Geotechnical & Groundwater

North Penrith

Assessment Report

Summary

Objectives

The objectives of the assessment are to ascertain the existing ground and groundwater conditions at the site, to determine the suitability of the site for the proposed land uses, and to recommend any further assessments and investigations, and/ or the courses of action to be taken during construction.

Method

The method of assessment was a review of reports of previous site investigations.

The findings were:

- the site is underlain by naturally occurring soils, with engineering properties favourable for residential, commercial and industrial construction;
- the soils at the site do not exhibit characteristics suggestive of significant dryland salinity. The erosion hazard is assessed as Moderate Risk due to the presence of erodible soils, requiring appropriate management controls;
- the salinity hazard of the soils at the site can be readily managed by designing and implementing a Soil and Water Salinity Management Plan;
- development of the site would require site works for construction of roads, placement of fill and construction of retention structures along the perimeter of the site.
- there is no risk of slope instability (risk assessed as Very Low);
- shallow and deep footings would both be feasible;
- the majority of the soils on the site may be re-used by means of excavation and filling (with additional assessment to determine any unsuitable material).

The geotechnical constraints that might be associated with the development are;

- presence of uncontrolled fill in some areas that might not be suitable;
- piling below depths of about 5m likely to encounter groundwater.

Conclusions

There are no known constraints that might impact on development and construction.

The site is suitable for residential and commercial development (low rise and medium rise) and light industrial development.

Recommendations

Concept Plan: The recommendations are:

1. **Soil and Water Salinity Management Plan.** The Construction Environmental Management Plan (CEMP) is to include a site-specific Soil and Water Salinity Management Plan. The Plan is to be implemented throughout the construction works under the responsibility of the Principal Contractor.

2. **Detailed geotechnical investigations to support the detailed design and construction.** Further targeted investigations will be required to confirm the detailed design, including ascertaining the suitability of soils for re-use on the site.

3. **Geotechnical assessment of imported fill material.** The CEMP is to include measures to ensure imported fill is suitable for the intended use on site.

Stage 1 Project Application: There are no specific recommendations for the Stage 1 Project Application. The recommendations for the Concept Plan apply for that part of the site addressed by the Stage 1 Project Application.

Contents

1. Objectives of the Assessment

The Director-General Requirements for the Concept Plan and the Stage 1 Project Application contain specific key requirements relating to geotechnical and groundwater matters.

The development will comprise residential, commercial, retail, community, light industrial and recreational development. Refer to the Concept Plan in Appendix A.

The primary objectives of the assessment are to determine the suitability of the site for the proposed land uses and to recommend any further assessments and investigations, and/ or courses of action to be taken during construction.

Director-General's Requirements

This report was prepared to respond to the Director-General Requirements (DGRs) regarding geotechnical and groundwater matters at the North Penrith site for the;

- Concept Plan (MP 10-0075);
- Stage 1 Project Application (MP 10-0078),

under section 75F of the *Environmental Planning Assessment Act 1979*.

For the Concept Plan, a geotechnical assessment of such matters as;

- the suitability of the site for the proposed land uses;
- slope stability;
- erosion hazard;
- proposed earthworks and retention methods,

are required, as well as:

- 'a geotechnical study to identify any constraints on the site, including slope analysis';
- 'addressing any impacts on groundwater resources, including potential degradation to the groundwater resource and any impacts on groundwater dependent ecosystems'. Where impacts are identified, the report is to provide contingency measures to remediate, reduce or manage potential impacts. The report is to demonstrate that groundwater is not connected to the surface water;
- to 'provide details of existing water and groundwater licences under the Water Act 1912 and any proposed surface water and groundwater extraction'.

For the Stage 1 Project Application, the Key Assessment Requirements (at 3 Geotechnical) require the report to provide a 'detailed geotechnical report' assessing the same matters as for the Concept Plan.

This report addresses the geotechnical and groundwater issues from both DGRs.

Proposed development

The development will comprise residential, commercial, retail, community, light industrial and recreational. Refer to the Concept Plan in Appendix A.

The Stage 1 Project Application will be confined to site preparation, roads and utilities infrastructure, community facilities and lot forming works. It does not extend to the construction of the built form on the individual lots.

