Land Capability Assessment

Document no: IS427200-0000-NP-RPT-0001
Revision no: 3

Victorian Planning Authority
D/22/2253

Merrifield North Precinct Structure Plan
26 June 2026

Client name:	Victorian Planning Authority		
Project name:	Merrifield North PSP Land Capability Assessment		
Client reference:	D/22/2253	**Project no:**	IS427200
Document no:	IS427200-0000-NP-RPT-0001	**Project Manager:**	Michelle Castro
Revision no:	3	**Prepared by:**	Various
Date:	26 June 2026	**File name:**	Merrifield North PSP_LCA_Rev3
Doc status:	Final		

Document history and status

Revision	Date	Description	Author	Checked	Reviewed	Approved
A	16/01/2023	Draft report for internal review	Various	MC	WR / BM	WR
0	20/01/2023	Draft report for client review	Various	MC	WR	WR
1	11/10/2023	Revised report	Various	MC	WR	WR
2	30/1/2026	Revised report	Various	MC	WR/SM	WR
3	26/06/2026	Final report	Various	WR	WR	WR

Distribution of copies

Revision	Issue approved	Date issued	Issued to	Comments
0	Draft	20/01/2023	VPA	Draft report for client review
1	Draft	11/10/2023	VPA	Revised report
2	Draft	30/01/2026	VPA	Revised report
3	Final	26/06/2026	DTP	Revised report

Jacobs Group (Australia) Pty Limited

Floor 13, 452 Flinders Street
Melbourne, VIC 3000
PO Box 312, Flinders Lane
Melbourne, VIC 8009
Australia

T +61 3 8668 3000
F +61 3 8668 3001
www.jacobs.com

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Acronyms and abbreviations

ANZECC	Australian and New Zealand Environment and Conservation Council
ANZG	Australian and New Zealand Guidelines
CEMP	Construction Environmental Management Plan
CDZ2	Comprehensive Development Zone – Schedule 2
DEECA	Department of Energy, Environment, and Climate Action
EAO	Environmental Audit Overlay
EPA	Environmental Protection Authority
ESA	Environmental Site Assessment
FZ1	Farming Zone – Schedule 1
GDE	Groundwater Dependent Ecosystem
GWZ	Green Wedge Zone
IN1Z	Industrial 1 Zone
LDRZ	Low Density Residential Zone
NEPC	National Environment Protection Council
NEPM	National Environment Protection Measure
NGCP	North Growth Corridor Plan
PPN30	Planning Practice Note 30
PASS	Potential Acid Sulfate Soils
PSP	Precinct Structure Plan
PRSA	Preliminary Risk Screening Assessment
PUCZ	Public Conservation and Resource Zone
PPRZ	Public Park and Recreation Zone
PUZ5	Public Use Zone – Cemetery/Crematorium
RCZ	Rural Conservative Zone
SAP	Sampling and Analysis Plan
SMO	Salinity Management Overlay
TDS	Total Dissolved Solids
TZ	Township Zone
TRZ2	Transport Zone 2
UGZ	Urban Growth Zone
VPA	Victorian Planning Authority

1. Introduction

1.1 Background and objectives

Jacobs Group (Australia) Pty Ltd (Jacobs) was commissioned by Victorian Planning Authority (VPA) to undertake a desktop review and assessment of the hydrogeological, hydrological, geomorphological, and geotechnical environmental setting of the Merrifield North Precinct Structure Plan area, hereafter referred to as the 'Merrifield North PSP area'.

The Merrifield North PSP covers an area of approximately 988 hectares with its location to be 35 kilometres north of Melbourne's Central Business District (CBD) and is found immediately to the north of the emerging Merrifield Town Centre. The Merrifield North PSP area straddles both the Mitchell Shire and Hume City local government areas. The Merrifield North PSP area is identified in the North Growth Corridor Plan (NGCP) wherein this plan provides a high-level vision for the northern growth corridor. The Merrifield North PSP area is to be developed for employment land uses, as well as open space, conservation, and water retardation.

This assessment aims to identify potential areas of contamination and to identify the historical land use, both in the past and the present that may cause an impact on future development in terms of hydrology, groundwater, geology/geomorphology, and amenity. The environmental conditions will be based on the combination of a desktop review and field site inspection within and within the boundaries of the Merrifield North Precinct. Both 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 cause the potential to cause adverse amenities. There will be no sampling that will be conducted at this stage and will include the above-mentioned process.

1.2. Scope of works

The following scope of work was undertaken at the site:

- **Stage 1 –** This 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 issues across the Merrifield North PSP area; and
- **Stage 2 –** This assessment included the selective inspection of properties within the Merrifield North PSP area. The area's current and historic land use, based on their potential for contamination, that was identified in the desktop assessment will be categorized as either 'high', 'medium', or 'no potential for contamination'. Their categorization will be based on the Planning Practice Note 30 (PPN30) for potentially contaminated land. Further assessment and planning provisions will then be implemented with the possible completion of site audits, for those sites classified as 'medium' and 'high' 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

The *Planning and Environment Act 1987* sets out the requirements of planning authorities when preparing planning schemes or amendments to planning schemes. 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.*"

Ministerial Direction No. 1 – Potentially Contaminated Land

Under Section 12 (2) (a) of the *Planning and Environment Act 1987*, the *Ministerial Direction No. 1 – Potentially Contaminated Land* requires planning authorities to satisfy themselves that the environmental conditions of land proposed to be used for a sensitive use, agriculture or public open space are, or will be, suitable for that use. This is generally done through the completion of an environmental site assessment and audit process.

In addition, in accordance with s. 12(2)(b) and s. 60(1)(e) of the Planning and Environment Act 1987, planning and responsible authorities must consider: (1) "*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*"; and (2) "*any significant effects which the responsible authority considers the use or development may have on the environment or which the responsible authority considers the environment may have on the use or development*."

Planning authorities must satisfy themselves that the site is suitable for its proposed use. Adequate information must be provided by the applicant on the existing potential for contamination to have future adverse effects, to enable the planners to make an informed decision.

Land use conflicts

The Merrifield North Precinct is to comprise of employment based land uses (i.e. industry). As such, it is not anticipated that sensitive land uses would be located within the Precinct, with the exception of childcare centres. These centres might be located in proximity to industry to support the local workforce. Careful consideration will need to be exercised by the responsible authority to ensure future land use conflicts are avoided that could constrain the use of the Precinct for industry and to avoid impacts on the amenity of the childcare centre.

The Victoria Planning Provisions (VPP) include policies that encourage good planning outcomes to avoid/minimise land use conflicts and planning controls to recommend separation distances ('land use buffers') between sensitive land uses (e.g. dwellings, hospitals and education) and amenity impacting land uses (e.g. industrial uses, broiler farms, piggeries and landfills) and to trigger an assessment process where new industry does not meet the recommended distance from a sensitive land use.

It is notable that while the planning controls discourage the location of sensitive land uses in proximity to industry with a buffer, they do not preclude such development from occurring. The exception to this is Clause 52.09 Extractive Industry and where the (infrequently used) Buffer Area Overlay or Environmental Significance Overlay has been applied to land to trigger an assessment. Encroachment into buffers can have a significant impact on industry as it can compromise their ability to meet their statutory obligations and result in higher costs to industry to then mitigate impacts.

A review of the Mitchell and Hume planning schemes has been undertaken to identify potential constraints and land use conflicts if sensitive land uses were located within the Precinct.

Planning Policy Framework

The Planning Policy Framework provides broad principles for use and development in relation to sensitive land uses. The Clauses of relevance are summarised below.

Clause 13.05-1S Noise management seeks to assist the management of noise effects on sensitive land uses. It is policy to:

> *Ensure that development is not prejudiced and community amenity and human health is not adversely impacted by noise emissions.*
>
> *Minimise the impact on human health from noise exposure to occupants of sensitive land uses (residential use, child care centre, school, education centre, residential aged care centre or hospital) near the transport system and other noise emission sources through suitable building siting and design (including orientation and internal layout), urban design and land use separation techniques as appropriate to the land use functions and character of the area.*

Clause 13.06-1S Air quality management seeks to assist the protection and improvement of air quality. It is policy to:

> *Ensure, wherever possible, that there is suitable separation between land uses that pose a human health risk or reduce amenity due to air pollutants, and sensitive land uses (residential use, child care centre, school, education centre, residential aged care centre or hospital).*
>
> *Minimise air pollutant exposure to occupants of sensitive land uses near the transport system through suitable siting, layout and design responses.*

Clause 13.07-1S Land use compatibility seeks to protect community amenity, human health and safety while facilitating appropriate industrial uses with potential adverse off-site impacts. It is policy to:

> *Ensure that use or development of land is compatible with adjoining and nearby land uses*
>
> *Avoid locating incompatible uses in areas that may be impacted by adverse off-site impacts from commercial, industrial and other uses.*
>
> *Avoid or otherwise minimise adverse off-site impacts from commercial, industrial and other uses through land use separation, siting, building design and operational measures.*
>
> *Protect commercial, industrial and other employment generating uses from encroachment by use or development that would compromise the ability of those uses to function safely and effectively.*

Particular Provisions

Clause 52.09 - Extractive Industry includes seeks to avoid conflicts between extractive industries and sensitive land uses due to their noise, dust and vibration output. The clause includes provisions that trigger an assessment process where conflicting land uses are within 500m of each other.

The Extractive Industry Interest Area (EIIA) data on VicPlan[1] shows there are no quarries that are active or pending approval within 500m of the Merrifield North Precinct. The nearest existing and planned quarries to the Merrifield Precinct are WA147 (current) and WA1473 (subject to approval). These are both more than 3.5kms from the Merrifield Precinct and are not a constraint on the use and development of sensitive land uses within the Precinct.

The EIIA layer does show an interest area (reference number: 884011) is located directly to the north of the Precinct. The interest area is located within the Beveridge South Precinct where the structure planning process for residential land uses is yet to commence. In accordance with Clause 52.09, a new extractive

[1] www.vicplan.vic.gov.au (accessed 19 January 2026)

industry in this area would need to consider its proximity to planned urban uses, and might include an end date for its use if specified in its planning permit at the time of approval.

Clause 53.10 - Uses and Activities with Potential Adverse Impacts

Clause 53.10 recommends separation distances from potentially amenity impacting industry to sensitive land uses. This purpose is to avoid industry from encroaching on sensitive land uses where noise, dust and odour may impact on the amenity of nearby neighbourhoods. The clause triggers an assessment process where industry does not meet the threshold distance or where a threshold distance is not specified (thus requiring referral of the matter to the Environment Protection Authority).

If a sensitive land use such as a childcare is proposed in the Precinct, then there are two instances where it would have the potential to constrain industry, these are:

- A childcare centre is developed on land within the Precinct and potential industry that require large buffers are then discouraged from locating within the Precinct as they would not be able to meet the recommended separation distance.
- Industry is developed and a childcare centre is approved on land within the buffer of an industry/s, causing those businesses to implement costly measures to reduce their emissions to avoid impacts to a sensitive land use that has encroached into their buffer.

Councils and the EPA will share partially overlapping responsibilities to regulate the use and development of land to avoid and minimise such outcomes. When a planning permit application is lodged to Hume City Council or Mitchell Shire Council, they will need to consider the land use implications, refer/notify the application to the EPA as may be appropriate and exercise their discretion when assessing the application.

2.1.3. Ministerial Direction No. 19

Ministerial Direction No. 19 came into effect on 18 October 2018. It requires planning authorities to seek early advice from 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 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" ; and*
- *"a written explanation of how the proposed amendment addresses any issues or matters raised by EPA".*

2.1.4. Planning Practice Note 30

Planning Practice Note 30 was published by Department of Energy, Environment and Climate Action (DEECA) 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) are provided in Table 2. This is not an exhaustive list but does include several land uses / activities relevant to rural residential areas such as those associated with the Merrifield PSP area.

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.

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

Extract of Table 3 from Planning Practice Note 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.

It is noted that in some circumstances it may be difficult or inappropriate to undertake either the 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 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).

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 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 (irrespective of how minor) will trigger the need to undertake either the PRSA or the environmental audit (as appropriate). Jacobs notes that no EAO has been identified to exist within the Merrifield North PSP area.

2.1.5. Environment Protection Act 2017

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-appointed Environmental 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 Environmental 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 Environmental Auditor when forming such an opinion. At the conclusion of the audit a certificate or statement of environmental audit may be issued. A certificate indicates that the use of the land is unrestricted, whereas a statement indicates that particular uses of the land or groundwater are either precluded or suitable only under specified conditions.

EPA has a role in assessing applications for industries/activities under the EP Act. The Environmental Protection Separation Distance Guideline – Publication 1949 (2024) also sets out recommended separation distances between industrial and sensitive land uses that have the potential to impact human health and wellbeing. The recommended separation distances generally range from 100m to 3,000m, with notes that set out process to undertake activity specific assessments.

General Environmental Duty (GED)

The General Environmental Duty (GED) is at the centre of the EP Act and it applies to all Victorians. The GED is found in s25 and states that:

"*A person engaging in an activity that may give rise to risks of harm to human health or the environment from pollution or waste must minimise those risks, so far as reasonably practicable.*"

The concept of elimination of harm starts with elimination of risks of harm so far as reasonably practicable and if this cannot be achieved then the risks must be reduced so far as reasonably practicable. The GED means it is not necessarily sufficient to demonstrate compliance with a standard or set of numbers (e.g., air emissions). The expectation is that you will manage your activities to avoid the risk of harm. You must also respond if pollution does occur. The GED brings an emphasis onto good management practices and effective systems.

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 by Australian and New Zealand Governments and Australian State and Territory Governments, Canberra ACT (ANZG) in 2018 provide a nationally consistent framework for water quality management. The ANZG (2018) guidelines 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) guidelines 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 what was in 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 works. 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.

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. 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 Map;
    - EPA Licensed sites; and
    - EPA landfill register.
- Topographical maps;
- State bore records on the DEECA 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:

- The 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 risk assessment has been undertaken as part of the Stage 1 assessment using a traffic light system which uses colour-coding to classify each PSP area as low, medium, or high risk from a contamination, hydrogeological and geotechnical perspective. The outcomes of the risk assessment are subsequently used to confirm the need for Stage 2 assessment for each PSP area (see below).

3.1.2. Stage 2 Assessment

The Stage 2 assessment for this investigation represents a selective site inspection at properties or areas (subject to land access permissions) that have been identified during the Stage 1 assessment as indicating potential features or activities of interest across any of the individual technical disciplines that comprise the LCA.

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 a series of boreholes and/or test pits and laboratory testing. Field and laboratory test data is used to develop a site model describing the soil and/or rock profile 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 the groundwater elevation through the installation of groundwater observation bores. Assessment of aquifer permeability can be undertaken through slug or pumping tests to inform potential groundwater inflow rates for construction of below-ground infrastructure. Water quality samples can be collected to inform disposal options.

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 Merrifield North PSP area is presented in **Table 4-1** below. Refer to Figure 1 in Appendix A for a site location map and Figure 2 in Appendix A for a site layout plan.

Table 4-1. Overview of Merrifield North PSP Area

Summary of precinct description details

Item	Details
Location / Address	The Merrifield North PSP area is located at the North Growth Corridor Plan (NGCP) which is 35 kilometers northwest of Melbourne's Central Business District (CBD, and directly to the west of the existing Kalkallo township which straddles both the Mitchell Shire and Hume City local government areas).
Extent (Approximate)	Centre at 37.51194°S, 144.93214545°E North-western extent at (37.50156737°S, 144.92347287°E South-western extent at 37.52501348°S,144.91187975°E North-eastern extent at 37.49722747°S, 144.95760156°E South-eastern extent at 37.52555218°S, 144.94800107°E
Site Area (ha)	The Merrifield North PSP area covers a land area of approximately 988 hectares with 20 listed owners. The PSP is divided by approximately 26 individual parcels of land. Please refer to the Map Reference Lot numbers in Appendix D.
Local Council	Hume City Council Mitchell Shire Council
Current Land Zonings	Under the NGCP, the Merrifield North PSP area is zoned within the Public Use Zone (PUZ1), Farming Zone (FZ), Urban Growth Zone (UGZ), Urban Floodway Zone (UFZ), and the Transport Zone 2 (TRZ2).
Zoning of Surrounding Land	Under the NGCP, the Merrifield North PSP Area is bounded variously by the following zones: ● Northwest – Rural Conservative Zone (RCZ) ● West – Green Wedge Zone (GWZ), Rural Conservation Zone (RCZ), Rural Conservation Zone-Schedule 1 (RCZ1), and Urban Growth Zone (UGZ) ● Southwest – Comprehensive Development Zone-Schedule2 (CDZ2) and Urban Growth Zone-Schedule 4 (UGZ4), ● South – Comprehensive Development Zone-Schedule 2 (CDZ2) ● Southeast – Farming Zone-Schedule 1 (FZ1), Public Conservation and Resource Zone (PCRZ), Public Park and Recreation Zone (PPRZ), Township Zone (TZ), Public Use Zone-Cemetery/Crematorium (PUZ5), and Urban Growth Zone (UGZ), ● East - Urban Growth Zone-Schedule 1 (UGZ1) and Urban Growth Zone-Schedule 5 (UGZ5)
Environmental Audit Overlay	There are no sites with an audit overlay within the Merrifield North PSP area and within 1 km radius of its boundaries.
Site Layout	The Merrifield North PSP area is an irregularly shaped area of land bounded by the Kalkallo Creek in the northwest, the Hume Freeway in the north-east, Gums Lane in the East, Mickleham area in the South, and the Gunns Gully Road from the central part and both the West and East side. The area is also divided into approximately 26 individual parcels of land.
Current Land Uses	The site revolves around its usage as a farming zone, a public zone for service and utility, a transport zone for the principal road network, an urban growth zone, and an urban floodway zone.
Proposed Land Uses	The Merrifield North PSP area has been identified as an area to be developed for employment, land use, as well as public open space, conservation, and water retardation.
Surrounding Land Uses	The Merrifield North PSP area is surrounded by the following land uses:

Item	Details
	● North – Farming (but to be developed for housing in the longer term in accordance with the Beveridge South West PSP), followed by vacant lots. ● West – Farming and rural lifestyle allotments, followed by vacant lots ● South – Residential in the south-west, retail and commercial to the south, and employment to the south-east, followed by open lands, industrial, and residential areas. ● East – Residential followed by the Gums Lane and Hume Freeway

5. Environmental setting

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

5.1. Regional geology

The Geological Survey of Victoria 1:50,000 Seamless Geology map (GSV, 2014) and 1:63,360 Sunbury geological map sheet (GSV, 1973) were reviewed to determine the geological conditions at the Merrifield PSP area. Extract of both geological maps are presented in **Figure 5-1** and **Figure** 5-2.

The 1:50k Seamless geology indicates that the PSP is likely underlain by several geological units. The description of geological units expected within the PSP are tabulated in **Table 5-1**.

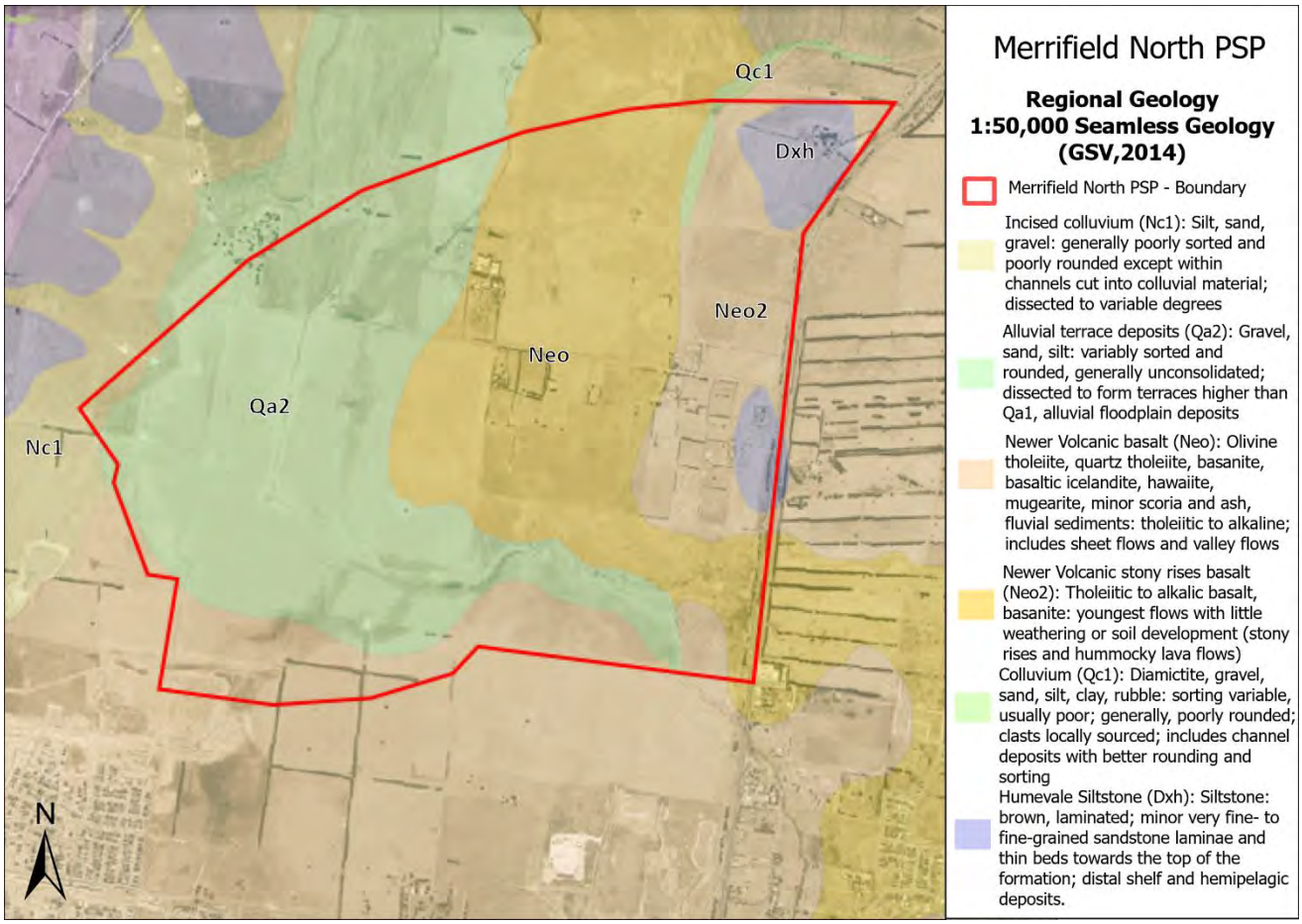


Figure 5-1. An extract of the 1:50k scale Seamless Geology map (Not to scale)

Table 5-1. Summary of geological units within the PSP area from 1:50k Seamless geology map

Unit	Description
	Incised colluvium (Nc1): Silt, sand, gravel: generally, poorly sorted and poorly rounded except within channels cut into colluvial material; dissected to variable degrees
	Alluvial terrace deposits (Qa2): Gravel, sand, silt: variably sorted and rounded, generally unconsolidated; dissected to form terraces higher than Qa1, alluvial floodplain deposits

Unit	Description
	Newer Volcanic basalt (Neo): 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
	Newer Volcanic stony rises basalt (Neo2): Tholeiitic to alkalic basalt, basanite: youngest flows with little weathering or soil development (stony rises and hummocky lava flows)
	Colluvium (Qc1): Diamictite, gravel, sand, silt, clay, rubble: sorting variable, usually poor; generally, poorly rounded; clasts locally sourced; includes channel deposits with better rounding and sorting
	Humevale Siltstone (Dxh): Siltstone: brown, laminated; minor very fine- to fine-grained sandstone laminae and thin beds towards the top of the formation; distal shelf and hemipelagic deposits.

The 1:63,360 Sunbury Map sheet (GSV 1973) indicates fewer geological units compared to the Seamless geology. The regional surface geology is generally of Quaternary and Tertiary Age Newer Volcanics (Qvn) comprising vesicular olivine basalts, with minor interbedded silty sand and baked soils and recent colluvial deposits (Qrc) comprising poorly to well sorted silt, sand, and gravel. These materials are likely underlain by Silurian Age Dargile Formation (Sud), consisting of thinly interbedded shale, mudstone, and greywacke.

The presence of the Upper Silurian Dargile Formation may be encountered particularly along the Hume Freeway as indicated in both maps.

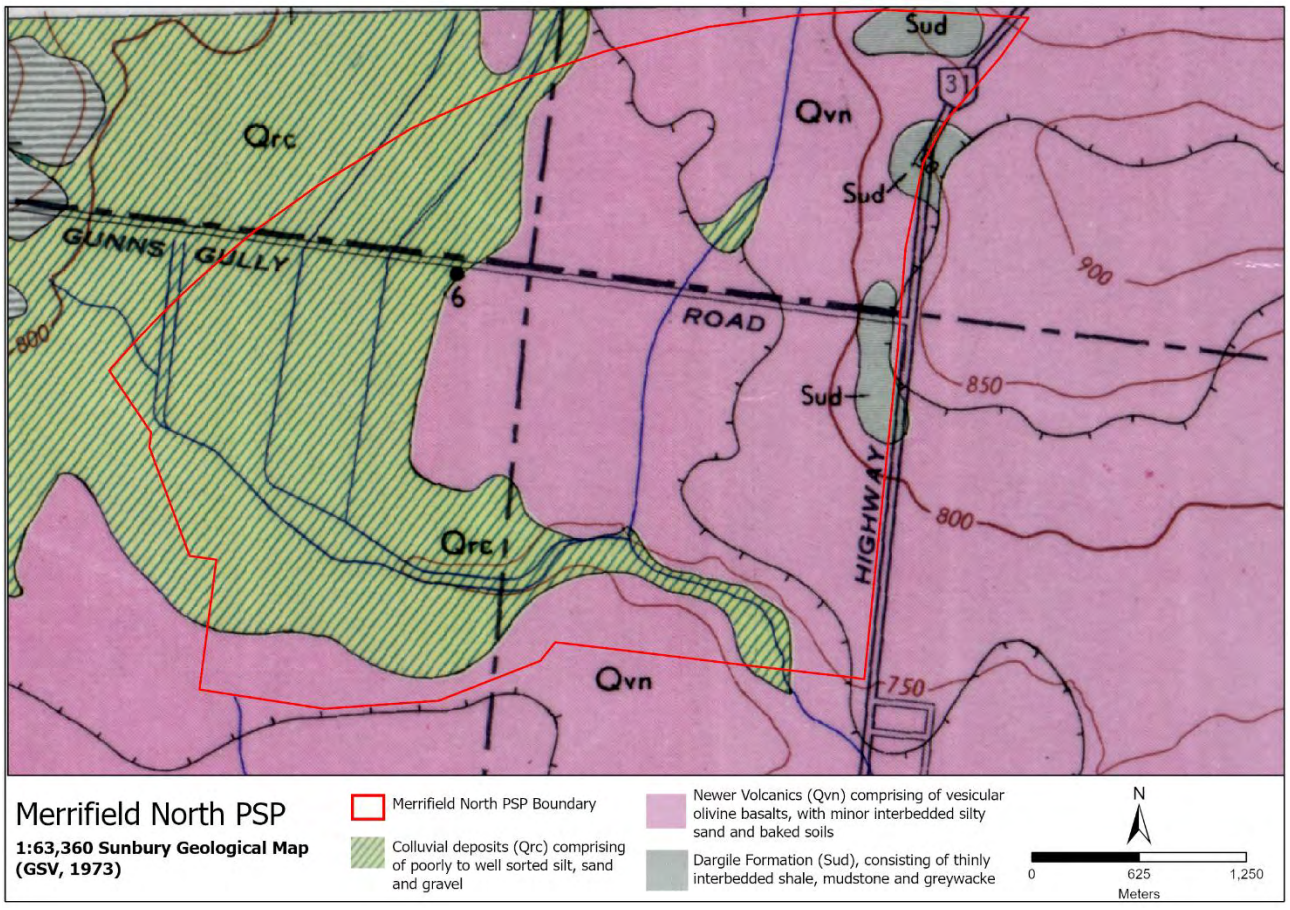


Figure 5-2. Extract of the 1:63k Sunbury Geological map (Not to scale)

Kalkallo creek flows across the PSP area predominantly through the Quaternary age Colluvium as indicated by the 1:63k Sunbury map.

Table 5-2. Summary of geological units within the PSP area from 1:63k Sunbury geological map

Unit	Description
	Colluvial deposits (Qrc) comprising poorly to well sorted silt, sand and gravel
	Newer Volcanics (Qvn) comprising vesicular olivine basalts, with minor interbedded silty sand and baked soils
	Dargile Formation (Sud), consisting of thinly interbedded shale, mudstone and greywacke

Alluvial deposits (Qa2) and Colluvial deposits (Qc1/Qrc/Nc1)

Alluvial and colluvial deposits are transported material, and therefore may be variable in nature. The Seamless geology identifies Qa2 as comprising variably sorted and rounded gravel, sand, silt, generally unconsolidated whilst the both the seamless geology and 1:63k Sunbury map identifies colluvial deposits as comprising poorly to well sorted silt, sand, and gravel. Generally, the material will vary significantly and will consist of interbedded layers of sand, silt and gravel. These Quaternary (recent) age deposits are typically the youngest soils in the Merrifield PSP area.

The Incised colluvium (Nc1) comprising silt, sand, and gravel, is further out to the west of the proposed project area and is unlikely to be encountered. However, if meet it should be noted regarding its potential poor sorting character and related difficulties in effective compaction that might affect shallow foundations

Newer Volcanics Group (Qvn/Neo/Neo2)

The basalt expected to be encountered in the Merrifield PSP area is typically of high strength with a variable degree of weathering. It is expected that Qvn will underly soils where encountered. Quaternary aged Newer Volcanics basalt is often comprised of multiple flows from multiple eruption events and therefore weathered zones appear in the rock profile between flows of high strength slightly weathered and fresh basalt.

Cooling of the lava results in sub-horizontal and sub-vertical joints in the basalt. Weathering within the basalt mass typically occurs spheroidally, influenced by the location of joints and passage of water through the joints. The deposition and weathering patterns result in a highly variable rock mass. Abrupt changes in fracturing, weathering, and strength are not uncommon within these volcanic rock masses.

Residual soil is derived from the complete weathering of the parent rock. The residual soil is typically stiff to very stiff high plasticity clay or clayey gravel.

Residual soil derived from Newer Volcanics basalt is typically sensitive to volume changes associated with moisture change and can exhibit high shrink swell properties and may be prone to fissuring. Soil weathered from basalt is also generally alkaline and sodic, resulting in a high potential for dispersion.

Dargile Formation (Sud)/Humevale Siltstone (Dxh)

Both published geological maps indicate the presence of Siltstone along the Hume freeway with slightly different terminology and description. The material is expected to be generally of low strength, laminated, minor very fine-grained sandstone laminae and thin beds towards the top of the formation.

Topography

The site is gently undulating with natural ground surface grading toward Kalkallo Creek. The ground surface elevation typically varies between 230metres Australian Height Datum (m AHD) around the Kalkallo Creek to

270m AHD further out on either side of the creek. An extract of the elevation of the site is presented in **Figure 5-3**.

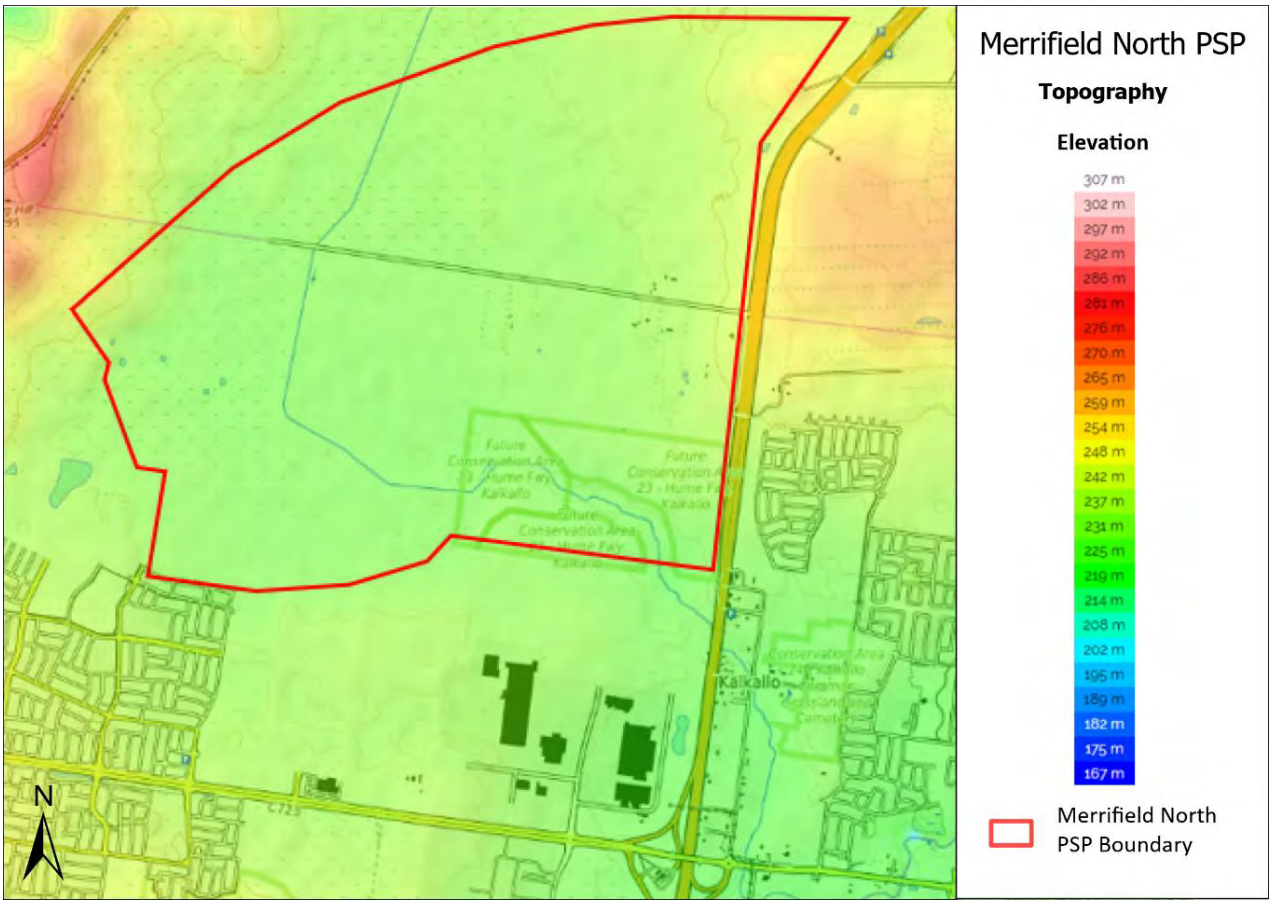


Figure 5-3. Topographical view of PSP site (Yamazaki et. al 2017)

5.2. Regional acid sulfate soils

Based on the June 2022 Lotsearch Reports, 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 Merrifield North PSP area is extremely low (defined as a 1% to 5% chance occurrence in small, localised areas), albeit noting the potential for occurrence in locations of swamp deposits (Qrm, refer to **Section 5.1.** Regional geology).

5.3. Regional hydrology

The Merrifield North PSP area (shown in **Figure 5-4**) comprises the downstream portion of the Kalkallo Drainage scheme. Kalkallo Creek, a designated waterway, drains roughly north to south upstream of the retarding basin, and drains to the southeast joining Merri Creek downstream of the PSP boundary. The existing Kalkallo Retarding Basin sits within the Merrifield North PSP and acts as a significant area of flood storage during flood events on Kalkallo Creek. The retarding basin contains a large area of Land Subject to Inundation Overlay (LSIO), in addition to Rural Floodway Zone (RFZ LSIOs indicate areas that present higher flood risks as they are susceptible to flooding associated with waterways systems and open drainage (Melbourne Water, 2017)).

The 1 in 100 Year Flood Extent obtained from the Victorian Flood Database does not contain information in this catchment, however more recent studies looking at the base case Kalkallo Retarding Basin Design under the proposed development of the Kalkallo Development Services Scheme (Jacobs, 2021) indicate significant

areas within the retarding basin and areas adjacent to Kalkallo Creek are inundated in a 1 in 100-year flood event.

The current base case model and concept design of the Kalkallo Retarding Basin (Jacobs, 2021) sets out storage and wetland requirements to meet flood storage and water treatment requirements. This is under a 'light-touch option' where excavation of sodic soils is minimised.

