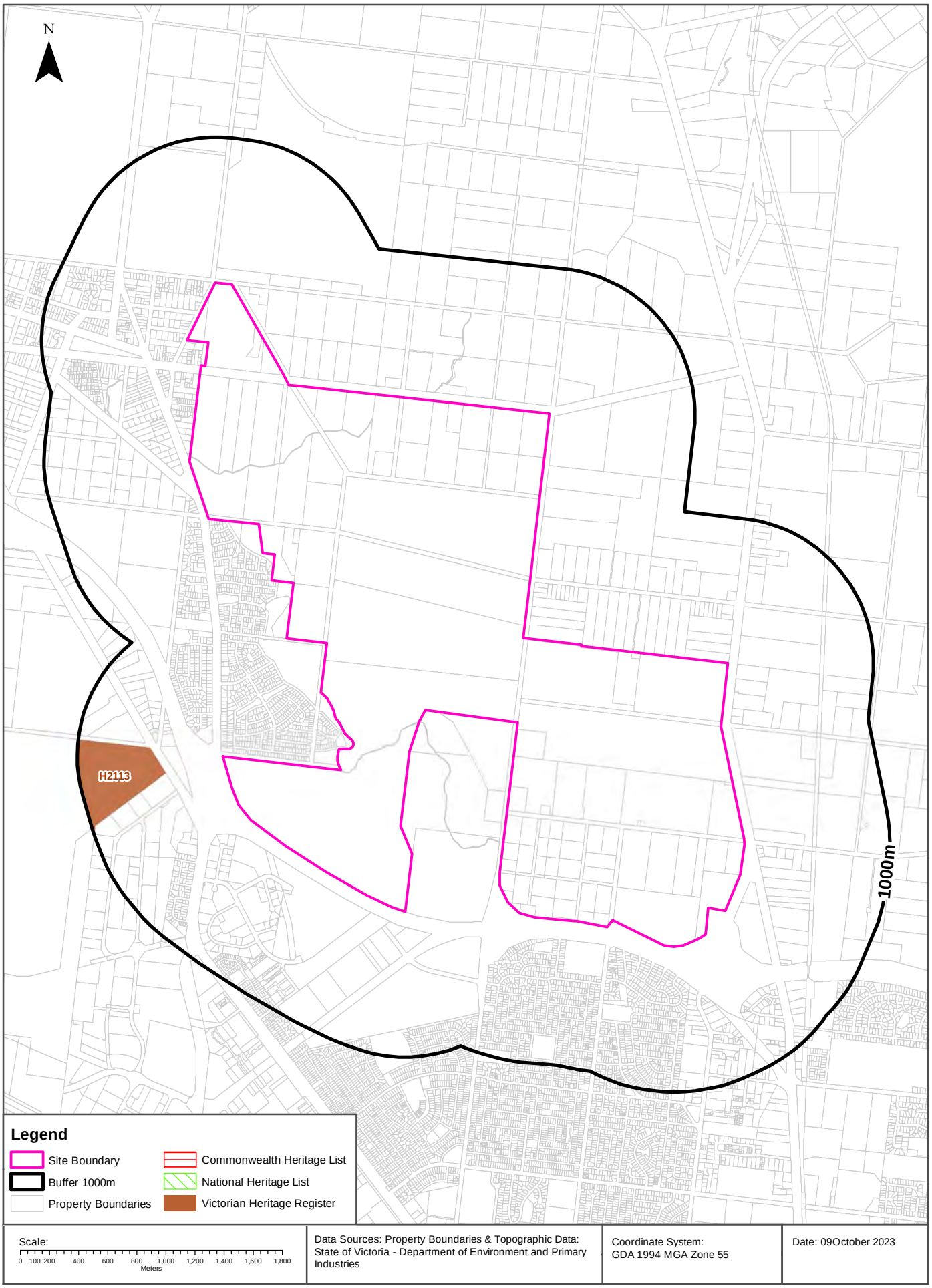
Planning overlays within the dataset buffer:

Zone Code	Description	Distance	Direction
ESO2	ENVIRONMENTAL SIGNIFICANCE OVERLAY - SCHEDULE 2	0m	On-site
FO	FLOODWAY OVERLAY	0m	On-site
SCO1	SPECIFIC CONTROLS OVERLAY - PS MAP REF SCO1	0m	On-site
BMO	BUSHFIRE MANAGEMENT OVERLAY	0m	On-site
ESO4	ENVIRONMENTAL SIGNIFICANCE OVERLAY - SCHEDULE 4	0m	On-site
DDO18	DESIGN AND DEVELOPMENT OVERLAY - SCHEDULE 18	0m	On-site
SLO	SIGNIFICANT LANDSCAPE OVERLAY	0m	On-site
EMO	EROSION MANAGEMENT OVERLAY	0m	On-site
EAO	ENVIRONMENTAL AUDIT OVERLAY	0m	On-site
LSIO	LAND SUBJECT TO INUNDATION OVERLAY	0m	On-site
LSIO	LAND SUBJECT TO INUNDATION OVERLAY	19m	South West
LSIO	LAND SUBJECT TO INUNDATION OVERLAY	20m	South West
DDO17	DESIGN AND DEVELOPMENT OVERLAY - SCHEDULE 17	22m	West
LSIO	LAND SUBJECT TO INUNDATION OVERLAY	33m	South East
ESO1	ENVIRONMENTAL SIGNIFICANCE OVERLAY - SCHEDULE 1	58m	East
LSIO	LAND SUBJECT TO INUNDATION OVERLAY	60m	West
LSIO	LAND SUBJECT TO INUNDATION OVERLAY	66m	South East
LSIO	LAND SUBJECT TO INUNDATION OVERLAY	95m	South West
AEO2	AIRPORT ENVIRONS OVERLAY (AEO2)	110m	West
PAO1	PUBLIC ACQUISITION OVERLAY - PS MAP REF PAO1	123m	South East
HO197	HERITAGE OVERLAY (HO197)	169m	West
AEO1	AIRPORT ENVIRONS OVERLAY (AEO1)	181m	West
LSIO	LAND SUBJECT TO INUNDATION OVERLAY	192m	South East
LSIO	LAND SUBJECT TO INUNDATION OVERLAY	237m	West
LSIO	LAND SUBJECT TO INUNDATION OVERLAY	238m	North West
FO	FLOODWAY OVERLAY	250m	North West
LSIO	LAND SUBJECT TO INUNDATION OVERLAY	252m	North West
LSIO	LAND SUBJECT TO INUNDATION OVERLAY	265m	South East
DPO10	DEVELOPMENT PLAN OVERLAY - SCHEDULE 10	347m	South West
HO190	HERITAGE OVERLAY (HO190)	411m	West
HO195	HERITAGE OVERLAY (HO195)	456m	North West

