



Salinity, Sodicity and Aggressivity Assessment

270 Aldington Road, Kemps Creek

Prepared for: Stockland Development Pty Ltd c/- AT&L

A101023.0279.00 | SMP v2f | Date: 19/10/2023



ADE
CONSULTING
GROUP

Document Information

Report Title: Salinity and Sodicity Management Plan
Prepared for: Stockland Development Pty Ltd c/o- AT&L
Project Address: 270 Aldington Road, Kemps Creek NSW
File Reference: A101023.0279
Report Reference: SMP.v2f
Date: 19 October 2023

Document Control

Version	Date	Author	Revision description	Reviewer
Vd	09/10/2023	Elisha Cassidy	Draft for internal review	Elin Griffiths
V1d	11/10/2023	Elisha Cassidy	Draft for client review	Elin Griffiths
V1f	16/10/2023	Elisha Cassidy	Final for issue	Elin Griffiths
V2f	19/10/2023	Nicholas Maricic	Update after client comments	Elin Griffiths

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1 Introduction

1.1 Background

ADE Consulting Group Pty Ltd (ADE) was engaged by AT&L on behalf of Stockland Development Pty Ltd (the Client) to prepare a salinity and soil sodicity management plan (SSMP) to support the application for subdivision works at 258 – 270 (Site 1) and 244 – 256 (Site 2) Aldington Road, Kemps Creek, New South Wales (hereafter collectively referred to as the site). This report has been prepared in accordance with ADE's fee proposal (reference A201023.0279.00), dated 23 March 2023 and the requirements of the Mamre Road Precinct Development Control Plan (DCP) (NSW DPIE, 2021), which will provide an indication of the potential risk of salinity and aggressivity occurring at site, and considers the suitability of land for the proposed development.

The 23 hectares (ha) site subject to the Development Application is shown in **Appendix A – Figures**. ADE understands that the proposed development includes the subdivision of the two existing lots (Lot 16 and 17) into four lots (temporarily designated as Lots 1-4, as the identification numbers have not been finalised at the time of writing this report), and the development of the site into a commercial/ industrial complex. In addition, a 40m wide collector road along the boundary of Lot 15 will be constructed (currently designated road 01). See **Appendix B – Development Plans** for more details.

It should be noted that no intrusive investigation was undertaken by ADE as part of this scope of works. This salinity and soil sodicity management plan has been prepared based on data provided in the following reports.

- Douglas Partners (2021a). *Preliminary Site Investigation – 244-270 Aldington Road, Kemps Creek, prepared for Stockland Corporation Ltd.*
- Douglas Partners (2021b). *Geotechnical Due Diligence Assessment – 244-270 Aldington Road, Kemps Creek, prepared for Stockland Corporation Ltd, (ref: 205819.01; July 2021).*

In addition, reference has been made to developmental controls in:

- NSW Department of Planning, Industry and Environment (DPIE) (2021). Development Control Plan: Mamre Road Precinct - Western Sydney Employment Area, (November 2021).

1.2 Objectives

The objective of this work is to provide salinity, aggressivity, and sodicity assessment and management of the in-situ soil and imported fill material present within the site, in the context of NSW Government guidelines and more specifically, the Mamre Road Precinct Development Control Plan (DCP) (NSW DPIE, 2021).

1.3 Scope of Works

The preparation of this report includes the following scope of works:

- Review all previous data for the site (where available) for the assessment of salinity, aggressivity and sodicity;
- Review and comparison of available data against the adopted site assessment criteria.

1.4 Regulatory Framework

The regulatory framework for this report is based on Australian Standards, principal acts and regulations, and guidelines that have been made or approved by the NSW Environment Protection Authority (EPA) and includes the following:

- Department of Land and Water Conservation (DLWC) (2002a), Site Investigations for Urban Salinity. NSW Department of Land and Water Conservation.
- Department of Land and Water Conservation (DLWC) (2002b). Map of Salinity Potential in Western Sydney.
- Department of Natural Resources (DNR) (2002). Local Government Salinity Initiative Series.
- Standards Australia. (2009). Australian Standard AS 2159 2009: Piling – Design and Installation.
- Richards, L. A (1954). Diagnosis and Improvement of Saline and Alkali Soils, Soil Science.
- Gold Coast City Council (GCCC) (2007). Policy 11: Land Development Guidelines; Section 13 Water Sensitive Urban Design (WSUD) Guidelines.

2 Site Identification and Details

2.1 Site Location

The site comprises part Lot 15, Lot 16 and 17 in DP 253503 located at 272-280 (half of proposed Collector Road) 258-270 (Site 1) and 244-256 (Site 2) Aldington Road, Kemps Creek, NSW respectively. The total site area is approximately 23ha (refer to Appendix A – Figures). Relevant site information is provided in **Table 1** to **Table 3** below.

Table 1. Site Information Summary – Future Collector Road

Site Details	
Site Address	272-280 Aldington Road, Kemps Creek NSW
Title Identification	Lot 15, DP 253503
LGA	Penrith City Council
Current Land Use Zoning	IN1, General industrial
Site Area	Approximately a 3ha area within the larger site. The site extends approximately 40m south of the northern border, for the length of the property.
Former and current land use	Rural
Environmental Plan	State Environment Planning Policy (Industry and Employment) 2021 under the Environmental Planning and Assessment Act 1979

Table 2. Site information summary – Site 1

Site Details	
Site Address	258-270 Aldington Road, Kemps Creek NSW
Title Identification	Lot 16, DP 253503
LGA	Penrith City Council
Current Land Use Zoning	IN1, General industrial
Site Area	Approximately 10.02 ha
Former and current land use	Rural
Environmental Plan	State Environment Planning Policy (Industry and Employment) 2021 under the Environmental Planning and Assessment Act 1979

Table 3. Site information summary – Site 2

Site Details	
Site Address	244-256 Aldington Road, Kemps Creek NSW
Title Identification	Lot 17, DP 253503
LGA	Penrith City Council
Current Land Use Zoning	IN1, General industrial
Site Area	Approximately 10.29 ha
Former and current land use	Agricultural and rural
Environmental Plan	State Environment Planning Policy (Industry and Employment) 2021 under the Environmental Planning and Assessment Act 1979

The site is currently situated amongst an area comprised predominantly of rural agricultural uses, with surrounding properties containing greenhouses and residences. Surrounding environment and features based on the inspection undertaken on 13 June 2023 as part of the DSI by ADE (ADE 2023) are summarised in **Table 4** below.

Table 4: Site surrounds

Direction	Description
North	Extensive earthworks are apparent at Lot 18 (DP253503) Aldington Road, which extends across the entire northern border of the Site. Aerial imagery shows footings for buildings are constructed.
East	Green field with multiple ponds, followed by residential properties along Bowood Road, Kemps Creek.
South	Green field, minor earthworks and small residential buildings, followed by extensive earthworks and stockpiles present on properties along Abbotts Road.
West	Large properties with small residential buildings, ponds and other ancillary buildings.

2.2 Environmental Setting

Table 5 summarises the site condition and surrounding environmental setting.

Table 5. Summary of site condition and surrounding environment

Attribute	Description
Site Inspection Details	The site inspection and soil sampling were undertaken during 13 to 20 June 2023 by experienced environmental consultants representing ADE, as part of the detailed site investigation. The site conditions at the time remained largely unchanged since previous investigations, and comprised largely of green field with various ponds and man-made dams, deep rooted trees, and residential buildings. Cattle grazing was identified as the primary use of the land.
Topography and Elevation	The site is comprised of low rolling hills with slopes of between 7 and 15%, grading west.
Surface Cover and Conditions	The north-eastern portion of the site contains a residence with surrounding built structures, tall grass, and ornamental trees. West of the residence, the site transitions to predominantly long grass with several man-made dams adjacent to the northern boundary. The south-western section of the site consists primarily of improved pastures used for cattle grazing and a large man-made dam. Established trees surround the residence and built structures to the east.
Local Geology	The precinct is underlain by Wianamatta Group Ashfield Shale and Bringelly Shale formations. The shale is comprised predominantly of claystones and siltstones with occasional sandstone layers.
Hydrology	The site consists of multiple man-made dams for the purposes of storing rainwater. It is ADE's opinion that the ground water will flow in an approximate northwest direction due to topography and location of Kemps Creek. Kemps Creek is located approximately 1.5km east of the site and is a tributary of South Creek which flows into the Hawkesbury River (refer to Appendix A – Figure 2).
Soil Salinity Potential	From the map of salinity potential in Western Sydney (Department of Infrastructure, Planning and Natural Resources, 2002), the site has an inferred moderate salinity potential. It is noted that the mapping is based on soil type, surface level and general groundwater considerations and, as such is approximate only (refer to Appendix A – Figure 1).
Acid Sulfate Soils	A review of the NSW Government Office of Environment and Heritage Acid Sulfate Soils Risk mapping indicates that the site is classed as having 'no known occurrence of acid sulfate soil' (refer to Appendix A – Figure 3).

3 Previous Investigations

The previous environmental and geotechnical investigations at the site have been reviewed in the preparation of this report and are summarised in **Table 6**.