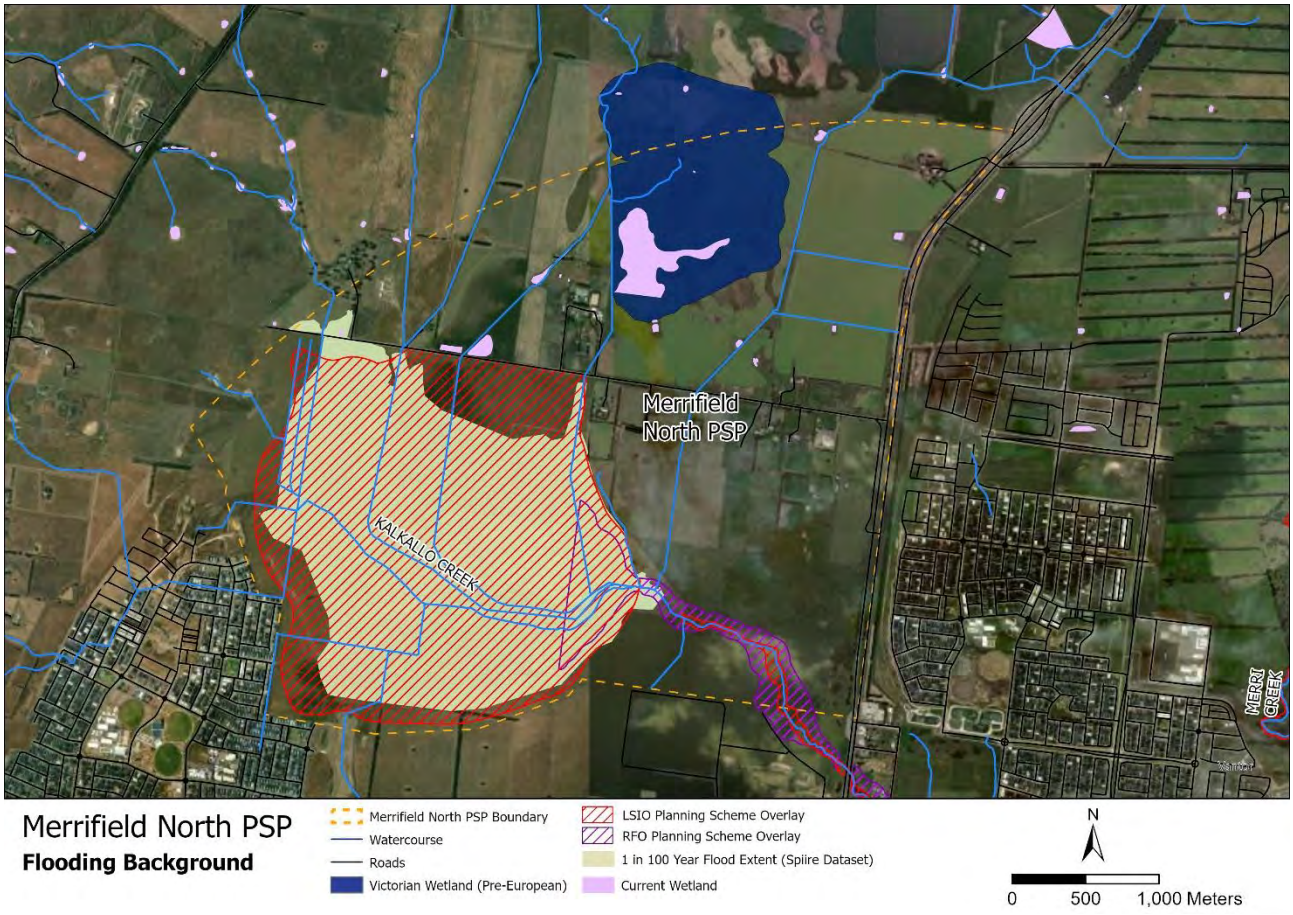


Figure 5-4. Flooding Background for Merrifield North PSP
Map illustrating the 1 in 100 Year Flood Extent (Victorian Flood Database), relevant drainage schemes (Kalkallo DS Drainage Scheme 6550).

The majority of the Merrifield North PSP area is located within the former wetland – known as the Inverlochy Wetland. DEECA mapping indicates one area of pre-European wetland, and within this extent, there is one Current Wetland.

The Kalkallo Drainage scheme has concentrated the required storage/wetland treatment zones within the retarding basin footprint; however, Melbourne Water indicates that the Drainage Scheme is under revision (Melbourne Water, 2021). A hydrological and hydraulic model was prepared by Jacobs in 2021 of the Kalkallo Retarding Basin as a base case for its future operation.

5.4. Regional geomorphology

The Merrifield North PSP area covers a volcanic landscape. The geomorphology and topography have been influenced by larva flows and drainage network development as the steams have incised surrounding larval, alluvial and colluvial deposits. The area is drained by Kalkallo Creek. Before agricultural development it is expected that there would have been more attenuation of water in the landscape with water collecting in depressions and swamps. No sites of geological or geomorphological significance are located within the Merrifield North PSP (Victorian Resources Online 2019).

The Merrifield North PSP area is located on soils that have formed from weathering of local Newer Volcanic Basalt rock, Quaternary Alluvium, Colluvium, and Humevale Siltstone. These geologies and associated soil types occur extensively in the northwest of Melbourne (Geological Survey of Victoria 1997). Previous reports reviewed as part of this project include Van de Graaff (2018), Brizga and Seymour (2018), GHD (2019), Jacobs (2019), and SESL (2020). All provide general detail on the presence of dispersive or sodic soils in the area and ranges of treatment methods. All reports note that the soils of the region are highly dispersive with photographic evidence of dispersive channel cuttings, turbid water, and eroded channel batters made evident by Brizga & Seymour (2018) and Van de Graaff (2018) from the adjacent Merrifield Central Employment PSP Area.

Figure 5-5. Merrifield Central Employment Area

Selected photographs of erosion and damage to drains at Merrifield following rainfall events (Brizga & Seymour 2018; Van de Graaf 2018).

These soils have a strong texture contrast, with sand to clay loamy surface horizons and dense and coarsely structured subsoil horizons that are sodic. Sodosols are susceptible to problems of waterlogging and erosion because of their physical structure and chemical composition. Soil sodicity potentially leads to dispersion, degrading soil structure, which is more frequently a problem with subsoil horizons, that are often relatively impermeable and become prone to gullying and tunnel erosion. This erosion risk is increased in circumstances where the surface soil has been removed and the subsoils are then exposed (Jacobs 2020a, 2000b, 2001a, 2001b).

There is increasing awareness that urban development in areas that have these geologies and soil types in the Melbourne Region is an issue both through the construction phase and 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 because 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). Jacobs (2022) have recently completed a redesign of stormwater assets in the Kalkallo Retarding Basin, which has given explicit consideration to the presence of dispersive soils. The revised design includes a series of low-flow channels and wetlands, the surface area and depth of excavations have been designed for the conveyance, retardation, and treatment of flows, whilst also reducing the risk of erosion.

5.5. Regional hydrogeology

5.5.1. Overview of regional hydrogeology

The Merrifield North PSP area is characterised by two main aquifer units. These are outlined below with reference to the Victorian Aquifer Framework (VAF) (GHD, 2012):

- The Quaternary Aquifer (QA – 100) is present on the western side of the study area around the Kalkallo Creek and tributaries, and along the Kalkallo Creek as it tends southeast (GSV, 2011). At the site, this surficial aquifer is characterised by alluvial terrace deposits of sand, silt, and gravel, overlying the Upper Tertiary/Quaternary Basalt aquifer (Newer Volcanics basalts). Groundwater flows through the gaps and pore spaces between the sand and gravel particles making up the aquifer. Where it occurs across the project area, this unit varies in thickness from 7-17 m and is likely to host the water table.
- The Upper Tertiary/Quaternary Basalts (UTB – 101) is a fractured rock aquifer in the basalt flows and stony rises of the Newer Volcanics. Groundwater flow in this aquifer is 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 UTB is of variable thickness across the site, typically thinnest (7 m) along the Hume Highway at the eastern bounds of the PSP area and thicker towards the south and central parts of the project area (10-24 m). This unit is expected to host the local water table where it is encountered at the surface. Outcrops of Humevale Siltstone (Undifferentiated Sedimentary Basement Rocks – BSE – 114) in the east and north of the site may also host the water table where present; otherwise, this aquifer is encountered at depth, underlying the Newer Volcanics.

State-wide depth-to-water table mapping indicates that groundwater is generally shallow (<5 mbgl) across the site (**Figure 5-6**). However, water level monitoring from Merrifield Central field investigations (south of the study area on Donnybrook Road) encountered groundwater at depths greater than 8m below ground, despite state-wide mapping indicating <5m below ground surface (Jacobs, 2018b) and hence onsite monitoring is required to confirm local water levels. The regional dataset indicates water table depth increases along the eastern bounds of the Merrifield North PSP area adjacent to the Hume Highway, ranging from 5-20 mbgl, except for the shallower intersection of the Kalkallo Creek (DELWP, 2018).

The primary recharge mechanism for the local aquifers is via diffuse rainfall and surface infiltration. Shallow groundwater locally is likely to contribute baseflow to surface water features. Regional groundwater flow is generally north to south towards Port Phillip Bay. Local groundwater flow is likely to follow topography and flow towards Kalkallo Creek.

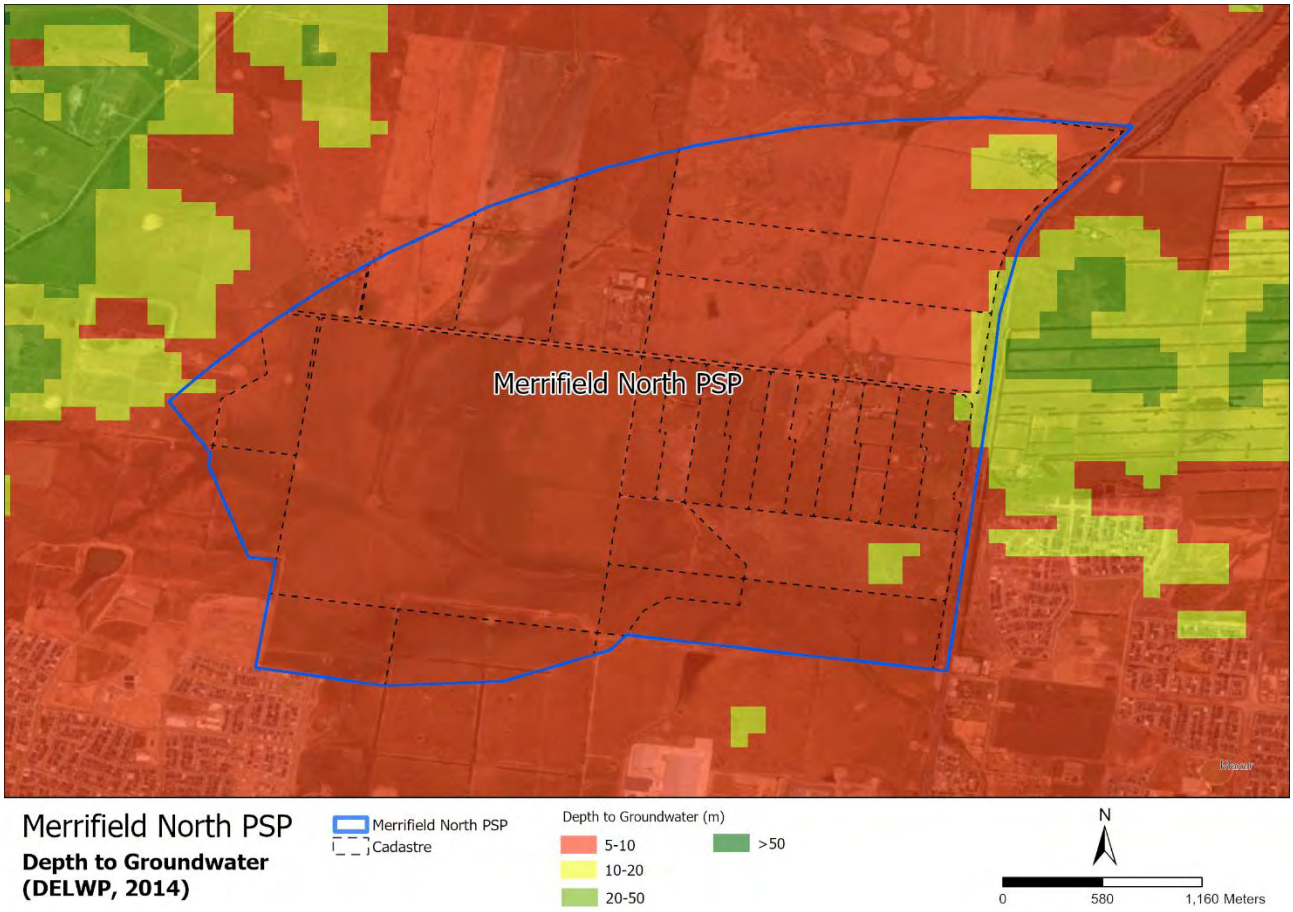


Figure 5-6. Depth to groundwater, meters below surface
Map illustrating depth to groundwater across the Merrifield North PSP area.

5.5.2. Groundwater dependent ecosystems

A review of the Atlas of Groundwater Dependent Ecosystems (GDEs) (BOM, 2012) was conducted to identify any potential GDEs within the Merrifield North PSP area and surrounds. The GDE Atlas serves as a national inventory of known and potential GDEs categorised by their degree of reliance on groundwater. The Atlas indicates if 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 ecosystems from the BOM Atlas which are relevant to the project 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: are ecosystems which depend on a subsurface supply of groundwater. These commonly occur as vegetation ecosystems.

The Atlas indicates that waterways approximately 2km to the east and west of the project area are likely to have high dependence on groundwater, notably Merri Creek and Deep Creek. Key GDEs within the immediate vicinity of the Merrifield North PSP include:

- Aquatic:
    - Kalkallo Creek is listed as having a high potential for groundwater interactions (from national assessment).

        - The southern section of Kalkallo Creek is part of the Growling Grass Frog (GGF) conservation area (CA34 and CA23) (DELWP, 2017a), as shown in **Figure 5-8**.
    - A temporary palustrine wetland identified to the east of Kalkallo Creek north of Gunns Gully Road is considered to have moderate potential for groundwater interaction (from regional studies).
- Terrestrial:
    - Minor areas of vegetation listed as grassy plains woodlands are classified as having high to moderate potential for groundwater dependence within the project area (from national assessment).

The Growling Grass Frog conservation areas were established under the Biodiversity Conservation Strategy for Melbourne's Growth Corridors for protection and enhancement to achieve the conservation outcomes for this threatened species. All conservation areas are protected for this purpose under the conditions of the Commonwealth Government's Environment Protection and Biodiversity Conservation Act approvals, zoning and overlay restrictions in the relevant planning schemes, and in some cases, land management co-operative agreements. The Biodiversity Conservation Strategy states (DELWP, 2017a):

> *Development that occurs as a direct result of urban development, such as transport infrastructure (i.e., roads, bridges), utility infrastructure and public facilities, will only be permitted within conservation areas with the agreement of [DELWP] and only after appropriate design and construction impact mitigation processes have been put in place.*

As such, any development within the declared conservation area will require review and agreement with DELWP. Works will need to consider potential for interaction with groundwater that may impact on Kalkallo Creek, which is groundwater dependent and of importance to growling grass frog habitation.

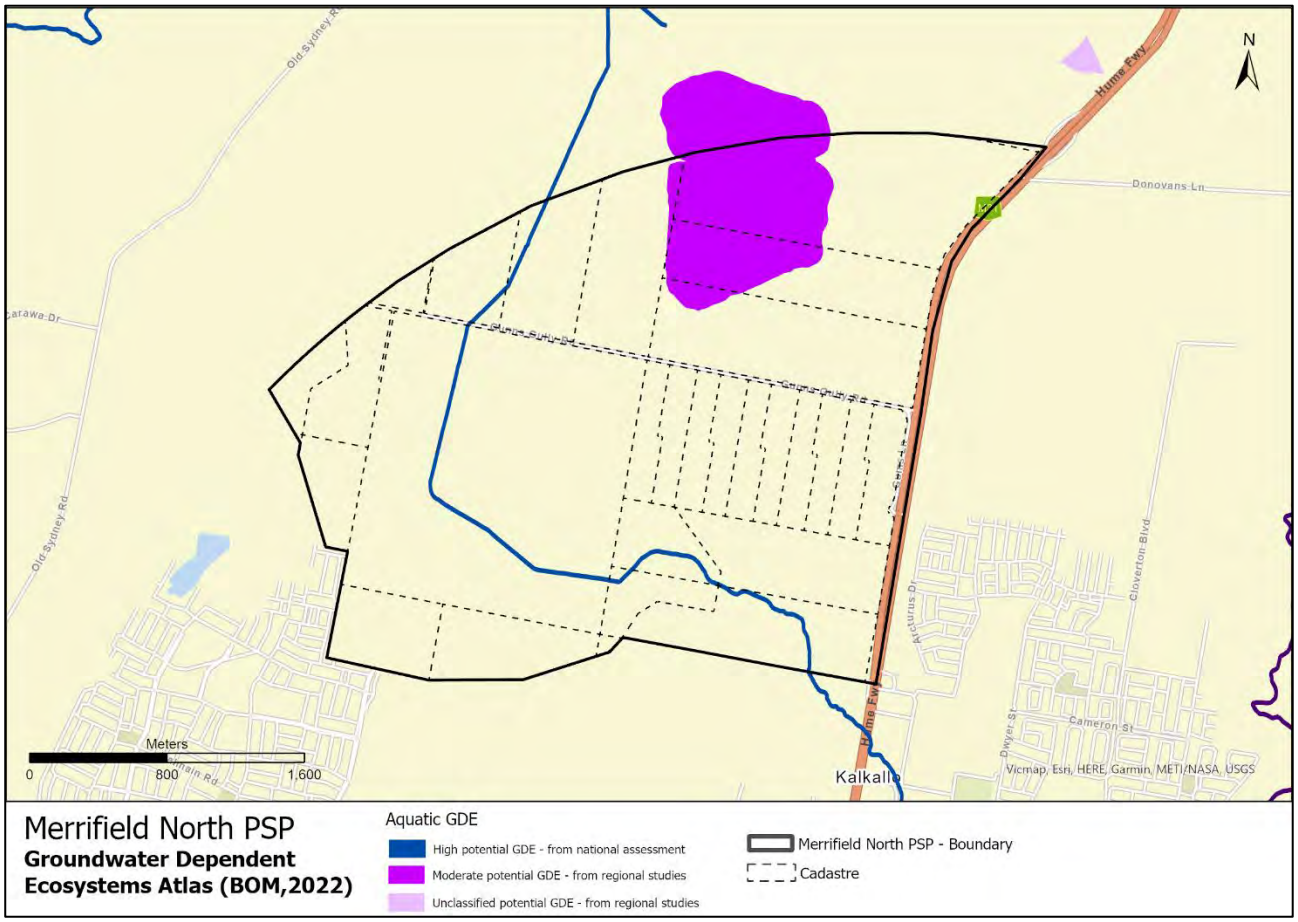


Figure 5-7. Aquatic Groundwater Dependent Ecosystems

Map illustrating the location of aquatic GDEs within the vicinity of the Merrifield North PSP area. Note PSP boundary is approximate. Map generated from the Bureau of Meteorology Groundwater Dependent Ecosystem Atlas (2012).

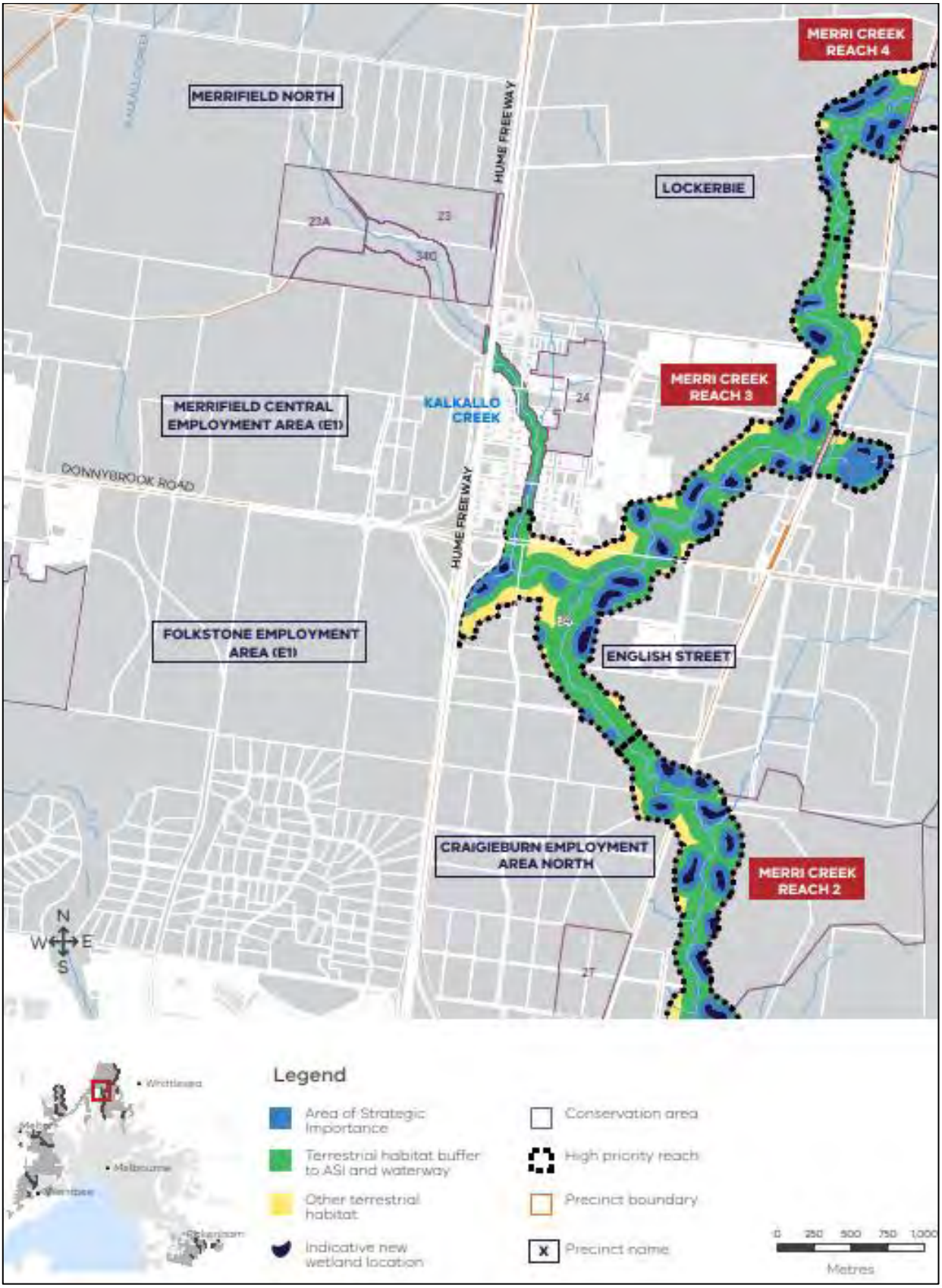


Figure 5-8. Growling Grass Frog conservation areas and areas of strategic importance
Map showing Growling Grass Frog conservation areas in the area of Merrifield North PSP (DELWP, 2017a).

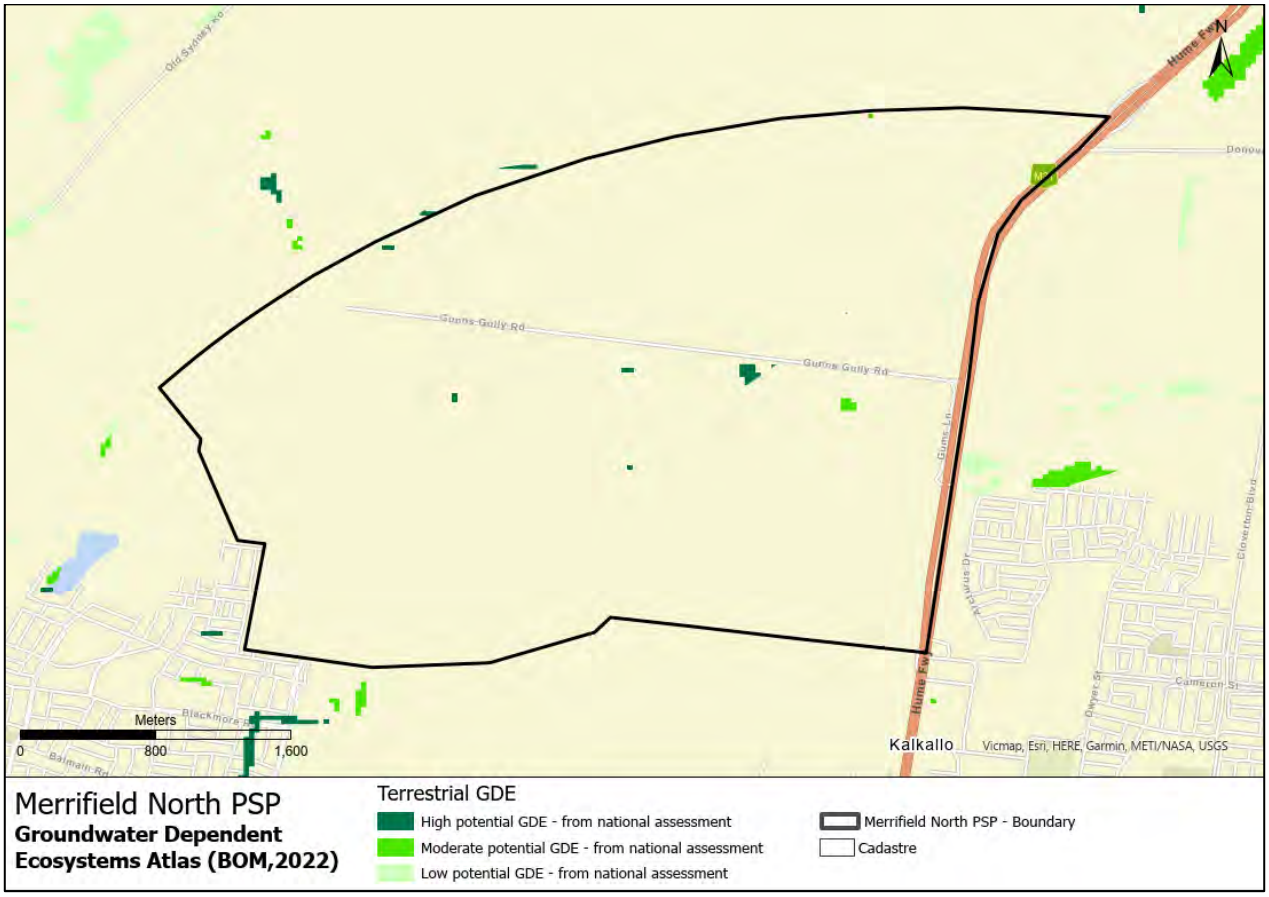


Figure 5-9. Terrestrial Groundwater Dependent Ecosystems
Map illustrating the location of terrestrial GDEs within the vicinity of the Merrifield North PSP area. Note PSP boundary is approximate. Map generated from the Bureau of Meteorology Groundwater Dependent Ecosystem Atlas (2012).

5.5.3. Groundwater quality

Regional groundwater salinity mapping indicates that groundwater quality within the Merrifield North PSP area is likely to be highly variable (**Figure 5-10**), ranging from 1,000-7,000 mg/L TDS (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 most conservative salinity values for the project area, the relevant groundwater segment is A2 (601-1,200 mg/L TDS). 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 (including stock watering)
- Industrial and commercial use
- Water-based recreation
- Traditional Owner cultural values
- Buildings and structures
- Geothermal properties

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. The aggressivity of groundwater cannot

be assessed with available data; groundwater quality sampling is recommended to understand potential for groundwater impact on below ground infrastructure, if required.

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

- Identify areas subject to saline groundwater discharge or high ground water recharge.
- Ensure development is compatible with site capability and the retention of vegetation and complies 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 project area.

Figure 5-10. Regional groundwater salinity
Map illustrating the regional groundwater salinity within the vicinity of the Merrifield North PSP area.

5.5.4. Groundwater users

The water authority responsible for groundwater licensing across the project area is Southern Rural Water. The state database lists 69 groundwater bores within 2km of the Merrifield North PSP area, with 11 of these identified within the PSP boundary.

- Of the 69 bores, 45 are listed for domestic and stock purposes.
- Of the 11 within the PSP boundary, 10 are listed for domestic and stock purposes, and one for "non-groundwater" purposes.

A summary of local groundwater users is provided in **Table 5-3**. A complete list of groundwater bores within the 2km buffer is provided in Appendix C – Groundwater bores. Given the number of sites, it is recommended that Southern Rural Water is contacted to confirm the existence of the bores and the currency of licenses.

Table 5-3. Summary of known groundwater users

Bore use type	No. bores	Bore depth range (mbgl)
Domestic and stock	45	0.00-106.68
Irrigation	2	18.00-47.00
Observation	6	12.00-15.00
Groundwater investigation	1	13.50
Non groundwater	5	N/A
Not known	10	0.00-150.00

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, the desktop review, and the land contamination site inspection.

6.1 Existing Uses

Several existing and historical land uses were identified in the existing Merrifield North PSP area using Historical Aerial Imagery (Appendix B- Lotsearch Reports). Certain areas are within the project boundary and along the boundaries were historically used for commercial uses, including, but not limited to hotels, motor garages , service stations and grocers. In addition, a large portion of parcels are currently being used for agricultural, residential and industrial uses.

The current project area is predominately zoned as Urban Growth Zone and Public Use Zone 1 (Service and Utility). Additionally, there are several large patches of Farming Zone and Green Wedge Zone.

6.2 Historical aerial imagery

Aerial photographs from 1946 to 2022 were reviewed for land use changes. Observations are summarised in the table below. Copies of aerial photographs are provided in the Lotsearch Reports in Appendix B – Lotsearch reports.

Table 6-1. Summary of Review of Historical Aerial Imagery

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

Year	Description	Source
1946	On-Site: ▪ Most of the areas within the PSP area are open areas with minimal to an absence of either residential, commercial, or industrial areas. ▪ The road within the PSP area is apparent which is currently the Gunns Gully Road. ▪ Presence of a residential/farm area in the central portion of the PSP area near Gunns Gully Road. Off-Site: ▪ The roads that are immediately adjacent to the east and northeast boundaries are apparent. They are Gums Lane and Hume Freeway, respectively. ▪ Unknown structures located in the southeast portion of the PSP area (such as buildings) are distinct but business directory records in the 1960's identified that this is in the vicinity of the hotel. ▪ Presence of a dam beyond the northwest corner of the Merrifield North PSP area.	Vicmap
1968	On-Site: ▪ No notable changes are evident since 1946 Off-Site: ▪ No notable changes are evident since 1946	Vicmap
1974	On-Site: ▪ No notable changes are evident since 1968 Off-Site: ▪ No notable changes are evident since 1968	Vicmap
1979	On-Site: ▪ No notable changes are evident since 1974 Off-Site: ▪ No notable changes are evident since 1974	Vicmap
1980	On-Site: ▪ Appearance of a residential/farm area on the northeast part of the PSP area.	Vicmap

Year	Description	Source
	Off-Site: ▪ No notable changes are evident since 1979	
1984	**On-Site:** ▪ No notable changes are evident since 1980 **Off-Site:** ▪ No notable changes are evident since 1980 ***Note:*** only partial (70%) mapping coverage of the area was available to review.	Vicmap
1989	**On-Site:** ▪ No notable changes are evident since 1984 **Off-Site:** ▪ No notable changes are evident since 1984 ***Note:*** only partial (90%) mapping coverage of the area was available to review.	Vicmap
2002	**On-Site:** ▪ No notable changes are evident since 1989 **Off-Site:** ▪ No notable changes since 1989	Vicmap
2005	**On-Site:** ▪ Appearance of several residential/farmlands and industrial establishments along Gunns Gully Road. **Off-Site:** ▪ Appearance of additional roads on the Eastern section of the PSP area. ▪ Appearance of additional agricultural establishments in the Southeast section of the PSP area.	Vicmap
2009	**On-Site:** ▪ No notable changes are evident since 2005 **Off-Site:** ▪ No notable changes are evident since 2005.	Vicmap
2016	**On-Site:** ▪ No notable changes are evident since 2009 **Off-Site:** ▪ No notable changes are evident since 2009 ***Note:*** only partial (40%) mapping coverage of the area was available to review, although between 2016 and 2017 100% coverage is available	Vicmap
2017	**On-Site:** ▪ No notable changes are evident since 2016 **Off-Site:** ▪ No notable changes are evident since 2016 ***Note:*** only partial (60%) mapping coverage of the area was available to review, although between 2016 and 2017 100% coverage is available	Vicmap
2022	**On-Site:** ▪ No notable changes are evident since 2017 **Off-Site:** ▪ Evidence of largely residential development immediately beyond the Hume Freeway to the southeast of the PSP. ▪ Evidence of largely residential development to the immediate southwest of the PSP.	Vicmap

The review of the historical aerial photographs indicates that most of the land covering the Merrifield North PSP area represents agricultural land with a small number of rural residential/farm properties. Agricultural land uses have the potential to result in contamination due to the presence of on-farm septic systems and general farm practices / activities as well as the presence of hazardous chemicals which are potentially labelled (indicating hydraulic oils, glyphosate, Spreadwet 1000, Roundup Ultramax and an unknown herbicide), and various containers without labels (typically in 220-L steel drums); stockpiled materials,

(including mulch, soil, general wastes, and used tires); abandoned vehicles; and likely presence of stock dips from farm residences and associated buildings and infrastructures such as farm sheds and stock handling or spraying areas in relation to the identified industrial property located by the EPA at 135 Gunns Gully Road.

Beyond the boundary of the PSP area, review of land current and historic land uses identified commercial / industrial land uses in close proximity to the PSP that also have the potential to have resulted in contamination. These land uses include:

- A hotel located at 1324 Hume Highway, approximately 174m southeast of the PSP where sewage treatment operations were previously licenced by EPA Victoria
- Two petrol stations located at 1340 and1330 Hume Highway, positioned approximately 14m and 45m southeast of the PSP respectively, where storage and distribution of fuel have historically occurred.

6.3 EPA Victoria Records

6.3.1. Priority sites register

The Lotsearch Reports (June 2022) within the Merrifield North PSP area reported an EPA priority site with a notice. Details of this site are summarized in **Table 6-2** below.

Table 6-2. Summary of EPA Victoria Priority Sites

Table presenting a summary of the EPA Victoria Priority Site located within the Merrifield North PSP boundary.

Notice Number	Address	Suburb	Issue	Distance
90012213	135 Gunns Gully Road	Mickleham	Current Industrial Site that requires an assessment and/or clean up	0 m

The above mentioned site at 135 Gunns Gully Road has a high likelihood to impact the Merrifield North PSP as it is within the identified Project Area.

A list of former EPA priority sites and other pollution notices within the Merrifield North PSP area is also included in the report and is listed in **Table 6-3**. This list is not expected to be exhaustive since notices are being revoked and removed from published lists.

The EPA Victoria database results are provided in Appendix B – Lotsearch reports.

Table 6-3. Former EPA Victoria Priority Sites and Other Pollution Notices

Table presenting a summary of previous EPA Victoria Priority Sites and other Pollution Notices located within the Merrifield North PSP boundary.

Notice Number	Notice Type	Company	Address	Suburb	Status	Issue	Date Issued	Distance
90007560	Pollution Abatement Notice	Kalkallo Hotel (Vic) Pty Ltd [Kalkallo]	Not identified	Kalkallo	Previous Pollution Notice	Not identified	08/08/2017	95 m, southeast
90007561	Pollution Abatement Notice	Kalkallo Hotel (Vic) Pty Ltd [Kalkallo]	Not identified	Kalkallo	Previous Pollution Notice	Not identified	21/06/2017	95 m, southeast

The potential for the above-mentioned sites to negatively impact the Merrifield North PSP area is considered insignificant given that the regional groundwater flow direction is towards the southern direction.

6.3.2. Licenced activities and works approvals

There are no records of any EPA-licensed activities within the Merrifield North PSP area.

Beyond the Merrifield North PSP boundary, a former licensed site was recorded within the area. The details are summarised in **Table 6-4** below.

Table 6-4. Summary of Former EPA Licences Activities (Beyond the PSP Boundary)

Summary of Former EPA Licenced Activities that exist beyond the Merrifield North PSP boundary

Transaction No.	Organisation	Address	Suburb	Scheduled Categories	Distance
4583	Kalkallo Hotel (VIC) Pty Ltd [Kalkallo]	1324 Hume Highway	Kalkallo VIC 3064	A03 Sewage Treatment	174 m, southeast

6.3.3 Environmental audit sites

There are no records of any EPA Environmental Audits within the Merrifield North PSP area.

6.3.4. Groundwater quality restricted use zones

No Groundwater quality restricted use zones (GQRUZ) sites exist either within the boundary of the Merrifield North PSP area.

6.4. Waste management facilities and landfills

There are no records of any waste management facilities and landfills within the Merrifield North PSP area.

6.5. Other reviewed reports

There are no available environment reports or studies related to Merrifield North that were reviewed before this report.

