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Site-and-soil evaluation Beasley Road Sunrise Estates



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1 INTRODUCTION

EcOz Environmental Consultants (EcOz) were engaged by Sunrise Estates (the client) to prepare a site-and-soil evaluation (SSE) as part of a proposed series of subdivisions within NT Portion 7860, 745 Edith Farms Rd, Edith (Figure 1-1).

The proposed subdivisions (collectively known as the study area) are outside of a building control area for the purpose of wastewater management systems (WMS) and are therefore regulated by the NT Department of Health, under the *Public and Environmental Health Act 2011*. According to the department's *Administrative procedures for the installation of wastewater management systems outside building control areas* (DoH 2020a), a proposed WMS for treatment of less than 2,000 litres per day requires a site-and-soil evaluation (SSE) in accordance with *Australian Standard 1547:2012 On-site domestic wastewater management* (AS/NZ 1547-2012).

The terms 'site' and 'study area' are both used in this report to refer to different aspects of the SSE. The term 'study area' is used to refer to the total area under assessment (i.e. all subdivisions), while the term 'site' refers to a specific location within the study area where a field assessment was undertaken.

This report presents the methods and results of an SSE for the study area in accordance with the requirements of the abovementioned AS/NZ 1547-2012, as well as the NT *Code of Practice for Wastewater Management* (2020b) (herein referred to as 'the Code') and the *Guidance notes for Wastewater Management* (2020c). It provides a general assessment of the suitability of the site and soil conditions for the accommodation of onsite wastewater treatment and disposal systems in accordance with AS/NZ 1547-2012 (Section C5.2.2.2), which states that "SSE surveys for multiple adjacent sites such as subdivisions are to evaluate if the area is favourable for land application systems and to determine those areas requiring further evaluation". A desktop assessment, field investigation, and laboratory analysis of soil samples were all utilised.

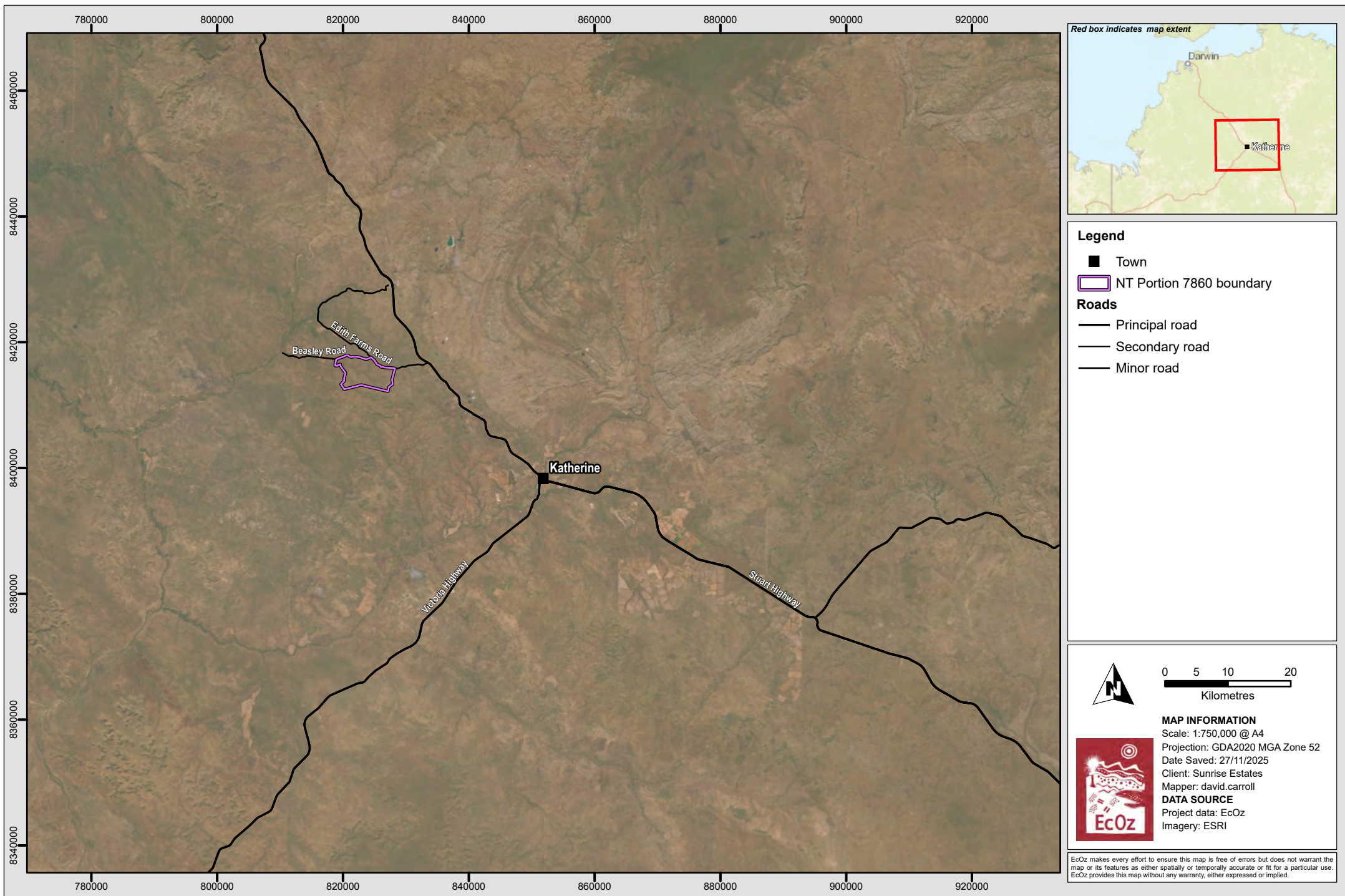
According to the Code, the key objectives of an SSE are to:

- Characterise the site, soil and hydrology and identify constraints that will influence design decisions and determine the site's suitability for a particular type of WMS.
- Identify surrounding land uses and how these could affect or influence the design requirements.

This SSE will be submitted along with a land suitability assessment (LSA) and development application. Nineteen subdivisions (Lots 7 – 25) are planned with access from Beasley Road, which forms the northern border of the property (Figure 1-2). All lots are at least 8 ha in size, in accordance with unzoned land requirements under the *Northern Territory Planning Scheme*. Water supply bores are proposed along the northern boundary for each individual lot. All lots are sufficiently sized to accommodate setbacks in the Code.

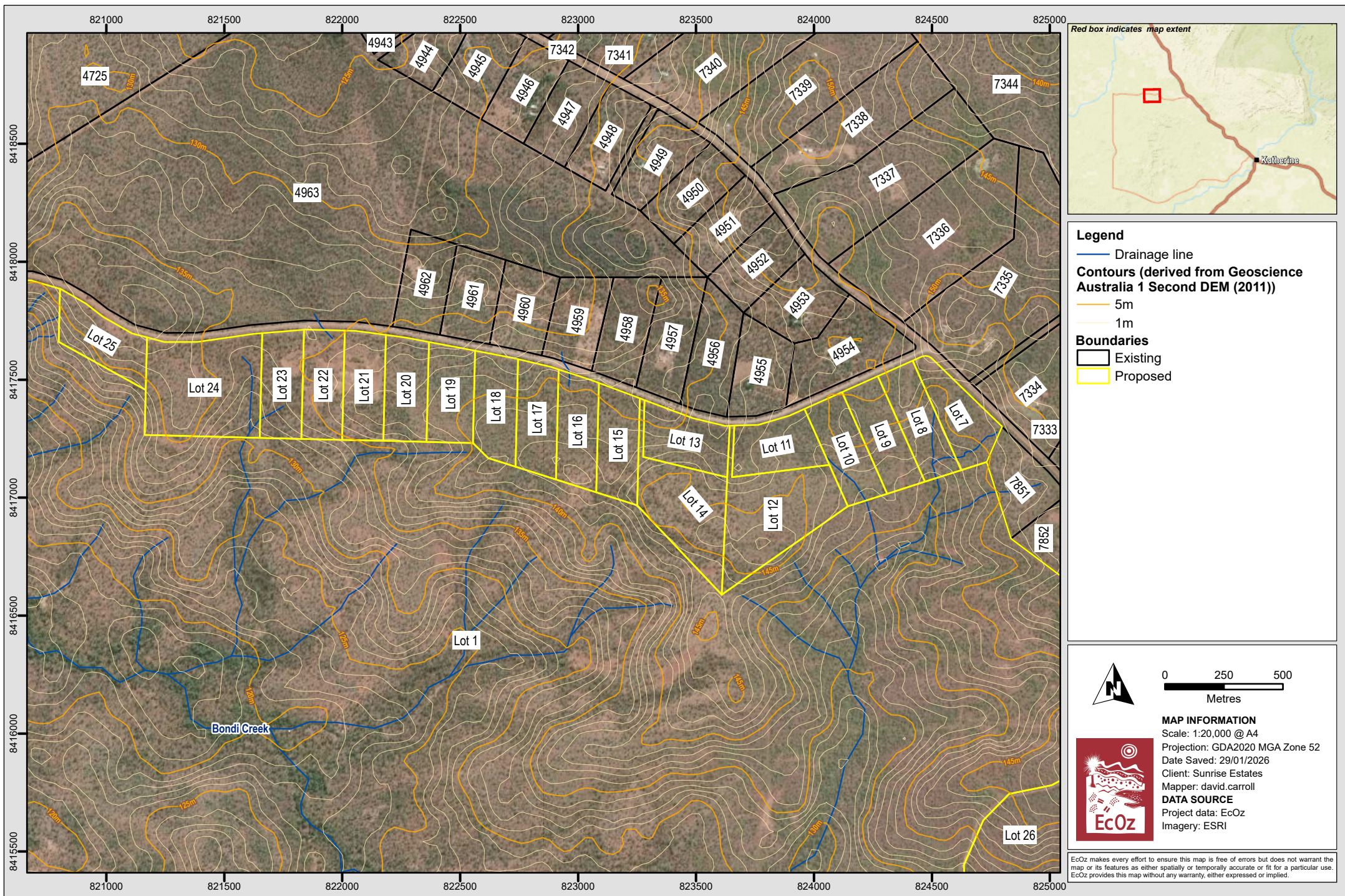
This report makes the following assumptions and limitations

- It is assumed that each lot will support a standard three-bedroom, five-person household with a design wastewater load of 750 L per day (150 L/person/day), based on Appendix H in AS/NZS 1547:2012.
- The field assessment occurred prior to subdivision boundaries being finalised. As a result, vegetation and soil assessment sites were not undertaken in each proposed lot. However, all land units within the study area have at least one assessment site, and most have more than one. In total, nine test pits had laboratory samples analysed, representing five land units.
- Further assessment of localised soil attributes is recommended prior to installation of WMS to take into account localised changes in soil properties.
- A limitation of the soil assessment method used in this SSE was the use of a motorised auger, which can mix soil. Every care was taken to minimise mixing of soil in the assessment process.



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 Layout: Figure 1-1. Location map

Figure 1-1. Map showing location of the project



Path: Z:\01 EcOz_Documents\05 EcOz M-Files GIS\2025\EZ25072 - Sunrise Estates - Beasley Road LSA1. Project Files\2. Report Maps\EZ25072 - Beasley Road SSE.aprx
 Layout: Figure 3-1. Beasley Road subdivisions

Figure 1-2. Beasley Road subdivisions

2 DESKTOP STUDY

A desktop study of the study area and proposed works was undertaken to collate relevant information – including legal description, site plans, setback requirements, soil maps, bore logs, depth to groundwater, depth to limiting horizons, nearby wells, groundwater direction, and other environmental factors. The results are presented in Table 2-1.

A Mavic 3 Enterprise drone with a 20MP camera equipped with a wide-angle lens, was flown over the project area at a height of 120 m on 3 April 2025 as part of preliminary investigations for the project. An orthomosaic of this data, as well as a review of available aerial photography (Google Earth Pro 2024) and online land information databases within NR Maps were analysed. Contour data (1 m) derived from Geoscience Australia 1 second DEM (2011), was processed in QGIS using the raster contour extraction tool. Other data were collected from various datasets accessed via the NT Government spatial data portal – [NR Maps](#).

Table 2-1. Desktop assessment of relevant study area information

Climate
<p>The climate for the Edith area, north of Katherine, is typical of the tropics with a pronounced ‘wet’ and ‘dry’ season. Climate data from the nearest station, Katherine Council Station (number 014902) indicates that there is little fluctuation in minimum (13.2 – 24.7°C) and maximum (29.9 – 38.0°C) temperatures throughout the year, but rainfall and humidity are highly seasonal (BoM 2025). The majority of annual rainfall (averaging 975 mm) falls within the summer/wet season months November – April (BoM 2025). The average annual pan evaporation is around 3000 mm. Evaporation rates are highest around October and lowest around February (DENR 2008). Mean solar exposure (MJ/m²) for the Katherine region is 22.5, with a maximum of 25.3 (Oct) and a minimum of 19.2 (Jun) (BoM 2025).</p>
Soil and landscape (topography) features including drainage patterns across the study area
<p>There are five existing land units of the study area mapped at a scale of 1:50,000 by Aldrick & Robinson (1970) – see Appendix A. The study area is predominantly plains with gentle slopes and well-drained soils (land units 3a, 3b, 3c and 3d), dominated by low woodlands of <i>Eucalyptus tectifera</i> and <i>Corymbia foelscheana</i> (previously <i>Eucalyptus foelscheana</i>). Existing aping for land unit 2c, on the corner of Beasley Road and Edith Farms Road, contains slopes up to 15% and shallow, rocky soils dominated by a low open woodland of <i>Eucalyptus dichromophloia</i>. However, the field survey found that large areas of 2c are gently inclined, with slopes <3%.</p> <p>Limitations of these land units for development are described by Aldrick & Robinson (1970) – see Appendix A. Land units 3a and 3b are both limited by severe rocky outcrops and small pockets of shallow soils, with limitations most pronounced in 3a. Shallow soils are also a limitation within land unit 2c, and potentially 3c. Soils are well drained in all land units (Aldrick & Robinson 1970).</p> <p>A number of ephemeral streams and drainage depressions intersect the study area with most draining into Bondi Creek, a third-order stream ~ 2 km to the south-west.</p> <p>Contours (1 m) of the study area show the eastern edge as the highest point (~147 m) of the study area and falling away to the west (~129 m) and south-west (~140 m). A ridge near the centre of the study area (~146 m) also directs run-off to the north and north-west of the study area. Two floodways were identified using satellite imagery that drained from the study area north across Beasley Road (Figure 1-2). Slopes calculated during the LSA indicate that slopes within the study area are predominantly between <1% to 3% within the study area, and not greater than 5%.</p>
Infrastructure information, for example, existing or planned buildings and services (power, gas)
<p>The current land use for NT Portion 7860 is pastoral. An historic gravel mine (~8 ha) exists in the west of the study area. Planned use is for the study area to be subdivided into 19 residential lots (Rural Living – RL), with the remainder of NT Portion 7860 to remain as pastoral use.</p>
Cumulative effects such as soil salinity
<p>There are no existing pastoral or non-pastoral permits and the location is not listed among the declared areas under the Soil Conservation Act.</p> <p>No Acid Sulfate Soil Risk identified. Presence of these soils is not likely given the distance from the coast. Because of the very high seasonal rainfalls, soil salinity is not an issue in the region.</p>
Off-site effects such as impacts on groundwater quality and surface water quality
<p>A number of ephemeral streams and drainage depressions intersect the study area with most draining into Bondi Creek, a third-order stream ~ 2 km to the south-west (Figure 1-2). Buffers have been applied to these streams in accordance with the NT <i>Land Clearing Guidelines</i>. For more information refer to Section 3.3.</p>

There are unlikely to be any impacts to groundwater based on a review of bores within and near the study area. These show that the depth to groundwater is expected to be approximately 30 m for the study area, and unlikely to be less than 20 m. This was based on the following information:

An historic bore (RN030538) exists within NT Portion 7860, approximately 700 m south of Beasley Road. It encountered water bearing beds at 26 m, 48 m and 60 m. Drilling took place in August 1996.

A current bore (RN029234) within NT Portion 7860, near the intersection of Beasley and Edith Farms Road recorded depth to water of 41 m at date of drilling. Drilling took place in April 1993.

Of seven bores¹ located on the northern side of Beasley Road (within the same land units as the study area), the average depth to water was 33 m, with the depths ranging from 21.8 m to 41.3 m.

Flood potential - The study area is not located nearby to any riverine flood areas. The nearest major drainage system to the subdivision is Bondi Creek located approximate 2 km to the south-west and flowing approximately 14 km into the Fergusson River. Granite Creek is located 1.5 km to the east of the proposed subdivision and flows approximately 14 km into the Edith River.

Areas of fill

The study area is a greenfield site apart from the gravel pit area (~8 ha). This area has not been remediated and some areas have been heavily disturbed, potentially altering soil and landscape attributes. Satellite imagery and site photographs show that this area has been mined without significant changes to the landform.

Erosion and land slippage, hazard-register records relating to geotechnical hazards

The study area has low levels of erosion except for land unit 3a and 2c. Erosion (in particular gully erosion) is visible in satellite and drone imagery of the surrounding area, particularly in land units 3a, 3b and 2c, in areas with steep slopes and ravines. Signs of erosion are uncommon in the flatter areas along Beasley Road.

Exclusion areas

None apparent.

Setback distances

Ephemeral drainage lines have been buffered by 25 m according to the NT Land Clearing Guidelines. The nearest large watercourse is Bondi Creek which is approximately 2 km south-west of the project area. A smaller, second-order stream, which feeds into Bondi Creek is 700 m from the study area. Bores within the proposed subdivisions will be set back at least 100 m from any land application areas.

Potential environmental and public health effects of any proposed on-site system.

A search of NT Portion 7860 and surrounds within the NT and Commonwealth threatened species databases and the NT Flora and Fauna Atlas did not record the presence of any threatened species or restricted ranges species within the project area. The habitat of the study area is common in the region. The nearest sensitive receptors are RL blocks on the northern side of Beasley Road, 40 m from the study area and there are more residences along Edith Farms Road. The town of Katherine is ~35 km south-east of the study area as the crow flies.

¹ Bores are: RN032323 (Drilled 10/99; depth to water 31.5), RN032693 (drilled 10/00; depth to water 39.3), RN036191 (Drilled 06/08; depth to water 30), RN043400 (Drilled 05/24; depth to water 31.9), RN043402 (Drilled 06/24; depth to water 21.8), RN032322 (Drilled 9/99; depth to water 41.3), RN036193 (Drilled 07/08; depth to water 39.3).

3 SITE- AND-SOIL CHECK

A site-and-soil check (SSC) is an on-site inspection to confirm or identify potential environmental and other constraints.

3.1 Methods

A field assessment was undertaken by two EcOz Environmental Consultants from the 11 – 13 June 2025. An 18V battery-powered mechanical auger was initially used which was later changed to a Tracked Mini Loader with auger for most test sites. A total of 12 sites² were assessed within or near the boundaries of the proposed subdivision.

The soil sites were located across the northern boundary of the study area. The more remote southern areas were not accessible using the Tracked Mini Loader due to time, safety risks from uneven ground, and potential damage to vegetation.

Vegetation structure and composition of the three dominant species within each stratum (NVIS level V) were recorded within a 20 m x 20 m quadrat at each site, according to methods outlined in the NT *Guidelines and Field Methodology for Vegetation Survey and Mapping* (Brocklehurst et al. 2007). Landform, slope and soil characteristics were recorded according to methods and descriptions outlined in the *Australian Soil and Land Survey Field Handbook* (NCST 2024) and the *Munsell Soil Colour Charts* (Munsell 2009).

Further information about the land and soils of the study area were analysed from the Northern Territory Government's *Report on the Land Units of the Katherine-Douglas Area* (Aldrick and Robinson 1970), which was found to be broadly accurate in describing the land units within the study area³. Slope data was downloaded from Geoscience Australia using SRTM-derived smoothed 1 second Digital Elevation Data.

Survey sites were located within each mapped land unit area to determine the accuracy of land unit descriptions, as follows:

- Land unit 3a: Survey sites BSS1, 2, 12 & 13
- Land unit 3b: Survey sites ASS3 & 4
- Land unit 3c: Survey sites ASS5, 6 & 7
- Land unit 3d: Survey site ASS8 & 9
- Land unit 2c: Survey site ASS10

Soil sampling methodology

Soils were assessed at 12 sampling sites through the excavation of soil test pits to a depth of 1 m or refusal, using a motorised auger. Two sites (ASS3 & ASS4) were only assessed to a depth of 0.6 m. Soils were described based on surface characteristics (i.e. presence of surface gravels/rock outcrops or inundation), and sub-surface soil horizons (coarse fragments, moisture content, texture, colour, presence of mottling and depth).

Full site assessments were not undertaken in four sites (BSS1, 2, 12 & 13) because all four soil test pits reached refusal at or below 0.4 mbgl. Despite this, all four sites are still included in this assessment. All four sites were within Section B.

More detail of soil assessment methodology is included below in Table 3-1.

² The original field assessment included 14 sites, which are included in the LSA. Two of these (CSS14/ASS14 and CSS15) are excluded from the SSE because they are ~900m west of the proposed subdivision lots. However, they are still relevant for two reasons: they are both within land unit 3a, and because ASS14/CSS14 is the only soil sample within land unit 3a that was sent for laboratory testing. (CSS14 and ASS14 are the same assessment site, from which a sample was sent for laboratory testing). The laboratory results for ASS14 are therefore included in Appendix C.

³ Land units were modified slightly after the field visit but these changes did not change the land unit boundaries of the study area.

Table 3-1. Soil assessment methodology

Activity	Comment
Soil sampling	Excavation of soils via mechanical and motorised auger to a depth of 0.6 mbgl, 1.0 mbgl or refusal. A total of 12 sample sites were excavated; however, soil samples were collected for only nine sites. The sites where soil conditions were considered not suitable (<0.6 mbgl and/or rocky soils) were excluded from the sampling collection procedures. Soil samples were collected at a rate of one sample per horizon per sampling area. Soil samples from each horizon were sent to an accredited laboratory (ALS) for analysis of pH, electrical conductivity, bulk density, exchangeable cations, phosphate sorption capacity, and Emerson Aggregate Class – see Appendix B for detailed results.
Soil description and observations	All soil field observations and descriptions were recorded on a dedicated field data sheet in accordance with the <i>Australian soil and land survey field handbook</i> (NCST 2024). Soil profile descriptions included horizon designation, excavation depth, Munsell colour, soil texture class, coarse fragments, and gravel content. Gravel content was estimated by sieving soil samples using a 1 mm sieve ⁴ , based on the proportion of the sample retained. It is noted that coarse sand was included as part of the gravel content. This information, in combination with vegetation and site indicators, provides insight into soil erosion risk, drainage, on-site wastewater management.

3.2 Results

The study area is located within land units 3a, 3b, 3c, 3d and 2c (see Table 3-2. More detailed description in Appendix A).

Table 3-2. Ground-truthed land unit data for proposed lots*

Land unit	Vegetation	Soil**	Drainage	Relevant lot numbers
2c	<i>Eucalyptus dichromophloia</i> low open woodland to mid-high open woodland (<i>Eucalyptus umbrawarrensis</i> and Lancewood in lower rainfall areas) with Spinifex and annual Sorghum grass layer	Kandosols / Rudosols Moderately deep to deep; massive, dark brown Kandosols.	Well drained soils; very rapid run-off	7, 8
3a	<i>Eucalyptus tectifera</i> and <i>Eucalyptus foelscheana</i> ; Low woodland; frequently well-developed understorey of <i>Hakea arborescens</i> and <i>Cochlospermum fraseri</i> and mixed annual Sorghum and perennial grass layer	Shallow to moderately deep; massive; hard setting surface, reddish-brown Kandosol.	Well drained soils; moderately rapid run-off	24 (dominant), 25
3b	<i>Eucalyptus tectifera</i> and <i>Eucalyptus foelscheana</i> ; Low woodland; frequently well-developed understorey of <i>Hakea arborescens</i> and <i>Cochlospermum fraseri</i> and mixed annual Sorghum and perennial grass layer	Moderately deep to deep soils; massive; dark yellow to strong brown Kandosols.	Imperfectly to well drained soils; slow runoff	15 (co-dominant with 3c), 16 (co-dominant with 3c), 17, 18, 19, 20, 21, 22, 23
3c	<i>Eucalyptus foelscheana</i> low woodland with few shrubs and mainly perennial <i>Sehima</i> tall grass layer	Moderately deep to deep soils; massive; brown and red to very	Imperfectly to well drained	12 (dominant), 13, 14 (dominant)

⁴ The use of a 1mm sieve rather than a 2 mm as is normal procedure will tend to increase the portion of gravel estimated.

Land unit	Vegetation	Soil**	Drainage	Relevant lot numbers
		dark brown and dark reddish-brown Kandosols	soils; slow runoff	
3d	Uniform <i>Eucalyptus tectifica</i> and <i>Eucalyptus foelscheana</i> low woodland with perennial <i>Sehima</i> and <i>Themeda</i> grass layer	Moderately deep to deep soils; massive, dark reddish-brown to Dark red Kandosols	Imperfectly to well drained soils; slow runoff	9 (co-dominant with 2c), 10, 11 (dominant)

* Adapted from Aldrick et al. (1970) post-field visit. Descriptions are generalised and local sites may vary.

Soil laboratory testing indicates that soils across the study area (i.e. land units 3a, 3b, 3c, 3d and 2c) all have clay loams in the A horizon with higher clay content in the B horizon, ranging from clay loam sandy (land unit 2c) light clay to medium clays (land units 3c and 3d) to medium heavy clays (land units 3a⁵ and 3b). Laboratory testing also indicates that soil samples from all land units (except 3d) are dispersive (with a laboratory Emerson Class Number of 2).

Table 5.1 of *Australian Standard AS 1547:2012* uses soil texture to determine indicative soil permeability. An initial assessment shows that weakly structured or massive light clays have an indicative permeability of <0.06 (Ksat) (m/d) (soil category 5), while weakly structured or massive medium to heavy clays also have an indicative permeability of <0.06 (Ksat) (m/d) (soil category 6). However, Appendix B of the Standard also states that any dispersive soils must be classed as category 6 soils. This makes all land units category 6 except for land unit 3d, which is category 5. Land unit 3d has been classified as category 5 rather than 6 because it has abundant (50-90%) coarse fragments in the sub-soil layer. Appendix E of the *Australian Standard 1547:2012* recommends lowering the soil category by one category when coarse fragments occupy more than 20% of the soil volume (for non-dispersive soils). While coarse fragments were abundant (50-90%) in all soil samples, only soils within land unit 3d (and associated soil samples ASS8 and ASS9) were not dispersive.

⁵ Land unit 3a soil information present here is based on soil laboratory results for ASS14, which is approximately 785m west of the site, and BSS12 and BSS13, which are 150m west of the site. LSA report Figures 2-5 and 2-6 show the location of these soil assessments.

Table 3-3. Summary of soil properties for most restrictive layer by land unit

Land unit	Sample ID	Soil depth (m)*	Colour**	Soil structure and texture **	Sub-soil gravel content (%)*	Soil category***	ESP (%)**	EC ($\mu\text{S/cm}$)**	pH**	Phosphate sorption capacity (mg / kg) **	Bulk density (kg/m^3)**	Surface soil condition and moisture*	Emerson class number**	Indicative permeability (K_{sat})(m/d)***
3a	BSS01, BSS02, BSS12, BSS13, ASS14 / CSS14	0.4	Reddish Brown	Massive – Medium heavy clay	60%	6	<0.2	65	8.9	4860	1220	Hard setting with surface crust	2	<0.06
3b	ASS03, ASS04	0.6+	Brown to Strong Brown	Massive – Medium Heavy Clay	95%	6	1.8	22	5.6	665 – 828	1340	Moist soil	2	<0.06
3c	ASS05, ASS06, ASS07	0.6+ – 1.0+	Dark Reddish Brown	Massive – Medium Clay	95%	6	2.7	15	5.8	438 – 1540	1140	-	2	<0.06
3d	ASS08, ASS09	1.0+	Dark Reddish Brown	Massive – Medium Clay	90%	5	0.5	13	6.0	723 – 1700	1200	-	3	<0.06
2c	ASS10	1.0 ⁶	Dark Brown	Massive – Clay loam sandy**	60%	6	<0.1	9	6.1	681 – 858	1340	-	2	<0.06

* field test results; ** laboratory test results *** as per AS/NZ 1547-2012

⁶ Dug to a depth of 1m without refusal. Due to administrative error the sample 0.5 – 1.0m was not sent to the laboratory. Data here relates to 0.1-0.5m horizon. The soil category has been amended to account for the coarse fragments which are >20% (See Appendix E, AS/NZ 1547-2012).

3.3 Considerations

The purpose of an SSC is to supplement the desktop study to inform the following considerations.

<p>a) Description of the domestic wastewater producing facilities to be served, their function, size, and expected wastewater flow on a daily peak and weekly total output basis</p>
<p>Table 8 in the NT <i>Code of Practice for Wastewater Management</i> (the Code) (DoH 2020b) stipulates a design flow of 150 L/person/day for facilities that have dwellings with 6/3 L flush toilets and standard fixtures (for all wastes). It is expected that each residential lot will have one residence with 3 bedrooms. Table 7 of the Code stipulates that for a 1–3-bedroom dwelling, the occupancy for design purposes is 5. The peak design wastewater load is therefore 750 L per day, or 5,250 L per week, per residence.</p>
<p>b) Property description, its size, topography, slope, buildings, services, and relationship to neighbouring properties and their facilities</p>
<p>NT Portion 7860 is a 3,437 ha privately owned property in the suburb of Edith, approximately 35 km north-west of Katherine, NT. There are 19 subdivisions proposed along the northern border of the property, all with property access from Beasley Road. Of these, 14 are 8 ha and 5 are larger blocks ranging in size from 13.2 ha to 14 ha. These subdivisions occupy approximately 182 ha, or 5.3% of the area of NT Portion 7860.</p> <p>The highest point within the project area is at the eastern side of Section A (elevation ~148m); however, in the centre of Section A, a ridge line exists (elevation 142m – 145m). Along Beasley Road the land is generally flat (0-2% slope) but becomes steeper further south, with slopes of 3-5%. Ravines and erosion gullies have been formed in some areas with smaller areas of steeper slope >5%.</p> <p>Analysis using 1m contour data identified a that rainfall run-off broadly flows from the east to the south and south-west across the project area, emptying into Bondi Creek. Water also runs west along the property below Beasley Road before crossing the road to the north at several points, which is partly because of the ridge line in the centre of the study area.</p> <p>The surrounding area is a mix of rural residential blocks of ~8 ha in size and larger properties used for grazing. The immediate neighbours to the proposed subdivided lots will be other subdivided blocks and rural blocks on the north side of Beasley Road. Large pastoral properties occur directly south and approximately 8 km west of NT Portion 7860.</p>
<p>c) Previous uses of the study area (such as agriculture, horticulture) including the likely degree of soil disturbance such as soil contamination, compaction or presence of fill and measures to ameliorate adverse effects of past land uses</p>
<p>Land is currently used for grazing cattle and there are feral buffalo and feral horses. Most notable signs of disturbance are erosion gullies which are common in steeper areas, particularly with land unit 3a. Also, an 8 ha within land unit 3b was used to extract gravel and has not been remediated and this area was assessed by drone and satellite imagery only. There may be areas within the historic gravel pit that have been backfilled.</p>
<p>d) Potential effects of effluent discharged within the property on health and ecosystems and its potential cumulative adverse influence (if any) on neighbouring properties and the downstream hydrologic catchment through run-off and groundwater quality and flows</p>
<p>There are no neighbouring properties or aquatic ecosystems within the WMS footprint.</p>
<p>e) The environmental quality objectives set by the regulatory authority for surface water and groundwater and the current water quality of those systems</p>
<p>None applicable.</p>
<p>f) Environmental features of significance within the subject property/properties and beyond the property boundaries (both on neighbouring properties and within the downstream hydrologic catchment in which the property is located)</p>
<p>There are no environmental features of significance within the potential footprint of the WMS. There are no sinkholes.</p>
<p>g) Distance downstream to the nearest water body or watercourse, or where relevant the coast and the risk and cumulative impact of contamination of waterways</p>
<p>A few ephemeral streams and drainage depressions intersect the study area with most draining into Bondi Creek, a third-order stream ~ 2 km to the south-west.</p>
<p>h) Risk of erosion and loss of stability of hill slopes</p>

There are areas mapped with a slope greater than 2% within the study area. These areas have been identified and mapped within the LSA and are susceptible to erosion if cleared. Erosion risk is highest in land unit 3a, 3b and 2c with erosion gullies visible in these land units in areas with slopes >3%. Most of the study area is covered in remnant vegetation including native trees, shrubs and grasses. Only small areas (~1 ha) of each site are likely to be cleared for residential purposes, reducing risk of erosion.

i) The soil-water regime, especially during wet seasons, and the duration of any shallow waterlogging (seasonal perched water tables) as known through anecdotal information, observations from any nearby test bores or boreholes, presence of water-loving vegetation or soil mottling, or estimated from soil morphology. The position of the permanent dry weather water table under the study area also needs to be considered

The site-and-soil check was conducted during the dry season (June). Plant species *Petalostigma pubescens* and *Grevillea heliosperma* were used as indicator species of imperfectly drained soils. These species were identified at check site ASS3 near where satellite imagery also showed evidence of a floodway crossing Beasley Road. Neither species was observed at ASS6.

The nearest bore (RN029234) is located within NT Portion 7860, near the intersection of Beasley and Edith Farms Road and recorded depth to water of 41 m at date of drilling. Drilling took place in April 1993. Another bore (RN030538) exists within NT Portion 7860, approximately 700 m south of Beasley Road. It encountered water bearing beds at 26 m, 48 m and 60 m. Drilling took place in August 1996. More information about proximate bores is included in Section 2.