Zone Code	Description	Distance	Direction
LSIO	LAND SUBJECT TO INUNDATION OVERLAY	478m	South East
HO138	HERITAGE OVERLAY (HO138)	558m	North
LSIO	LAND SUBJECT TO INUNDATION OVERLAY	559m	North West
LSIO	LAND SUBJECT TO INUNDATION OVERLAY	623m	North West
LSIO	LAND SUBJECT TO INUNDATION OVERLAY	671m	North
LSIO	LAND SUBJECT TO INUNDATION OVERLAY	707m	North West
LSIO	LAND SUBJECT TO INUNDATION OVERLAY	808m	North West
FO	FLOODWAY OVERLAY	824m	East
FO	FLOODWAY OVERLAY	900m	East
LSIO	LAND SUBJECT TO INUNDATION OVERLAY	927m	North East

Heritage

Ballarat North, Ballarat City, VIC 3350



Heritage

Ballarat North, Ballarat City, VIC 3350

Commonwealth Heritage List

What are the Commonwealth Heritage List Items located within the dataset buffer?

Place Id	Name	Address	Place File No	Class	Status	Register Date	Distance	Direction
N/A	No records in buffer							

National Heritage List

What are the National Heritage List Items located within the dataset buffer?
Note. Please click on Place Id to activate a hyperlink to online website.

Place Id	Name	Address	Place File No	Class	Status	Register Date	Distance	Direction
N/A	No records in buffer							

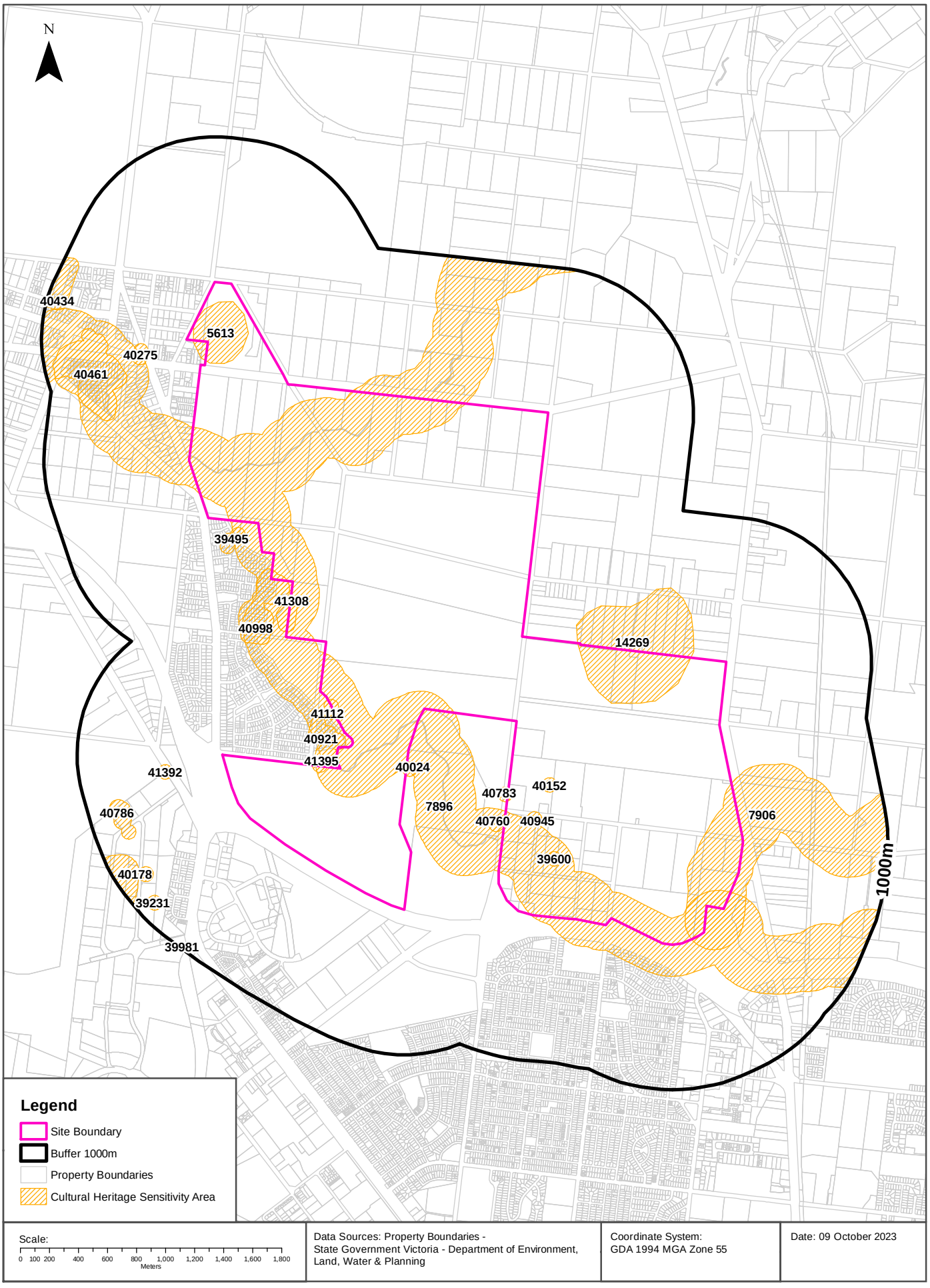
Victorian Heritage Register

What are the Victorian Heritage Register items located within the dataset buffer?:

