ENVIRONMENTAL EARTH SCIENCES
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**REPORT NO.** **213066_PSP75**

# LAND CAPABILITY ASSESSMENT FOR THE LANCEFIELD ROAD PRECINCT STRUCTURE PLAN, SUNBURY, VICTORIA

**ENVIRONMENTAL EARTH SCIENCES VIC**
**REPORT TO GROWTH AREAS AUTHORITY**
**JULY 2015**
**VERSION 1**




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# EXECUTIVE SUMMARY


**Objective**

The Growth Areas Authority (GAA) requires a land capability assessment for the Lancefield Road Precinct (known as Lancefield Road Precinct Structure Plan [PSP]). The objective of this study was to identify the potential for contamination within the Lancefield Road Precinct area, and to identify any issues or considerations for the future urban development of the study area in regard to hydrology, groundwater and geology.

**Findings**

Of the properties within the Lancefield Road Precinct, four properties (170, 280 and 295 Lancefield Road) were classified as having as having a 'moderate' potential contamination risk due to activities associated with past or present agricultural activities. Due to the possible storage of fuels, solvents and agricultural chemicals and/or the maintenance of machinery and equipment. An additional property (275 Lancefield Road) was rated as 'moderate' due to the presence of stockpiled soil that appeared to be sourced from onsite; the source of these stockpiles should be verified. The remaining properties with the Lancefield Road Precinct have been rated as a 'low' potential for contamination as no potential contaminating activities were observed during the site inspection. The temporary storage of di-ammonium phosphate fertiliser was observed within the Villawood Salesian development (Allotment. 5 Section 8, Parish of Bollinda); however, it was not considered to represent a risk to human health or the environment. The assessments of potential risk have been made in accordance with the Victoria Department of Sustainability and Environment, Potentially Contaminated Land, General Practice Note, 2005.

**Outcomes**

Properties classified with 'moderate' potential contamination risk are recommended for further works or environmental assessment as detailed in Table 7. Further assessment of these sites should be undertaken in accordance with the following guidelines and standards:

- National Environmental Protection Council, 2013 *National Environmental Protection (Assessment of Contaminated Sites) Amendment Measure*;
- Standards Australia 1999, *Australian Standard AS 4482.2 - Guide To The Sampling and Investigation Of Potentially Contaminated Soil. Part 2: Volatile Substances*;
- Standards Australia 2005, *Australian Standard AS4482.1 - Guide to the Investigation and Sampling of Sites with Potentially Contaminated Soil. Part 1: Non-volatile and Semi-Volatile Compounds*; and
- EPA Victoria, 2009, *Soil Hazard Categorisation and Management*, Industrial Waste Resource Guideline 621.

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# 1 INTRODUCTION

The Growth Areas Authority (GAA) requires a land capability assessment for the Lancefield Road Precinct (known as Lancefield Road Precinct Structure Plan [PSP]). The precinct is a large-scale development area in the Sunbury-Diggers Rest Growth Corridor around the Township of Sunbury. The Sunbury-Diggers Rest Growth Corridor Plan identifies specific locations where urban development needs to be considered as part of the preparation of a PSP (i.e. where some urban development is likely to occur within the current Rural Conservation Zone). Based on the environment and historic/ current land uses, this study has been completed to identify issues or considerations that pose a contamination risk, for the future urban development of the precinct.

# 2 OBJECTIVE AND SCOPE

The objective of this study was to identify the potential for contamination on accessible properties within each Precinct and to identify any issues or considerations for the future urban development of the study area in regard to hydrology, groundwater and geology.

This information will be used to determine the future land use and help inform the future urban structure for the Sunbury South and Lancefield Road Precinct Structure Plans.

The scope of works carried out meets the requirements as set by the Project Brief provided by GAA. The scope of works comprised the following three stages:

- Stage 1 – Desktop review;
- Stage 2 – Site inspection; and
- Stage 3 – Reporting.

# 3 LAND CHARACTERISTICS

## 3.1 Location and general description

The Lancefield Road Precinct is located in the suburb of Sunbury in Victoria and is administered by Hume City Council. The location and properties are shown in Figure 1. Figure 2 shows the planning zones.

The Lancefield Road Precinct encompasses a total area of 1109 ha of which 700 ha are proposed for development which includes 6000 dwellings. Table 1 lists the current addresses and corresponding legal descriptions.

## TABLE 1 SITE PROPERTY DETAILS LANCEFIELD ROAD

| Address | Legal Description |
|---|---|
| **55 Raes Road** | 1309 LP138233 |
| **45 Raes Road** | 1310 LP138233 |
| **75 Stockwell Drive** | 1311 LP138233 |
| **65 Stockwell Drive** | 1312 LP138233 |
| **55 Stockwell Drive** | 1313 LP138233 |
| **45 Stockwell Drive** | 1314 LP138233 |
| **35 Stockwell Drive** | 1315 LP138233 |
| **25 Stockwell Drive** | 1316 LP138233 |
| **15 Stockwell Drive** | 1317 LP138233 |
| **11 Stockwell Drive** | Lot 1, PS403051 |
| **5 Stockwell Drive** | Lot 2, PS403051 |
| **25 Raes Road** | 1318 LP138233 |
| **70 Stockwell Drive** | 1319 LP138233 |
| **15 Raes Road** | 1274 LP133936 |
| **5 Raes Road** | 1275 LP133936 |
| **25 St Ronans Court** | 1276 LP133936 |
| **60 Stockwell Drive** | 1320 LP138233 |
| **50 Stockwell Drive** | 1321 LP138233 |
| **40 St Ronans Court** | 1281 LP133936 |
| **30 St Ronans Court** | 1325 LP138233 |
| **20 St Ronans Court** | 1324 LP138233 |
| **40 Stockwell Drive** | 1322 LP138233 |
| **30 Stockwell Drive** | 1323 LP138233 |
| **10 Balbethan Drive** | 1282 LP133936 |
| **15 St Ronans Court** | 1277 LP133936 |
| **20 Baltbethan Drive** | 1329 LP138233 |
| **30 Balbethan Drive** | 1328 LP138233 |
| **20 Stockwell Drive** | 1326 LP138233 |
| **10 Stockwell Drive** | 1327 LP138233 |
| **5 Balbethan Drive** | 1285 LP133936 |
| **15 Balbethan Drive** | 1332 LP138233 |
| **25 Balbethan Drive** | 1331 LP138233 |
| **35 Balbethan Drive** | 1330 LP138233 |

| Address | Legal Description |
|---|---|
| **41 Balbethan Drive** | 953 PS536853 |
| **45 Gellies Road** | Allotment 3 Sec 2 TP19600 |
| **170 Lancefield Road** | Lot 3, 4 LP208321 |
| **210 Lancefield Road** | Lot 1 LP146456 |
| **250 Lancefield Road** | Lot 2 TP113714 |
| **280 Lancefield Road** | Lot 1, 3 TP832356 |
| **330 Lancefield Road** | Lot 1, 2, 3 TP372589 |
| **265 Lancefield Road** | Lot 2 LP141875 |
| **275 Lancefield Road** | Lot 1 LP141875 |
| **295 Lancefield Road** | Lot 2 LP76657 |
| **315 Lancefield Road** | Lot 1 LP76657 |
| **20 Raes Road** | Lot 2 LP141876 |
| **40 Raes Road** | Lot 1 LP141876 |
| **3-5 Macedon Street** | Lot Q PS435007 and Allotment 5 Sec 8 TP504 |

## 3.2 Surrounding land uses

Sunbury township is located south west of the Lancefield Road Precinct and includes a mix of standard residential and commercial/ industrial land uses. The remainder of the surrounding land uses are rural/ agricultural and rural residential.

## 3.3 Geology

The geology across most of the Precinct as described by the Sunbury 1:63,360 map sheet (Geological Survey of Victoria, 1973) is late Tertiary-aged Newer Volcanics. This formation is characterised by olivine basalts, minor limburgite, trachy-andesite, and scoria, with thin inter-bedded layers of sand, clay and tuff. The Newer Volcanics formation is expected to overlay Upper Ordovician aged marine sediments comprised of interbedded shale and greywacke, with minor grit horizons.

Quaternary deposits are present along Emu Creek comprising of sand, sandy silt, silt and gravel alluvial deposits; poorly to well sorted silt, sand and gravel colluvial deposits; and sand, gravel, sandy silt, clay alluvial terrace deposits. Tertiary older volcanics comprising of olivine basalt, mostly weathered to plastic clay and weathered dyke rock are exposed at one section.

Upper Ordovician marine sediments are exposed west of Jacksons Creek and Quaternary deposits overlay the Ordovician sediments closer along the creek consisting of alluvial and colluvial deposits similar to those present along Emu Creek.

## 3.4 Soil

According to Van de Graaf and Wootton (1996), the soil in the area is classified as heavy clay on younger basalts. These soils occur extensively north west of Melbourne and are described as shallow dark and reddish brown heavy clays with thin loamy topsoil. They have poor drainage, are hard when dry and very sticky when wet and are slightly alkaline to slightly acidic.