Soil testing did not indicate mottling; however, ASS3 soil was moist at the time of sampling.

j) An assessment of restrictive soil horizons within the soil absorption zone, for example heavy clays, hardpans, or any other factors limiting the design loading rate (DLR)

Land units 3a, 3b, 3c and 3d (i.e. all except 2c) contain medium clays in the B horizon. One soil sample⁷ (ASS4) contains medium heavy clay in B horizon. However, due to abundant (50-90%) coarse fragments, the soil category of these soils is changed from 6 to 5 (as per Appendix E in AS 1547-2012) with the assumption that high coarse fragments increase drainage.

k) A description of the mitigation measures proposed to avoid or remedy any potential or actual adverse effects

Australian Standards AS 1547-2012 (Table L1) recommends special design requirements and distribution techniques or soil modification for category 5 soils (land units 3a, 3b, 3c and 3d) with weak or massive structure. And that the effluent absorption rate should be based upon soil permeability testing. Furthermore, the standards state that effluent absorption rate should be based upon soil permeability testing. Soil laboratory testing indicates that the soils within the study area are not dispersive, with an exchangeable sodium percentage (ESP) range of <0.1% to 2.7%.

l) Likely impact of construction/earthmoving activity, including subdivisional and building platform earthworks (if relevant), on system performance

Not relevant – the WMS will be installed at the same time as construction of other infrastructure.

m) Monitoring details for special designs, installations, and operation and maintenance features

To be determined by the system designer.

n) Identification of all persons interested in or likely to be affected by the proposal, consultation that has been undertaken, and proposed responses.

The study area is in a rural area north of Katherine such that the nearest interested parties are landowners of ten lots (nine north of Beasley Road and one to the east). These landowners are unlikely to be affected by wastewater management systems given that they will likely be installed at least 250m from nearest residence (considering the road and setback distances). The proposed wastewater management systems are common in all rural residential blocks in the area and are unlikely to be controversial. The large distances between each lot reduce likelihood of disturbance during either installation or operation of WMS.

⁷ ASS14/CSS14 (land unit 3a) also has a medium heavy clay in the B horizon, which is a restrictive layer. It also has high coarse fragments and is classified as a category 5 soil. See LSA for more details.

4 SITE-AND-SOIL ASSESSMENT

A site-and-soil assessment (SSA) involves a review of the detailed subsoil investigations, site inspection results and desktop studies to determine suitability for onsite wastewater management. Subsoils were examined and the soil profile and soil features were recorded at 12 sites within the proposed WMS (ASS3-ASS10) during an examination of the property. Soil samples from each horizon were also sent to an accredited laboratory (ALS) for analysis of pH, electrical conductivity, exchangeable cations, sodicity (ESP), bulk density and Emerson Aggregate Class – see Appendix C for detailed results. This has enabled determination of soil characteristics, allocation of soil categories and identification of potential soil limitations (see Table 3-3).

It was found that the soils are mostly light clays and medium clays in the B horizon with a tendency to dispersion under the Emerson Aggregate Test (Emerson Class Number 2). Consequently, and notwithstanding the abundant gravel content of all soil sites, land units 3a, 3b, 3c and 2c are classified as category 6 soils, while land unit 3d is classified as category 5.

Following the process outlined in Section 5.2 of the Australian Standard 1547:2012, soil texture can be used to determine permeability, using Table 5.1 of the Standard. Category 5 and 6 soils have an indicative soil permeability of <0.06 (K_{sat}) (m/d) – soils categories 5 and 6 (weakly structured or massive).

4.1 Limiting factors regarding WMS design and placement.

Four of the land units had an Emerson Class Number of 2, indicating dispersive soils (see Table 4-1). Dispersive soils can form suspensions in water leading to erosion and potentially reducing permeability of the soils. Table 5.1 of AS/NZ 1547-2012 states that specialist soil advice and special design techniques are required to enable their use for land application systems. High gravel content (abundant coarse fragments) was found in all soils tested which can impede or accelerate the flow of water (Appendix E, AS1547-2012). Shallow soils were found in land unit 3a. These soils limit the capacity of soil to receive, treat and absorb wastewater flows.

Table 4-1 below shows limitations at the study area by land unit. Land unit 3a has most limitations for WMS and is the least represented by laboratory sampling. Land unit 3d has the least limitations because soil samples were not found to be dispersive. Land unit 2c has dispersive soil in the upper B horizon; however, laboratory testing was not carried out on soils deeper than 0.5m. Soil depth was at least 0.6m in all land units except 3a where there are localised patches of shallow soil (0.4m to bedrock) and extensive patches of rocky outcrops.

Table 4-1. Table showing limitations per land unit

Land unit	Sample ID	Limitations
3a	BSS01, BSS02, BSS12, BSS13, ASS14 / CSS14	Shallow soil depth; abundant coarse fragments; dispersive soil (ASS14/CSS14: 0.0-0.7m); rocky outcrops.
3b	ASS03, ASS04	Abundant coarse fragments; dispersive soil in B horizon (ASS3: 0.3-0.6m); some areas imperfectly drained (ASS3).
3c	ASS05, ASS06, ASS07	Abundant coarse fragments; dispersive soil in B horizon (ASS6: 0.1-0.4m); some imperfectly drained soils due to floodway (ASS3).
3d	ASS08, ASS09	Abundant coarse fragments.
2c	ASS10	Abundant coarse fragments; dispersive soil in B horizon (ASS10: 0.1-0.5m).

Some common land application systems are listed below. These are described in the *NT Code of Practice for Onsite Wastewater Treatment Systems* and Appendix K of *AS 1547-2012*. Some of these systems are designed for primary treated effluent (e.g. a standard septic tank) and others require secondary treatment of effluent before application.

- Absorption trenches and absorption beds
- Evapotranspiration/absorption/seepage beds/trenches
- Subsurface and covered surface irrigation – Drip irrigation
- Surface irrigation – Spray irrigation
- Subsurface irrigation – LPED irrigation
- Mounds.

According to Table K1 of the Standards, the most suitable land application system for the study area are mound systems, due to the limitations of soil depth, high seasonal rainfall, dispersive soils and high stones, cobbles or boulders. Mound systems (also referred to as Wisconsin mounds) use imported fill material (usually sand) to construct land application systems on the surface of the soil, thus overcoming limitations of drainage within the soil. Sub-surface drip irrigation may also be considered where topsoil is likely to be non-dispersive and where there is a minimum of 0.6m depth below dripper (eg in land unit 3d). If subsurface drip irrigation is the preferred, then secondary treatment is required to reduce effluent to a specified level (see Appendix M AS/NZ 1547-20012). Modifications of other application systems may also be considered if the modifications are directly targeted at the specific limitations of the study area.

4.2 Effluent quality

The required effluent quality dictates the necessary wastewater treatment system for the Property. Secondary treatment of effluent reduces the limitations of the receiving environment.

Mound absorption beds can be utilised for primary treated effluent (i.e. standard septic tank). Whitehead et al. (2005) recommend that primary treated domestic effluent will contain approximately 150-250 mg/L BOD; 50-100 mg/L SS and < 15 mg/L FOG before application to the mound land application system. This is in line with Table 10 of the Code (2020b) which estimates organic loading rates for dwellings in a rural living area (i.e. BOD₅ loading rate) of 50 g/p/d after primary treatment/septic tank.

4.3 Sizing of land application area

Mounds were sized based on standard sizing calculations in the *Technical Guidelines for Design, Installation and Operation of Mound Systems for Onsite Effluent Management* (Whitehead et al. 2005) as well as site data. Input data for these calculations, and results, are summarised in Table 4-2, and full calculations are provided in Appendix D.

AS/NZ 1547-2012 details how to determine the recommended design loading rate (DLR) for mound systems. For category 5 and 6 soils the DLR is 5 mm/day⁸.

⁸ Table N1 of AS 1547-2012 recommends soil permeability testing and specialist soils advice and special design techniques when working with dispersive soils (which includes all land units except 3d). Specific design of a customised WMS to address the permeability issues at the site is beyond the remit and expertise of the authors of this report.

Table 4-2. Sizing calculations - mounds

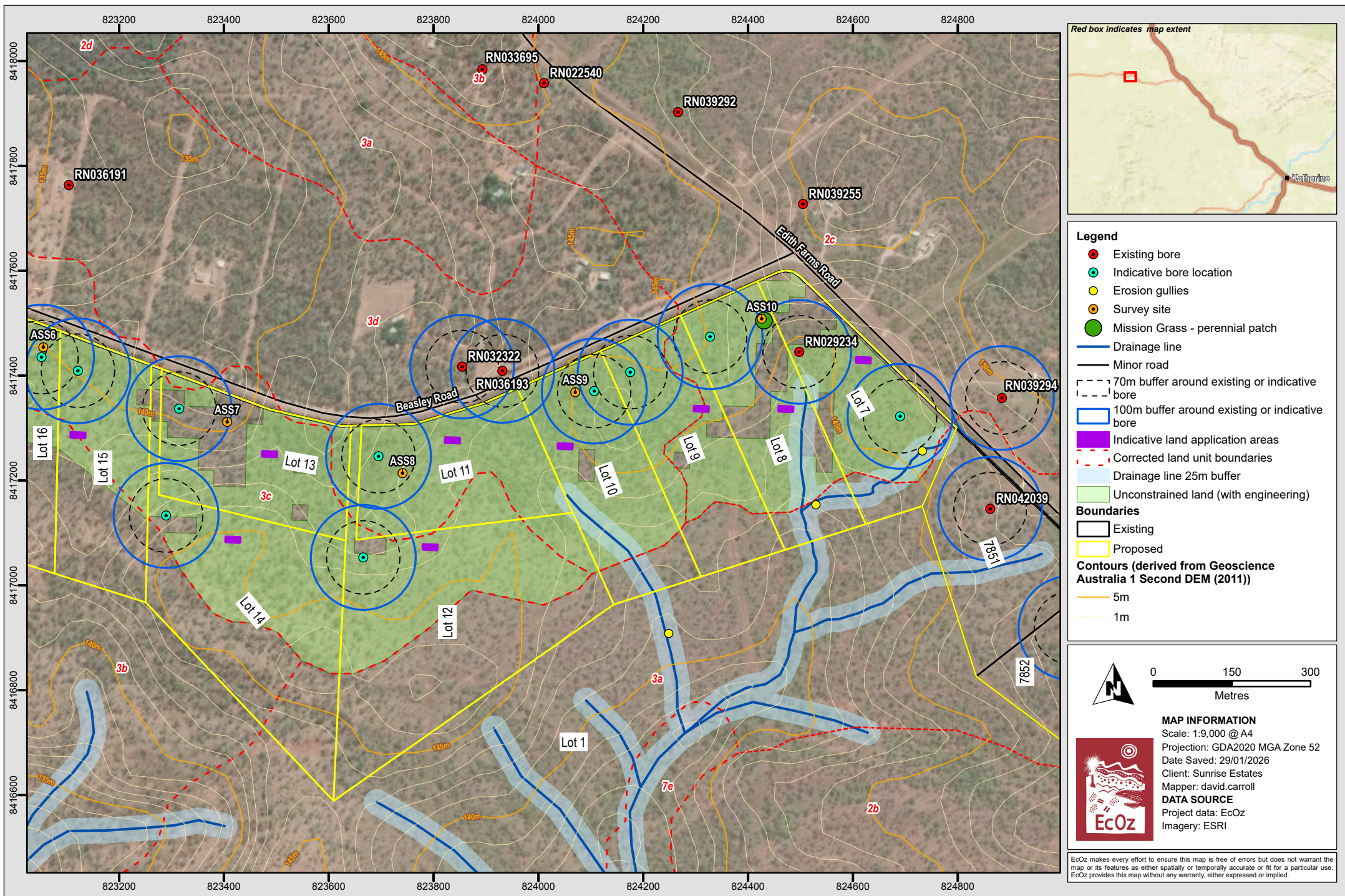
Parameter	Units	Value	Comments
Design wastewater flow	L/day	750	Table H1 in AS/NZS 1547:2012
Slope	%	2	Based on average slope of assessment sites
Soil depth to limiting layer	m	1.0	Average depth from soil test pits (noting that only land unit 3a met with refusal).
Sand loading rate	mm/day	35	Based on primary treatment
Basal loading rate	L/m/day	5	Based on soil texture
Linear loading rate	L/m/day	30	Tyler (2001) does not state LLR for weakly structured clay soils. This is estimate only and should be used with caution.
Batter slope	-	3:1	Standard slope
Upslope correction factor	Decimal	0.94	Based on average site slope of 2%
Downslope correction factor	Decimal	1.06	Based on average site slope of 2%
Required mound dimensions			
Length (m)		26.42	
Width (m)		8.43	
Height (m)		1.07	

The calculations undertaken enable area requirements to be estimated and mapped. The selection of treatment and land application methods, and infrastructure locations, would be the responsibility of future lot owners (in consultation with appropriately qualified plumbers and Department of Health), and mapping is indicative only.

4.4 Set back distances

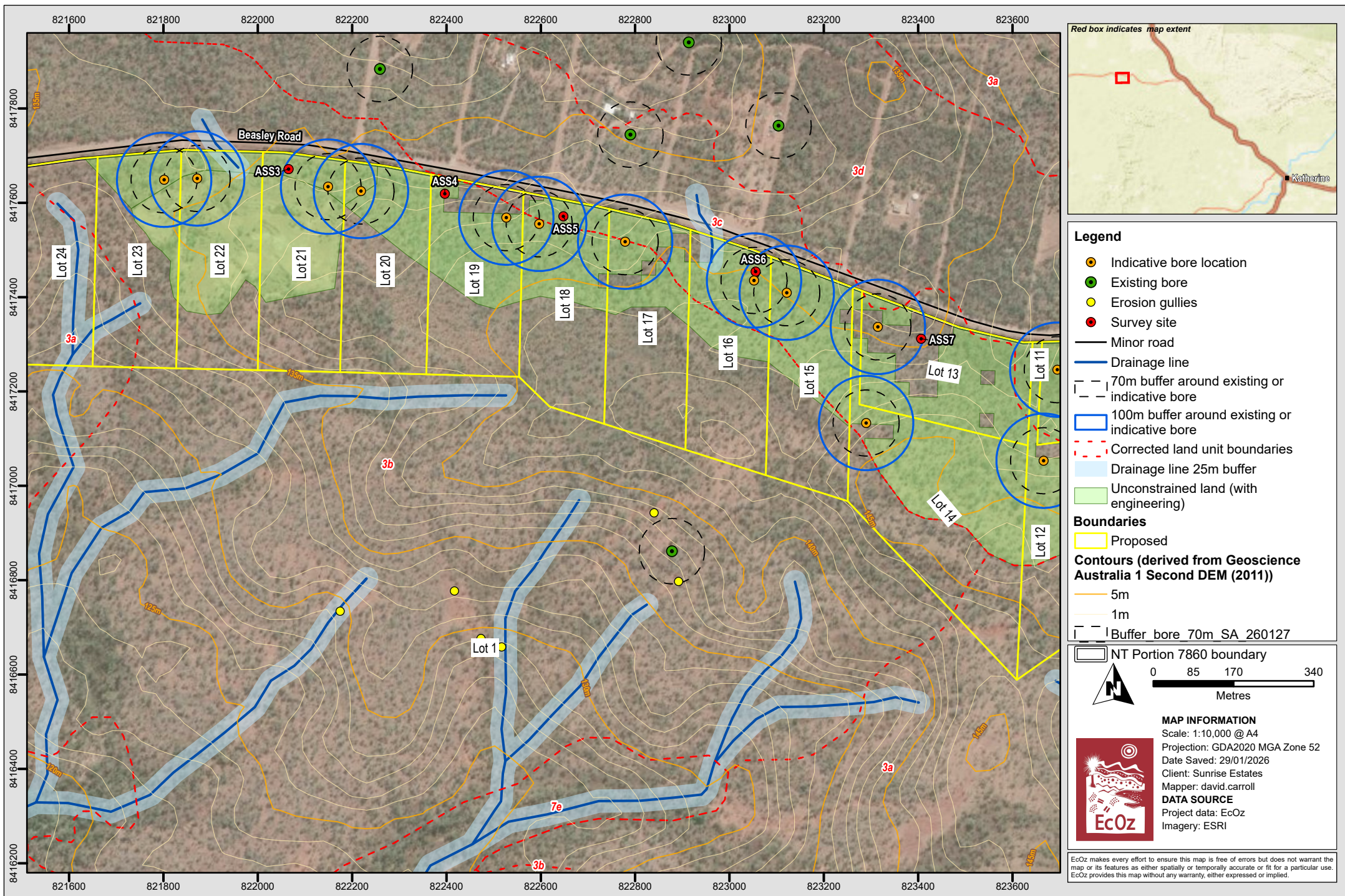
Minimum setback distances for septic systems and land application systems are mandated in Table 14 of the Code. These setback distances replace those stated in AS/NZ 1547-2012 Appendix R.

Mapping of indicative land application areas indicates that mound systems can be accommodated within the future lots while maintaining the required buffer distances from infrastructure (e.g. bores) and drainage areas (see Figure 4-1, Figure 4-2 and Figure 4-3).



Path: Z:\01 EcOz_Documents\05 EcOz M-Files GIS\2025\EZ25072 - Sunrise Estates - Beasley Road LSA1. Project Files\2. Report Maps\EZ25072 - Beasley Road SSE.aprx Layout: Map of suitable and constrained land in Section A - east

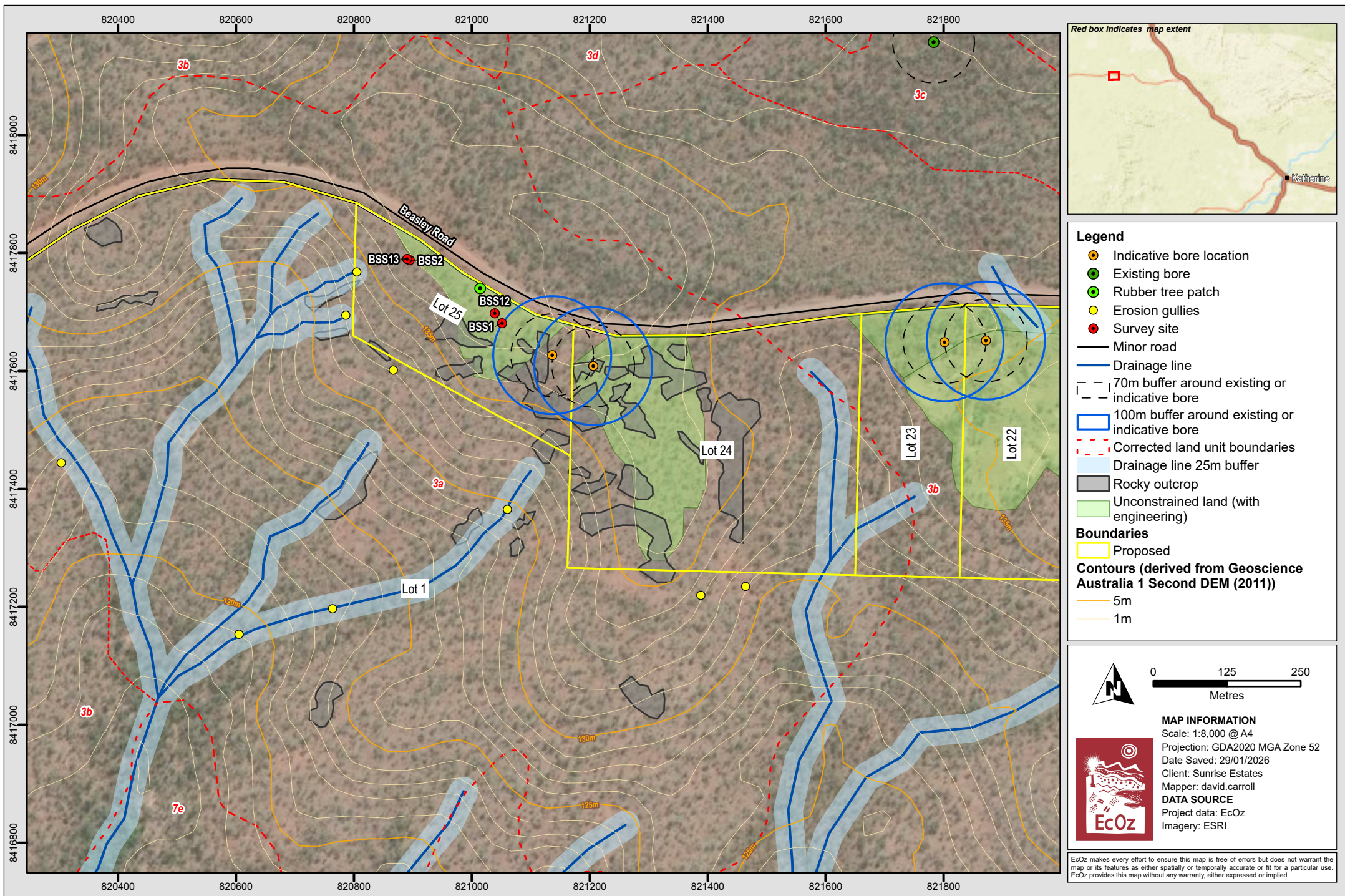
Fig 4-1. Map of proposed sites for treatment and land application systems and applicable setbacks (Lots 7-15).



Path: Z:\01 EcOz_Documents\05 EcOz M-Files GIS\2025\EZ25072 - Sunrise Estates - Beasley Road LSA1. Project Files\2. Report Maps\EZ25072 - Beasley Road SSE.aprx Layout: Map of suitable and constrained land in Section A - west

Fig 4.2 Map of proposed sites for treatment and land application systems and applicable setbacks (Lots 16-23).

EcOz makes every effort to ensure this map is free of errors but does not warrant the map or its features as either spatially or temporally accurate or fit for a particular use. EcOz provides this map without any warranty, either expressed or implied.



Path: Z:\01 EcOz_Documents\05 EcOz M-Files GIS\2025\EZ25072 - Sunrise Estates - Beasley Road LSA1. Project Files\2. Report Maps\EZ25072 - Beasley Road SSE.aprx Layout: Map of suitable and constrained land in Section B

Fig 4-3. Map of proposed sites for treatment and land application systems and applicable setbacks (Lots 24-25).

5 RECOMMENDATIONS

The NT Department of Health website provides guidance on sourcing pre-approved wastewater treatment systems and products. Information is also available on the administration processes required for notifying the Department of the installation of an on-site wastewater management system, and the steps required for approval and certification of such systems.

Effective treatment and disposal of effluent require on-going maintenance of the wastewater management systems. The following general recommendations are made:

- Desludging of septic tanks should be undertaken every four years for a tank 4,000 L or less (DoH 2020b)
- It is recommended that mounds be inspected by an experienced professional at least once per year (Whitehead et al. 2005)
- Avoid traffic in the mound areas, including livestock. Avoid travel on the mound or the downslope area when the soil is saturated (Whitehead et al. 2005).
- Mound systems should be grassed using grasses adapted to the area (AS/NZ 1547-2012)
- A vegetated or landscaped buffer must be placed around mounds to accommodate for a 6 m wide buffer on the downslope side and 3 m wide on all other sides; no permanent or sealed structures should be placed within this buffer (Whitehead et al. 2005)
- Stormwater and surface run-on should be diverted around, or away from, land application areas (Whitehead et al. 2005).

Minimising the volume of wastewater produced will aid in ensuring the effective long-term operation of the systems and water saving devices (e.g. AAA rated taps and shower heads, dual flush toilets) should be installed in houses. Chemicals, large quantities of cleaning products, fats, oils and grease, and food scraps should not be discharged to the wastewater treatment and disposal system, as they risk overloading or interfering with the functioning of the system.

For detailed information on the design, construction, operation and maintenance of the various systems, refer to the NT *Code of Practice for Wastewater Management* (DoH 2020b) and AS/NZ 1547-2012.

6 REFERENCES




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APPENDIX A LAND UNIT DESCRIPTIONS (ALDRICK 1970)


Description of the existing land units within the zones (Aldrick & Robinson 1970)

Land unit	Landform description	Vegetation description	Drainage	Soil	Limitations
Hills					
2c	Hills - hilly terrain; slopes 5-15%; rocky and boulder-strewn	<i>Eucalyptus dichromophloia</i> low open woodland to mid-high open woodland (<i>Eucalyptus umbrawarrensensis</i> and Lancewood in lower rainfall areas) with <i>Spinifex</i> and annual Sorghum grass layer	Well drained soils; very rapid run-off.	Soils generally shallow or skeletal; Rudosols	Shallow rocky soils; very erodible
Plains					
3a	Plains - undulating and dissected terrain; slopes to 2%; frequent linear outcrops of intermixed limestone and sandstone.	<i>Eucalyptus tectifica</i> and <i>Eucalyptus foelscheana</i> ; Low woodland; frequently well-developed understorey of <i>Hakea arborescens</i> and <i>Cochlospermum fraseri</i> and mixed annual Sorghum and perennial grass layer	Well drained soils; moderately rapid run-off	Tippera – small pockets of very shallow Loamy Red Earths; minor Elliott (Florina) - Loamy Yellow Earths; Kandosols	Severe rock outcrop; shallow soils in small pockets; steeper slopes are highly erodible if cleared; severely restricted accessibility
3b	Plains – gently undulating with dissected terrain; slopes less than 2%; scattered limestone pavement or rock outcrop.	<i>Eucalyptus tectifica</i> and <i>Eucalyptus foelscheana</i> ; Low woodland; frequently well-developed understorey of <i>Hakea arborescens</i> and <i>Cochlospermum fraseri</i> and mixed annual Sorghum and perennial grass layer	Well drained soils; slow runoff.	Tippera - shallow Loamy Red Earths; minor Elliott (Florina) - Loamy Yellow Earths; Kandosols	Severe rock outcrop; restricted accessibility.
3c	Plains - Flat to gently sloping; slopes less than 2%; scattered limestone pavement or outcrop; indistinct drainage floors	<i>Eucalyptus foelscheana</i> low woodland with few shrubs and mainly perennial <i>Sehima</i> tall grass layer	Well drained soils; slow run-off	Tippera - Loamy Red Earths, deep with minor outcrop or shallow with small amounts of surface stone or grave; Kandosol	Minor rock; sometimes shallow soils; erodible on slopes over 1% if cleared
3d	Plains - flat to gently sloping; slopes less than 2%; indistinct drainage floors	Uniform <i>Eucalyptus tectifica</i> and <i>Eucalyptus foelscheana</i> low woodland with perennial <i>Sehima</i> and <i>Themeda</i> grass layer	Well drained soils; slow runoff.	Tippera - deep Loamy Red Earths; minor small inclusions of Elliott (Florina) – Loamy Yellow Earths; Kandosols	Minor rock; sometimes shallow soils; erodible on slopes over 1% if cleared.



APPENDIX B SURVEY SITE LAND, VEGETATION AND SOIL DESCRIPTIONS

Reference Site	BSS01		
Coordinates (Y,X)	-14.294175, 131.975583		
Vegetation Type	A full site assessment was not undertaken		
Corrected land unit	3a		
Ground cover	Vegetation Leaf litter Bare soil Rock Gravel		
Other site notes	Large flat area, with potential scalding because limited vegetation in ground, mid or upper layers. Rubber Bush patch present. Minimal rocky outcrops. Soil was very rocky and impenetrable with 18V mechanical auger.		
Vegetation			
Upper Stratum	Mid Stratum	Ground Stratum	
Cover: Height range: Average height:	Cover: Height range: Average height:	Cover: Height range: Average height:	
Species			
<i>Eucalyptus tectifica</i>	<i>Hakea arborescens</i>	-	
-	-	-	
-	-	-	
Soil			
Slope	1.5%		 
Aspect	Southeast		
Drainage Potential	N/A		
Gravel cover	N/A		
Rock cover	N/A		


Gravel portion		N/A		
Soil Profile				
Horizon	Depth range (m)	Soil Description	Soil type	Comment
B1	0-0.15	Sandy LOAM with gravel and cobble inclusions	Kandosol	Hard setting with crust on top, A horizon not present. No samples were collected

Reference Site	BSS02	
Coordinates (Y,X)	-14.293227, 131.97412	
Vegetation Type	<i>A full site assessment was not undertaken</i>	
Corrected land unit	3a	
Ground cover	Vegetation Leaf litter Bare soil Rock Gravel	
Other site notes	Impenetrable layer of hard clay at 0.7m. <i>Hakea arborescens</i> dominant in the mid-layer.	

Vegetation		
Upper Stratum	Mid Stratum	Ground Stratum
Cover:	Cover:	Cover:
Height range:	Height range:	Height range:
Average height:	Average height:	Average height:
Species		
<i>Eucalyptus tectifica</i>	<i>Hakea arborescens</i>	-
-	-	-
-	-	-

Soil			
Slope	3.0%		
Aspect	Southwest		
Drainage Potential	N/A		
Gravel cover	N/A		
Rock cover	N/A		
Gravel portion		Not recorded	



Soil Profile				
Horizon	Depth range (m)	Soil description	Soil type	Comments
B1	0-0.30	Sandy LOAM with gravel and cobble inclusions	Kandasol	Hard setting with crust on top, A horizon not present. No samples were collected

Reference Site	ASS03	
Coordinates (Y,X)	-14.294143, 131.984975	
Vegetation Type	<i>Corymbia foelscheana</i> , <i>Eucalyptus tectifica</i> mid high open woodland over <i>Petalostigma pubescens</i> mid-layer and ground cover of <i>Themeda triandra</i> , <i>Sehima nervosum</i> and mixed <i>Sorghum</i> spp.	
Corrected land unit	3b	
Ground cover	Vegetation 70% Leaf litter 15% Bare soil 10% Rock 0% Gravel 5%	
Other site notes	Quarry located 50 m toward the south. Termite mounds and <i>Hyptis</i> sparse throughout	
Vegetation		
Upper Stratum	Mid Stratum	Ground Stratum
Cover: 7% Height range: 5-8 m Average height: 6 m	Cover: 40% Height range: 1-5 m Average height: 3 m	Cover: 40%
Species		
<i>Corymbia foelscheana</i> (5%)	<i>Petalostigma pubescens</i> (20%)	<i>Themeda triandra</i> (10%)
<i>Eucalyptus tectifica</i> (2%)	<i>Terminalia ferdinandiana</i> (5%)	<i>Sehima nervosum</i> (10%)
-	<i>Acacia holosericea</i> (5%)	<i>Mixed sorghum</i> (30%)
-	<i>Terminalia pterocarya</i> (10%)	-
Soil		
Slope	1%	
Aspect	North	
Drainage Potential	Imperfectly drained	
Gravel cover	5%	
Rock cover	0%	



Soil Profile				
Horizon	Depth range (m)	Soil description	Soil type	Comments
A1	0.00-0.30	Dark yellowish brown (10YR4/4) silty CLAY, coarse fragments 3 – 30 mm with an average size of 7 mm (90% abundance)	Kandasol	Imperfectly drained. Sample ASS03_0.00-0.30
B1	0.30–0.60	Reddish brown (5YR5/5), CLAY, coarse fragments 3 – 30 mm with an average size of 10 mm (95% abundance)	Kandasol	Imperfectly drained. Sample ASS03_0.30-0.60. Termination depth at 0.60 (mechanical limitation, hand auger)

Reference Site	ASS04	
Coordinates	-14.294576, 131.988048	
Vegetation Type	<i>Corymbia foelscheana</i> , mid high open woodland over <i>Terminalia pterocarya</i> with <i>Aristida</i> sp. dominated ground layer.	
Corrected land unit	3b	
Ground cover	Vegetation 40% Leaf litter 45% Bare soil 10% Rock 0% Gravel 5%	
Other site notes	Termite mound and <i>Hyptis</i> sparse throughout	
Vegetation		
Upper Stratum	Mid Stratum	Ground Stratum
Cover: 10% Height range: 8-10 m Average height: 9 m	Cover: 52% Height range: 2-7 m Average height: 4.5 m	Cover: 90%
Species		
<i>Corymbia foelscheana</i> (10%)	<i>Terminalia pterocarya</i> (30%)	<i>Aristida</i> sp. (75%)
-	<i>Hakea arborescens</i> (5%)	<i>Mixed sorghum</i> (10%)
-	<i>Petalostigma pubescens</i> (10%)	<i>Chrysopogon latifolius</i> (5%)
-	<i>Grevillea mimosoides</i> (2%)	-
Soil		
Slope	1-2%	
Aspect	South	
Drainage Potential	Well drained	
Gravel cover	5%	
Rock cover	0%	

		
<p>Gravel portion</p>		

Soil Profile				
Horizon	Depth range (m)	Soil description	Soil type	Comments
A1	0.00-0.30	Yellowish red (5YR4/6) clay LOAM, coarse fragments 5 mm (80% abundance)	Kandasol	Sample ASS04_0.00-0.30
B1	0.30–0.60	Dark red (10YR3/6), clay LOAM, coarse fragments 5 – 10 mm (80% abundance)	Kandasol	Sample ASS04_0.30-0.60. Termination depth at 0.60 (mechanical limitation, hand auger)


Reference Site	ASS05
Coordinates (Y,X)	-14.294979, 131.99038
Vegetation Type	<i>Corymbia foelscheana</i> mid high woodland with <i>Corymbia foelscheana</i> over a mid-layer of <i>Terminalia pterocarya</i> and <i>Aristida sp.</i> ground cover.
Corrected land unit	3c
Ground cover	Vegetation 30% Leaf litter 40% Bare soil 20% Rock 0% Gravel 10%
Other site notes	Hyptis (<i>Mesosphaerum suaveolens</i>) found throughout site. Termite mounds present.