- Douglas Partners (2021a). *Preliminary Site Investigation – 244-270 Aldington Road, Kemps Creek, prepared for Stockland Corporation Ltd.*
- Douglas Partners (2021b). *Geotechnical Due Diligence Assessment – 244-270 Aldington Road, Kemps Creek, prepared for Stockland Corporation Ltd, (ref: 205819.01; July 2021).*
- ADE (2023). *Detailed Site Investigation – 244-270 Aldington Road, Kemps Creek, prepared for Stockland Corporation Ltd, (ref: A101023.0279 DSI. V1f; July 2023).*

Table 6: Summary of Previous Investigations

	Scope of works	Key Findings
DP 2021a – Preliminary Site investigation	• Site history search • Site inspection • Excavation of 30 test pits (TP1-TP30 between 15 and 16 June 2021	Encountered ground conditions comprised: • Topsoil/ topsoil fill: brown silty clay with organic matter and rootlets, to depths of 0.1-0.3 metres below ground level (mBGL); • Fill: brown silty clay with building rubble recorded in some test pits, to depths of 0.3 – 2.0 mBGL; and • Residual soil: red, grey and brown silty CLAY. No asbestos containing material (ACM) were observed in any of the test pits. Two pieces of ACM were observed amongst other building rubble at the surface at site 2. One of the fragments was tested and confirmed to contain asbestos. A surface soil sample was taken from an area with dark staining adjacent to several empty 44-gallon drums labelled 'Castrol' or unlabelled at site 1. This sample had exceedances in total recoverable hydrocarbons (TRH) TRH>C10-C16, TRH F3 (C16-C34), TRH F4 (>C34-C40) and Zinc. No other exceedances were recorded in any of the other soil samples. 2 surface water samples were collected from 2 existing dams at site 1 and 2 surface water samples were collected from 4 existing dams at site 2. Elevated concentrations of total copper were observed in the samples collected from the two dams receiving water from off-site. At the time of the investigation, the ANZG (2018) ecological nutrient thresholds were under review, however, high levels of nitrate and phosphate were recorded in all samples. No other exceedances were recorded in the surface water samples.
DP 2021b – Geotechnical Due Diligence	• 16 test pits (TP101 – TP116), undertaken between 22 and 23 June 2021, • in-situ dynamic cone penetrometer testing (DCP),	Encountered ground conditions comprised of topsoil (silty CLAY and clayey SILT), fill (silty CLAY), and weathered, low-strength siltstone. Groundwater seepage was observed to be perched between the base

	laboratory analysis of soil materials and an engineering assessment.	of gravelly fill and residual clays, and at the interface between clay and bedrock. Included salinity and sodicity assessment which has formed the basis of this management plan (ref to Appendix A). The results of the engineering assessment will not be discussed. For more details, refer to the report in full.
ADE 2023 – Detailed Site Investigation	- This report was designed to assess the site following a desktop review, and areas of concern and contaminants of potential concern (CoPC) identified during the Phase I Preliminary Site Investigation (PSI), completed by Douglas Partners (DP, 2021a) and investigate areas of the site not previously assessed. - The site investigation and corresponding sampling regime was undertaken between 13 and 20 June 2023 and included the collection and analysis of 80 soil samples from 38 test pits (17 of which were placed on hold at the laboratory), 7 sediment (Sample IDs SED1-SED7) and 7 surface water samples (Sample IDs SW1-7) from dams within the site.	Commercial/industrial health criteria, site specific environmental investigation levels and TRH management limits were adopted for the site given the proposed development. All soil samples were below health screening values, except for exceedances of ecological criteria for Zinc and TRHs. Exceedances of TRH management limits were also reported. The observed exceedances across both ADE and DP investigations were both localised around a small spill near adjacent to rusted and upturned 44-gallon drums and were attributed to the contents of the drums and spill (assumed diesel or oil). However, based on the proposed development, the exceedances are considered to pose a manageable level of risk.

4 Salinity, Aggressivity and Sodicty Assessment

4.1 Soil Sampling

Analysis of soil aggressivity was undertaken by DP as part of the scope of works for the geotechnical due diligence assessment (DP, 2021b). The results of this investigation have been reviewed in preparation of this SSMP.

The investigation by DP included the excavation of 16 test pits (TP101 – TP116) to depths of between 1.1m and 4.2m, undertaken between 22 and 23 June 2021. A further 30 test pits were excavated as part of the contamination assessment between 15 and 16 July 2021 (DP 2021a) to depths of between 0.7 m and 3.0 m

Encountered ground conditions comprised:

- Topsoil: clayey silt and silty clay to depths of between 0.2 and 0.4 mBGL
- Fill: brown silty clay with gravel in TP101 and TP102 only to a maximum depth of 1.0mBGL
- Residual Clay: Silty CLAY with some ironstone gravel, extending to depths of between 0.9 and 4.2 mBGL
- Weathered rock: Very low to low strength weathered Siltstone.
- Groundwater seepages were observed within TP106 ,TP108 (site 1) and TP113 (site 2) at depths of 1.8m, 1.4m and 3.0m and considered to represent perched groundwater between the base of gravelly fill and residual clay. Groundwater was also observed in TP114 at 3.4mBGL at the interface between residual clay and bedrock.

Soil samples were collected from the upper 3.5m of the soil profile and submitted for laboratory analysis. Soil tests were undertaken to assess the physical and chemical properties of soils under the effects of water movement and included:

- Cation exchange capacity (CEC) – sodium, calcium, magnesium and potassium;
- Sodicty – exchangeable sodium percentage (ESP); and
- Dispersion – Emerson class number.

Soil tests were also undertaken to assess the potential for salt release and the effect of water on soil chemistry and structures, and included:

- pH;
- Chlorides;
- Sulphates;
- Electrical conductivity; and
- Classification – soil texture.

A copy of the test pit logs by DP (2021b) are included in Appendix B, for reference.

5 Assessment Criteria

5.1 Salinity

The salinity assessment is mainly conducted based on extract electrical conductivity (ECe). Salinity refers to the presence of excessive salt, which is toxic to most plants. Because salt separates into positively and negatively charged ions when dissolved in water, the electrical conductivity of the water increases as the amount of salt increases. To test the electrical conductivity of soil one part of the soil is mixed with 5 parts of water (EC 1:5). This value can be converted to electrical conductivity of a saturated extract (ECe) by multiplication with a factor dependent on soil texture, ranging from 6 to 17, based on the soil matrix. Richards (1954) classified soil salinity based on ECe and described the implications of the salinity classes on agriculture as seen in **Table 7**.

Table 7. Soil Salinity Classification

Class	ECe (dS/m)	Implication
Non-saline	<2	Salinity effects mostly negligible
Slightly-saline	2 – 4	Yields of sensitive crops affected
Moderately-saline	4 – 8	Yields of many crops affected
Very-saline	8 – 16	Only tolerant crops yield satisfactorily
Highly-saline	>16	Only a few very tolerant crops yield satisfactorily

Note: This classification scheme is based on agricultural sensitivity. At this point in time no structure-based classification system exists.

5.2 Aggressivity

The following tables are developed from AS 2159 – 2009 Piling Design and Installation. The aggressivity classification is mainly conducted on the pH content, chloride content and sulfate content of the soils.

- pH-Measures acidity or basicity of soil and is important in determining the aggressivity of the soil to building materials. Acidic solutions are measured to have lower pH values. Acids combine with the calcium hydroxide component of cement to form soluble calcium compounds which can leach from the concrete increasing its porosity and decreasing its strength.
- Chlorides - are negatively charged ions (anions) that are corrosive to building material, mainly for steel materials. In concrete, chlorides react with the steel reinforcement causing it to corrode and expand making physical stress on the concrete.
- Sulfates - are negatively charged particles (anions) that are corrosive to building materials, mainly for concrete. Sulphates react with the hydrated calcium aluminate in concrete. The products of the reaction causing volume increment and hence producing physical stress in concrete

The guideline values presented below in **Table 8** and **Table 9** were used to classify the soils for aggressivity.

Table 8. Aggressivity Classification for Concrete Piles

Sulfates SO_4^{2-} (ppm) in soil	pH	Classification
<5000	>5.5	Non-aggressive
5000 – 10000	4.5 – 5.5	Mild
10000 – 20000	4 – 4.5	Moderate
> 20000	<4	Severe

Table 9. Aggressivity Classification for Steel Piles

Chlorides (ppm in soil)	pH	Classification
<5000	>5	Non-aggressive
5000 – 20000	4 – 5	Non-aggressive
20000 – 50000	3 – 4	Mild
> 50000	<3	Moderate

5.3 Sodicty/ Exchangeable Sodium Percentage

As part of the investigation soil susceptibility to dispersion and possible erosion was estimated. Although salinity and sodicty (potential erosion) are not directly related, the problem associated with sodic soils occur because these soils disperse when wet and fill the pore spaces in the soil effectively blocking them. This impermeable layer can severely impede water movement, if excessive water enters the profile it may prevent draining by the sodic layer and may result in soil erosion. It is therefore important to know the sodic conditions of the soil. Soils are potentially prone to erosion where soils contain high amounts of sodium (sodic soils – where the ESP is greater than 5%).