Jeffrey (1981) described the soils in the Sunbury area derived from Ordovician parent material as mottled yellow brown duplex soils which are sodic. This is in agreement with search results from the Australian soil resource information system (ASRIS) (CSIRO, 2008) which also indicates that the soils in the area are sodosols. Sodosols are described as soils with a strong texture contrast between the A and B horizons and the upper B horizon is sodic and not strongly acidic (Isbell, 1996). Sodic soils are dispersive and can be a high erosion hazard.

Soils derived from the alluvial deposits along Jacksons Creek and Emu Creek consist of loams, clays and sands that have variable drainage rates depending on sand, gravel and clay content (Van de Graaf and Wootton, 1996).

Observations during the site inspections are also consistent with these findings.

Due to the elevation of the area (>10 m AHD) and the distance from the coast, the site is not considered to be a risk for the presence of potential acid sulfate soils.

## 3.5 Topography

The Sunbury area contains three former eruption points which have formed hills higher than the surrounding area. Former eruption points in the area are Sunbury Hill, Winilba Hill and Resdstone Hill.

The Lancefield Road Precinct generally slopes from north (highest point at approximately 280 m AHD) to the south and steeply down to Emu Creek in the east and Jacksons Creek in the west.

The topography contours are shown in Figure 3.

## 3.6 Surface water

Two major creeks dissect the Sunbury area; Emu Creek runs north south along the eastern boundary of the precinct and Jacksons Creek (also fed by Harpers Creek in the south) runs north south in the western portion of the precinct. Emu Creek is a tributary of Deep Creek which both feed into the Maribyrnong River which discharges into the Yarra River and Port Philip Bay.

A number of dams are located on rural properties in the precinct. If these properties are to be redeveloped and the dams are not to be retained, they will need to be drained and filled with suitably clean fill.

**Inundation overlays**

Land subject to inundation overlays are present along Jacksons Creek in the Lancefield Road Precinct. The current zoning allows for a suitable buffer distance along the creek to account for the land subject to inundation.

## 3.7 Hydrogeology

According to Dahlhaus (2004) *Port Phillip and Westernport Groundwater Flow Systems*, the uppermost aquifer occurs in the fractured basalt. This aquifer is hosted in a fine-grained crystalline lithology (basalt) and has been weathered to form a layer of clay soil of various thicknesses. These weathered clays buried by subsequent lava flows have resulted in discontinuous confining layers in the basalt aquifer.

The depth to groundwater ranges considerably across the precinct (Victoria Government, 2013) and generally reflects the topography, with the shallowest watertable close the creeks and the deepest watertable under Redstone Hill. Groundwater flow is expected to flow towards either Jacksons Creek or Emu Creek.

According to the Groundwater Resources Victoria Map (Department of Mines and Energy, 1982), groundwater beneath the Lancefield Road Precinct has a yield less than 10 L/s and a TDS concentration of 1000 – 3000 mg/L which makes the groundwater suitable for all stock and salt tolerant plants, however due to the low yield, is not suitable for irrigation. The aquifer lithology is basalt, tuff and scoria.

Groundwater of this salinity is classified as either Segment B or Segment C under Victorian Government (December 1997) *State Environment Protection Policy - Groundwaters of Victoria*. The beneficial uses of groundwater that are protected for Segment B and Segment C classified groundwater, which are the following:

- maintenance of ecosystems;
- potable mineral water supply (Segment B only);
- agriculture, parks and gardens (Segment B only);
- stock watering;
- industrial water use;
- primary contact recreation; and
- buildings and structures.

The Visualising Victorias Groundwater (Victoria Government, 2013), was used to identify groundwater bores within the vicinity of the site. According to this resource, there are 12 registered groundwater bores located in the Lancefield Road Precinct. Table 2 summarises the relevant information.

**TABLE 2 GROUNDWATER BORES LANCEFIELD ROAD**

| Bore number | Easting | Northing | Depth (mbgs) | Bore Type/Use |
|---|---|---|---|---|
| **S9023981/1** | 300175 | 5842617 | 37.5 | Domestic & Stock |
| **S9024168/1** | 300281 | 5842658 | 93 | Domestic & Stock |
| **302047** | 302071.173 | 5842608.214 | 82.6 | Non-Groundwater |
| **302057** | 301975.172 | 5842434.214 | 2.9 | Non-Groundwater |
| **50447** | 301883.172 | 5842124.214 | 110 | Domestic & Stock |
| **302056** | 302063.172 | 5841321.212 | 1.12 | Non-Groundwater |
| **50444** | 302263.172 | 5841234.212 | 67 | Domestic & Stock |

| Bore number | Easting | Northing | Depth (mbgs) | Bore Type/Use |
|---|---|---|---|---|
| **302696** | 302138.171 | 5840471.211 | 1.52 | Non-Groundwater |
| **302695** | 302163.17 | 5839496.21 | 1.6 | Non-Groundwater |
| **137800** | 302163.17 | 5839364.21 | 75 | Irrigation |
| **302686** | 302259.17 | 5839279.21 | 134.11 | Non-Groundwater |
| **302694** | 302188.169 | 5838502.209 | 2.58 | Non-Groundwater |

## 3.8 Environmental considerations

### 3.8.1 Ministers Direction No. 1

The Minister for Planning re-issued *Ministers Direction No. 1 – Section 12 (2) (a) of the Planning and Environment Act 1987 – Potentially Contaminated Land* on 27 September 2001. This document specifically addresses how planning authorities make a decision on whether potentially contaminated land (i.e. land used for industry, mining, chemical, gas, wastes or liquid fuel storage) can be used for more sensitive uses (such as residential, a child care centre, a pre-school centre or a primary school).

The Minister's Direction No. 1 directs planning authorities that in preparing any amendment to a planning scheme that would allow potentially contaminated land to be used for a more sensitive use; they must satisfy themselves that the environmental condition of the land is suitable for the nominated use.

### 3.8.2 Protected Areas

The Department of Environment Protected Matters Search Tool identified one protected area, in the Sunbury South Precinct. The protected area, titled Holden Fauna and Flora Reserve, is located between Watsons Road and Jacksons Creek.

### 3.8.3 Biodiversity Conservation Strategy (BCS)

The Biodiversity Conservation Strategy for Melbourne's Growth Corridors (Department of Environment and Primary Industries, 2013) has been prepared to inform the Growth Corridor Plans of areas committed to conservation outcomes and to protect matters of national environmental significance. Conservation areas in the Lancefield Road Precincts include the following:

- Nature Conservation areas 18 (Lancefield Road, Sunbury) and 19 (Grassy Eucalypt Woodland site, Sunbury);
- Open space 20 (Racecourse Road, Sunbury); and
- Growling grass frog corridor 21.

The above areas are within therural conservation zones.

### 3.8.4 Growling grass frog habitat

The Sub-regional Species Strategy for the Growling Grass Frog (Department of Environment and Primary Industries, 2013) has been prepared to inform the Growth Corridor Plans and the design of precincts of the areas of habitat to be protected in the precinct areas.

There are Growling Grass Frog corridors along Jacksons Creek and Emu Creek in the Lancefield Road Precinct. The areas include Category 1 protection areas and potentially important habitat outside urban expansion areas. Furthermore, Category 2 (other suitable habitat requiring offset if cleared) is present across the precinct and offsets will need to be considered in these areas.

### 3.8.5 Environmental significance overlays

Environmental significance overlays exist over parts of the Lancefield Road Precinct. The three different schedules present in the precinct are detailed below.

- ESO01 which represents rural waterways and environs is present along and nearby both Jacksons Creek and Emu Creek;
- ESO10 which represents rural conservation areas is present in similar areas to ESO01 along both Jacksons Creek and Emu Creek; and
- ESO04 which represents the northern railways reservation exists along parts of the railway line.

A permit is generally required in these areas before development can proceed unless the schedule specifically states that it is not required.

The protected areas have been incorporated into the planning zones. Protected areas are accounted for in the regional conservation zones (RCZ1) with the exception of the Bulla Hi Quality which falls in a special use zone (SUZ).

### 3.8.6 Wetlands

A search of protected wetlands (Department of the Environment Protected Matters Search Tool, 2013) was undertaken and did not identify any Ramsar wetlands or nationally important wetlands in the Precinct.

### 3.8.7 Bushfire prone areas

According to Landchannel, the entire area is under a designated bushfire prone area. Planning restrictions associated with a bushfire prone area will need to be considered and this overlay may need to be updated in accordance with the proposed land uses.

## 3.9 Heritage considerations

There are two heritage overlays in the Lancefield Road Precinct, details are as follows:

- Boondannah (HO326) is located at 340 Lancefield Road (partially located within the Precinct). External paint controls apply and prohibited uses may be permitted; and
- Cannon Gully (HO366) located at 3-5 Macedon Street is the eastern escarpment of Jacksons Creek. No special conditions apply.

The above locations will need to be considered in line with any development.

## 3.10 Geotechnical considerations

Geotechnical considerations based on available desktop information have been summarised below. Please note that during the planning and design phase, site and project specific geotechnical investigations will be required. The full geotechnical report can be found in Appendix B.