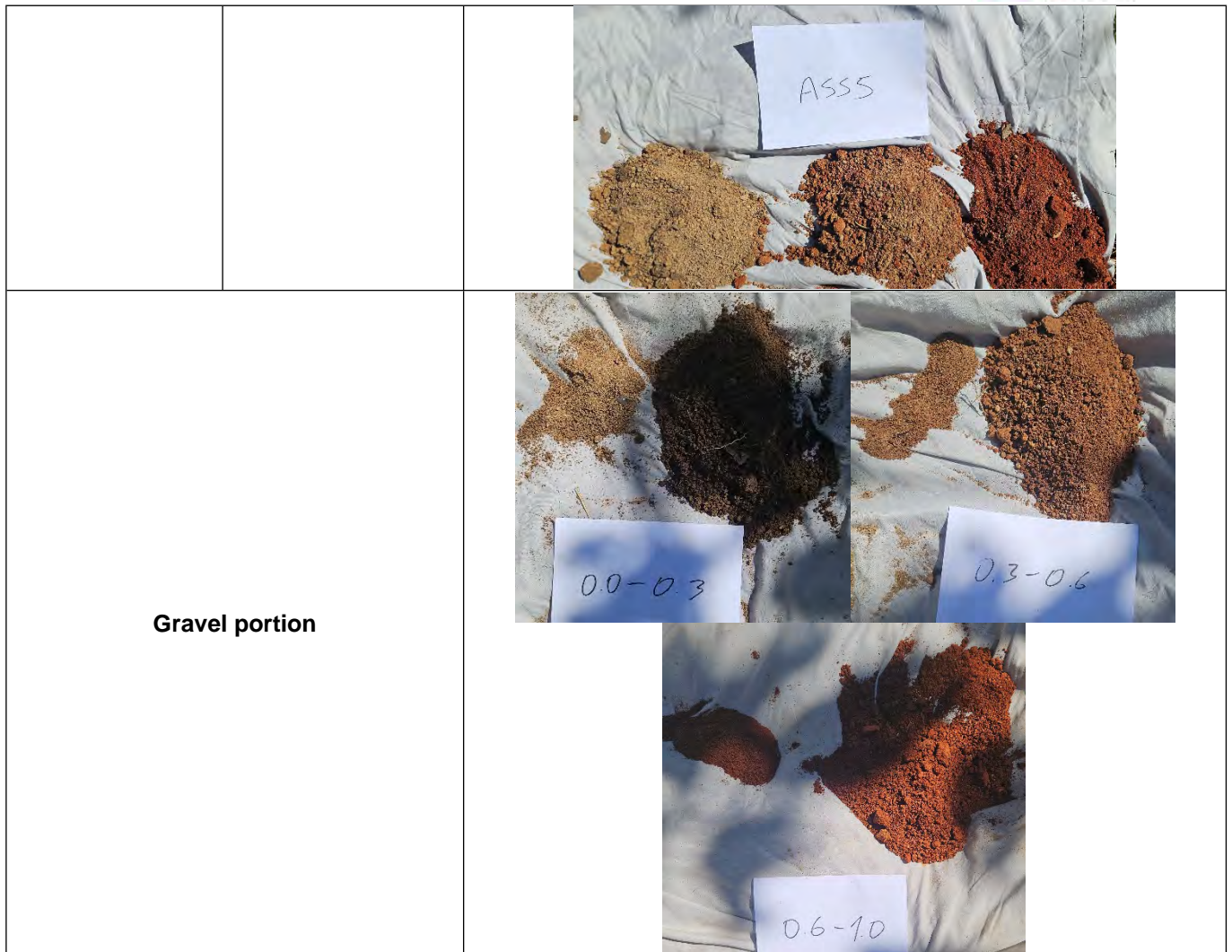
Vegetation

Upper Stratum	Mid Stratum	Ground Stratum
Cover: 20% Height range: 4 -8 m Average height: 6.5 m	Cover: 40% Height range: 2 - 6 Average height: 4 m	Cover: 10%


Species		
<i>Eucalyptus tectifica</i> (5%)	<i>Petalostigma pubescens</i> (10%)	<i>Aristida sp.</i> (30%)
<i>Corymbia foelscheana</i> (15%)	<i>Terminalia Ferdinandiana</i> (5%)	Mixed sorghum (10%)
-	<i>Terminalia pterocarya</i> (20%)	-
-	<i>E. chlorostachys</i> (5%)	-

Soil

Slope	1-2%	
Aspect	South	
Drainage Potential	Well drained	
Gravel cover	10%	
Rock cover	0%	




Soil Profile				
Horizon	Depth range (m)	Soil description	Soil type	Comments
A1	0.00-0.30	Brown (7.5YR4/3) clay LOAM, coarse fragments 3 – 5 mm (80% abundance)	Kandasol	Sample ASS05_0.00-0.30
B1	0.30–0.60	Dark red (25YR3/6) clay LOAM, brown and red mottled, coarse fragments 3 – 5 mm with clay inclusions (80% abundance)	Kandasol	Sample ASS05_0.30-0.60
B2	0.60–1.00	Dark red (10R3/6) sandy LOAM, coarse fragments 3 - 5 mm with clay inclusions (80% abundance)	Kandasol	Sample ASS05_0.60 – 1.00

Reference Site	ASS06	
Coordinates	-14.295989, 131.994168	
Vegetation Type	<i>Eucalyptus tectifica</i> , <i>Corymbia foelscheana</i> mid high woodland over <i>Terminalia ferdinandiana</i> with a ground layer of <i>Chrysopogon fallax</i>	
Corrected land unit	3c	
Ground cover	Vegetation 35% Leaf litter 50% Bare soil 10% Rock 0% Gravel 5%	
Other site notes	Termite mounds, Hyptis (<i>Mesosphaerum suaveolens</i>), 3 small hollows visible in <i>E. tintinnans</i>	
Vegetation		
Upper Stratum	Mid Stratum	Ground Stratum
Cover: 35% Height range: 4 – 8 m Average height: 6.5 m	Cover: 37% Height range: 3 – 6 m Average height: 4.5 m	Cover: 80%
Species		
<i>Eucalyptus tectifica</i> (20%)	<i>Terminalia ferdinandiana</i> (30%)	<i>Chrysopogon fallax</i> (50%)
<i>Corymbia foelscheana</i> (20%)	<i>Cochlospermum fraseri</i> (5%)	-
<i>E. tintinnans</i> (5%)	<i>Hakea arborescens</i> (2%)	-
Soil		
Slope	1%	
Aspect	Southwest	
Drainage Potential	Well drained	
Gravel cover	5%	
Rock cover	0%	



Soil Profile				
Horizon	Depth range (m)	Soil description	Soil type	Comments
A1	0.00-0.10	Very dusky red (2.5YR2.5/2) clay LOAM, coarse fragment 3 – 4 mm with clay inclusions (90% abundance)	Kandasol	Sample ASS06_0.00-0.10
B1	0.10–0.40	Yellowish red (5YR4/6) clay LOAM, coarse fragments 3 – 4 mm with clay inclusions (95% abundance)	Kandasol	Sample ASS06_0.10-0.40
B2	0.40–0.60	Dark red (10YR3/6) clay LOAM, coarse fragments 4 mm with clay inclusions (90% abundance)	Kandasol	Sample ASS06_0.40 – 0.60



Reference Site	ASS07	
Coordinates	-14.297234, 131.997434	
Vegetation Type	<i>Eucalyptus tectifica</i> mid high woodland with <i>C. foelscheana</i> over <i>T. pterocarya</i> and <i>B. megaphyllus</i> with a <i>C. fallax</i> ground layer.	
Corrected land unit	3c	
Ground cover	Vegetation 45% Leaf litter 30% Bare soil 20% Rock 0% Gravel 5%	
Other site notes	Few termite mounds, Hyptis weed present	
Vegetation		
Upper Stratum	Mid Stratum	Ground Stratum
Cover: 25% Height range: 4 – 8 m Average height: 5.5 m	Cover: 20% Height range: 1 – 6 m Average height: 3 m	Cover: 65%
Species		
<i>Corymbia foelscheana</i> (5%)	<i>Terminalia pterocarya</i> (5%)	<i>Themeda triandra</i> (10%)
<i>Eucalyptus tectifica</i> (20%)	<i>Brachychiton megaphyllus</i> (5%)	<i>Themeda sp</i> (5%)
-	<i>C. foelscheana</i> (5%)	<i>Chrysopogon fallax</i> (40%)
-	<i>E. tetradonta</i> (5%)	Mixed <i>Sorghum</i> (10%)
Soil		
Slope	1%	
Aspect	Southwest	
Drainage Potential	Well drained	
Gravel cover	5%	
Rock cover	0%	



Soil Profile				
Horizon	Depth range (m)	Soil description	Soil type	Comments
A1	0.00-0.15	Dark reddish brown (2.5YR3/4) clay LOAM, coarse fragments 3 mm (90% abundance) with clay inclusions	Kandasol	Sample ASS07_0.00-0.15
B1	0.15-1.00	Dusky red (10YR3/4) clay LOAM, coarse fragments 3 - 5 mm (95% abundance) with clay inclusions	Kandasol	Sample ASS07_0.15-1.00

Reference Site	ASS08
Coordinates	-14.298077, 132.000543
Vegetation Type	<i>Eucalyptus tectifica</i> mid high woodland with <i>Corymbia foelscheana</i> and <i>Erythrophleum chlorostachys</i> mid storey over <i>Themeda triandra</i> and <i>Sehima nervosum</i> ground layer.
Corrected land unit	3d
Ground cover	Vegetation 65% Leaf litter 10% Bare soil 20% Rock 0% Gravel 5%
Other site notes	Hyptis (<i>Mesosphaerum suaveolens</i>) sparse throughout whole area, dense near Beasley Road, evidence of fire (fire scar 1m) approximately 1 year old

Vegetation		
Upper Stratum	Mid Stratum	Ground Stratum
Cover: 25% Height range: 6-10 m Average height: 8.5 m	Cover: 20% Height range: 2 - 6 m Average height: 4	Cover: 60%
Species		
<i>Eucalyptus tectifica</i> (15%)	<i>Eucalyptus tectifica</i> (15%)	<i>Themeda triandra</i> (10%)
<i>Corymbia foelscheana</i> (10%)	<i>Ficus aculeata</i> (5%)	<i>Sehima nervosum</i> (50%)

Soil		
Slope	2-3	
Aspect	South	
Drainage Potential	Well drained	
Gravel cover	5%	
Rock cover	0%	
		



Soil Profile				
Horizon	Depth range (m)	Soil description	Soil type	Comments
A1	0.00-0.10	Dark reddish brown (5YR3/4) clay LOAM, coarse fragment 3 mm (90% abundance) with clay inclusions	Kandasol	Sample ASS08_0.0-0.10
B1	0.10-0.40	Dark reddish brown (2.5YR3/4) clay LOAM, coarse fragments 3 mm (90% abundance) with clay inclusions	Kandasol	Sample ASS08_0.10-0.40
B2	0.40-1.00	Dark red (2.5YR3/6) sandy clay LOAM, coarse fragments 3 – 5 mm (80% inclusions) with clay inclusions	Kandasol	Sample ASS08_0.40-1.00

Reference Site	ASS09
Coordinates	-14.296645, 132.003575
Vegetation Type	<i>Corymbia foelscheana</i> mid high open woodland with <i>Erythrophleum chlorostachys</i> over <i>E. chlorostachys</i> with dense <i>Hyptis</i> grassland.
Corrected land unit	3d
Ground cover	Vegetation 45% Leaf litter 45% Bare soil 15% Rock 0% Gravel 5%
Other site notes	Occasional termite mounds, <i>Hyptis</i> (<i>Mesosphaerum suaveolens</i>) dense throughout. Evidence of past fires (fire scars) approximately 2 years old.

Vegetation		
Upper Stratum	Mid Stratum	Ground Stratum
Cover: 35% Height range: 8 – 12 m Average height: 9.5 m	Cover: 40% Height range: 2 – 6 m Average height: 4 m	Cover: 90%
Species		
<i>Eucalyptus tectifica</i> (15%)	<i>Erythrophleum chlorostachys</i> (30%)	<i>Hyptis</i> (90%)
<i>Corymbia foelscheana</i> (20%)	<i>Cochlospermum fraseri</i> (5%)	-
-	<i>Brachychiton megaphyllus</i> (2%)	-
-	<i>Gardenia megasperma</i> (5%)	-

Soil	
Slope	1-2% undulating
Aspect	Southeast
Drainage Potential	Well drained
Gravel cover	5%
Rock cover	0%

		
<p style="text-align: center;">Gravel portion</p>		

Soil Profile				
Horizon	Depth range (m)	Soil description	Soil type	Comments
A1	0.00 – 0.10	Yellowish red (5YR4/6) clayey SAND, coarse fragments 5 mm (60% abundance)	Kandasol	Sample ASS09_0.0-0.10
B1	0.10 – 0.40	Red (2.5YR4/6) clayey SAND, coarse fragments 5-10 mm (50% abundance) with clay inclusions	Kandasol	Sample ASS09_0.10-0.40
B2	0.40 – 1.00	Dark red (2.5YR3/6) clayey SAND, coarse fragments 5-10 mm (60% abundance)	Kandasol	Sample ASS09_0.40-1.00


Reference Site	ASS10	
Coordinates	-14.295338, 132.006852	
Vegetation Type	<i>Eucalyptus tectifica</i> mid high open woodland over <i>Eucalyptus tectifica</i> and <i>Erythrophleum chlorostachys</i> mid high open shrubland over <i>Heteropogon contortus</i> tussock grassland	
Corrected land unit	2c	
Ground cover	Vegetation 95% Leaf litter 5% Bare soil 0% Rock 0% Gravel 0%	
Other site notes	Dense <i>Hypitis</i> (<i>Mesosphaerum suaveolens</i>) throughout, small patch of Mission Grass – perennial (<i>Cenchrus polystachios</i>)	
Vegetation		
Upper Stratum	Mid Stratum	Ground Stratum
Cover: 30% Height range: 6 – 10 m Average height: 8 m	Cover: 5% Height range: 2-4 m Average height: 3 m	Cover: 90% Height range: 0 – 1.5 m Average height: 0.7 m
Species		
<i>Eucalyptus tectifica</i> (20%)	<i>Erythrophleum chlorostachys</i> (5%)	Mixed Sorghum (90%)
<i>Erythrophleum chlorostachys</i> (10%)		
Soil		
Slope	2-3%	
Aspect	Southeast	
Drainage Potential	Well drained	
Gravel cover	0%	
Rock cover	0%	




Gravel portion




Soil Profile				
Horizon	Depth range (m)	Soil description	Soil type	Comments
A1	0.00 – 0.10	Dark reddish brown (5YR3/3/) clayey SAND, coarse fragments 3 – 5 mm (50% abundance)	Rudosol	Sample ASS10_0.0-0.10
B1	0.10 – 0.50	Reddish brown (5YR 4/4) clayey SAND, coarse fragments 3-10 mm (60% abundance)	Rudosol	Sample ASS10_0.10-0.50
B2	0.50 – 1.00	Red (2.5YR4/6) clayey SAND, coarse fragments 5-10 mm (60% abundance) with clay inclusions	Rudosol	Sample ASS09_0.50-1.00

Reference Site	BSS12		
Coordinates	-14.294025, 131.975466		
Vegetation Type	<i>A full site assessment was not undertaken</i>		
Corrected land unit	3a		
Ground cover	Vegetation Leaf litter Bare soil Rock Gravel		
Other site notes	Site at same location as BSS1		
Vegetation			
Upper Stratum % cover - 35 Height range (m) – 7-14 Average height (m) - 10	Mid Stratum % cover - 5 Height range (m) – 0.5-7 Average height (m) - 3	Ground Stratum % cover - 20 Height range (m) – 0-0.5 Average height (m) – 0.2	
-	-	-	
-	-	-	
-	-	-	
Soil			
Slope	3%*		
Aspect	Southeast		
Drainage Potential	N/A		
Gravel cover	N/A		
Rock cover	N/A		


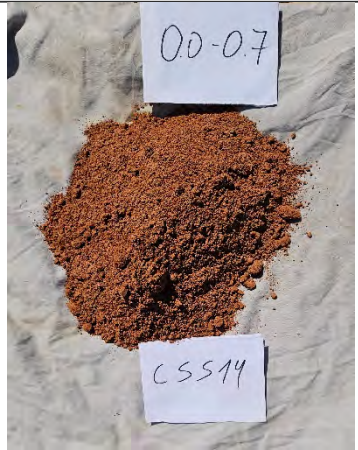
		
Gravel portion*		Not recorded

*Estimated with aerial imagery

Soil Profile				
Horizon	Depth range (m)	Soil description	Soil type	Comments
A1	0-0.4	Silty CLAY	Kandasol	Hard setting with crust on top, A horizon not present. No samples were collected

Reference Site	BSS13		
Coordinates	-14.293227, 131.97412		
Vegetation Type	<i>A full site assessment was not undertaken</i>		
Corrected land unit	3a		
Ground cover	Vegetation Leaf litter Bare soil Rock Gravel		
Other site notes	Site at same location as BSS2		
Vegetation			
Upper Stratum % cover - 30 Height range (m) – 12-18 Average height (m) - 16	Mid Stratum % cover - 10 Height range (m) – 1-7 Average height (m) - 3	Ground Stratum % cover - 60 Height range (m) – 0-1 Average height (m) – 0.8	
-	-	-	
-	-	-	
-	-	-	
Soil			
Slope	1.5%*		
Aspect	Southwest		
Drainage Potential	N/A		
Gravel cover	N/A		
Rock cover	N/A		
Gravel portion		Not recorded	

Soil Profile				
Horizon	Depth range (m)	Soil description	Soil type	Comments
A1	0-0.40	Silty clay LOAM	Kandasol	Hard setting with crust on top, A horizon not present. No samples were collected

Reference Site	CSS14	
Coordinates	-14.294423, 131.966924	
Vegetation Type	<i>Eucalyptus tectifica</i> low open woodland over <i>Hakea arborescens</i> and <i>Erythrophleum chlorostachys</i> with a <i>Melhania oblongifolia</i> and mixed <i>Sorghum</i> ground layer.	
Corrected land unit	3a	
Ground cover	Vegetation 15% Leaf litter 30% Bare soil 15% Rock 10% Gravel 30%	
Other site notes	No weeds or fire scars observed	
Vegetation		
Upper Stratum	Mid Stratum	Ground Stratum
Cover: 12% Height range: 6- 10 m Average height: 7 m	Cover: 34% Height range: 2 - 6 m Average height: 5 m	Cover: 20%
Species		
<i>Eucalyptus tectifica</i> (5%)	<i>Hakea arborescens</i> (20%)	<i>Melhania oblongifolia</i> (10%)
<i>Corymbia foelscheana</i> (5%)	<i>Ficus aculeata</i> (2%)	Mixed sorghum (10%)
<i>Eucalyptus confertiflora</i> (2%)	<i>Cochlospermum fraseri</i> (5%)	-
-	<i>Vachellia pachyphloia</i> (2%)	-
-	<i>Erythrophleum chlorostachys</i> (5%)	-
Soil		
Slope	0.5 – 1.5%	 
Aspect	South	
Drainage Potential	Moderately well drained	
Gravel cover	30	
Rock cover	10	



Soil Profile				
Horizon	Depth range (m)	Soil description	Soil type	Comments
A1	0.00 – 0.70	Red (2.5YR4/8) silty CLAY, coarse fragments 5-13 mm (60% abundance)	Kandasol	Top layer with cobbles and some rocks found while digging. Sample CSS14_0.0-0.7

APPENDIX C SOIL LABORATORY RESULTS



CERTIFICATE OF ANALYSIS

Work Order : **ES2517364**
Client : **ECOZ ENVIRONMENTAL SERVICES**
Contact : SIMON AYLOTT
Address : Level 1, 70 Cavenagh Street, Darwin
Darwin 0800
Telephone : ----
Project : ----
Order number : ----
C-O-C number : ----
Sampler : ----
Site : ----
Quote number : ES25ECOZENV0003_V2
No. of samples received : 22
No. of samples analysed : 21

Page : 1 of 7
Laboratory : Environmental Division Sydney
Contact : Andrew Wotherspoon
Address : 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone : +61-2-8784 8555
Date Samples Received : 12-Jun-2025 11:30
Date Analysis Commenced : 17-Jun-2025
Issue Date : 20-Jun-2025 16:14



Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ankit Joshi	Senior Chemist - Inorganics	Sydney Inorganics, Smithfield, NSW
Dian Dao	Senior Chemist - Inorganics	Sydney Inorganics, Smithfield, NSW
Layla Hafner	Acid Sulphate Soils - Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD



General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contract for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- ALS is not NATA accredited for the analysis of Exchangeable Cations on Alkaline Soils when performed under ALS Method ED006.
- EA058 Emerson: V. = Very, D. = Dark, L. = Light, VD. = Very Dark
- ED007 and ED008: When Exchangeable Al is reported from these methods, it should be noted that Rayment & Lyons (2011) suggests Exchange Acidity by 1M KCl - Method 15G1 (ED005) is a more suitable method for the determination of exchange acidity (H⁺ + Al³⁺).
- ALS is not NATA accredited for the analysis of bulk density in a soil matrix.



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	ASS3_0.0_0.3	ASS3_0.3_0.6	ASS4_0.0_0.3	ASS4_0.3_0.6	ASS5_0.0_0.3
Sampling date / time				05-Jun-2025 00:00	05-Jun-2025 00:00	05-Jun-2025 00:00	05-Jun-2025 00:00	05-Jun-2025 00:00	
Compound	CAS Number	LOR	Unit	ES2517364-001	ES2517364-002	ES2517364-003	ES2517364-004	ES2517364-005	
				Result	Result	Result	Result	Result	
EA002: pH 1:5 (Soils)									
pH Value	----	0.1	pH Unit	6.5	5.6	5.8	5.8	5.8	
EA010: Conductivity (1:5)									
Electrical Conductivity @ 25°C	----	1	µS/cm	22	5	5	7	5	
EA051 : Bulk Density									
Ø Bulk Density	BULK_DENSITY	1	kg/m3	1240	1340	1340	1120	1140	
EA058: Emerson Aggregate Test									
Color (Munsell)	----	-	-	Dark Yellowish Brown (10YR 3/4)	Strong Brown (7.5YR 4/6)	Brown (7.5YR 5/3)	Brown (7.5YR 5/4)	Brown (7.5YR 4/2)	
Texture	----	-	-	Clay Loam Sandy	Medium Clay	Clay Loam	Medium Heavy Clay	Silty Clay Loam	
Emerson Class Number	EC/TC	-	-	5	2	3	3	3	
ED007: Exchangeable Cations									
Exchangeable Calcium	----	0.1	meq/100g	0.5	0.1	0.2	0.6	0.7	
Exchangeable Magnesium	----	0.1	meq/100g	1.4	2.2	0.8	1.5	0.6	
Exchangeable Potassium	----	0.1	meq/100g	0.3	0.3	0.2	0.3	0.2	
Exchangeable Sodium	----	0.1	meq/100g	<0.1	<0.1	<0.1	<0.1	<0.1	
Cation Exchange Capacity	----	0.1	meq/100g	2.2	2.7	1.2	2.4	1.5	
Exchangeable Sodium Percent	----	0.1	%	1.6	1.6	1.8	1.2	1.0	
EK072: Phosphate Sorption Capacity									
Phosphate Sorption Capacity	----	250	mg P sorbed/kg	687	828	665	698	438	



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)		Sample ID		ASS5_0.3_0.6	ASS5_0.6_1.0	ASS6_0.0_0.1	ASS6_0.1_0.4	ASS6_0.4_0.9
Sampling date / time		05-Jun-2025 00:00		05-Jun-2025 00:00	05-Jun-2025 00:00	05-Jun-2025 00:00	05-Jun-2025 00:00	05-Jun-2025 00:00
Compound	CAS Number	LOR	Unit	ES2517364-006	ES2517364-007	ES2517364-008	ES2517364-009	ES2517364-010
				Result	Result	Result	Result	Result
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	6.1	6.0	5.8	5.7	6.1
EA010: Conductivity (1:5)								
Electrical Conductivity @ 25°C	----	1	µS/cm	8	7	7	5	6
EA051 : Bulk Density								
ø Bulk Density	BULK_DENSITY	1	kg/m3	1140	953	1120	1010	954
EA058: Emerson Aggregate Test								
Color (Munsell)	----	-	-	Reddish Brown (5YR 4/4)	Dark Red (2.5YR 3/6)	Very Dark Brown (7.5YR 2.5/3)	Brown (7.5YR 4/4)	Red (2.5YR 4/6)
Texture	----	-	-	Light Clay	Light Clay	Clay Loam	Light Medium Clay	Medium Clay
Emerson Class Number	EC/TC	-	-	5	5	3	2	5
ED007: Exchangeable Cations								
Exchangeable Calcium	----	0.1	meq/100g	0.7	1.1	2.0	0.6	0.8
Exchangeable Magnesium	----	0.1	meq/100g	1.2	3.0	0.8	0.8	2.0
Exchangeable Potassium	----	0.1	meq/100g	0.2	0.5	0.3	0.2	0.5
Exchangeable Sodium	----	0.1	meq/100g	<0.1	<0.1	<0.1	<0.1	<0.1
Cation Exchange Capacity	----	0.1	meq/100g	2.1	4.7	3.1	1.6	3.4
Exchangeable Sodium Percent	----	0.1	%	1.0	1.3	<0.1	0.8	2.7
EK072: Phosphate Sorption Capacity								
Phosphate Sorption Capacity	----	250	mg P sorbed/kg	690	1260	606	531	1110



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)		Sample ID		ASS7_0.0_0.15	ASS7_0.15_1.0	ASS8_0.0_0.1	ASS8_0.1_0.4	ASS8_0.4_1.0
Sampling date / time		05-Jun-2025 00:00		05-Jun-2025 00:00	05-Jun-2025 00:00	05-Jun-2025 00:00	05-Jun-2025 00:00	05-Jun-2025 00:00
Compound	CAS Number	LOR	Unit	ES2517364-011	ES2517364-012	ES2517364-013	ES2517364-014	ES2517364-015
				Result	Result	Result	Result	Result
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	6.4	6.7	6.4	6.1	6.2
EA010: Conductivity (1:5)								
Electrical Conductivity @ 25°C	----	1	µS/cm	14	15	8	12	11
EA051 : Bulk Density								
ø Bulk Density	BULK_DENSITY	1	kg/m3	1090	960	1120	958	953
EA058: Emerson Aggregate Test								
Color (Munsell)	----	-	-	Dark Reddish Brown (5YR 3/3)	Dark Reddish Brown (5YR 3/4)	Dark Reddish Brown (5YR 3/2)	Dark Reddish Brown (5YR 3/4)	Dark Reddish Brown (2.5YR 3/4)
Texture	----	-	-	Silty Clay Loam	Medium Clay	Sandy Clay Loam	Light Medium Clay	Light Medium Clay
Emerson Class Number	EC/TC	-	-	3	4	3	5	4
ED007: Exchangeable Cations								
Exchangeable Calcium	----	0.1	meq/100g	3.5	3.3	2.4	2.7	2.4
Exchangeable Magnesium	----	0.1	meq/100g	1.1	1.3	0.9	1.6	2.0
Exchangeable Potassium	----	0.1	meq/100g	0.5	0.5	0.3	0.5	0.6
Exchangeable Sodium	----	0.1	meq/100g	<0.1	<0.1	<0.1	<0.1	<0.1
Cation Exchange Capacity	----	0.1	meq/100g	5.1	5.1	3.6	4.8	5.1
Exchangeable Sodium Percent	----	0.1	%	<0.1	<0.1	<0.1	0.2	0.4
EK072: Phosphate Sorption Capacity								
Phosphate Sorption Capacity	----	250	mg P sorbed/kg	536	1540	1130	1340	1700



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	ASS9_0.0_0.1	ASS9_0.1_0.4	ASS9_0.4_1.0	ASS10_0.0_0.1	ASS10_0.1_0.5
Sampling date / time				05-Jun-2025 00:00	05-Jun-2025 00:00	05-Jun-2025 00:00	05-Jun-2025 00:00	05-Jun-2025 00:00	
Compound	CAS Number	LOR	Unit	ES2517364-016	ES2517364-017	ES2517364-018	ES2517364-019	ES2517364-020	
				Result	Result	Result	Result	Result	
EA002: pH 1:5 (Soils)									
pH Value	----	0.1	pH Unit	6.0	6.1	6.5	6.2	6.1	
EA010: Conductivity (1:5)									
Electrical Conductivity @ 25°C	----	1	µS/cm	7	8	13	9	5	
EA051 : Bulk Density									
Ø Bulk Density	BULK_DENSITY	1	kg/m3	1190	1200	1010	1130	1340	
EA058: Emerson Aggregate Test									
Color (Munsell)	----	-	-	Dark Brown (7.5YR 3/3)	Dark Red (2.5YR 3/6)	Dark Red (2.5YR 3/6)	Dark Brown (7.5YR 3/3)	Dark Brown (7.5YR 3/4)	
Texture	----	-	-	Clay Loam Sandy	Light Medium Clay	Medium Clay	Clay Loam	Clay Loam Sandy	
Emerson Class Number	EC/TC	-	-	3	4	4	3	2	
ED007: Exchangeable Cations									
Exchangeable Calcium	----	0.1	meq/100g	1.7	1.8	1.8	2.0	0.7	
Exchangeable Magnesium	----	0.1	meq/100g	0.7	1.2	1.3	1.1	1.0	
Exchangeable Potassium	----	0.1	meq/100g	0.2	0.2	0.2	0.3	0.2	
Exchangeable Sodium	----	0.1	meq/100g	<0.1	<0.1	<0.1	<0.1	<0.1	
Cation Exchange Capacity	----	0.1	meq/100g	2.7	3.2	3.3	3.4	1.9	
Exchangeable Sodium Percent	----	0.1	%	<0.1	0.4	0.5	<0.1	<0.1	
EK072: Phosphate Sorption Capacity									
Phosphate Sorption Capacity	----	250	mg P sorbed/kg	723	1130	1450	858	681	



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)		Sample ID		ASS14_0.0_0.7	----	----	----	----
		Sampling date / time		05-Jun-2025 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit	ES2517364-021	-----	-----	-----	-----
				Result	----	----	----	----
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	8.9	----	----	----	----
EA010: Conductivity (1:5)								
Electrical Conductivity @ 25°C	----	1	µS/cm	65	----	----	----	----
EA051 : Bulk Density								
Ø Bulk Density	BULK_DENSITY	1	kg/m3	1220	----	----	----	----
EA058: Emerson Aggregate Test								
Color (Munsell)	----	-	-	Reddish Brown (2.5YR 4/4)	----	----	----	----
Texture	----	-	-	Medium Heavy Clay	----	----	----	----
Emerson Class Number	EC/TC	-	-	2	----	----	----	----
ED006: Exchangeable Cations on Alkaline Soils								
Ø Exchangeable Calcium	----	0.2	meq/100g	4.1	----	----	----	----
Ø Exchangeable Magnesium	----	0.2	meq/100g	0.9	----	----	----	----
Ø Exchangeable Potassium	----	0.2	meq/100g	<0.2	----	----	----	----
Ø Exchangeable Sodium	----	0.2	meq/100g	<0.2	----	----	----	----
Ø Cation Exchange Capacity	----	0.2	meq/100g	5.0	----	----	----	----
Ø Exchangeable Sodium Percent	----	0.2	%	<0.2	----	----	----	----
EK072: Phosphate Sorption Capacity								
Phosphate Sorption Capacity	----	250	mg P sorbed/kg	4860	----	----	----	----

Inter-Laboratory Testing

Analysis conducted by ALS Brisbane, NATA accreditation no. 825, site no. 818 (Chemistry / Biology).

(SOIL) EA058: Emerson Aggregate Test

APPENDIX D MOUND SIZING CALCULATIONS

Mound calculations were based on the following assumptions:

- Design wastewater flows were based on standard 5 person/3 bedroom households
- Depth of soil available for absorption was based on the most common soil profile encountered at the site – land unit 3a may have limitations in soil depth
- Slope was based conservatively on the maximum slope (3%) within the land units assessed, and upslope and downslope correction factors are based on this.
- Sand loading rates assume primary treatment will be undertaken, and basal and linear loading rates are based on the soil texture and structure encountered in test pits, which may vary across the study area.
- These calculations are an estimate only because dispersive soils require specialist design techniques. Table N1 in AS 1547-2012 states that:

To enable use of such soils for on-site wastewater land application, special design requirements and distribution techniques or soil modification procedures will be necessary. For any system designed for these soils, the effluent absorption rate shall be based upon soil permeability testing. Specialist soils advice and special design techniques will be required for clay dominated soils having dispersive (sodic) or shrink/swell behaviour. Such soils shall be treated as Category 6 soils. In most situations, the design will need to rely on more processes than just absorption by the soil.

- Standard figures were used for many of the mound calculations based on the technical guidelines from Whitehead et al. (2005) and actual site conditions may vary.
- Calculations assume grass or turf will be established on mound systems to aid in evapotranspiration

Mound Sizing Calculations			
Input Data	Code	Unit	
Daily effluent load	W	L/day	750
Quality			Primary treatment
Slope	NS	%	2
Soil depth to limiting layer	SD	m	1
Sand Loading Rate	SLR	mm/day	35
Basal Loading Rate	BLR	L/m/day	5
Linear Loading Rate	LLR	L/m/day	30
Batter Slope	BS		3:1
Upslope Correction Factor	UCF		0.94
Downslope Correction Factor	DCF		1.06

Calculations				
Required area	Code	Formula	Unit	
Absorption bed width	A	LLR/SLR	m	2.0
Absorption bed Length	B	W/LLR	m	20.0
Absorption bed thickness	F	N/A	m	0.3
Absorption bed area	Aa	A x B	m ²	40.0
Sand fill depth on upslope	Du	1-SD	m	0.60
Sand fill depth on downslope	Dd	$Du + A * (NS/100)$	m	0.64
Sand fill depth in centre	Dc	$(Du + Dd) / 2$	m	0.62
Capping depth	G		m	0.15
Capping depth peak	P		m	0.3
Basal Area	Ab	W/BLR	m	150
Basal width downslope (hydraulics)	J	$(LLR/BLR)-A$	m	4.0
Basal width downslope (geometry)	J	$(Dd+F+G) \times BS \times DCF$	m	3.47
Basal width upslope	I	$(Du+F+G) \times BS \times UCF$	m	2.96
End slope mound length	K	$(Dc + F + G) * BS$	m	3.21
Mound Length	L	$B + (2 * K)$	m	26.42
Mound Width	W	$A + I + J$	m	8.43
Mound Height	H	$Dc + F + G$	m	1.07



07 April 2026

Our ref.: EZ25072

Brad Cunnington
Director
Cunnington Rosse Town Planning and Consulting
brad@crtpc.com.au

Re: Addendum to 745 Edith Farms Road land capability assessment report

Dear Brad,

This document is an addendum to the 2018 Land Capability Assessment (LCA) – 745 Edith Farms Road report (EcOz 2018) for submission to the NT Department of Health (DoH) as part of a development application for six proposed subdivisions along Edith Farms Road, within NT Portion 7860 – see Figure 1¹. It aims to satisfy the requirement for a site-and-soil evaluation mandated in Clause 6.3 of the *Northern Territory Planning Scheme (2020)*.