7. Site characterisation

7.1. Site contamination assessment

Each parcel of land within the boundary of the Merrifield North PSP area was evaluated 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 'no potential for contamination' (unless determined otherwise based on professional judgement). This would apply to properties where highly localized 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 evident of potentially contaminative activities has been identified (i.e., open paddocks with no history of intensive agriculture, buildings, or structures present).

A site inspection (Stage 2 assessment) was then undertaken at selected properties to verify the assigned potential for contamination. While the site inspection focused more on specific areas of interest, Jacobs also assessed the wider site extent to confirm land uses, where practicable.

The outcomes of the Stage 1 and Stage 2 assessment are presented in:

- **Table 7-1**, which presents a summary of the overall number of parcels within the Merrifield North PSP Area that were characterised as either presenting a 'high potential', 'medium potential' or 'no potential' to contaminate land
- Appendix D which presents the evaluation outcome for each of the 26 parcels of land within the Merrifield North PSP area
- Figure 3 in Appendix A, which spatially represents the evaluation outcome

While each identified property is slightly different with respect to the potential for contamination, there are some land uses that are commonly present across the Merrifield North PSP area. The potential sources of contamination observed within the Merrifield North PSP area were related to the general agricultural land use of the PSP. Observations include presence of containers with labels (indicating hydraulic oils, glyphosate, Spreadwet 1000, Roundup Ultramax and an unknown herbicide), and various used containers without labels (typically in 220-L steel drums); stockpiled materials, (including mulch, soil, general wastes, and used tires); abandoned vehicles; and likely presence of stock dips from farm residences and associated buildings and infrastructures such as farm sheds and stock handling or spraying areas. While the evaluation completed has sought to identify potential contaminants of concern relevant to each parcel assessed, the presence of other contaminants of concern cannot be ruled out at this stage owing to the limited assessment of each individual property (i.e., generally targeted observations, with no intrusive sampling conducted, and presence of thick vegetation in many areas that hid the ground surface).

Common land uses are discussed below as well as general comments relating to the Merrifield 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 parcels forming the Merrifield North PSP area have been used for agricultural purposes for an extended period of time. As such, there is likely to be a long history of general agricultural processes within the Merrifield North PSP area. The most notable of these is crop spraying, livestock grazing, and horse agistment/equine operations. Contaminants of concern associated with this process typically include metals,

pesticides, herbicides, and fungicides as well as potentially nutrients (from manure, slurry application, and other fertilizers) and biological contaminants (from animal burial). Residential land uses can also be found within the PSP area which indicates the presence of septic tank systems for on-property sewerage treatment (in the absence of a reticulated sewerage system across the PSP). Since these are located underground, they can be difficult to identify during the site inspection. In this case, contaminants of concern can include biological contaminants and nutrients associated with leakages from septic tank systems.

General agricultural use and rural septic tank systems are generally considered to present a minimal to nil potential to contaminate the land. At some locations however, contamination potential has been determined to be either medium or high - such properties are identified in Appendix D.

7.1.1.2 Farm residences and associated buildings

Farm residences and associated buildings are the most common potential source of contamination across the Merrifield North PSP area. These areas are typically used for storage of farm machinery (both operational and non-operational), materials, vehicles, and many other miscellaneous items. Buildings and structures may also include fuel storage areas for refuelling farm machinery (typically in above-ground storage tanks) as well as storage areas for items such as agricultural chemicals (pesticides, herbicides, fungicides, etc.), oils, lubricants, and solvents for machinery maintenance.

Based on the above, the most likely sources of contamination include potential spill to ground of petroleum hydrocarbons / fuels and chemicals from general farm machinery/equipment storage and maintenance activities. However, spillages of other agricultural chemicals may also impact upon soils. Given that such chemicals are typically stored in small volumes impacts are therefore likely to be localised in extent.

There were also old buildings that were present within the PSP area which could indicate the use of asbestos 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). While asbestos presents a limited risk while it remains in the bonded matrix (i.e., as bonded asbestos cement sheeting in roofing, insulation, and tile adhesives), free fibres can present a greater potential risk. Mobilisation can occur through several processes including (but not limited to) abrasion, sanding and cutting that can result in the release of fibres. 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 presence of imported fill can be difficult to identify without undertaking intrusive investigations, particularly in areas that are heavily vegetated. Fill material is most likely to be found in locations where previous construction/development works have been undertaken.

Wastes can also be generated and deposited on-site, the type and volume of wastes are contingent on the activities and processes being performed. 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.

Potential contaminants of 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 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), and metals.

7.1.1.4. Surrounding land uses

Sites located immediately outside of the Merrifield 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 PSP area. Off-site sources identified in the vicinity of the PSP areas are summarised in **Table**

7-2. Sites listed in this table were inspected from the closest publicly accessible areas during the Stage 2 assessment.

The site located outside of the PSP areas with the highest risk ranking can be found in the southeast portion where there are operational petrol stations just beyond the south-east corner of the Merrifield North PSP area (two petrol stations located 14m and 45m southeast respectively). While the presence of such land uses would represent a high potential for contamination, the potential for these land uses to impact on the Merrifield North PSP is considered insignificant due to:

- Regional groundwater flow direction is likely to be from north to south, meaning that any contamination from groundwater (if present) would be unlikely to intersect the PSP area. Locally, groundwater flow is likely to be towards Kalkallo Creek, which is also towards the south of these petrol stations (away from the PSP area)
- The closest petroleum service station site can be found on the southeast side at 14m and 45m from the PSP area boundary, respectively. The potential for contamination is nil based on the regional and local groundwater flow direction.

The remaining off-site properties comprised small farms, rural residences, and small-scale commercial properties. There are also some industrial premises on the eastern fringe of the Merrifield North PSP area (beyond the Hume Freeway) but based on their proximity as well as the nature of the operations observed, the potential for contamination of the PSP areas was perceived to be minimal to nil.

7.1.2. Site characterisation

The potential on-site sources of contamination were selectively assessed (where access was permitted) during the site inspection of the Merrifield North PSP area on the 12th of October 2022. Access was only provided for property no. 4 and 6 (Refer to Figure 3 in Appendix A) while several properties were also inspected from the closest publicly accessible areas due to access restrictions (or other practical reasons).

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 'medium' and 'high' ranked sites including those with no potential for contamination are also presented in **Table 7-1**.

In the Merrifield North PSP area, farming and agricultural practices represented the most commonly encountered potential contamination sources. Observed items included labelled containers (e.g., hydraulic oil, herbicides, wetting agents), various unlabelled drums, and stockpiled materials. These impacts are likely confined to localized areas. Based on this assessment, properties were generally categorized as having no potential for contamination, except as noted 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 below. In some instances, access to the property is restricted; thus, observations were made outside the vicinity of the land parcel.

Table 7-1. Summary of On-Site Characterisation – Potential for Contamination

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

No Sites	Contamination Potential	Recommended Further Action
0	High	Proceed to Environmental Audit
6	Medium	Proceed to Preliminary Risk Screening Assessment to determine the need for an Environmental Audit

No Sites	Contamination Potential	Recommended Further Action
20	No potential for contamination	No further action required – General Environmental Duty applies

Table 7-2. Summary of Off-Site Characterisation – Potential for Contamination

Table summarising the contamination potential for sites within the vicinity of the Merrifield North PSP, 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 Merrifield North PSP area.

Address	Land Use	Contamination Potential	Potential Impact on Properties within Merrifield North PSP
1340 Hume Freeway	Caltex Petrol station	High	Located 14m to the immediate southeast of the PSP boundary, on the eastern side of the Hume Freeway. Groundwater is likely to be flowing to the south, limiting the potential for contamination (if present) to impact upon the Merrifield North PSP area.
1340 Hume Freeway	Independent Fuel Supplies Petrol station	High	Located 45m to the immediate southeast of the PSP boundary, on the eastern side of the Hume Freeway. Groundwater is likely to be flowing to the south, limiting the potential for contamination (if present) to impact upon the Merrifield North PSP area.

Picture 7-1. Site Inspection – Selective Photographs

A selection of photographs that illustrate common observations relating to land use across the Merrifield North PSP area. Top left: Example of general surface waste (i.e., used tyres and steel and plastic containers). Top Right: Steel container indicating hydraulic oil for heavy equipment. Bottom left: Plastic isotainer bulk drums with fire hose reels, generators, and heavy machinery. Bottom right: Abandoned wrecked vehicle and rusted above-ground storage tank.

Picture 7-2. Site Inspection – Selective Photographs

A selection of photographs that illustrate common observations relating to land use across the Merrifield North PSP area. Top left: Orange soil atop scrap metal stockpile. Top Right: Example of a plastic container indicating contents as herbicide. Bottom Right: Dilapidated and unlabelled steel drums. Bottom left: Stockpiled general waste materials including plastic crates and drums.

7.2 Surrounding PSPs

The Lockerbie Precinct Structure Plan (2012) is located to the east of Merrifield North PSP and is predominantly planned for residential development, education facilities, local activity centres and open space.

The Folkstone Employment Area Precinct Structure Plan (2008) is located to the south of the Merrifield Central Employment area and is planned for industrial and business activities. The area is predominately zoned for industrial land uses, Mickleham Post-Entry Quarantine Facility (Commonwealth land), and residential land uses.

The Merrifield West Precinct Structure Plan (2012) is located to the south east of the Merrifield North PSP area. The area is primarily planned for residential purposes, supported by education centres, local services and commercial uses.

The Beveridge South West Precinct Structure Plan (VPA 1061), located directly to the north of the Merrifield Precinct, is planned for future residential land uses and therefore would not be a constraint. The Beveridge North West Precinct Structure Plan (2024) is located further to the north. While there is a proposed quarry (WA1473), it is approximately 6kms from the Merrifield Precinct and therefore is not a constraint on sensitive land uses.

The Merrifield Central Employment Area Precinct Structure Plan, approved in 2008 under Amendment C092, established the Merrifield Business Park. It is located directly to the south of the Merrifield Precinct. The area is currently zoned as Comprehensive Development Zone (Clause 37.02) Schedule 2 (along the east of the PSP area) and Schedule 4 (along the west of the PSP area). These employment precincts may contain industry that were developed with adequate separation distances at the time. Having undertaken a review of the current businesses established within the Merrifield Central Employment Area, the use of land are predominately warehousing and manufacturing. A site visit would be required to confirm how the land is used and whether there are any sites that may be undertaking activities that require a land use buffer. It is likely that the Merrifield Business Park (CDZ2) is already constrained by sensitive land uses located to the south-west and east, and will be further constrained by future sensitive land uses in the CDZ4.

7.3. Geotechnical assessment

7.3.1. Available geotechnical information

The following existing geotechnical reports are noted to be available within the PSP Area and have been referenced to obtain a general understanding of the likely subsurface conditions at the proposed project site.

- Jacobs (2020), NGC Missing Link Package 2, Detailed Design Report, Revision A, ref: IS0803
- Jacobs (2019), NGC Missing Link Package 2, Concept Design Report, Revision B, ref: IS0803NG-CV-RP-0001
- Jacobs (2018), NGC Missing Link Package 2, Ground Conditions Desktop Assessment, Revision B, ref: IS0803NG-GE-RP-0001
- Jacobs (2018), Kalkallo Creek Main Sewer Stages 1E, Geotechnical Baseline Report, Revision B, ref: IS0803M6-GE-RP-0001 (1)
- Jacobs (2018a), Kalkallo Creek Main Sewer Stages 1E, Supplementary Ground Investigation Factual Report, Revision A, ref: IS0803M6-GE-RP-0005
- Jacobs (2017), Kalkallo Creek Main Sewer Stages 1E, Geotechnical Factual Report, Revision B, ref: IS0803HE-GE-RP-0011

- Jacobs (2016), Kalkallo Creek Main Sewer Stages 1B, Ground Conditions Report, Revision C, ref: IS0803HE-GE-RP-0006
- Jacobs (2016), Bald Hill South Drinking Water (DW) and Non-Drinking Water (NDW) Infrastructure Project, Ground Conditions Report, Revision A, ref: IS0803HX-GE-RP-0002
- Jacobs, 2016, Kalkallo Creek Main Sewer Stage 1A – Ground Conditions Factual Report, ref: IS0803EY-GE-RP-0004

Considerations have been based on publicly available sources such as soil and geology maps. In addition, the geotechnical considerations have also been based on Jacobs own experience of local/regional ground considerations & associated engineering aspects in similar ground conditions within the general adjacent vicinity of Merrifield North PSP area.

The Jacobs (2020) report summarises the ground condition within the available reports and will be referenced in this desktop assessment. Relevant information from the above reports was considered when preparing this desktop study. The boreholes that were located within a relevant distance (less than 1km to project boundary) to the proposed PSP site were assessed and were used to assist in developing a preliminary geological model for the site and are summarised as below.

7.3.2 Subsurface condition

The observed soil and rock profile have been characterized into geotechnical units. These geotechnical units were assessed from the available geological information, as well as from the borehole logs. A summary of the ground condition is presented in Table 3.5 of the Jacobs (2020) report and reproduced in **Table 7-3**, which outlines the geotechnical units developed for the soil and rock profiles. The subsurface layers have been separated into topsoil, basaltic residual soil, weathered basalt rock, siltstone residual soil and weathered siltstone rock.

Table 7-3. Summary of subsurface condition reproduced from Jacobs (2020) report

Unit	Depth to top of Layer (m)	Thickness (m)	Unit description
1a-Topsoil	0.0	0.15-0.2	TOPSOIL: silty clay of low plasticity, brown to dark grey/brown trace/with some rootlets, dry
1b-Fill	0.0	0.55	FILL: Gravelly CLAY, high plasticity, red brown, firm to stiff (only in BH1B-11)
2a-Residual soil (Basalt)	0.15-0.2	0.6-6.3	Silty CLAY and clay: medium to high plasticity, dark brown to dark grey/brown, stiff to very stiff, dry to moist, trace white minerals and cemented clay gravel
2b-Weathered Basalt	0.6-6.3	>9	BASALT: Highly to slightly weathering, highly vesicular to non-vesicular (1 to 10 mm vesicles), dark grey and brown, trace iron staining and calcite
3a-Siltstone residual soil	0.15	1.8	Silty CLAY, medium plasticity silty clay yellow/brown and brow, stiff, dry (only in borehole KAL10A),
3b-Extremely weathered Siltstone	1.8	0.4	SILTSTONE: extremely weathered, fine grained, yellow/brown to grey/brown, trace iron staining and trace iron oxide (only in borehole KAL10A)
3c-Highly or less Weathered Siltstone	2.15-	>7.8	SILTSTONE: high to moderately weathered, fine grained, grey brown to pale grey, trace iron staining and trace iron oxide (only in borehole KAL10A)

Note: reference should be made to the Jacobs (2020) report for detailed information.

Table 7-3 does not include presence of Alluvial deposits (Qa2) and Colluvial deposit (Qc1/Qrc/Nc1) indicated in the geological map and seamless geology.

7.3.3. Variation in ground model

Variable ground conditions are expected within the project area as indicated in **Table 5-1** and **Table 5-2**. The main geological units presented in the regional geological maps are Alluvial (Qa2) and Colluvial soil deposits (Qc1/Qrc/Nc1) and underlying and variably weathered bedrock rock types of the Newer Volcanics Group (Qvn/Neo/Neo2) and the Dargile Formation (Sud)/Humevale Siltstone (Dxh).

The Seamless geology indicates that Kalkallo Creek runs through alluvial terrace deposits (Qa2). Alluvial soils along the banks of the Creek are anticipated to comprise an interbedded sequence of sand, gravel, silt, and sandy silt. The ground profile in this unit will be highly variable, with potential layers of soft silt and loose sand contained within denser/harder sand and silt layers. This material is indicated by Sunbury Map (1:63k scale) to be of a colluvial origin. As the Seamless geology map is recent in production, is the Sunbury geological map indication is likely outdated. However, the material will need to be confirmed through intrusive investigation works.

Newer Volcanics Basalt typically comprises residual soil and extremely weathered to fresh basalt characterized by the clay of high plasticity with occasional gravel. The high plasticity clay is typically characterized by high shrinkage and swell potential due to changes in soil moisture contents.

The depth of weathered rock in the Newer Volcanics group can be highly variable over short horizontal distances. Weathering within the basalt profile is generally extremely weathered to slightly weathered with locally fresh rock. The strength of the rock encountered at rock head level (typically defined as medium strength moderately weathered or better) is generally medium to extremely high depending on the degree of weathering. It is also common to encounter basalt 'floaters' which represent basalt ejected at the surface level which is then contained within the upper weathering profile. Excavations should consider the potential to intercept competent basalt boulders and cobbles within the residual soil profile.

7.3.4. Soil reactivity

The samples tested for soil classification purposes indicate Liquid Limit ranges between 66-72 and Plasticity Index between 47-52 in the residual soil. The residual soil of the Newer Volcanic Group is typical of high reactivity and prone to shrinkage and swelling due to the seasonal changes to the moisture content of the soil. Australian Standard AS2870-2011 "Residential Slabs and Footings – Construction" indicates that Merrifield North is in a Climatic Zone 3 concerning shrink-swell movements. The depth of design suction changes in Climatic Zone 3 can be up to 2.3m below ground level, i.e., the depth of soil profile prone to shrink-swell activity.

Based on the Melbourne climatic zones indicators and the classification system presented in Table D1 of AS2870-2011, an indicative site classification of Class "H2 to E" (Highly reactive to extremely reactive clay site) could be adopted for design purposes, where the depth of clay over massive rock is greater than 1.5 m. Although this classification would depend on the depth, thickness, and reactivity of the clay material in this area, a characteristic surface movement (ys) of between 60 mm to greater than 75 mm could be expected as per Table 2.3 of AS2870-2011.

The thickness of the residual soil profile in the Newer Volcanics is likely to be highly variable, and it is Jacobs's experience in this area and with this geological unit that the depth to basalt can vary significantly over relatively short horizontal distances.

The above site classification is based on regional geological information and is intended for preliminary consideration only. Site-specific geotechnical site investigations, which may include appropriate soil sampling and associated laboratory testing should be undertaken before the design and construction of any shallow foundations, pavements, and associated civil infrastructure as part of any future building permit application.

It should also be noted that the residual basaltic clay is expected to be alkaline and sodic, resulting in an increased risk of dispersion, blocking of drainage systems, etc.

Australian Standard AS 2870-2011 establishes performance requirements and specific designs for common foundation conditions, as well as provides guidance on the design of footing systems for residential slabs and footings on reactive soils. Although this standard applies directly to residential foundations, it is typically used to define conditions for most shallow footings for structures, as well as in part within the Australian construction industry, to assess shrink-swell impacts on other infrastructure such as roads and railways.

7.3.5. Sodic soils

Jacobs undertook a review of the proposed Kalkallo Retarding Basin for Melbourne Water (Jacobs 2021) concerning the design of stormwater assets in dispersive soils, specifically focussing upon the findings of the SESL (January 2020) sodic soil investigation. The summary findings of the associated Jacobs 2021 report were as follows:

- Sodic soils were identified on the site
- The risk of dispersion is currently low due to long-term site stability
- Soil conditions do not vary widely across the site with clay textures dominating
- Sodic conditions increase with depth i.e., have a high sodic nature below 0.50mbgl becoming very high/extreme at 1.0mbgl
- Soils are amenable to improvement with gypsum and biosolids
- There is a natural detention basin on the site with potentially re-developable land around the periphery
- Soils were also found to have both vertic and non-vertic properties
- Low-lying and central sections appear as darker soils with greater shrink-swell capacity.

Profiles in the north and west of the site were paler in colour and did not exhibit the same degree of shrink-swell and were not vertic.

The Mitchell Planning Scheme is undergoing current revisions related to the development of Urban Growth Zones. These include the following measures as denoted in the proposed Urban Growth Zone Schedule 3:

- Clause 2.5 – *A permit is required to undertake bulk earthworks, where the land has been identified as having sodic/dispersive soils*
- Clause 3.0 – *An application to subdivide land or undertake bulk earthworks must be accompanied by a sodic and dispersive management plan*
- Clause 4.0 – *A permit to subdivide land or undertake bulk earthworks must include a condition that requires a site management plan be prepared that implements the recommendations identified in the sodic and dispersive soil management plan.*

It is unclear if this proposed approach to managing sodic dispersive soils will apply to Merrifield North developments in the future, but due to their proximity and probable similar ground conditions, this could be likely.

Sodosols are likely to compose most of the proposed area. These tend to be sodic and therefore if exposed to overland flow can result in extensive dispersion. These characteristics require considerable management during construction and in the permanent operational phase of the Merrifield North PSP area relating not only to structures, roads/pavements, earthworks, and drainage features, but also buried utilities. In addition, these types of soils should not be used for construction materials unless ameliorated, protected, or encapsulated accordingly.

7.3.6. Geotechnical risk assessment

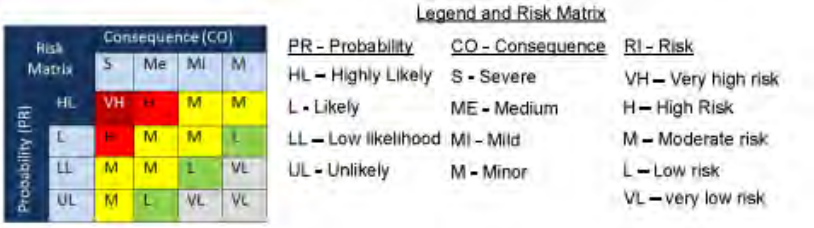
A preliminary assessment of the geotechnical risks associated with the land suitability assessment has been undertaken. A risk assessment matrix considering the likelihood and consequence, as shown below has been used to characterize risks. The risk ranking presented in **Table 7-4** below has been undertaken based on the available desktop information to date.

Table 7-4. Design Geotechnical Risk Summary

Summary of the geotechnical risk associated with the Merrifield PSP, including the relevant risk matrix

Risk	Risk Rating	Risk Description	Potential Mitigation Measures	Mitigated Risk Rating
Uncertainty of ground conditions	H (HL x ME)	Lack of information leading to incorrect ground models. Unduly conservative design Potential construction delays to revise design	Carry out site specific additional ground investigation and laboratory testing	L (LL x MI)
Instability of excavation	M (LL x S)	Potential instability of soils Collapse of excavation Excessive inflow of perched water	Open cut excavations up to 1.5m height shall be battered to a slope no steeper than 1V:2H. Dewatering to be designed, installed and managed properly.	L (LL x MI)
sodic soils for earthworks	M (LL x S)	Significant risks both during construction and the permanent situation exist for proposed developments on soils with a sodic nature. These include any significant earthworks (cuttings or exposure of natural underlying soils) that are to be undertaken, the installation of utilities (especially fluid carrying services), and drainage channels. Significant erosion/dispersion could occur if exposure to rainfall and/or overland flow was to occur in these circumstances	Undertaking an appropriate investigation for sodic soils. Earthworks – staging of works to minimize exposures during construction; adequate and appropriate covering of exposed surface during construction to minimize rainfall drop action/overland flow impacts	L (LL x MI)
Surface movement of shallow foundations due to shrinkage and swelling of expansive soil	M (L x ME)	Excessive surface movement due to shrinkage and swelling of the potential expansive soil subjected to seasonal changes in moisture content.	Excavate the expansive soil and replace with blinding concrete to base of concrete. If shallow rock is expected, remove all expansive soil and found the structure on weathered rock.	L (LL x MI)
Settlement and Bearing capacity of shallow foundations	M (LL x ME)	Bearing capacity failure of shallow foundations, excessive settlement and damage to structures/equipment (particularly regarding swamp sediments)	Ensure that weight of structures does not exceed the bearing capacity of the soil If bearing capacity of soil is not adequate, remove any soft ground and replace with either blinding concrete or selected non-reactive cohesive and non-porous fill	L (LL x MI)

Risk	Risk Rating	Risk Description	Potential Mitigation Measures	Mitigated Risk Rating
Damage to adjacent properties	L (LL x MI)	Ensure existing utilities have been cleared and diverted from excavation location Excavation may lead to excessive vibration and induce structural damage to the adjacent properties.	Undertake pre-construction survey of adjacent properties Contractor to undertake vibration assessment and select appropriate machinery for excavation. Contractor to monitor vibration level during excavation and minimise damage.	VL (UL x MI)



7.4. Hydrogeological assessment

Based on the available hydrogeological information and bore data for the Merrifield North PSP area, a summary hydrogeological conceptual model is outlined below:

- The local hydrogeology is defined by two main aquifers: the Quaternary Aquifer – QA (surficial alluvial terrace deposits associated with Kalkallo Creek and local watercourses) and the Upper Tertiary/Quaternary Basalts – UTB (regional aquifer in the Newer Volcanics basalt lithology).
- The QA overlies the UTB across the western side of the site and follows the Kalkallo Creek as it tends southeast towards the Hume Highway. The UTB is predominant at the surface of the western part of the site.
- Local aquifers are recharged by diffuse rainfall and surface water infiltration. As such, all areas of the site are potential groundwater recharge areas.
- The water table is expected to be shallow (<5 mbgl) across most of the Merrifield North PSP area. Nearby field investigations indicate groundwater could be deeper (Jacobs, 2018) and onsite monitoring is required to verify local water table depth. Deeper groundwater (5-20 mbgl) is likely to be encountered in the eastern extremes of the site.
- State-wide groundwater salinity mapping indicates that groundwater quality within the project area is likely to be highly variable, ranging between 1,000-7,000 mg/L TDS. The conservative end of this range corresponds to salinity segment A2 in the Environmental Reference Standard. No SMO applies to the PSP.
- Review of the Groundwater Dependent Ecosystems (GDEs) Atlas identified several high to moderate potential GDEs in the project area.
    - Kalkallo Creek is listed as a high-potential aquatic GDE, and a palustrine wetland is classed as having a moderate dependence on groundwater. The southern section of Kalkallo Creek is part of the Growling Grass Frog conservation area (CA34 and CA23) (DELWP, 2017a).
    - Scatterings of grassy plains woodlands across the site range from high to moderate terrestrial GDEs.
- Review of the state bore database indicates 10 stock and domestic bores within the PSP area (a total of 45 within 2 km of the project area).

In summary, in terms of land suitability, proposed works will need to be planned, constructed, and managed concerning the groundwater conditions expected and the environmental value of the resource. Consultation with DELWP will be required for any works within the established Growling Grass Frog conservation 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 any feasible land use. However, there are specific area that present a 'medium' (six properties) potential for contamination of land (refer to Appendix A-Figure 3 and Appendix D). These properties would require further assessment to better characterize the nature of contamination (if any) present.

- In accordance with Planning Practice Note 30 (PPN30), and assuming that all areas within the Merrifield North PSP area to be assessed on the assumption that they may be used in the future for a sensitive use:
    - Those sites that have been identified where current and/or former uses present a 'medium' potential for contamination of land should be assessed further through a Preliminary Risk Screening Assessment (PRSA). The PRSA process will determine whether an Environmental Audit is required and if so, the scope of that audit.
    - Those sites that have been identified where current and/or former uses present a 'high' potential for contamination of land should proceed directly to an Environmental Audit. It is noted that no land parcels in the PSP area are classified as 'high' potential for contamination.

  If the PRSA and/or Environmental Audit process were to be conducted as part of the planning stages for the Merrifield North PSP rezoning conducted by VPA (rather than representing a requirement of the developer of the site in the future) this may be considered a potential constraint due to the time and costs required to complete this assessment process.

  However, it is noted that in some circumstances it may be difficult or inappropriate to undertake either the PRSA or the environmental audit at the time of the planning scheme amendment, for example when *'the rezoning relates to a large strategic planning exercise or involve multiple sites in separate ownership'* (extract from PPN30 – DELWP, 2021). In such circumstances (which is consistent with the circumstances of this planning scheme amendment) it is acceptable to defer the requirements to complete a PRSA and / or environmental audit until after the planning scheme amendment has occurred. This can be achieved through the application of an Environmental Audit Overlay (EAO).

- It is likely that identified areas of concern will comprise discrete or localized areas of contamination that can be cost-effectively managed or remediated as part of the site development process (unless the additional assessments recommended for 'medium' and 'high' contamination potential site above establish otherwise). For example:

    - Septic tank systems associated with the rural residences are likely to be present within the Merrifield North PSP area which 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.
    - Containers with labels indicating that it likely contains agricultural chemicals, such as glyphosate, Spreadwet 1000, Roundup Ultramax, and other herbicides / pesticides and hydraulic oils were observed at specific properties within the PSP area. These are typically associated with the rural residences and farm properties and have the potential to cause localized subsurface contamination. As such, it is recommended that any such chemicals are identified, and appropriately contained and disposed of as part of future site development activities.
    - Miscellaneous small stockpiles and areas of discarded material/equipment on the ground surface were observed at some of the properties. These stockpiles, which include mulch, soil, and scrap metals with orange soil, imported fill, and rubbish 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.

Table 8-1. PPN30 Potentially contaminated land

Planning proposal *		Potential For contamination		Merrifield North precinct	PRSA or environmental Audit
		High	Medium		
Uses defined in Ministerial Direction No. 1, the EAO, and clause 13.04-1S					
• Sensitive uses: Residential use, childcare centre, kindergarten, preschool 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	No sites within category A No sites within category B	Not required
	Buildings and works associated with an existing use	B	B	No sites within category B	Not required
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	No sites within category C There is one site that is potentially within Category D, referred to as Property 10. Refer to table Appendix D - Summary of Potential for Contamination for more information.	C - Not required D – Required An Environmental Audit is required for Property 10 as identified in section Recommendations.

In accordance with Appendix D, a sensitive land use should not be located within property 10 (2\LP136262) without implementing the recommended steps as summarised in Section 10.

* This assessment is informed by Table 3 in PPN30 – Potentially Contaminated Land

8.2. Geotechnical consideration

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

Variable ground conditions

- The depth and reactivity of the Newer Volcanics residual clay which forms the surface geology for over half of the project area are unknown. Alluvium depth and reactivity along Kalkallo Creek are also

unknown. It is expected that the site would generally be considered highly reactive (Class "H2 to E") for residential footing design. It is noted that a geotechnical site investigation is recommended to characterize the site classification across the site.
- The variable thickness of the soil horizon over relatively short horizontal distances can lead to differential settlement of structures. As such, a geotechnical investigation is required to assess the depth to rock across the site.
- Samples acquired through the geotechnical investigation can be used to determine the presence of PASS, in addition to sodium content, pH, and dispersion characteristic of encountered soils.
- The site investigation is recommended to determine the location, extent, depth, and mechanical properties of identified swamp sediment deposits which may be unsuitable for use as foundation material.

Excavatability & stability of temporary excavations

- The variable geological conditions across the site can lead to sudden changes in ground conditions for excavation. Excavation in sand, gravel, and fill, or excavations extending below the water table may be unstable and should be battered or shored. This will need to be assessed at the time of construction; however, a conservative approach should be adopted when considering the stability of short-term batter slopes.
- The excavation of any surficial fill, alluvium, and natural soils is expected to be possible with the standard bucket excavation method utilizing a traditional excavator of suitable capacity.
- Excavation within granular Alluvium may provide a risk of caving and collapse. Alternative ground collapse control measures during excavation (i.e., benching/battering, shoring, shielding, etc.) should be considered to ensure that sidewall and overall integrity of the excavation are maintained.
- Excavations in Newer Volcanics could vary between relatively easy excavations in residual soils to difficult excavation in weathered rock. It is expected that the existing natural soils may be excavated using conventional excavation equipment such as tracked excavators. Excavators equipped with ripper attachments or hydraulic impact breakers may be required to loosen any weathered basalt that is encountered, before excavation. Blasting may be required for excavation in very high strength, fresh, or slightly weathered basalt rock.
- Construction adjacent to or near the crest of the Creek may pose several risks including slope failure and overturning of machinery. Ground Investigation and creek bank inspection are recommended to confirm the strength of soil and stability of the creek bank during construction and serviceability. The bearing capacity of footings constructed at the top of slopes would also require assessment, ensuring sufficient bearing capacity is available to the foundation soil.
- Temporary open-cut trenches less than 1.5 m depth may be constructed by battering the side of the excavation. Temporary batter slopes should not be steeper than 1V:2H in the cohesive alluvial deposits. High plasticity clays may be fissured and have weak shear planes, where soil block failures could occur, and this should also be allowed.
- Dispersive soils may be encountered throughout the project area. Dispersive soils are easily revealed and are susceptible to erosion and washing away. These soils may not be suitable for use as fill material as part of engineered fill to support foundations or pavements. Gypsum treatment for soil used to line drainage systems such as swale drains may be required. The dispersive nature of the soils should be tested as part of any investigation programme.

Foundation design

- Construction of shallow footings above alluvium deposits may pose a risk of structural damage due to insufficient bearing capacity and excessive settlement. Ground Investigation is recommended to confirm the ground conditions and assess the composition, thickness, strength, and compressibility characteristics of the underlying soil.
- Shallow footings of private and residential development constructed above residual basaltic soil may be subjected to large seasonal surface movement due to shrinkage and swelling of expansive clay. Care should be taken during the foundation design to minimize the impact of soil shrinkage and swelling and

limit the change in moisture content of the reactive soil (i.e., implementing drainage systems during bulk earthworks).
- Design of roads, drainage works, and underground assets would require consideration of the highly reactive and potentially dispersive nature of the clays to ensure serviceable performance and minimize ongoing maintenance requirements.
- Fill material, which may be present on-site, is expected to be uncontrolled and may not be suitable as a founding material in its current state.

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 adjacent to groundwater receptors (Kalkallo Creek, wetland, grassy plains woodlands) depending on location, footprint, and extent of works within the subsurface/water table.
- The location and type of infrastructure located near and within the Growling Grass Frog conservation area (DELWP, 2017) will require consideration and approval by DELWP.
- Due to the shallow manifestation of the water table across much of the site, construction may be difficult during wet months, particularly as most of the site is of low-lying elevation. Where saturated conditions occur 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 most of the project area). The magnitude of groundwater inflow into excavations cannot currently be assessed; 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 users). This will include, as a minimum, an analytical assessment to determine the extent of groundwater drawdown to achieve dry conditions and whether the cone of depression will interact with groundwater receptors. If impacts are identified, consideration of the proposed construction method and timing to minimize or eliminate impacts is required. If there is high uncertainty or if impacts cannot be mitigated through design and timing, field investigations will be required to determine groundwater levels, quality, and hydraulic conductivity. A field monitoring program will require design and implementation during construction to ensure assessment objectives are followed in the field.
    - Consideration of disposal options for extracted groundwater will be required. Disposal of groundwater should be in accordance with the relevant authorities and conditions on permits obtained.
- Areas subject to poor drainage may comprise soft material which provides low bearing capacity for foundations.
- 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 low-value salinity is encountered). Salt tolerance limits vary for different plants and animals, so it is advisable to determine which salinity range would be acceptable for the intended use. Based on the expected salinity, groundwater it may need to be supplemented by or shandied with potable water to improve the quality for the intended purpose.

8.4 Hydrology

Melbourne Water is in the process of developing drainage schemes for Kalkallo DS. Given this, flooding information for the region – including the drainage schemes and planning overlays referred to in this report – may change soon.

Most of the Merrifield North PSP boundary contains hydrological constraints significant enough to constrain development. The Land Subject to Inundation Overlay (LSIO) associated with the flooding extent of the Kalkallo retarding basin covers a significant proportion of the PSP. Under the LSIO, a permit is required to construct a building or carry out works, and to subdivide land. In addition to this, any works at or near waterways require the appropriate planning approvals. Additional investigations in consultation between MW and the VPA are currently underway to provide clarity on the proposed design of the basin and implications for Aitken Boulevard extension and potential recreational (sports facilities/open space) uses of land within the retarding basin footprint.

8.5 Geomorphology

The Merrifield North PSP Area is located on soils that have formed from weathering of local New Volcanic Basalt rock. Quaternary Alluvium, Colluvium and Humevale Siltstone. They are likely to be similar in characteristics to sodic/dispersive soils that have previously been assessed by Jacobs in the Beveridge Northwest PSP Area (Jacobs, 2020a) and Van De Graaff (2018) in the Merrifield Central Employment PSP Area.

Topsoils have better structural stability, but subsoils have the potential to be highly 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 contacting and eroding these soils. Development in these areas will require very careful planning, staging of works to minimize disturbance, and possible remediation of soils to enhance their stability.

With the 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 the development of the drainage services scheme Melbourne Water will want further advice as to how future development and the drainage services scheme can be prepared so as manage erosion risks and provide appropriately protection to waterways, including any swamps that are present in the Merrifield North PSP area.

8.6 Amenity impacting industry

Based on the available public information, the approved surrounding PSPs (noting the Beveridge North PSP has not been approved or reviewed) and noting that a site visit has not been undertaken, there is no known industry that has an existing land use separation distance that encroaches into the developable areas of the Merrifield North Precinct. No piggeries, broiler farms or landfills were identified within required separation distances under the EPA or Clause 53.10 of the Planning and Environment Act 1987. As such there are no known existing constraints on the development of a childcare centre within the Precinct on appropriately zoned land, other than Property No.10 where there are land contamination issues that would need to be addressed prior to the use of the land for a sensitive use.