- The precinct is predominantly flat or gently undulating with significant slopes surrounding the creeks. The steep slopes will significantly constrain development in these areas.
- Steeply undulating areas and creek banks are likely to consist of exposed and shallow rock which will result in more difficult and costly excavation.
- In generally, the land appears to be suitable for creek crossings. The construction may require substantial road works and earthworks to overcome the topography. Rocky ground conditions will result in more difficult excavation for bridge abutments and associated earthworks and subsurface erosion may pose a problem if significant excavation is required.
- Creek crossings and associated works should be constructed above the creek flow path (including inundation areas) or should accommodate creek flow through the works.
- An allowance for dewatering areas of earthworks or excavations should be provided for and a geotechnical investigation conducted as part of the planning and design phase may determine this requirement.
- Light traffic new road pavements typically consist of granular sub base and base material with an asphalt surface with an approximate thickness of 300 mm to 500 mm. Heavy traffic road pavements typically require a thickness of 500 mm to 1000 mm. Alternative pavement compositions should be considered for heavy traffic areas or overlays of existing roads.
- Considerations of road pavement should include the subgrade conditions, anticipated traffic over the life of the pavement and the preferred or locally available construction materials and equipment.
- In general, it would be best to site allotments up and down any slope and construct roads to follow the contours. This minimises road profile grades, minimises driving up or down steep slopes, minimises earthworks and allows roads to be used for surface drainage control.
- Selection of residential building footings is primarily based on the shrink-swell potential of the soil. Areas of the Lancefield Road precinct may include these types of soils. These areas will require deeper and more expensive building footings.
- Subsurface erosion is a potential in steep sites and may present a problem in areas where deep excavations (greater than 3 m) are cut and exposed. In areas where slope instability is an issue, a full geotechnical investigation should be undertaken.

# 4 HISTORICAL REVIEW

## 4.1 Aerial photography

A review of historical and current aerial photographs of the precinct was undertaken. The objective of the review was to provide supporting information obtained from other sources and identify any large scale changes that may have impacted the contamination status of the area.

**Lancefield Road Aerial summary**

The Lancefield Road aerial photographs show that the area has been used for agriculture and farming activities since at least 1966. Residential development is evident in the western and southern part since 1982 and has continued to expand up until present. Emu Creek and Jackson's Creek do not appear to change dramatically since 1966. The Lancefield road area has some intersecting roads/ access routes to small farm houses and buildings and these remain relatively unchanged.

The aerial photographs obtained from DSE Aerial Photograph Archive are described in Table 3 and copies are provided in Appendix A.

**TABLE 3 AERIAL PHOTOGRAPH REVIEW LANCEFIELD ROAD**

| Year | Title | Colour/ Black and White | Comments |
|---|---|---|---|
| **1966** | Melbourne 1966 Project | Black and white | The aerial shows three small farm establishments located north of Lancefield road. The railway line is evident. Small buildings/structures appear on the central part of the railway line. Another farm with a wind break is located in the centre of the aerial. Emu Creek appears towards the east of Lancefield road. Jackson's creek appears towards the west of Lancefield road. |
| **1982** | Melbourne M/S 1982 | Black and white | The aerial shows the south-western part has been developed for residential housing with associated roadways. The northern and eastern parts of Lancefield road remain mostly unchanged from the previous aerial in 1966 (i.e. agriculture). Farming paddocks and small farm houses are evident in these areas. Both creeks and also evident, as is the railway line. |
| **2004** | Google Earth | Colour | The aerial shows that the west and south of the area of Lancefield road has been developed further for residential housing. Both Emu and Jackson's creek remain unchanged. The northern and eastern parts of Lancefield road remain mostly unchanged and appears as farming land. A racing/track to the east of Lancefield road is also evident. |
| **2013** | Google Earth | Colour | The aerial shows that Lancefield road has had no significant changes to the east. The racecourse is the only significant change. The northern and eastern parts from Lancefield road remain unchanged (i.e. farmland). Small farm houses remain to the north of Lancefield road. The southern and western areas have been further developed. |

## 4.2 Historical title search

In order to obtain details of the historical owners of the site, a historical title search was conducted. The historical title searches provide details about past owners and leases, including business names, which may provide an indication of potential contaminating activities undertaken during the respective use period.

Table 4 below provides a summary of ownership of the site in chronological order. The original titles can be provided on request.

**TABLE 4 SELECTED HISTORICAL TITLES**

| Street address | Significant past or present usage |
|---|---|
| **170 Lancefield Road, Sunbury** | Currently Wincity Development Pty Ltd.<br>Previous uses include grazing and farming since 1930 |
| **275 Lancefield Road, Sunbury** | Currently Hume Contracting Pty Ltd.<br>Previous use includes farming and grazing since 1931 |
| **295 Lancefield Road, Sunbury** | Currently Dominic Foschia (Private Proprietor)<br>Previous land uses include grazing and farming since 1937 |

## 4.3 EPA records

The Priority Sites Register lists properties which the Environment Protection Authority (EPA) Victoria has issued a clean-up notice or pollution abatement notice under the *Environment Protection Act 1970*. These properties are considered to present an unacceptable risk to human health or the environment. A search conducted on the Priority Sites Register dated July 2013, identified that there are no sites in the Lancefield Road Precinct or in the immediate vicinity listed.

A search of the Statement of Environmental Audit and Certificates of Environmental Audit register revealed that there are no properties with previously issued Statutory Audits in the Lancefield Road Precinct or in the immediate vicinity.

## 4.4 Local government records

Hume City Council was contacted to obtain records relating to the Sunbury South Precinct. Records requested and reviewed include information on former and current landfills and quarries, planning permits and development approvals and information on former council depots.

# 5 SITE INSPECTION

An initial inspection of the Lancefield Road Precinct was undertaken on 18 October 2013. A further more detailed inspection of selected properties was undertaken on 6 November 2013.

All properties were inspected from the road. The Salesian property was also inspected in further detail (site walkover).

Properties located east and west of Lancefield Road are rural residential holdings. Current activities appear to be non intensive with some sheep grazing and cropping occurring being undertaken.

Activities of specific note are summarised below:

- 45 Gellies Road and 170 Lancefield Road are used for cropping (wheat and barley).

- 275 Lancefield Road had a number of stockpiles were present, as well as an excavator and truck. No information was able to be collected on the activities at the site.
- 295 Lancefield Road has pasture and a shearing shed.
- 315 Lancefield Road was a house property, open woodlands and a nursery is located north of 315 Lancefield Road (outside precinct).
- 280 Lancefield Road used for cropping and has the potential for machinery sheds that may contain chemicals.
- 330 Lancefield Road used for cropping/ pasture.
- 170 Lancefield Road used for cropping and has the potential for machinery sheds that may contain chemicals.
- 40 Raes Road was very wet/ swampy ground.
- At the end of Raes Road (40 Raes Road) some stockpiles were noted on the railway reserve.
- 250 Lancefield Road has drainage lines which feed into Emu Creek and will need to be considered for inundation.

**Salesian property**

- West of the creek some old equestrian jumps and a grain storage shed were observed. Some gully erosion was observed. A holding shed. One small stockpile of rubble/ dirt was observed, likely originating from the subdivision/ residential development adjacent. A dam is also present on the site.
- East of creek a shed containing six 1 tonne bags of DAP were present. The escarpment which is part of the flood zone has unimproved pasture and weeds.

# 6 SUMMARY OF IDENTIFIED ISSUES AND MANAGEMENT OPTIONS

## 6.1 Stockpiles of unclassified fill material.

A number of stockpiles of soil and/or fill material were identified during the initial site inspections of the Sunbury South and Lancefield Road precincts. Sampling and analysis of any soil to be removed off site is recommended as per EPA Publication IWRG621 to confirm if soil is clean fill or otherwise. If the stockpiled material is classified as contaminated material it needs to be disposed of at a landfill licensed to accept that type of material.

## 6.2 Asbestos containing materials

Asbestos containing materials, mainly corrugated cement sheet and cladding were observed in building/sheds onsite at 670 and 675 Sunbury Road. Removal of ACM must be undertaken by a Licensed Asbestos Removalist and a clearance certificate provided by an occupational hygienist stating that the ACM has been removed to the extent practicable. Relevant guidance on asbestos removal:

- WorkSafe Compliance Code Removing asbestos in workplaces (2008); and

- Victorian Occupational Health and Safety Regulations (2007).

## 6.3 Chemical/ fuel storage

The potential exists for the storage of fuels/oils/degreasers and agricultural chemicals (i.e. herbicides and/or pesticides) on former and/ or existing agricultural properties across the precinct. The potential for spillage of these chemicals needs to be considered as they represent a source of contamination. Following removal of any chemical or fuel containers, a visual inspection should be undertaken to determine the presence of any spills, such as the staining or discolouration of soils. If staining is identified, a soil assessment should be undertaken to determine the concentrations of the chemicals of concern and remediated appropriately (if required).