VHR Number	Description	Distance	Direction
H2113	FORMER BALLARAT RAAF BASE	411m	West

Cultural Heritage Sensitivity

Ballarat North, Ballarat City, VIC 3350



Heritage

Ballarat North, Ballarat City, VIC 3350

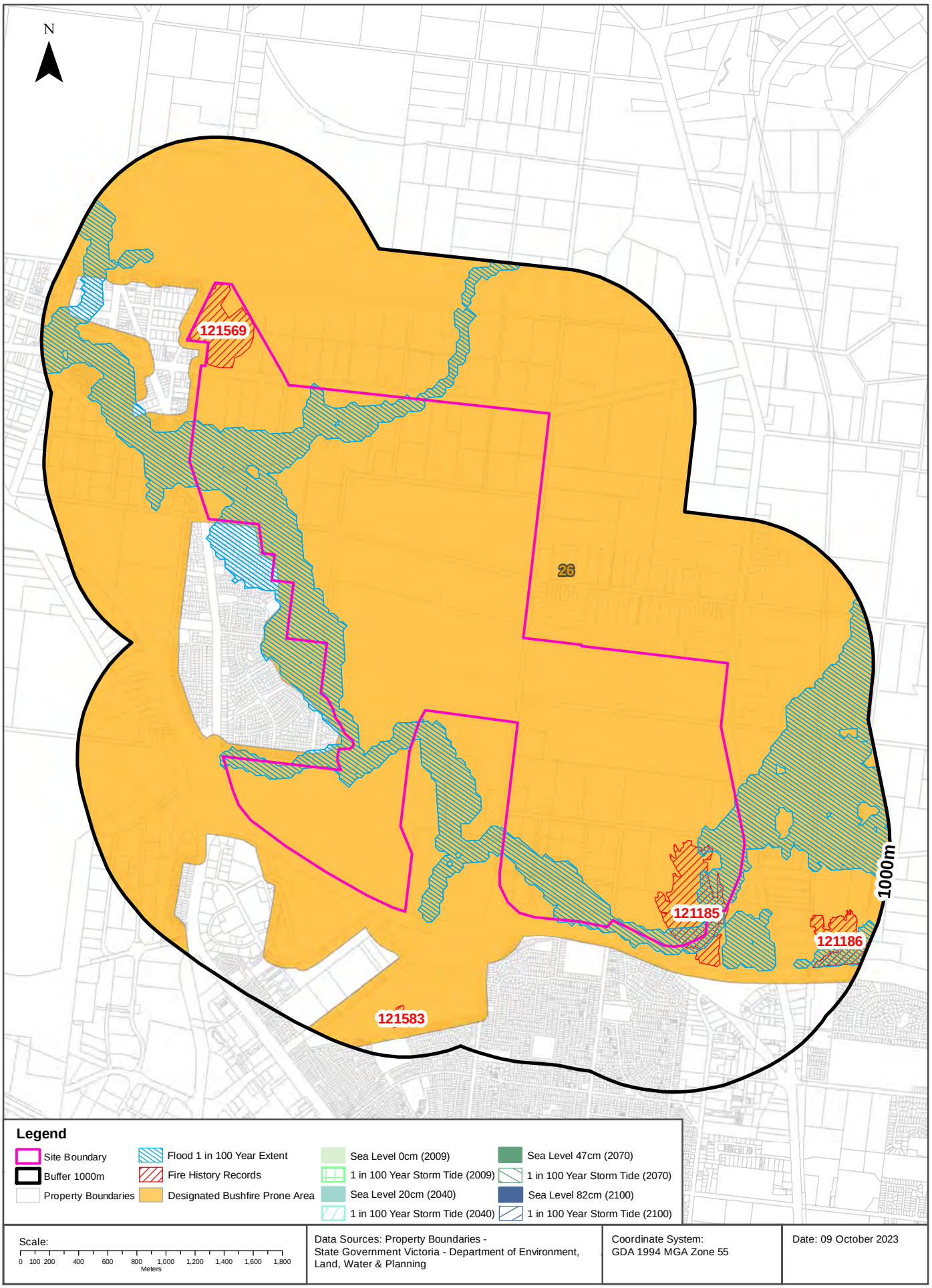
Cultural Heritage Sensitivity

Areas of Cultural Heritage Sensitivity as specified in Division 3 of Part 2 in the Victorian Aboriginal Heritage Regulations 2018, within the dataset buffer:

Map Id	Distance	Direction
7896	0m	On-site
7906	0m	On-site
14269	0m	On-site
5613	0m	On-site
41308	0m	On-site
40945	0m	On-site
40152	0m	On-site
39600	0m	On-site
41112	0m	On-site
40998	0m	On-site
41395	0m	On-site
40783	0m	On-site
40024	0m	On-site
40921	0m	On-site
40760	0m	On-site
39495	43m	North West
40275	275m	North West
41392	361m	South West
40461	480m	North West
40786	710m	South West
40178	749m	South West
39231	826m	South West
40434	863m	North West
39981	967m	South West

Natural Hazards

Ballarat North, Ballarat City, VIC 3350



Natural Hazards

Ballarat North, Ballarat City, VIC 3350

Bushfire Prone Areas

What are the designated bushfire prone areas within the dataset buffer?

Map ID	Feature	Plan No	LGA	Gazetted Date	Distance	Direction
26	Designated Bushfire Prone Area	LEGL./22-168	BALLARAT	17/08/2022	0m	On-site

Fire History

What are the fire history records of fires primarily on public land, within the dataset buffer?

Map Id	Fire Type	Fire Key	Season	Fire No	Fire Name	Treatment	Fire Cover	Start Date	Dist (m)	Direction
121185	BUSHFIRE	W201815076	2018	76	MIDLANDS 76 - INVERMAY - WESTERN FREEWAY	FIRE		25/02/2018	0m	On-site
121569	BURN		2008	EC17		ECOLOGICAL		15/04/2008	0m	On-site
121186	BUSHFIRE	W201815076	2018	76	MIDLANDS 76 - INVERMAY - WESTERN FREEWAY	FIRE		25/02/2018	565m	South East
121583	BUSHFIRE	W20201792626	2020	1792626	ERICA ST	FIRE		06/01/2020	645m	South

Flood - 1 in 100 year modelled flood extent

What 1 in 100 year flood extent features exist within the dataset buffer?