The Merrifield North Precinct has been strategically located to separate potentially conflicting industrial land uses from sensitive land uses located in nearby precincts. Should the VPA seek to further guide and plan for the separation of sensitive land uses within the industrial-focused Precinct, which is yet to be developed, then it is recommended that the VPA consider the following:

- Identify areas within the Precinct that could accommodate large buffers, these would generally be within the core away from sensitive land uses located in interfacing residential precincts.
- Identify areas within the Precinct that will have a lower amenity which would be less attractive to sensitive land uses, for example along the interface to the Outer Ring Road, Hume Freeway and their respective interchanges.
- Identify areas within the Precinct that are likely to be an activity hub, seek to design a land use outcome whereby industry and other land uses that do not require buffers envelope the sensitive land use within the activity hub.

- Consider other land use constraints within the Precinct, such as areas that are subject to land contamination and flooding (or may be subject to flooding in the future as a result of changes to the Melbourne Water drainage scheme).
- Consider industry located in nearby employment Precinct and agricultural areas that have not transitioned to urban uses which may constrain the siting of sensitive land uses within the Merrifield Precinct.
- Ease of access for users of the childcare centre, such as near the future intersection of Gunns Gully Road and Aitken Boulevard.

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 the Merrifield North PSP:

- The site history assessment found that the site has a long history of agricultural land uses based on the aerial photographs & records that were reviewed as well as the site visit conducted on 12 October 2022.
- Based on the available information, properties can be categorized as follows:
    - Current and/or former activities at a total of six properties (map reference nos. 1, 4, 6, 10, 14, and 17) present a medium potential for contamination. Such properties typically represented locations where relatively widespread or more substantial areas of potential contamination were identified. Potential for contamination was typically associated with labelled containers (including hydraulic oils, glyphosate, Spreadwet 1000, Roundup Ultramax, and other pesticides / herbicides), and variously used, unlabelled containers (typically in 220-L steel drums), stockpiled materials, (including mulch, soil, general wastes, and used tires), abandoned vehicles, and likely presence of stock dips in proximity to farm residences and associated buildings. In one instance (property 10) the property represents an industrial site that EPA Victoria had placed on the Priority Sites Register, identifying this site as one that '*requires assessment and / or clean up*'. However, at the time of finalising this report (in June 2026) this property had been removed from the register. No further information is available for this property.
    - Current and/or former activities at a total of 20 properties present a no potential for contamination. The majority of these properties represented locations where no evidence of current or former potentially contaminative activities were identified (i.e., paddocks with no evidence of buildings or structures, and no evidence of intensive agriculture land uses that may be indicative of widespread and intensive commercial use of pesticides). However, a small number of these properties represented locations where highly localised areas of potential contamination associated with stockpiles and general dumped materials were observed, where septic systems are likely to be present or other such potential sources that could be managed through modest / straightforward management actions.
- Several off-site sources of potential contamination have been identified in the vicinity of the Merrifield North PSP area. Based on the nature of the site uses, the greatest risk to the PSP areas is likely to be presented by the existing petrol stations to the immediate southeast of the PSP area. However, the risk presented by these service stations to the Merrifield North PSP is low, since regional (and local) groundwater direction is likely to be from north to south, meaning that any contamination of groundwater (if present) would be unlikely to intersect the PSP area. The closest service station sites can be found beyond the southeastern corner of the PSP area approximately 14m and 45m from the PSP area boundary.

Based on the information obtained from the sources described in this report, except for the identified localized areas of potential contamination associated with current and/or former land uses identified above, there do not appear to be any significant risks from a site contamination perspective which would render the land unsuitable for residential or other sensitive land uses. Any areas of localized contamination are likely to be able to be effectively managed or remediated during any future site development.

9.2. Geotechnical

Based on the available geological information the Merrifield North PSP project site is likely underlain by alluvial soils &/or basaltic residual soils derived from the underlying basalt bedrock. These soils may have a high shrink-swell potential which is not advantageous for either the structures or as use as construction materials. Alluvium is also expected to be encountered in most parts of the western zone of the project site

with potentially highly compressible and weak sediments. An indicative site classification of Class "H2 to E" has been assessed following Table D1, AS2870-2011.

Sodic soils with a dispersive nature are present in the proposed PSP area. These soil characteristics could lead to erosion of drainage channels/features and associated blockage/sedimentation of downstream drainage areas or undermining of constructed works. Sodic soils by their characteristics are highly problematic for construction materials if untreated or not improved. Key geotechnical issues associated with the development of the site include the depth and reactivity of the basaltic clay and alluvium in terms of its influence on on-site classification, change and interface of variable ground conditions, foundation selection, differential settlement, subgrade performance, excavations, and site accessibility. Fill material, if present, is expected to be uncontrolled and may not be suitable for development in its present state. Areas subject to poor drainage may comprise soft material which provides low bearing capacity for foundations.

Subsurface conditions may present a critical issue for the design of the structures and foundations, and therefore there is likely to be a benefit in obtaining geotechnical data at targeted locations.

The results of the geotechnical investigation would form the basis of the geotechnical model for the site, which would be used to assess subgrade conditions, confirm the site classes, foundation design parameters, excavations, and recommendations on earthworks.

Sodic and specific geotechnical investigation of the proposed development needs to be undertaken and assessed to address the challenges presented by these soil types. Such investigations need to focus on the definition of ground models and the behavior of inherent soils and rocks encountered with particular emphasis on soil index, sodic, shrink-swell, earthworks assessments, and trials with additives for an amelioration assessment.

9.3 Hydrogeology

Based on the regional hydrogeological information, the local water table is expected to be relatively shallow across the site and hosted in the fractured rock Upper Tertiary/Quaternary Basalts and the alluvial Quaternary Aquifer were present.

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

- Shallow depth to groundwater is likely to occur in most of the project 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 adjacent to groundwater receptors (Kalkallo Creek, wetland, grassy plains woodlands) depending on location, footprint, and extent of works within the subsurface/water table.
- Groundwater dewatering or extraction associated with development has the potential to reduce discharge to nearby surface water features, which could potentially have a negative impact on the ecological health of local groundwater receptors (Kalkallo Creek, areas of grassy plains woodlands, wetlands).
- The location and type of infrastructure located near and within the Growling Grass Frog conservation area (DEECA, 2017) will require consideration and approval by DEECA.

There are ten stock and domestic bores within the PSP boundaries that require consideration in terms of location, existence, condition, and current license to prevent unacceptable impacts during construction.

- 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 shandied with potable water to improve the quality for the intended purpose.

It is recommended that a field investigation into groundwater elevation and quality be undertaken to confirm the findings of this desktop study. This may include:

- Sampling of existing bores (if active and accessible) for groundwater level and quality; and
- Drilling and construction of test bores for ongoing observation to determine water level and quality and monitor for seasonal variations (if required).

Groundwater field investigations are expected to become a high priority where excavations are likely to exceed 5m in depth or are adjacent to groundwater-sensitive sites (Area of Strategic Importance Kororoit Creek Reach 4 and other wetlands). For large or deep excavations, groundwater investigations can be used to inform the quantity, quality, and impact of dewatering.

9.4. Hydrology

The 1 in 100 Year Flood Extent associated with Kalkallo Creek covers the area of the Kalkallo Retarding Basin within the Merrifield North PSP boundary. The flooding stems from overbank flooding associated with Kalkallo Creek as well as the operation of the Kalkallo retarding basin as part of the Kalkallo Drainage Scheme. Additionally, a pre-European wetland exists; however, the remainder of the Merrifield North PSP area is free from hydrological constraints significant enough to constrain development.

Melbourne Water is in the process of developing drainage schemes for Kalkallo, in particular the base case model for the Kalkallo Retarding Basin. Given this, flooding information for the region – including the drainage schemes and planning overlays referred to in this report – may change in the near future. Currently, VPA and MW are investigating the implications of the current basin design, the constraints applied to the extension alignment of Aitken Boulevard, and the opportunities for recreational uses of the land within the retarding basin.

9.5. Geomorphology

The Merrifield North PSP area is located on soils that have formed from weathering of local New Volcanic Basalt rock, Quaternary Alluvium, Colluvium, and Humevale Siltstone. Topsoils 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.

9.6 Amenity impacting industry

There are no known existing land uses with separation distance that would constrain the establishment of a sensitive land use within the Merrifield North Precinct. If a sensitive land use is proposed within the Merrifield North Precinct, then it should be located in an area that will minimise constraints on use and development of the Precinct for industrial uses.

10. Recommendations

We understand that the proposed future use of the site is as land set aside for conservation and water retarding. As part of the NGCP, the Merrifield North PSP area will also complement the existing surrounding development. Since specific future land uses within the PSP area are yet to be confirmed, this assessment has been completed based on the initial intended use of the area as mentioned above. The following further works are recommended, including recommended timings:

- Completion of Preliminary Risk Screening Assessments at all properties where current and/or former land uses were assessed as presenting a 'medium' potential for contamination. These PRSAs will determine whether an Environmental Audit is required at the property, and the scope of the Environmental Audit (if deemed necessary). This recommendation would apply to six properties, specifically to map reference property no. 1, 4, 6, 10, 14, and 17. These assessments may include the completion of targeted/limited sampling and should be completed in accordance with EPA Victoria publication 2021 *Guidelines for Conducting Preliminary Risk Screening Assessments* and EPA Victoria publication 2022 *Environmental Auditor Guidelines – Provision of Statements and Reports for Environmental Audits and Preliminary Risk Screen Assessments*. The PRSA may only be conducted by an Environmental Auditor. *Timing: These additional assessments may either be conducted as part of the planning process or deferred until future development of the land occurs through the application of an Environmental Audit Overlay.*
- Classification and appropriate removal (if required) of various stockpiles and dumped materials observed and present at any sites across the PSP areas. This includes subsequent validation following removal. 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. *Timing: This task should be undertaken on a site-by-site basis during future site development.*
- It is recommended that a geotechnical investigation comprising soil and rock sampling, and geotechnical laboratory testing is undertaken. This will lead to the determination of the ground conditions, design constraints, and geotechnical design parameters for temporary excavation, building foundation, and road design, as well as the associated and necessary control measures for utilities and drainage features. *Timing: This task should be undertaken on a site-by-site basis during future development as part of the building permit application process.*
- It is recommended that the local registered bores identified in this assessment are confirmed with Southern Rural Water to determine whether they are actively utilized for groundwater purposes or whether decommissioning should be undertaken to prevent contamination of the aquifer.
- Any investigation/observation bores in the vicinity identified as active can be used to verify groundwater conditions based on the risk of proposed land use affecting groundwater. Groundwater hydraulic testing (slug tests) may also be undertaken to determine aquifer properties. This assumes existing wells are in a suitable condition for such an assessment. Due to the lack of groundwater investigation or observation bores within the immediate project area, the installation and development of new investigation bores are also 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 risk to groundwater. Alternatively, groundwater investigations can be undertaken concurrently with geotechnical investigations by installing observation bores to measure groundwater level, quality, and aquifer permeability.*
- It is recommended that further site investigation, sampling, laboratory analysis, and characterization of soils is undertaken to confirm their erodibility and develop a plan to stabilize the soils (options include chemical treatment of soils, and careful staging of works). The scope of this work would be like the Sodic Soils Assessment previously completed by Jacobs for Beveridge North-West, Shenstone Park, Wallan South, and Wallan East (Part 1). *Timing: This task will be undertaken across the Merrifield North PSP area as part of the planning stage for the PSP. The scope of this work forms component 2 of the Merrifield North PSP Land Capability and Sodic Soils Assessment. 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.*
- A field geomorphology assessment of waterways is recommended to assess their current condition and how this is likely to change with changes in hydrology and hydraulics for future development scenarios.

The scope of this geomorphology assessment should be agreed upon with Melbourne Water. Jacobs has recently completed such investigations for the Werribee Junction Precinct Structure Plan (Jacobs 2019). *Timing: This task should be undertaken across the Merrifield North PSP 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.*

- The review of industry is based on a desktop assessment only. It is recommended that a site visit be undertaken to identify what industry is operating in existing industrial precincts and rural areas that may potentially have land use separation distance in operation around their sites that encroach into the Merrifield North Precinct.
- It is recommended that the PSP process give regard to land uses within the Merrifield North Precinct and seeks to encourage the co-location of industry that do not require buffers in proximity to a central activity hub that contains a childcare centre.

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Appendix A – Figures

The following figures are presented below:

- Figure 1 – Site Location
- Figure 2 – Site Layout
- Figure 3 - Site Characterization (Potential for Contamination of Land)

Figure 1: Site Locality Plan

LEGEND

- Major Road
- Minor Road
- Merrifield North PSP - Boundary

N

A4 1:25,000

GDA2020 MGA Zone 55

0 0.5 1

Kilometers

Jacobs

Data Sources: Geosciences Australia (2006)
Imagery Sources: Aerometrex MetroMap

LEGEND

- Merrifield North PSP - Boundary
- Cadastre
- 1 Property Number

N

A4 1:25,000

GDA2020 MGA Zone 55

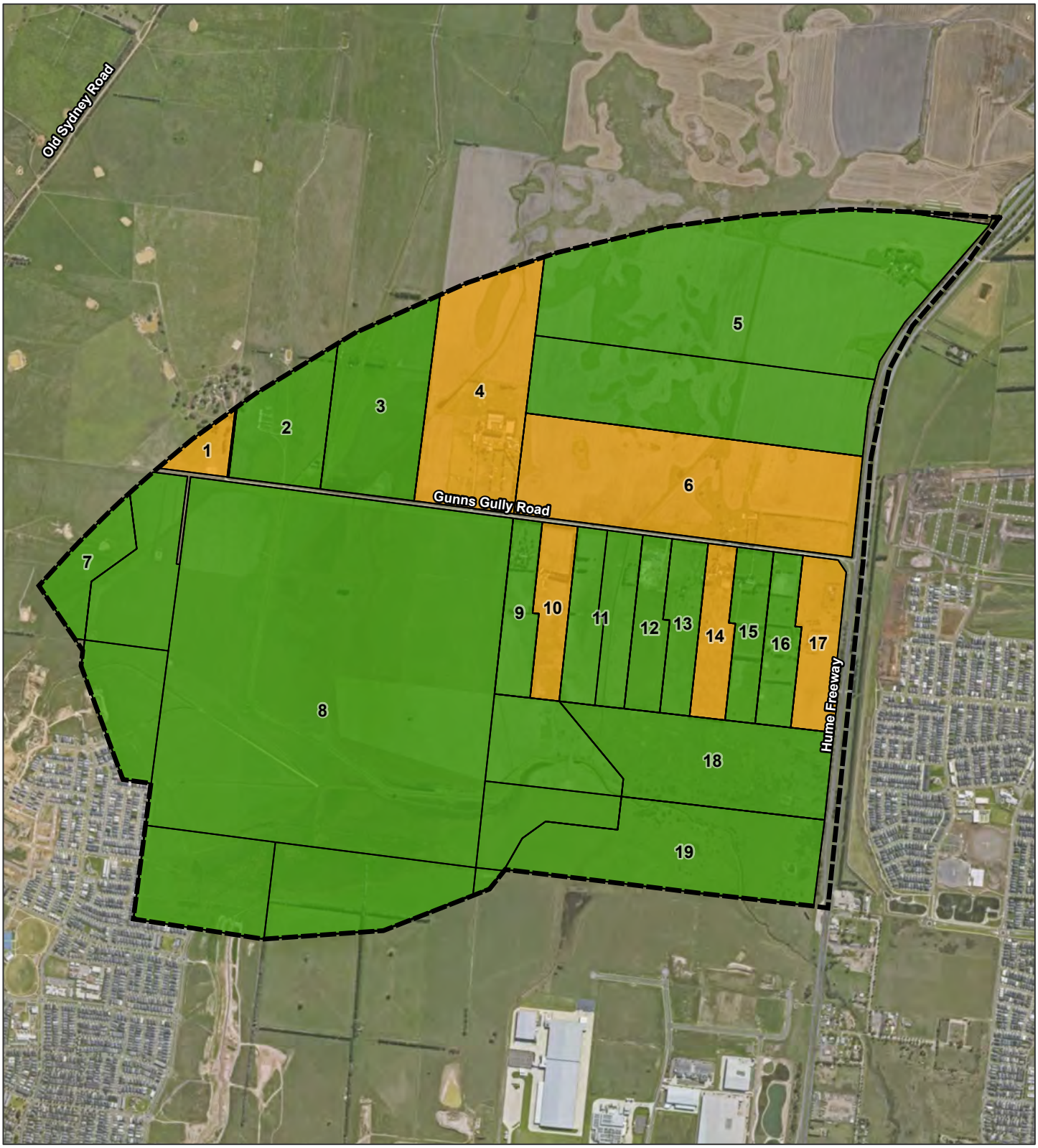
0 0.5 1

Kilometers

Jacobs

Data Sources: Geosciences Australia (2006)
Imagery Sources: Aerometrex MetroMap

Figure 3: Potential for Contamination



LEGEND

- Merrifield North PSP - Boundary
- Property Number
- 1 Cadastre

Potential for Contamination

- No potential for contamination
- Medium

N

A4 1:25,000

GDA2020 MGA Zone 55

0 0.5 1

Kilometers

Jacobs

Data Sources: Geosciences Australia (2006)
Imagery Sources: Aerometrex MetroMap

Appendix B – Lotsearch reports

LOTSEARCH

LOTSEARCH ENVIRO LITE

Date: 16 Jun 2022 12:23:48

Reference: LS033421 EL

Address: Merrifield North Psp, Hume City, VIC 3064

Dataset Listing

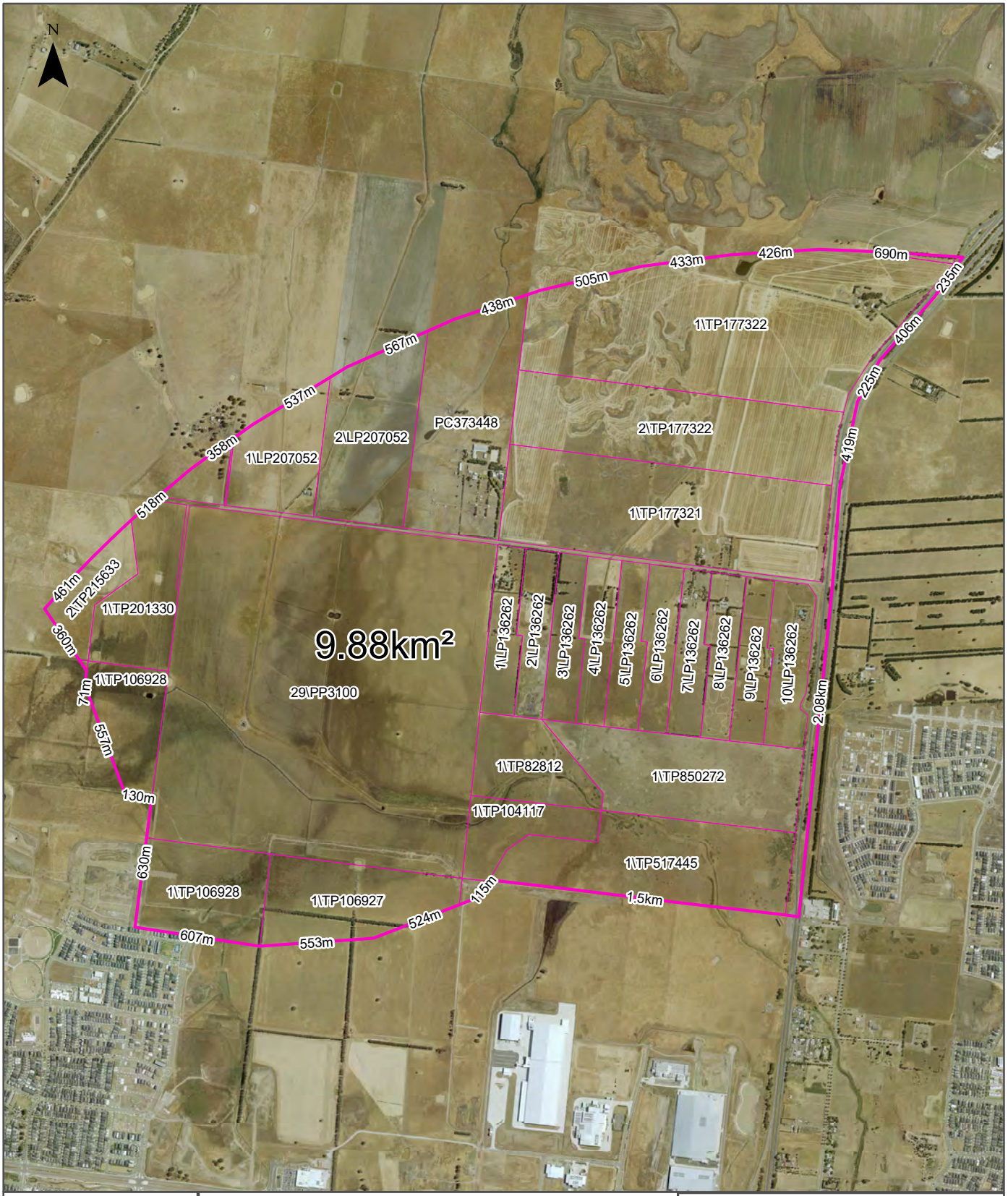
Datasets contained within this report, detailing their source and data currency:

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	15/06/2022	14/06/2022	Monthly	-	-	-	-
Current EPA Priority Sites	Environment Protection Authority (Vic)	25/05/2022	28/02/2022	Monthly	1000m	1	1	1
Former EPA Priority Sites & other Remedial Notices	Environment Protection Authority (Vic)	04/10/2021	01/09/2021	Monthly	1000m	0	2	2
EPA PFAS Site Investigations	Environment Protection Authority (Vic)	28/09/2021	18/09/2020	Monthly	2000m	0	0	0
Defence PFAS Investigation & Management Program - Investigation Sites	Department of Defence	15/06/2022	15/06/2022	Monthly	2000m	0	0	0
Defence PFAS Investigation & Management Program - Management Sites	Department of Defence	15/06/2022	15/06/2022	Monthly	2000m	0	0	0
Airservices Australia National PFAS Management Program	Airservices Australia	15/06/2022	15/06/2022	Monthly	2000m	0	0	0
Defence 3 Year Regional Contamination Investigation Program	Department of Defence	06/06/2022	06/06/2022	Quarterly	2000m	0	0	0
EPA Environmental Audit Reports	Environment Protection Authority (Vic)	14/06/2022	14/06/2022	Monthly	1000m	0	0	0
EPA Groundwater Zones with Restricted Uses	Environment Protection Authority (Vic)	06/06/2022	06/06/2022	Monthly	1000m	0	0	0
Current EPA Licensed Activities	Environment Protection Authority (Vic)	14/06/2022	22/07/2021	Monthly	1000m	0	0	0
Former EPA Licensed Activities	Environment Protection Authority (Vic)	14/06/2022	26/11/2021	Monthly	1000m	0	0	1
EPA Works Approvals	Environment Protection Authority (Vic)	03/06/2022	03/06/2022	Monthly	1000m	0	0	0
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	0
EPA Prescribed Industrial Waste	Environment Protection Authority (Vic)	12/08/2020	12/08/2020	Quarterly	1000m	0	0	0
EPA Victorian Landfill Register	Environment Protection Authority (Vic)	03/06/2022	25/08/2020	Quarterly	1000m	0	0	0
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	15/02/2021	15/03/2012	Annually	1000m	0	2	2
Historical Business Directories (Premise & Intersection Matches)	Hardie Grant; Sands & McDougall, State Library Victoria			Not required	150m	0	1	1
Historical Business Directories (Road & Area Matches)	Hardie Grant; Sands & McDougall, State Library Victoria			Not required	150m	-	14	14
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	-	3	3
Features of Interest	State Government Victoria - Department of Environment, Land, Water & Planning	29/09/2021	29/09/2021	Quarterly	1000m	0	2	12
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	3	-	-
Surface Elevation	State Government Victoria - Department of Environment, Land, Water & Planning	14/08/2015	23/09/2013	Unknown	0m	1	-	-

Dataset Name	Custodian	Supply Date	Currency Date	Update Frequency	Dataset Buffer (m)	No. Features On-site	No. Features within 100m	No. Features within Buffer
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	23/08/2021	23/08/2021	Quarterly	2000m	11	15	69
Groundwater Boreholes Earth Resources Database	State Government Victoria - Department of Economic Development, Jobs, Transport and Resources	20/05/2021	17/02/2010	Annually	2000m	10	11	31
Groundwater Boreholes Fed Uni	Federation University Australia	21/12/2017	07/01/2014	As required	2000m	0	0	0
Historical Mining Activity - Shafts	State Government Victoria - Department of Economic Development, Jobs, Transport and Resources	26/05/2022	26/05/2022	Annually	1000m	0	0	0
Geological Units 1:50,000	State Government Victoria - Department of Economic Development, Jobs, Transport and Resources	13/01/2015	24/06/2014	Unknown	1000m	6	6	8
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	2	2	3
Victorian Soil Type Mapping	State Government Victoria - Department of Economic Development, Jobs, Transport and Resources	24/08/2017	21/03/2016	Unknown	1000m	3	5	7
Atlas of Australian Acid Sulfate Soils	CSIRO	19/01/2017	21/02/2013	As required	1000m	1	1	2
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	10/02/2022	02/02/2022	Monthly	1000m	5	15	26
Planning Scheme Overlay	State Government Victoria - Department of Environment, Land, Water & Planning	10/02/2022	02/02/2022	Monthly	1000m	8	20	34
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	05/08/2021	05/08/2021	Quarterly	1000m	0	0	0
Cultural Heritage Sensitivity	State Government Victoria - Department of Premier and Cabinet	29/09/2021	29/09/2021	Quarterly	1000m	4	9	26
Bushfire Prone Area	State Government Victoria - Department of Transport, Planning and Local Infrastructure	05/08/2021	06/07/2021	Quarterly	1000m	2	2	2
Fire History	State Government Victoria - Department of Environment, Land, Water & Planning	15/11/2021	15/11/2021	Quarterly	1000m	2	2	2
Flood - 1 in 100 Year Modelled Flood Extent	State Government Victoria - Department of Environment, Land, Water & Planning	11/08/2021	05/02/2018	Quarterly	1000m	0	0	0
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	4	4	7
Ramsar Wetland Areas in Victoria	State Government Victoria - Department of Environment, Land, Water & Planning	28/03/2022	13/03/2019	Annually	1000m	0	0	0
Groundwater Dependent Ecosystems Atlas	Bureau of Meteorology	14/08/2017	15/05/2017	Unknown	1000m	6	6	11
Inflow Dependent Ecosystems Likelihood	Bureau of Meteorology	14/08/2017	15/05/2017	Unknown	1000m	8	8	14

Site Diagram

Merrifield North Psp, Hume City, VIC 3064



Legend

- Site Boundary
- Internal Parcel Boundaries

Total Area: 9.88km²

Total Perimeter: 13.34km

Scale: 0 125 250 500 750 1,000 1,250 Meters

Data Source Aerial Imagery:
© Aerometrex Pty Ltd

Disclaimers:

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

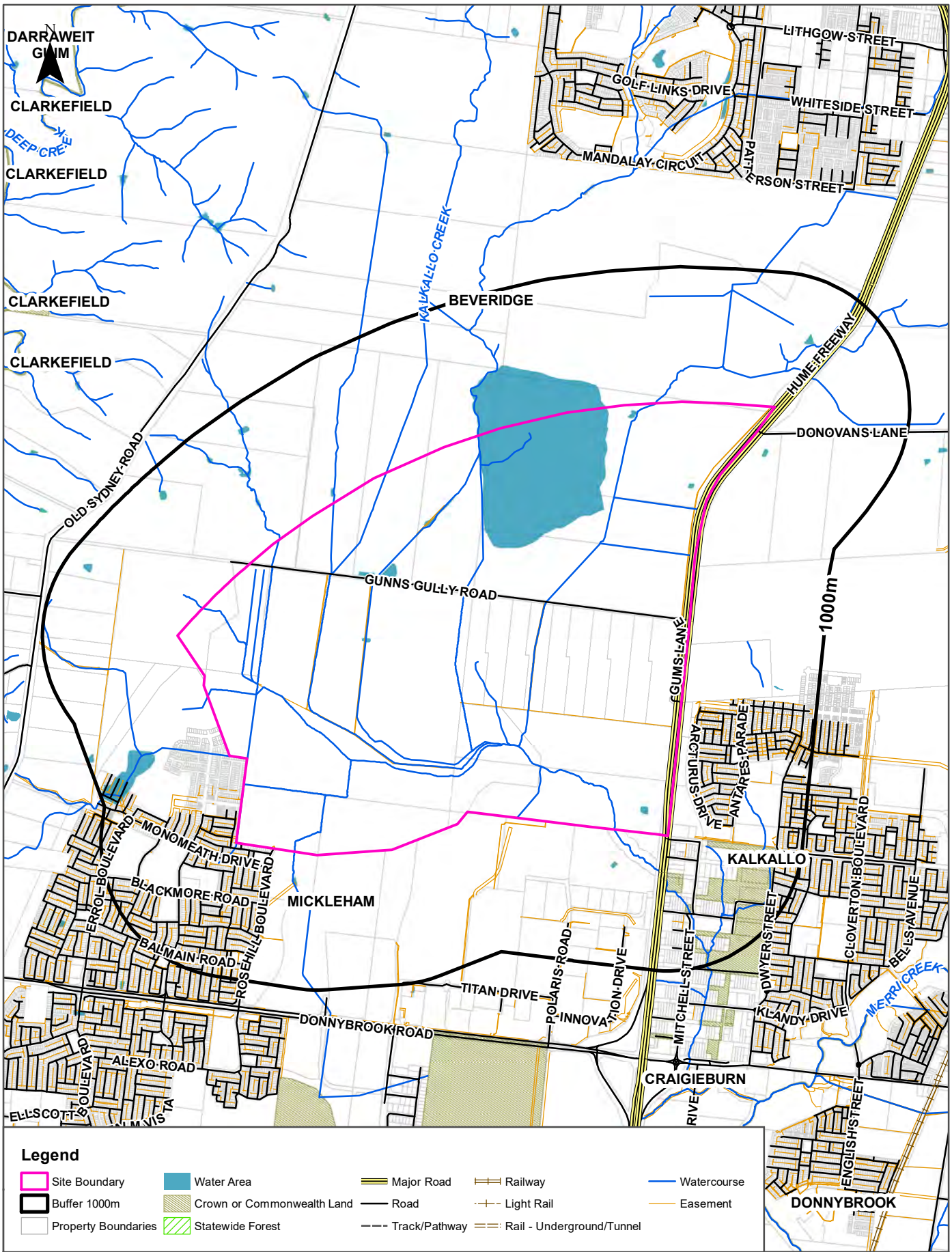
Parcels that make up a small percentage of the total site area have not been labelled for increased legibility.

Coordinate System:
GDA 1994 MGA Zone 55

Date: 16 June 2022

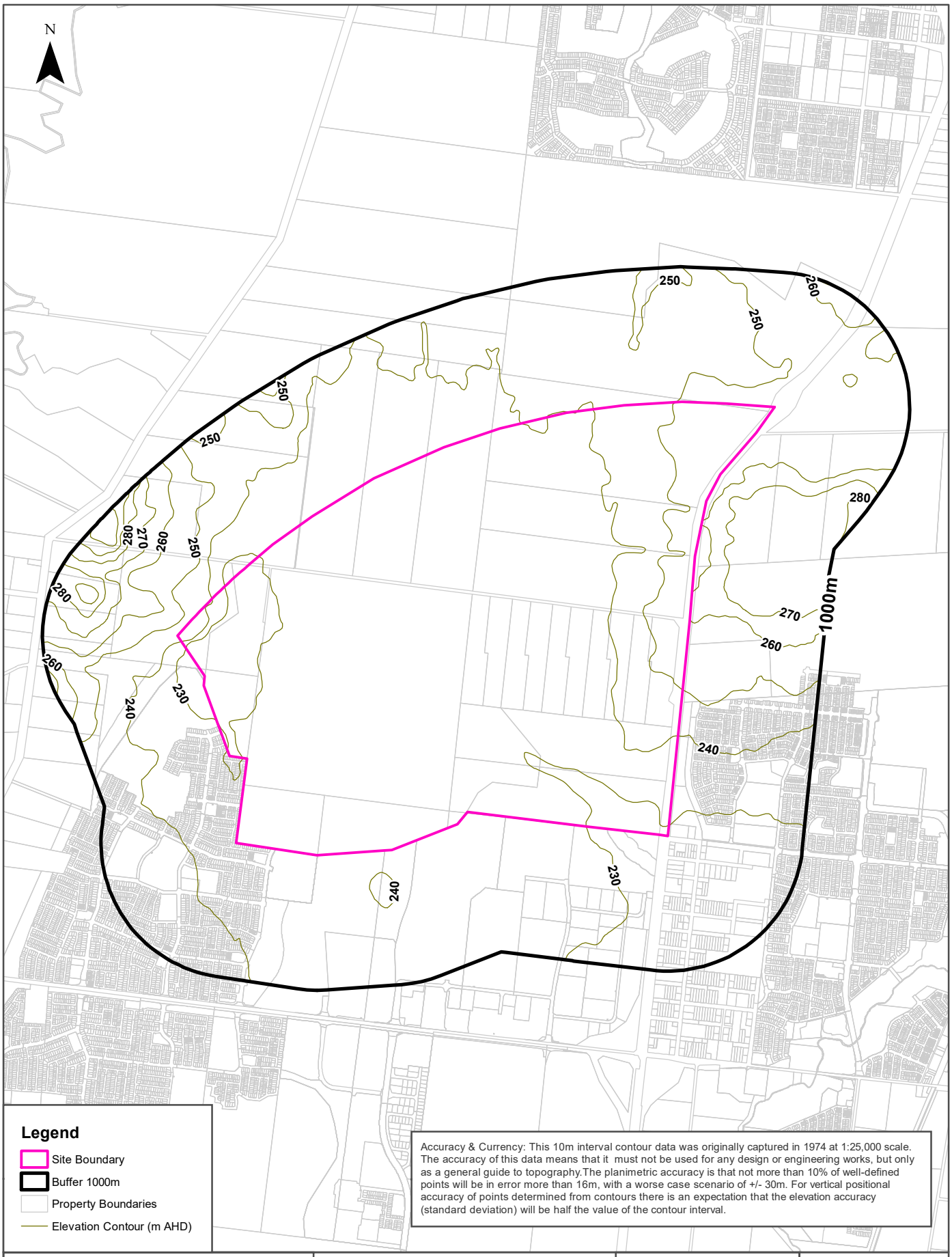
Topographic Data

Merrifield North Psp, Hume City, VIC 3064



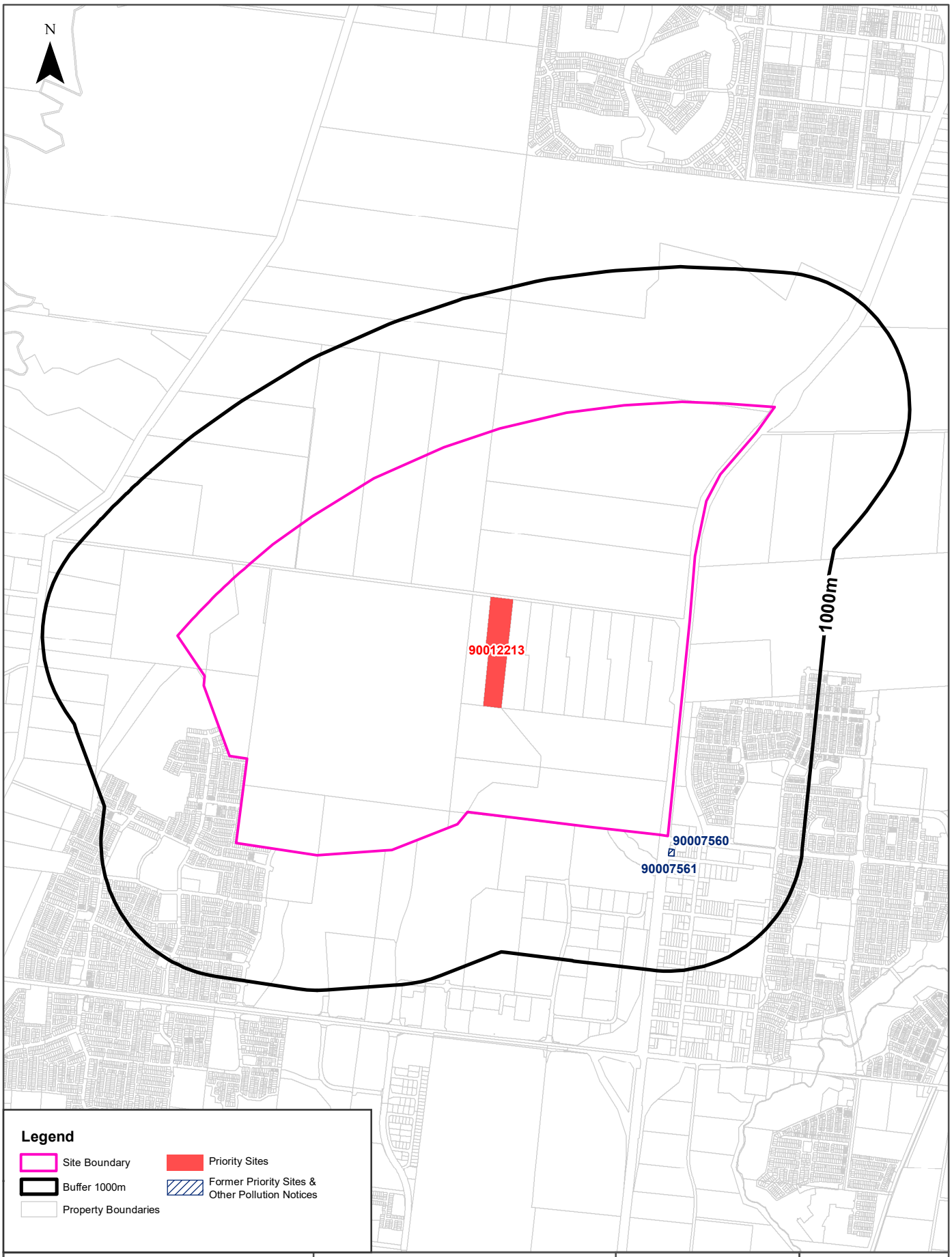
Elevation Contours (m AHD)

Merrifield North Psp, Hume City, VIC 3064



EPA Records - Priority Sites & Pollution Notices

Merrifield North Psp, Hume City, VIC 3064



EPA Priority Sites & Pollution Notices

Merrifield North Psp, Hume City, VIC 3064

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
90012213	135 GUNNS GULLY RD	MICKLEHAM	Current Industrial Site. Requires assessment and/or clean up.	Premise Match	0m	On-site

Priority Sites 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
90007560	Pollution Abatement Notice	KALKALLO HOTEL (VIC) PTY LTD [KALKALLO]		KALKALLO	Previous Pollution Notice		08/08/2017	Premise Match	95m	South East
90007561	Pollution Abatement Notice	KALKALLO HOTEL (VIC) PTY LTD [KALKALLO]		KALKALLO	Previous Pollution Notice		21/06/2017	Premise Match	95m	South East

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

PFAS Investigation & Management Programs

Merrifield North Psp, Hume City, VIC 3064

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

Merrifield North Psp, Hume City, VIC 3064

Defence 3 Year Regional Contamination Investigation Program

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

EPA Records

Merrifield North Psp, Hume City, VIC 3064

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.