# 7 ENVIRONMENTAL RISK ASSESSMENT

## 7.1 Introduction

The environmental risk assessment was based on the *source-pathway-receptor* relationship, which allows an assessment of potential environmental risks to be determined, based on the source, extent of exposure of a receptor to a source and the sensitivity of the receptor to the type of contamination. As such an assessment is made of the environmental liabilities associated with risk. These liabilities may be expressed in terms of additional costs associated with site redevelopment or remediation measures, the potential for fines or penalties imposed for contravention of particular environmental legislation or loss of land value.

The identified potential environmental liabilities with regard to contamination have been evaluated with respect to the potential impacts on:

- sensitive sites and ecosystems;
- groundwater aquifers;
- soils;
- surface water bodies;
- construction and maintenance workers; and
- current and future site users.

## 7.2 Sources of potential contamination

Sources of potential contamination were identified within the Precinct, and the following contaminants were identified as having the potential to be on-site:

- petroleum hydrocarbons – total petroleum hydrocarbons (TPH); benzene, toluene, ethylbenzene, xylenes and naphthalene (BTEXN); and polycyclic aromatic hydrocarbons (PAH);
- heavy metals, in particular lead;
- fertilisers, pesticides, fungicides and herbicides;

- arsenic, organochlorines, organophosphates, synthetic pyrethroids;
- waste livestock products – buried carcasses, manure and slurry pits;
- asbestos containing materials; and
- volatile and semi-volatile organic hydrocarbons.

## 7.3 Pathways of potential contamination

Potential contaminant pathways that may impact on human health and/ or the environment include the following:

- localised drainage to down-gradient surface water bodies;
- leaching of contaminants to groundwater;
- vapour inhalation of contaminants; and
- direct contact with soil contaminants or hazardous materials.

The potential exists for the migration of contaminants from the PSP via surface water runoff to local surface water features, by seepage through the subsoil into groundwater, as an airborne release such as dust or vapour (usually from demolition and excavation activities), and by dermal absorption caused by direct contact between skin with contaminated material.

Contaminated soil has the potential to migrate during transportation or movement of stockpiles to either on-site or offsite locations.

Within the Precinct the dispersal and migration of chemical of concern (contaminants) will generally be controlled by sub-surface conditions (soil type/ permeability and groundwater levels) along with physical and chemical properties of individual contaminants and climatic conditions. Other factors that may impact on the migration of contaminants include:

- erosion of disturbed and cleared areas that contribute to sediment transport and deposition;
- removal of topsoil material and exposure of underlying sodic subsoils to erosion;
- on-site movement of light vehicles and machinery that will contribute to shallow soils being disturbed;
- construction of drainage infrastructure forming preferential migration pathways down gradient of identified areas of environmental concern; and
- precipitation rates.

## 7.4 Potential receptors

Potential receptors indentified within the precinct and the surrounding areas include:

- residential properties onsite and offsite;
- agricultural land onsite and offsite;
- construction works involve in redevelopment activities;
- surface water bodies onsite and offsite; and

- groundwater beneath the investigation areas.

## 7.5 Qualitative risk assessment

A qualitative risk assessment was conducted to identify the risk of potential contaminating activities in the area. Risk is a function of both likelihood and a measure of consequence, and it can be defined as:

Risk = Consequence × Likelihood

The risk matrix is presented in Table 5 and the risk rating is presented in Table 6.

### 7.5.1 Likelihood

- Almost certain (95-100%): is expected to occur in most circumstances;
- Likely (55-95%): will probably occur in most circumstances;
- Possible (45-55%): could occur;
- Unlikely (5-45%): could occur but not expected; and
- Rare (0-5%): occurs only in exceptional circumstances.

### 7.5.2 Consequences

- Extreme: death, contaminant release off-site with detrimental effect to human health and/or the environment, huge financial loss;
- Major: extensive injuries, off-site contaminant migration release contained with outside assistance and little detrimental impact, major financial loss;
- Moderate: medical treatment required, on site release contained with outside assistance, high financial loss;
- Minor: first aid treatment, on site release immediately contained, medium financial loss; and
- Insignificant: no injuries, low financial loss, negligible environmental impact.

**TABLE 5 RISK MATRIX**

| Consequence | Likelihood | | | | |
|---|---|---|---|---|---|
| | 1 – Almost Certain | 2 – Likely | 3 – Possible | 4 – Unlikely | 5 – Rare |
| 1 – Extreme | 1 | 2 | 3 | 4 | 5 |
| 2 – Major | 2 | 4 | 6 | 8 | 10 |
| 3 – Moderate | 3 | 6 | 9 | 12 | 15 |
| 4 – Minor | 4 | 8 | 12 | 16 | 20 |
| 5 – Insignificant | 5 | 10 | 15 | 20 | 25 |

**TABLE 6 RISK RATING**

| Risk Matrix Result | Risk Rating | Mitigation Recommendation |
|---|---|---|
| **1 to 2** | Extreme | Immediate intervention required to eliminate or reduce risk. |
| **3 to 6** | High | Essential to eliminate or reduce risk to a lower level with the implementation of control measures. |
| **8 to 12** | Moderate | Management may be required via monitoring or response to procedures; however risk should be appropriately quantified. |
| **15 to 25** | Low | Manage potential risk by routine procedures, unlikely to require further action. |

**Note:** Risk issues with a rating of Moderate to Extreme require associated controls or actions.

## 7.6 Risk Assessment

Based on the observations and results of the site inspections, desktop review and Environmental Earth Sciences' understanding of the proposed future land use for the precinct, the overall risk of contamination being encountered across the majority of the precinct during the proposed development works is considered to be 'Low to Moderate'.

However, the likelihood or risk of contamination being encountered at specific locations within the precinct due to identified potential sources of contamination is considered 'Moderate'. A summary of the risk of contamination being encountered is provided in Table 7 and shown in Figure 4.

The recommendations provided below should be considered as part of any rezoning or prior to redevelopment of sites to a more sensitive land use. In accordance with the Ministers Direction No. 1, Council must satisfy itself that the environmental condition of the land will be suitable for the proposed land use.

## TABLE 7 RISK ASSESSMENT – LANCEFIELD ROAD PRECINCT

| Property | Risk issue | Consideration | Risk rating | Recommendations |
|---|---|---|---|---|
| **45 Gellies Rd** | Agricultural activities | Historic and current agricultural activities including cropping and the use of herbicides and pesticides | Low | - |
| **170 Lancefield Rd** | Agricultural activities | Historic and current agricultural activities including cropping and the use of herbicides and pesticides | Low | - |
| | Machinery storage and maintenance | Use and possible leakage of small amounts of fuel, oil, grease and solvents during machinery maintenance activities. | Moderate | Removal and disposal of fuels/oils/solvents/agricultural chemicals offsite. Soil investigation of any identified spills or staining |
| | Storage of fuels/agricultural chemicals | Potential for uncontrolled storage and potential spillage of pesticides and herbicides, fuels, oils and solvents | Moderate | |
| **275 Lancefield Rd** | Stockpiled soil | Stockpiles of soil from onsite excavations and site preparation | Moderate | Sampling and analysis of any topsoil to be removed off site as per EPA Publication IWRG621 to confirm if soil is clean fill or otherwise |
| | Machinery storage and maintenance | Use and possible leakage of small amounts of fuel, oil, grease and solvents during machinery maintenance activities. | Moderate | Removal and disposal of fuels/oils/solvents/agricultural chemicals offsite. Soil investigation of any identified spills or staining |
| **280 Lancefield Rd** | Machinery storage and maintenance | Use and possible leakage of small amounts of fuel, oil, grease and solvents during machinery maintenance activities. | Moderate | |
| **Allotment. 5 Section 8 Parish of Bollinda** | Agricultural activities | Historic and current agricultural activities including cropping and livestock grazing, including the use of fertilisers, herbicides and pesticides. | Low | - |
| **Lot Q PS435007** | Agricultural activities | Historic and current agricultural activities including cropping and livestock grazing, including the use of fertilisers, herbicides and pesticides. | Low | - |
| **295 Lancefield Rd** | Agricultural activities | Historic and current agricultural activities including livestock grazing and the use of herbicides and pesticides | Low | - |
| | Storage of fuels/agricultural chemicals | Potential for uncontrolled storage and potential spillage of pesticides and herbicides, fuels, oils and solvents | Moderate | Removal and disposal of fuels/oils/solvents/agricultural chemicals offsite. Soil investigation of any identified spills or staining |

# 8 CONCLUSION AND RECOMMENDATIONS

Based on the environmental desktop evaluation, property specific site inspections and a qualitative risk assessment, the risk for potential contamination of soil, surface water and groundwater in the Lancefield Road Precinct has been determined. Table 7 and Figure 4 show the properties as having a'moderate' or 'low' potential for contamination.