Objectives

The objectives of this geotechnical and groundwater assessment are to:

- provide information on the site conditions(by way of a geotechnical model, a hydrology and hydrogeology model and considering geotechnical, salinity and other issues);
- assess the suitability of the site for the proposed land uses;
- identify any constraints for development;
- recommend any further assessments or investigations and/ or the courses of action to be taken during construction.

Geotechnical model and hydrology and hydrogeology models

The objectives of the models are to determine:

- sub-surface conditions across the entire site and the impact of the development on those conditions;
- positive or negative effects these conditions might have on the proposed development.

Included in the sub-surface conditions considerations are:

- variations in sub-surface conditions;
- groundwater table;
- salinity of soils and groundwater;
- erodible soils;
- soft and loose soils;
- reactive soils.

2. Site analysis

The 40ha site is essentially vacant land and comprises a number of Lots in a number of Deposited Plans. Refer to Appendix B.

The North Penrith site assessed in this report excludes the sites of the Commuter Car Park and the Penrith Training Depot.

The site was previously part of a large Defence facility.

The site area addressed in the Stage 1 Project Application is shown in the diagram in Appendix C.

The western portion of the site is underlain by sand and gravel river deposits. The eastern portion is underlain by heavy clays derived from weathering of the underlying shale bedrock.

The site is located in a 'Moderate Salinity Potential' area.

The eastern portion of the site has a low potential for groundwater movement and a high salinity potential. The western portion of the site has a medium to high potential for groundwater movement, with low salinity potential.

The development has no requirement for extraction of groundwater.

Summary site description

The site comprises about 40ha of vacant land and is located between:

- Coreen Avenue to the north;
- Penrith Railway Station to the south;
- Castlereagh Street and light industrial development to the west;
- Residential developments to the east.

The site is shown in the Site Boundary Plan in Appendix B. The site area that is the subject of the Stage 1 Project Application is shown in the diagram in Appendix C.

The site was previously part of a large Defence facility. On deeming the facility surplus to requirements, the Department of Defence demolished all but one minor structure and one heritage-significant former dwelling (Thornton Hall). The former building slabs and the internal road network also remain.

The North Penrith site assessed in this report excludes the sites of:

- future Lot 12, for the Commuter Car Park, to be constructed by Penrith City Council
- future Lot 13, for the Penrith Training Depot, being that part of the former defence facility being retained by the Department of Defence.

The western portion of the site is relatively flat and low lying in comparison to the elevated eastern portion of the site.

Site geology

The western (mostly low-lying) portion of the site, closer to the Nepean River, is generally underlain by sand and gravel river deposits.

The eastern portion is underlain by heavy clays, which are derived from weathering of the underlying shale bedrock (Wianamatta Shales).

The boundary between the mainly clayey soils and the river deposits will be close to the base of the slope of the elevated eastern portion of the site.

Site salinity

The Salinity Potential in Western Sydney Map indicates that the site is located in a 'Moderate Salinity Potential' area.

Site hydrogeology

Site surface run-off is generally diverted into naturally occurring channels/depressions that traverse the site and ultimately discharge into two large concrete stormwater pipes located at the north-western corner of the site.

Groundwater

The eastern portion of the site, underlain by Wianamatta shales, has;

- low potential for groundwater movement;
- high salinity potential.

The western portion of the site, with soils deposited by rivers, has medium to high potential for groundwater movement, with low salinity potential.

It is understood that the development has no requirement for extraction of groundwater.

3. Methods & Results

Assessment based on review of reports for the numerous previous investigations at the site.

The outcomes of these investigations used to establish geotechnical and hydrogeology models.

Methods

The methodology for the assessment was based on understanding and considering the numerous previous investigations at the site. Refer the reports listed in Section 5.

These investigations included;

- drilling boreholes across the site, using truck mounted drilling rigs, to depths in the order of 5m;
- excavation of shallow test pits across the site, using small sized excavators, such as backhoes, to depths in the order of 3m;
- recovery of representative samples from different soil strata across the site, which were visually assessed and stored for laboratory testing;
- monitoring groundwater levels using PVC open standpipes installed in some of the boreholes;
- testing the soils using insitu methods such as the Standard Penetration Test;
- laboratory testing of selected soil samples to determine classification and general properties and characteristics.