Cation Exchange Capacity (CEC) indicates the soil's capacity to store the available positively charged cations such as sodium (Na), calcium (Ca), magnesium (Mg) and potassium (K). It is dependent on the amount and type of clay and organic matter present in the soil. Soil having higher CEC value has a greater capacity to retain nutrients and lower values of CEC have a reduced capacity to retain nutrients and may result in leaching of nutrients from the soil in event of excess nutrient applications.

Sodic soils may be affected by very severe surface crusting, very low permeability, infiltration and hydraulic conductivity, very hard and dense subsoils as well as high susceptibility to gully and tunnel erosion. Sodicty also affects the shrink – swell properties of a soil. The general rating of sodicty as shown in DLWC (2002) is given in **Table 10**.

Table 10. DLWC (2002) Sodicty Classification System

ESP %	Classification
<5	Non-sodic
5 – 15	Sodic
>15	Highly Sodic

5.4 Permeability

Permeability of soils will determine how quickly and easily rain, applied effluent and contaminants penetrate into the soil profile and possibly raise and/or contaminate the groundwater system.

Permeability is expressed as a rate at which water passes through a water-soil interface expressed as millimetres per hour (mm/hr). The typical soil types and associated permeability as shown in LDG (2007) is provided within **Table 11**.

Table 11. LDG (2007) Permeability rates

Soil Type	Infiltration	Permeability (mm/hr)
Sand	Very rapid	>120
Sandy loam	Rapid	60-120
Loam	Moderately rapid	20-60
Light clay	Moderate	5-20
Medium to heavy clay	Slow	5-20
Medium to heavy clay	Very slow	<2.5

6 Results

Table 12: Summary of analytical results, DP 2021b

Test Pit	Texture Class	Depth (m)	pHw (1:5)	EC1:5 (dS/m)	ECe (dS/m)	Cl (mg/kg)	SO4 (mg/kg)	CEC (meq%) v	Emerson Class No.	ESP (%)	Dispersibility	Sodicity	Salinity	Acidity	Aggressivity (concrete)	Aggressivity (steel)
TP101	MC	3.2-3.3	8.7	0.69	4.8	820	110	7.5	2	31	Very high	strongly sodic	Moderately saline	Strongly alkaline	Non-aggressive	Non-aggressive
TP102	MC	1.0-1.1	8.6	0.71	5	790	89	16	2	14	Very high	strongly sodic	Moderately saline	Strongly alkaline	Non-aggressive	Non-aggressive
TP104	MC	1.0-1.1	4.6	0.61	4.3	670	180	14	-	29	-	strongly sodic	Moderately saline	Extremely acidic	Mild	Non-aggressive
TP105	MC	0.5-0.6	7.8	0.14	<2	93	20	21	-	4	-	non-sodic	Non-saline	Mildly alkaline	Non-aggressive	Non-aggressive
TP106	CL	2.0-2.1	8.8	0.06	<2	<10	<10	25	2	3	Very high	non-sodic	Non-saline	Strongly alkaline	Non-aggressive	Non-aggressive
TP108	LMC	1.0-1.1	9	0.44	3.5	290	65	42	2	5	Very high	non-sodic	Slightly saline	Strongly alkaline	Non-aggressive	Non-aggressive
TP109	MC	0.5-0.6	5.4	0.01	<2	36	35	12	2	7	Very high	sodic	Non-saline	Strongly acidic	Mild	Non-aggressive
TP110	HC	1.6-1.7	5	0.34	2	300	110	9.1	2	37	Very high	strongly sodic	Slightly saline	Very strongly acidic	Mild	Non-aggressive
TP113	LMC	3.0-3.1	8.5	0.46	3.6	510	65	15	2	15	Very high	strongly sodic	Slightly saline	Strongly alkaline	Non-aggressive	Non-aggressive
TP114 ¹	LMC	2.0-2.1	8.7	0.6	4.8	630	72	19		10	-	Sodic	Moderately saline	Strongly alkaline	Non-aggressive	Non-aggressive
TP115	LMC	1.0-1.1	5.3	0.23	<2	180	77	18	2	18	Very high	strongly sodic	Non-saline	Strongly acidic	Mild	Non-aggressive
TP116	MC	2.0-2.1	4.6	0.95	6.6	1000	330	14		30	-	strongly sodic	Moderately saline	Very strongly acidic	Mild	Non-aggressive

Notes to Table 11

EC1:5 = Electrical Conductivity

ECe = Electrical Conductivity corrected for texture

pHw = pH in water

LMC – Light medium clay

MC – Medium clay

HC – Heavy clay

CL – Clay loam

7 Salinity Management Plan

The salinity investigation undertaken by DP (2021b) indicates that the majority of soils within the site are classified as non-saline to moderately saline. However, moderately saline soils tend to be located below a depth of 1 meter along the northern and southeastern boundaries of the site. For areas where the RL is lower, these findings indicate that the soil's salinity rises as you progress deeper into the ground.

Testing of other parameters associated with salinity indicates that the soils within the site are non-aggressive to steel (using the resistivity and chloride criteria of AS2159) and non-aggressive to mild aggressive to concrete (using the pH and sulphate criteria of AS2159).

The presence of locally moderately saline soils and mildly aggressivity to concrete are not considered significant impediments for future development of the site, provided appropriate management techniques are employed.

The following management strategies are confined to the management of those factors with a potential to impact on the development.

- Managing disturbance of the soil - focus on capping of the soil surface, both exposed when excavating and filling, with more permeable material which will prevent ponding and reduce capillary rise. This will also act as a drainage layer and reduce potential erosion.
- Minimising mixing of material during cut and fill works - where possible use excavated soils in fill areas with similar salinity characteristics and placed back in the original order.
- Minimising water infiltration - ensuring cut and fill areas are well compacted.
- Groundwater recharge is to be minimised by maintaining good surface drainage and minimising water logging on the site.
- All disturbed areas of soil are to be stabilised.
- Ensure the site is well drained- the collection of water in low lying areas, depressions or behind fill can lead to the water logging of the soils, evaporative concentration of salts and eventual breakdown in soil structure resulting in accelerated erosion.
- Surface drains should generally be provided along the top of batter slopes to reduce the potential for concentrated flows of water down slopes possibly causing scour.
- The following should be addressed in an Erosion and Sediment Control Plan (ESCP) and discussed as part of the Construction Environmental Management Plan (CEMP):
 - Consideration should be given to the high dispersion potential of the clay soils. Care should be exercised to ensure dispersive soils are covered with a layer of topsoil where appropriate.
 - Employ construction techniques that prevent structural damage to the environment as a result of salinity (NSW DECC 2008)

In addition to the above, the following control measures put forth by DP (2021b) can be used as preventative and conservative measures. These strategies should be complementary to standard building practice recommended within the building code of Australia.

- Increase strength of concrete used in footings and buried services and pipes.

Initial development plans for Lot 16 and 17 provided by the client show significant cut and fill will occur at the site (maximum cut of 16m). In the ultimate development scenario, it is anticipated that structures will cover

approximately 85% of the site, and incorporated water management systems (guttering, stormwater runoff etc) will considerably decrease the interaction of the saline soils, with concrete and steel structures, and are considered to be suitable in managing the mild risk to the proposed development.

Most of the surface area of the collector road at Lot 15, once constructed, will be hardstand and roadway. Water management systems along the road will considerably decrease the interaction of the saline soils, with concrete and steel structures, and are considered to be suitable in managing the mild risk to the proposed development.

8 Conclusion

Based on ADE's detailed review of previous investigations, the following conclusions were drawn regarding the salinity, aggressivity, and sodicity of the site. Additional investigation may be required in areas of deeper excavation, or where direct sampling and testing has been carried out.

- Of the 12 samples submitted for analysis by DP (2021), four were classified as non-saline, three as slightly saline and five as moderately saline.
- Soils were identified to be non-aggressive, to mild to concrete, and non-aggressive to steel.
- Of the 12 samples analysed for sodicity, nine samples were characterised as sodic to strongly sodic. The sodic soils were found to be evenly distributed across the site.
- The salinity, aggressivity, and sodicity levels are considered naturally occurring features of the local landscape. Provided that appropriate management techniques are utilised, they are not considered to be significant impediments to the proposed development
- Topsoils observed on site ranged from 0.2-0.4 mBGL, which consisted mostly of silty clays and clayey silt, with an estimated permeability of 5-60 mm/hr. Organics were noted primarily in the upper 0.1-0.15m bgl of the topsoil.
- The underlying strata consisted of silty clay fill with traces of gravel, to a range of depths between 0.3-1.0 m bgl. The estimated permeability of the fill is 5-60 mm/hr.
- The natural strata consisted of residual, silty clays with traces of ironstone gravels, extending to depths of 0.9-4.2m bgl. Generally, the material was found to be stiff to very stiff and grading to hard with depth. The estimated permeability of the natural clay is <2.5 mm/hr. This is supported by the absence of free groundwater in test pits, which indicate very low permeability.
- Based on a review of the available information, ADE does not consider that the proposed development will adversely impact soil salinity and sodicity.

9 Limitations and Disclaimer

This report has been prepared for the exclusive use of the client and is limited to the scope of the work agreed in the terms and conditions of contract (including assumptions, limitations and qualifications, circumstances, and constraints). ADE has relied upon the accuracy of information and data provided to it by the client and others. This report includes detailed review of data provided by the client through previous investigations and ADE has necessarily relied upon information provided by the client to form the basis of the current management plan.