Of the properties within the Lancefield Road Precinct, four properties (170, 280 and 295 Lancefield Road) were classified as having as having a 'moderate' potential contamination risk due to activities associated with past or present agricultural activities. Due to the possible storage of fuels, solvents and agricultural chemicals and/or the maintenance of machinery and equipment. An additional property (275 Lancefield Road) was rated as 'moderate' due to the presence of stockpiled soil that appeared to be sourced from onsite; the source of these stockpiles should be verified. The remaining properties with the Lancefield Road Precinct have been rated as a 'low' potential for contamination as no potential contaminating activities were observed during the site inspection. The temporary storage of di-ammonium phosphate fertiliser was observed within the Villawood Salesian development (Allotment. 5 Section 8, Parish of Bollinda); however, it was not considered to represent a risk to human health or the environment. The assessments of potential risk have been made in accordance with the Victoria Department of Sustainability and Environment, Potentially Contaminated Land, General Practice Note, 2005.

Properties classified with 'moderate' potential contamination risk are recommended for further works or environmental assessment as detailed in Table 7. Further assessment of these sites should be undertaken in accordance with the following guidelines and standards:

- National Environmental Protection Council, 2013 *National Environmental Protection (Assessment of Contaminated Sites) Amendment Measure*;
- Standards Australia 1999, *Australian Standard AS 4482.2 - Guide To The Sampling and Investigation Of Potentially Contaminated Soil. Part 2: Volatile Substances*;
- Standards Australia 2005, *Australian Standard AS4482.1 - Guide to the Investigation and Sampling of Sites with Potentially Contaminated Soil. Part 1: Non-volatile and Semi-Volatile Compounds*; and
- EPA Victoria, 2009, *Soil Hazard Categorisation and Management*, Industrial Waste Resource Guideline 621.

The results of any soil sampling and analysis undertaken should be compared with the relevant guidelines for protection of human health and the environment, as well as waste disposal criteria (as applicable).

In addition, hazardous materials surveys should be carried out for structures identified for demolition due to the potential presence of asbestos containing materials. The surveys should address lead-based paint and hazardous materials storage (fuels, oils, solvents and chemicals). If asbestos containing materials are observed, removal is required to be undertaken by a suitably qualified and licensed asbestos removalist.

In accordance with The Minister's Direction No. 1, recommendations in this report (refer to Table 11) should be considered/implemented as part of Council consideration of any planning scheme amendments (rezoning) or planning permit applications (redevelopment). Council may seek further information/advice for the level of assessment required under the Land Practice Note (Potentially Contaminated Land).

# 9 LIMITATIONS

This report has been prepared by Environmental Earth Sciences VIC ABN 13 109 404 024 in response to and subject to the following limitations:

1. The specific instructions received from Growth Area Authority;
2. The specific scope of works set out in PO213121 issued by Environmental Earth Sciences for and on behalf of Growth Areas Authority;
3. May not be relied upon by any third party not named in this report for any purpose except with the prior written consent of Environmental Earth Sciences VIC (which consent may or may not be given at the discretion of Environmental Earth Sciences VIC);
4. This report comprises the formal report, documentation sections, tables, figures and appendices as referred to in the index to this report and must not be released to any third party or copied in part without all the material included in this report for any reason;
5. The report only relates to the site referred to in the scope of works being located at Lancefield Road ("the site");
6. The report relates to the site as at the date of the report as conditions may change thereafter due to natural processes and/or site activities;
7. No warranty or guarantee is made in regard to any other use than as specified in the scope of works and only applies to the depth tested and reported in this report,
8. Fill, soil, groundwater and rock to the depth tested on the site may be fit for the use specified in this report. Unless it is expressly stated in this report, the fill, soil and/or rock may not be suitable for classification as clean fill if deposited off site; and
9. Our General Limitations set out at the back of the body of this report.

# 10 REFERENCES

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Victorian Government 1997, *State Environment Protection Policy - Groundwaters of Victoria*.

# ENVIRONMENTAL EARTH SCIENCES GENERAL LIMITATIONS

## Scope of services

The work presented in this report is Environmental Earth Sciences response to the specific scope of works requested by, planned with and approved by the client. It cannot be relied on by any other third party for any purpose except with our prior written consent. Client may distribute this report to other parties and in doing so warrants that the report is suitable for the purpose it was intended for. However, any party wishing to rely on this report should contact us to determine the suitability of this report for their specific purpose.

## Data should not be separated from the report

A report is provided inclusive of all documentation sections, limitations, tables, figures and appendices and should not be provided or copied in part without all supporting documentation for any reason, because misinterpretation may occur.

## Subsurface conditions change

Understanding an environmental study will reduce exposure to the risk of the presence of contaminated soil and or groundwater. However, contaminants may be present in areas that were not investigated, or may migrate to other areas. Analysis cannot cover every type of contaminant that could possibly be present. When combined with field observations, field measurements and professional judgement, this approach increases the probability of identifying contaminated soil and or groundwater. Under no circumstances can it be considered that these findings represent the actual condition of the site at all points.

Environmental studies identify actual sub-surface conditions only at those points where samples are taken, when they are taken. Actual conditions between sampling locations differ from those inferred because no professional, no matter how qualified, and no sub-surface exploration program, no matter how comprehensive, can reveal what is hidden below the ground surface. The actual interface between materials may be far more gradual or abrupt than an assessment indicates. Actual conditions in areas not sampled may differ from that predicted. Nothing can be done to prevent the unanticipated. However, steps can be taken to help minimize the impact. For this reason, site owners should retain our services.

## Problems with interpretation by others

Advice and interpretation is provided on the basis that subsequent work will be undertaken by Environmental Earth Sciences VIC. This will identify variances, maintain consistency in how data is interpreted, conduct additional tests that may be necessary and recommend solutions to problems encountered on site. Other parties may misinterpret our work and we cannot be responsible for how the information in this report is used. If further data is collected or comes to light we reserve the right to alter their conclusions.

## Obtain regulatory approval

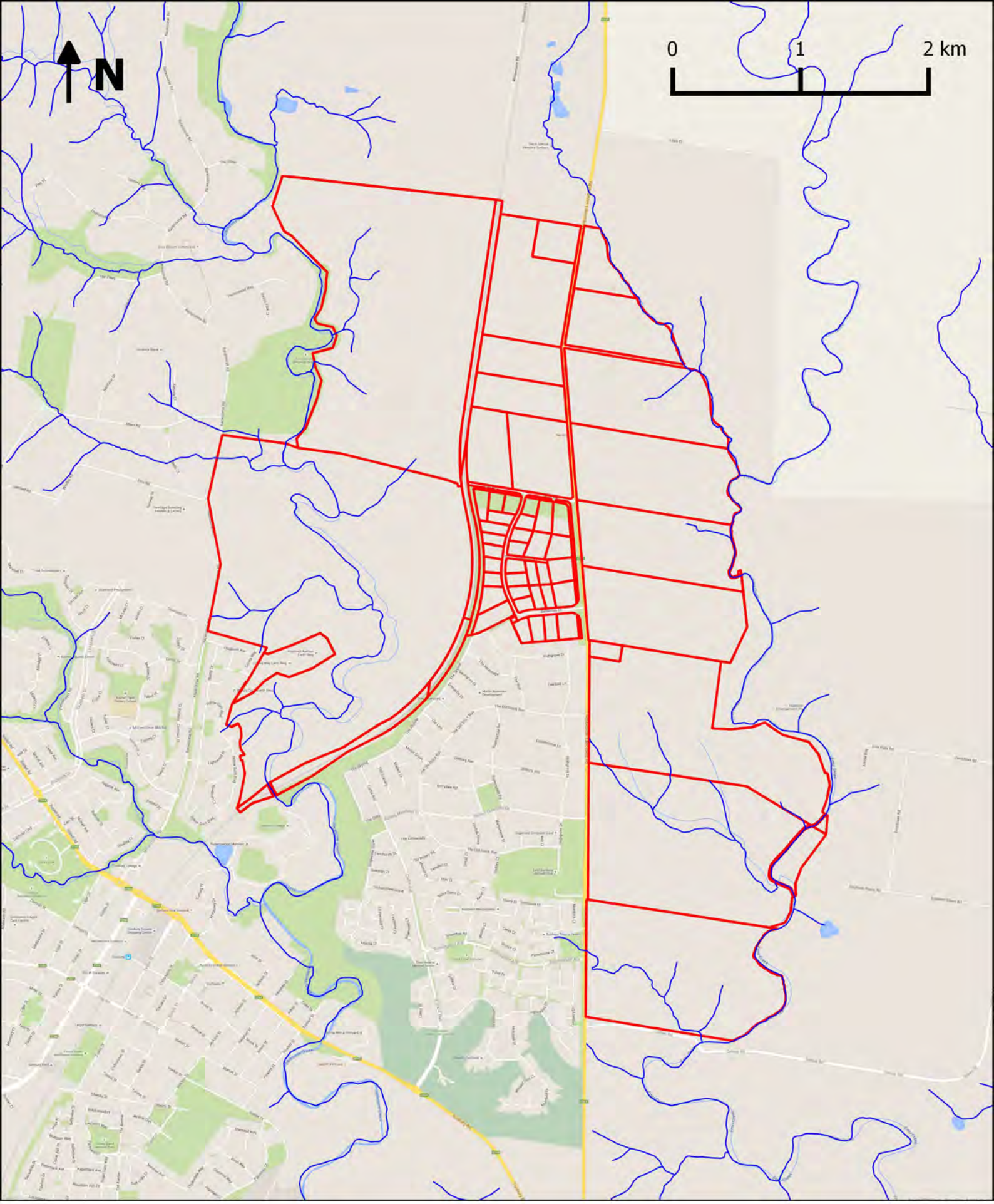
The investigation and remediation of contaminated sites is a field in which legislation and interpretation of legislation is changing rapidly. Our interpretation of the investigation findings should not be taken to be that of any other party. When approval from a statutory authority is required for a project, that approval should be directly sought by the client.