Feature	Source	Method	Scale	Modified Date	Distance	Direction
100 Year Flood Outline	Consultants	Modelled	10000	17/02/2006	0m	On-site

Natural Hazards

Ballarat North, Ballarat City, VIC 3350

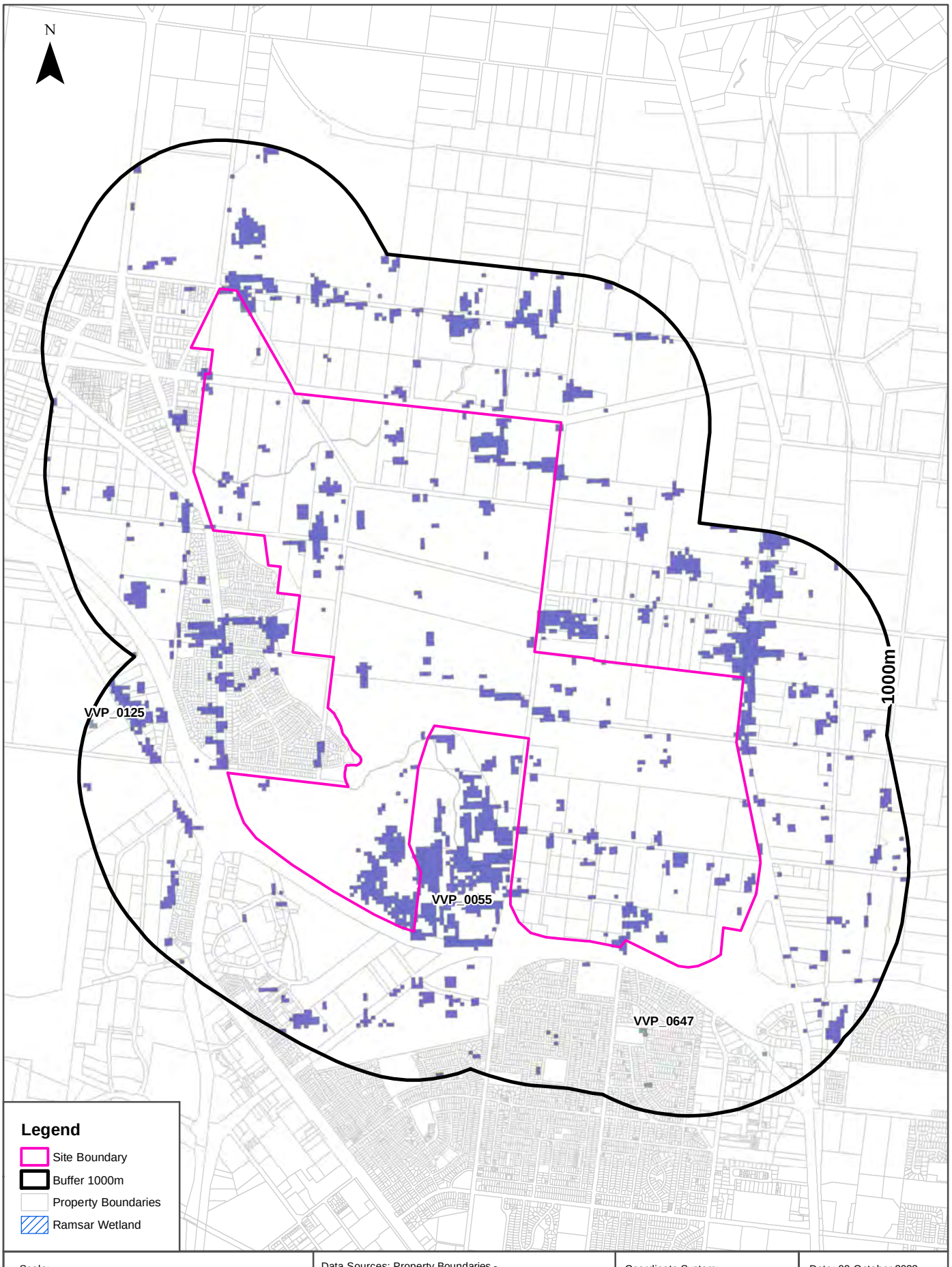
Victorian Coastal Inundation Sea Level Rise

What coastal inundation sea level rise features exist within the dataset buffer?

Description	Distance	Direction
No records in buffer		

Ecological Constraints - Native Vegetation 2005 & Ramsar Wetlands

Ballarat North, Ballarat City, VIC 3350



Ecological Constraints

Ballarat North, Ballarat City, VIC 3350

Native Vegetation (Modelled 2005 Ecological Vegetation Classes)

What native vegetation exists within the dataset buffer?

Veg Code	EVC Name	EVCCode	Group	Subgroup	Bioregion	Conservation Status	Geographic Occurance	Dist	Dir
VVP_0055	Plains Grassy Woodland	0055	Plains Woodlands or Forests	Freely-draining	Victorian Volcanic Plain	Endangered	Common	0m	On-site
VVP_0647	Plains Sedgy Wetland	0647	Wetlands	Freshwater	Victorian Volcanic Plain	Endangered	Common	0m	On-site
VVP_0125	Plains Grassy Wetland	0125	Wetlands	Freshwater	Victorian Volcanic Plain	Endangered	Common	929m	West