Results

The results for the geotechnical model, including from laboratory testing, are summarised as follows.

- evidence of widespread shallow filling, comprising silty sands and clayey clays, across the site. This fill generally comprised materials gained from on-site excavations and is underlain by naturally occurring soils, which are either sand and gravel (alluvial soils) deposited in the Nepean River flood plain, or clays derived from weathering of the shale bedrock (residual soils).
- laboratory testing generally indicated medium plasticity clays with a moderate inherent swelling capacity;
- insitu testing indicated that the majority of the soils will be very stiff clays.

The results for the salinity model are summarised as follows.

- laboratory testing indicated that the near surface soil horizons (to depths of 500mm) generally exhibit a low salinity hazard. The underlying naturally occurring clays exhibit a low to moderate salinity hazard;

- soils are likely to be erodible.

The results for the hydrology and hydrogeology model are summarised as follows.

- site surface run-off is generally diverted into naturally occurring channels/ depressions that traverse the site and ultimately discharge into two large concrete stormwater pipes located at the north-western corner of the site. Considering the low-lying nature, the site can be considered to be well drained;

- groundwater over the central and western portions is situated within probable relatively highly permeable coarse gravel aquifers, at depths in excess of 5m from surface levels;

- groundwater over the eastern portion is situated within probable relatively low permeability clays, at depths in excess of 8m from surface levels;

- groundwater underlying the site appears to flow in a north to north-westerly direction;

- the groundwater table at the site is at depths greater than 5m;

- groundwater does not appear to rise significantly following heavy rainfall so as to become a potential hazard for rising salinity.

4. Assessment

From a geotechnical and groundwater perspective, the site is suitable for residential and commercial development (low rise and medium rise) and light industrial development.

Assessment summary

It is concluded that:

- the site is underlain by naturally occurring soils, with engineering properties favourable for residential, commercial and industrial construction;
- the soils at the site do not exhibit characteristics suggestive of significant dryland salinity. The erosion hazard is assessed as Moderate Risk due to the presence of erodible soils, requiring appropriate management controls;
- the salinity hazard of the soils at the site can be readily managed by designing and implementing a Soil and Water Salinity Management Plan;
- the site could receive fill to raise levels and/or to construct retaining walls along the site boundaries;
- there is no risk of slope instability (risk assessed as Very Low);
- shallow and deep footings would both be feasible;
- the majority of the soils in the site may be re-used by means of excavation and filling (with additional assessment to determine any unsuitable materials).

Geotechnical constraints

The geotechnical constraints that might be associated with the development are;

- the presence of uncontrolled fill in some areas that might not be suitable;
- piling below depths of about 5m likely to encounter groundwater.

Recommendations

Detailed investigations to support detailed design and construction will be required for the different stages of development.

Detailed investigation to support the design and construction of possible retaining structures.

Imported fill should be of similar characteristics to the soils on site and should be imported and placed in accordance with design specifications.

A Soil and Water Salinity Management Plan to be prepared and implemented.

Given the low-lying nature of the majority of the site, the stormwater system for the development will require careful attention so as to achieve effective drainage.

5. References

Reports etc., referenced for this geotechnical and groundwater assessment

#	Originator	Date	Description
1	Douglas Partners	Dec 1992	Preliminary Contamination Assessment
2	Dames & Moore	Sept 1994	Review of DP reports for Penrith Council to judge whether or not the land is suitable for residential development
3	CMPS&F/ Rust PPK	May 1998	Geotechnical Study, Contamination Assessment & Remediation Strategy - Phase 1 Site History, Preliminary Sampling and Work Plan
4	CMPS&F/ Rust PPK	Sept 1998	Geotechnical Study, Contamination Assessment & Remediation Strategy - Phase 2, Volume 1
5	CMPS&F/ Rust PPK	Sept 1998 (847) pages	Geotechnical Study, Contamination Assessment & Remediation Strategy - Phase 2, Volume 2 Appendices
6	Egis Consulting	April 1999	Preliminary Geotechnical
7	Egis Consulting	Feb 2002	Salinity Study
8	Egis Consulting	Oct / Nov 2002	Data Summary Report
9	Geotechnique Pty Ltd	April 2009	Geotechnical & Contamination Advice