This addendum should be read in conjunction with the original 2018 LCA report. It adds additional subdivisions to the scope of the 2018 report and evaluates these in the light of the report's conclusions. Because the 2018 LCA report was written using a previous version of the wastewater management guidelines (DoH 2014), this document also ensures that the report's conclusions are consistent with the updated DoH guidelines, principally the *Code of practice for wastewater management (DoH 2020)*. It is noted that the original report referenced the *Australian standards for on-site domestic wastewater management (AS/NZ 1547-2012)*, which is still current.

The 2018 LCA report evaluated the project area for the purpose of installing wastewater management systems in nine subdivisions. It was accompanied by a land suitability assessment (LSA) of the same area and involved both desktop and field-based research, and soil laboratory testing. The additional scope of work discussed in this addendum is for six subdivisions, all located within the project area previously assessed in the 2018 LCA report and accompanying LSA report.

Land units 2b, 2e, 3a and 3c occur within the proposed subdivisions. Four of the original LCA field assessment sites (SS4, SS5, SS6 and SS10) were within the proposed subdivision boundaries and are directly relevant to this update. They are land units 2b, 2e and 3c (see Figure 2). Note that land unit 3a has been excluded because it was found to be not suitable for development. A description of these land units and relevant lot numbers is included in Table 1.

¹ Mapping of cadastre boundaries (existing and proposed) has been made based on engineering drawings and satellite imagery and should not be used for construction or installation of WWM systems.

Table 1. Ground-truthed land unit data for proposed lots

Land unit	Summary	Drainage	Relevant lot numbers
2b	<i>Eucalyptus dichromophloia</i> ; Low open woodland to mid-high open woodland (<i>Eucalyptus umbrawarrens</i> and Lancewood in lower rainfall areas) with Spinifex and annual Sorghum grass layer	Well drained soils; very rapid run-off	Lots 1 - 5
2e	Low woodland or tall shrubland on shallow gravelly soils and open forest on rocky sandy soils with mainly Spinifex and annual Sorghum grass layer	Well drained soils; very rapid run-off	Lots 5 & 6
3a	<i>Eucalyptus tectifera</i> and <i>Eucalyptus foelscheana</i> ; Low woodland; frequently well-developed understorey of <i>Hakea arborescens</i> and <i>Cochlospermum fraseri</i> and mixed annual Sorghum and perennial grass layer	Well drained soils; moderately rapid run-off	Lot 1
3c	<i>Eucalyptus foelscheana</i> low woodland with few shrubs and mainly perennial <i>Sehima</i> tall grass layer	Well drained soils; slow run-off	All lots (1 - 6)

Other relevant information regarding the proposed subdivisions:

- A first-order stream runs through Lots 5 and 6. This has been buffered by 25 m according to the NT *Land Clearing Guidelines* (2024).
- Four existing bores occur in the project area (see Figure 2). Setback distances of 100 m between land application areas and existing or indicative bores was found to be achievable within each lot.
- Land unit 2e was found to have rocky outcrops in the original LCA report (near existing lots 7, 8, & 9). A review of field data from survey site SS5 shows that this limitation is unlikely to be present within proposed lots 5 and 6.
- Recommended land application treatment systems are mound and subsurface drip irrigation for both 2e (lots 5 and 6) and 3c (all lots), with preference given to land unit 3c where possible (Table 2). Indicative land application areas are displayed in Figure 2.

Table 2. Land units and recommended treatment and application systems

Land unit	Represented lots	Survey sites	Design considerations/ constraints	Recommended treatment system	Recommended land application system
2b	1	SS10	Well drained soils; very rapid run-off; bedrock at 1 m (shallow soil)	Primary treatment (septic tank) or Secondary treatment (AWTS)	Mound system ²
2e	6	SS5	Moderately- to rapidly-drained, moderate coarse fragments	Primary treatment (Septic tank)	Mound system subsurface drip irrigation; however, preference given to positioning system on land unit 3c
3c	1 - 6	SS6	Moderately- to rapidly-drained soils Flat to gently sloping Areas of lateritic bedrock at 0.7m (shallow soil) Moderate levels of coarse fragments Moderate permeability	Primary treatment (septic tank) or Secondary treatment (AWTS)	Mound system or subsurface drip irrigation

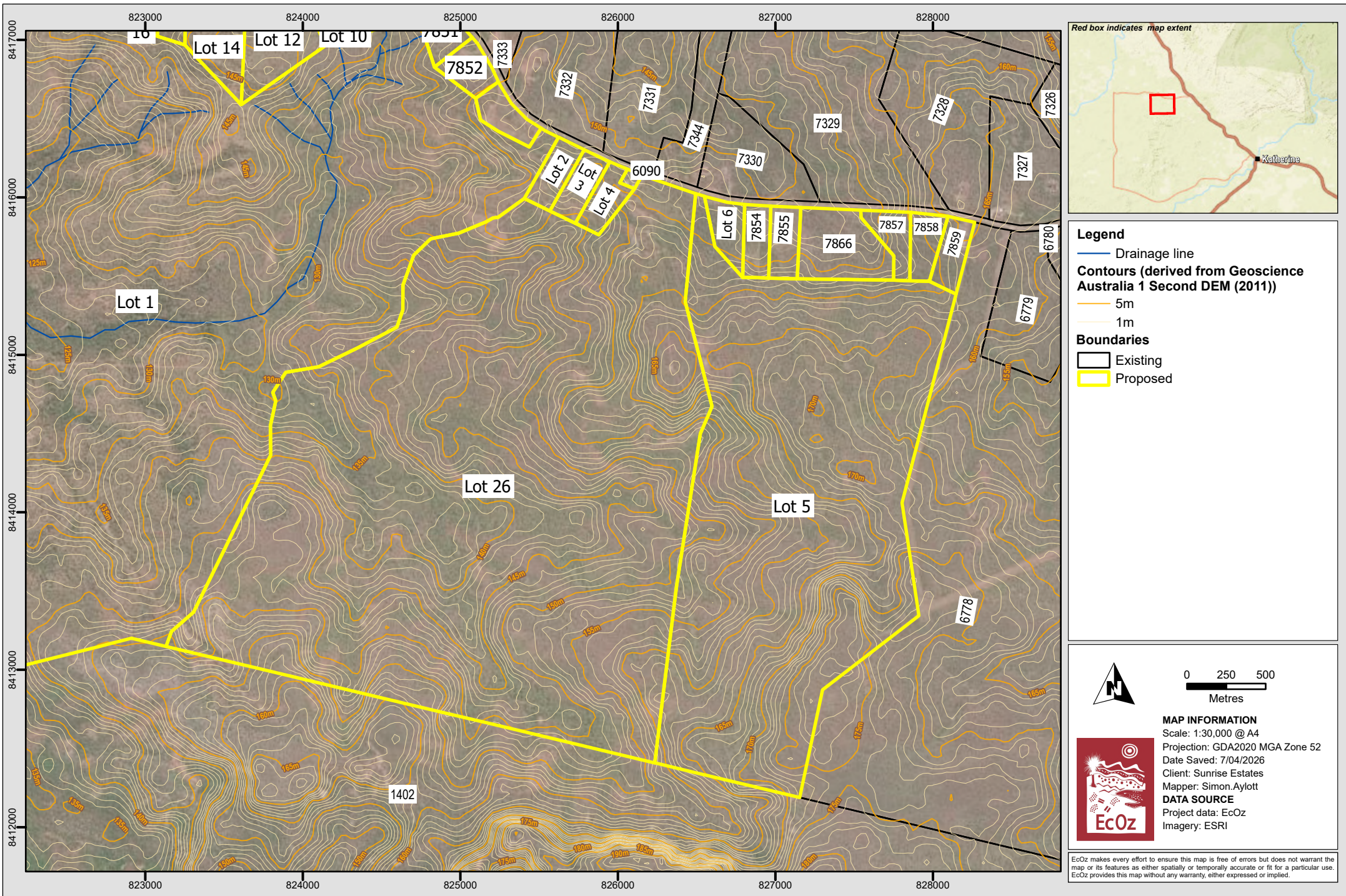
² While land unit 2b was not formally recommended for land application systems in the 2018 LCA, suitable land was mapped within the eastern edge of this land unit. It is included here based on SS10 attributes and land unit description.

The conclusions of the original 2018 LCA report were found to be relevant for the proposed new subdivisions and correctly describe wastewater management options in line with current guidelines. The presence of survey sites within the new subdivisions provides confidence that the land attributes have been adequately described.

Yours sincerely,

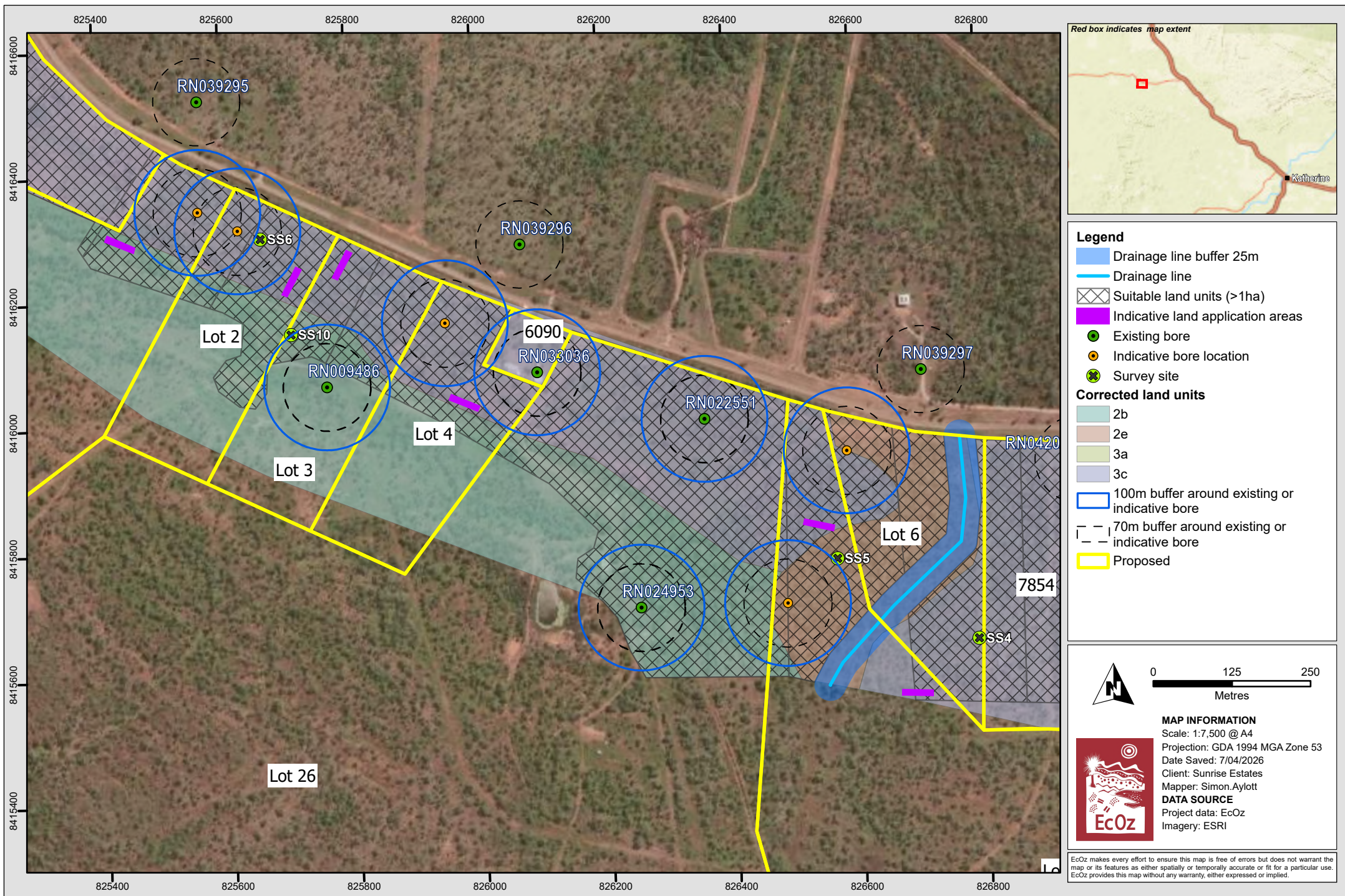
A handwritten signature in black ink that reads "Simon Aylott". The signature is written in a cursive, flowing style.

Simon Aylott
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 Layout: Proposed lots and existing infrastructure

Figure 1. Proposed lots and existing infrastructure



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 Layout: Figure 2. Map of proposed sites for treatment and land application systems and applicable setbacks

Figure 2. Map of proposed sites for treatment and land application systems and applicable setbacks



Land Capability Assessment for Onsite Waste Management 745 Edith Farms Road Daly River Pastoral Pty Ltd



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APPENDIX A SITE VEGETATION AND SOIL BORE LOGS

APPENDIX B LABORATORY RESULTS

APPENDIX C WATER AND NUTRIENT BALANCES AND MOUND SIZING CALCULATIONS

**APPENDIX D STANDARD DESIGNS FOR PROPOSED WASTEWATER MANAGEMENT
INFRASTRUCTURE**

ACRONYMS

AS/NZS	Australian Standards/New Zealand Standards
AWTS	Aerated wastewater treatment system
BOD	Biological Oxygen Demand
BoM	Bureau of Meteorology
DoH	Department of Health
LCA	Land Capability Assessment
LSA	Land Suitability Assessment
LTAR	Long term acceptance rate
N	Nitrogen
NT	Northern Territory
NTPS	Northern Territory Planning Scheme
P	Phosphorus
SS	Suspended solids
TP	Test pit

1 INTRODUCTION

Land Capability Assessments (LCAs) consider the capacity for an area of land to accommodate on-site wastewater treatment and land application. A range of site features contribute to the suitability of the land for this purpose, including lot size, climatic considerations and land form and features. An assessment of these aspects provides a preliminary indication of the considerations for designing wastewater treatment and land application systems on a site-specific scale.

The aim of this document is to investigate the capability of the land to accommodate onsite wastewater treatment systems with reference to NT *Guidelines for Land Capability Assessment for On-site Water Management* (DoH 2014) and *Australian/New Zealand Standards for On-site Domestic Wastewater Management* (AS/NZS 1547:2012).

1.1 Background

The existing lot is approximately 3530 ha in size and is located 40 km north of Katherine at Edith and comprises NT Portion 6777 ('the Property') (Figure 1).

The proposed subdivision seeks to subdivide nine lots ranging in size from 8.01 ha to 18.17 ha, all fronting onto and accessed via Edith Farms Road. The Property is currently leased for pastoral production and is unzoned. The Northern Territory Planning Scheme (NTPS) allows the subdivision of unzoned land with a minimum lot size of 8 ha, of which a minimum of 1 ha must be found suitable for development. The remaining lot is proposed to continue under pastoral production ('remaining pastoral lot'). The proposed lot design and existing infrastructure is shown in Figure 2.

A Land Suitability Assessment (LSA) was also undertaken by EcOz for the proposed development (EcOz 2018). The field assessment has identified that four of the current land unit types attributed to the Property are correct. Survey sites were located within each land unit to determine the accuracy of land unit descriptions and boundaries (Figure 3 and Figure 4). Additional soil pits and a vegetation assessment site were surveyed outside the subdivision lots to contextualise land unit distribution in the landscape and better understand soil properties.

Survey sites and the corresponding corrected land units attributed to the Property include:

- Land unit 2b: Survey site SS10
- Land unit 2e: Survey sites SS1 and SS5
- Land unit 3c: Survey sites SS2, SS3, SS4, SS6, SS7 and SS8
- Land unit 3a: Survey site VS9

1.2 Description of land

Location

The Property is located 40 km north of Katherine, along the Stuart Highway on Portion 6777 and is accessed via Edith Farms Road (Figure 1).

Address

745 Edith Farms Road, Edith, NT

Owner

Daly River Pastoral Pty Ltd.

Zoning

Unzoned

Existing site land use

Pastoral production

Surrounding site land use

Surrounding land use consists mainly of pastoral production. The adjacent land on the northern side of Edith Farms Road has been subdivided into large rural blocks, suitable for small scale cattle production. The local NT Volunteer Bushfire Brigade compound is located on the southern side of Edith Farms Road and has been previously subdivided from the Property.

1.3 Development details

Development permit

This LCA will be submitted along with the LSA and development application.

Subdivision layout

The proposed subdivision seeks to subdivide nine lots ranging in size from 8.01 ha to 18.17 ha, all fronting onto and accessed via Edith Farms Road (Figure 2).

Lot size

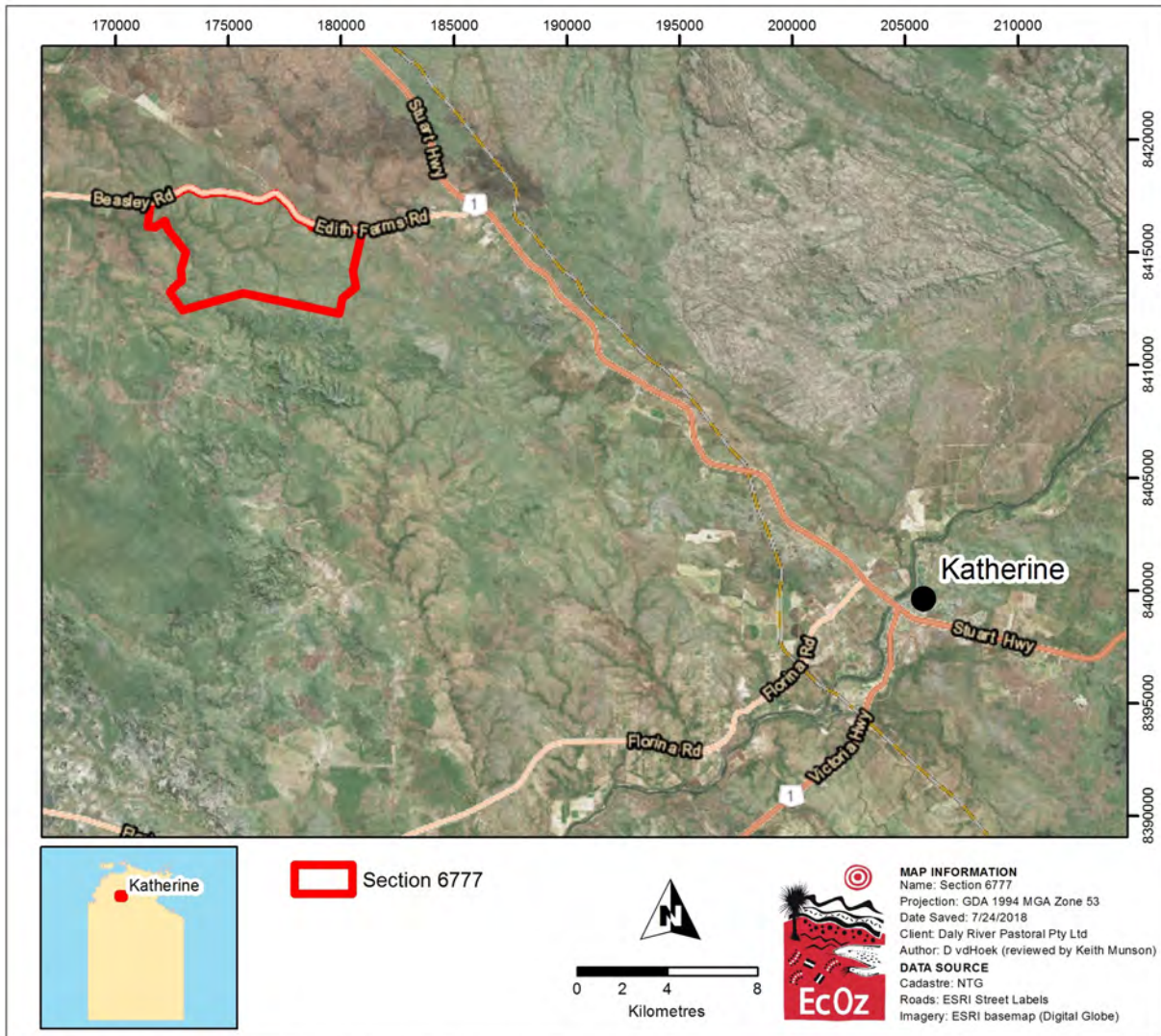
All lots are at least 8 ha in size, in accordance with unzoned land requirements under the NTPS.

Water supply

Water supply bores are proposed for each individual lot. Bores are proposed along the northern boundary of all lots. All lots are sufficiently sized to accommodate setbacks in the Code of Practice for Small On-site Sewage and Sullage Treatment Systems and the Disposal or Reuse of Sewage Effluent ('NT Code of Practice', THS 2014).

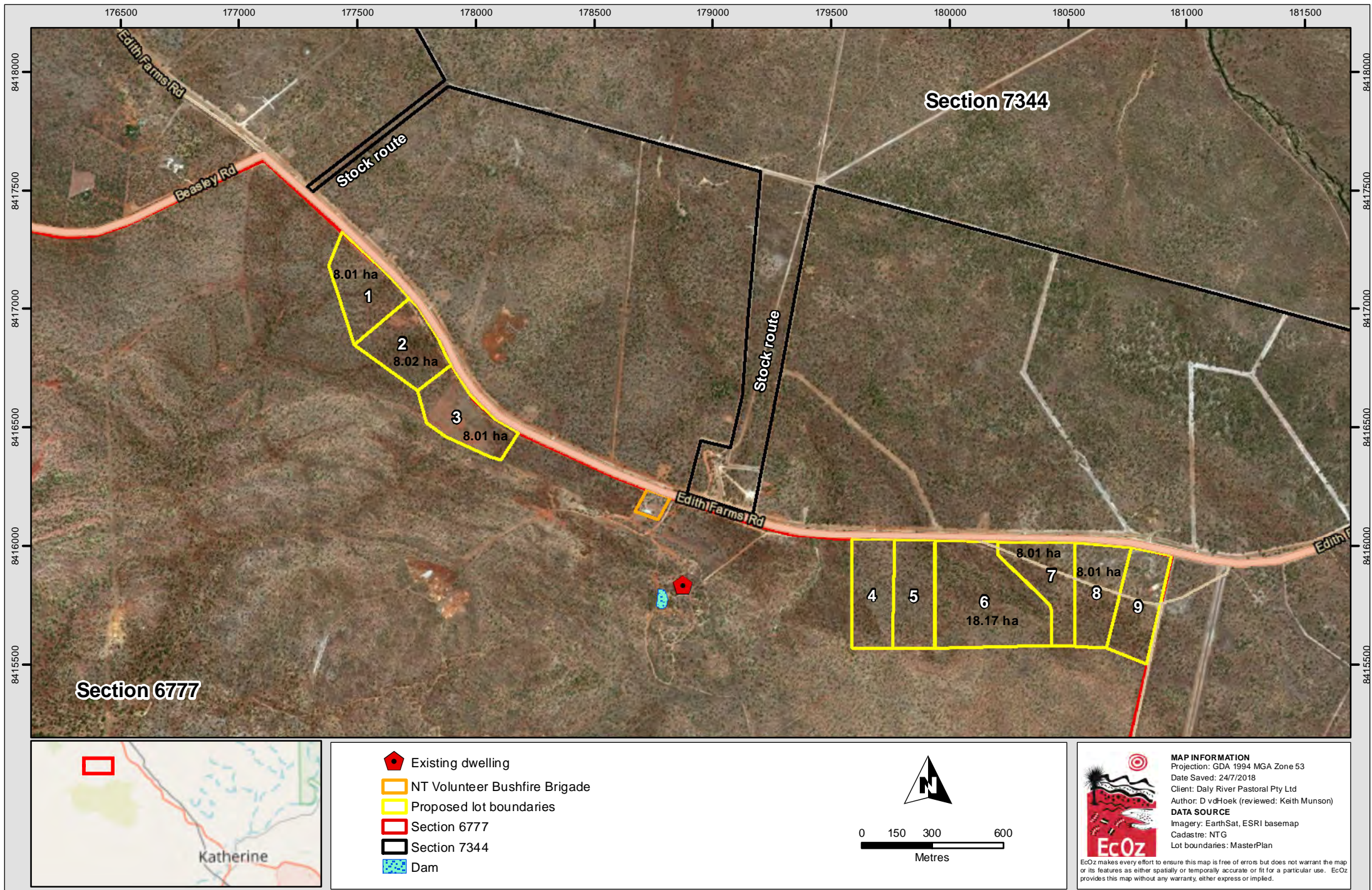
Anticipated waste water load

Wastewater loads have been estimated based on Appendix H in AS/NZS 1547:2012. It is assumed that each lot will support a standard three bedroom, five person household with a design wastewater load of 750 L per day (150 L/person/day).



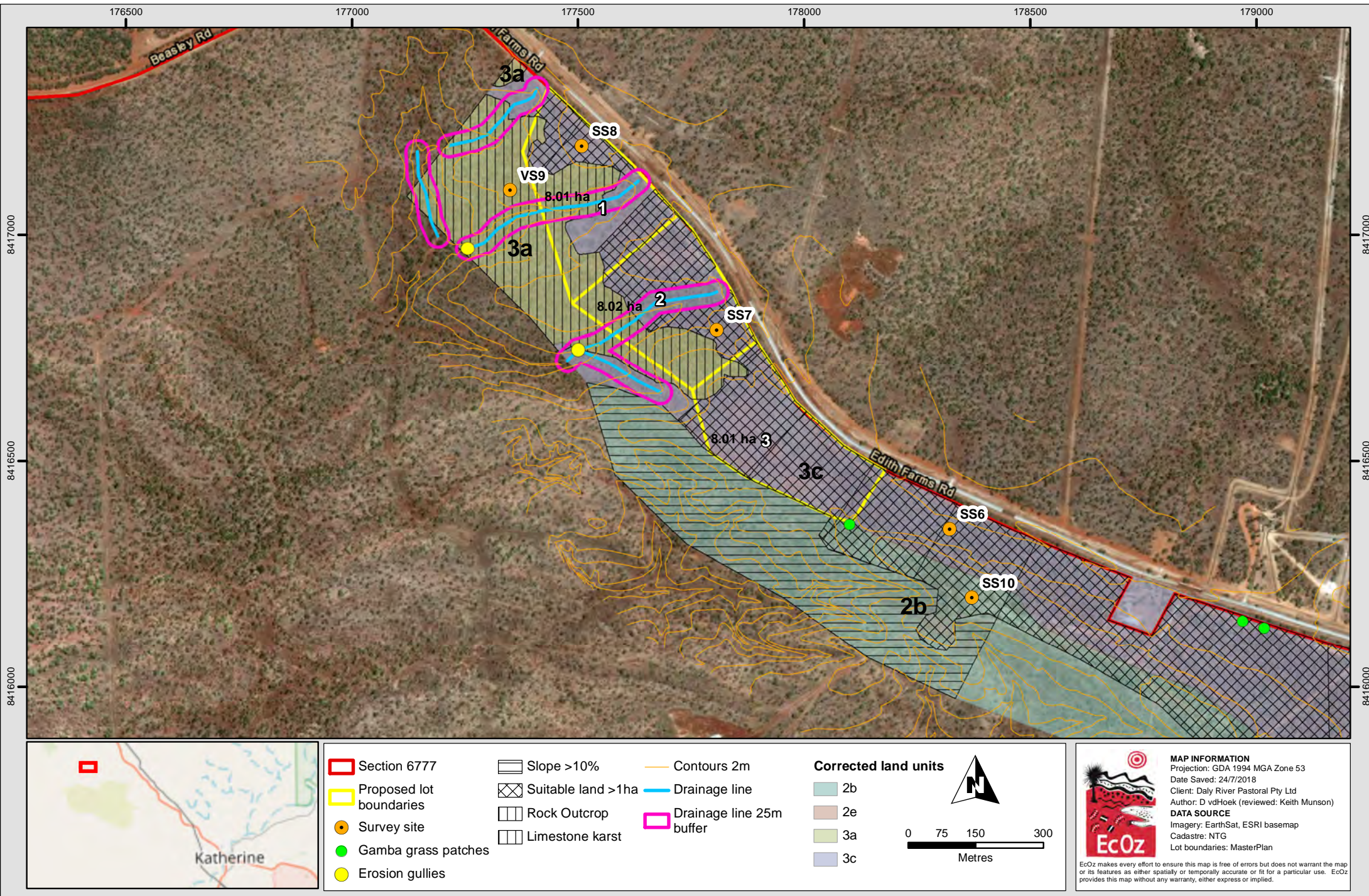
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Figure 1. Map of project location



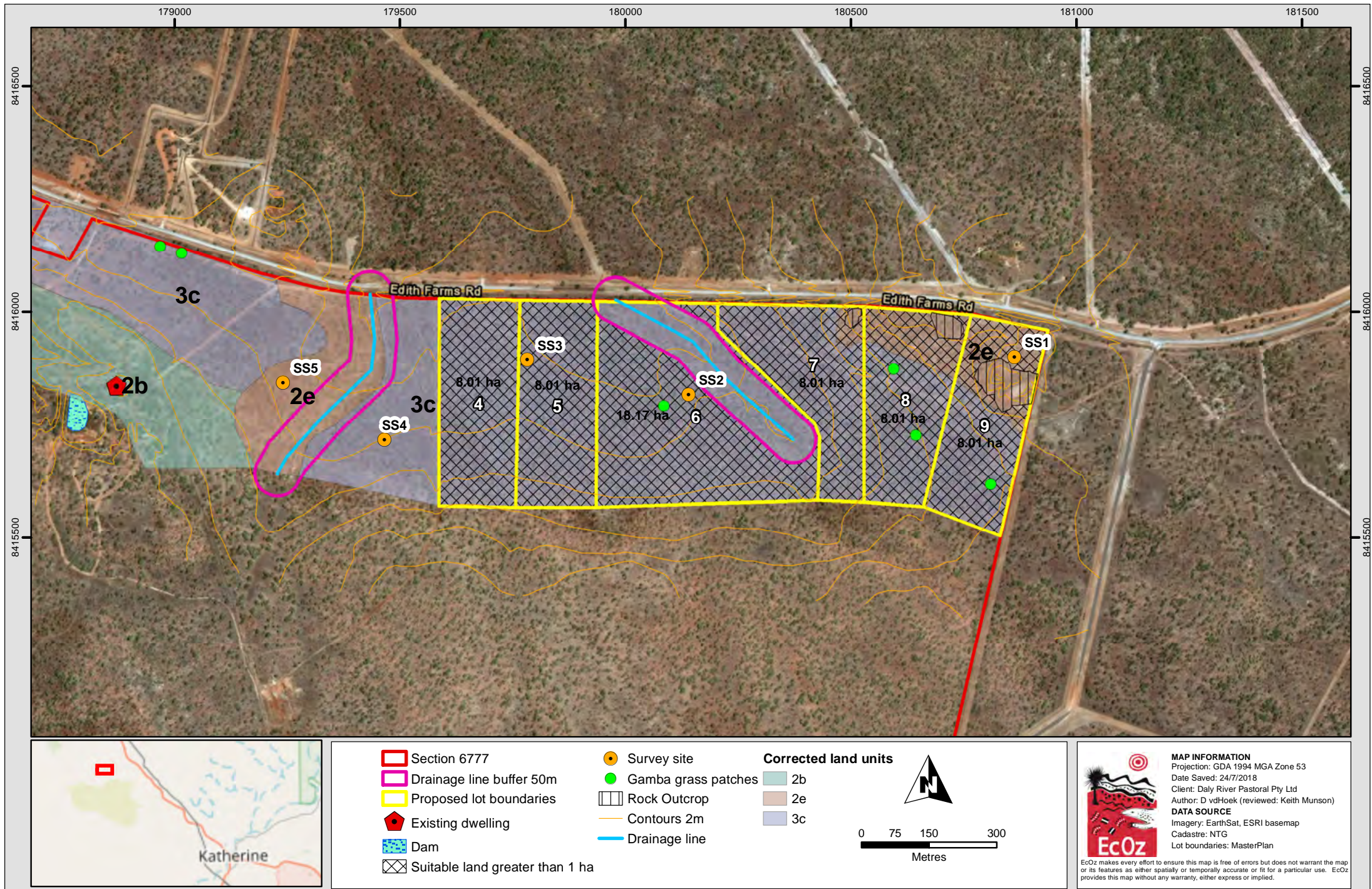
Path: Z:\01 EcOz_Documents\04 EcOz Vantage GIS\EZ18088 - LSA LCA Edit Farms Road\01 Project Files\Project Reports\Figure 2. Proposed lots and existing infrastructure.mxd

Figure 2. Proposed lots and existing infrastructure



Path: Z:\01 EcOz_Documents\04 EcOz Vantage GIS\EZ18088 - LSA LCA Edit Farms Road\01 Project Files\Project Reports\Figure 6. Map of suitable land and constrained areas in lots 1 - 3.mxd

Figure 3. Map of suitable land and constrained areas in lots 1 - 3



Path: Z:\01 EcOz_Documents\04 EcOz Vantage GIS\EZ18088 - LSA LCA Edith Farms Road\01 Project Files\Project Reports\Figure 7. Map of suitable land and constrained areas in lots 4-9.mxd

Figure 4. Map of suitable land and constrained areas in lots 4 - 9

2 SITE ASSESSMENT

A site investigation was undertaken by two EcOz Environmental Scientists on 4th – 6th July 2018. With reference to the land capability rating scale described in DoH (2014), site features related to subdivision lots were rated for capability to support onsite wastewater management. The site features and capability ratings are summarised in Table 1.