## Limit of liability

This study has been carried out to a particular scope of works at a specified site and should not be used for any other purpose. This report is provided on the condition that Environmental Earth Sciences VIC disclaims all liability to any person or entity other than the client in respect of anything done or omitted to be done and of the consequence of anything done or omitted to be done by any such person in reliance, whether in whole or in part, on the contents of this report. Furthermore, Environmental Earth Sciences VIC disclaims all liability in respect of anything done or omitted to be done and of the consequence of anything done or omitted to be done by the client, or any such person in reliance, whether in whole or any part of the contents of this report of all matters not stated in the brief outlined in Environmental Earth Sciences VIC's proposal number and according to Environmental Earth Sciences general terms and conditions and special terms and conditions for contaminated sites.

To the maximum extent permitted by law, we exclude all liability of whatever nature, whether in contract, tort or otherwise, for the acts, omissions or default, whether negligent or otherwise for any loss or damage whatsoever that may arise in any way in connection with the supply of services. Under circumstances where liability cannot be excluded, such liability is limited to the value of the purchased service.

# FIGURES



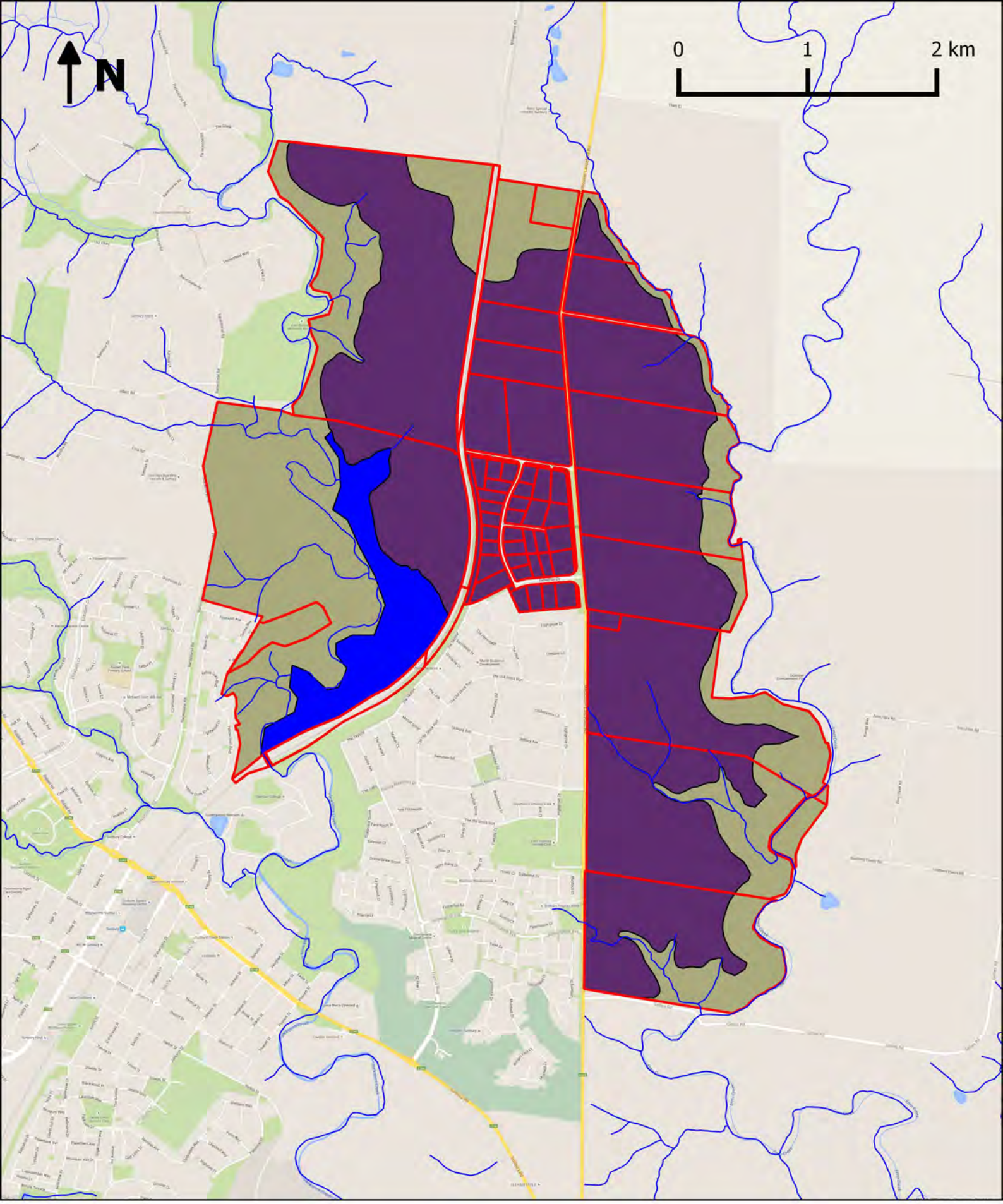

**Legend**

Lot Boundaries

**Figure 1: Site locations (Lancefield Rd PSP)**

Client: Growth Areas Authority
Job Number: 213066 PM: TA
Date: July 2015
Source Imagery: Google Maps

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Lot Boundaries

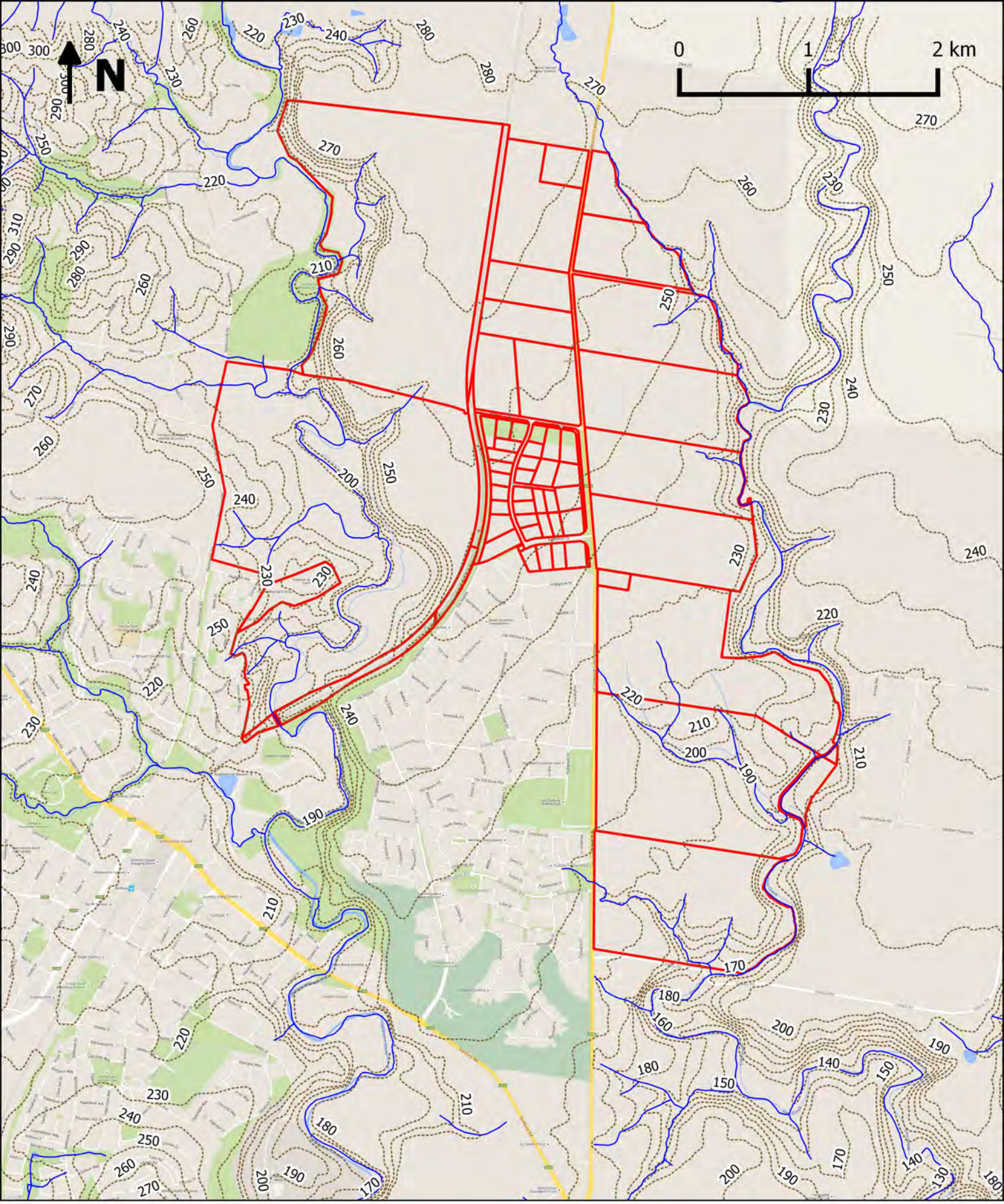
**Planning Zones**

- RCZ1
- UFZ
- UGZ

**Figure 2: Planning Zones (Lancefield Rd PSP)**

Client: Growth Areas Authority
Job Number: 213066 PM: TA
Date: July 2015
Source Imagery: Google Maps