Appendix 1: Concept Plan

North Penrith

ILLUSTRATIVE CONCEPT PLAN

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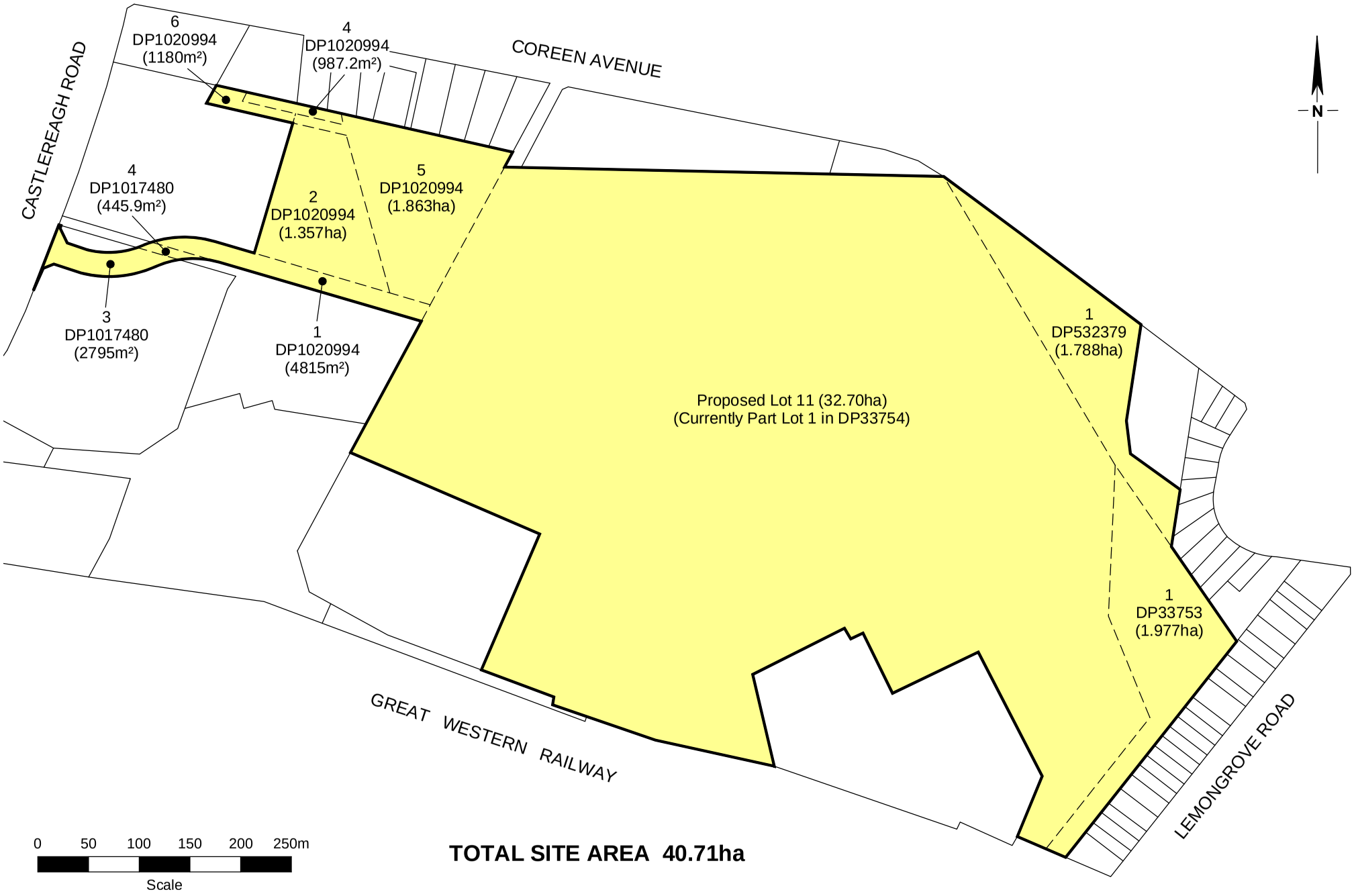
AAUD
ARMAND ALCOCK URBAN DESIGN