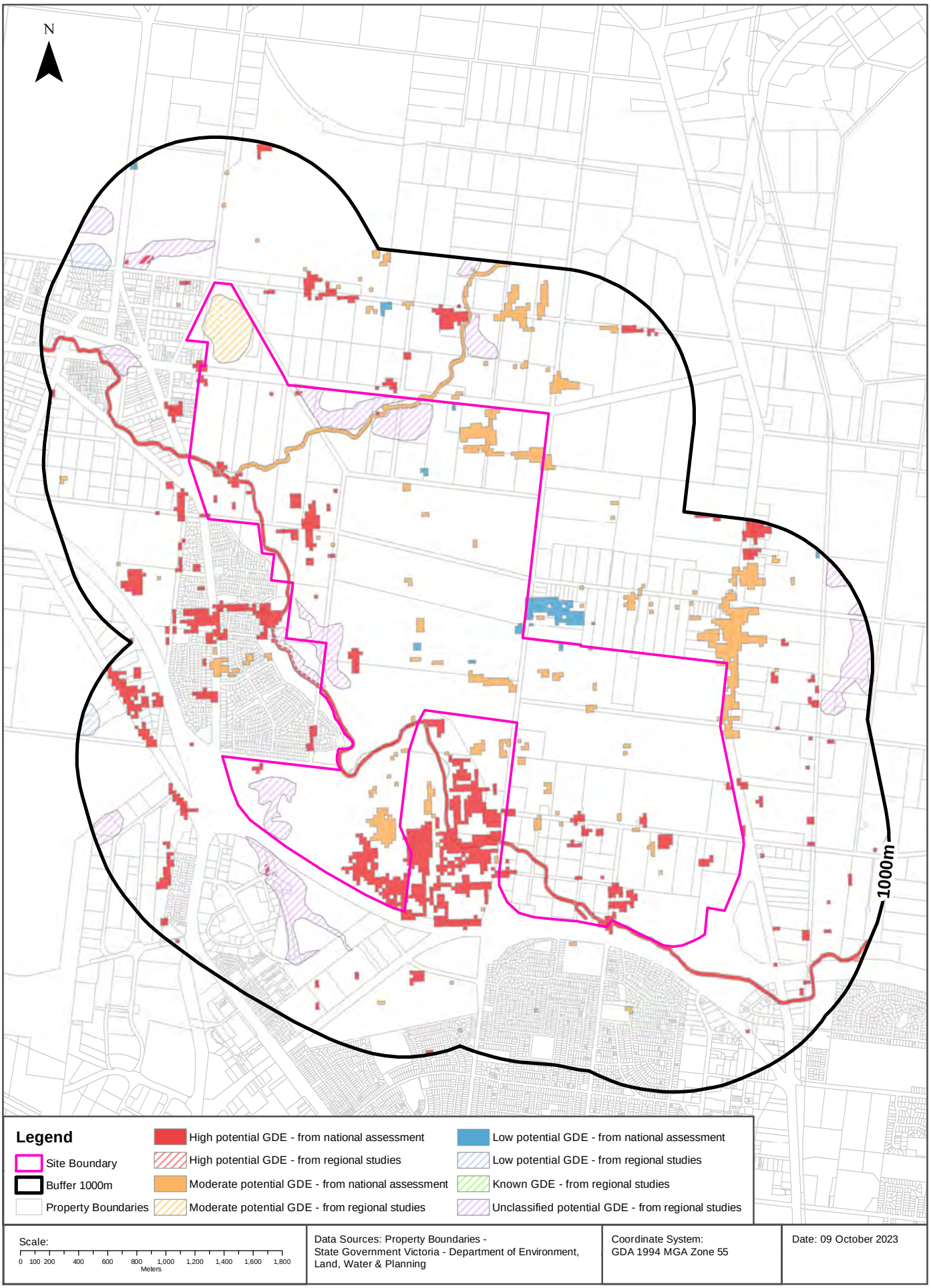
Ramsar Wetlands

What Ramsar wetland areas exist within the dataset buffer?