CARMS No	Transaction No	Site	Address	Suburb	Date Complete	Audit Category	Loc Conf	Distance	Direction
N/A	No records in buffer								

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

EPA Records

Merrifield North Psp, Hume City, VIC 3064

EPA Groundwater Zones with Restricted Uses

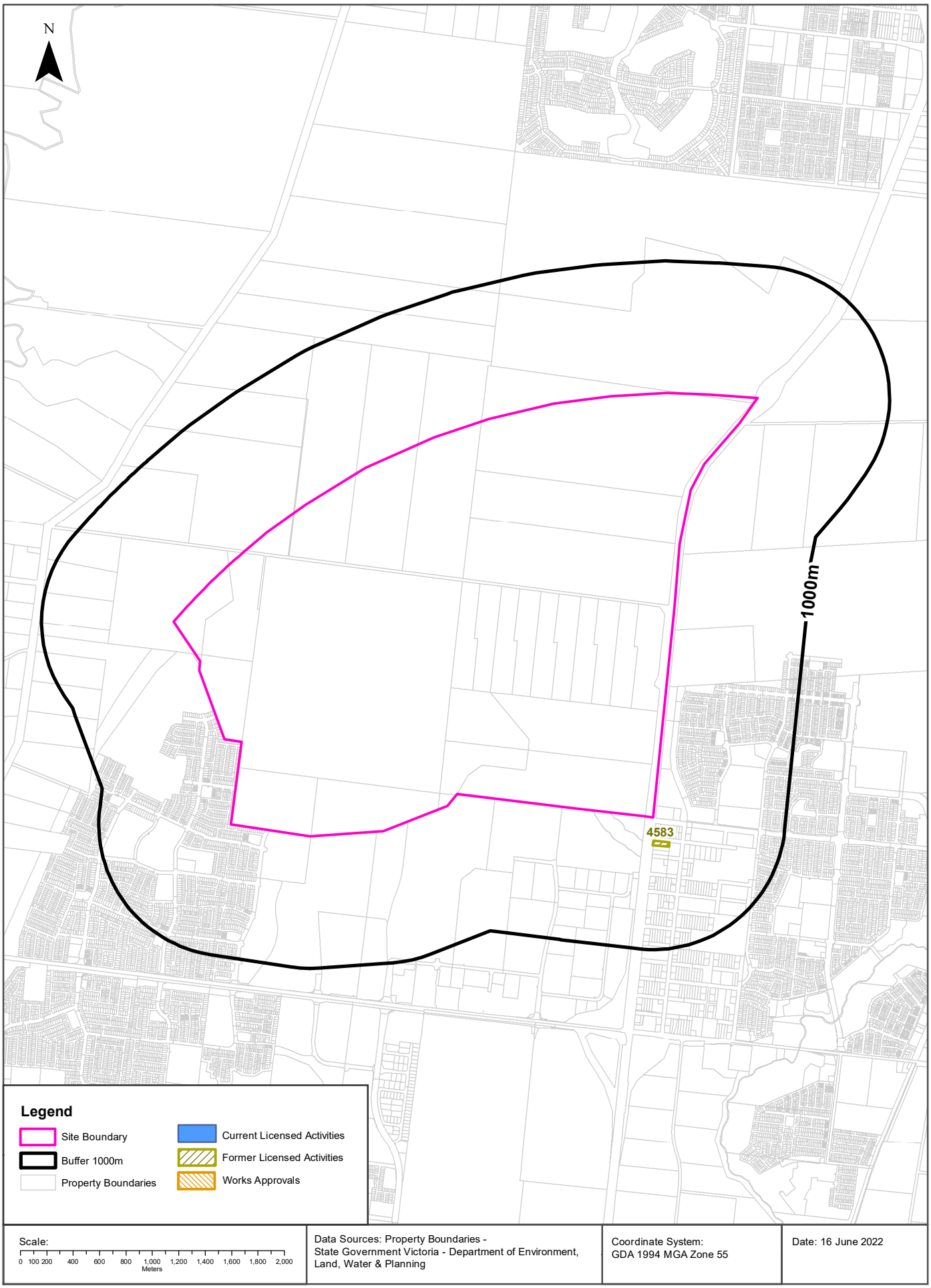
EPA GQRUZ records that exist within the dataset buffer:
Note. Please click on CARMS No. to activate a hyperlink to online documentation.

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 Records - Licensed Activities & Works Approvals

Merrifield North Psp, Hume City, VIC 3064



EPA Activities

Merrifield North Psp, Hume City, VIC 3064

EPA Licensed Activities

EPA licensed activities that exist 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
N/A	No records in buffer									

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

Former EPA Licensed Activities

Former EPA licensed activities that exist within the dataset buffer:

Licence No	Organisation	Premise Address	Suburb	Activities	Loc Conf	Dist (m)	Direction
4583	KALKALLO HOTEL (VIC) PTY LTD [KALKALLO]	1324 HUME HWY	KALKALLO VIC 3064	A03 Sewage Treatment	Premise Match	174m	South East

Former Licensed Activity Data Custodian: State Government Victoria - Environmental Protection Authority (EPA)

EPA Works Approvals

EPA works approvals that exist within the dataset buffer:

Transaction No	Status	Approval No	Organisation	Premise Address	Suburb	Scheduled Categories	Loc Conf	Dist (m)	Direction
N/A	No records in buffer								

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

Waste Management Facilities & Landfills

Merrifield North Psp, Hume City, VIC 3064

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
N/A	No records in buffer								

SWRRIPF Data Source: State Government Victoria - Department of Sustainability

EPA Prescribed Industrial Waste

EPA Prescribed Industrial Waste treaters, disposers and permitted transporters within the dataset buffer:

Map Id	Company Name	Address	Suburb	Treatment /Disposal	Transport	Accredited Agent	EPA List Status	Loc Conf	Dist (m)	Dir
N/A	No records in buffer									

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

Waste Management Facilities & Landfills

Merrifield North Psp, Hume City, VIC 3064

EPA Victorian Landfill Register

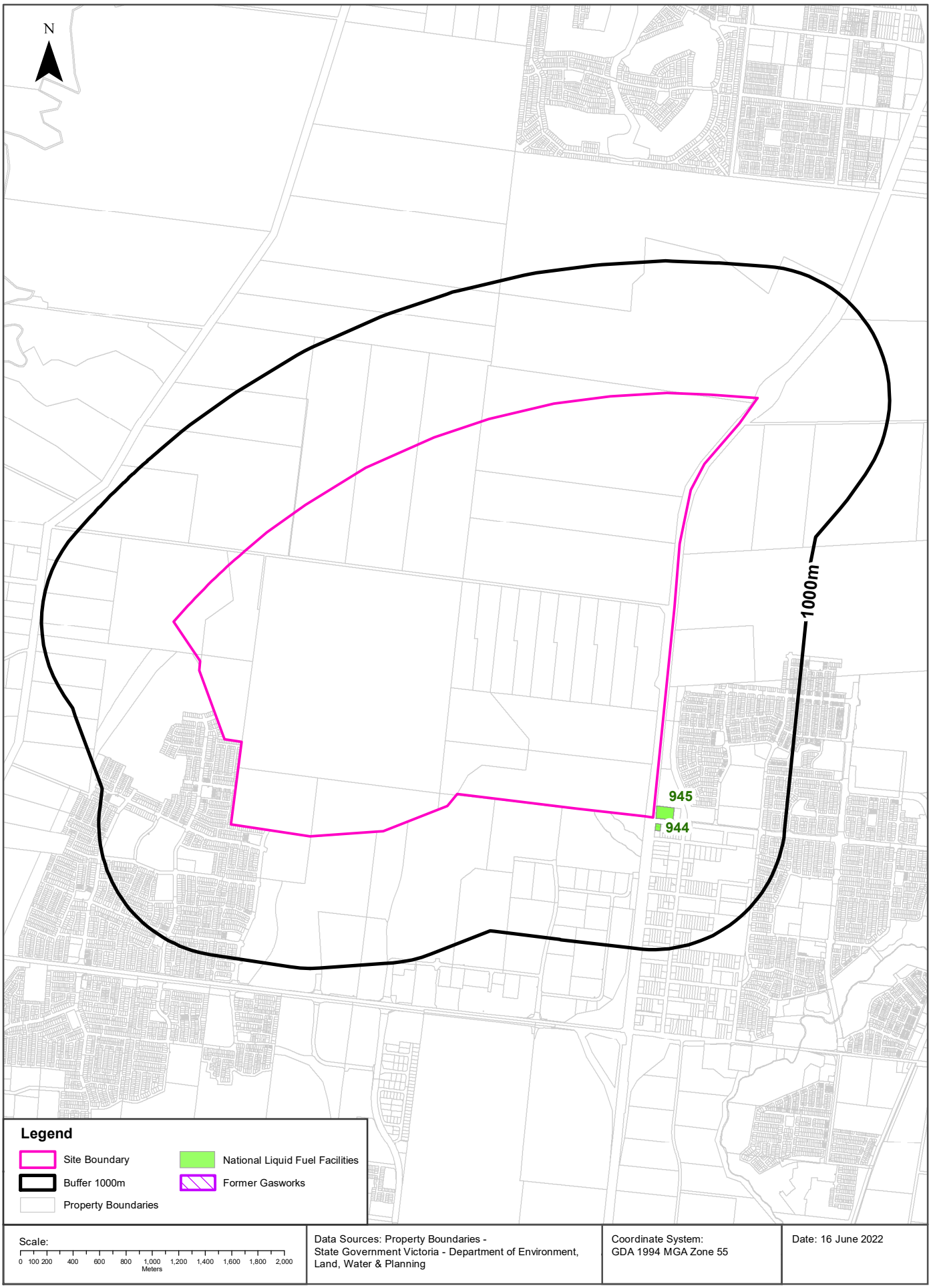
EPA Victorian Landfill Register sites within the dataset buffer:

Landfill Register No.	Site	Address	Operating Status	Est. Year Of Closure	Waste type	Loc Conf	Dist (m)	Direction
N/A	No records in buffer							

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

Former Gasworks & Liquid Fuel Facilities

Merrifield North Psp, Hume City, VIC 3064



Former Gasworks and Liquid Fuel Facilities

Merrifield North Psp, Hume City, VIC 3064

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

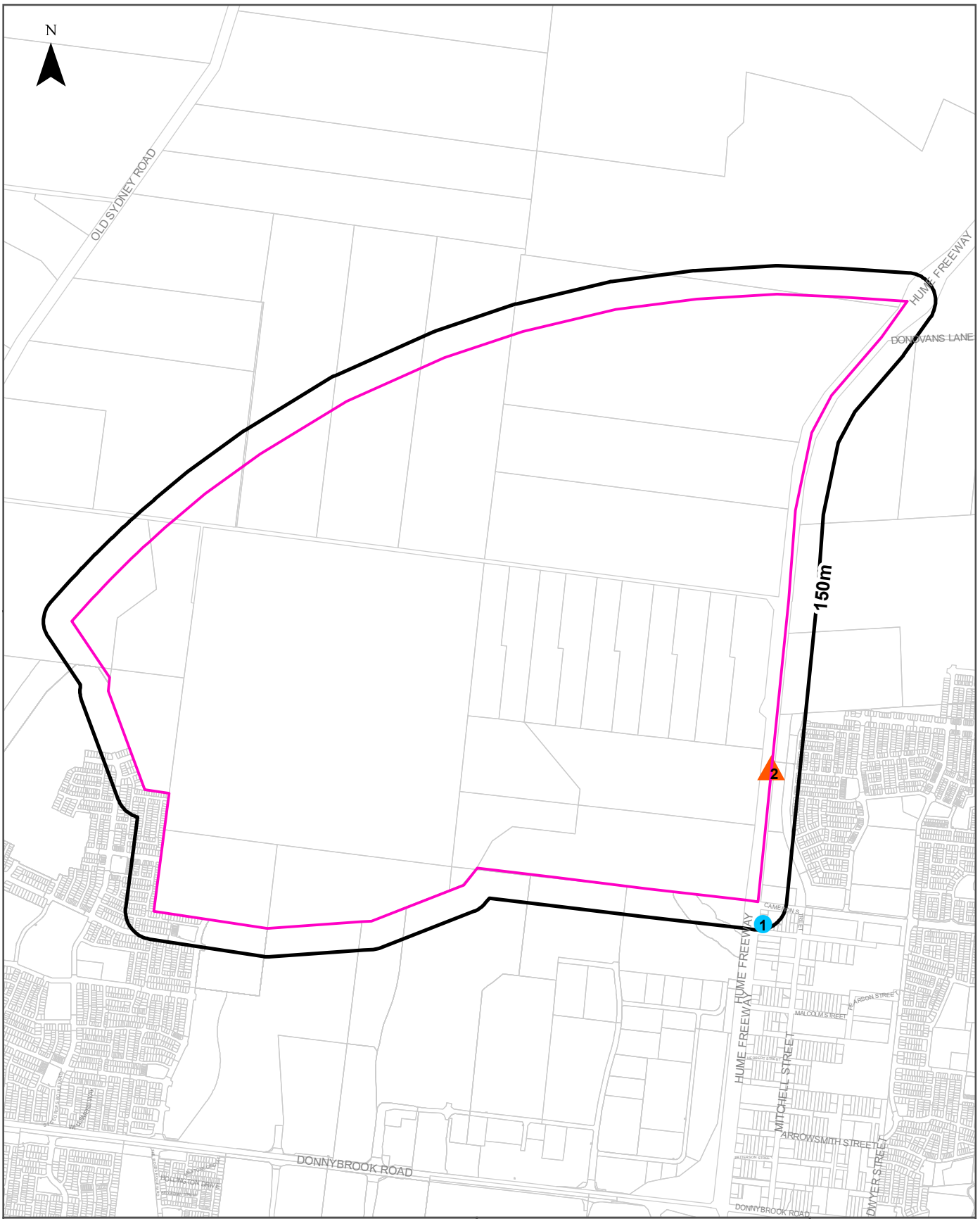
National Liquid Fuel Facilties within the dataset buffer:

Map Id	Owner	Name	Address	Suburb	Class	Operational Status	Operator	Revision Date	Loc Conf	Dist (m)	Direction
945	Caltex	Caltex Kalkallo	1340 Hume Freeway	Kalkallo	Petrol Station	Operational		25/07/2011	Premise Match	14m	South East
944	Independent Fuel Supplies	Independent Kalkallo	1330 Hume Freeway	Kalkallo	Petrol Station	Operational		25/07/2011	Premise Match	45m	South East

National Liquid Fuel Facilities Data Source: Geoscience Australia

Historical Business Directories

Merrifield North Psp, Hume City, VIC 3064



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: 0 390 780 1,170 1,560 Meters

Coordinate System: GDA 1994 MGA Zone 55

Date: 16 June 2022

Historical Business Directories

Merrifield North Psp, Hume City, VIC 3064

Business Directory Records 1905-1991
Premise or Road Intersection Matches

Universal Business Directory and Sands & McDougall Directory records, from years 1991, 1980, 1974, 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	HOTELS-LICENSED	Donnybrook Hotel, Hume Hwy,Kalkallo , Donnybrook.	150721	1960	Premise Match	95m	South East

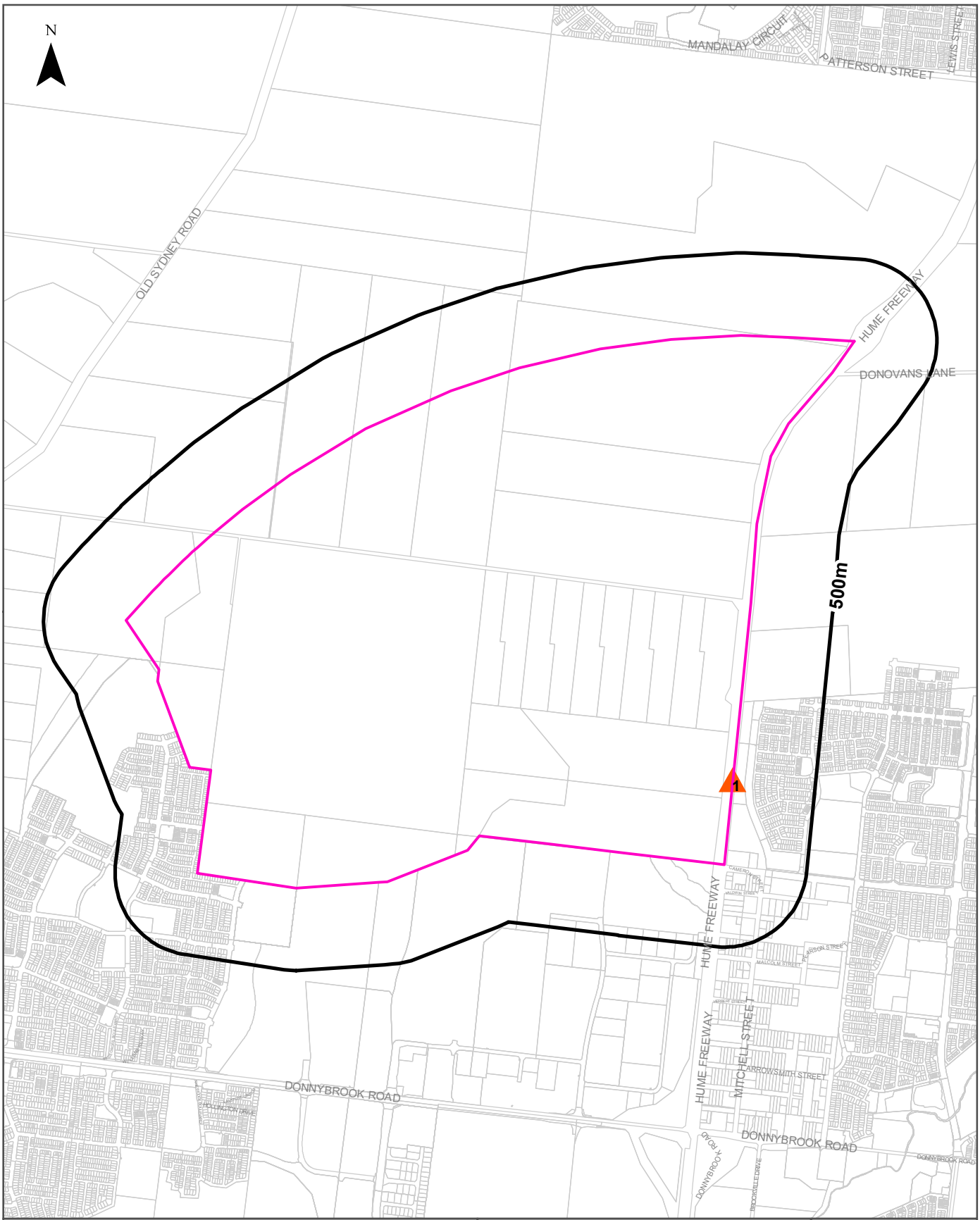
Business Directory Records 1905-1991
Road or Area Matches

Universal Business Directory and Sands & McDougall Directory records, from years 1991, 1980, 1974, 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	HOTELS-LICENSED	Bunker Hill Service Station, Hume Hwy., Donnybrook.	150723	1960	Road Match	0m
	MOTOR SERVICE STATIONS.	Bunker Hill Service Station, Hume Hwy., Donnybrook.	150725	1960	Road Match	0m
	GROCERS & GENERAL STOREKEEPERS.	Congram, J. S., Hume Hwy., Kalkallo , Donnybrook.	150719	1960	Road Match	0m
	HOTELS-LICENSED	Donnybrook Springs Hotel, Hume Hwy., Donnybrook.	150722	1960	Road Match	0m
	CARRIERS & CARTAGE CONTRACTORS	Jenkins, O. V., Hume Hwy., Donnybrook.	150718	1960	Road Match	0m
	MOTOR GARAGES & ENGINEERS.	Mckay's Garage, Hume Hwy., Kalkallo, Donnybrook.	150724	1960	Road Match	0m
	MOTOR SERVICE STATIONS.	Pastoral Motors, Hume Hwy., Donnybrook.	150726	1960	Road Match	0m
	GROCERS & GENERAL STOREKEEPERS.	Post Office Store, Hume Hwy., Beveridge , Donnybrook.	150720	1960	Road Match	0m
	BOOTMAKERS AND DEALERS	Buckley, Thos., Sydney Rd Donnybrook	169850	1905	Road Match	0m
	STOREKEEPERS	Cummins, Mrs Jane, Sydney Rd Donnybrook	178250	1905	Road Match	0m
	HOTELS	Donnybrook - Fitzpatrick, Wm., Sydney Rd Donnybrook	178214	1905	Road Match	0m
	BLACKSMITHS , FARRIERS , AND WHEEL- WRIGHTS	Doyle, Ernest, Sydney Rd Donnybrook	163518	1905	Road Match	0m
	STOREKEEPERS	Fitzpstrick Wm., Sydney Rd Donnybrook	178251	1905	Road Match	0m
	HOTELS	Wheelmans Rest - Lundey Mrs Margt, Sydney Rd Donnybrook	178222	1905	Road Match	0m

Dry Cleaners, Motor Garages & Service Stations

Merrifield North Psp, Hume City, VIC 3064



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: 0 450 900 1,350 1,800 Meters

Coordinate System: GDA 1994 MGA Zone 55

Date: 16 June 2022

Historical Business Directories

Merrifield North Psp, Hume City, VIC 3064

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						

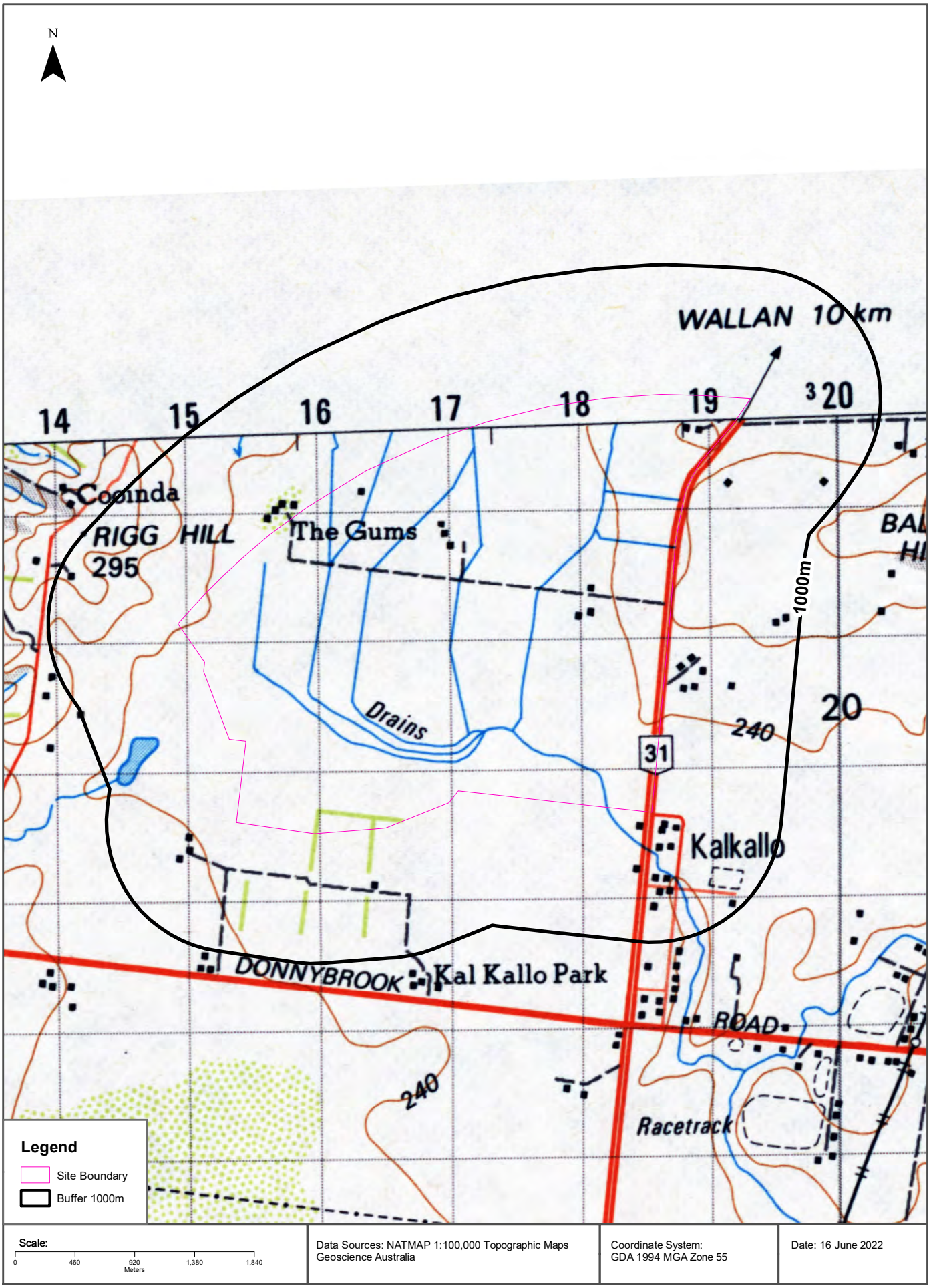
Dry Cleaners, Motor Garages & Service Stations Road or Area Matches

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 SERVICE STATIONS.	Bunker Hill Service Station, Hume Hwy., Donnybrook.	150725	1960	Road Match	0m
	MOTOR GARAGES & ENGINEERS.	Mckay's Garage, Hume Hwy., Kalkallo, Donnybrook.	150724	1960	Road Match	0m
	MOTOR SERVICE STATIONS.	Pastoral Motors, Hume Hwy., Donnybrook.	150726	1960	Road Match	0m