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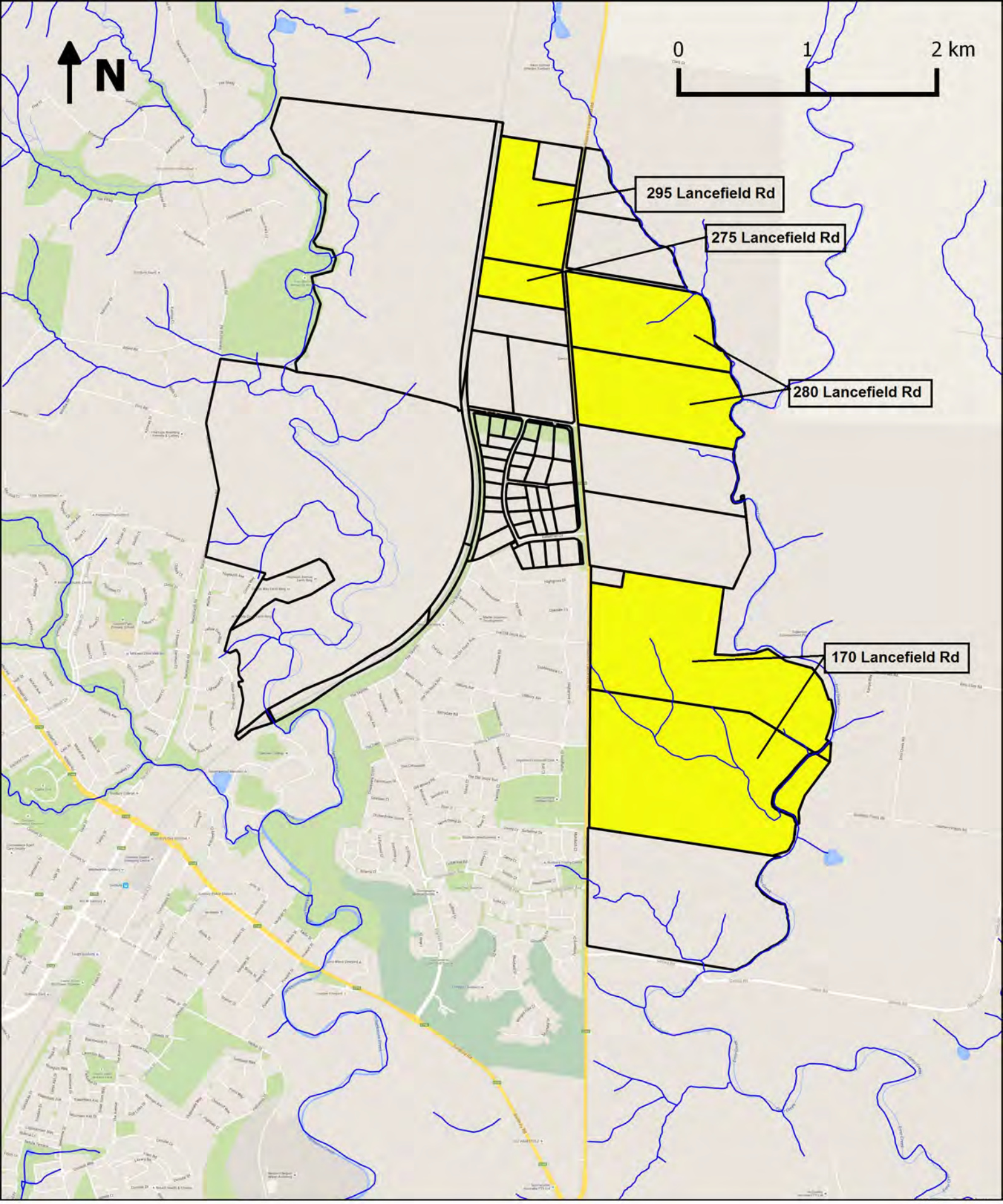

**Legend**

- Lot Boundaries
- 10m Contours

## Figure 3: Topography (Lancefield Rd PSP)

Client: Growth Areas Authority
Job Number: 213066 PM: TA
Date: July 2015
Source Imagery: Google Maps

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**Risk Rating**

- Low
- Moderate
- High
- Streams

## Figure 4: Risk Areas (Lancefield Rd PSP)

Client: Growth Areas Authority
Job Number: 213066 PM: TA
Date: July 2015
Source Imagery: Google Maps

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# APPENDIX A AERIAL PHOTOGRAPHS


LANGFORD RD
3698-189
MELBOURNE 7822 M/S RUN 2
39 00' ASL VIC DLS© 2 -11-82


VIC
1916
MELBOURNE 1966 PROJECT RUN 1 6·2·66 LENS 122 151·75MM 9.800 ADASTRAPHOTO
41

# APPENDIX B GEOTECHNICAL REPORT

CIVILTEST PTY LTD
SOIL TESTING & GEOTECHNICAL CONSULTANTS
ABN 91 006 855 689 ACN 006 855 689

7 November 2013 **Our Ref: 1131089**

Environmental Earth Sciences
PO Box 2253
FOOTSCRAY VIC 3011

**Attention:** Ms Tamara Ashford

**RE: Sunbury Growth Corridor – Lancefield Road PSP and Sunbury South PSP**

Dear Ms Ashford,

At your request, Civiltest Pty Ltd have reviewed the available documents and drawings and provided comments on potential geotechnical constraints and considerations as per Ms Tamara Ashford's email dated 31 October 2013. The following documents were provided by Ms Tamara Ashford and formed part of this review:

- Growth Corridor Plan - SUNBURY
- Sunbury – PSP Boundaries – Appendix 1 for RFQs

It should be understood that any comments made are based on general considerations for the Lancefield Road PSP area and the Sunbury South PSP area as a whole. Comments are based on general knowledge of the region, this organisation's experience in Sunbury and with geotechnical studies in general, and recognised geological data for the area.

No site or intrusive investigations were conducted as part of this review. A comprehensive geotechnical investigation is recommended for the planning and design of any proposed bridge, road, building works or associated earthworks. Geotechnical investigations conducted as part of the planning and design of proposed works would provide site specific details of existing ground conditions and geotechnical constraints.

## 1. GEOTECHNICAL CONSTRAINTS:

The Lancefield Road PSP area is predominantly flat or gently undulating with significant slopes in the areas surrounding the creeks, specifically Jacksons Creek and Emu Creek. The steep slopes surrounding the creeks generally slope down towards the creeks. These steep slopes will significantly constrain development in these areas.

The Sunbury South PSP area is moderately undulating south of Sunbury towards Diggers Rest and gently undulating in the areas South East of Sunbury. Moderate undulations will somewhat constrain the layout of any proposed road and block formations.

Redstone Hill in the Sunbury South PSP area comprises of predominantly moderate slopes. This hill, as well as any other notable slopes or hills, will constrain the layout of any proposed road and block formations.

The moderately to steeply undulating areas and creek bank areas are likely to consist of exposed or shallow rock. Rocky ground conditions will result in more difficult excavation for road and earthworks, incurring additional costs.

Geotechnical investigations conducted as part of the planning and design of proposed works will provide site specific details of existing ground conditions and geotechnical constraints if applicable.

## 2. CREEK CROSSINGS:

In regard to creek crossings, there would appear to be nothing out of the ordinary in this area and in general, the land would appear to be suitable for creek crossings.

The construction of creek crossings for any creeks that are within low-lying areas may require substantial road works and earthworks to overcome the topography. Additionally, rocky ground conditions will result in more difficult excavation for bridge abutments and associated earthworks, incurring additional costs. Subsurface erosion may also pose a problem if significant excavation is required in these areas.

Typically, the areas in the vicinity of the creeks are mapped with a Land Subject to Inundation overlay. Creek crossings and any other works within existing or projected creek flows should not unintentionally inhibit creek flow. Works should be constructed above the creek flow path or should accommodate creek flow through the works.

During construction, an allowance for dewatering areas of earthworks or excavations for foundation works should be provided for in these low-lying areas, or areas within the Land Subject to Inundation overlay. A geotechnical investigation conducted as part of the project planning or design phase may determine a requirement for dewatering during construction. A comprehensive geotechnical investigation is recommended for the planning and design of any proposed bridge, road, or associated earthworks.