ADE has used a degree of care and skill ordinarily exercised in similar investigations by reputable members of the environmental industry in Australia. No other warranty, expressed or implied, is made or intended. No one section or part of a section of this report should be taken as giving an overall idea of this document. Each section must be read in conjunction with the whole of this report, including its appendixes and attachments. The report is an integral document and must be read in its entirety. To the fullest extent permitted by law, ADE does not accept or assume responsibility to any third party (other than the client) for the investigative work, the report or the opinions given.

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ADE's professional opinions are based upon its professional judgement, experience, training, and results from analytical data. In some cases, further testing and analysis may be required, thus producing different results and/or opinions. ADE has limited its investigation to the scope agreed upon with its client. This Limitation and Disclaimer must accompany every copy of this report.

10 References

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11 Appendix A – Figures

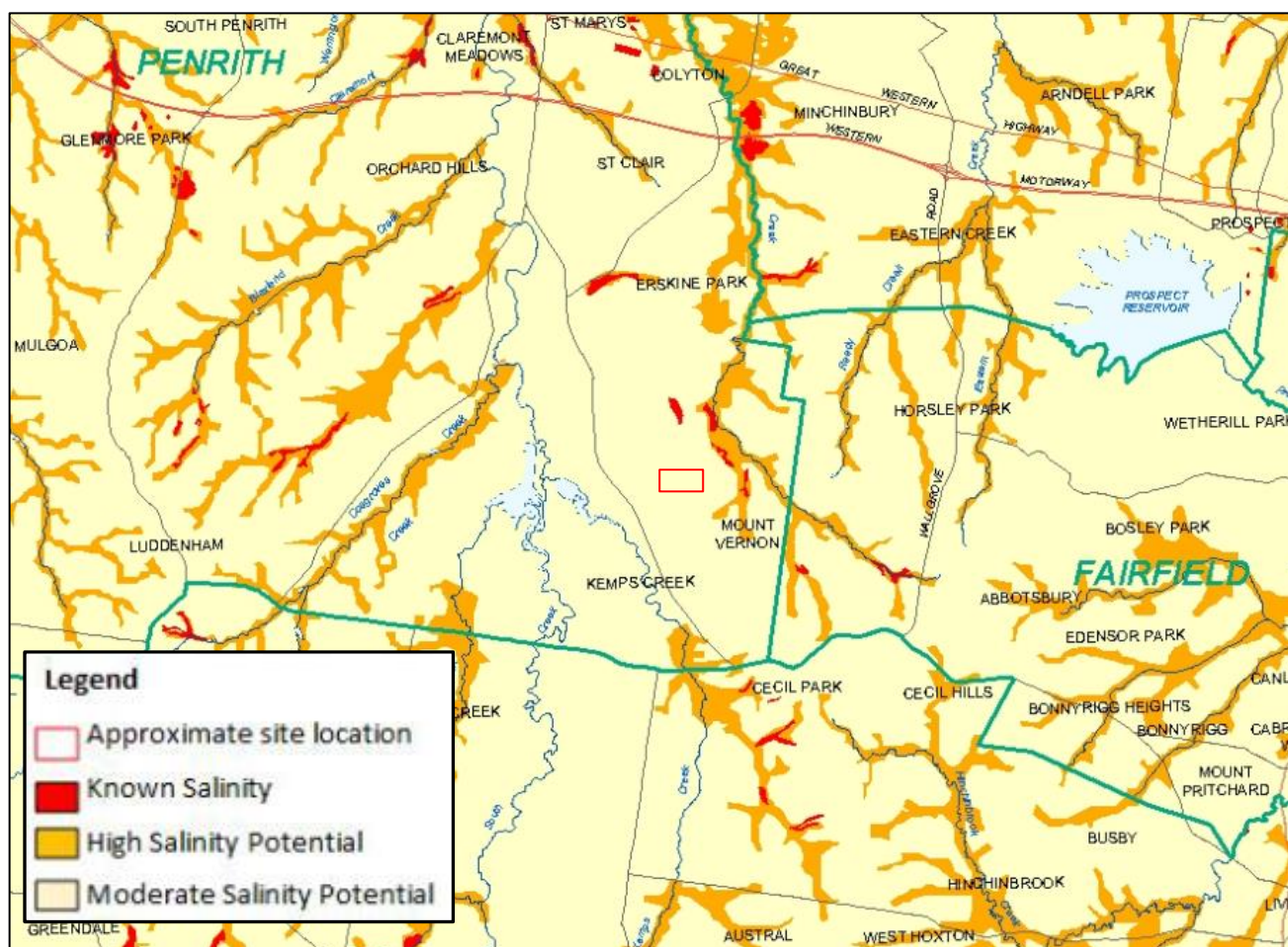


Figure 1: Map of salinity potential in Western Sydney (Department of Infrastructure, Planning and Natural Resources, 2002)

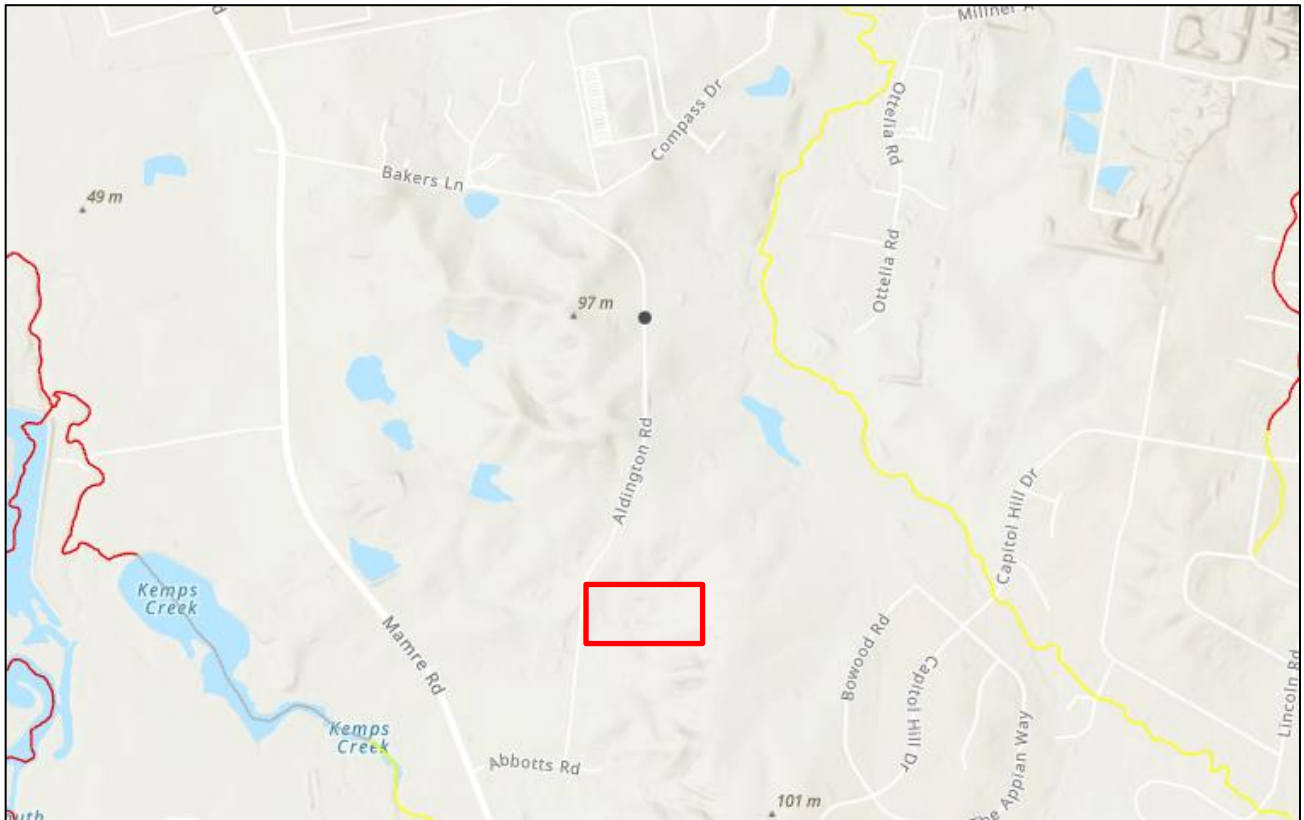


Figure 2: Map of local river styles within Kems Creek, NSW (Department of Planning and Environment, 2022)