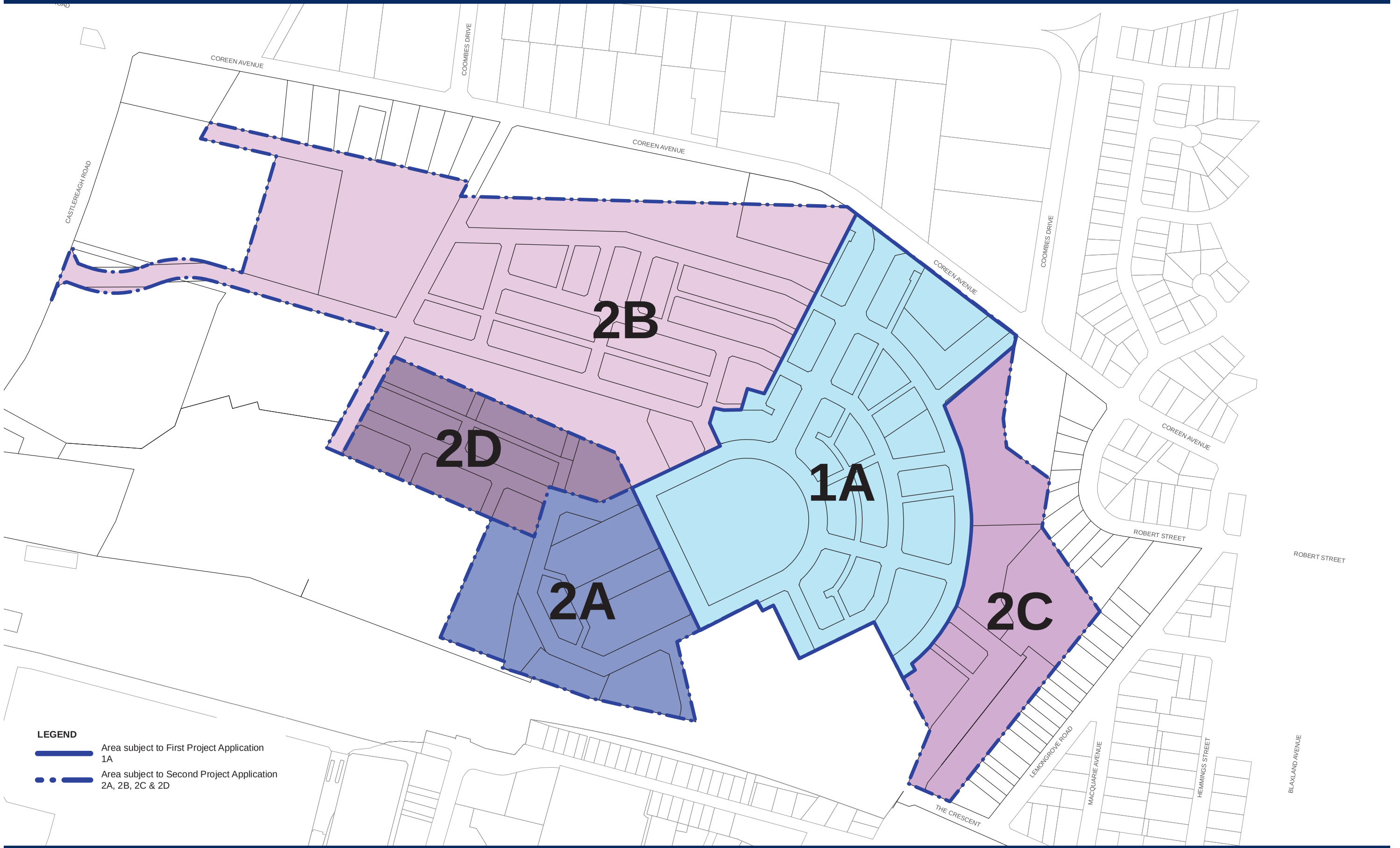
LANDCOM

Appendix 2: Site Boundaries Plan



TOTAL SITE AREA 40.71ha

Appendix 3: Stage 1 Project Application Area Plan



North Penrith

LAND SUBJECT TO PROJECT APPLICATIONS & STAGING

0 20 40 60 80 100m

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AAUD ANNAND ALCOCK URBAN DESIGN

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