Map ID	Site Name	Lake Name	Distance	Direction
N/A	No records in buffer			

Ecological Constraints - Groundwater Dependent Ecosystems Atlas

Ballarat North, Ballarat City, VIC 3350



Ecological Constraints

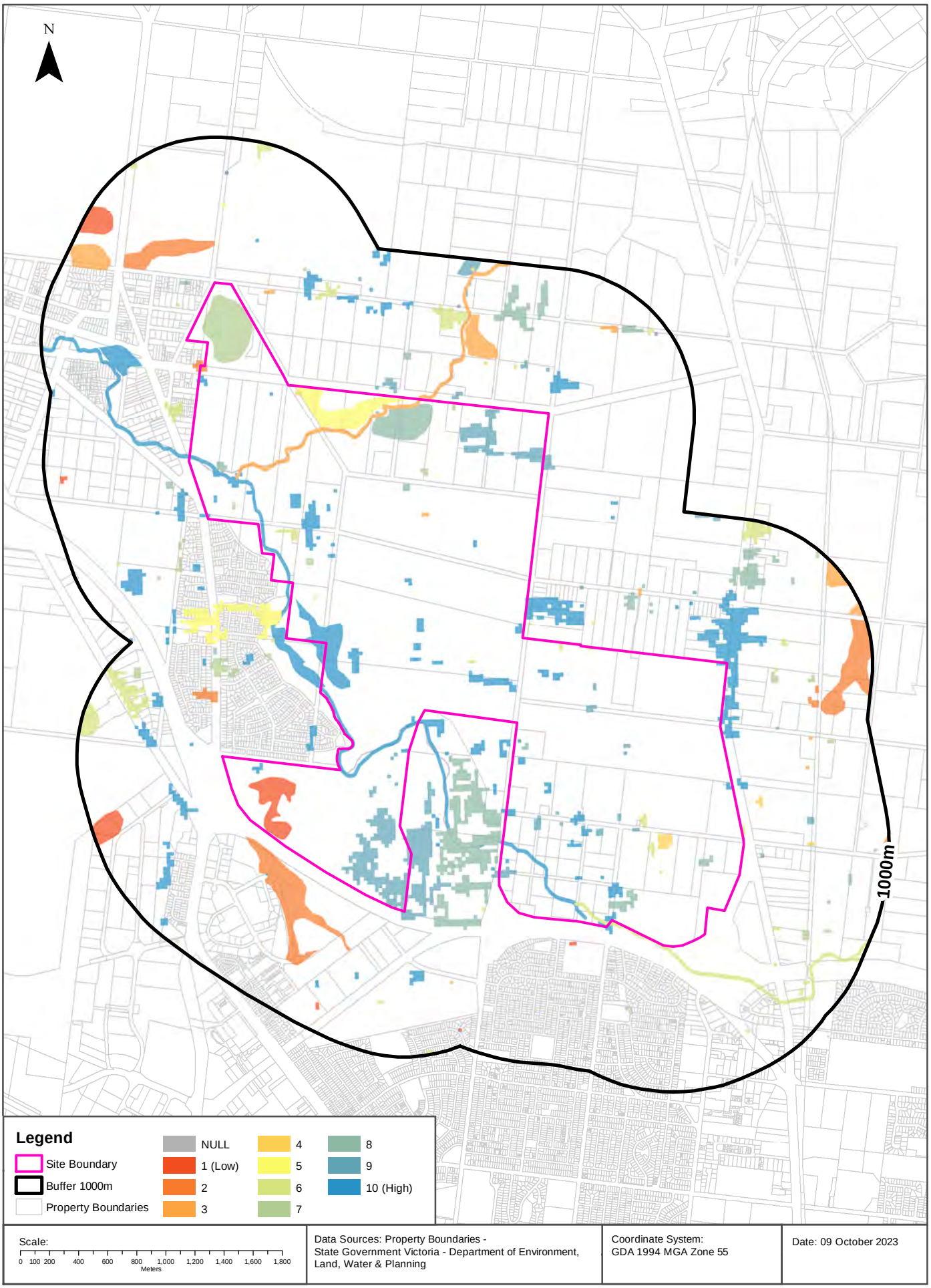
Ballarat North, Ballarat City, VIC 3350

Groundwater Dependent Ecosystems Atlas

Type	Name	GDE Potential	Geomorphology	Ecosystem Type	Aquifer Geology	Distance	Direction
Aquatic		Moderate potential GDE - from regional studies	Moderately high plateaus and strike ridges.	Wetland		0m	On-site
Aquatic		Unclassified potential GDE - from regional studies	Moderately high plateaus and strike ridges.	Wetland		0m	On-site
Aquatic		High potential GDE - from national assessment	Moderately high plateaus and strike ridges.	River	Fractured rock	0m	On-site
Aquatic		Moderate potential GDE - from national assessment	Moderately high plateaus and strike ridges.	River	Unconsolidated sedimentary	0m	On-site
Aquatic		High potential GDE - from national assessment	Moderately high plateaus and strike ridges.	River	Unconsolidated sedimentary	0m	On-site
Terrestrial		High potential GDE - from national assessment	Moderately high plateaus and strike ridges.	Vegetation	Fractured rock	0m	On-site
Terrestrial		Low potential GDE - from national assessment	Moderately high plateaus and strike ridges.	Vegetation	Fractured rock	0m	On-site
Terrestrial		Low potential GDE - from national assessment	Moderately high plateaus and strike ridges.	Vegetation	Unconsolidated sedimentary	0m	On-site
Terrestrial		Moderate potential GDE - from national assessment	Moderately high plateaus and strike ridges.	Vegetation	Fractured rock	0m	On-site
Terrestrial		High potential GDE - from national assessment	Moderately high plateaus and strike ridges.	Vegetation	Unconsolidated sedimentary	0m	On-site
Terrestrial		Moderate potential GDE - from national assessment	Moderately high plateaus and strike ridges.	Vegetation	Unconsolidated sedimentary	28m	North
Aquatic		Low potential GDE - from regional studies	Moderately high plateaus and strike ridges.	Wetland		698m	North West

Inflow Dependent Ecosystems Likelihood

Ballarat North, Ballarat City, VIC 3350



Ecological Constraints

Ballarat North, Ballarat City, VIC 3350

Inflow Dependent Ecosystems Likelihood

Type	Name	IDE Likelihood	Geomorphology	Ecosystem Type	Aquifer Geology	Distance	Direction
Aquatic		7	Moderately high plateaus and strike ridges.	Wetland		0m	On-site
Aquatic		5	Moderately high plateaus and strike ridges.	Wetland		0m	On-site
Aquatic		8	Moderately high plateaus and strike ridges.	Wetland		0m	On-site
Aquatic		10	Moderately high plateaus and strike ridges.	River	Fractured rock	0m	On-site
Aquatic		1	Moderately high plateaus and strike ridges.	Wetland		0m	On-site
Aquatic		3	Moderately high plateaus and strike ridges.	River	Unconsolidated sedimentary	0m	On-site
Aquatic		10	Moderately high plateaus and strike ridges.	River	Unconsolidated sedimentary	0m	On-site
Aquatic		6	Moderately high plateaus and strike ridges.	River	Unconsolidated sedimentary	0m	On-site
Terrestrial		8	Moderately high plateaus and strike ridges.	Vegetation	Unconsolidated sedimentary	0m	On-site
Terrestrial		10	Moderately high plateaus and strike ridges.	Vegetation	Fractured rock	0m	On-site
Terrestrial		2	Moderately high plateaus and strike ridges.	Vegetation	Fractured rock	0m	On-site
Terrestrial		4	Moderately high plateaus and strike ridges.	Vegetation	Fractured rock	0m	On-site
Terrestrial		7	Moderately high plateaus and strike ridges.	Vegetation	Fractured rock	0m	On-site
Terrestrial		3	Moderately high plateaus and strike ridges.	Vegetation	Fractured rock	0m	On-site
Terrestrial		9	Moderately high plateaus and strike ridges.	Vegetation	Fractured rock	0m	On-site
Terrestrial		10	Moderately high plateaus and strike ridges.	Vegetation	Unconsolidated sedimentary	0m	On-site
Terrestrial		7	Moderately high plateaus and strike ridges.	Vegetation	Unconsolidated sedimentary	0m	On-site
Aquatic		10	Moderately high plateaus and strike ridges.	Wetland		0m	On-site
Terrestrial		9	Moderately high plateaus and strike ridges.	Vegetation	Unconsolidated sedimentary	0m	On-site
Terrestrial		6	Moderately high plateaus and strike ridges.	Vegetation	Fractured rock	0m	On-site
Terrestrial		6	Moderately high plateaus and strike ridges.	Vegetation	Unconsolidated sedimentary	0m	On-site
Terrestrial		8	Moderately high plateaus and strike ridges.	Vegetation	Fractured rock	0m	On-site
Terrestrial		5	Moderately high plateaus and strike ridges.	Vegetation	Fractured rock	44m	West
Aquatic		2	Moderately high plateaus and strike ridges.	Wetland		90m	South West
Terrestrial		4	Moderately high plateaus and strike ridges.	Vegetation	Unconsolidated sedimentary	129m	South East
Terrestrial		1	Moderately high plateaus and strike ridges.	Vegetation	Fractured rock	142m	South
Aquatic		3	Moderately high plateaus and strike ridges.	Wetland		328m	North
Terrestrial		3	Moderately high plateaus and strike ridges.	Vegetation	Unconsolidated sedimentary	514m	East
Terrestrial		2	Moderately high plateaus and strike ridges.	Vegetation	Unconsolidated sedimentary	574m	East
Aquatic		6	Moderately high plateaus and strike ridges.	Wetland		874m	West
Aquatic		9	Moderately high plateaus and strike ridges.	Wetland		880m	North