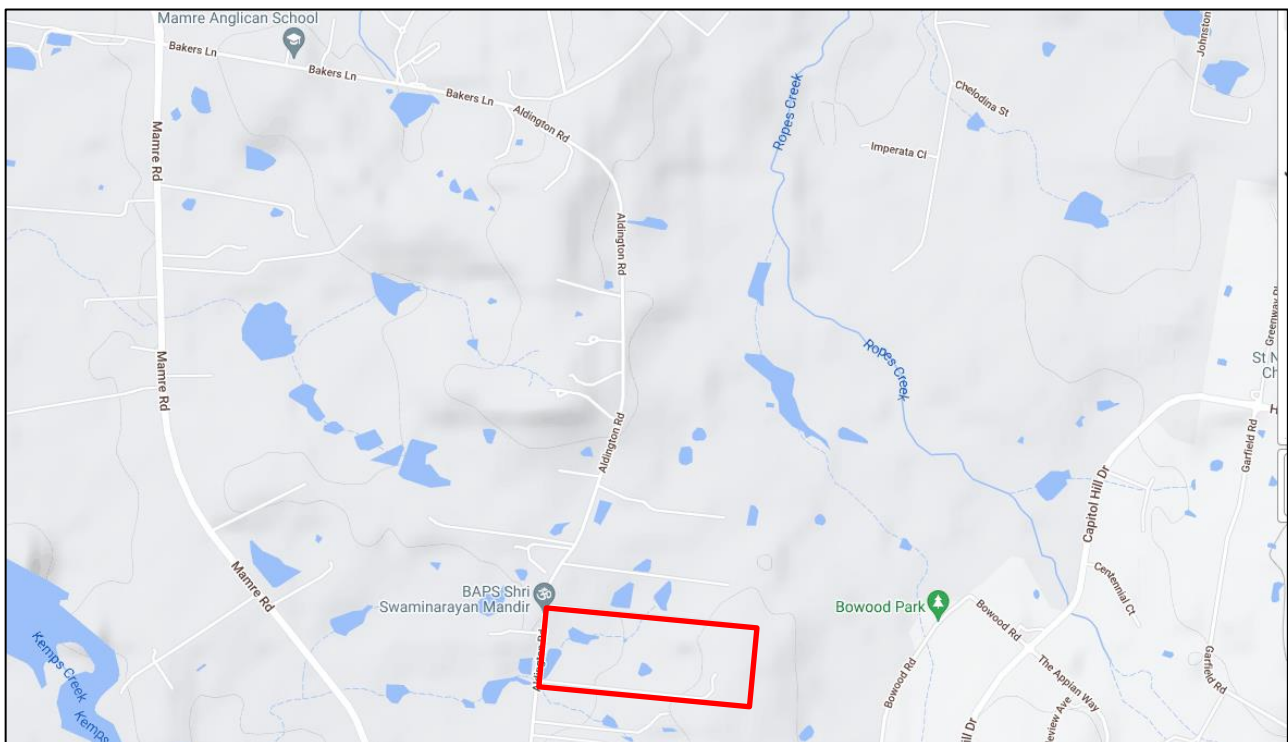
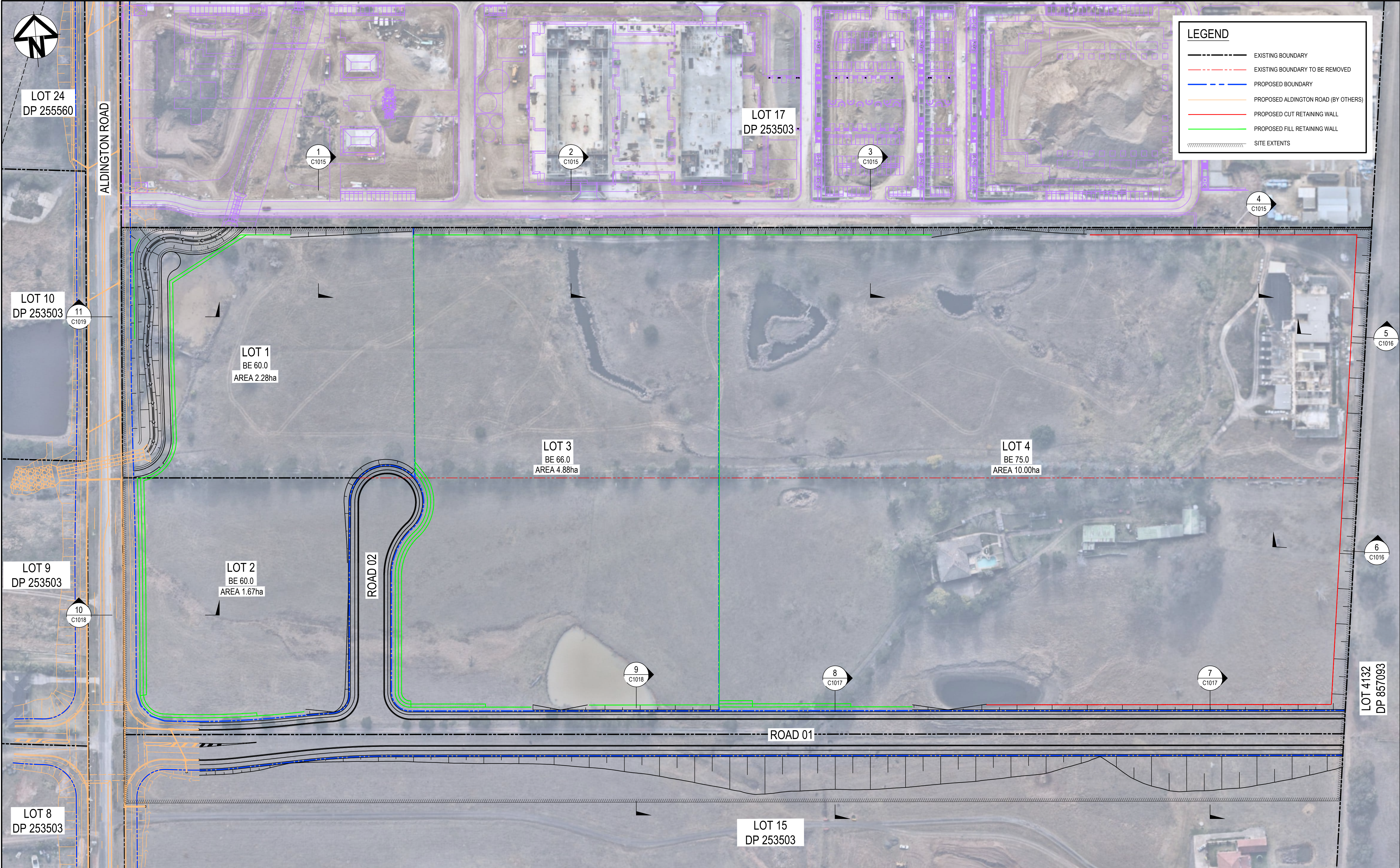
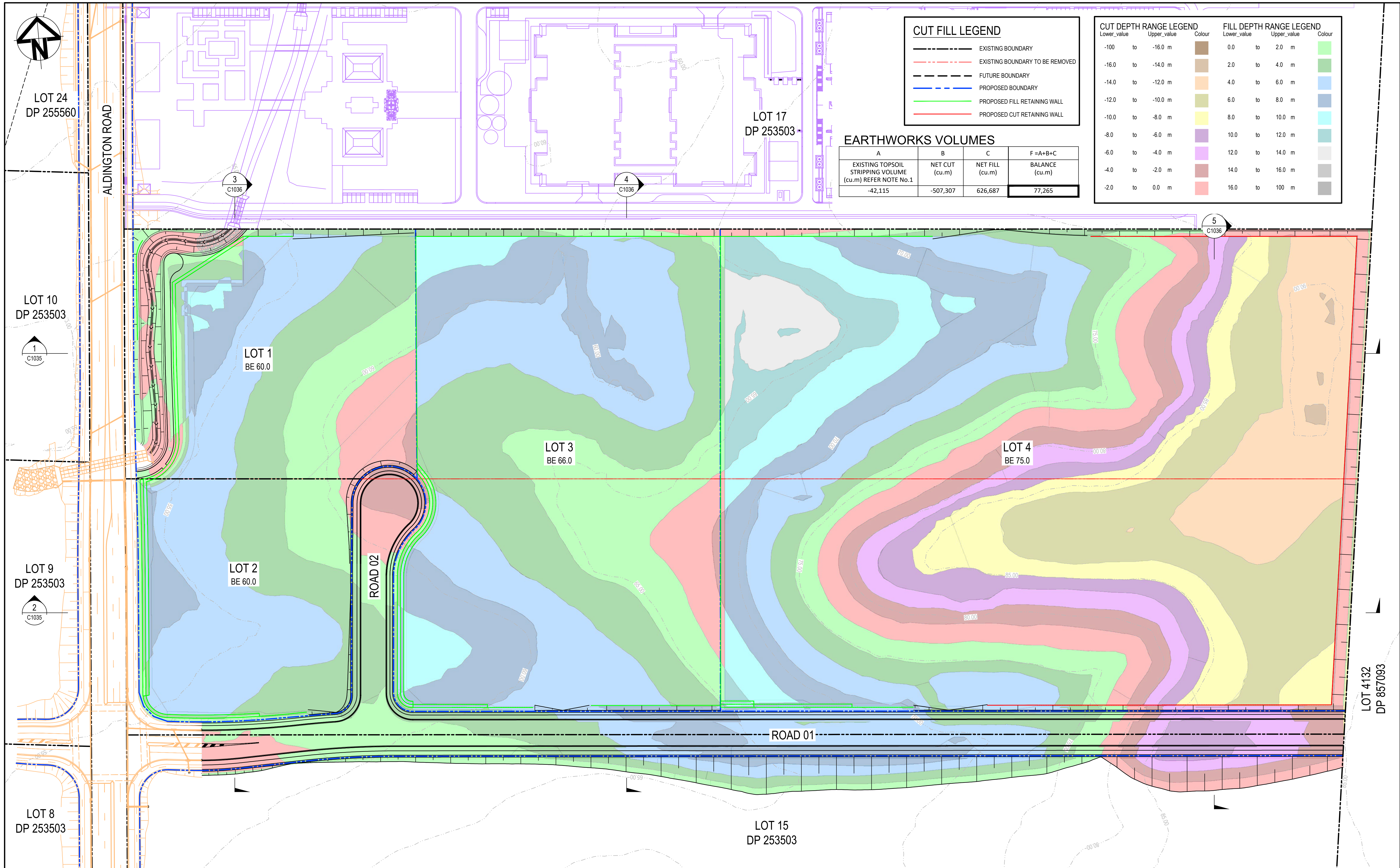


Figure 3: Acid sulfate soils risk map for Kems Creek, NSW (eSPADE tool, NSW Environment and Heritage, 2023).