## 3. ROAD PAVEMENTS:

Lightly trafficked new road pavements would typically consist of granular sub-base and base material with an asphalt surface with an approximate thickness of 300mm to 500mm. Heavily trafficked pavements will typically require a thickness of 500mm to 1000mm. Alternative pavement compositions should be considered for heavily trafficked pavements or overlays of existing roads.

Road pavements founded on softer natural subgrade materials may require subgrade improvement or select filling. Subgrade improvements or select filling will increase the thickness of road works required.

Each road pavement should be designed specifically to the subgrade conditions found on the site, the anticipated traffic over the life of the pavement, and the preferred or locally available construction materials and equipment. A geotechnical investigation along the proposed route of any road will be required to assess the existing subgrade conditions. The projected traffic loading and traffic types plays a significant role in the design of road pavements. Traffic information for design of road pavements may include;

- Traffic count data for the existing or connecting roads,
- Types of proposed and connecting developments,
- Numbers or plans of serviced dwellings, and
- Design Equivalent Standard Axles (DESA).

## 4. BLOCK FORMATION ON SLOPES:

In general it would be best to site allotments up and down any slope and construct roads to approximately follow the contours. Constructing roads to approximately follow contour lines minimises road profile grades and minimises driving up or down steep slopes. This arrangement also minimises earthworks required for access roads and building pads, and allows roads to be used for surface drainage control.

Figures 1 and 2 (on the following page) by the California Coastal Commission (1994) provide examples of a subdivision layout on a steep slope. Each of the examples demonstrates blocks/lots oriented up and down the slope or on relatively level areas, with the main roads running approximately along the contours. Sections of roads oriented up and down the slope are minor and kept to minimum lengths.

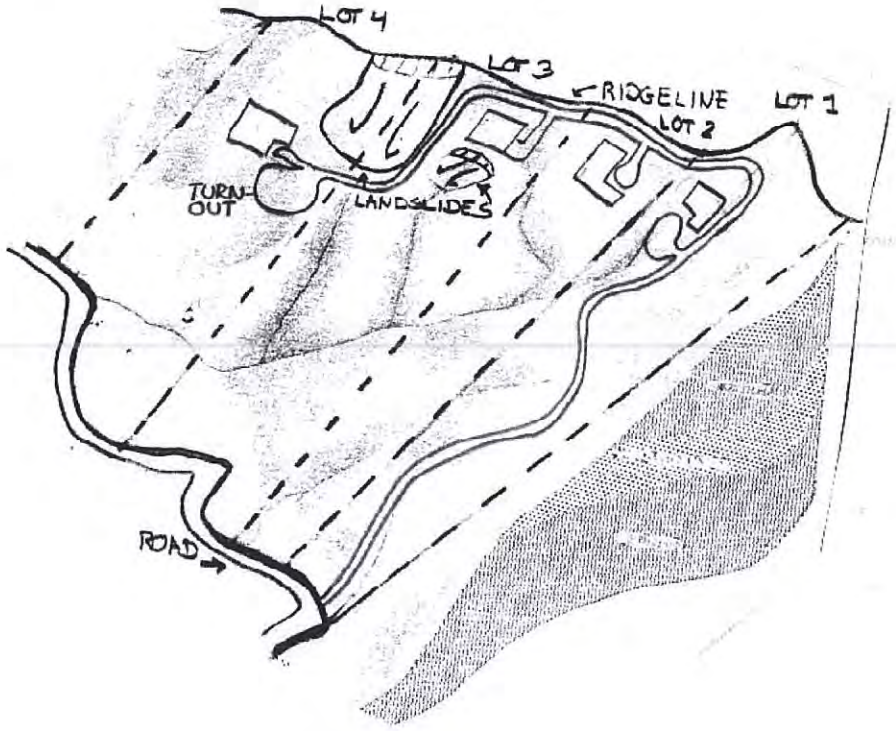



***Figure 1*: California Coastal Commission (1994) Land Form Alteration Policy Guidance, VI. Subdivision Examples, Parcel on Ridge Top with Steep Slope, Alternative 2 – Modified Lot Layout, http://www.coastal.ca.gov/landform/sec6c.html**

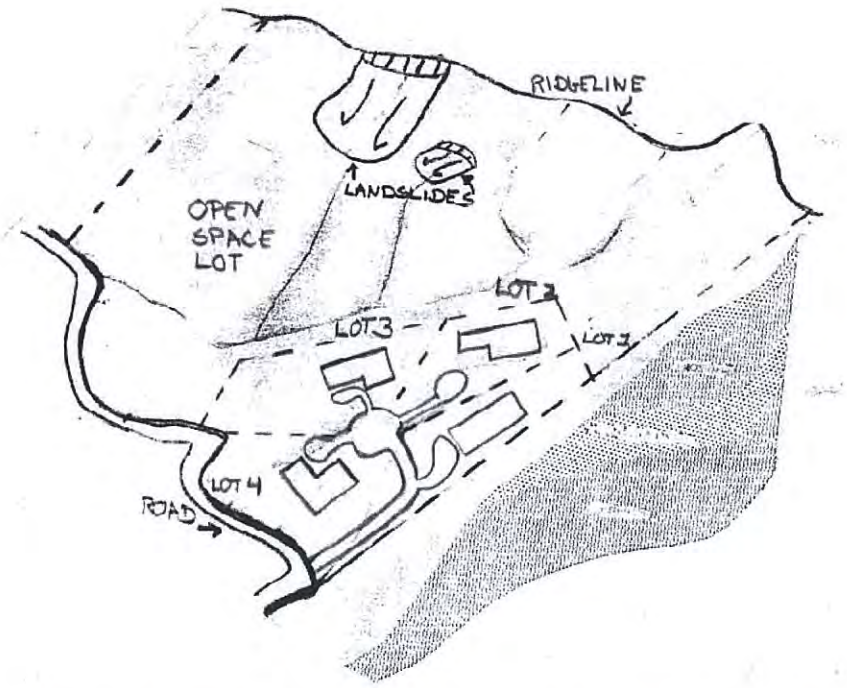



***Figure 2*: California Coastal Commission (1994) Land Form Alteration Policy Guidance, VI. Subdivision Examples, Parcel on Ridge Top with Steep Slope, Alternative 3 – Lot Layout with Lot Line Changes, http://www.coastal.ca.gov/landform/sec6c.html**

## 5. REACTIVITY OF SOILS:

Based on our experience, the soils in and around Sunbury are usually found to be moderately reactive where only moderate ground movement would be expected due to moisture changes. However, south of Sunbury the soils are found to be highly reactive, which typically experience high levels of ground movement from moisture changes. It should be expected that relatively level and gently undulating areas of greater Sunbury will have different ground conditions to areas of different character, such as the low-lying areas affected by creek flows.

Geological maps of the area, *VANDENBERG, A.H.M., 1997. MELBOURNE SJ 55-5 Edition 2, 1:250 000 Geological Map Series 1:250,000 geological map Geological Survey of Victoria*, shows the geology of the greater Sunbury area. Distinct differences are observed between the surroundings of Jacksons Creek including tributaries, and other areas away from Jacksons Creek.

The predominant geology of the Jacksons Creek surroundings, which incorporates the majority of the Lancefield Road PSP area, is various Sedimentary Quaternary Alluvium. The predominant geology of the greater Sunbury areas away from Jacksons Creek, which incorporates the majority of the Sunbury South PSP area, is Extrusive Igneous Quaternary Basalt. Quaternary Basalt sites are often found to be highly to extremely reactive.

Selection of residential building footings based on standard designs is primarily based on the reactivity or shrink-swell potential of the founding soil. To provide a sufficiently strong and stable base for building on more reactive sites, deeper more expensive building footings are required.

In addition to the natural geology, the study areas will be interspersed with various developments, such as quarries, dams, and other earthworks that have altered the natural ground conditions.

## 6. SUBSURFACE EROSION:

Based on our knowledge of the Sunbury area, we are aware that on steep sites there is a potential to encounter subsurface erosion. This does not normally cause a problem during construction except where deep excavations (greater than 3.0 metres) are cut and exposed.

Subsurface erosion can occur where an aquifer is allowed to drain, such as on a steep slope or excavation cut. The flow out of the aquifer erodes the aquifer soil, usually sand, from the point of drainage. This erosion or tunnelling can continue to worsen over time as long as the flow continues and can lead to broader slope instability. Steep slopes with substantial upslope areas can be susceptible to subsurface erosion.

For any proposed development site where there is potential for slope instability, it is recommended that the full slope be considered in a slope stability geotechnical investigation and assessment. The slope stability assessment should assess the site and proposed development for the potential of subsurface erosion as well as other failure modes.

Should you require any further information regarding this matter, please do not hesitate to contact me at our Mornington office.

Yours faithfully



**Liam Cox**
**Geotechnical Engineer**
**CIVILTEST PTY LTD**

**REF:** LC/SDB