Inflow Dependent Ecosystems Likelihood Data Source: The Bureau of Meteorology

Location Confidences

Where Lotsearch has had to georeference features from supplied addresses, a location confidence has been assigned to the data record. This indicates a confidence to the positional accuracy of the feature. Where applicable, a code is given under the field heading “LC” or “LocConf”. These codes lookup to the following location confidences:

LC Code	Location Confidence
Premise Match	Georeferenced to the site location / premise or part of site
Area Match	Georeferenced to an approximate or general area
Road Match	Georeferenced to a road or rail corridor
Road Intersection	Georeferenced to a road intersection
Buffered Point	A point feature buffered to x metres
Adjacent Match	Land adjacent to a georeferenced feature
Network of Features	Georeferenced to a network of features
Suburb Match	Georeferenced to a suburb boundary
As Supplied	Spatial data supplied by provider

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LOTSEARCH

LOTSEARCH AERIALS

Date: 09 Oct 2023

Reference: LS048898 EA

Address: Ballarat North (1 of 4), Ballarat City, VIC 3350

Aerial Imagery 2022

Ballarat North (1 of 4), Ballarat City, VIC 3350

Scale:	Data Source Aerial Imagery:	Coordinate System:	Date: 09 October 2023
0 140 280 420 560 Meters	© Aerometrex Pty Ltd	GDA 1994 MGA Zone 55	

Aerial Imagery 2019

Ballarat North (1 of 4), Ballarat City, VIC 3350

Scale:	Data Source Aerial Imagery:	Coordinate System:	Date: 09 October 2023
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Aerial Imagery 2017

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Scale:	Data Source Aerial Imagery:	Coordinate System:	Date: 09 October 2023
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Aerial Imagery 2015