12Appendix B – Development Plans



		Bar Scales		THIS DRAWING CANNOT BE COPIED OR REPRODUCED IN ANY FORM OR USED FOR ANY OTHER PURPOSE OTHER THAN THAT ORIGINALLY INTENDED WITHOUT THE WRITTEN PERMISSION OF AT&L	Client  	Scales 1:1000		Drawn JH	Project 270 ALDINGTON ROAD	Civil Engineers and Project Managers  Level 7, 153 Walker Street North Sydney NSW 2060 P 02 9439 1777 E info@atl.net.au www.atl.net.au ABN 96 130 882 405		
						Grid 2020 GDA		Designed JH		Title GENERAL ARRANGEMENT		
E PRELIMINARY ISSUE						04-10-23		Height Datum				Checked DF
D PRELIMINARY ISSUE						19-09-23		Approved				
C PRELIMINARY ISSUE						07-09-23						
B PRELIMINARY ISSUE		21-08-23		Issue	Description	Date			Status FOR APPROVAL NOT FOR CONSTRUCTION		A1	
A PRELIMINARY ISSUE		12-04-23							Project - Drawing No. 22-1041-C1005		Issue E	



CUT FILL LEGEND

- EXISTING BOUNDARY
- EXISTING BOUNDARY TO BE REMOVED
- FUTURE BOUNDARY
- PROPOSED BOUNDARY
- PROPOSED FILL RETAINING WALL
- PROPOSED CUT RETAINING WALL

EARTHWORKS VOLUMES

A	B	C	F = A+B+C
EXISTING TOPSOIL STRIPPING VOLUME (cu.m) REFER VOLUME No.1	NET CUT (cu.m)	NET FILL (cu.m)	BALANCE (cu.m)
-42,115	-507,307	626,687	77,265

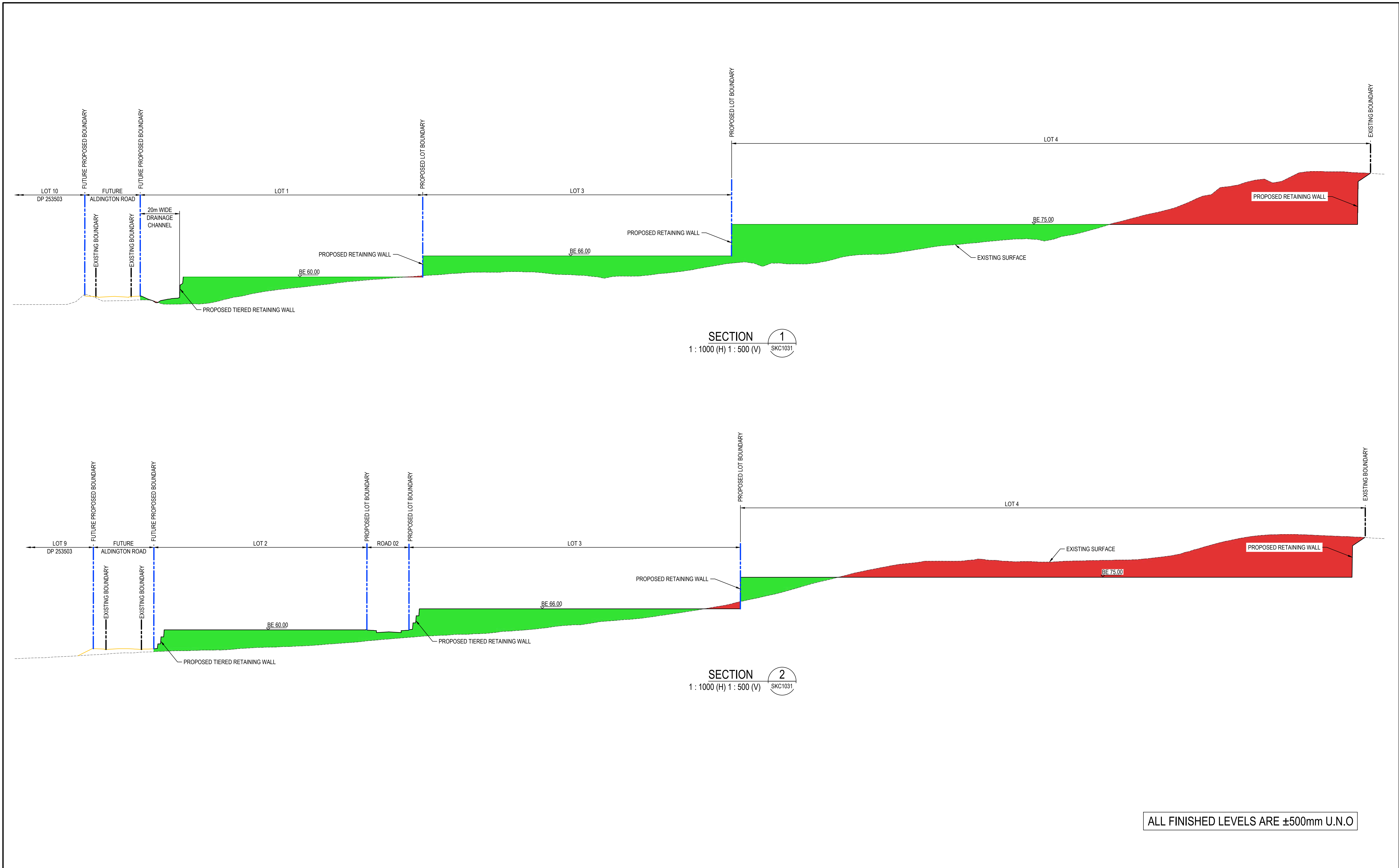
CUT DEPTH RANGE LEGEND

Lower_value	Upper_value	Colour
-100	to -16.0 m	
-16.0	to -14.0 m	
-14.0	to -12.0 m	
-12.0	to -10.0 m	
-10.0	to -8.0 m	
-8.0	to -6.0 m	
-6.0	to -4.0 m	
-4.0	to -2.0 m	
-2.0	to 0.0 m	

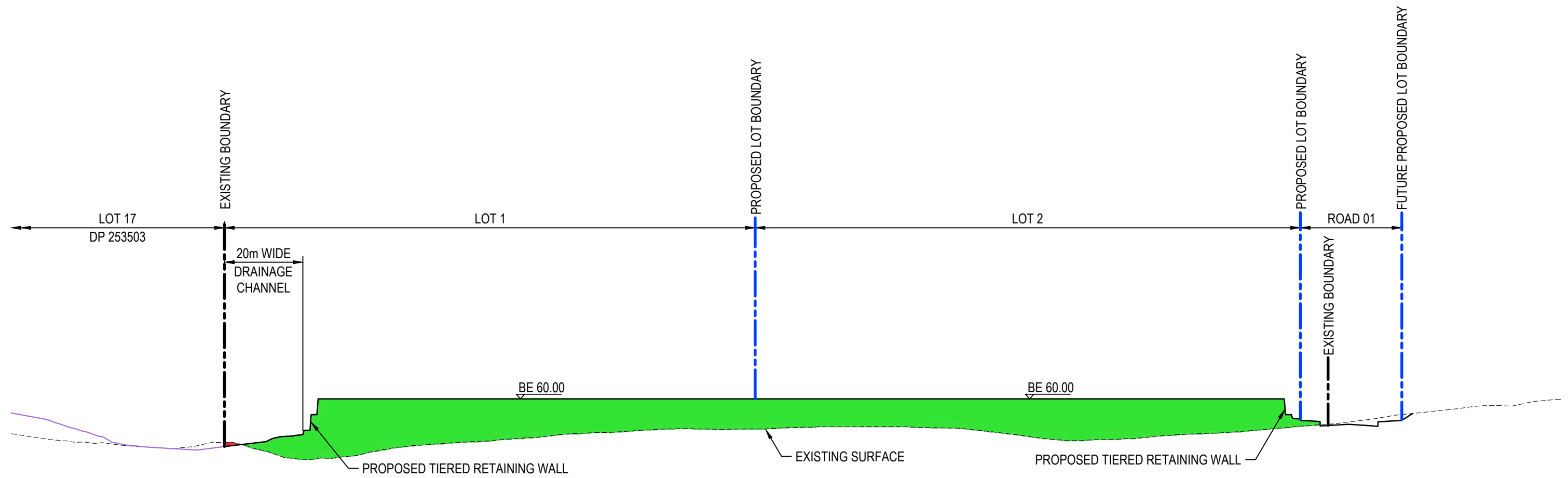
FILL DEPTH RANGE LEGEND

Lower_value	Upper_value	Colour
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4.0	to 6.0 m	
6.0	to 8.0 m	
8.0	to 10.0 m	
10.0	to 12.0 m	
12.0	to 14.0 m	
14.0	to 16.0 m	
16.0	to 100 m	