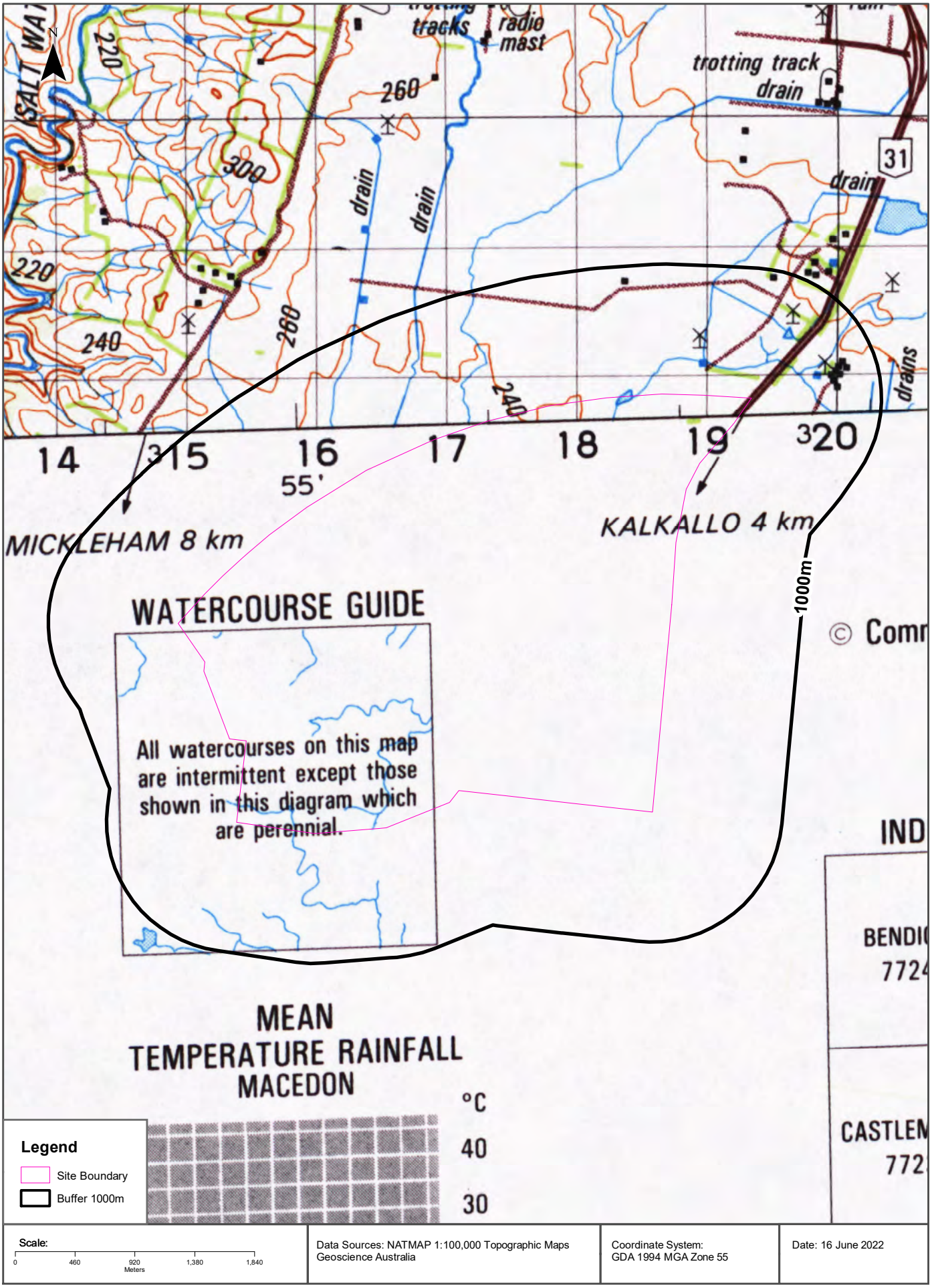
Historical Map 1982

Merrifield North Psp, Hume City, VIC 3064



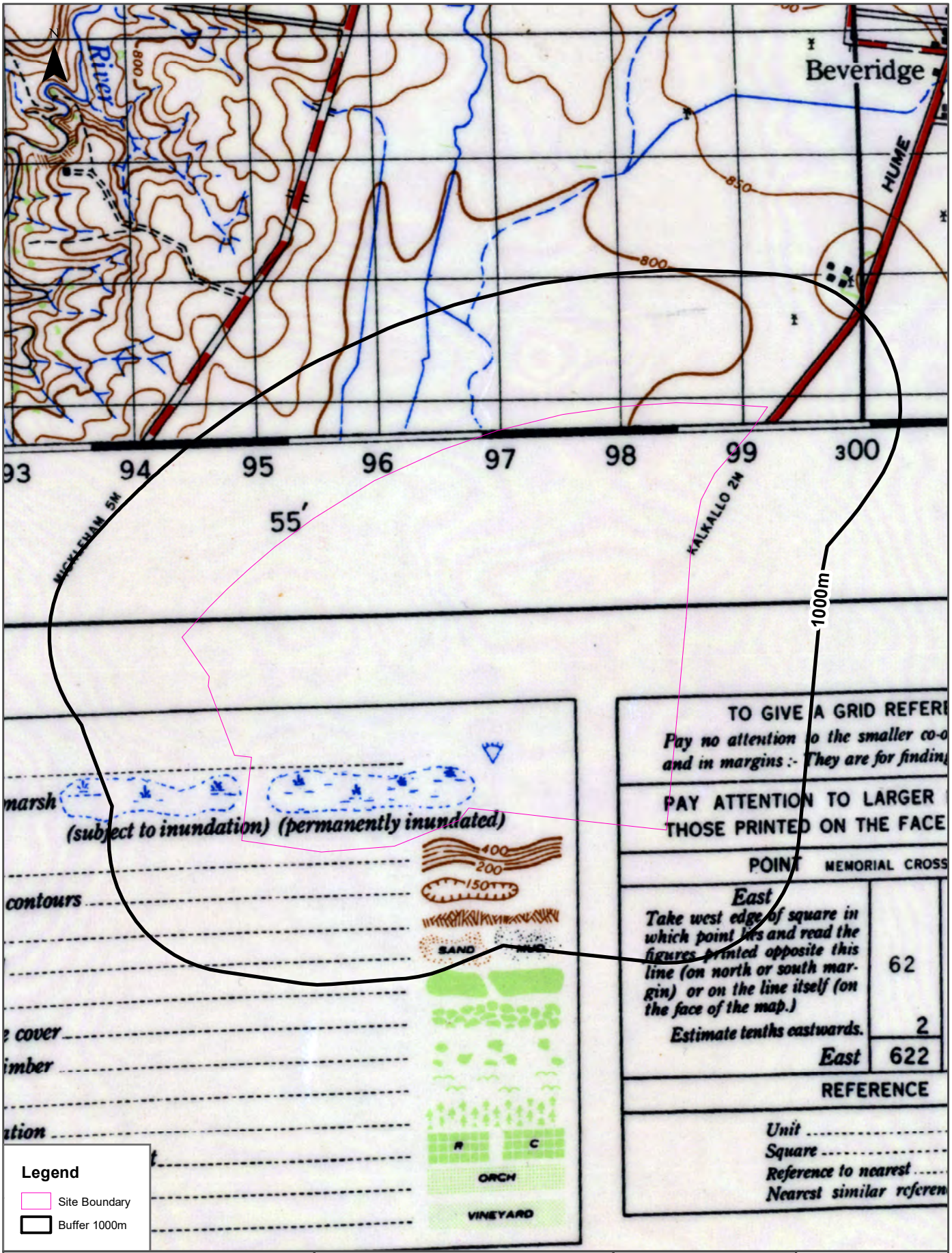
Historical Map 1979

Merrifield North Psp, Hume City, VIC 3064



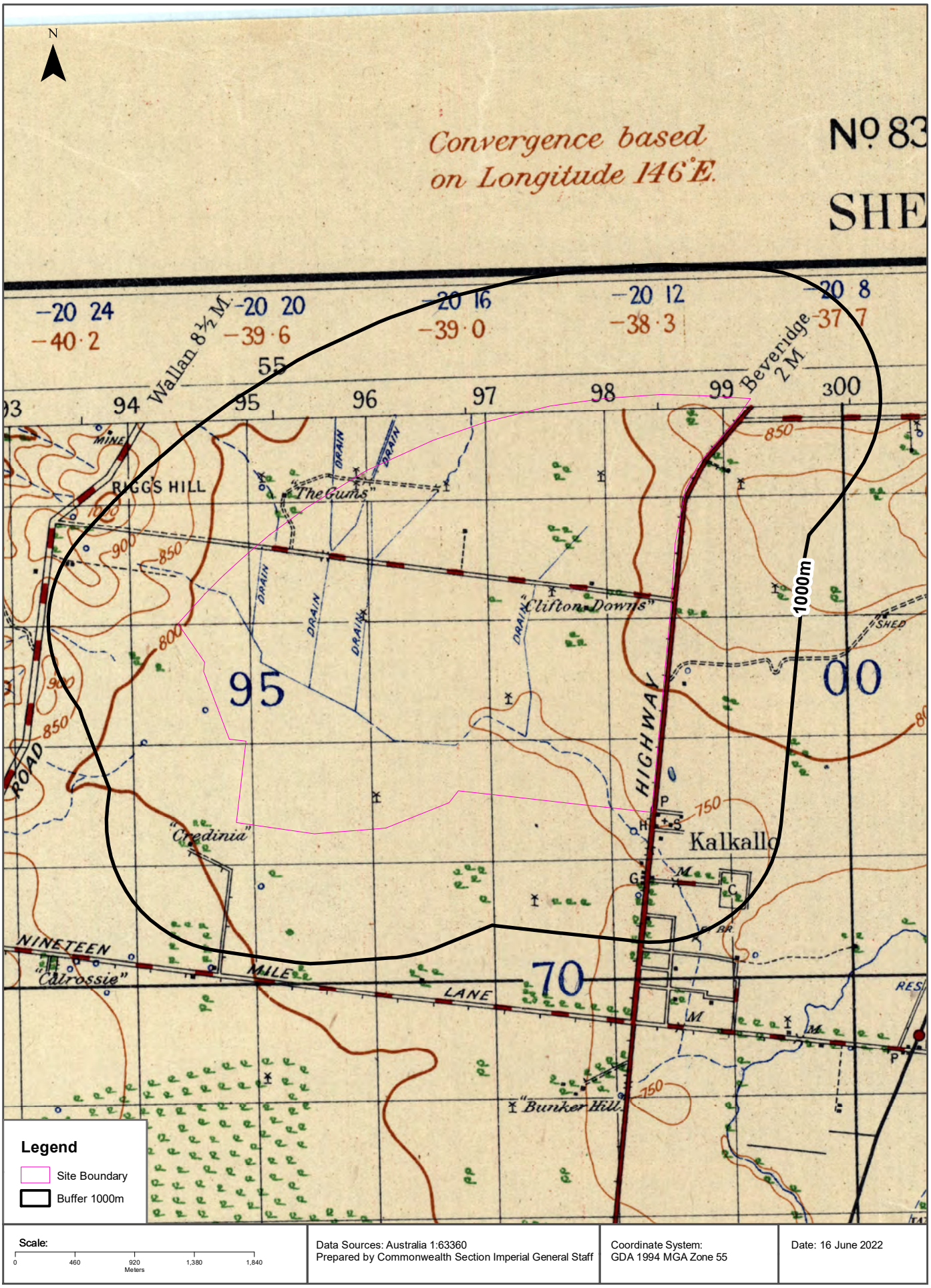
Historical Map c.1947

Merrifield North Psp, Hume City, VIC 3064



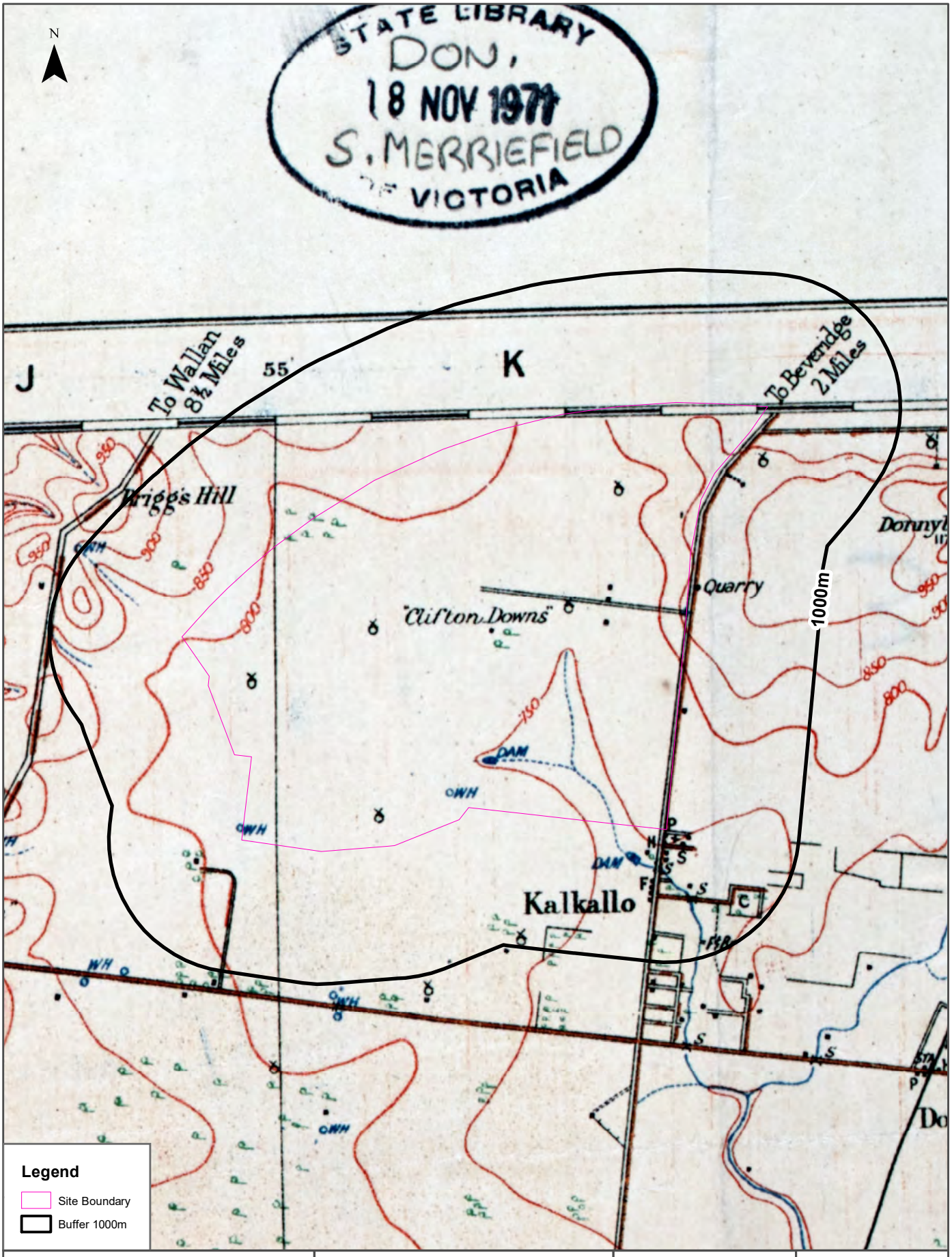
Historical Map c.1938

Merrifield North Psp, Hume City, VIC 3064



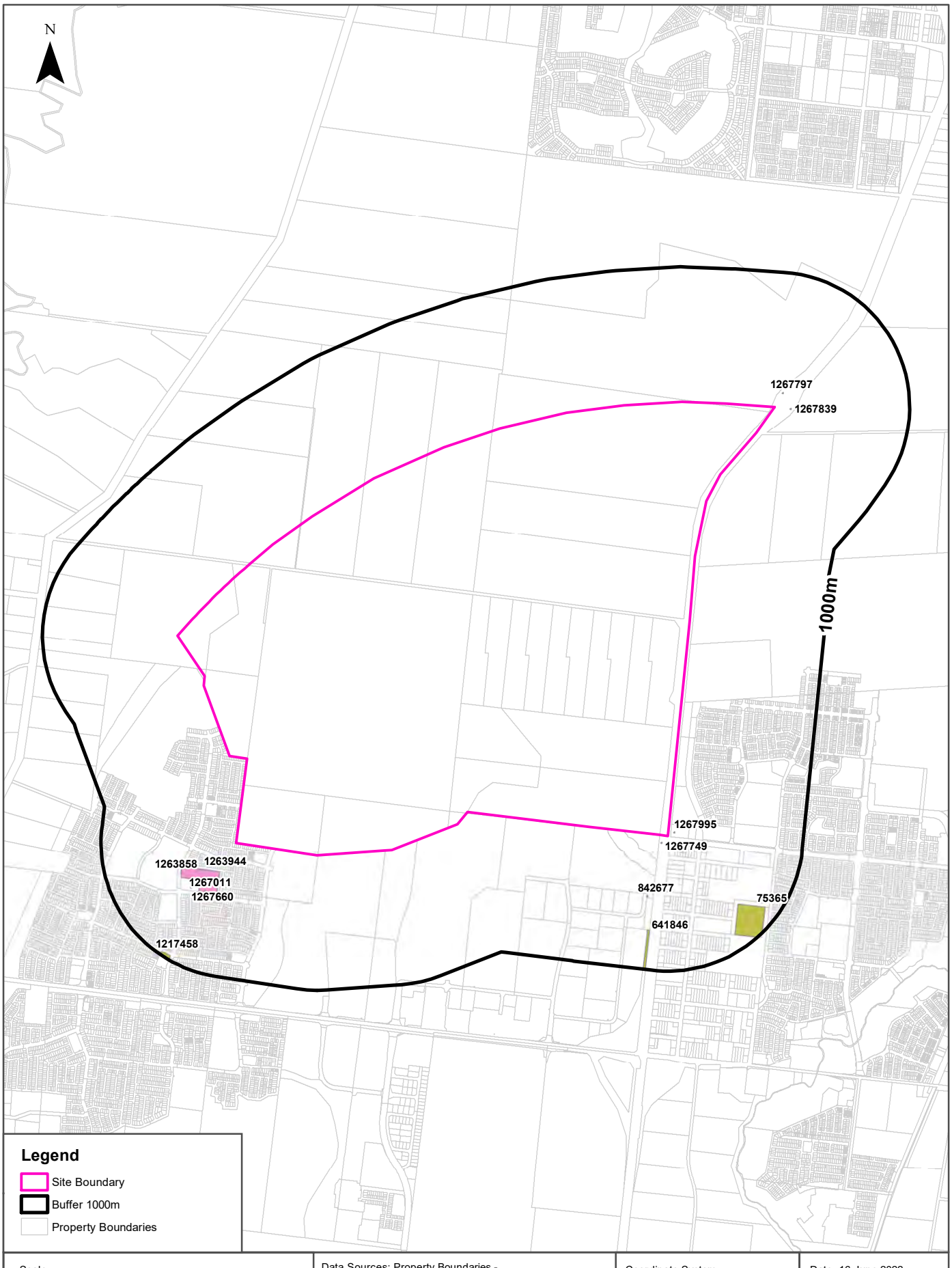
Historical Map c.1916

Merrifield North Psp, Hume City, VIC 3064



Features of Interest

Merrifield North Psp, Hume City, VIC 3064



Features of Interest

Merrifield North Psp, Hume City, VIC 3064

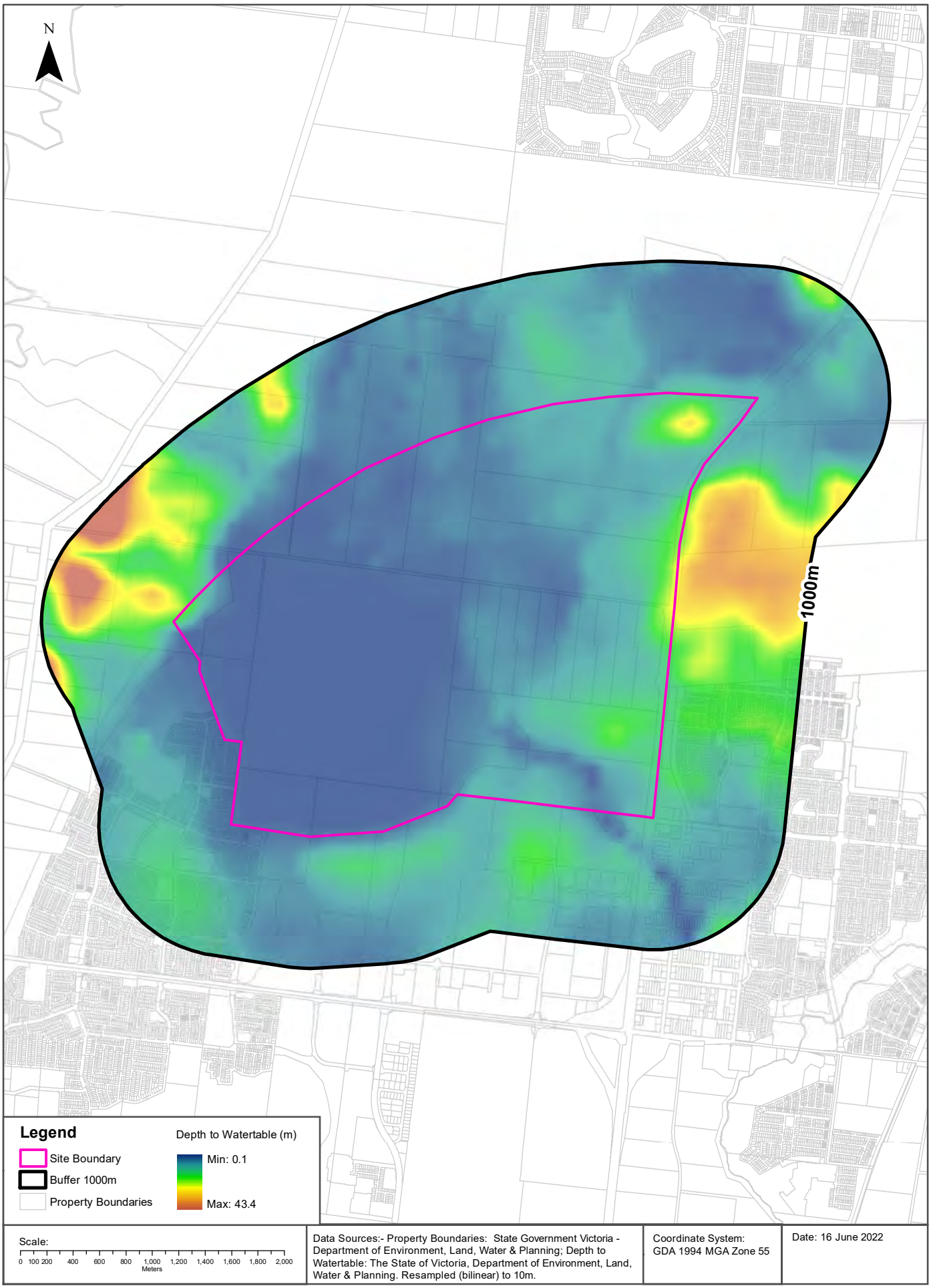
Features of Interest

Features of Interest within the dataset buffer:

Feature Id	Feature Type	Feature Sub Type	Name	Distance	Direction
1267995	community space	rest area		35m	South East
1267749	community space	rest area		50m	South East
1267839	community space	rest area		110m	North East
1267797	community space	rest area		114m	North East
1263944	education centre	education complex		248m	South West
1263858	care facility	child care	Gaayip-Yagila Ps Theircare	325m	South West
1267011	education centre	primary school	Gaayip-Yagila Primary School	422m	South West
842677	communication service	telephone exchange	Kalkallo Telephone Exchange	460m	South East
1267660	care facility	child care	Mickleham North Community Centre	468m	South West
641846	reserve	park		709m	South East
75365	reserve	cemetery	Donnybrook Cemetery	719m	South East
1217458	reserve	park		968m	South West

Depth to Watertable

Merrifield North Psp, Hume City, VIC 3064



Hydrogeology & Groundwater

Merrifield North Psp, Hume City, VIC 3064

Hydrogeology

Description of aquifers within the dataset buffer:

Description	Distance	Direction
Fractured or fissured, extensive aquifers of low to moderate productivity	0m	On-site

Groundwater Salinity

On-site Groundwater Salinity:

Groundwater Salinity	Percent Of Site Area
1,000 - 3,500 mg/l	84
3,500 - 7,000 mg/l	16

Depth to Watertable

On-site Depth to Watertable:

Depth to Watertable	Percent Of Site Area
Less than 5 metres	81
5 to 10 metres	15
10 to 20 metres	3

Surface Elevation

Approximate on-site Surface Elevation:

Surface Elevation
223 AHDm to 267 AHDm

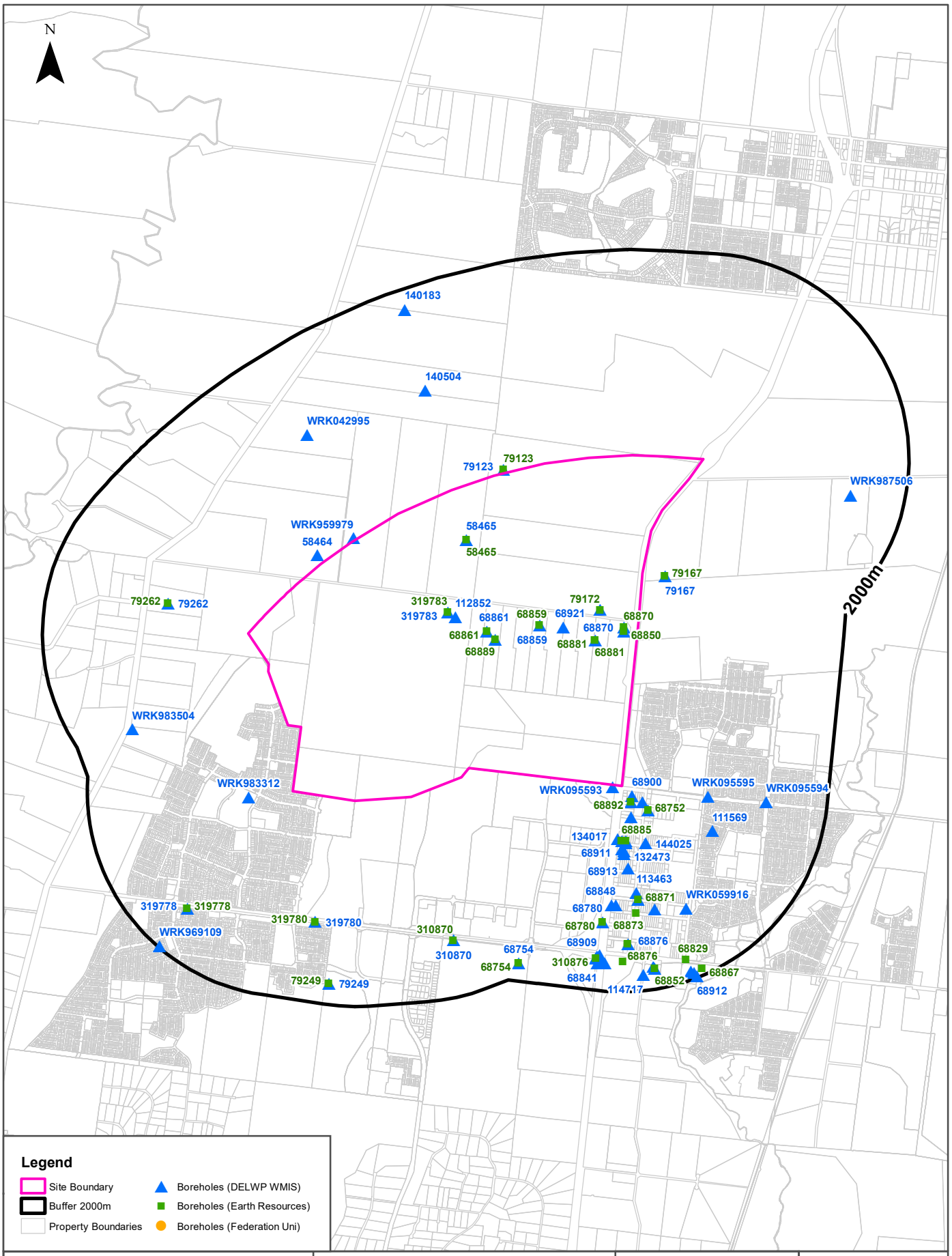
Basement Elevation

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
209 AHDm to 268 AHDm

Groundwater Boreholes

Merrifield North Psp, Hume City, VIC 3064



Legend

- Site Boundary
- Buffer 2000m
- Property Boundaries
- Boreholes (DELWP WMIS)
- Boreholes (Earth Resources)
- Boreholes (Federation Uni)

Scale: 0 200 400 800 1,200 1,600 2,000 2,400 Meters

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

Coordinate System: GDA 1994 MGA Zone 55

Date: 16 June 2022

Groundwater Boreholes

Merrifield North Psp, Hume City, VIC 3064

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
112852	Domestic, Stock	0.00m-6.00m SOIL & CLAY 6.00m-7.50m BASALT 7.50m-14.00m BASALTIC CLAY 14.00m-18.00m BASALT 18.00m-20.00m BROWN CLAY	-0.30m-14.00m INNER LINING - CASING = Steel 14.00m-18.00m INNER LINING - SCREEN = Steel 18.00m-20.00m INNER LINING - SCREEN = Slotted Steel 0.00m-0.50m OUTER LINING - GRAVEL = Cement 0.50m-18.00m OUTER LINING - GRAVEL = Gravel		14.00m-18.00m Basalt 18.00m-20.00m Clay	03/02/1992	0m	On-site
319783	Non Groundwater					02/09/1971	0m	On-site
58465	Stock	0.00m-0.20m TOP SOIL 0.20m-12.00m HARD BASALT 12.00m-13.50m MEDIUM HARD PARTLY DECOMPOSED BASALT PEAT AND COARSE SAND	0.00m-12.00m INNER LINING - CASING = Mild Steel 12.00m-13.50m INNER LINING - SCREEN = Mild Steel		12.00m-13.50m Basalt	18/03/1982	0m	On-site
68850	Domestic, Stock	0.00m-0.60m TOP SOIL 0.60m-53.30m BASALT	0.00m-40.00m INNER LINING - CASING = Pvc 40.00m-50.00m INNER LINING - SCREEN = Pvc 50.00m-53.30m INNER LINING - CASING = Pvc		40.00m-50.00m Basalt	11/09/1982	0m	On-site
68859	Domestic, Stock	0.00m-2.00m SOIL AND CLAY 2.00m-12.00m BASALT 12.00m-43.00m MOTTLED CLAY 43.00m-72.00m GREY MUDSTONE	0.00m-53.00m INNER LINING - CASING = Mild Steel 53.00m-60.00m INNER LINING - SCREEN = Mild Steel		53.00m-60.00m Mudstone	03/05/1983	0m	On-site
68861	Domestic, Stock	0.00m-22.50m BASALT	0.00m-16.00m INNER LINING - CASING = Mild Steel 16.00m-22.50m INNER LINING - SCREEN = Mild Steel		16.00m-22.50m Basalt	04/05/1983	0m	On-site
68870	Domestic, Stock	0.00m-14.00m WEATHERED BASALT 14.00m-17.00m RED CLAY	0.00m-12.00m INNER LINING - CASING = Pvc 12.00m-17.00m INNER LINING - SCREEN = Pvc		12.00m-17.00m Clay	21/12/1984	0m	On-site
68881	Domestic, Stock	0.00m-0.61m TOP SOIL 0.61m-24.38m MOTTLED CLAY 24.38m-62.48m BASALT	0.00m-30.48m INNER LINING - CASING = Mild Steel 30.48m-62.48m INNER LINING - SCREEN = Mild Steel		30.48m-62.48m Basalt	15/03/1983	0m	On-site
68889	Domestic, Stock	0.00m-18.00m CLAY AND RUBBLES 18.00m-50.00m BASALT	0.00m-18.00m INNER LINING - CASING = Pvc 18.00m-50.00m INNER LINING - SCREEN = Pvc		18.00m-50.00m Basalt	30/04/1983	0m	On-site
68921	Domestic, Stock	0.00m-0.30m SOIL 0.30m-7.00m BASALT 7.00m-20.00m MOTTLED CLAY 20.00m-36.00m YELLOW MUDSTONE 36.00m-62.00m GREY SILTSTONE	0.00m-50.00m INNER LINING - CASING = Pvc 50.00m-62.00m INNER LINING - SCREEN = Pvc 36.00m-0.00m OUTER LINING - GRAVEL = Seal		50.00m-62.00m Siltstone	22/01/1989	0m	On-site
79172	Domestic, Stock	0.00m-0.91m TOP SOIL 0.91m-12.19m BASALT 12.19m-18.29m SCORIA 18.29m-48.76m BASALT	0.00m-15.24m INNER LINING - CASING = Steel 15.24m-42.67m INNER LINING - SCREEN = Steel 42.67m-48.76m INNER LINING - SCREEN = Slotted Steel		15.24m-42.67m Basalt 42.67m-48.76m Basalt	08/04/1983	0m	On-site
WRK095593	Observation	0.00m-0.40m CLAY/FILL 0.40m-6.00m BASALT 6.00m-8.00m WEATHERED ROCK 8.00m-9.50m CLAY 9.50m-15.00m BROKEN BASALT	0.00m-11.00m INNER LINING - CASING = Pvc 11.00m-14.00m INNER LINING - SCREEN = Pvc 14.00m-14.50m INNER LINING - CASING = Pvc 0.00m-10.10m OUTER LINING - GRAVEL = Cement 10.10m-11.10m OUTER LINING - GRAVEL = Bentonite 11.10m-14.60m OUTER LINING - GRAVEL = Gravel 14.60m-15.00m OUTER LINING - GRAVEL = Bentonite			26/08/2016	17m	South East

Bore Id	Use Type	Drillers Log	Construction	Latest Water Levels	Geology	Completed Date	Dist (m)	Dir
WRK959979	Domestic & Stock	0.00m-1.50m OVERBURDEN 1.50m-7.50m GREY CLAY 7.50m-10.10m BROWN CLAY 10.10m-18.00m SOFT BROWN MUDSTONE 18.00m-22.50m HARD BROWN MUDSTONE 22.50m-30.00m FRACTURED MUDSTONE	-0.50m-20.00m INNER LINING - CASING = Pvc 20.00m-30.00m INNER LINING - SCREEN = Pvc 0.00m-0.50m OUTER LINING - GRAVEL = Cement			24/11/2002	21m	North West
79123	Not Known		0.00m-17.06m INNER LINING - CASING = Not Known 17.06m-27.43m INNER LINING - SCREEN = Not Known		17.06m-27.43m	31/07/1963	37m	North
58464	Stock	0.00m-0.10m TOP SOIL 0.10m-3.00m FIRM DARK CLAY 3.00m-6.20m BASALTIC BOULDERS AND CLAY 6.20m-15.20m FIRM GREY BASALTIC CLAY 15.20m-27.50m MEDIUM HARD GREY MUDSTONE 27.50m-36.50m MEDIUM HARD MOTTLED GREY AS ABOVE 36.50m-61.00m MEDIUM HARD BLUE SHALE 61.00m-97.50m HARD AS ABOVE	0.00m-5.50m INNER LINING - CASING = Pvc 5.50m-7.00m INNER LINING - SCREEN = Pvc 7.00m-58.00m INNER LINING - CASING = Pvc		5.50m-7.00m Clay	28/04/1981	88m	North West
68900	Domestic, Miscellaneous, Stock	0.00m-0.50m SOIL 0.50m-36.00m BASALT 36.00m-72.00m MUDSTONE	0.00m-60.00m INNER LINING - CASING = Pvc 60.00m-72.00m INNER LINING - SCREEN = Pvc		60.00m-72.00m Mudstone	09/02/1988	137m	South East
68892	Domestic, Stock	0.00m-0.30m SURFACE SOIL 0.30m-1.20m FIRM BASALTIC CLAY 1.20m-30.00m BLUE/GREY HONEYCOMB BASALT 30.00m-34.00m HARD BLUE BASALT 34.00m-40.00m MEDIUM HARD GREY MUDSTONE 40.00m-49.00m MOTTLED BLUE SLATE 49.00m-67.00m HARD BLUE SLATE WITH SOME FRACTURES	0.00m-1.50m INNER LINING - CASING = Steel 0.00m-55.00m INNER LINING - CASING = Pvc 55.00m-67.00m INNER LINING - SCREEN = Steel		55.00m-67.00m Shale	29/11/1985	179m	South East
79167	Domestic		0.00m-74.00m INNER LINING - CASING = Pvc 74.00m-83.00m INNER LINING - SCREEN = Pvc 83.00m-83.80m INNER LINING - CASING = Pvc		74.00m-83.00m Basalt	13/08/1982	221m	East
68918	Domestic, Stock	0.00m-24.00m BASALT 24.00m-33.00m BASALTIC CLAY 33.00m-36.00m WEATHERED BASALT 36.00m-50.00m YELLOW MUDSTONE 50.00m-59.00m GREY MUDSTONE	0.00m-53.00m INNER LINING - CASING = Pvc 53.00m-59.00m INNER LINING - SCREEN = Pvc		53.00m-59.00m Mudstone	01/09/1987	252m	South East
68899	Domestic	0.00m-0.50m SOIL 0.50m-33.00m BASALT 33.00m-37.00m BASALTIC CLAY 37.00m-60.00m MUDSTONE 60.00m-71.58m SANDSTONE	0.00m-60.00m INNER LINING - CASING = Pvc 60.00m-71.58m INNER LINING - SCREEN = Pvc		60.00m-71.58m Sandstone	04/11/1988	318m	South East
68752	Domestic					31/12/1963	347m	South East
WRK983312							433m	South West
134017	Domestic	0.00m-0.20m SOIL 0.20m-10.00m BASALT 10.00m-12.00m WEATHERED BASALT 12.00m-13.00m RED BASALTIC CLAY 13.00m-16.00m MUDSTONE	0.20m-16.00m INNER LINING - CASING = Pvc Class 9 10.50m-15.00m INNER LINING - SCREEN = Pvc Class 9 0.00m-0.50m OUTER LINING - GRAVEL = Cement 6.00m-16.00m OUTER LINING - GRAVEL = Gravel 15.50m-16.00m OUTER LINING - GRAVEL = Bentonite		10.50m-15.00m Clay	08/04/1997	517m	South East
68885	Domestic, Stock	0.00m-1.00m SOIL AND CLAY 1.00m-4.00m BASALT 4.00m-12.00m WEATHERED BASALT 12.00m-14.00m RED CLAY 14.00m-15.00m MUDSTONE	0.00m-9.00m INNER LINING - CASING = Pvc 9.00m-12.00m INNER LINING - SCREEN = Pvc 12.00m-15.00m INNER LINING - CASING = Pvc		9.00m-12.00m Basalt	20/10/1985	535m	South East
68887	Domestic	0.00m-1.00m SOIL AND CLAY 1.00m-14.00m BASALT 14.00m-15.00m SILURIAN CLAY	0.00m-10.00m INNER LINING - CASING = Pvc 10.00m-15.00m INNER LINING - SCREEN = Pvc		10.00m-15.00m Basalt	28/02/1985	537m	South East
68896	Domestic, Miscellaneous, Stock	0.00m-0.30m SOIL 0.30m-15.00m BASALT 15.00m-16.00m MUDSTONE	0.00m-10.00m INNER LINING - CASING = Pvc 10.00m-16.00m INNER LINING - SCREEN = Pvc		10.00m-16.00m Basalt	15/01/1987	557m	South East

Bore Id	Use Type	Drillers Log	Construction	Latest Water Levels	Geology	Completed Date	Dist (m)	Dir
144025	Domestic, Stock	0.00m-0.20m SOIL 0.20m-21.00m BASALT	0.00m-21.00m INNER LINING - CASING = Pvc 15.00m-21.00m INNER LINING - SCREEN = Pvc 0.00m-1.00m OUTER LINING - GRAVEL = Cement			08/03/2001	601m	South East
68911	Domestic	0.00m-0.50m SOIL 0.50m-17.00m BASALT 17.00m-23.00m MUDSTONE	0.00m-11.00m INNER LINING - CASING = Pvc 11.00m-17.00m INNER LINING - SCREEN = Pvc 17.00m-23.00m INNER LINING - CASING = Pvc		11.00m-17.00m Basalt	07/03/1988	616m	South East
68926	Domestic	0.00m-0.50m SOIL 0.50m-19.00m BASALT 19.00m-20.00m MUDSTONE	0.00m-14.00m INNER LINING - CASING = Pvc 14.00m-20.00m INNER LINING - SCREEN = Pvc		14.00m-20.00m Basalt	10/12/1987	636m	South East
132473	Domestic, Stock	0.00m-0.50m SOIL 0.50m-11.00m BASALT 11.00m-15.00m SCORIA 15.00m-25.00m BASALT	0.20m-25.00m INNER LINING - CASING = Pvc Class 9 14.00m-25.00m INNER LINING - SCREEN = Pvc Class 9 0.00m-0.50m OUTER LINING - GRAVEL = Cement		14.00m-25.00m Basalt	07/04/1997	656m	South East
68913	Domestic	0.00m-0.20m SOIL 0.20m-3.00m CLAY 3.00m-26.00m BASALT	0.00m-20.00m INNER LINING - CASING = Pvc 20.00m-26.00m INNER LINING - SCREEN = Pvc		20.00m-26.00m Basalt	27/02/1989	798m	South East
79262	Domestic, Stock	0.00m-1.00m CLAY 1.00m-18.00m MUDSTONE 18.00m-106.68m BASALT	0.00m-31.00m INNER LINING - CASING = Pvc 31.00m-106.68m INNER LINING - SCREEN = Pvc		31.00m-106.68m Basalt	22/03/1982	831m	West
WRK095595	Observation	0.00m-0.70m CLAY 0.70m-3.00m BASALT 3.00m-8.00m ROCK/WEATHERED 8.00m-9.00m CLAY 9.00m-12.00m BASALT	0.00m-8.00m INNER LINING - CASING = Pvc 8.00m-11.00m INNER LINING - SCREEN = Pvc 11.00m-11.50m INNER LINING - CASING = Pvc 0.00m-6.50m OUTER LINING - GRAVEL = Cement 6.50m-7.50m OUTER LINING - GRAVEL = Bentonite 7.50m-11.20m OUTER LINING - GRAVEL = Gravel 11.20m-12.00m OUTER LINING - GRAVEL = Cement		8.00m-11.00m Basalt	29/08/2016	843m	South East
111569	Domestic, Stock	0.00m-0.70m SOIL & CLAY 0.70m-34.50m BASALT	0.00m-24.00m INNER LINING - CASING = Pvc Class 9 24.00m-34.50m INNER LINING - SCREEN = Pvc Class 9 0.00m-0.50m OUTER LINING - GRAVEL = Cement		24.00m-34.50m Basalt	05/12/1991	980m	South East
140504	Domestic, Stock	0.00m-0.20m SOIL 0.20m-41.00m BROWN CLAY 41.00m-51.00m WEATHERED BASALT, SILTSTONE	0.00m-42.00m INNER LINING - CASING = Steel 0.00m-3.00m OUTER LINING - GRAVEL = Cement			13/04/2000	995m	North
113463	Domestic & Stock	0.00m-0.50m SOIL 0.50m-3.00m BASALTIC CLAY 3.00m-25.50m BASALT	-0.30m-18.00m INNER LINING - CASING = Pvc Class 9 18.00m-25.50m INNER LINING - SCREEN = Pvc Class 9 10.00m-25.50m OUTER LINING - GRAVEL = Gravel			23/04/1992	1045 m	South East
WRK042995	Irrigation	0.00m-0.30m TOP SOIL 0.30m-7.00m YELLOW SAND 7.00m-18.00m LIMESTONE WITH LAYERS OF SAND & STONE, RED CLAY	0.00m-15.00m INNER LINING - CASING = Pvc 15.00m-18.00m INNER LINING - SCREEN = Pvc 0.00m-10.00m OUTER LINING - GRAVEL = Bentonite 10.00m-18.00m OUTER LINING - GRAVEL = Gravel			03/03/1999	1114 m	North West
68871	Domestic, Stock	0.00m-1.00m CLAY 1.00m-6.00m WEATHERED BASALT 6.00m-29.00m BASALT	0.00m-26.00m INNER LINING - CASING = Pvc 26.00m-29.00m INNER LINING - SCREEN = Pvc		26.00m-29.00m Basalt	13/02/1985	1117 m	South East
68848	Domestic, Stock	0.00m-1.00m BASALTIC CLAY 1.00m-20.00m WEATHERED BASALT 20.00m-21.00m RED CLAY 21.00m-23.00m SANDSTONE	0.00m-17.00m INNER LINING - CASING = Pvc 17.00m-23.00m INNER LINING - SCREEN = Pvc		17.00m-23.00m Basalt	26/02/1981	1157 m	South East
68828	Domestic	0.00m-1.50m TOP SOIL AND CLAY 1.50m-12.50m WEATHERED BASALT	0.00m-10.00m INNER LINING - CASING = Pvc 5.00m-12.50m INNER LINING - SCREEN = Pvc		5.00m-12.50m	08/01/1976	1160 m	South East
319780	Non Groundwater					02/03/1970	1223 m	South West
79267	Domestic, Stock	0.00m-32.00m BASALT 32.00m-41.00m MUDSTONE	0.00m-28.00m INNER LINING - CASING = Pvc 28.00m-34.00m INNER LINING - SCREEN = Pvc 34.00m-41.00m INNER LINING - CASING = Pvc		28.00m-34.00m Basalt	06/03/1988	1237 m	South East