Table 1. Summary of site features

Aspect	Land Capability
<p>Climate: The climate for the Edith Farms area is typical of the tropics with a pronounced 'wet' and 'dry' season. Climate data from the nearest station, Katherine Council Station (number 014902) indicates that there is little fluctuation in minimum and maximum temperatures (13.2 – 24.7°C and 29.9 – 38.0°C respectively) throughout the year, but rainfall and humidity are highly seasonal (BoM 2018a). The majority of annual rainfall (averaging ~970 mm falls within the summer/wet season months November – April (BoM 2018a). The average pan evaporation rate is approximately 2400 mm per year (BoM 2018b).</p>	<p>Moderate (rainfall) High (evaporation)</p>
<p>Exposure: Aspect varies across the property but is predominantly north. Mean solar exposure in (MJ/m²) for the Katherine region is 22.4, with a maximum of 25.3 (Oct) and a minimum of 19.3 (Jun) (BoM 2018a). The property is moderately vegetated and relatively flat.</p>	<p>Moderate</p>
<p>Vegetation: 2e – Low woodland or tall shrubland on shallow gravelly soils and open forest on rocky sandy soils with mainly Spinifex and annual Sorghum grass layer. 3a – <i>Eucalyptus tectifica</i> and <i>Eucalyptus foelscheana</i>; Low woodland; frequently well developed understorey of <i>Hakea arborescens</i> and <i>Cochlospermum fraseri</i> and mixed annual Sorghum and perennial grass layer. 3c – <i>Eucalyptus foelscheana</i> low woodland with few shrubs and mainly perennial <i>Sehima</i> tall grass layer.</p>	<p>Moderate</p>
<p>Landform and Drainage: 2e – Low hills - Gently undulating crests and upper slopes to 5%; frequent outcrop of sandstone or laterite. Well drained soils; rapid run-off. 3a – Plains - Gentle slopes or undulating and dissected terrain; slopes to 2%; severe limestone and sandstone pavement and outcrop. Well drained soils; moderately rapid run-off. 3c – Plains - Flat to gently sloping; slopes less than 2%; scattered limestone pavement or outcrop; indistinct drainage floors. Well drained soils; slow run-off.</p>	<p>High</p>
<p>Slope: Slopes calculated during the LSA indicate that slopes range from <1% to 3% for the areas of suitable land.</p>	<p>High</p>
<p>Fill: Although some historic earthworks have been undertaken in sections of the property, no fill was identified in the proximity of the LCA test pits.</p>	<p>High</p>
<p>Surface Gravel and Rock Outcrops: Surface gravel was observed at two of the survey sites (VS9 and SS1) with covers of 5 and 55 % respectively. Sandstone and laterite outcropping were identified and the boundaries mapped within corrected land unit area 2e within</p>	<p>Low (surface gravel – SS1 only) High (surface gravel for all other sites)</p>

Aspect	Land Capability
lots 7, 8 and 9. Areas of limestone pavement were identified and the boundaries mapped within corrected land unit area 3a. Vegetation (<i>Hakea arborescens</i>) was used to indicate areas of shallow soils overtopping limestone and these areas were also mapped as limestone karst.	Moderate (rock cover)
<p>Erosion Potential: Soils were mostly sandy clays, sandy clay loams, clay loams and silty clay loams, with some occurrence of gravelly sands. Emerson aggregate tests indicated that most soils are stable and have low dispersion levels, however, some soils have a slight to moderate risk of dispersion, increasing erosion risk due to possible soil structure issues.</p>	Moderate
<p>Groundwater Bore reports from within the property and in the surrounding areas indicate that groundwater was intercepted at depths ranging from 44 to 47 m below ground level, with yields of 0.5L/s to 1.5 L/s (DENR 2018). Field observations also indicate that there is a relatively shallow rock layer underlying the area which would obstruct rising water tables during the wet season. Shallow groundwater is unlikely to be a constraint for the assessed areas (i.e. sections of the property that are not seasonally waterlogged).</p>	High
<p>Rainfall run-on and seepage: Drainage lines subject to overland flow (run-on) traverse Lots 1, 2 and 6 receiving run-on from areas north of the lots on the northern side of Edith Farms Road. Despite the number of areas which receive run-on and are likely to be seasonally saturated or inundated, there is sufficient well drained area in each lot to support onsite wastewater management, and are considered High capability.</p>	High
<p>Flood potential: The property is not located nearby to any riverine flood areas. The nearest major drainage system to the subdivision is Bondi Creek located approximate 1 km to the south and flowing approximately 14 km into the Fergusson River. Granite Creek is located 1.5 km to the east of the proposed subdivision and flows approximately 14 km into the Edith River.</p>	High
<p>Recommended Buffer Distances: All buffers specified in the <i>NT Code of Practice for Onsite Wastewater Management</i> can be achieved (see Figure 5 and Figure 6).</p>	High
<p>Available Land Application Area: All nine lots are at least 8 ha and meet minimum lot size requirements for accommodating on-site wastewater management systems.</p>	High
Overall site rating	Low

**The overall site rating must be based on the lowest ranking. The majority of the assessment criteria are considered 'Moderate' or 'High' capability and this will influence the selection of on-site wastewater management systems.*

3 SOILS ASSESSMENT

The soils of the proposed subdivision area were surveyed during a site inspection and the information from this, in combination with a desktop review of published soil information, enabled an assessment to be undertaken for their capacity to accommodate onsite wastewater treatment systems.

Table 2. Ground-truthed land unit data for proposed lots

Land unit	Summary	Drainage	Relevant lot numbers
2b	<i>Eucalyptus dichromophloia</i> ; Low open woodland to mid-high open woodland (<i>Eucalyptus umbrawarrensensis</i> and Lancewood in lower rainfall areas) with Spinifex and annual Sorghum grass layer	Well drained soils; very rapid run-off	Occurs adjacent to lot 3
2e	Low woodland or tall shrubland on shallow gravelly soils and open forest on rocky sandy soils with mainly Spinifex and annual Sorghum grass layer	Well drained soils; very rapid run-off	7, 8, 9
3a	<i>Eucalyptus tectifera</i> and <i>Eucalyptus foelscheana</i> ; Low woodland; frequently well-developed understorey of <i>Hakea arborescens</i> and <i>Cochlospermum fraseri</i> and mixed annual Sorghum and perennial grass layer	Well drained soils; moderately rapid run-off	1, 2, 3
3c	<i>Eucalyptus foelscheana</i> low woodland with few shrubs and mainly perennial <i>Sehima</i> tall grass layer	Well drained soils; slow run-off	All lots (1 - 9)

Nine soil cores/pits were sampled across the site (refer Figure 3 and Figure 4). Soil test pits were dug with a two-man operated auger, and aimed to reach a depth of 1.5 m or refusal. Test pits were located across the Property to assess the accuracy of existing land unit descriptions within each corrected land unit area.

In each test pit the soil horizons were identified and classified on site in terms of colour, texture, moisture content, mottling, coarse fragment content and structure with reference to the *Australian Soil and Land Survey Field Handbook* (NCST 2009) and *Munsell Soil Color Charts* (Munsell 2009). Laboratory testing was undertaken on samples of each horizon to assess pH, electrical conductivity, exchangeable cations and Emerson Aggregate Class. Soil bore logs are provided in Appendix A and is summarised in Horizon A1 coarse fragments ranged in size from 2-70 mm and <1-55% content. Horizon B1 coarse fragments ranged in size from 3-30 mm and 10-55% content. Horizon B2 coarse fragments ranged in size from 2-100 mm and 1-45% content. Horizon C coarse fragments ranged in size from 3 - 40 mm and 30-45% content. The highest coarse fragment percentages were recorded for sites SS1 and SS10 with 55%. Sites SS3, SS5, SS6 and SS8 recorded moderate coarse fragment % content, and SS2, SS4 and SS7 recorded low coarse fragment % content.

Table 3 provides a summary of soil characteristics with land capability rankings assigned in accordance with the LCA Guidelines. Laboratory results are provided in Appendix B.

Soils were relatively consistent throughout the nine test pits and the general characteristics of the soils are:

- All nine of the test pits identified at least two horizons; A1 horizon and B1/B2 horizon. SS1 and SS5 also identified C horizons.
- Four of the nine test pits were met with refusal. SS3 met a hard layer of impenetrable clay at 0.7 m, SS4 met lateritic bedrock at 0.7 m and SS7 and SS8 met hard impenetrable ground at 1 m.
- Horizon A1 consisted mostly of dark reddish brown (SS3, SS4, SS6, SS7, SS8), with some dark/very dark greyish brown (SS1, SS5) and dark brown (SS2) and some dark yellow brown

- (SS10) soils. Horizon A1 was made up of mostly sandy clay (SS3, SS6, SS8) and sandy clay loams (SS2, SS4, SS5), clay loam (SS7) and gravelly sand (SS1, SS10).
- Horizon B1 consisted of dark reddish browns (SS2, SS3) and yellowish reds (SS10). Horizon B1 was made up of silty clay loams (SS2, SS3) and sandy clay (SS10)
 - Horizon B2 consisted of mostly dark reds (SS2, SS3, SS4) to dark reddish browns (SS6, SS7, SS8), with some strong brown (SS1), brown (SS5) and some yellowish red (SS10) soils. Horizon B2 was mostly made up of sandy clay (SS1, SS2, SS5, SS10), clay loams (SS3, SS6, SS8) and sandy clay loams (SS4, SS7).
 - Horizon C consisted of light brown (SS1) and yellowish red (SS5) soils. Horizon C was made up of sandy clay (SS1) and gravelly sand (SS5).
 - Mottles were recorded in 3 horizons, horizon B1 (SS10) and horizon B2 (SS1, SS10).
 - The water table was not intercepted in any of the test pits and no notable moisture content was observed.
 - Horizon A1 coarse fragments ranged in size from 2-70 mm and <1-55% content. Horizon B1 coarse fragments ranged in size from 3-30 mm and 10-55% content. Horizon B2 coarse fragments ranged in size from 2-100 mm and 1-45% content. Horizon C coarse fragments ranged in size from 3 - 40 mm and 30-45% content. The highest coarse fragment percentages were recorded for sites SS1 and SS10 with 55%. Sites SS3, SS5, SS6 and SS8 recorded moderate coarse fragment % content, and SS2, SS4 and SS7 recorded low coarse fragment % content.

Table 3. Summary of soil characteristics

Feature	Land Capability
<p>Soil depth: Four of the nine test pits were met with refusal. SS3 met a hard layer of impenetrable clay at 0.7 m, SS4 met lateritic bedrock at 0.7 m and SS7 and SS8 met hard impenetrable ground at 1 m. Horizon A1 ranged in depth from 0.04 m (SS10) to 0.5 m (SS1). Horizon B1 ranged in depth from 0.08 m (SS10) to 0.35 m (SS2). Horizon B2 ranged in depth from 0.5 m (SS5) to 1 m (SS6, SS7, SS8, SS10). Horizon C ranged in depth from 0.7 m (SS5) to 1 m (SS1).</p>	High
<p>Depth to water table: The water table was not intercepted in any of the test pits and no noticeable water content was seen, although excavations were undertaken in the dry season. Mottles were recorded in two test pits, horizon B1 and B2 (SS10) and horizon B2 (SS1).</p>	High
<p>Coarse fragments (%): On average soils had moderate to low gravel content. Test pits SS1 and SS10 recorded high coarse fragment (55%). Test pits SS2, SS5, SS6 and SS8 recorded low to moderate coarse fragment (2-40%), and test pits SS2, SS4 and SS7 had low coarse fragment (<1%-10%). Eleven of the 21 records were <20%, five were between 20 and 40% and five of the 21 records were >40%.</p>	High (11 records) Moderate (Five records) Low (Five records)
<p>Soil colour and mottling: Horizon A1 consisted mostly of dark reddish browns (SS3, SS4, SS6, SS7, SS8), with some dark/very dark greyish brown (SS1, SS5) and dark browns (SS2) and some dark yellow browns (SS10) soils. Horizon B1 consisted of dark reddish browns (SS2, SS3) and yellowish reds (SS10). Horizon B2 consisted of mostly dark reds (SS2, SS3, SS4) to dark reddish browns (SS6, SS7, SS8), with some strong brown (SS1), brown (SS5) and some yellowish red (SS10) soils. Horizon C consisted of light brown (SS1) and yellowish red (SS5) soils.</p>	Moderate

Feature	Land Capability
Mottles were recorded in two test pits, horizon B1 and B2 (SS10) and horizon B2 (SS1).	
<p>Soil texture and structure / permeability category:</p> <p>Horizon A1 was made up of mostly sandy clay (SS3, SS6, SS8) and sandy clay loams (SS2, SS4, SS5), clay loam (SS7) and gravelly sand (SS1, SS10). Horizon B1 was made up of silty clay loams (SS2, SS3) and sandy clay (SS10). Horizon B2 was mostly made up of sandy clay (SS1, SS2, SS5, SS10), clay loams (SS3, SS6, SS8) and sandy clay loams (SS4, SS7). Horizon C was made up of sandy clay (SS1) and gravelly sand (SS5). Soils were weakly to moderately structured. The majority of the soil permeability categories for soil textures and structure were 4 and 5 (moderate). Permeability categories were determined using Table 5.1 in AS/NZS 1547:2012. Sandy clay – 5 Sandy clay loam – 4 Clay loam – 4 Silty clay loam – 4 Gravelly sand – 1</p>	Moderate
<p>Soil permeability and Design Loading Rates:</p> <p>Soil permeability and DLR's are inferred from Tables 5.2, M1, N1 and L1 in AS/NZS 1547:2012 and are based on soil structure and texture. Soil permeability was generally low for the sandy clay loams, clay loams and silty clay loams at 0.12-0.5 m/d (K Sat). The sandy clay has the lowest soil permeability at <0.06 m/d (K Sat). The gravelly sands had the highest soil permeability at >3.0 m/d (K Sat). Based on this, DLR's for the sandy clay loams, clay loams and silty clay loams are 6 mm/d to 20 mm/day, 2.5 mm/d to 8 mm/day for the sandy clay and 5 mm/d to 32 mm/day for the gravelly sand. All these DLR figures depend on the level of treatment undertaken (primary vs. secondary).</p>	Moderate
<p>pH:</p> <p>The pH of the soils ranged from 5.5 to 6.6*, and are considered slightly acidic to neutral. These pH values are within the normal range for soils within a humid/high rainfall environment.</p>	Moderate
<p>Electrical conductivity:</p> <p>Electrical conductivity ranged from 4 μS/cm to 28 μS/cm* and soil salinity is therefore considered low in all sites.</p>	High
<p>Sodicity (exchangeable sodium percentage-ESP):</p> <p>ESP ranged from 0.2% to 4.4% and therefore are all considered low ESP results, indicating that there may not be structural issues with the soil.</p>	High
<p>Emerson Aggregate Test:</p> <p>The majority of the Emerson class numbers for the test pits is 4. At site SS1 and SS8 all results are either 4 or 8 indicating no slaking or dispersion. Horizon A1 had results of 3 at sites SS2, SS3, SS5 and SS6, as did horizon B2 at site SS10. Class 3 indicates moderate risk of structural issues (slight to moderate dispersion). However, all of the A1 horizon sites that had class 3 results had class 4 results in B2 horizon.</p>	High
<p>Overall site rating</p>	Low**

*Refer to laboratory results in Appendix B.

**The overall site rating must be based on the lowest ranking and the most limiting factors relevant to the property are the percentage of coarse fragments.

4 WASTEWATER MANAGEMENT SYSTEM

4.1 Overview of options

The following sections provide an overview of the proposed on-site wastewater management system, with sizing and design considerations and justification for its selection. Detailed design for the system is beyond the scope of this study, but should be undertaken prior to installing the system. The LCA guidelines recommend that the selection of wastewater management system be based on:

- Appropriate land application system
- Required effluent quality based on regulations, surrounding land uses, nearby sensitive receptors.

Selection of the on-site wastewater management system has been undertaken with reference to the *NT Code of Practice for Onsite Wastewater Treatment Systems*, the *Australian/New Zealand Standards for Onsite Domestic Wastewater Management (AS/NZS 1547:2012)*, and various relevant reports (Whitehead and Associates (W&A) 2005, W&A 2007). This enabled recommendations to be made on the potential siting of wastewater treatment and land application systems. These are provided as indicative, rather than obligatory, to demonstrate appropriate treatment systems for the property, and potential locations of these within lots.

There are many options available for treatment of wastewater based on desired land application and reuse of the treated water (Table 4). If a standard septic tank is installed, it is required to have the capacity to hold inflows for at least 24 hours; therefore, on-site septic tanks must be at least 750 L in size. Other available treatment methods include Aerated Wastewater Treatment Systems (AWTS), septic tanks with sand filters, or alternative treatment systems such as composting toilets. The various treatment systems available (summarised in Table 4) are appropriate for different land application or reuse systems (Table 5).

Table 4. Treatment and land application systems available (Source: DoH, 2014)

Level of Treatment	Treatment System Examples	Land Application and Reuse System
Primary	<ul style="list-style-type: none"> • Septic tank • Greywater diversion device • Waterless composting toilet • Wet composting toilet • Incinerating toilet 	<ul style="list-style-type: none"> • Subsurface absorption system (trenches) • Evapotranspiration beds • Amended soil and Wisconsin (sand) mounds • Burial (for compost from composting toilets)
Secondary	<ul style="list-style-type: none"> • Aerated wastewater treatment system (AWTS) • Biological filter • Greywater treatment system • Septic tank and fabric filter, sand/peat filter or sand mound • Surface or subsurface flow wetlands or reed beds 	<ul style="list-style-type: none"> • Subsurface irrigation • Surface spray or drip irrigation • Other disposal systems as above
Tertiary	<ul style="list-style-type: none"> • Membrane system • Greywater treatment with disinfection • Secondary treatment with additional disinfection (UV irradiation, chlorination etc) 	<ul style="list-style-type: none"> • Restricted non-potable reuse (e.g. toilet flushing, laundry, outdoor use) • Other disposal systems as above

Table 5. Common land application systems (adapted from AS/NZS 1547:2012)

System	Considerations
Mounds	<ul style="list-style-type: none"> • Beneficial for shallow soils, high rock contents, or high water tables • Requires an above-ground mound for effluent absorption that contains imported sand/soil • Treatment will not be limited by soil absorption capacity, and less influenced by sodic soils and new soil can be imported • Not influenced by climatic factors
Subsurface irrigation	<ul style="list-style-type: none"> • Secondary treatment is required prior to irrigation • Suitable for areas of high exposure with high evaporation rates (limited during wet season) • Suitable for sites with shallow soils • Not suitable for areas that are seasonally inundated or waterlogged • Sodic soils may lose permeability over life of system; but sodicity is generally lower in surface soils than subsoils • Can be hindered by high rock or gravel content
Conventional absorption trench	<ul style="list-style-type: none"> • Only requires primary effluent treatment • Cheaper to install than other methods, and not influenced by climatic factors • Requires deep soil, generally >1.2 m, above limiting layers (e.g. bedrock or seasonal water tables) • Treatment by absorption trench may be impeded due to high % of coarse fragments • Soil supplementation may be an option to improve absorptive capacity • Sodic soils may lose permeability over life of system; larger trench lengths required • Ideal for sites with little to no constraints in terms of soil depth, rock content, waterlogging, inundation or shallow water tables

4.2 Site constraints and recommended treatment system(s)

Each site feature with a 'Low' to 'Moderate' land capability constrains the design and siting of land application systems. Based on the site and soil assessments (in Sections 2 and 3), the most limiting factors which require consideration are summarised as:

- The Property is located in the wet-dry tropics and climatic factors, including periods of high rainfall volumes in the wet season, limit some of the land application options (particularly surface irrigation)
- Surface gravel at site SS1 (lot 9) was recorded at 55%, all other sites had no or very low surface gravels and are therefore considered highly suitable.
- On average soils had moderate to low gravel content. Test pits SS1 (lot 9) recorded high coarse fragment at 55%. All other records were 40% or less.
- Soil permeability was generally low for the sandy clay loams, clay loams and silty clay loams at 0.12-0.5 m/d (K Sat). The sandy clay has the lowest soil permeability at <0.06 m/d (K Sat). The gravelly sands have the highest soil permeability of all the soils at >3.0 m/d (K Sat). Gravelly sands were recorded in A1 horizon at SS1 (lot 9)

Coarse fragments and high soil permeability rates limit wastewater treatment through reduced water storage capacity, which limits effluent absorption. Based on these potential limitations, the most appropriate land application system for the future lots is either a mound system or subsurface drip irrigation (Table 6).

Table 6. Land units and recommended treatment and application systems

Land Unit	Represented Lots	Survey Sites	Design Considerations/ Constraints	Recommended Treatment System	Recommended Land Application System
2e	7, 8, 9	SS1	<ul style="list-style-type: none"> Well drained, however some mottles present in SS1 B2 horizon Frequent rock outcrops Moderate to high (30 - 55%) coarse fragment Mostly consisted of gravelly sands and sandy clays 	Primary treatment (Septic tank)	Mound system, however preference given to positioning system on land unit 3c
3a	1, 2, 3	VS9	<ul style="list-style-type: none"> Well drained, shallow soils over limestone karst in unsuitable land 	NA	This land unit was not found suitable for development due to extensive limestone pavement
3c	1 - 9 (all lots)	SS2, SS3, SS7, SS8	<ul style="list-style-type: none"> Well drained soils Flat to gently sloping Areas of lateritic bedrock at 0.7m (shallow soil) Moderate to low levels of coarse fragments Moderate permeability 	Primary treatment (septic tank) or Secondary treatment (AWTS)	Mound system or subsurface drip irrigation

4.3 Required effluent quality

The required effluent quality dictates the necessary wastewater treatment system for the Property. The land capability of the site is usually of lower limitation if secondary treatment is undertaken. AS/NZS 1574:2012 specifies standard treatment quality levels for various wastewater treatment systems in terms of biological oxygen demand (BOD) and suspended solids (SS):

- Standard septics: 120-240 g/m³ BOD₅ and 65-180 g/m³ SS
- AWTS: 20 g/m³ BOD₅ and 30g/m³ SS
- Sand filters: 10 g/m³ BOD₅ and 10 g/m³ SS

Nitrogen (N) and Phosphorus (P) levels in standard raw household wastewater are:

- Total N: 30-85 mg/L
- Total P: 4-15 mg/L

These remain within the same range for standard septic system effluent, but can be reduced to 10-60 g/L Total N and 4-10 g/L Total P through the use of secondary treatment systems (although the final nutrient load depends on the treatment system(s) selected).

Mound absorption beds can be utilised for primary treated effluent (i.e. standard septic tank), however if subsurface drip irrigation is the preferred method then secondary treatment is required.

4.4 Sizing for treatment and land application area

Water and nutrient balances were calculated to determine the required size of subsurface irrigation systems, and also the most limiting factors for sizing. Calculations were based on the *Northern Territory Effluent Irrigation Areas Standard Sizing and Design* (W&A 2007). Mounds were sized based on standard sizing calculations in the *Technical Guidelines for Design, Installation and Operation of Mound Systems for Onsite Effluent Management* (W&A 2005) and site data. Input data for these calculations, and results, are summarised in Table 7 and Table 8, and full calculations are provided in Appendix C. Note these calculations and sizing were undertaken based on data from land unit 3C, as it is the preferred land unit of land application and treatment systems.

Table 7. Water and nutrient balance data – irrigation system

Parameter	Units	Value	Comments
Design wastewater flow	L/day	750	Table H1 in AS/NZS 1547:2012
Precipitation	mm/month	80	From BoM climate data
Pan evaporation	mm/month	158	From BoM climate data
Retained rainfall	Unitless	0.5	0.5 is conservative estimate based on Climate Zone A in the NT Trenches Standard Design Report- may change depending on location
Crop factor	Unitless	0.8-0.9	Based on typical crop factors for native grasses in NT – adjust for seasonal fluctuation
Long term acceptance rate (LTAR)	L/m ² /day	10-15	See Figure 7 of NT Code of Practice (based on land unit 3c, being most suitable and most common land unit across site)
Design irrigation rate	mm/day	3.5	See DLR's from Table 5.2 in AS/NZS 1547:2012 (based on land unit 3c, being most suitable and most common land unit across site)
Effluent total N concentration	mg/L	50	Based on conservative expected treatment quality using secondary treatment
N lost to soil	Decimal	0.2	Standard N loss multiplier
Effluent total P concentration	mg/L	15	Based on expected treatment quality using secondary treatment
Soil P sorption capacity	mg/kg	579	Based on laboratory results (average for 3c SS results)
Crop N uptake	kg/Ha/yr	220	Conservative for turf (assume grassed)
Crop P uptake	kg/Ha/yr	50	As above
Bulk density	g/cm ³	2.3	Based on laboratory results (average for 3c SS results)
Depth of soil	m	0.7	Based on field excavations (average for 3c SS results)
Design life of system	Years	50	Standard expected design life
Results – required land application area and limiting factor			

Parameter	Units	Value	Comments
Water balance – subsurface drip irrigation	m ²	200	*Nitrogen is the limiting factor.
Nitrogen balance	m²	498*	
Phosphorus balance	m ²	273	

Table 8. Sizing calculations - mounds

Parameter	Units	Value	Comments
Design wastewater flow	L/day	750	Table H1 in AS/NZS 1547:2012
Slope	%	3	Based on average of assessment sites
Soil depth to limiting layer	m	0.7	Minimum depth from soil test pits
Sand loading rate	mm/day	35	Based on primary treatment
Basal loading rate	L/m/day	8	Based on soil texture
Linear loading rate	L/m/day	47	Based on soil texture
Batter slope	-	3:1	Standard slope
Upslope correction factor	Decimal	0.92	Based on site slope
Downslope correction factor	Decimal	1.1	Based on site slope
Required mound dimensions			
Length (m)		20	
Width (m)		9	
Height (m)		1	

The calculations undertaken for either land application method enable area requirements to be estimated and mapped. Mapping indicates that either method can be accommodated within the future lots while maintaining the required buffer distances from infrastructure (e.g. bores) and drainage areas (refer to Figure 5 and Figure 6). The selection of treatment and land application methods, and infrastructure locations, would be the responsibility of future lot owners (in consultation with appropriately qualified plumbers and Department of Health (DoH)), and mapping is indicative. Standard designs for recommended land application systems are provided in Appendix D.

4.5 Applying recommended treatment and land application methods

The results of the site and soil assessment indicate that, while the Property presents some limitations (specifically high gravel content, high surface gravel, and soil permeability), on-site wastewater treatment and disposal can be accommodated subject to site specific design.

The most appropriate land application method to overcome the constraints is the use of mounds, which can be built up above the existing ground with imported sand and soil, reducing impacts of gravels and permeability. The benefit of mound systems is that only primary treatment (i.e. standard septic tank) is required, and they can operate efficiently in high rainfall areas.

Subsurface irrigation may also be applicable to the Property, although water and nutrient calculations using standard data and site specific information indicate that a land application area of at least 498 m² (50 m x 10 m) would be required to adequately treat effluent. The use of subsurface drip irrigation systems requires secondary treatment of effluent (e.g. with an AWTS, sand or biological filter) and site specific design; refer to Appendix D for examples of irrigation system designs. Note that installation of subsurface irrigation systems may also require soil replacement and/or soil treatment in gravelly or low permeability soils.

As displayed in Figure 5 and Figure 6, mapping undertaken using the most conservative land application areas indicates that all recommended treatment and disposal areas can be accommodated within lots while meeting the required setback distances. Design and sizing of the selected systems should be undertaken for each lot by a suitably qualified plumber at the time of installation.

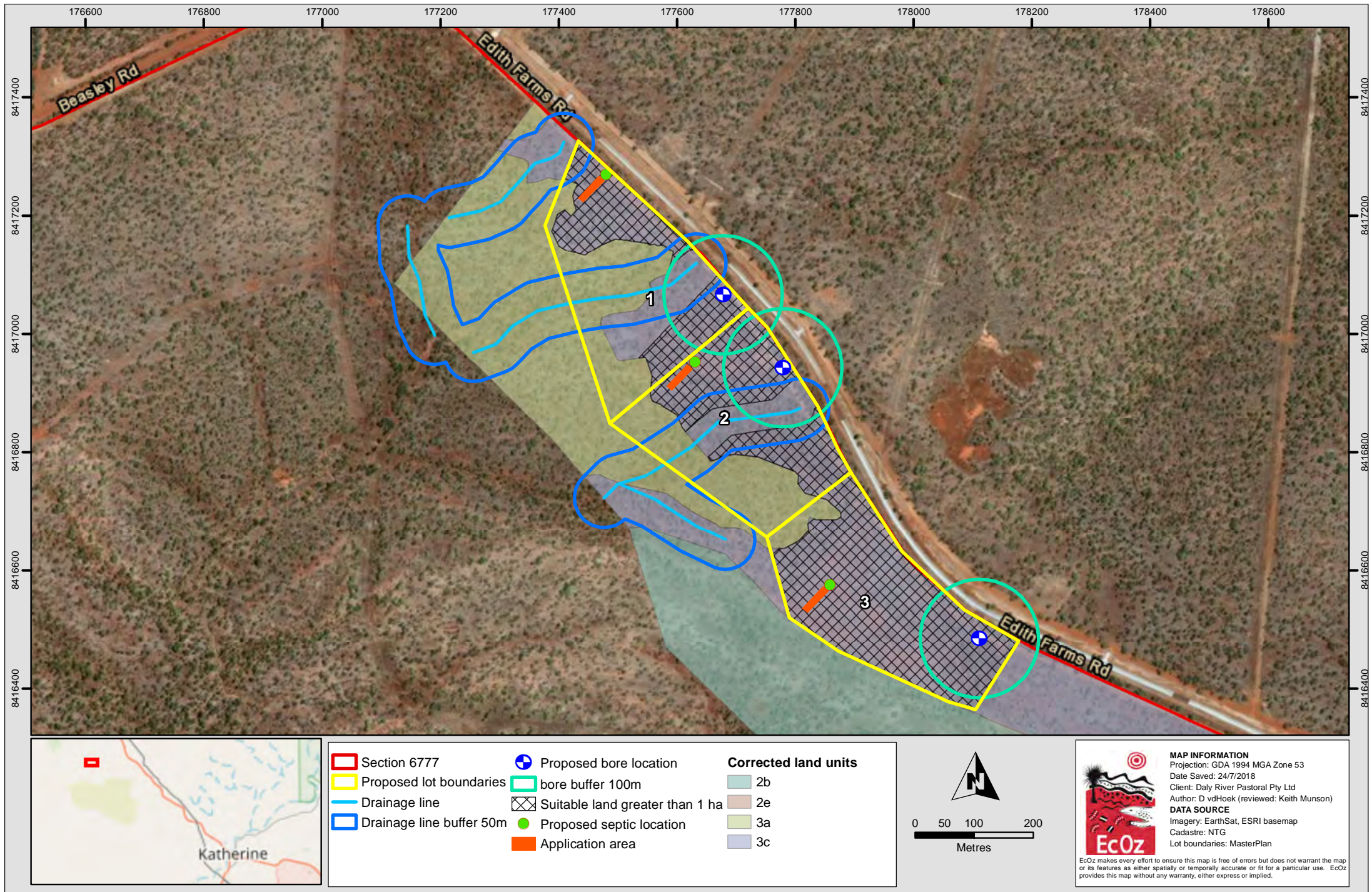
The NT DoH website provides guidance on sourcing pre-approved wastewater treatment systems. Information is also available on the administration processes required for notifying the Department of the installation of an on-site wastewater management system, and the steps required for approval and certification of such systems. This process regulates installation of systems to ensure appropriate construction and effective operation for the site conditions.

Effective treatment and disposal of effluent requires on-going maintenance of the wastewater management systems. The following recommendations are made:

- Annual inspections should be undertaken on treatment tanks (septic with sand filter or biological filter, or AWTS), and desludging undertaken on annual, two yearly or four yearly cycles depending on the size of the tank installed (5,000 L; 5,000 – 10,000 L; or 10,000 L respectively) (Territory Health Services, 2014).
- All land application systems should be sited in an area that will not be frequented by vehicle or foot traffic, or will not be built on or covered with paved over (W&A, 2007).
- Any subsurface irrigation areas should be vegetated (i.e. with grass that can be mown regularly) to encourage growth and maximise nutrient uptake (DoH, 2014).
- Irrigation lines should be maintained as per manufacturer's instructions (e.g. flushing) (W&A, 2007).
- Mound systems should be planted with grass to stabilise the soil, but deep rooted shrubs should be avoided (Jarrett and Ragan, 2002). Grass should be cut regularly to promote growth (W&A, 2005)
- Mound systems should be checked every 6 months for malfunctions (Jarrett and Ragan, 2002)
- A vegetated or landscaped buffer must be placed around mounds to accommodate for a 6 m wide buffer on the downslope side and 3 m wide on all other sides; no permanent or sealed structures should be placed within this buffer (W&A, 2005)
- Stormwater and surface run-on should be diverted around, or away from, land application areas
- Lot owners should be cognisant of the operation of their system and monitor the treatment and land application area to identify any potential issues (e.g. insufficient septic treatment, clogging of the system, pooling of treated effluent).