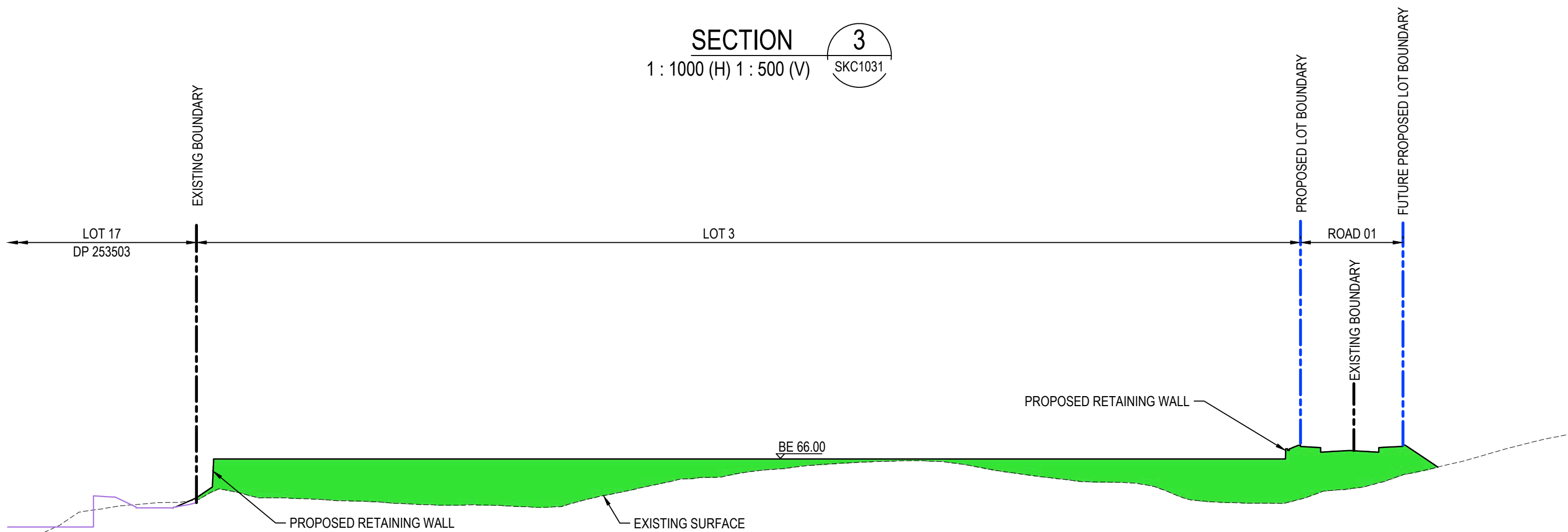
A PRELIMINARY ISSUE	Description	Date	Bar Scales 0 20 40 60 80 100m 1:1000 @ A1 1:2000 @ A3	THIS DRAWING CANNOT BE COPIED OR REPRODUCED IN ANY FORM OR USED FOR ANY OTHER PURPOSE OTHER THAN THAT ORIGINALLY INTENDED WITHOUT THE WRITTEN PERMISSION OF AT&L	Client Stockland FIFECAPITAL	Scales 1:1000 Grid 2020 GDA Height Datum AHD	Drawn Designed Checked Approved	JH ADS AM	Project 270 ALDINGTON ROAD	Title BULK EARTHWORKS GENERAL ARRANGEMENT PLAN	Civil Engineers and Project Managers Level 7, 153 Walker Street North Sydney NSW 2060 P 02 9439 1777 E info@atl.net.au www.atl.net.au ABN 96 130 882 405	Status FOR APPROVAL NOT FOR CONSTRUCTION	Project - Drawing No. 22-1041-C1031	Issue A



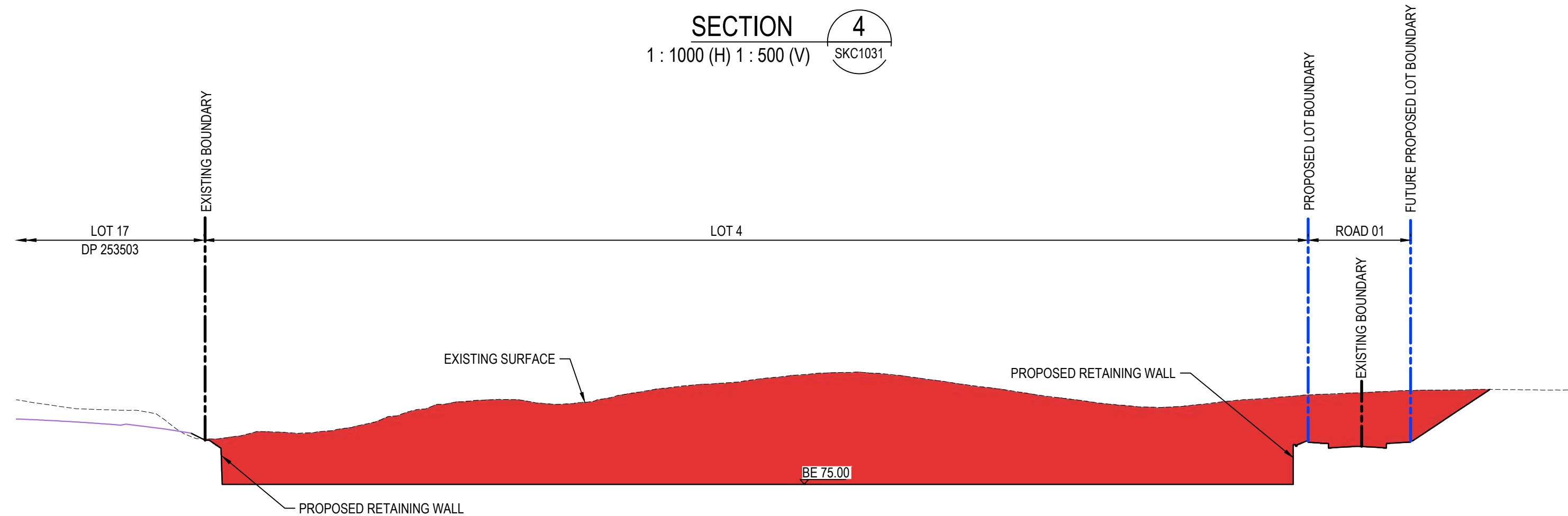
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			 1 : 500 @ A1 1 : 1000 @ A3  1 : 1000 @ A1 1 : 2000 @ A3				Grid		2020 GDA	Checked	AM			Title	270 ALDINGTON ROAD	BULK EARTHWORKS CUT/FILL SECTIONS SHEET 1	Status FOR APPROVAL NOT FOR CONSTRUCTION	A1
							Height Datum		AHD	Approved								
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Issue	Description		Date															



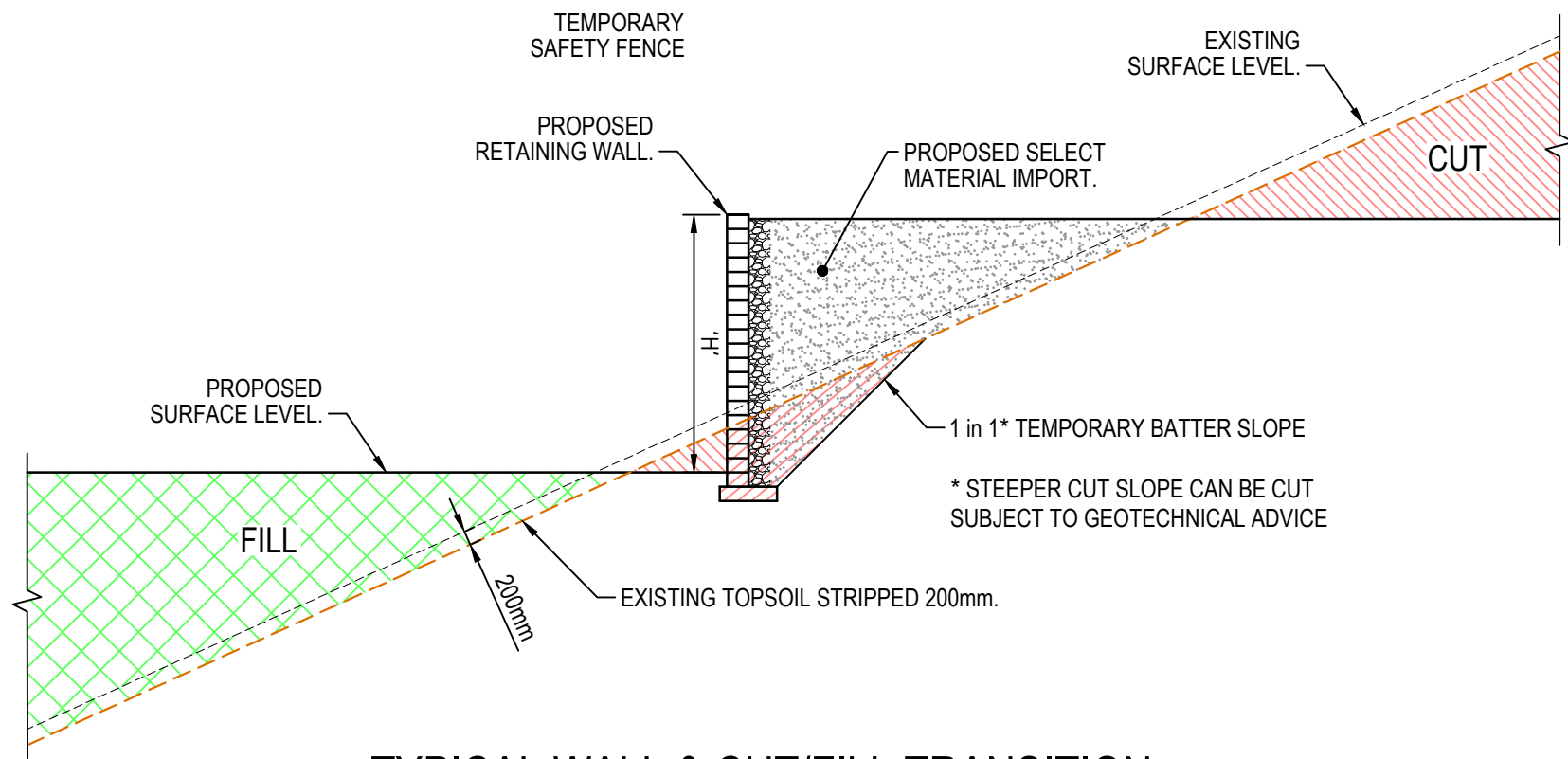
SECTION 3
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SECTION 4
1 : 1000 (H) 1 : 500 (V) SKC1031