Ballarat North (1 of 4), Ballarat City, VIC 3350

Scale:
0 150 300 450 600
Meters

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0 150 300 450 600
Meters

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Aerial Imagery 1990

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Aerial Imagery 1989

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0 150 300 450 600
Meters

Aerial Imagery 1981

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Aerial Imagery 1961

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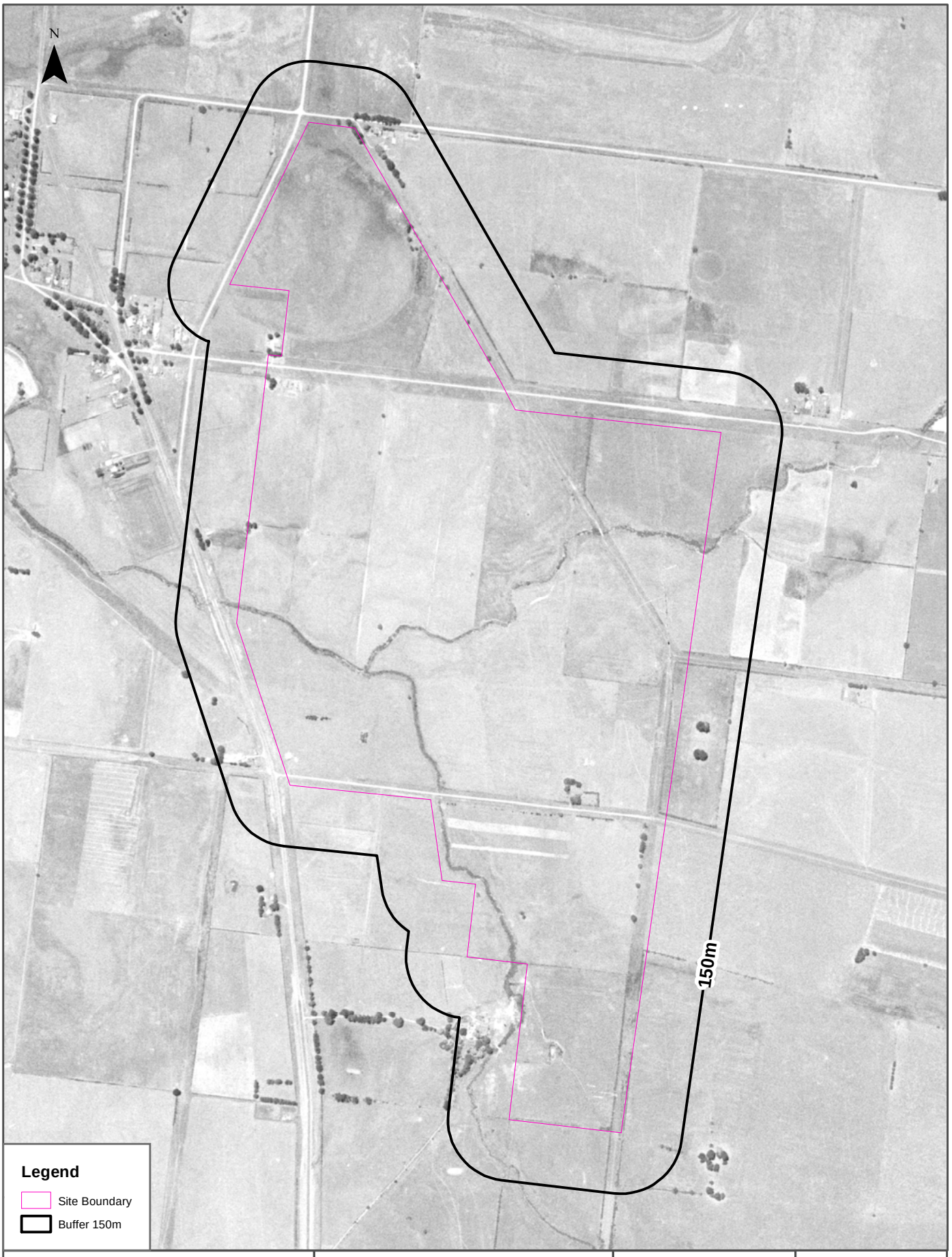
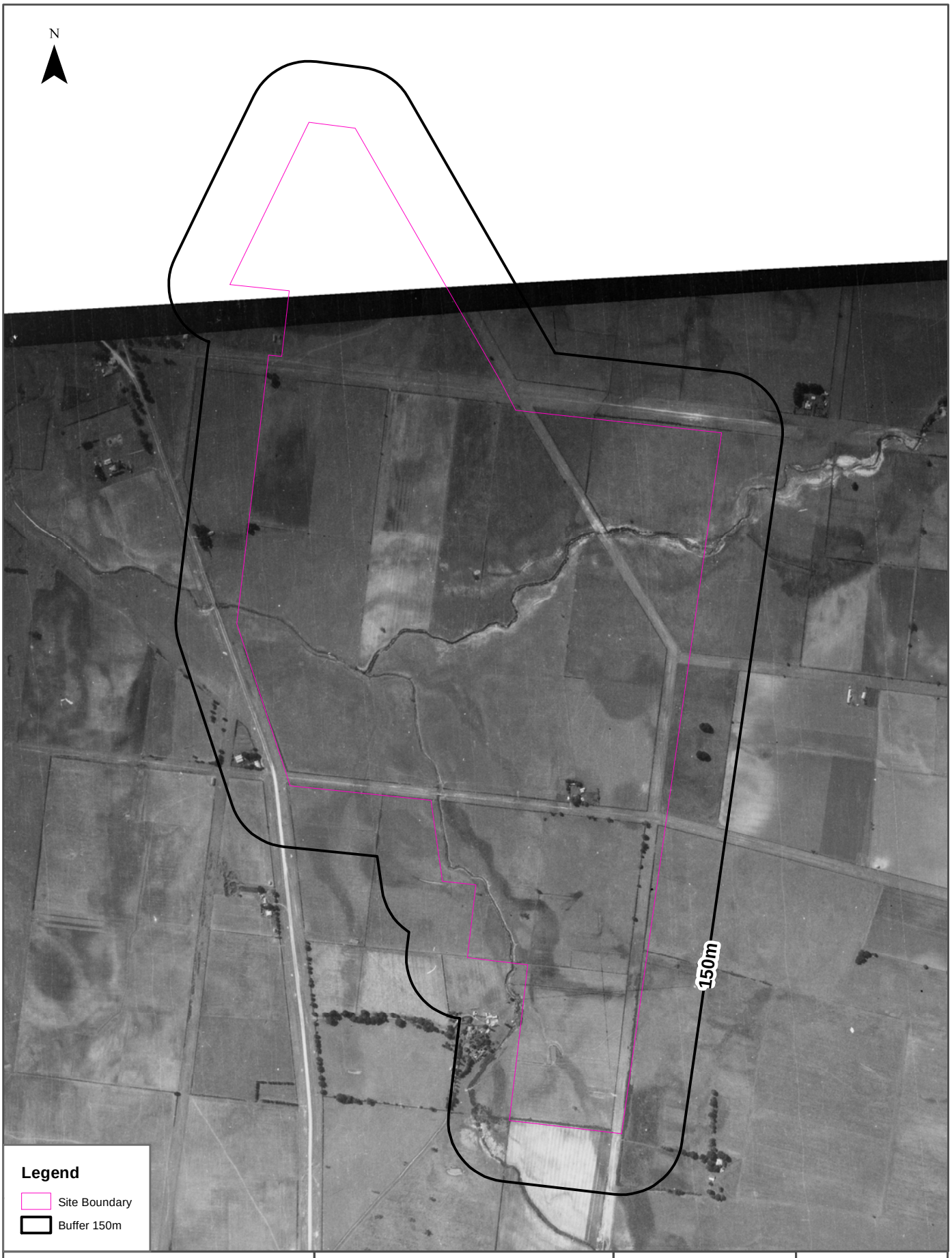


Aerial Imagery 1934

Ballarat North (1 of 4), Ballarat City, VIC 3350



Scale:	Data Source Aerial Imagery:© 2023 Geoscience Australia	Coordinate System: GDA 1994 MGA Zone 55	Date: 06 October, 2023

0 150 300 450 600
Meters

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LOTSEARCH AERIALS

Date: 09 Oct 2023

Reference: LS048899 EA

Address: Ballarat North (2 of 4), Ballarat City, VIC 3350

Aerial Imagery 2022

Ballarat North (2 of 4), Ballarat City, VIC 3350

Scale:	Data Source Aerial Imagery:	Coordinate System:	Date: 09 October 2023
0 130 260 390 520 Meters	© Aerometrex Pty Ltd	GDA 1994 MGA Zone 55	

Aerial Imagery 2019

Ballarat North (2 of 4), Ballarat City, VIC 3350

Scale:	Data Source Aerial Imagery:	Coordinate System:	Date: 09 October 2023
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Aerial Imagery 2017

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Aerial Imagery 2015

Ballarat North (2 of 4), Ballarat City, VIC 3350

Aerial Imagery 2011

Ballarat North (2 of 4), Ballarat City, VIC 3350

Aerial Imagery 1990

Ballarat North (2 of 4), Ballarat City, VIC 3350

Scale: 0 130 260 390 520 Meters	Data Source Aerial Imagery: © Department of Environment, Land, Water and Planning (Vicmap Topographic Mapping Program)	Coordinate System: GDA 1994 MGA Zone 55	Date: 06 October 2023