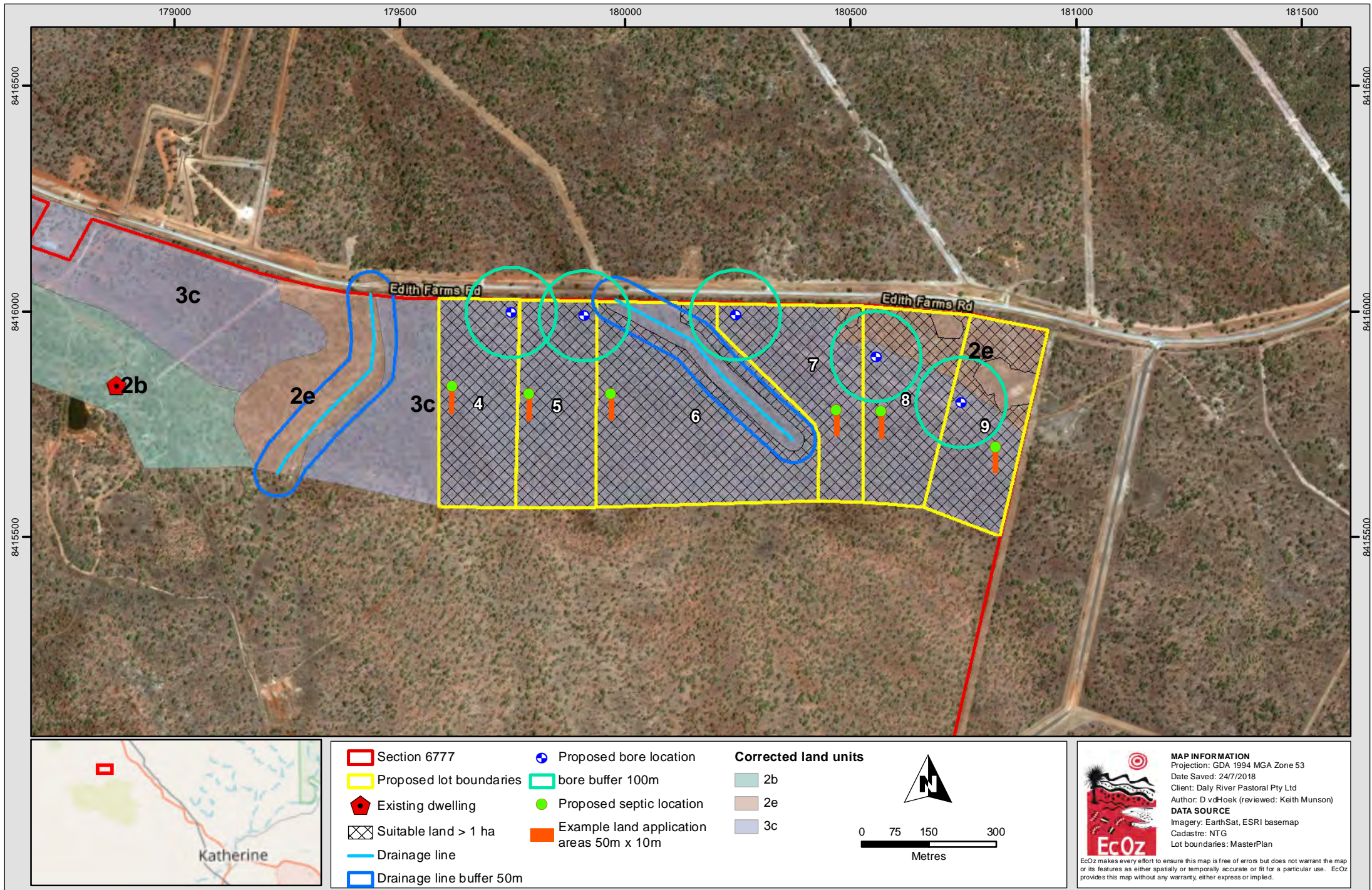
Minimising the volume of wastewater produced will aid in ensuring the effective long term operation of the systems and water saving devices (e.g. AAA rated taps and shower heads, dual flush toilets) should be installed in houses. Chemicals, large quantities of cleaning products, fats, oils and grease, and food scraps should not be discharged to the wastewater treatment and disposal system, as they risk overloading or interfering with the functioning of the system.

For detailed information on the design, construction, operation and maintenance of the various systems, refer to the NT Code of Practice (THS 2014) and the technical guidelines for mound and irrigation systems (W&A 2005 and 2007).



Path: Z:\01 EcOz_Documents\04 EcOz Vantage GIS\EZ18088 - LSA LCA Edith Farms Road\01 Project Files\Project Reports\Figure 5. Map of proposed sites for treatment and land application systems and applicable setbacks (lots 1-3).mxd

Figure 5. Map of proposed sites for treatment and land application systems and applicable setbacks (lots 1-3)



Path: Z:\01 EcOz_Documents\04 EcOz Vantage GIS\EZ18088 - LSA LCA Edit Farms Road\01 Project Files\Project Reports\Figure 6. Map of proposed sites for treatment and land application systems and applicable setbacks (lots 4-9).mxd

Figure 6. Map of proposed sites for treatment and land application systems and applicable setbacks (lots 4-9)

5 CONCLUSION & RECOMMENDATIONS

This report provides an assessment of site and soil suitability within Section 6777, 745 Edith Farms Road for the accommodation of on-site wastewater treatment and disposal systems. A desktop assessment, field investigation and laboratory analysis of soil samples enabled identification of the most appropriate wastewater management systems, with reference to the proposed subdivision design provided by Daly River Pastoral Pty Ltd. Specifically, the proposed subdivision seeks to subdivide nine lots ranging in size from 8.01 ha to 18.17 ha.

Nine soil test pits were sampled across the site, and were dug to depths ranging from 0.7 m to 1 m, meeting refusal in the form of laterite bedrock or hard impenetrable ground. Soils were generally well drained but some sites were gravelly and some sites had outcropping rock.

Soil data and site characteristics indicate that the most appropriate land application systems for the future lots are above ground mounds or subsurface irrigation. These systems overcome the constraints present on site, but it should be noted that absorption of effluent by sub-surface irrigation may be limited due to high gravel contents; mound systems are less impacted by site gravel content as they can be constructed from imported soil.

Different wastewater treatment methods are required for each land application system. Primary treatment is suitable for mound systems, for example standard septic tank. If sub-surface irrigation is the desired method, secondary treatment will be required prior to land disposal; for example, AWTS or sand filters.

Mound sizing calculations, water balances and nutrient modelling was undertaken to determine the required size of each recommended land application system. These were mapped to assess whether they can be accommodated within the future lots (as per the approved lot layout) while adhering to the required buffers (setbacks) for water supply bores and drainage areas. The map confirms that either method can be accommodated (see Figure 5 and Figure 6). The selection of individual lot wastewater treatment and land application methods would be the responsibility of future lot owners, who would be required to seek approval from DoH prior to installation.


The recommended treatment and land application systems, and proposed locations of such systems, are provided to indicate that on-site wastewater management can be accommodated within each lot.

The above recommendations are based on the findings of the assessed sites and are assumed to be representative of the greater Property; however, lot-specific limitations may occur and each lot will require assessment from a suitably qualified plumber on the appropriate system to be installed.

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APPENDIX A SITE VEGETATION AND SOIL BORE LOGS

Reference Site	SS1	 <p>GDA 1994 MGA Zone 53 180862E, 8415899N</p>
Vegetation Type	<i>Corymbia foelscheana</i> , <i>Eucalyptus tectifica</i> mid high open woodland over <i>Erythrophleum chlorostachys</i> and <i>Croton arnhemicus</i> mid high sparse shrubland over <i>Eriachne</i> sp. open tussock grassland	
Corrected land unit	2e	
Ground cover	Vegetation 20% Leaf litter 20% Bare soil 5% Rock 0% Gravel 55%	
Other site notes		

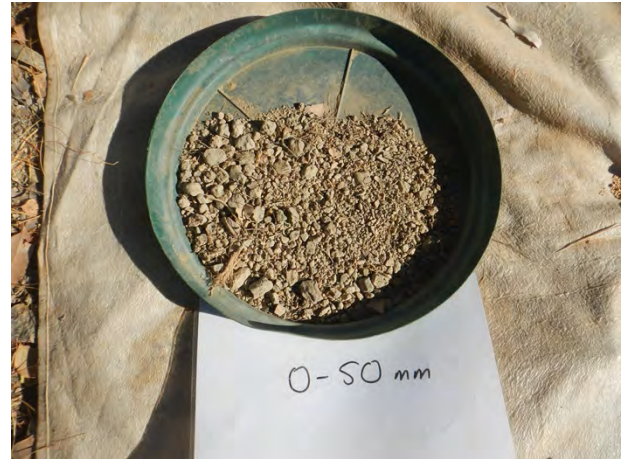
Vegetation		
Upper Stratum	Mid Stratum	Ground Stratum
% cover - 35	% cover - 5	% cover - 20
Height range (m) – 7-14	Height range (m) – 0.5-7	Height range (m) – 0-0.5
Average height (m) - 10	Average height (m) - 3	Average height (m) – 0.2
<i>Corymbia foelscheana</i>	<i>Erythrophleum chlorostachys</i>	<i>Eriachne</i> sp.
<i>Eucalyptus tectifica</i>	<i>Croton arnhemicus</i>	<i>Schizachyrium fragile</i>
<i>Erythrophleum chlorostachys</i>	-	<i>Petalostigma quadriloculare</i>

Soil	
Slope (%)	2
Aspect	North-North-West
Drainage Potential	Moderately well drained
Gravel cover (%)	55
Rock cover (%)	0





Soil profile

Gravel portion




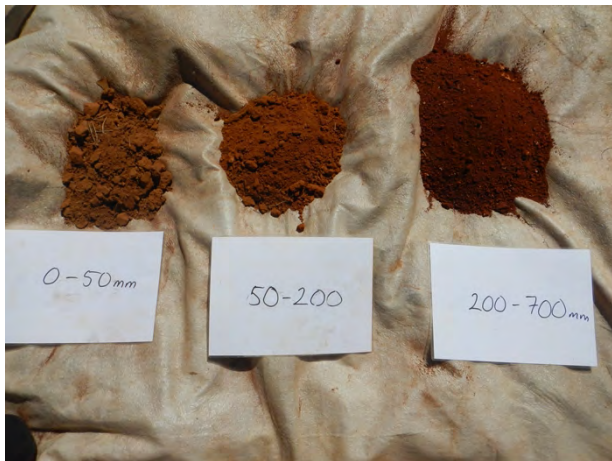
Soil Profile						
Horizon	Depth range (m)	Colour	Texture	Mottles	Course fragments size and %	Soil type
A1	0-0.5	10YR 4/2 Dark greyish brown	Gravelly sand	No	3-40mm 55% Mode = 3mm	kandosol
B2	0.05-0.7	7.5YR 5/6 Strong brown	Sandy clay	Yes	3-40mm 25% Mode = 3mm	kandosol
C	0.7-1.0	7.5YR 6/4 Light brown	Sandy clay	No	3-40mm 45% Mode = 3mm	kandosol

Reference Site	SS2		 <p>GDA 1994 MGA Zone 53 180140E, 8415816N</p>
Vegetation Type	<i>Eucalyptus tectifica</i> and <i>Eucalyptus bigalerita</i> mid high woodland over <i>Corymbia foelscheana</i> and <i>Eucalyptus tectifica</i> mid high open shrubland over <i>Heteropogon contortus</i> tussock grassland		
Corrected land unit	3c		
Ground cover	Vegetation 50% Leaf litter 40% Bare soil 10% Rock 0% Gravel 0%		
Other site notes	Alluvial flat		
Vegetation			
Upper Stratum	Mid Stratum	Ground Stratum	
% cover - 25	% cover - 12	% cover - 50	
Height range (m) – 10-14	Height range (m) – 1-7	Height range (m) – 0-1	
Average height (m) - 12	Average height (m) - 4	Average height (m) – 0.5	
<i>Eucalyptus tectifica</i>	<i>Corymbia foelscheana</i>	<i>Heteropogon contortus</i>	
<i>Eucalyptus bigalerita</i>	<i>Eucalyptus tectifica</i>	<i>Themeda triandra</i>	
<i>Corymbia foelscheana</i>	-	-	
Soil			
Slope (%)	1		
Aspect	North		
Drainage Potential	Rapidly drained		
Gravel cover (%)	0		
Rock cover (%)	0		
			Soil profile

Gravel portion





Soil Profile						
Horizon	Depth range (m)	Colour	Texture	Mottles	Course fragments size and %	Soil type
A1	0-0.1	7.5YR 3/4 Dark brown	Sandy clay loam	No	3-5mm 5% Mode = 3mm	kandosol
B1	0.01-0.35	5YR 3/4 Dark reddish brown	Silty clay loam	No	3-30mm 10% Mode = 3mm	kandosol
B2	0.35-1.0	2.5YR 3/6 Dark red	Sandy clay	No	3-10mm 10% Mode = 3mm	kandosol

Reference Site	SS3		 <p>GDA 1994 MGA Zone 53 179782E, 8415894N</p>
Vegetation Type	<i>Eucalyptus tectifica</i> mid high open woodland over <i>Eucalyptus tectifica</i> and <i>Corymbia foelscheana</i> mid high sparse shrubland over <i>Chrysopogon fallax</i> tussock grassland		
Corrected land unit	3c		
Ground cover	Vegetation 70% Leaf litter 20% Bare soil 8% Rock 2% Gravel 0%		
Other site notes	Impenetrable layer of hard clay at 0.7m.		
Vegetation			
Upper Stratum	Mid Stratum	Ground Stratum	
% cover - 8	% cover - 4	% cover - 70	
Height range (m) – 8-12	Height range (m) – 0.5-5	Height range (m) – 0-0.5	
Average height (m) - 10	Average height (m) - 3	Average height (m) – 0.3	
<i>Eucalyptus tectifica</i>	<i>Eucalyptus tectifica</i>	<i>Chrysopogon fallax</i>	
-	<i>Corymbia foelscheana</i>	<i>Themeda triandra</i>	
-	-	-	
Soil			
Slope (%)	1		 <p>Soil profile</p>
Aspect	North		
Drainage Potential	Moderate to rapidly drained		
Gravel cover (%)	0		
Rock cover (%)	2		

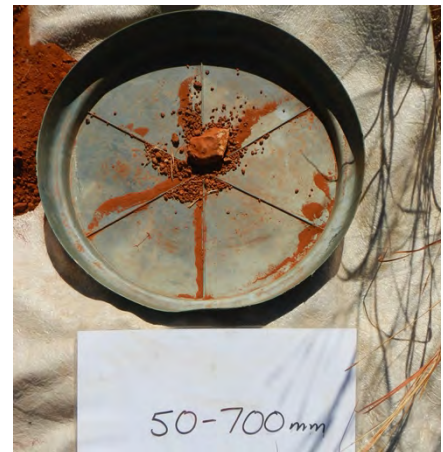
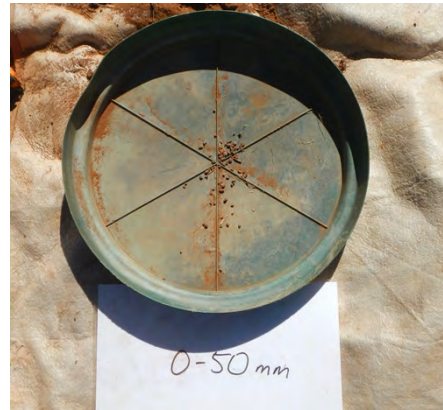
Gravel portion





Soil Profile						
Horizon	Depth range (m)	Colour	Texture	Mottles	Course fragments size and %	Soil type
A1	0-0.05	5YR 3/4 Dark reddish brown	Sandy clay	No	3-70mm 20% Mode = 4mm	kandosol
B1	0.05-0.2	5YR 3/4 Dark reddish brown	Silty clay loam	No	3-40mm 15% Mode = 3mm	kandosol
B2	0.2-0.7	2.5YR 3/6 Dark red	Clay loam	No	3-40mm 15% Mode = 3mm	kandosol

Reference Site	SS4		 <p>GDA 1994 MGA Zone 53 179466E, 8415717N</p>
Vegetation Type	<i>Corymbia confertiflora</i> , <i>Eucalyptus tectifica</i> mid high woodland over <i>Corymbia confertiflora</i> mid high open shrubland over <i>Heteropogon contortus</i> tussock grassland		
Corrected land unit	3c		
Ground cover	Vegetation 60% Leaf litter 20% Bare soil 20% Rock 0% Gravel 0%		
Other site notes			
Vegetation			
Upper Stratum	Mid Stratum	Ground Stratum	
% cover - 30	% cover - 10	% cover - 60	
Height range (m) – 12-18	Height range (m) – 1-7	Height range (m) – 0-1	
Average height (m) - 16	Average height (m) - 3	Average height (m) – 0.8	
<i>Corymbia confertiflora</i>	<i>Corymbia confertiflora</i>	<i>Heteropogon contortus</i>	
<i>Eucalyptus tectifica</i>	-	<i>Themeda triandra</i>	
-	-	-	
Soil			
Slope (%)	1		 <p>Soil profile</p>
Aspect	North		
Drainage Potential	Rapidly drained		
Gravel cover (%)	0		
Rock cover (%)	0		

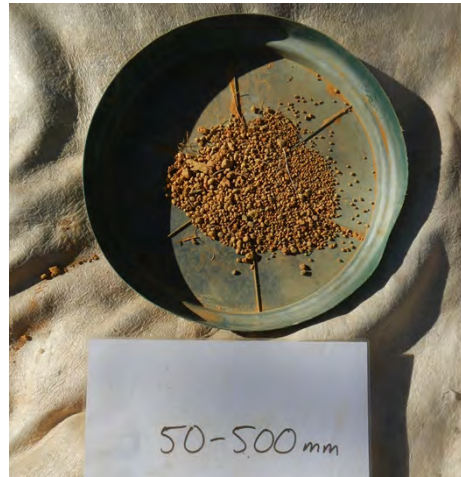
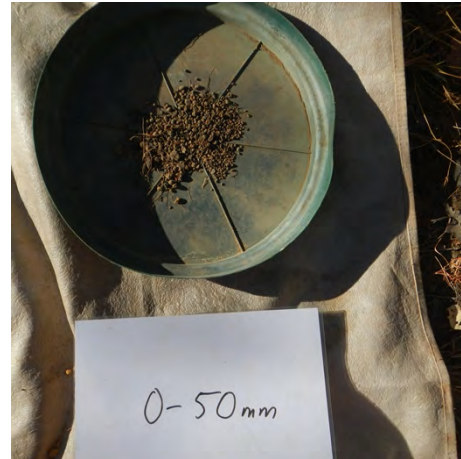
Gravel portion





Soil Profile						
Horizon	Depth range (m)	Colour	Texture	Mottles	Course fragments size and %	Soil type
A1	0-0.05	2.5YR 2.5/4 Dark reddish brown	Silty clay loam	No	2-5mm 1% Mode = 2mm	kandosol
B2	0.05-0.7	2.5YR 3/6 Dark red	Silty clay loam	No	2-100mm 1% Mode = 3mm	kandosol
Laterite bedrock	0.7+	-	-	-	-	-

Reference Site	SS5		 <p>GDA 1994 MGA Zone 53 179235E, 8415840N</p>
Vegetation Type	<i>Corymbia foelscheana</i> , <i>Eucalyptus tectifica</i> mid high woodland over <i>Terminalia ferdinandiana</i> and <i>Corymbia foelscheana</i> mid high open shrubland over <i>Heteropogon contortus</i> tussock grassland		
Corrected land unit	2e		
Ground cover	Vegetation 50% Leaf litter 40% Bare soil 10% Rock 0% Gravel 0%		
Other site notes			
Vegetation			
Upper Stratum	Mid Stratum	Ground Stratum	
% cover - 25	% cover - 10	% cover - 50	
Height range (m) – 10-16	Height range (m) – 1-7	Height range (m) – 0-1	
Average height (m) - 14	Average height (m) - 3	Average height (m) – 0.6	
<i>Corymbia foelscheana</i>	<i>Terminalia ferdinandiana</i>	<i>Heteropogon contortus</i>	
<i>Eucalyptus tectifica</i>	<i>Corymbia foelscheana</i>	-	
-	-	-	
Soil			
Slope (%)	1		
Aspect	South-East		
Drainage Potential	Moderately to rapidly drained		
Gravel cover (%)	0		
Rock cover (%)	0		
			Soil profile

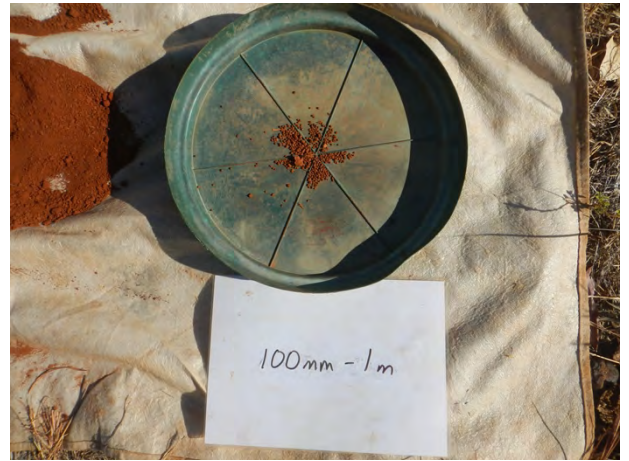
Gravel portion





Soil Profile						
Horizon	Depth range (m)	Colour	Texture	Mottles	Course fragments size and %	Soil type
A1	0-0.05	10YR 3/2 Very dark greyish brown	Sandy clay loam	No	3-20mm 5% Mode = 3mm	kandosol
B2	0.05-0.5	10YR 5/3 Brown	Sandy clay	No	3-20mm 20% Mode = 3mm	kandosol
C	0.5-0.7	5YR 4/6 Yellowish red	Gravelly sand	No	3-40mm 30% Mode = 3mm	kandosol
Laterite bedrock	0.7+	-	-	-	-	-

Reference Site	SS6		 <p>GDA 1994 MGA Zone 53 178322E, 8416350N</p>
Vegetation Type	<i>Corymbia foelscheana</i> , <i>Eucalyptus tectifica</i> mid high open woodland over <i>Corymbia foelscheana</i> and <i>Acacia holosericea</i> low sparse shrubland over <i>Chrysopogon fallax</i> tussock grassland		
Corrected land unit	3c		
Ground cover	Vegetation 50% Leaf litter 35% Bare soil 12% Rock 3% Gravel 0%		
Other site notes			
Vegetation			
Upper Stratum	Mid Stratum	Ground Stratum	
% cover - 6	% cover - 2	% cover - 50	
Height range (m) – 10-20	Height range (m) – 1-5	Height range (m) – 0-1	
Average height (m) - 16	Average height (m) - 2	Average height (m) – 0.2	
<i>Corymbia foelscheana</i>	<i>Corymbia foelscheana</i>	<i>Chrysopogon fallax</i>	
<i>Eucalyptus tectifica</i>	<i>Acacia holosericea</i>	<i>Themeda triandra</i>	
<i>Corymbia grandifolia</i>	<i>Planchonia careya</i>	<i>Heteropogon contortus</i>	
Soil			
Slope (%)	3		 <p>Soil profile</p>
Aspect	North		
Drainage Potential	Moderately to rapidly drained		
Gravel cover (%)	0		
Rock cover (%)	3		

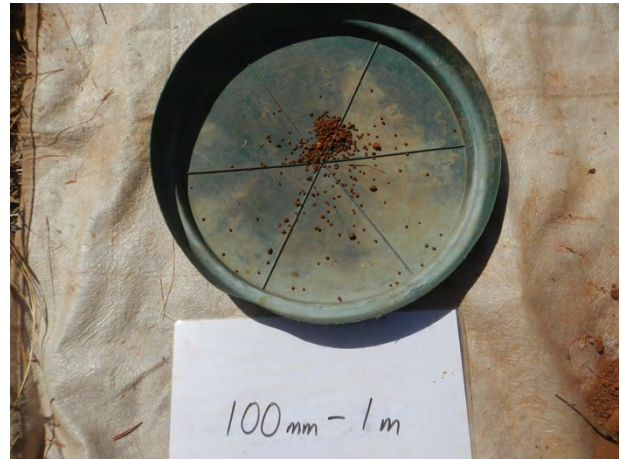
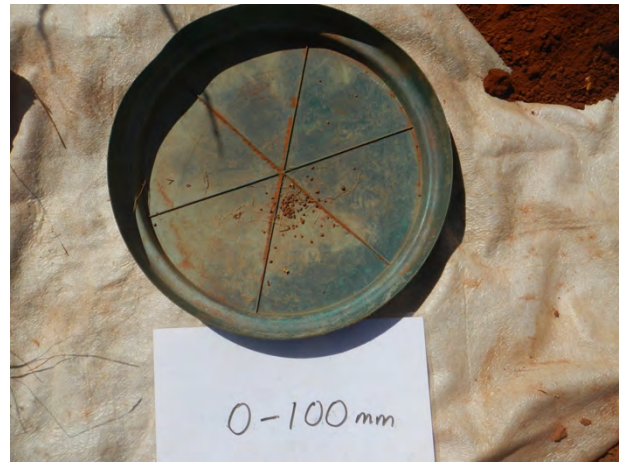
Gravel portion




Soil Profile						
Horizon	Depth range (m)	Colour	Texture	Mottles	Course fragments size and %	Soil type
A1	0-0.1	2.5YR 3/4 Dark reddish brown	Sandy clay	No	3-50mm 40% Mode = 3mm	kandosol
B2	0.1-1	2.5YR 2.5/4 Dark reddish brown	Clay loam	No	3-25mm 1% Mode = 3mm	kandosol

Reference Site	SS7		 <p>GDA 1994 MGA Zone 53 177806E, 8416790N</p>
Vegetation Type	<i>Eucalyptus tectifica</i> and <i>Corymbia foelscheana</i> mid high woodland over <i>Corymbia foelscheana</i> and <i>Cochlospermum fraseri</i> mid high sparse shrubland over <i>Heteropogon contortus</i> tussock grassland		
Corrected land unit	3c		
Ground cover	Vegetation 70% Leaf litter 20% Bare soil 0% Rock 10% Gravel 0%		
Other site notes	Ground impenetrable from 1m.		
Vegetation			
Upper Stratum	Mid Stratum	Ground Stratum	
% cover - 12	% cover - 3	% cover - 70	
Height range (m) – 10-16	Height range (m) – 1-7	Height range (m) – 0-1	
Average height (m) - 14	Average height (m) - 5	Average height (m) – 0.8	
<i>Eucalyptus tectifica</i>	<i>Corymbia foelscheana</i>	<i>Heteropogon contortus</i>	
<i>Corymbia foelscheana</i>	<i>Cochlospermum fraseri</i>	<i>Chrysopogon fallax</i>	
-	<i>Acacia holosericea</i>	-	
Soil			
Slope (%)	2		 <p>Soil profile</p>
Aspect	North-West		
Drainage Potential	Rapidly drained		
Gravel cover (%)	0		
Rock cover (%)	10		

Gravel portion




Soil Profile						
Horizon	Depth range (m)	Colour	Texture	Mottles	Course fragments size and %	Soil type
A1	0-0.1	5YR 3/4 Dark reddish brown	Clay loam	No	3mm only <1%	kandosol
B2	0.1-1	2.5YR 2.5/4 Dark reddish brown	Silty clay loam	No	3-5mm 1% Mode = 3mm	kandosol

Reference Site	SS8	 <p>GDA 1994 MGA Zone 53 177507E, 8417196N</p>
Vegetation Type	<i>Eucalyptus tectifica</i> , <i>Corymbia foelscheana</i> mid high open woodland over <i>Corymbia foelscheana</i> and <i>Erythrophleum chlorostachys</i> mid high sparse shrubland over <i>Themeda triandra</i> tussock grassland	
Corrected land unit	3c	
Ground cover	Vegetation 55% Leaf litter 35% Bare soil 10% Rock 0% Gravel 0%	
Other site notes	Ground impenetrable from 1m.	

Vegetation		
Upper Stratum	Mid Stratum	Ground Stratum
% cover - 10	% cover - 5	% cover - 55
Height range (m) – 10-16	Height range (m) – 1-7	Height range (m) – 0-1
Average height (m) - 14	Average height (m) - 4	Average height (m) – 0.7
<i>Eucalyptus tectifica</i>	<i>Corymbia foelscheana</i>	<i>Themeda triandra</i>
<i>Corymbia foelscheana</i>	<i>Erythrophleum chlorostachys</i>	<i>Chrysopogon fallax</i>
<i>Corymbia grandifolia</i>	-	<i>Heteropogon contortus</i>

Soil	
Slope (%)	<1
Aspect	North
Drainage Potential	Moderately to rapidly drained
Gravel cover (%)	0
Rock cover (%)	0






Soil profile

Gravel portion



Soil Profile						
Horizon	Depth range (m)	Colour	Texture	Mottles	Course fragments size and %	Soil type
A1	0-0.1	5YR 3/4 Dark reddish brown	Sandy clay	No	3-60mm 40% Mode = 3mm	kandosol
B2	0.1-1	2.5YR 2.5/4 Dark reddish brown	Clay loam	No	3-20mm 2% Mode = 3mm	kandosol

Reference Site	VS9		 <p>GDA 1994 MGA Zone 53 177350E, 8417099N</p>
Vegetation Type	<i>Corymbia foelscheana</i> , <i>Eucalyptus tectifica</i> mid high open woodland over <i>Hakea arborescens</i> and <i>Vachellia pachyphloia</i> mid high open shrubland over <i>Sehima nervosum</i> tussock grassland		
Corrected land unit	3a		
Ground cover	Vegetation 40% Leaf litter 37% Bare soil 3% Rock 15% Gravel 5%		
Other site notes	Limestone pavement		
Vegetation			
Upper Stratum	Mid Stratum	Ground Stratum	
% cover - 8	% cover - 12	% cover - 40	
Height range (m) – 10-16	Height range (m) – 1-8	Height range (m) – 0-1	
Average height (m) - 14	Average height (m) - 4	Average height (m) – 0.5	
<i>Corymbia foelscheana</i>	<i>Hakea arborescens</i>	<i>Sehima nervosum</i>	
<i>Eucalyptus tectifica</i>	<i>Vachellia pachyphloia</i>	<i>Heteropogon contortus</i>	
<i>Corymbia grandifolia</i>	<i>Gardenia megasperma</i>	<i>Themeda triandra</i>	
Soil			
Slope (%)	3	- Soil profile	
Aspect	South		
Drainage Potential	Rapidly drained		
Gravel cover (%)	5		
Rock cover (%)	15		
Gravel portion	-		

Reference Site	SS10		 <p>GDA 1994 MGA Zone 53 178371E, 8416198N</p>
Vegetation Type	<i>Eucalyptus tectifica</i> mid high open woodland over <i>Eucalyptus tectifica</i> and <i>Erythrophleum chlorostachys</i> mid high open shrubland over <i>Heteropogon contortus</i> tussock grassland		
Corrected land unit	2b		
Ground cover	Vegetation 20% Leaf litter 30% Bare soil 40% Rock 10% Gravel 0%		
Other site notes			
Vegetation			
Upper Stratum	Mid Stratum	Ground Stratum	
% cover - 5	% cover - 15	% cover - 20	
Height range (m) – 10-16	Height range (m) – 1-7	Height range (m) – 0-1	
Average height (m) - 14	Average height (m) - 4	Average height (m) – 0.5	
<i>Eucalyptus tectifica</i>	<i>Eucalyptus tectifica</i>	<i>Heteropogon contortus</i>	
-	<i>Erythrophleum chlorostachys</i>	-	
-	<i>Acacia holosericea</i>	-	
Soil			
Slope (%)	2		
Aspect	South		
Drainage Potential	Moderately well drained		
Gravel cover (%)	0		
Rock cover (%)	10		
			
	Soil profile		

Gravel portion



Soil Profile						
Horizon	Depth range (m)	Colour	Texture	Mottles	Course fragments size and %	Soil type
A1	0-0.04	10YR 4/6 Dark yellowish brown	Gravelly sand	No	3-70mm 55% Mode = 3mm	kandosol
B1	0.04-0.08	5YR 4/6 Yellowish red	Sandy clay	Yes	3-40mm 55% Mode = 3mm	kandosol
B2	0.8-1	5YR 4/6 Yellowish red	Sandy clay	Yes	3-70mm 45% Mode = 3mm	kandosol

APPENDIX B LABORATORY RESULTS

APPENDIX C WATER AND NUTRIENT BALANCES AND MOUND SIZING CALCULATIONS

The following assumptions were made during the water and nutrient balance calculations:

- Rainfall and evaporation data is based on average monthly data from Bureau of Meteorology (Katherine) data and is assumed to be representative of site conditions. Actual site conditions will fluctuate from these averages.
- Crop factors were based on grassed landscaped areas
- Design wastewater flows were based on standard 5 person/3 bedroom households
- Retained rainfall coefficients were obtained from NT Standards and are a conservative estimate
- Design irrigation rates are based on soil texture and structure encountered during the site assessment and may vary in different soil conditions
- Nutrient concentrations in wastewater are conservative estimates assuming secondary treatment is undertaken, and actual nutrient concentrations are likely to be lower than the figures used in the modelling
- Crop nutrient uptakes are based on turf which is maintained (e.g. mown) and may vary depending on landscaping
- Depth of soil available for adsorption was based on the most shallow soil profile encountered at the site, and deeper soil may be selected for location of subsurface irrigation
- Gravel content has not been accommodated in subsurface irrigation calculations and gravelly soils may reduce absorption

Mound calculations were based on the following assumptions:

- Design wastewater flows were based on standard 5 person/3 bedroom households
- Depth of soil available for adsorption was based on the most shallow soil profile encountered at the site
- Slope was based on the average slope calculated within the land units assessed, and upslope and downslope correction factors are based on this average slope
- Sand loading rates assume primary treatment will be undertaken, and basal and linear loading rates are based on the soil texture and structure encountered in test pits, which may vary across the site.
- Standard figures were used for many of the mound calculations based on the technical guidelines from NT (W&A 2005) and actual site conditions may vary
- Calculations assume grass or turf will be established on mound systems to aid in evapotranspiration