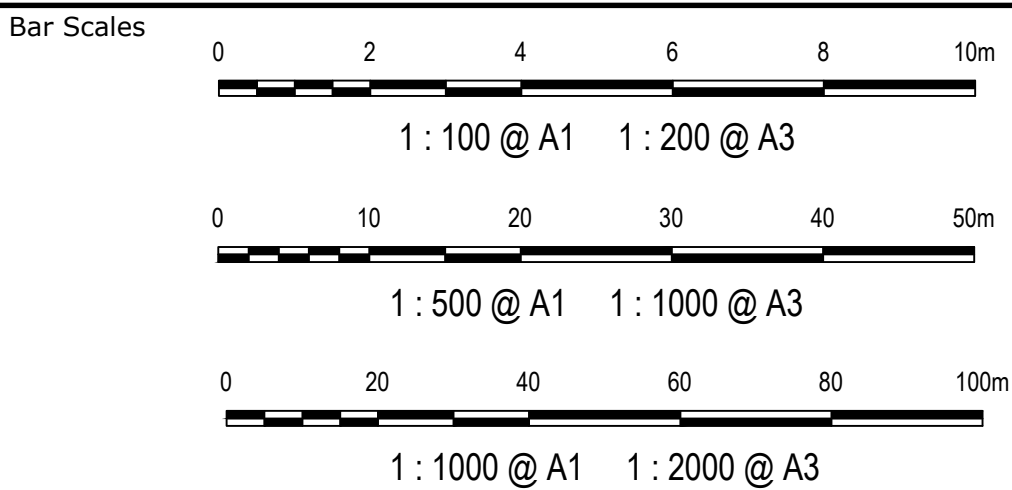
SECTION 5
1 : 1000 (H) 1 : 500 (V) SKC1031



TYPICAL WALL & CUT/FILL TRANSITION
1 : 100

ALL FINISHED LEVELS ARE ±500mm U.N.O

A	PRELIMINARY ISSUE	
Issue	Description	Date



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Scales	1:100 1:1000 (H) 1:500 (V)	Drawn	JH
		Designed	ADS
		Checked	AM
Grid	2020 GDA	Approved	
Height Datum	AHD		

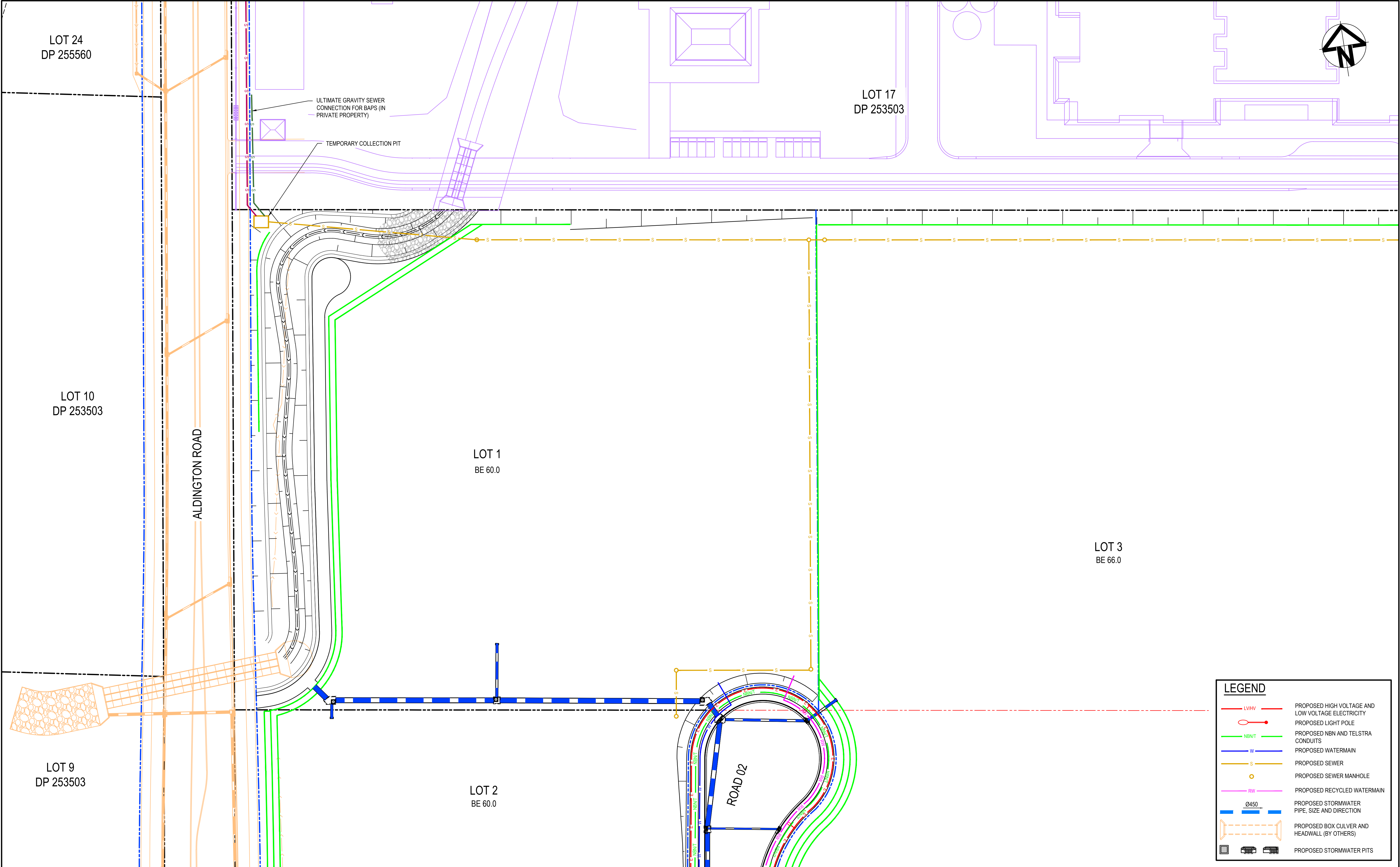
Project
270 ALDINGTON ROAD

Title
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CUT/FILL
SECTIONS
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Status	FOR APPROVAL NOT FOR CONSTRUCTION	A1
Project - Drawing No.	22-1041-C1036	Issue A



LEGEND

LVHV

NBN/T

W

S

RW

Ø450

PROPOSED HIGH VOLTAGE AND LOW VOLTAGE ELECTRICITY

PROPOSED LIGHT POLE

PROPOSED NBN AND TELSTRA CONDUITS

PROPOSED WATERMAIN

PROPOSED SEWER

PROPOSED RECYCLED WATERMAIN

PROPOSED STORMWATER PIPE, SIZE AND DIRECTION

PROPOSED BOX CULVER AND HEADWALL (BY OTHERS)

PROPOSED STORMWATER PITS

A	PRELIMINARY ISSUE	
Issue	Description	Date

Bar Scales

0

10

20

30

40

50m

1 : 500 @ A1 1 : 1000 @ A3

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Client

Scales	1:500	Drawn	JH
		Designed	ADS
Grid	2020 GDA	Checked	AM
Height Datum	AHD	Approved	

Project

270 ALDINGTON ROAD

Title

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NOT FOR CONSTRUCTION

A1

Project - Drawing No.

22-1041-C1111

Issue

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