Bore Id	Use Type	Drillers Log	Construction	Latest Water Levels	Geology	Completed Date	Dist (m)	Dir
68780	Not Known					31/12/1970	1338 m	South East
WRK059916	Domestic & Stock	0.00m-1.00m soil 1.00m-4.30m clay 4.30m-9.00m weathered baslat 9.00m-12.00m clay 12.00m-18.00m weathered basalt 18.00m-39.00m baslat	0.00m-38.00m INNER LINING - CASING = Pvc 0.00m-3.00m OUTER LINING - GRAVEL = Cement 15.00m-16.00m OUTER LINING - GRAVEL = Bentonite 16.00m-38.00m OUTER LINING - GRAVEL = Gravel		0.00m-38.00m Basalt		1341 m	South East
WRK095594	Observation	0.00m-0.60m CLAY 0.60m-4.00m BASALT 4.00m-8.00m ROCK/WEATHERED 8.00m-9.00m CLAY 9.00m-12.00m BASALT	0.00m-8.00m INNER LINING - CASING = Pvc 8.00m-11.00m INNER LINING - SCREEN = Pvc 11.00m-11.50m INNER LINING - CASING = Pvc 0.00m-6.50m OUTER LINING - GRAVEL = Cement 6.50m-7.50m OUTER LINING - GRAVEL = Bentonite 7.50m-11.20m OUTER LINING - GRAVEL = Gravel 11.20m-12.00m OUTER LINING - GRAVEL = Bentonite		8.00m-11.00m Basalt	19/08/2016	1410 m	South East
WRK983504							1433 m	West
310870	Non Groundwater					31/12/1965	1455 m	South
WRK987506							1472 m	East
319778	Non Groundwater					31/12/1965	1536 m	South West
68876	Domestic	0.00m-20.00m BASALT	0.00m-14.00m INNER LINING - CASING = Pvc Class 6 14.00m-20.00m INNER LINING - SCREEN = Pvc Class 6		14.00m-20.00m Basalt	26/02/1985	1537 m	South East
WRK985495	Groundwater Investigation	0.00m-3.00m clay 3.00m-13.50m basalt	0.00m-6.00m INNER LINING - CASING = Pvc 6.00m-13.50m INNER LINING - SCREEN = Pvc 0.00m-4.50m OUTER LINING - GRAVEL = Cement 4.50m-5.50m OUTER LINING - GRAVEL = Bentonite 5.50m-13.50m OUTER LINING - GRAVEL = Gravel			28/03/2008	1657 m	South
WRK063024	Observation	0.00m-2.50m CLAY 2.50m-12.00m BASALT	0.00m-7.00m INNER LINING - CASING = Pvc 7.00m-12.00m INNER LINING - SCREEN = Pvc 0.00m-5.50m OUTER LINING - GRAVEL = Cement 5.50m-6.50m OUTER LINING - GRAVEL = Bentonite 6.50m-12.00m OUTER LINING - GRAVEL = Gravel		7.00m-12.00m Basalt	15/07/2011	1669 m	South
68909	Domestic, Stock	0.00m-3.00m SOIL & CLAY 3.00m-9.00m WEATHERED BASALT 9.00m-43.00m BASALT 43.00m-47.00m SILURIAN BEDROCK	0.00m-29.00m INNER LINING - CASING = Pvc 29.00m-41.00m INNER LINING - SCREEN = Pvc 41.00m-47.00m INNER LINING - CASING = Pvc 6.00m-47.00m OUTER LINING - GRAVEL = Gravel		29.00m-41.00m Basalt	10/09/1989	1673 m	South
68800	Domestic, Stock	0.00m-2.44m CLAY 2.44m-7.62m CLAY AND BASALT BOULDERS 7.62m-10.97m BASALT SOFT 10.97m-18.28m BASALT HARD	0.00m-12.50m INNER LINING - CASING = Not Known 16.15m-18.28m INNER LINING - SCREEN = Not Known		16.15m-18.28m	21/10/1974	1691 m	South
310876	Non Groundwater					25/06/1970	1698 m	South
WRK990749	Observation	0.00m-1.20m brown clay 1.20m-12.00m brown basalt	0.00m-7.00m INNER LINING - CASING = Pvc 7.00m-12.00m INNER LINING - SCREEN = Pvc 0.00m-5.50m OUTER LINING - GRAVEL = Cement 5.50m-6.50m OUTER LINING - GRAVEL = Bentonite 6.50m-12.00m OUTER LINING - GRAVEL = Gravel		0.00m-7.00m Basalt 7.00m-12.00m Basalt	12/06/2009	1700 m	South

Bore Id	Use Type	Drillers Log	Construction	Latest Water Levels	Geology	Completed Date	Dist (m)	Dir
WRK990748	Observation	0.00m-1.50m brown clay 1.50m-5.50m basalt & clay 5.50m-14.00m grey basalt	0.00m-7.00m INNER LINING - CASING = Pvc 7.00m-14.00m INNER LINING - SCREEN = Pvc 0.00m-5.50m OUTER LINING - GRAVEL = Cement 5.50m-6.50m OUTER LINING - GRAVEL = Bentonite 6.50m-14.00m OUTER LINING - GRAVEL = Gravel			11/06/2009	1701 m	South
WRK990750							1727 m	South
68841	Domestic	0.00m-0.70m CLAY FILLINGS 0.70m-3.00m FIRM BASALTIC CLAY AND BOULDERS 3.00m-12.20m MEDIUM HARD BASALT WITH BROKEN SEAMS 12.20m-18.50m HARD BASALT (BLUE) 18.50m-42.50m HARD PINK BASALT WITH BROKEN LAYERS 42.50m-43.70m FIRM RED CLAY	0.00m-20.00m INNER LINING - CASING = Galvanised Iron 20.00m-43.00m INNER LINING - SCREEN = Galvanised Iron 43.00m-43.70m INNER LINING - CASING = Galvanised Iron		20.00m-43.00m Basalt	14/03/1980	1735 m	South
68860	Not Known	0.00m-29.00m BASALT	0.00m-23.00m INNER LINING - CASING = Pvc 23.00m-29.00m INNER LINING - SCREEN = Pvc		23.00m-29.00m Basalt	25/03/1983	1779 m	South East
79249	Not Known					31/12/1970	1793 m	South West
68852	Domestic, Stock	0.00m-22.00m BROKEN BASALT	0.00m-16.00m INNER LINING - CASING = Pvc 16.00m-22.00m INNER LINING - SCREEN = Pvc		16.00m-22.00m Basalt	07/04/1983	1804 m	South East
140183	Stock	0.00m-0.40m SOIL 0.40m-7.00m BROWN & GREY CLAY 7.00m-20.00m WEATHERED MUDSTONE 20.00m-27.50m BROWN & GREY SILTSTONE	0.00m-27.50m INNER LINING - CASING = Not Known 20.00m-27.50m INNER LINING - SCREEN = Not Known 0.00m-0.70m OUTER LINING - GRAVEL = Cement 7.00m-9.00m OUTER LINING - GRAVEL = Cement			11/11/1999	1807 m	North
68754	Not Known					24/03/1965	1828 m	South
114717	Domestic & Stock	0.00m-1.00m TOP SOIL & CLAY 1.00m-3.00m CLAY 3.00m-46.00m BASALT	0.00m-40.00m INNER LINING - CASING = Not Known 40.00m-42.00m INNER LINING - SCREEN = Not Known		40.00m-42.00m	15/01/1992	1847 m	South East
WRK038875	Irrigation	0.00m-0.10m FILL 0.10m-0.40m CLAY 0.40m-47.00m BASALT	0.00m-38.00m INNER LINING - CASING = Mild Steel 38.00m-43.00m INNER LINING - SCREEN = Mild Steel 43.00m-47.00m INNER LINING - CASING = Mild Steel		38.00m-43.00m Basalt	22/02/1989	1925 m	South East
68915	Domestic, Stock	0.00m-0.50m SOIL 0.50m-6.00m WEATHERED BASALT 6.00m-26.00m BASALT	0.00m-14.00m INNER LINING - CASING = Pvc 14.00m-26.00m INNER LINING - SCREEN = Pvc 7.50m-0.00m OUTER LINING - GRAVEL = Seal		14.00m-26.00m Basalt	08/06/1989	1945 m	South East
68912	Domestic, Stock	0.00m-0.40m SOIL 0.40m-20.00m WEATHERED BASALT 20.00m-23.00m RED BASALT	0.00m-14.00m INNER LINING - CASING = Pvc 14.00m-23.00m INNER LINING - SCREEN = Pvc		14.00m-23.00m Basalt	15/06/1989	1984 m	South East
WRK969109							1987 m	South West

Groundwater Boreholes

Merrifield North Psp, Hume City, VIC 3064

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
319783		Department of Manufacturing & Industry Development		Rotary (diamond/drag bit)		02/09/1971	21.49	215.50	300	0m	On-site
58465		Private Individual/Corporation	Stock/Poultry water supply	Air Percussion/Air Rotary		18/03/1982	13.50		100	0m	On-site
68850		Private Individual/Corporation	Domestic & Stock water supply	Rotary (diamond/drag bit)		11/09/1982	53.30		100	0m	On-site
68859		Private Individual/Corporation	Stock/Poultry water supply	Air Percussion/Air Rotary		03/05/1983	72.00		100	0m	On-site
68861		Private Individual/Corporation	Domestic & Stock water supply	Air Percussion/Air Rotary		04/05/1983	22.50		100	0m	On-site
68870		Private Individual/Corporation	Domestic & Stock water supply	Air Percussion/Air Rotary		21/12/1984	17.00		100	0m	On-site
68881		Private Individual/Corporation	Public/town water supply	Air Percussion/Air Rotary		15/03/1983	62.48		100	0m	On-site
68881		Private Individual/Corporation	Domestic & Stock water supply	Air Percussion/Air Rotary		15/03/1983	62.48		100	0m	On-site
68889		Private Individual/Corporation	Domestic water supply	Air Percussion/Air Rotary		30/04/1983	50.00		100	0m	On-site
79172		Private Individual/Corporation	Domestic & Stock water supply	Air Percussion/Air Rotary		08/04/1983	48.76		100	0m	On-site
79123		Department of Education, Victoria				31/07/1963	34.74		300	38m	North
68892		Department of Education, Victoria	Domestic water supply	Air Percussion/Air Rotary		29/11/1985	67.00		100	177m	South East
79167		Private Individual/Corporation	Domestic water supply	Rotary (diamond/drag bit)		13/08/1982	83.80		100	219m	East
68752		Department of Education, Victoria				31/12/1963	36.58		300	346m	South East
68885		Private Individual/Corporation	Domestic & Stock water supply	Percussion (cable)		20/10/1985	15.00		100	535m	South East
68887		Private Individual/Corporation	Domestic water supply	Percussion (cable)		28/02/1985	15.00		100	536m	South East
79262		Private Individual/Corporation	Domestic & Stock water supply	Air Percussion/Air Rotary		22/03/1982	106.68		100	832m	West
68871		Private Individual/Corporation	Domestic & Stock water supply	Air Percussion/Air Rotary		13/02/1985	29.00		100	1116 m	South East
319780		Department of Manufacturing & Industry Development		Rotary (diamond/drag bit)		02/03/1970	36.58	243.53	300	1222 m	South West
68873		Private Individual/Corporation	Domestic water supply	Air Percussion/Air Rotary		26/02/1985	16.70		100	1242 m	South East

Bore Id	Bore Type	Company	Usage	Method	Status	Drill Date	Depth	Elevation	Accuracy (m)	Dist (m)	Dir
68780		Private Individual/Corporation				31/12/1970			300	1337 m	South East
310870		Department of Manufacturing & Industry Development				31/12/1965	42.36		300	1453 m	South
68876		Private Individual/Corporation	Domestic water supply	Air Percussion/Air Rotary		26/02/1985	20.00		100	1536 m	South East
319778		Department of Manufacturing & Industry Development				31/12/1965	14.02		300	1537 m	South West
310876		Department of Manufacturing & Industry Development		Rotary (diamond/drag bit)		25/06/1970	50.90	226.20	300	1697 m	South
68860		Private Individual/Corporation	Industrial/commercial water	Air Percussion/Air Rotary		25/03/1983	29.00		100	1705 m	South East
79249		Private Individual/Corporation				31/12/1970			300	1793 m	South West
68829		Private Individual/Corporation	Irrigation	Air Percussion/Air Rotary		04/03/1978	24.50		300	1798 m	South East
68852		Private Individual/Corporation	Domestic & Stock water supply	Air Percussion/Air Rotary		07/04/1983	22.00		100	1802 m	South East
68754		Private Individual/Corporation				24/03/1965	39.62		300	1828 m	South
68867		Private Individual/Corporation	Domestic & Stock water supply	Percussion (cable)		14/10/1975	13.72		100	1937 m	South East

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
N/A	No records in buffer						

Historical Mining Activity - Shafts

Merrifield North Psp, Hume City, VIC 3064

Historical Mining Activity - Shafts

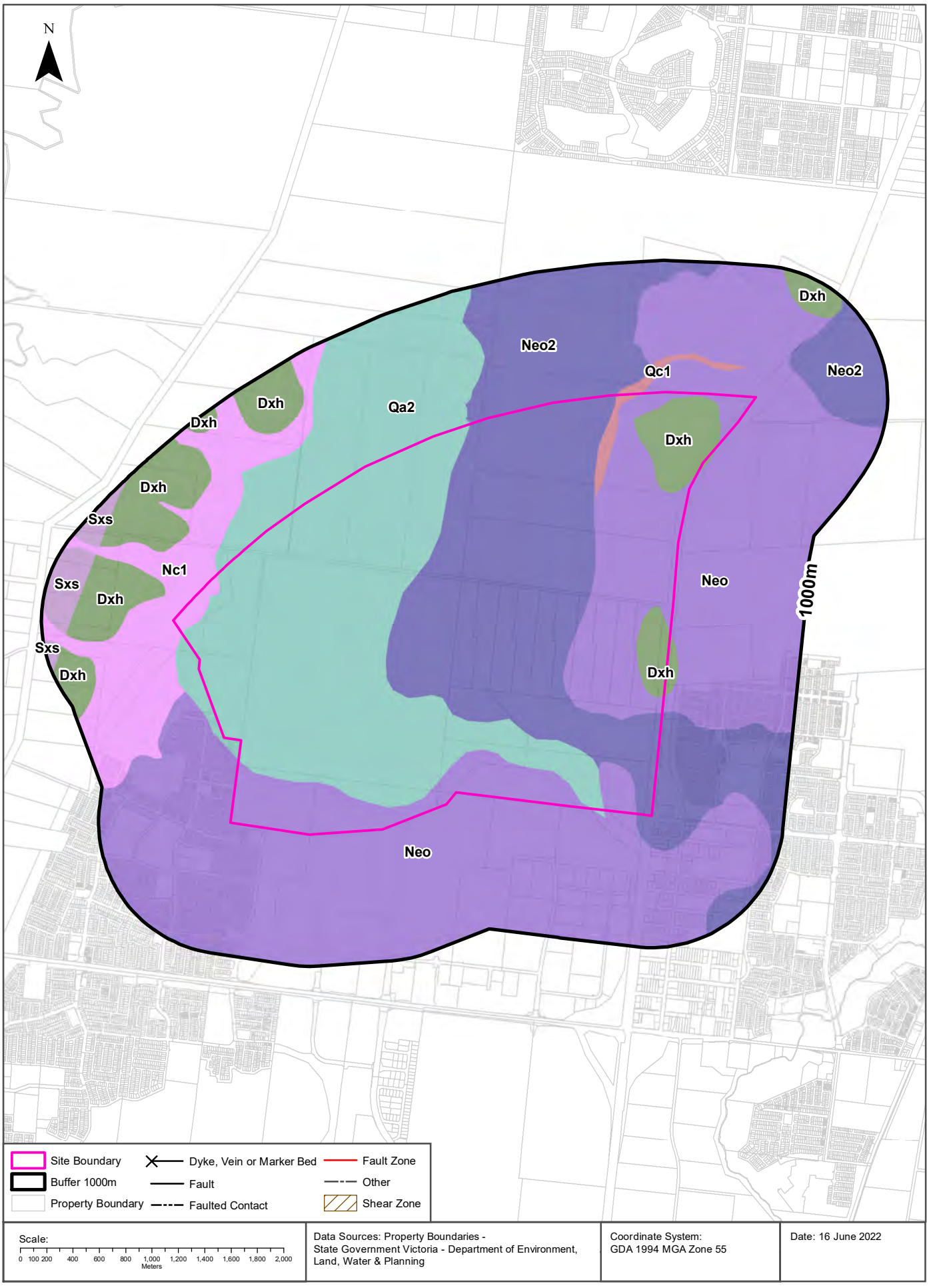
Mine Shaft Locations were collected by a variety of methods from 1869 in some areas of the state, mainly concentrating in Ballarat and Bendigo. In places a shaft may be recorded multiple times with a different source. In cases where several shaft locations are shown close together (generally with separations 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
N/A	No records in buffer								

Geology

Merrifield North Psp, Hume City, VIC 3064



Geology

Merrifield North Psp, Hume City, VIC 3064

Geological Units 1:50,000

What are the Geological Units within the dataset buffer?

Symbol	Name	Description	Geological Age	Lithology	Distance	Direction
Qa2	alluvial terrace deposits(Qa2): generic	Gravel, sand, silt: variably sorted and rounded, generally unconsolidated; dissected to form terraces higher than Qa1, alluvial floodplain deposits	Pleistocene to Pleistocene	gravel material (significant); sand (significant); silt material (significant)	0m	On-site
Neo2	Newer Volcanic Group - stony rises basalt (Neo2): generic	Tholeiitic to alkalic basalt, basanite: youngest flows with little weathering or soil development (stony rises and hummocky lava flows)	Miocene to Holocene	basalt (all)	0m	On-site
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
Dxh	Humevale Siltstone (Dxh): generic	Siltstone: brown, laminated; minor very fine- to fine-grained sandstone laminae and thin beds towards the top of the formation; distal shelf and hemipelagic deposits.	Llandovery to Early Devonian	siltstone (major proportion); sandstone (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
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
Sxs	Springfield Sandstone (Sxs): generic	Sandstone, siltstone and conglomerate: medium to thick bedded, lithic quartz sandstone alternating with grey-green shaly siltstone and thin-bedded sandstone; variably bioturbated, occasional graptolites; deep-marine turbidite fan deposits.	Rhuddanian to Telychian	sandstone (major proportion); conglomerate (significant); siltstone (minor proportion)	727m	West
Dxh	Humevale Siltstone (Dxh): hornfels	hornfels	Llandovery to Early Devonian; Late Devonian to Late Devonian	hornfels (all)	752m	North East

Geology

Merrifield North Psp, Hume City, VIC 3064

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					

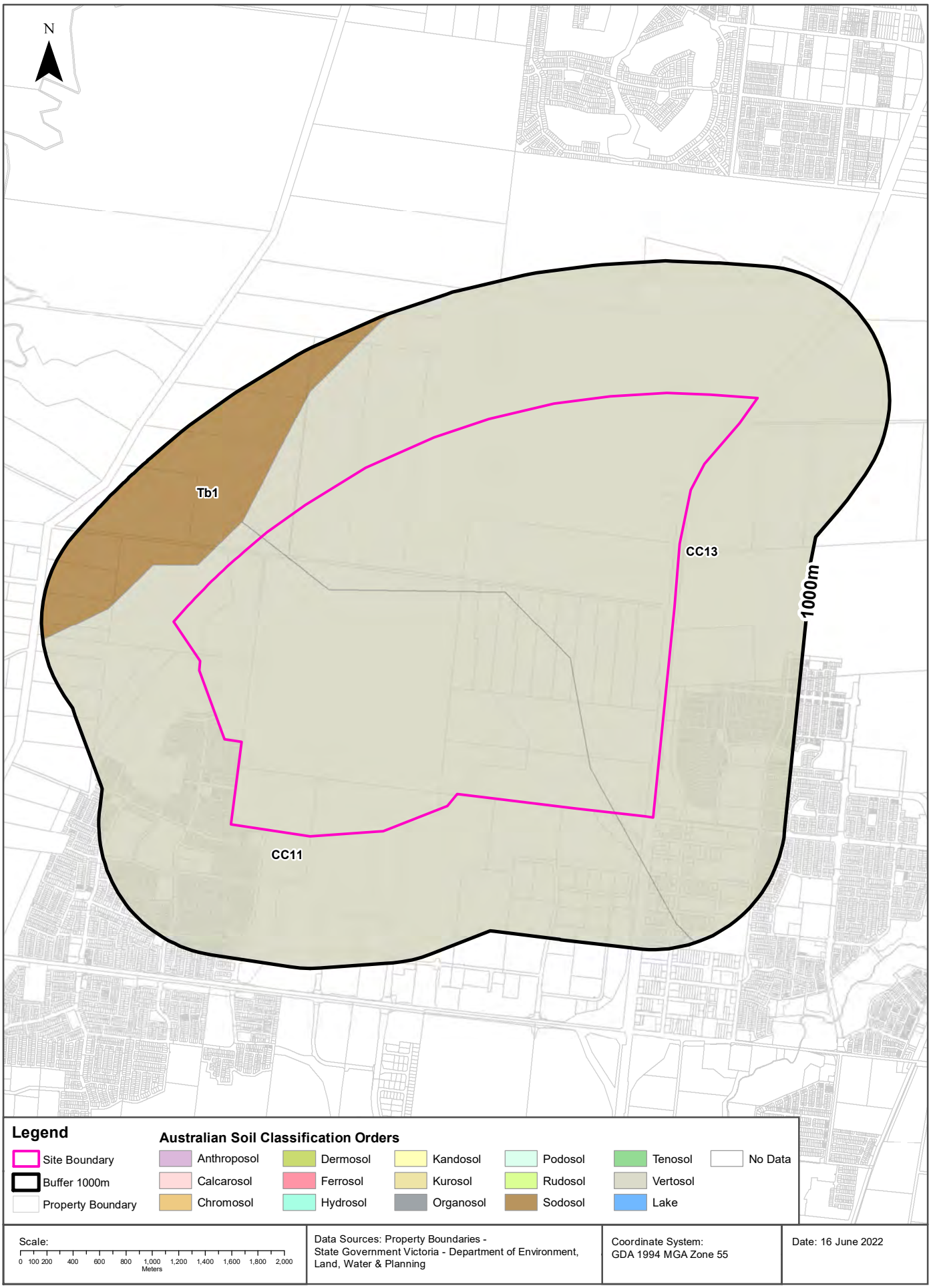
Geological Structures 1:250,000

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

Merrifield North Psp, Hume City, VIC 3064



Soils

Merrifield North Psp, Hume City, VIC 3064

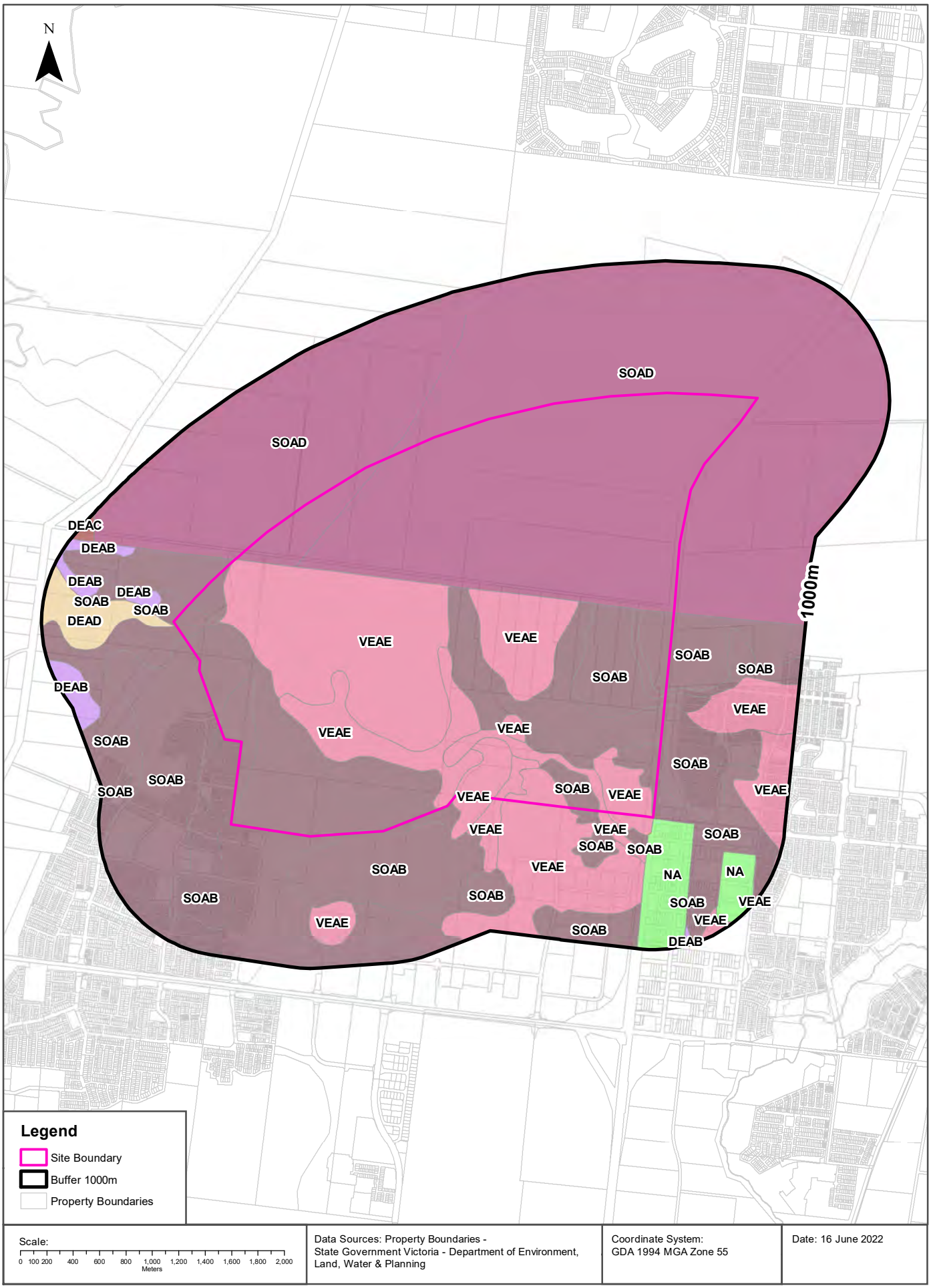
Atlas of Australian Soils

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

Map Unit Code	Soil Order	Map Unit Description	Distance	Direction
CC13	Vertosol	Gently undulating plains with some stony rises and basalt hills: gilgai plains of cracking grey clays (Ug5.2) in association with hard alkaline yellow mottled soils (Dy3.33 and Dy3.43), hard alkaline dark mottled soils (Dd2.33), and hard alkaline yellow soils (Dy2), and also some swampy areas of cracking grey clays (Ug5.2); the stony rises are of irregular distribution and have friable loamy soils especially (Um6.21, Um6.41, and Um6.24) on the rises and usually gilgai areas of cracking dark clays (Ug5.13 and Ug5.14) at their base; soils of the basalt hills are classed with those of the plain; small areas of other undescribed red soils in the northern portion of the unit. Ironstone gravels may occur in surface horizons of (D) soils.	0m	On-site
CC11	Vertosol	Gently undulating dissected tablelands at low to moderate elevation: on the flatter tableland remnants, the gilgai plains with but few basalt boulders have cracking grey clays (Ug5.2) in association with hard yellow mottled soils (Dy3.43, Dy3.42, and Dy3.41) and (Dy3.13), while those gilgai plains with numerous basalt boulders have cracking dark clays (Ug5.14) in associ- ation with friable dark soils (Dd3.12) and hard yellow mottled soils (Dy3); stony rises of friable loamy soils, especially (Um6.24, Um6.13, and Um6.21) with hard alkaline brown soils (Db1.13) on saddles between rises, and with gilgai areas of cracking dark clays (Ug5.14 and Ug5.13) spreading out from the base of the rises, occur either on the tableland plains or on their scarps where the (Um6) soils are the common ones; other undescribed soils occur on and around volcanic cones; bands of cracking dark clays (Ug5.15) occur along some of the narrow incised stream valleys. Ironstone gravels may occur in the surface horizons of the (D) soils.	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.	164m	North West

Victorian Soil Type Mapping

Merrifield North Psp, Hume City, VIC 3064



Soils

Merrifield North Psp, Hume City, VIC 3064

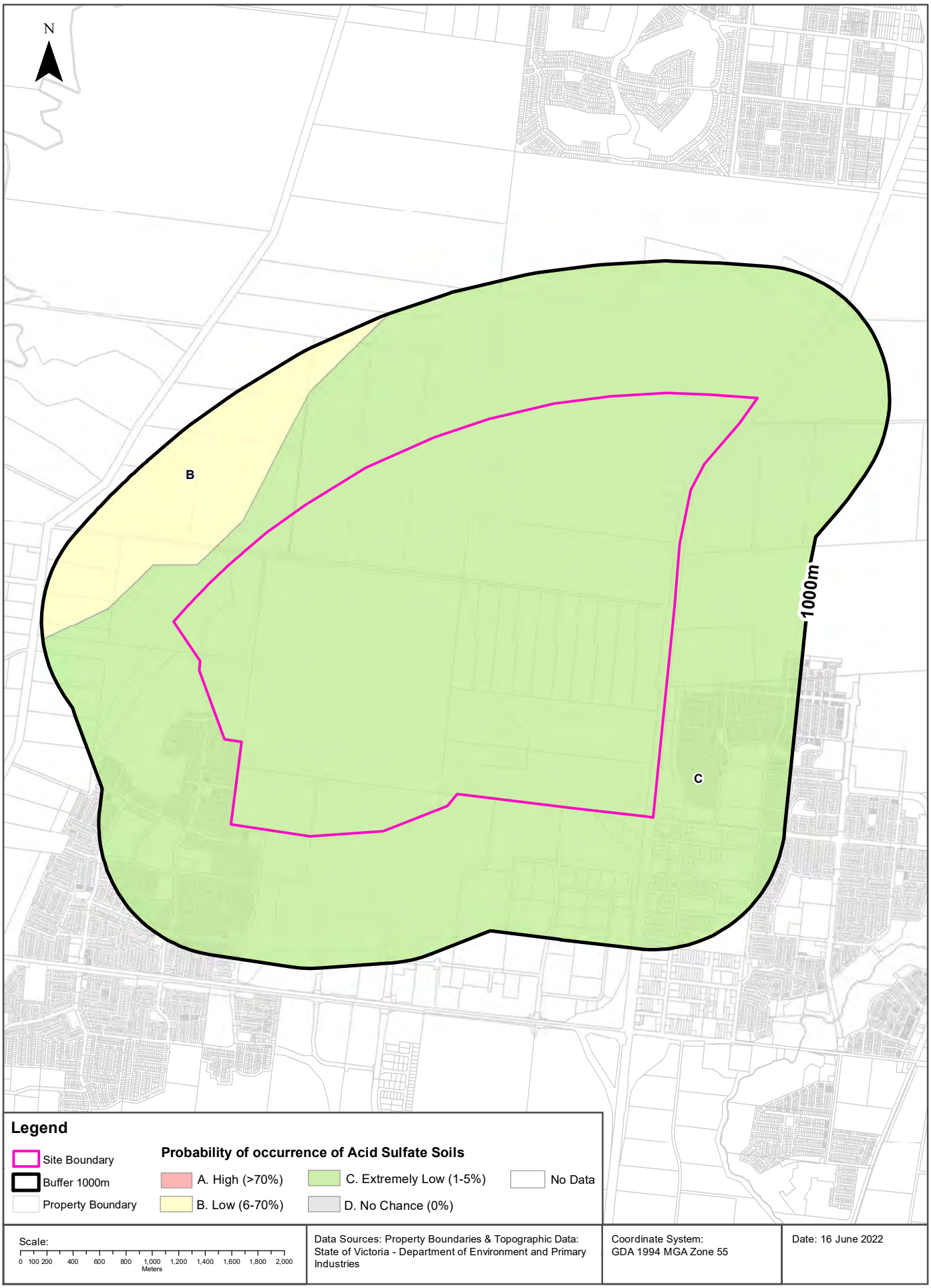
Victorian Soil Type Mapping

Victorian Soil Types within the dataset buffer:

Symbol	Description	Distance	Direction
SOAB	Brown Sodosols	0m	On-site
SOAD	Grey Sodosols	0m	On-site
VEAE	Black Vertosols	0m	On-site
NA	Unassigned	7m	South East
DEAD	Grey Dermosols	14m	West
DEAB	Brown Dermosols	172m	West
DEAC	Yellow Dermosols	850m	West

Atlas of Australian Acid Sulfate Soils

Merrifield North Psp, Hume City, VIC 3064



Acid Sulfate Soils

Merrifield North Psp, Hume City, VIC 3064

Atlas of Australian Acid Sulfate Soils

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

Class	Description	Distance	Direction
C	Extremely low probability of occurrence. 1-5% chance of occurrence with occurrences in small localised areas.	0m	On-site
B	Low Probability of occurrence. 6-70% chance of occurrence.	165m	North West

Acid Sulfate Soils

Merrifield North Psp, Hume City, VIC 3064

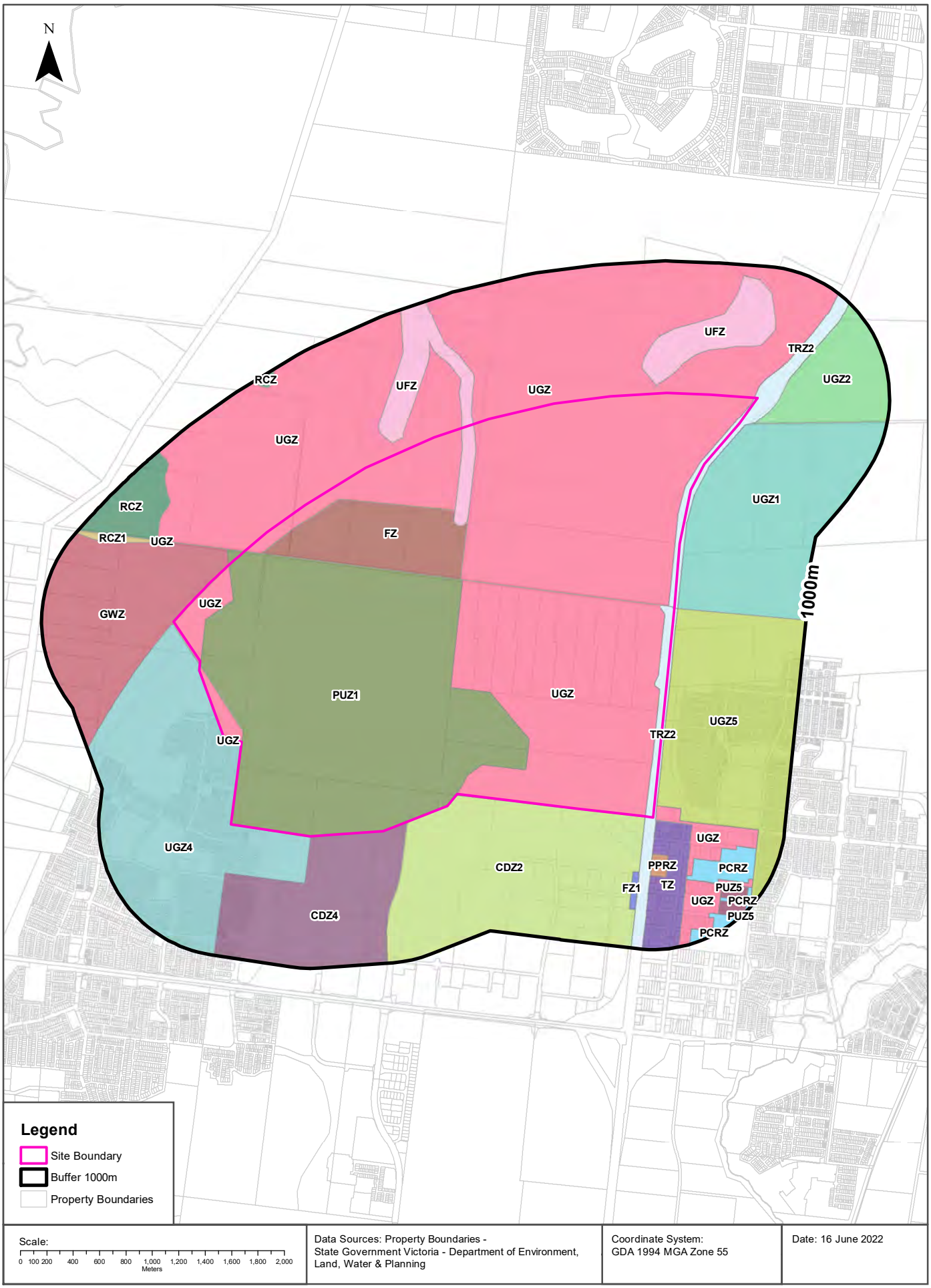
Coastal Acid Sulfate Soils

Coastal Acid Sulfate Soil types within the dataset buffer:

Coastal Acid Sulfate Soil Types	Distance	Direction
No records in buffer		

Planning Zones

Merrifield North Psp, Hume City, VIC 3064



Planning

Merrifield North Psp, Hume City, VIC 3064

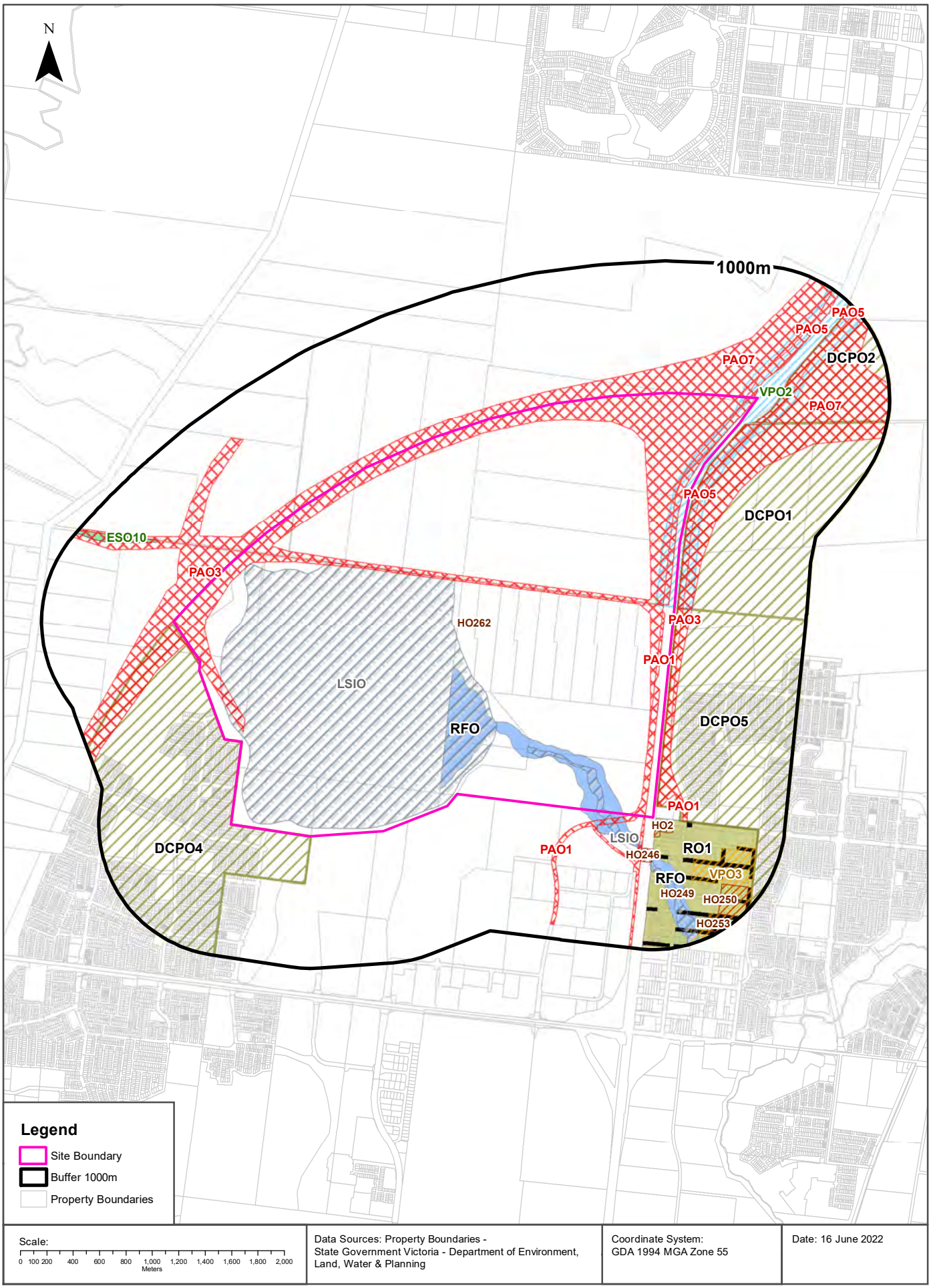
Planning Zones

Planning zones within the dataset buffer:

Zone Code	Description	Distance	Direction
PUZ1	PUBLIC USE ZONE - SERVICE AND UTILITY	0m	On-site
FZ	FARMING ZONE	0m	On-site
UGZ	URBAN GROWTH ZONE	0m	On-site
UFZ	URBAN FLOODWAY ZONE	0m	On-site
TRZ2	TRANSPORT ZONE 2 - PRINCIPAL ROAD NETWORK	0m	On-site
CDZ2	COMPREHENSIVE DEVELOPMENT ZONE - SCHEDULE 2	0m	South
GWZ	GREEN WEDGE ZONE	0m	West
CDZ4	COMPREHENSIVE DEVELOPMENT ZONE - SCHEDULE 4	0m	South West
UGZ4	URBAN GROWTH ZONE - SCHEDULE 4	0m	South West
UGZ	URBAN GROWTH ZONE	14m	South East
UGZ5	URBAN GROWTH ZONE - SCHEDULE 5	14m	East
UGZ1	URBAN GROWTH ZONE - SCHEDULE 1	16m	East
TZ	TOWNSHIP ZONE	23m	South East
UFZ	URBAN FLOODWAY ZONE	63m	North East
UGZ2	URBAN GROWTH ZONE - SCHEDULE 2	67m	North East
PPRZ	PUBLIC PARK AND RECREATION ZONE	276m	South East
UGZ	URBAN GROWTH ZONE	420m	West
FZ1	FARMING ZONE - SCHEDULE 1	426m	South East
PCRZ	PUBLIC CONSERVATION AND RESOURCE ZONE	436m	South East
RCZ1	RURAL CONSERVATION ZONE - SCHEDULE 1	502m	West
RCZ	RURAL CONSERVATION ZONE	510m	West
UGZ	URBAN GROWTH ZONE	530m	South East
PUZ5	PUBLIC USE ZONE - CEMETERY/CREMATORIUM	719m	South East
PCRZ	PUBLIC CONSERVATION AND RESOURCE ZONE	785m	South East
PUZ5	PUBLIC USE ZONE - CEMETERY/CREMATORIUM	804m	South East
RCZ	RURAL CONSERVATION ZONE	910m	North West

Planning Overlays

Merrifield North Psp, Hume City, VIC 3064



Planning

Merrifield North Psp, Hume City, VIC 3064

Planning Overlays

Planning overlays within the dataset buffer:

Zone Code	Description	Distance	Direction
PAO7	PUBLIC ACQUISITION OVERLAY 7	0m	On-site
RFO	RURAL FLOODWAY OVERLAY	0m	On-site
PAO3	PUBLIC ACQUISITION OVERLAY 3	0m	On-site
VPO2	VEGETATION PROTECTION OVERLAY - SCHEDULE 2	0m	On-site
PAO5	PUBLIC ACQUISITION OVERLAY 5	0m	On-site
PAO1	PUBLIC ACQUISITION OVERLAY 1	0m	On-site
LSIO	LAND SUBJECT TO INUNDATION OVERLAY	0m	On-site
HO262	HERITAGE OVERLAY (HO262)	0m	On-site
DCPO4	DEVELOPMENT CONTRIBUTIONS PLAN OVERLAY - SCHEDULE 4	0m	South West
DCPO5	DEVELOPMENT CONTRIBUTIONS PLAN OVERLAY - SCHEDULE 5	14m	East
PAO1	PUBLIC ACQUISITION OVERLAY 1	14m	South East
RO1	RESTRUCTURE OVERLAY - SCHEDULE 1	14m	South East
DCPO1	DEVELOPMENT CONTRIBUTIONS PLAN OVERLAY - SCHEDULE 1	16m	East
PAO5	PUBLIC ACQUISITION OVERLAY 5	16m	North East
PAO3	PUBLIC ACQUISITION OVERLAY 3	51m	East
PAO7	PUBLIC ACQUISITION OVERLAY 7	59m	North East
DCPO2	DEVELOPMENT CONTRIBUTIONS PLAN OVERLAY - SCHEDULE 2	67m	North East
HO2	HERITAGE OVERLAY (HO2)	78m	South East
PAO5	PUBLIC ACQUISITION OVERLAY 5	92m	North East
HO245	HERITAGE OVERLAY (HO245)	95m	South East
HO246	HERITAGE OVERLAY (HO246)	241m	South East
RXO	ROAD CLOSURE OVERLAY	253m	South East
RFO	RURAL FLOODWAY OVERLAY	260m	South East
RXO	ROAD CLOSURE OVERLAY	276m	South East
RXO	ROAD CLOSURE OVERLAY	426m	South East
VPO3	VEGETATION PROTECTION OVERLAY - SCHEDULE 3	436m	South East
RXO	ROAD CLOSURE OVERLAY	482m	South East
ESO10	ENVIRONMENTAL SIGNIFICANCE OVERLAY - SCHEDULE 10	502m	West
HO249	HERITAGE OVERLAY (HO249)	588m	South East
RXO	ROAD CLOSURE OVERLAY	675m	South East
HO250	HERITAGE OVERLAY (HO250)	719m	South East

Zone Code	Description	Distance	Direction
RXO	ROAD CLOSURE OVERLAY	719m	South East
HO253	HERITAGE OVERLAY (HO253)	860m	South East
RXO	ROAD CLOSURE OVERLAY	938m	South East

Heritage

Merrifield North Psp, Hume City, VIC 3064

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							

Heritage Data Source: Australian Government Department of the Environment and Energy - Heritage Branch

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							

Heritage Data Source: Australian Government Department of the Environment and Energy - Heritage Branch

Victorian Heritage Register

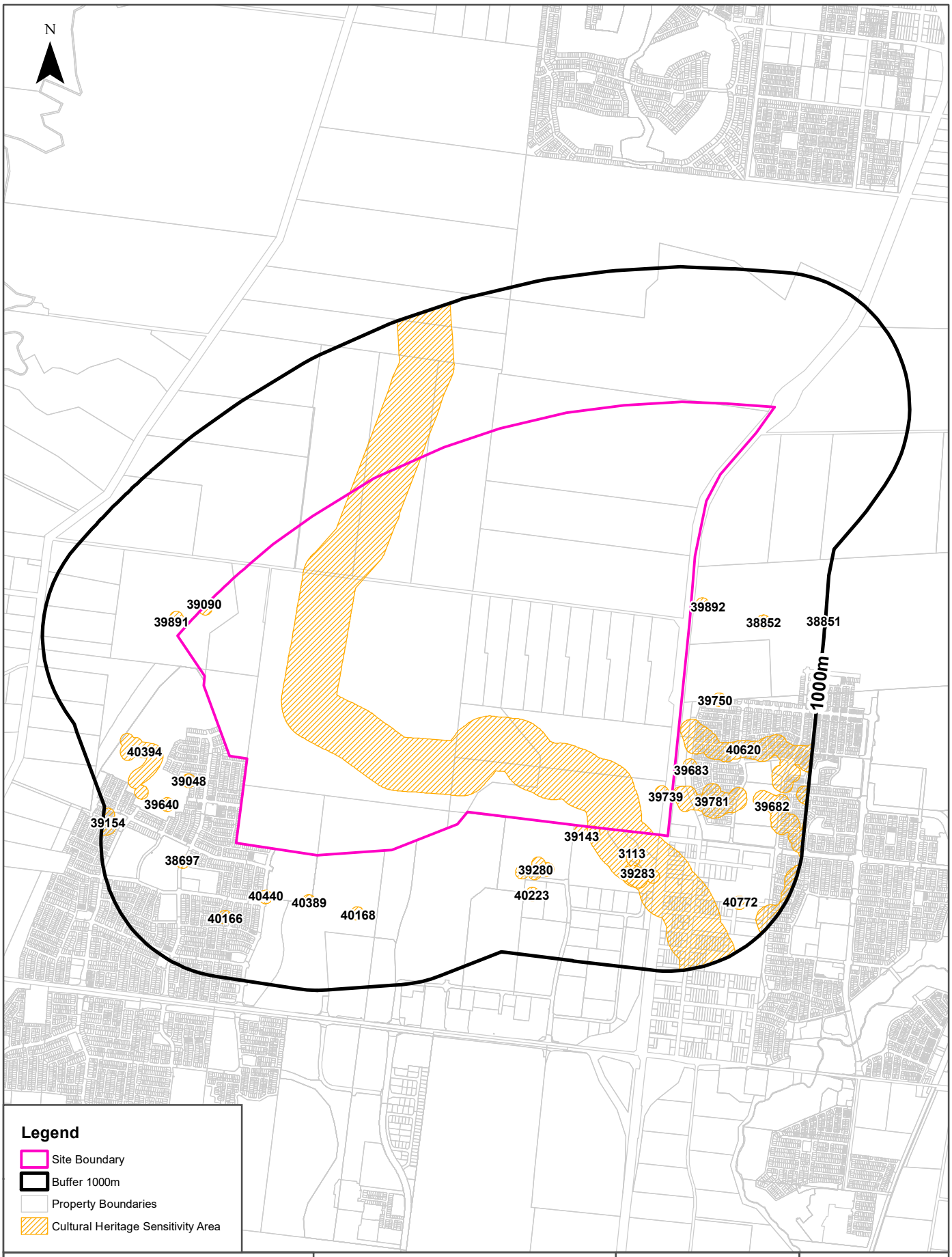
What are the Victorian Heritage Register items located within the dataset buffer?:

VHR Number	Description	Distance	Direction
N/A	No records in buffer		

Victorian Heritage Register Data Custodian: State Government Victoria - Dept of Environment, Land, Water & Planning

Cultural Heritage Sensitivity

Merrifield North Psp, Hume City, VIC 3064



Heritage

Merrifield North Psp, Hume City, VIC 3064

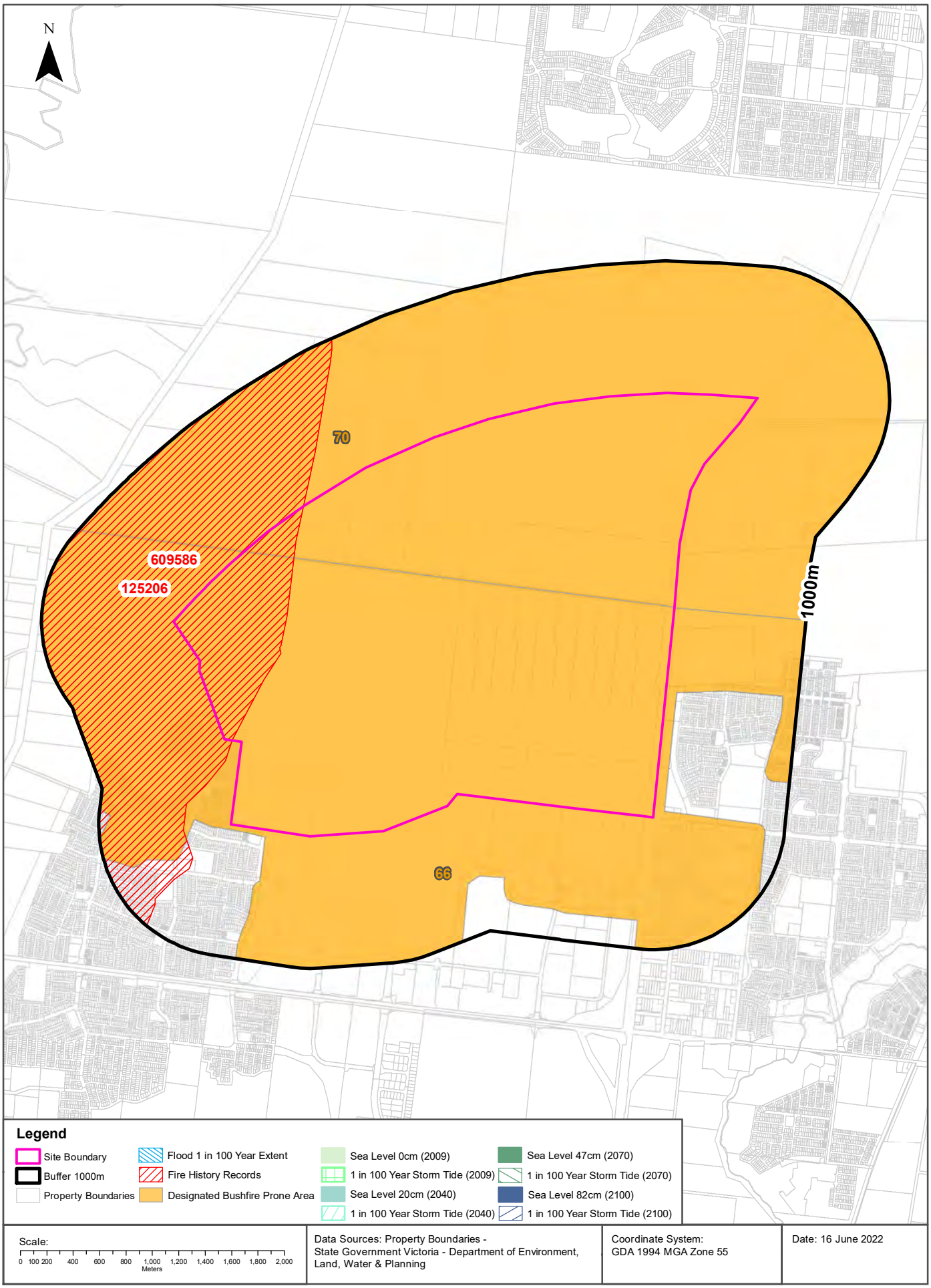
Cultural Heritage Sensitivity

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
3113	0m	On-site
39739	0m	On-site
39090	0m	On-site
39143	0m	On-site
39781	4m	South East
40620	9m	South East
39892	34m	East
39891	43m	West
39683	58m	South East
39283	149m	South East
39750	224m	East
39280	267m	South
40389	298m	South West
39048	305m	South West
40440	314m	South West
38697	369m	South West
40168	401m	South West
40394	458m	West
39640	493m	South West
38852	494m	East
40223	496m	South
40166	507m	South West
39682	600m	South East
40772	674m	South East
39154	899m	South West
38851	968m	East

Natural Hazards

Merrifield North Psp, Hume City, VIC 3064



Natural Hazards

Merrifield North Psp, Hume City, VIC 3064

Bushfire Prone Areas

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

Map ID	Feature	Plan No	LGA	Gazetted Date	Distance	Direction
66	Designated Bushfire Prone Area	LEGL./21-582	HUME	06/07/2021	0m	On-site
70	Designated Bushfire Prone Area	LEGL./21-586	MITCHELL	06/07/2021	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
125206	BUSHFIRE	W201452031	2014	31	MICKLEHAM - KILMORE	FIRE		09/02/2014	0m	On-site
609586	BUSHFIRE	W201452031	2014	31	MICKLEHAM - KILMORE	FIRE		09/02/2014	0m	On-site

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
N/A	No records in buffer					

Natural Hazards

Merrifield North Psp, Hume City, VIC 3064

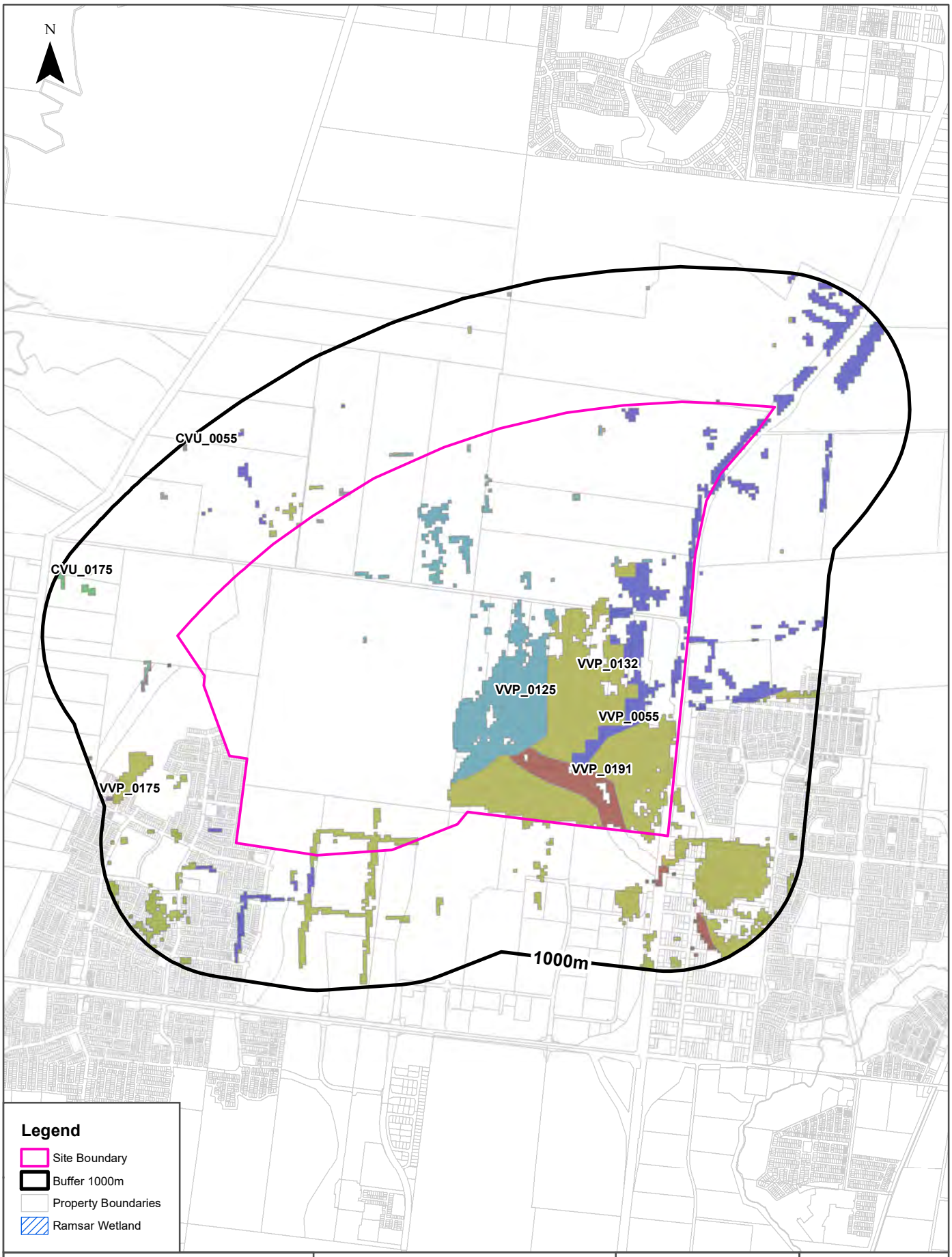
Victorian Coastal Inundation Sea Level Rise

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

Merrifield North Psp, Hume City, VIC 3064



Ecological Constraints

Merrifield North Psp, Hume City, VIC 3064

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_0191	Riparian Scrub	0191	Riparian Scrubs or Swampy Scrubs and Woodlands		Victorian Volcanic Plain	Endangered	Minor	0m	On-site
VVP_0132	Plains Grassland	0132	Plains Grasslands and Chenopod Shrublands	Clay soils	Victorian Volcanic Plain	Endangered	Common	0m	On-site
VVP_0125	Plains Grassy Wetland	0125	Wetlands	Freshwater	Victorian Volcanic Plain	Endangered	Common	0m	On-site
VVP_0055	Plains Grassy Woodland	0055	Plains Woodlands or Forests	Freely-draining	Victorian Volcanic Plain	Endangered	Common	0m	On-site
CVU_0175	Grassy Woodland	0175	Lower Slopes or Hills Woodlands	Grassy	Central Victorian Uplands	Endangered	Common	271m	West
VVP_0175	Grassy Woodland	0175	Lower Slopes or Hills Woodlands	Grassy	Victorian Volcanic Plain	Endangered	Common	287m	West
CVU_0055	Plains Grassy Woodland	0055	Plains Woodlands or Forests	Freely-draining	Central Victorian Uplands	Endangered	Common	811m	North West

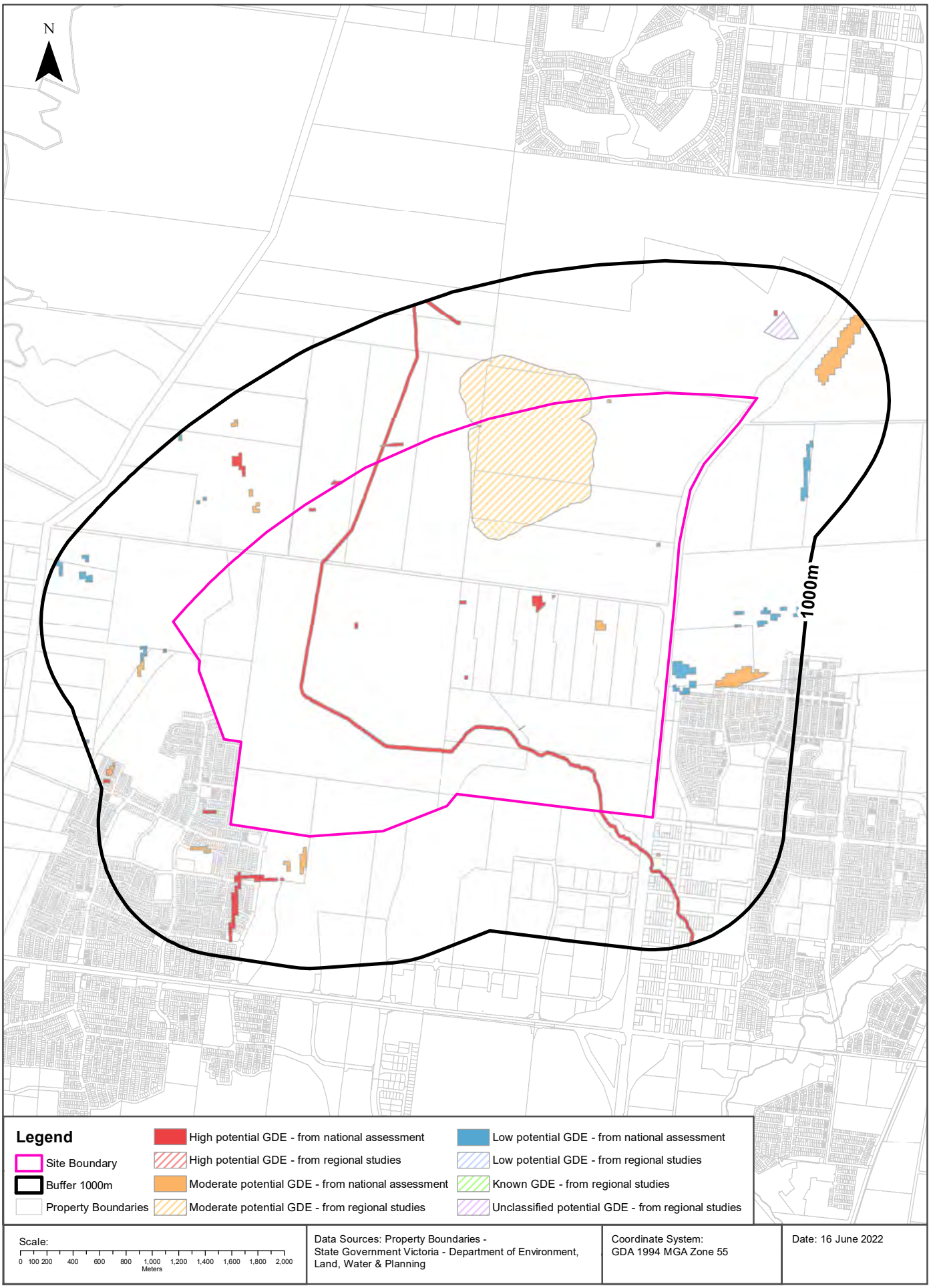
Ramsar Wetlands

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

Merrifield North Psp, Hume City, VIC 3064



Ecological Constraints

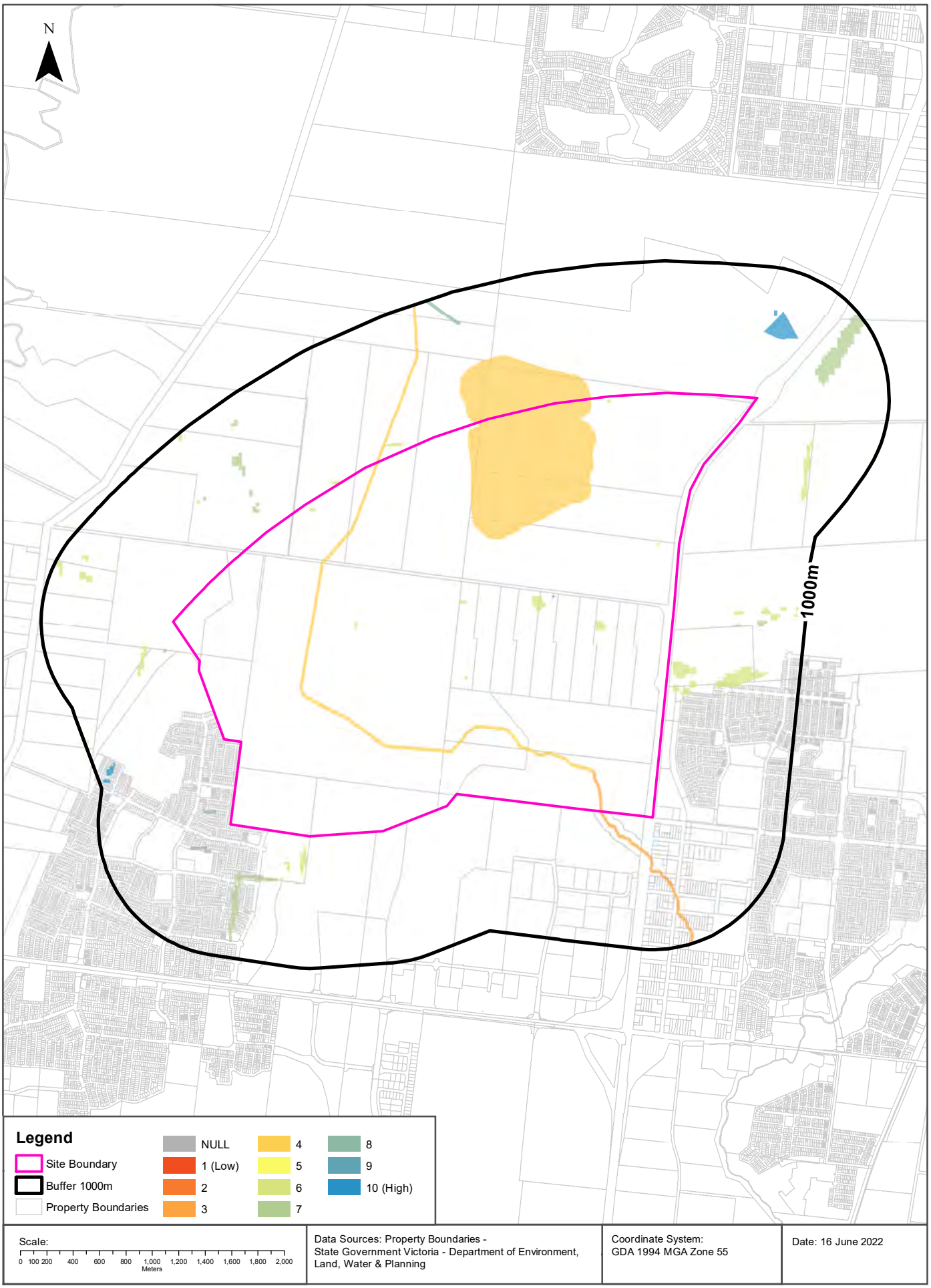
Merrifield North Psp, Hume City, VIC 3064

Groundwater Dependent Ecosystems Atlas

Type	Name	GDE Potential	Geomorphology	Ecosystem Type	Aquifer Geology	Distance	Direction
Aquatic		Moderate potential GDE - from regional studies	Plains mainly on basalt lavas with many volcanic forms and lakes, partly on weak sedimentary rocks.	Wetland		0m	On-site
Aquatic	KALKALLO CREEK	High potential GDE - from national assessment	Plains mainly on basalt lavas with many volcanic forms and lakes, partly on weak sedimentary rocks.	River	Fractured rock	0m	On-site
Terrestrial		High potential GDE - from national assessment	Plains mainly on basalt lavas with many volcanic forms and lakes, partly on weak sedimentary rocks.	Vegetation	Fractured rock	0m	On-site
Terrestrial		Low potential GDE - from national assessment	Plains mainly on basalt lavas with many volcanic forms and lakes, partly on weak sedimentary rocks.	Vegetation	Fractured rock	0m	On-site
Terrestrial		High potential GDE - from national assessment	Plains mainly on basalt lavas with many volcanic forms and lakes, partly on weak sedimentary rocks.	Vegetation	Unconsolidated sedimentary	0m	On-site
Terrestrial		Moderate potential GDE - from national assessment	Plains mainly on basalt lavas with many volcanic forms and lakes, partly on weak sedimentary rocks.	Vegetation	Fractured rock	0m	On-site
Terrestrial		Moderate potential GDE - from national assessment	Plains mainly on basalt lavas with many volcanic forms and lakes, partly on weak sedimentary rocks.	Vegetation	Unconsolidated sedimentary	155m	North West
Aquatic		Unclassified potential GDE - from regional studies	Plains mainly on basalt lavas with many volcanic forms and lakes, partly on weak sedimentary rocks.	Wetland		475m	North East
Terrestrial		Low potential GDE - from national assessment	Plains mainly on basalt lavas with many volcanic forms and lakes, partly on weak sedimentary rocks.	Vegetation	Unconsolidated sedimentary	480m	North West
Terrestrial		Low potential GDE - from national assessment	Moderately high plateaus and strike ridges.	Vegetation	Fractured rock	680m	West
Aquatic	KALKALLO CREEK	High potential GDE - from national assessment	Plains mainly on basalt lavas with many volcanic forms and lakes, partly on weak sedimentary rocks.	River	Unconsolidated sedimentary	745m	North

Inflow Dependent Ecosystems Likelihood

Merrifield North Psp, Hume City, VIC 3064



Ecological Constraints

Merrifield North Psp, Hume City, VIC 3064

Inflow Dependent Ecosystems Likelihood

Type	Name	IDE Likelihood	Geomorphology	Ecosystem Type	Aquifer Geology	Distance	Direction
Aquatic		4	Plains mainly on basalt lavas with many volcanic forms and lakes, partly on weak sedimentary rocks.	Wetland		0m	On-site
Aquatic	KALKALLO CREEK	4	Plains mainly on basalt lavas with many volcanic forms and lakes, partly on weak sedimentary rocks.	River	Fractured rock	0m	On-site
Aquatic	KALKALLO CREEK	3	Plains mainly on basalt lavas with many volcanic forms and lakes, partly on weak sedimentary rocks.	River	Fractured rock	0m	On-site
Terrestrial		6	Plains mainly on basalt lavas with many volcanic forms and lakes, partly on weak sedimentary rocks.	Vegetation	Unconsolidated sedimentary	0m	On-site
Terrestrial		6	Plains mainly on basalt lavas with many volcanic forms and lakes, partly on weak sedimentary rocks.	Vegetation	Fractured rock	0m	On-site
Terrestrial		4	Plains mainly on basalt lavas with many volcanic forms and lakes, partly on weak sedimentary rocks.	Vegetation	Fractured rock	0m	On-site
Terrestrial		3	Plains mainly on basalt lavas with many volcanic forms and lakes, partly on weak sedimentary rocks.	Vegetation	Fractured rock	0m	On-site
Terrestrial		10	Plains mainly on basalt lavas with many volcanic forms and lakes, partly on weak sedimentary rocks.	Vegetation	Fractured rock	0m	On-site
Terrestrial		8	Plains mainly on basalt lavas with many volcanic forms and lakes, partly on weak sedimentary rocks.	Vegetation	Fractured rock	116m	South West
Terrestrial		7	Plains mainly on basalt lavas with many volcanic forms and lakes, partly on weak sedimentary rocks.	Vegetation	Unconsolidated sedimentary	155m	North West
Terrestrial		7	Plains mainly on basalt lavas with many volcanic forms and lakes, partly on weak sedimentary rocks.	Vegetation	Fractured rock	158m	West
Aquatic		10	Plains mainly on basalt lavas with many volcanic forms and lakes, partly on weak sedimentary rocks.	Wetland		475m	North East
Terrestrial		6	Moderately high plateaus and strike ridges.	Vegetation	Fractured rock	680m	West
Aquatic	KALKALLO CREEK	8	Plains mainly on basalt lavas with many volcanic forms and lakes, partly on weak sedimentary rocks.	River	Unconsolidated sedimentary	745m	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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