Water Balance: Subsurface Irrigation															
Site Address: 745 Edith Farms Road															
Input Data															
Design Wastewater Flow	Q	L/day	750												
Design Irrigation Rate	DIR	mm/day	3.5												
Nominated Land Application Area	L	m ²	200												
Crop Factor	C	unitless	0.8-0.9												
Retained Rainfall	RR	unitless (most conservative)	0.5												
Rainfall Data	R	mm/month	80												
Evaporation Data	E	mm/month	158												
Parameter		Formula	Units	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Days in Month	D	N/A	days	31	28	31	30	31	30	31	31	30	31	31	31
Rainfall	R	N/A	mm/month	237.7	216.5	158.9	33.1	5.5	1.9	0.9	0.5	6.5	27.6	88.7	199.6
Evaporation	E	N/A	mm/month	161.2	145.6	161.2	156	161.2	156	161.2	161.2	156	161.2	161.2	161.2
Crop Factor	C	N/A	N/A	0.9	0.9	0.9	0.8	0.8	0.8	0.8	0.8	0.8	0.9	0.9	0.9
Outputs															
Evapotranspiration	ET	E x C	mm/month	145.1	131.0	145.1	124.8	129.0	124.8	129.0	129.0	124.8	145.1	145.1	145.1
Percolation	DPR	DPR	mm/month	108.5	98.0	108.5	105.0	108.5	105.0	108.5	108.5	105.0	108.5	108.5	108.5
Total Outputs	O	ET + DPR	mm/month	253.6	229.0	253.6	229.8	237.5	229.8	237.5	237.5	229.8	253.6	253.6	253.6
Inputs															
Retained Rainfall	RR	R x 0.5	mm/month	118.85	108.25	79.45	16.55	2.75	0.95	0.45	0.25	3.25	13.8	44.35	99.8
Effluent Input	W	(Q x D)/L	mm/month	116.3	105.0	116.3	112.5	116.3	112.5	116.3	116.3	112.5	116.3	116.3	116.3
Total Inputs	I	RR + W	mm/month	235.1	213.3	195.7	129.1	119.0	113.5	116.7	116.5	115.8	130.1	160.6	216.1
Storage Calculation															
Storage	S	I - O	mm/month	-18.5	-15.8	-57.9	-100.8	-118.5	-116.4	-120.8	-121.0	-114.1	-123.5	-93.0	-37.5
Cumulative Storage	CS		mm	-18.5	-34.3	-92.2	-192.9	-311.4	-427.7	-548.5	-669.4	-783.5	-907.0	-1000.0	-1037.5
Maximum Storage for Area	N		mm	-18.5											
Wet weather storage	V	N x L/1000	m ³	-4.053											

Nutrient Balance – Subsurface Irrigation Input Data			
Wastewater Loading	Code	Unit	
Hydraulic Load	Q	L/day	750
Effluent N Conc.	N	mg/L	50
N lost to soil	NL	decimal	0.2
Total N lost to soil	TNL	mg/day	7500
Remaining N after soil loss		mg/day	30000
Effluent P Conc	P	mg/day	15
Design Life of System	DL	Years	50

Nutrient Crop Uptake	Code	Unit	
Crop N uptake	CN	kg/ha/yr	220
Crop P uptake	CP	kg/ha/yr	50
P-sorption rate	PSR	mg/kg	579
Bulk Density	BD	g/cm ³	2.3
Depth of Soil	D	m	0.7
% of P sorbed		%P	0.75

N Area Required	Formula	Unit	
Daily N load	Q*N	mg/day	37500
Annual N load	(Q*N)*365	mg/L	13687500
N lost to soil	D23 * NL	mg/yr	2737500
Annual N load (ANL)	D23-D24	kg/yr	10.95
Plant uptake	CN	kgN/ha/yr	220
Annual N load after application	ANL/CN	ha	0.049772727
Area required		m²	498

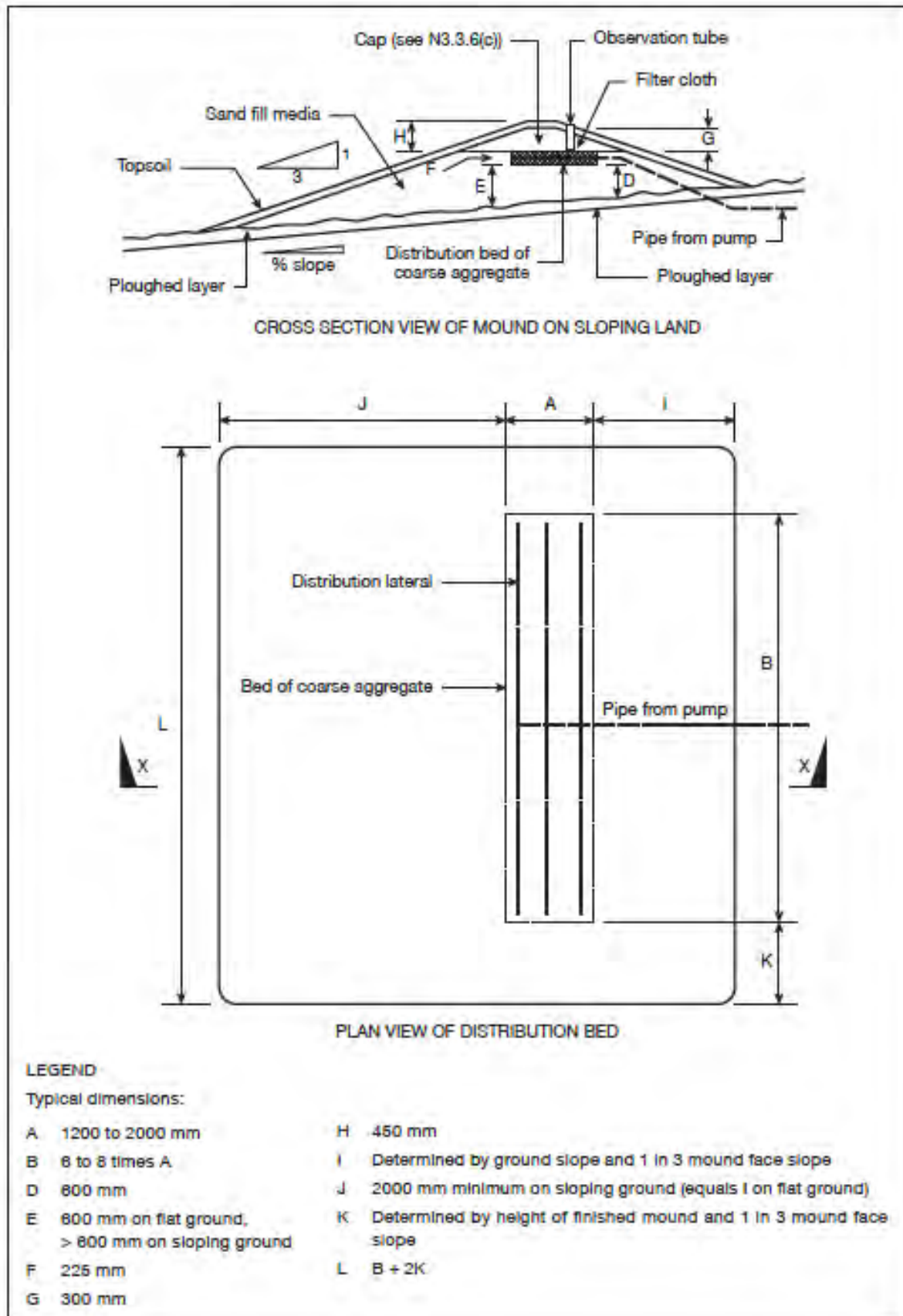
P Area Required	Formula	Unit	
P adsorbed (Pad)	(PSR*BD*D*.75)*10000	kg/ m ²	0.6991425
P uptake (Pup)	3*365*DL	kg/m ²	0.055
P generated (Pgen)	P*Q*365*DL		205312500
	Convert to kg	kg	205.3125
Area required	Pgen/(Pad+Pup)	m²	273

Mound Sizing Calculations			
Input Data	Code	Unit	
Daily effluent load	W	L/day	750
Quality			Primary treatment
Slope	NS	%	3
Soil depth to limiting layer	SD	m	0.7
Sand Loading Rate	SLR	mm/day	35
Basal Loading Rate	BLR	L/m/day	8
Linear Loading Rate	LLR	L/m/day	47
Batter Slope	BS		3:1
Upslope Correction Factor	UCF		0.92
Downslope Correction Factor	DCF		1.1

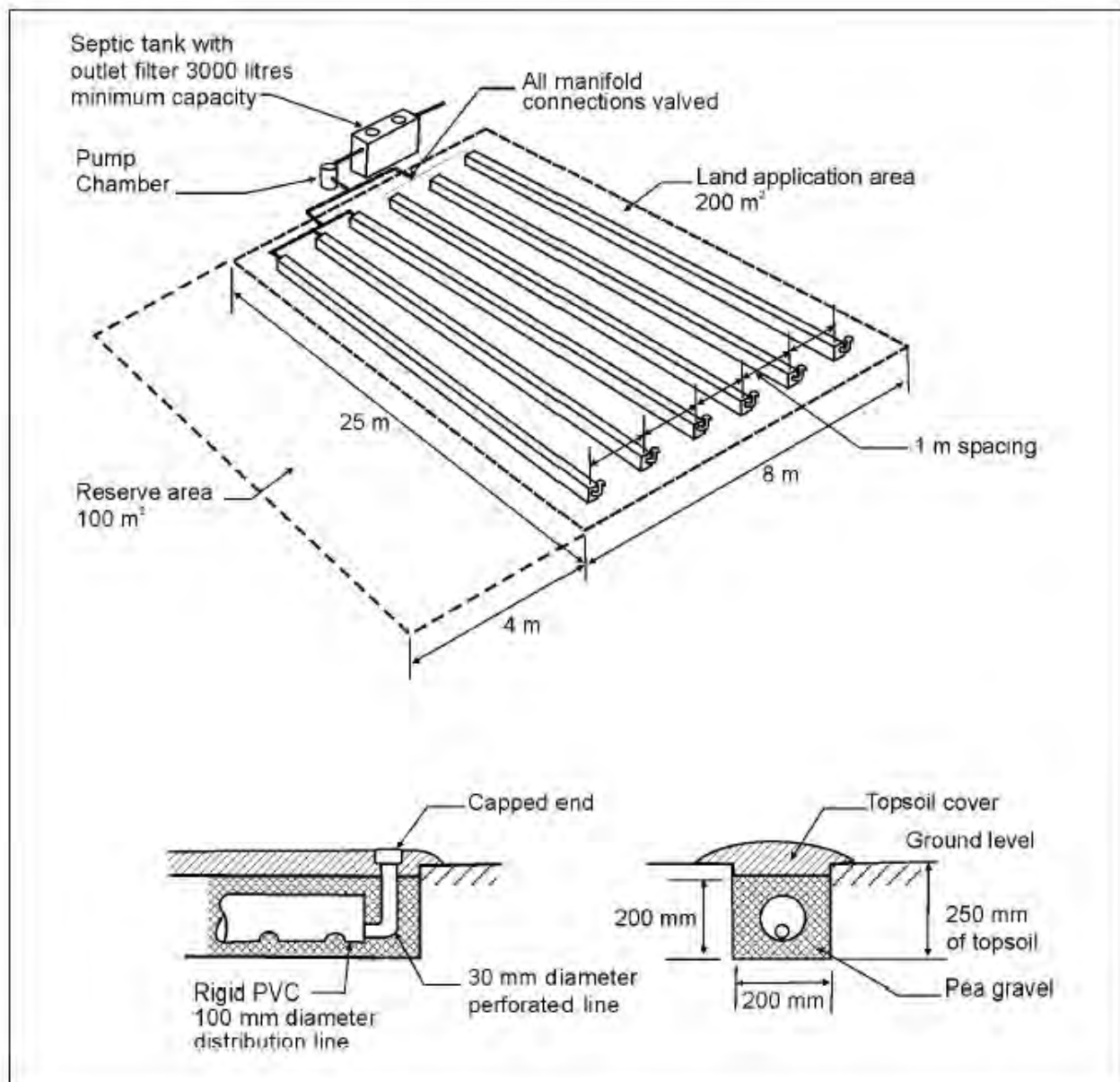
Calculations				
Required area	Code	Formula	Unit	
Absorption bed width	A	LLR/SLR	m	2.00
Absorption bed Length	B	W/LLR	m	14.00
Absorption bed thickness	F	N/A	m	0.3
Absorption bed area	Aa	A x B	m ²	28.00
Sand fill depth on upslope	Du	1-SD	m	0.60
Sand fill depth on downslope	Dd	$Du + A * (NS/100)$	m	0.66
Sand fill depth in centre	Dc	$(Du + Dd) / 2$	m	0.63
Capping depth	G		m	0.15
Capping depth peak	P		m	0.3
Basal Area	Ab	W/BLR	m	93.75
Basal width downslope (hydraulics)	J	$(LLR/BLR)-A$	m	3.88
Basal width downslope (geometry)	J	$(Dd+F+G) \times BS \times DCF$	m	3.66
Basal width upslope	I	$(Du+F+G) \times BS \times UCF$	m	2.90
End slope mound length	K	$(Dc + F + G) * BS$	m	3.24
Mound Length	L	$B + (2 * K)$	m	20.48
Mound Width	W	$A + I + J$	m	8.77
Mound Height	H	$Dc + F + G$	m	1.08

APPENDIX D STANDARD DESIGNS FOR PROPOSED WASTEWATER MANAGEMENT INFRASTRUCTURE

Example standard design for Wisconsin Sand Mound (AS/NZS 1547:2012)



Example subsurface irrigation system (AS/NZS 1547:2012)



NOTES:

- 1 Example system sized for 700 L/d and DIR of 3.5 mm/d in soil Category 3 (see Table M1).
- 2 Preferred dosing method is by a 6-way automatic sequencing valve.
- 3 Good quality topsoil to 250 mm depth is required.
- 4 Flexible 100 mm diameter corrugated drainage line can be used in place of rigid PVC.
- 5 Distribution aggregate of 10 mm to 15 mm size can be used in place of pea gravel.



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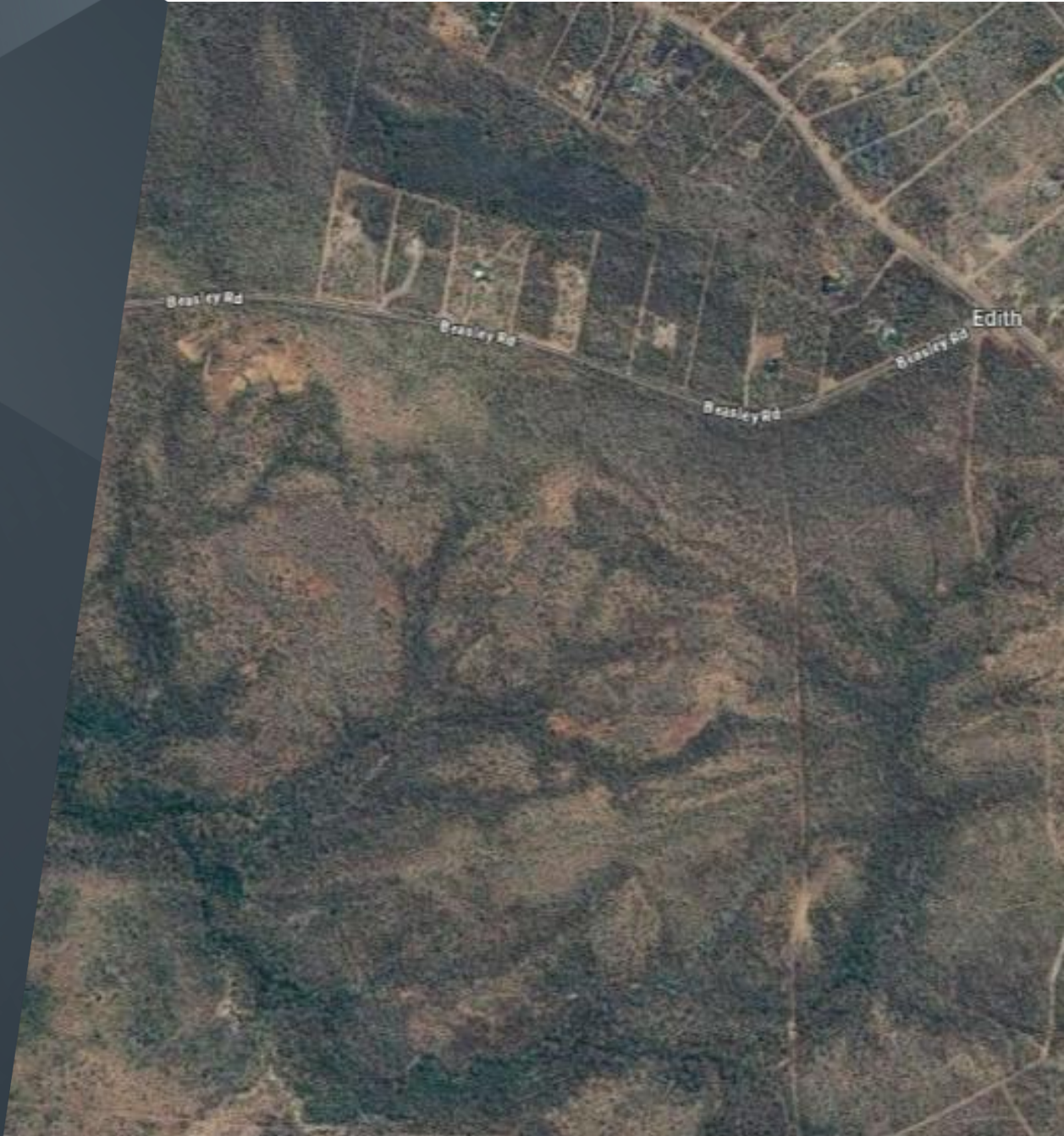


Sunrise Estates Subdivision – Stage 3 NT Portion 7860, Edith Farms Road, Edith

Erosion and Sediment Control Plan

Daly River Pastoral




8 April 2026



byrne.

Document Control

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 Prepared by: Patrick Chin
 Reviewed by: Paul Brandis

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In preparing this report, Byrne Consultants has relied upon, and presumed accurate, any information provided by Daly River Pastoral and other sources. Unless noted otherwise, Byrne Consultants has not attempted to verify the accuracy or completeness of any such information.



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1 Introduction

Daly River Pastoral (the Developer) is proposing to subdivide Section 7860, 745 Edith Farms Road, Edith NT (the Site) into 26 large Rural Lots of minimum 8ha (the Subdivision). The Site is currently unzoned.

Byrne has been engaged by the Developer to prepare this Erosion and Sediment Control Plan to support the Development Application, and ultimately construction of the Subdivision.

1.1 CPESC Certification

This Erosion and Sediment Control Plan (ESCP) has been prepared and certified by Paul Brandis (CPESC No. 9681) and complies with the *International Erosion Control Association (IECA) Australasia Best Practice Erosion and Sediment Control (BPESC) Guidelines*.

2 Background Information

2.1 About the Site

The Site (**Figure 1**) is approximately 3437ha and is unincorporated unzoned land. The Site is leased for pastoral use and is predominantly natural bushland with a small dwelling and a small quarry.

The Site is bounded by Beasley Road to the North, and Edith Farms Road to the North-East which includes several smaller lots (approx. 8ha) previously developed as part of Sunrise Estates – Stage 2. Other boundaries about similar large private rural/pastoral properties.

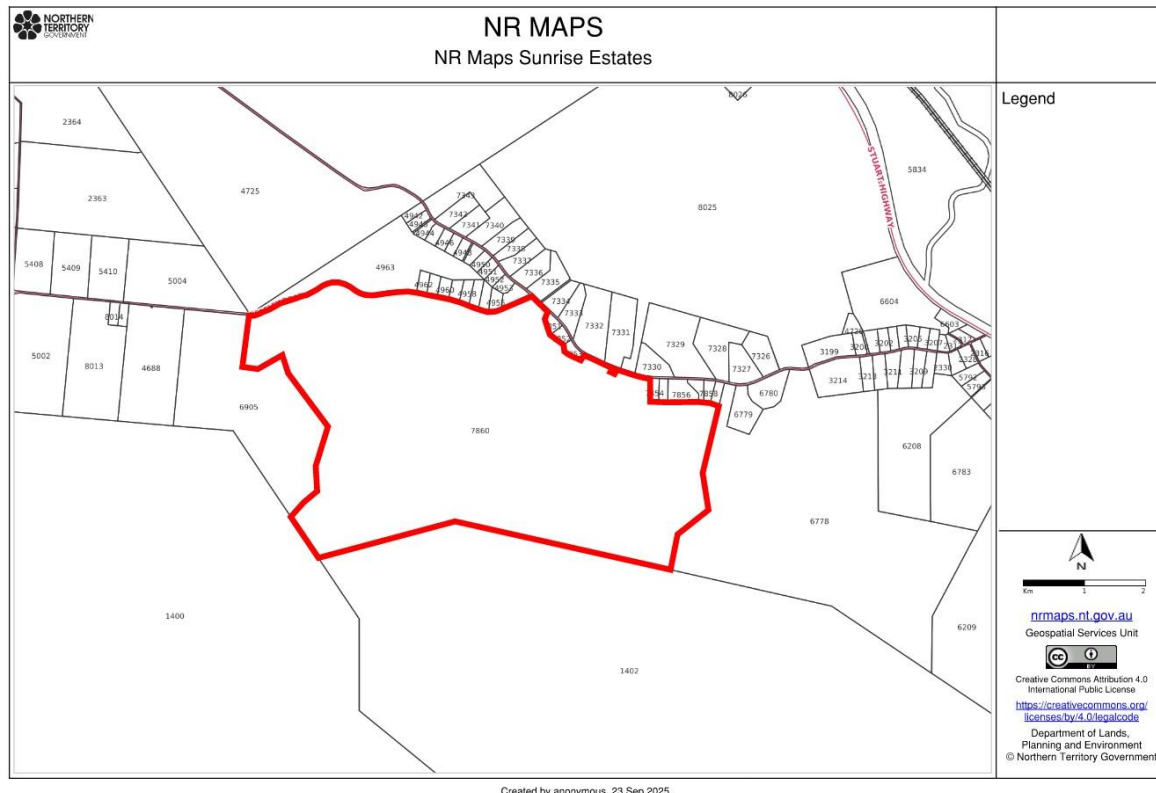


Figure 1. Site Locality (Source: NR Maps)

2.2 Subdivision Plans

Subdivision Plans are provided in Drawings NT25091-C001 to NT25091-C005 Revision C (Attachment A). The Site is proposed to be subdivided into 26 Lots, which are typically in the order of 8.01 ha except for:

- NT Portion 6777 Balance Lot – 589.72 ha
- Lot 1 – 1981.89 ha
- Lot 5 – 440.81 ha
- Lot 12 – 17.28 ha
- Lot 14 – 13.81 ha
- Lot 24 – 20.15 ha

2.3 Development Works

The development works (the Works) required to facilitate the Subdivision is generally limited to:

- Clearing and establishment of 10m wide firebreaks along new Subdivision boundaries; and
- Installation of access driveways fronting each new allotment, typically comprising concrete invert crossovers as per DLI Standard Drawing CS-3005.

Minimal alteration in land use or clearing is expected to result from the proposed Subdivision, with only minor clearing required for the establishment of firebreaks.

Lots 21, 22 and 23 include an existing gravel pit, which has historically been cleared. It is proposed that this be rehabilitated as part of the Works with some minor reshaping and revegetation.

2.4 Topography

Byrne Consultants obtained topography information from the following sources:

- 1m smoothed contour data, derived from Elevation and Depth - Foundation Spatial Data (ELVIS)
- 1 : 2,500 Topo Maps (NR Maps)

Site elevation ranges from approx. 110m to 170m AHD. The Site broadly slopes from east to west, with Beasley Road and Edith Farms Road generally following ridgelines.

2.5 Construction Program

The Works are proposed to be undertaken during the 2026 'Dry Season' (May to September).

3 Erosion Risk

An Erosion Risk Assessment has been undertaken using the RUSLE soil loss equation, in accordance with BPESC Guidelines. Due to the scale of work required and intended construction program, there will be a:

- 'Very Low' rainfall erosivity risk; and
- 'Moderate' wind erosion risk.

4 Erosion and Sediment Control Management

4.1 Lot Boundaries / Firebreaks

The Works includes clearing and establishment of 10m wide firebreaks along new Subdivision boundaries.

As part of the planning process, Subdivision boundaries and associated firebreaks have been set out to minimise ongoing drainage and erosion issues, so far as reasonably practicable. This includes:

- Locating boundaries outside of drainage lines, including 25m riparian vegetation buffers and seepage zones. Where this is not possible, they have been set out to cross drainage lines at right angles to minimise interference (Attachment A).
- Locating boundaries along contours to minimise longitudinal gradients and mitigate long stretches of flow accumulation along firebreaks. Refer Site slope heat map with boundary locations (Attachment B). Where this is not possible, diversion banks will be provided in accordance with *DENR Technical Note 8*, with locations determined by the ESCP designer through field inspection to adapt to site topography and conditions.

Construction of the firebreaks must comply with the following management measures, where practicable:

1. Firebreaks are to be cleared and grubbed. Existing topsoil, where available, is to be retained over the firebreaks and respread for natural revegetation.
2. Firebreaks are to be graded to fill in localised hollows and depressions, and to encourage sheet flow conditions across the tracks. No debris or windrows are to remain which could cause channelisation of flows along the firebreaks.
 - **Hold Point 1** - ESCP Designer to inspect the firebreaks to confirm steps 1 and 2 have been completed satisfactorily and identify locations where diversion banks are required.
3. Diversion Banks are to be installed in accordance with the DENR Technical Note 8 (Attachment C).
 - **Hold Point 2** – ESCP Designer to inspect the completed diversion banks and provide CPESC Certification for the as-constructed works.

4.2 Access Driveways

The Works requires installation of access driveways fronting each new allotment, typically comprising concrete invert crossovers as per DLI Standard Drawing CS-3005.

Construction of the driveways must comply with the following management measures, where practicable:

- Utilise existing sealed roadways to prevent damage to the road verge and minimise trafficking of sediments onto the sealed roadway.
- Where rainfall is reasonably possible, and erodible soils are exposed within table drains, provide effective ground cover (e.g. polymer, geotextile, builders plastic) to minimise erosion and damage.

All disturbed areas are to be rehabilitated upon completion, to the satisfaction of DLI Transport and Civil Services Division.

4.3 Gravel Pit Rehabilitation (Lots 21, 22 and 23)

The Works requires rehabilitation of an existing gravel pit within proposed Lots 21, 22 and 23. Works will involve minor reshaping and revegetation, to restore natural values.

Construction of these works must comply with the following management measures:

- Provide entry/exit controls (e.g. rock pad or shaker grid) to minimise trafficking of sediments onto the sealed roadway as per IECA Standard Drawing EXIT-01.
- Manage dust through managing site vehicle movements and applying water suppression, or similar.
- Where rainfall is reasonably possible, provide sediment fence or mulch filter berms to all downslope perimeters, with controlled release points in the form of rock filter dams or similar. Refer IECA Standard Drawings SF-01/SF-02, MB-01 and RFD-03 for details.

Note: All IECA Standard Drawings are available through:

<https://austieca.com.au/resources/resources-list/bpesc-document/standard-drawings>

5 Conclusion

Compliance with this Erosion and Sediment Control Plan will mitigate potential drainage, erosion and sedimentation risks associated with the Subdivision so far as reasonably practicable.

This ESCP complies with IECA BPESC Guidelines, has been certified by a CPESC, and is deemed to satisfy the requirements of the NT Planning Scheme 2020.

Please contact me if you wish to discuss this report further.

Yours sincerely,



Paul Brandis

Principal Engineer (CPESC No. 9681)

BEng(Civil), MIEAust, CPEng, NER, RPEQ, DipPM, CPESC, GAICD

Attachments

Attachment A – Subdivision Plans (NT25091-C001 to C003, and NT25091-C101 to C103)

Attachment B – Site Slope Heat Map with Boundary Locations

Attachment C – DENR Technical Note 8: Diversion Banks

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TECHNICAL ASSESSMENT OF PROPOSED DEVELOPMENT AGAINST RELEVANT PROVISIONS OF THE NORTHERN TERRITORY PLANNING SCHEME 2020

Application No: PA2026/0137

Lot number: 7860 (745) Edith Farms Rd, Edith

Town/Hundred: N.T. Portion

Zone: Unzoned

Site Area: 3437ha

Proposal: Subdivision to create 26 lots (25 new lots and the balance parcel) in 3 stages

Plans used for assessment:

Date assessment finalised: 02 June 2026

The proposed development requires consent under the Northern Territory Planning Scheme 2020 as described in the below table:

Unzoned			
Development	Assessment Category	Overlays	Subdivision Requirements
Subdivision	Impact Assessable	3.2 CNV – Clearing of Native Vegetation	6.3.2 (Lot Size and Configuration for Subdivision in Zones RL, R and H, and Unzoned Land) 6.3.3 (Site Characteristics for Subdivision for Lots of 1ha or Greater in Zones RR, RL, R and H, and Unzoned Land) 6.3.4 Infrastructure for Subdivision in Zones RL, R and Unzoned Land 6.3.6 Lots less than 8 ha on Unzoned Land

This is a technical assessment of the proposal against the requirements of the Northern Territory Planning Scheme 2020 (NTPS2020) and is no indication of whether or not approval will be given by the consent authority.

Part 1 - Guidance

1.8 (When development consent is required)

NTPS 2020		DAS DLPE comments
1.	<p>The need for consent and the level of assessment that applies to the use and development of land is set out in the framework below:</p> <p>(c) <i>Impact Assessable</i> – use and development that requires the exercise of discretion by the consent authority to determine if it is appropriate given the location of the site and the potential impacts on surrounding uses, and if it accords with the Strategic Framework.</p> <p>Use and development of land requires consent and is <i>Impact Assessable</i> when any of the following apply:</p> <p>ii. it is for the subdivision of land other than that included at Clause 1.8(1)(b)(iii)</p>	The application is for subdivision other than for the purpose of consolidation/UTS (Clause 1.8(1)(b)(iii))

1.10 Exercise of Discretion by the Consent Authority

NTPS 2020		DAS DLPE comments
1.	<p>In considering an application for consent for a use or development, the consent authority must consider the use or development in its entirety except in relation to:</p> <p>(a) an application to alter, change or vary a development permit under sections 43A, 46 or 57 of the Act;</p> <p>(b) access to a main road; or</p> <p>(c) a <i>Merit Assessable</i> application under Clause 1.8(1)(b)(ii)(2).</p>	Applicable – the proposed subdivision must be considered in its entirety because the use/development is not listed under sub-clauses (a), (b) or (c).
4.	<p>In considering an application for a use or development identified as <i>Impact Assessable</i> the consent authority must take into account all of the following:</p> <p>(a) any relevant requirements, including the purpose of the requirements, as set out in Parts 5 or 6;</p> <p>(b) any Overlays and associated requirements in Part 3 that apply to the land;</p> <p>(c) the guidance provided by the relevant zone purpose and outcomes in Part 4, or Schedule 4.1 Specific Use Zones; and</p> <p>(d) any component of the Strategic Framework relevant to the land as set out in Part 2.</p>	<p>The proposed subdivision is <i>Impact Assessable</i> and therefore the consent authority must take into account:</p> <ul style="list-style-type: none"> • The following Part 6 requirements: <ul style="list-style-type: none"> ○ Clause 6.3.2 (Lot Size and Configuration for Subdivision in Zones RL, R and H, and Unzoned Land) ○ Clause 6.3.3 (Site Characteristics for Subdivision for Lots of 1ha or Greater in Zones RR, RL, R and H, and Unzoned Land) ○ Clause 6.3.4 Infrastructure for Subdivision in Zones RL, R and Unzoned Land • Overlays: <ul style="list-style-type: none"> ○ Clause 3.2 – CNV (Clearing of Native Vegetation) • The following components of the strategic framework: <ul style="list-style-type: none"> ○ Katherine Land Use Plan

5.	The consent authority may consent to a proposed use or development that is not in accordance with a requirement set out in Parts 3, 5 or 6 only if it is satisfied that the variation is appropriate having regard to:	The application is considered to comply with all requirements (subject to conditions on a permit if issued).
(a)	the purpose and administration clauses of the requirement; and	
(b)	the considerations listed under Clause 1.10(3) or 1.10(4).	

Part 2 – Strategic Framework

While ILIS indicates that the Katherine Land Use Plan is relevant to the subject lot, the proposed area of subdivision is located outside the ‘Study Area’ (image below) and therefore is not applicable to the application.

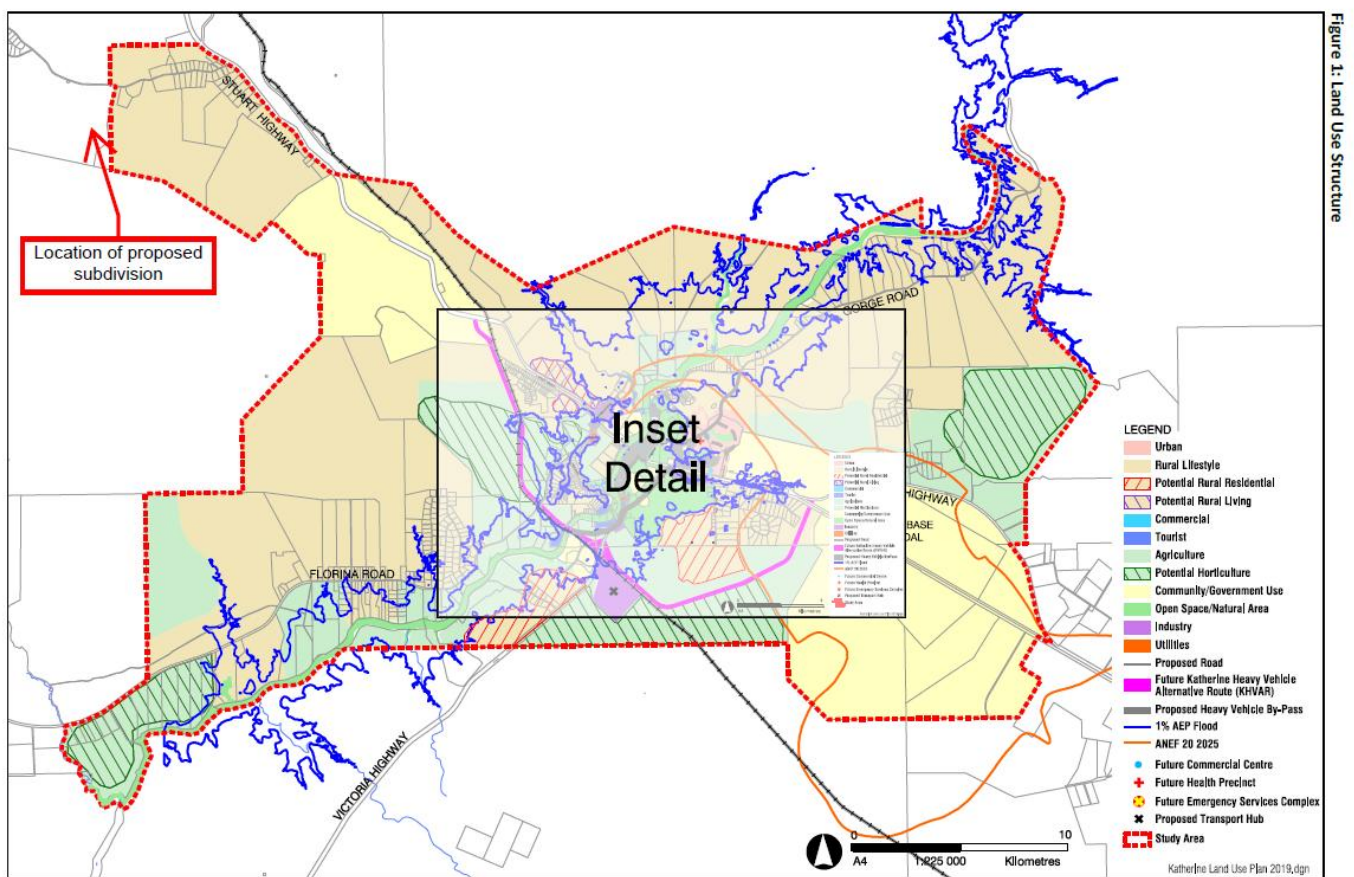


Figure 1: Land Use Structure

NOT APPLICABLE

Part 3 - Overlays

3.2 – CNV Clearing of Native Vegetation

Sub-clause 5 provides that “This Overlay does not apply to the clearing of native vegetation that:

(b) is for the following purposes:

- i. a firebreak as specified by the Bushfires Management Act 2016 or the Fire and Emergency Act 1996, up to 5m wide along a boundary of a lot having an area of 8ha or less, or up to 10m wide on a lot having an area greater than 8ha, unless otherwise specified by a Regional Fire Control Committee;

- ii. an internal fence line up to 10m wide on a lot having an area greater than 8ha;
- iii. an internal vehicle access track up to 10m wide and at least 100m away from any cleared land used for a vehicle access track within the same site;
- vi. a road to **access** the land or other land;

The applicant indicates that no clearing other than for firebreaks and vehicle access will be carried out, and no other clearing in excess of 1 hectare. Therefore, Clause 3.2 is not considered to be applicable.

NOT APPLICABLE

Part 4 - Zones

The application is on Unzoned Land and therefore no Zone requirements are applicable.

NOT APPLICABLE

Part 5 – Development Requirements

The proposal is for a subdivision and not the establishment of a use, and therefore there are no applicable Part 5 development requirements.

NOT APPLICABLE

Part 6 – Subdivision Requirements

6.3.2 (Lot Size and Configuration for Subdivision in Zones RL, R and H, and Unzoned Land)

Northern Territory Planning Scheme 2020		DAS DLPE Comments
<i>Purpose</i>		
<i>Ensure subdivisions of rural and unzoned land:</i>		DAS assesses that the proposal complies with lot size and configuration requirements, and therefore is consistent with the purpose of this clause.
(a)	<i>have lots that are of a size and configuration suited for the intended purpose;</i>	
(b)	<i>have lots that are of a size consistent with the topographical constraints of the land (that may dictate that lots are of an area in excess of the specified minimum); and</i>	
(c)	<i>do not impose unsustainable demands on groundwater or unreasonably degrade the environment.</i>	
<i>Administration</i>		
1.	<i>The consent authority may consent to a subdivision that is not in accordance with sub-clauses 5-10 if it is satisfied that:</i>	Not applicable – the proposal has been assessed as compliant with lot size and configuration requirements.

	(a)	the subdivision does not result in an increased lot yield; and	
	(b)	the lot size and/or configuration achieves at least one of the following:	
	i.	an existing boundary encroachment by a building is remedied;	
	ii.	the lots created are more regular in shape;	
	iii.	access is provided to a lot that previously had no access or an unsuitable access;	
	iv.	the subdivision will better meet the overall outcomes for the zone and the relevant components of the strategic framework applicable to the locality;	
	v.	the arrangement of lots results in a significant protection of areas of environmental value; or	
	vi.	provides opportunity for a future local road network; and	
	(c)	the consent authority is satisfied that the lots created will be consistent with the purpose of this requirement and the zone purpose and outcomes.	
2.		The consent authority may consent to a subdivision on Unzoned Land that is not in accordance with the table to this clause only if it is satisfied that the lots created will be consistent with the purpose of this requirement.	
3.		Despite sub-clause 1, the consent authority must not consent to a subdivision in Zone RL in Alice Springs and adjacent zoned areas that is not in accordance with the table to this clause.	
4.		The unconstrained nature of the land is to be demonstrated by a land suitability assessment addressing the NT Land Suitability Guidelines, in accordance with clause 6.3.3.	The applicant has provided a land suitability assessment the address the unconstrained land in accordance with the NT Land Suitability Guidelines.
Requirements			

5. Land is to be subdivided in accordance with the table to this clause.

Table to Clause 6.3.2: Lot Size and Configuration for Subdivision in Zones RL, R and Unzoned Land	
Zone	Minimum Lot Size and Requirements
RL	2ha with a minimum of 1ha of unconstrained land
R	8ha with a minimum of 1ha of unconstrained land or 40ha in Alice Springs and Tennant Creek municipalities, with a minimum of 1ha of unconstrained land
H	25ha all unconstrained land
Unzoned Land	8ha

Complies – drawing numbers C102 & C103 show lot sizes ranging from 8.01ha to 1981.89ha.

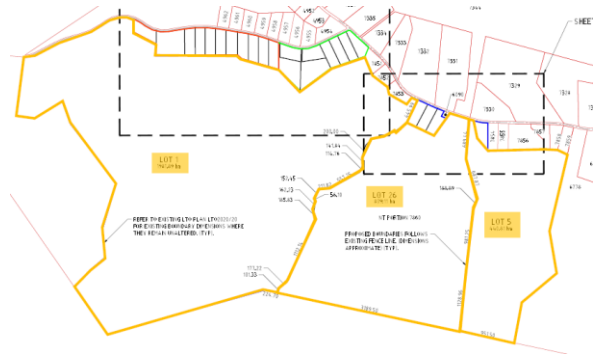
Drawings numbered C002 & C003 include a table (below) that shows at least 1ha of unconstrained land that is directly accessible for a public road.

UNCONSTRAINED LAND ASSESSMENT		
LOT No.	LOT SIZE (ha)	AREA OF UNCONSTRAINED LAND (ha)
7	8.03	4.19
8	8.02	2.55
9	8.01	5.95
10	8.03	5.45
11	8.01	7.86
12	17.28	8.56
13	8.03	5.67
14	13.81	7.25
15	8.01	4.40
16	8.01	3.38
17	8.01	1.38
18	8.01	3.76
19	8.01	3.79
20	8.00	2.73
21	8.01	5.01
22	8.01	5.22
23	8.02	2.62
24	20.15	5.41
25	8.02	2.33

LEGEND	
	EXISTING PROPERTY BOUNDARY
	PROPOSED PROPERTY BOUNDARY
	EXISTING SURFACE CONTOUR (1m)
	STAGE 3A BOUNDARY
	STAGE 3B BOUNDARY
	STAGE 3C BOUNDARY
	UNCONSTRAINED LAND
	CONSTRAINED LAND DRAINAGE LINE & 25m BUFFER ZONE
	CONSTRAINED LAND SLOPE >3%
	UNCONSTRAINED LAND EXCLUDED FROM ASSESSMENT TABLE

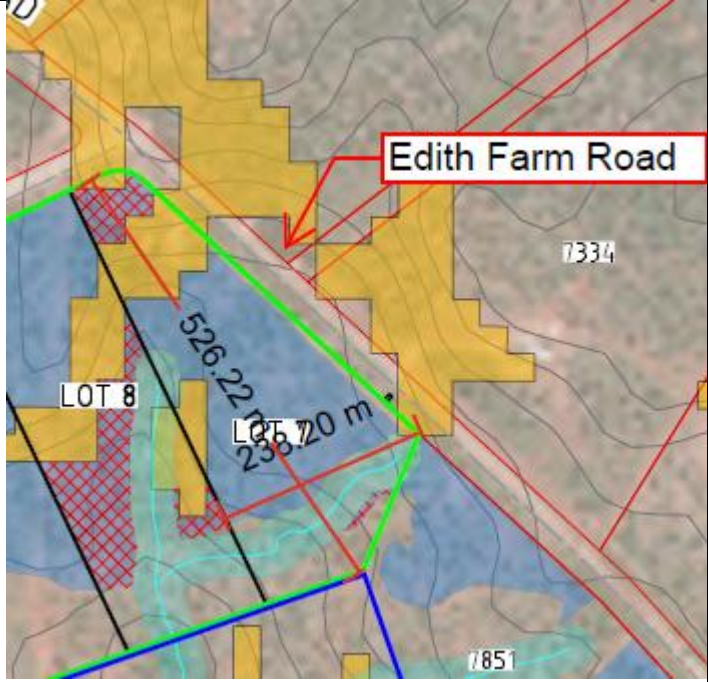
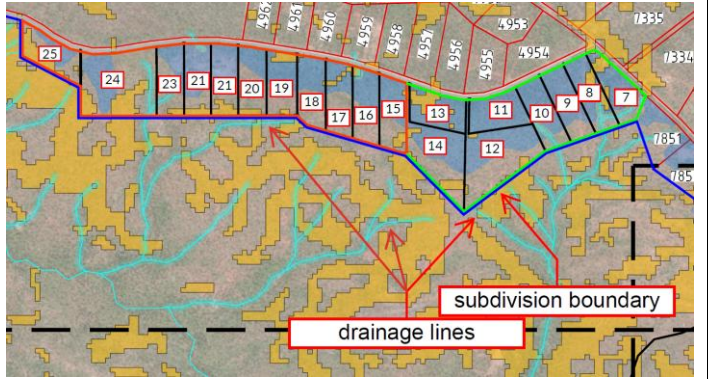
6. Lots have a depth to width ratio not exceeding 4:1.

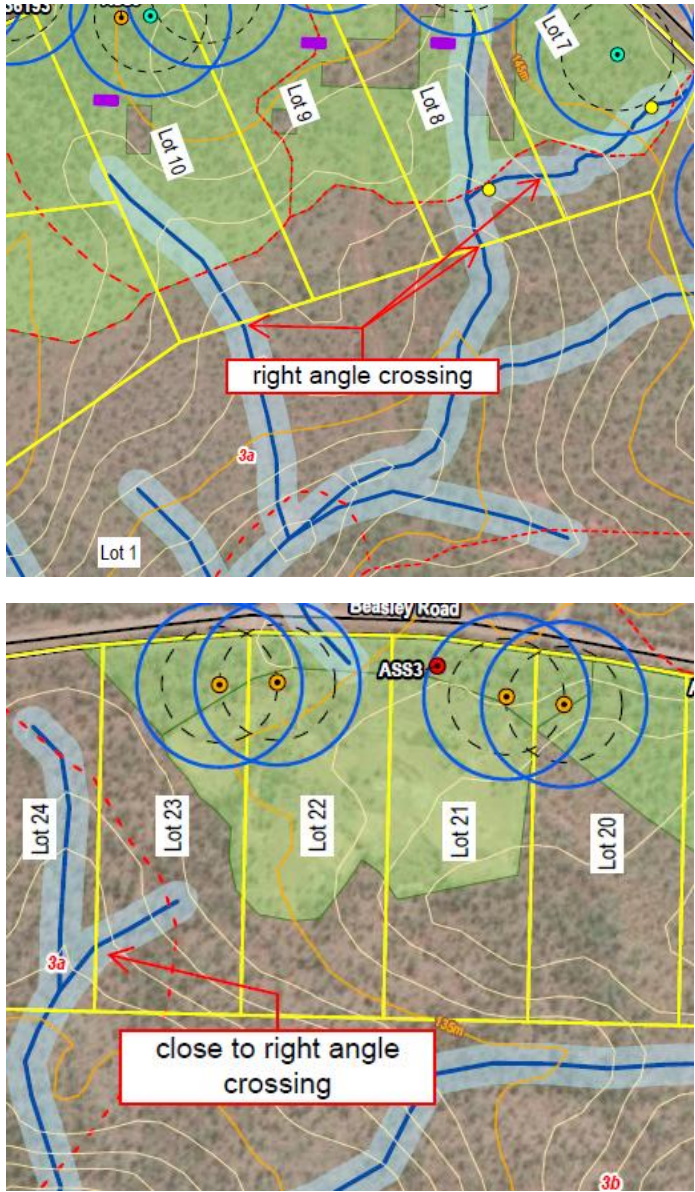
Generally complies – lots 1, 5 & 26 are effectively remanent parcels lots capable of being subdivided further.

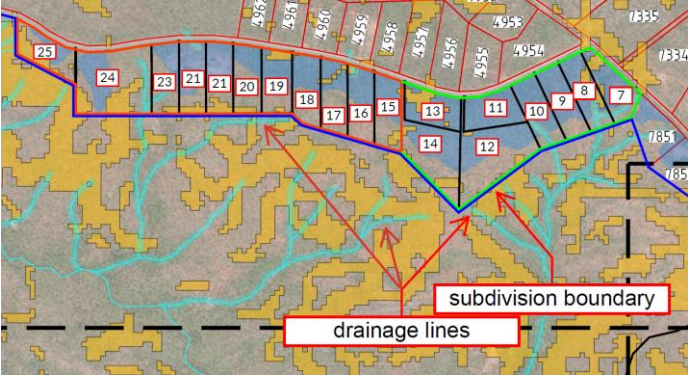


Lots 2-4, 6, and 8-25 all have depth to width ratio of less than 4:1 (the highest ratio is for lot 8 which has a ratio of 3.16:1).

Lot 7 has a (maximum) depth of approximately 526.22m and a (maximum) width of 238.2m which equals a simplified ratio of approximately 2.21:1 (or 4:8.84 if Edith Farm Road was counted as the primary street – image below).

		 <p>Edith Farm Road</p> <p>7334</p> <p>7851</p> <p>LOT 8</p> <p>526.22</p> <p>70 m</p>
7.	<p><i>Incorporate as far as practicable, drainage lines and drainage floors wholly within a single lot.</i></p>	<p>Generally complies – the subdivision layout generally avoids drainage lines.</p>  <p>subdivision boundary</p> <p>drainage lines</p> <p>The applicant indicates that drainage lines cross the following lot boundaries:</p> <ul style="list-style-type: none"> • the rear boundary of lot 24 • the lot 23/24 shared side boundary • the rear boundary of lot 10 • the rear boundary of lot 8 • lot 7/8 shared side boundary • the rear boundary of lot 6
8.	<p><i>Allow for 70m separation between bores, both proposed and existing.</i></p>	<p>Complies – figures 4.1 – 4.3 show that all lots can accommodate a 70m separation between bores.</p>
9.	<p><i>Lot boundaries are to be:</i></p>	<p>See below:</p>








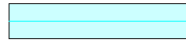


(a)	<p><i>at right angles to any watercourse;</i></p>	<p>Generally complies – drainage lines generally cross boundary lines at right angles or as close to as possible.</p> 
(b)	<p><i>sufficiently up slope to be outside of seepage zones where following drainage lines; and</i></p>	<p>Not applicable – the proposed lot boundaries cross drainage lines at right angles (or as close as practical to right angles), and do not follow drainage lines.</p>
(c)	<p><i>at right angles to contours or along contours where slope is between 2.0% and 5.0% and follow ridge lines, spurs or contours where slope is above 5.0%.</i></p>	<p>Generally complies – the subdivision boundary slope plan shows that all boundary lines avoid slopes in excess of 5%, are predominantly located on land with slopes less than 2%, and where the boundaries are located on slopes between 2% and 5% either cross ridgelines at right angles (or close to), or along contours (as much as practical).</p>

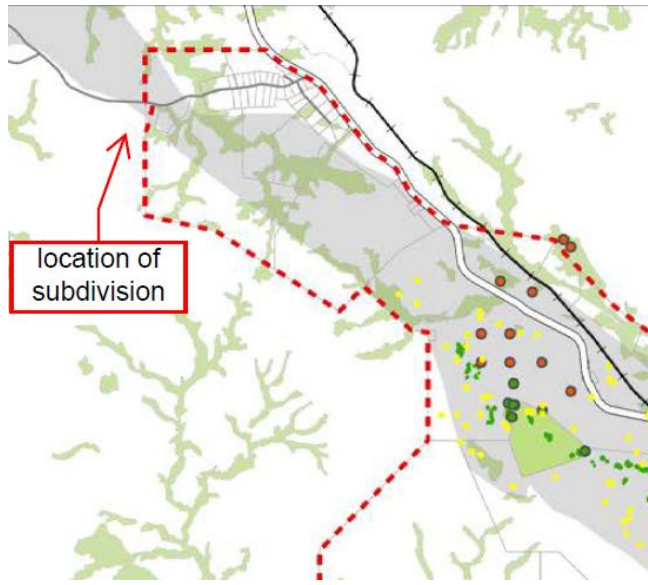
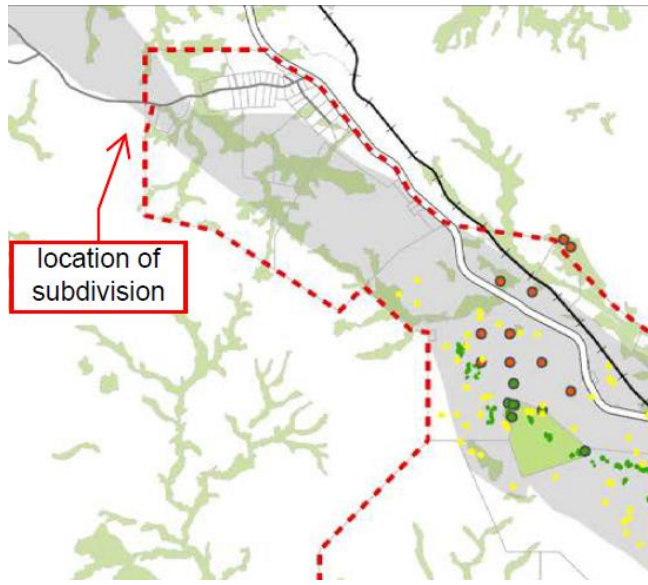
10.	Minimise the number of watercourse crossings.	<p>Generally complies – the subdivision layout generally avoids drainage lines.</p>  <p>The applicant indicates that drainage lines cross the following lot boundaries:</p> <ul style="list-style-type: none"> • the rear boundary of lot 24 • the lot 23/24 shared side boundary • the rear boundary of lot 10 • the rear boundary of lot 8 • lot 7/8 shared side boundary • the rear boundary of lot 6
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GENERALLY COMPLIES

6.3.3 (Site Characteristics for Subdivision for Lots of 1ha or Greater in Zones RR, RL, R and H, and Unzoned Land)

Northern Territory Planning Scheme 2020	DAS DLPE Comments
<i>Purpose</i>	
<i>Ensure subdivision of land in Zones RR, RL, R and H, and unzoned land, responds to the physical characteristics of the land.</i>	The application is considered to respond appropriately to the physical characteristics of the land including stormwater drainage lines, ridges and slopes, etc.
<i>Administration</i>	
<p>1. <i>The consent authority must not consent to a subdivision that does not include 1ha of land per lot in Zones RL, R and Unzoned Land, and 25ha in Zone H, identified as unconstrained in relation to:</i></p> <p>(a) <i>Storm tide flooding;</i></p> <p>(b) <i>Riverine flooding;</i></p> <p>(c) <i>Localised stormwater flooding;</i></p>	Not applicable – the proposal is considered to comply with site characteristic requirements.

	<i>in accordance with the land suitability assessment and stormwater management plan.</i>																																																																
2.	<i>The consent authority must not consent to a subdivision unless the relevant government agencies, local government council and service authorities provide formal comment to the consent authority in relation to the land suitability assessment and stormwater management plan and the possibility of storm tide flooding, riverine flooding and localised stormwater flooding of the identified 1ha of land.</i>																																																																
3.	<i>The consent authority may consent to an application that is not in accordance with sub-clauses 4-7 if the application includes preliminary land assessment and stormwater management plans prepared by the applicant and approved by the relevant government agency and or service authority, demonstrating that 1ha of land per lot and all internal roads are unconstrained by localised stormwater flooding and by those issues addressed in the NT Land Suitability Guidelines.</i>																																																																
Requirements																																																																	
4.	<i>Each lot is to have unconstrained access from a public road to the identified unconstrained land.</i>	<p>Complies – drawings numbered C002 & C003 include a table (below) that shows at least 1ha of unconstrained land that is directly accessible for a public road.</p> <table border="1"> <thead> <tr> <th colspan="3">UNCONSTRAINED LAND ASSESSMENT</th> </tr> <tr> <th>LOT No.</th> <th>LOT SIZE (ha)</th> <th>AREA OF UNCONSTRAINED LAND (ha)</th> </tr> </thead> <tbody> <tr><td>7</td><td>8.03</td><td>4.19</td></tr> <tr><td>8</td><td>8.02</td><td>2.55</td></tr> <tr><td>9</td><td>8.01</td><td>5.95</td></tr> <tr><td>10</td><td>8.03</td><td>5.45</td></tr> <tr><td>11</td><td>8.01</td><td>7.86</td></tr> <tr><td>12</td><td>17.28</td><td>8.56</td></tr> <tr><td>13</td><td>8.03</td><td>5.67</td></tr> <tr><td>14</td><td>13.81</td><td>7.25</td></tr> <tr><td>15</td><td>8.01</td><td>4.40</td></tr> <tr><td>16</td><td>8.01</td><td>3.38</td></tr> <tr><td>17</td><td>8.01</td><td>1.38</td></tr> <tr><td>18</td><td>8.01</td><td>3.76</td></tr> <tr><td>19</td><td>8.01</td><td>3.79</td></tr> <tr><td>20</td><td>8.00</td><td>2.73</td></tr> <tr><td>21</td><td>8.01</td><td>5.01</td></tr> <tr><td>22</td><td>8.01</td><td>5.22</td></tr> <tr><td>23</td><td>8.02</td><td>2.62</td></tr> <tr><td>24</td><td>20.15</td><td>5.41</td></tr> <tr><td>25</td><td>8.02</td><td>2.33</td></tr> </tbody> </table> <p>LEGEND</p> <ul style="list-style-type: none">  EXISTING PROPERTY BOUNDARY  PROPOSED PROPERTY BOUNDARY  EXISTING SURFACE CONTOUR (1m)  STAGE 3A BOUNDARY  STAGE 3B BOUNDARY  STAGE 3C BOUNDARY  UNCONSTRAINED LAND  CONSTRAINED LAND DRAINAGE LINE & 25m BUFFER ZONE  CONSTRAINED LAND SLOPE >3%  UNCONSTRAINED LAND EXCLUDED FROM ASSESSMENT TABLE 	UNCONSTRAINED LAND ASSESSMENT			LOT No.	LOT SIZE (ha)	AREA OF UNCONSTRAINED LAND (ha)	7	8.03	4.19	8	8.02	2.55	9	8.01	5.95	10	8.03	5.45	11	8.01	7.86	12	17.28	8.56	13	8.03	5.67	14	13.81	7.25	15	8.01	4.40	16	8.01	3.38	17	8.01	1.38	18	8.01	3.76	19	8.01	3.79	20	8.00	2.73	21	8.01	5.01	22	8.01	5.22	23	8.02	2.62	24	20.15	5.41	25	8.02	2.33
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5.	<i>An application to subdivide rural or unzoned land should include the following documents prepared by suitably qualified professionals:</i>	Complies – (a), (b) and (c) discussed below:																																																															
	(a) <i>a land suitability assessment addressing the NT Land Suitability Guidelines; and</i>	<u>Land Suitability Assessment (LSA)</u> The LSA (and addendum) assesses the area of subdivision against the Land Suitability Guidelines. The assessment shows the unconstrained land matches with that shown as unconstrained on drawings C002 & C003. It is noted that the report does not include an assessment against Storm Tide Flooding however this is not considered required																																																															
	(b) <i>a stormwater management plan including but not limited to; the potential impact on neighbouring land, external roads, internal roads and the 1ha of land identified as</i>																																																																

	<p>unconstrained, the upstream and downstream flows and any proposed mitigation measures.</p>	<p>due to the distance of the subdivision from any coastal areas.</p> <p><u>Stormwater Management Plan (SMP)</u> An SMP has been provided with application. The SMP indicates that there will be minimal changes to the existing hydrological flow regimes and negligible impact on the stormwater quality within existing drains and creeks subject to this subdivision.</p> <p>No internal roads are proposed.</p>
6.	<p>The subdivision design must address the constraints as identified in the land suitability assessment and stormwater management plan in relation to the location of internal roads, lot boundaries and the identified 1ha of unconstrained land.</p>	<p>Complies – the land suitability assessment identifies minor constraints that can be managed through engineering.</p> <p>The report concludes that these constraints can be managed by:</p> <ul style="list-style-type: none"> • implementing an ESCP (for erosion) and septic system design (for wastewater management) • remediation of a gravel pit <p>A condition can be included that requires an ESCP to be implemented and for remediation of the gravel pit.</p>
7.	<p>An application to subdivide land on the maps “Priority Environmental Management Areas – Litchfield” and “Priority Environmental Management Areas – Katherine” as an area potentially of environmental significance should, on the advice of the relevant government agency, be accompanied by and the consent authority shall have regard to an evaluation by a suitably qualified professional of the environmental significance of the native vegetation and land form (e.g. lagoons, wetlands, rugged terrain and drainage systems).</p>	<p>Not applicable – the subdivision is located outside the ‘Priority Environmental Management Areas – Katherine’ map (image below).</p> 
8.	<p>An application described in sub-clause 7 must demonstrate that the proposed subdivision design does not adversely affect the environmental values as identified in the evaluation.</p>	
9.	<p>Subdivision design of rural and unzoned land should:</p>	<p>Complies – the applicant indicates that no significant natural or cultural features were</p>

(a)	Retain and protect significant natural and cultural features;	<p>existing, or identified during field studies.</p> <p>The LSA indicates that there are no areas of high conservation significance within the subdivision area, and that riparian zones are in land units 7e which is located outside the main subdivision area. Additionally, the Stormwater Management Plan indicates that the existing stormwater drainage regime will remain practically unchanged.</p> <p>The subdivision design has been created to minimise erosion hazard, sedimentation and pollution of water course (boundaries crossing drainage lines at right angles and avoiding slopes, etc).</p> <p>Comments have been requested from the Land Resource Division of DLPE.</p>
(b)	Minimise the number of lots in, or exclude from subdivision, areas of high conservation significance and riparian zones;	
(c)	Minimise alteration or disturbance to natural drainage systems including drainage areas, recognisable watercourses, lagoons and permanent and semi-permanent springs; and	
(d)	Minimise erosion hazard, sedimentation and pollution of watercourses.	

COMPLIES

6.3.4 Infrastructure for Subdivision in Zones RL, R and Unzoned Land

Northern Territory Planning Scheme 2020		DAS DLPE Comments
<i>Purpose</i>		
Ensure that subdivision of land in Zones RL, R and unzoned land, is integrated with infrastructure, community services and facilities and will not unreasonably affect the environment.		<p>No reticulated services are available in the area. The applicant has provided a land suitability assessment and site and soil test to demonstrate that required infrastructure can be implemented.</p> <p>Additionally, the applicant proposes minimal earthworks, and only where required (firebreaks, access and remediation works).</p>
<i>Administration</i>		
1.	The consent authority may consent to a subdivision that is not in accordance with sub-clauses 2-7, only if it is satisfied the subdivision is consistent with the purpose of this clause.	Not applicable – the application is considered to comply with infrastructure requirements.
<i>Requirements</i>		
2.	Minimise disturbance through earthworks associated with the provision of infrastructure.	Complies – the applicant has provides that “Earthworks are limited to the quarry remediation, installation of driveway crossovers and stabilisation of firebreaks. No new roads or reticulated infrastructure is proposed”

3.	<i>Provide for connection to reticulated services where practical.</i>	Not applicable - no reticulated services are available in the location.
4.	<i>Where no reticulated sewerage is available, a site and soil evaluation report must be completed by an appropriately qualified site-and-soil evaluator demonstrating that onsite wastewater management systems can be installed on each lot in accordance with the requirements of the Code of Practice for Wastewater Management.</i>	Complies - a site and soil assessment is provided with the application which demonstrates that onsite wastewater management systems can be installed on each lot.
5.	<i>Where no reticulated water is available, development is to demonstrate that an adequate supply of groundwater is available for domestic purposes, except where the land is:</i>	Can comply - the applicant has indicated that water availability has been discussed with Water Resources and bore yields in the immediate areas suggest there will be an adequate supply of groundwater for domestic purposed.
(a)	<i>Located within Zone RL or R in the Top End Region; and</i>	Comments have been requested from Water Resources.
(b)	<i>Within a 'restricted water extraction area' as declared by the Minister responsible for the administration of the Water Act 1992.</i>	

COMPLIES

Proposed Planning PA2026-0137 subdivision
NT Portion 07860 – 745 Edith Farms Road, Edith NT 0852

Concerns about this development

- The *underground water supply* to these blocks. Being a landholder, I have noticed that with the current usage from the underground water supply, the water level of my bore and others around have dropped and the pressure towards the end of the year has decreased as well as the sediment in the water supply. With more bores to be drilled for these blocks this is only going to become more pronounced. Depending on the wet season the water table does not get replenished each year. I am concerned that some of the bores in the area may even dry up towards the end of a dry.
- *Changing the layout of the gullies (water ways)* on these blocks. Filling in watercourses then alters where the water runs, this will then affect where water crosses roadways etc. At present there are lots of waterways across both Edith Farms Road and Beasley Road which become an issue especially, for low clearance vehicles in the area, and altering where the water flows will only make this worse.
- The *maintenance and upgrade of both Edith Farms Road and Beasley Roads*. At present this is lacking and with this subdivision the traffic will only increase on both. At present there are potholes that, if lucky, get a bit of repair each year only to be washed out again with the next lot of rain. Some of these become quite large and dangerous especially when there is water over the road as well. Both roads need upgrading or at least maintained to allow for the extra traffic this subdivision will bring.



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TOWN COUNCIL

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Ph: 08 8972 5500
Fax: 08 8971 0305
ABN 4783 6889 865

Our Ref: 745 Edith Farms Rd, Edith NT
Your Ref: PA2026/0137

15 May 2026

Development Assessment Services
Department of Lands, Planning and Environment
GPO Box 1680
Darwin NT 0800

PROPOSED DEVELOPMENT APPLICATION – PA2026/0137 - 745 EDITH FARMS RD, EDITH NT 0852

Dear George,

Council writes to advise the Development Assessment Services that it has no issues of concern with Development Application PA2026/0137 Subdivision to create 26 lots (25 new lots and the balance parcel) in 3 stages for NTP 07860, 745 Edith Farms Road, Edith NT.

Council advises that it does not currently own or maintain any registered assets or infrastructure within the area of the proposed subdivision. Accordingly, the development is not expected to have a significant impact on Council managed infrastructure.

The submitted driveway plans and stormwater management plans have been reviewed and are considered satisfactory.

Council supports and encourages appropriate development within its municipality, subject to compliance with all relevant planning and regulatory requirements.

Yours sincerely

Casey Anderson
ACTING CHIEF EXECUTIVE OFFICER

28 May 2026

E DevelopmentAssessment.DLPE@nt.gov.au

Mr Daniel Herlihy
Development Assessment Services
Department of Lands, Planning and Environment
GPO Box 1680
DARWIN NT 0801

T 08 8999 4446

Our Ref: DLPE2026/0146
Your Ref: PA2026/0137

Dear Mr Herlihy

Re: PA2026/0137 Subdivision to create 26 lots (25 new lots and the balance parcel) in 3 stages

The information provided for the above application has been assessed by the relevant divisions within the department, and the following comments are provided:

Flora and Fauna Division

Threatened Species

The threatened species listed in **Table 1** occur, or are likely to occur within, or immediately adjacent to, the application area. This is based on a search of the Department of Lands, Planning and Environment (DLPE) databases within a 10km radius of the application area, expert knowledge of species' habitat requirements, and information about habitats occurring within the application area. **Table 1** provides an assessment of the potential risks posed by the proposal to each species, based on current available information (including that provided by the applicant) and indicates whether the available information is sufficient to make a robust assessment, including identifying where further surveys are required to address important information gaps.

Table 1 – Threatened species listed under the *Territory Parks and Wildlife Conservation Act 1976* (TPWC Act) and/or the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) that are known to occur, or have a high potential of occurring within, or adjacent to, the application area.

Conservation status: VU = Vulnerable; EN = Endangered; CR = Critically Endangered.

Common Name	Scientific Name	TPWC Act Status	EPBC Act Status	Risk of potential impact	Survey Required
Fauna					
Bare-rumped Sheath-tailed Bat	<i>Saccolaimus saccolaimus</i>	-	VU	Low	No

Common Name	Scientific Name	TPWC Act Status	EPBC Act Status	Risk of potential impact	Survey Required
Black-footed Tree-rat (Kimberley and mainland Northern Territory)	<i>Mesembriomys gouldii gouldii</i>	EN	EN	Low	No
Ghost Bat	<i>Macroderma gigas</i>	-	VU	Low	No
Gouldian Finch	<i>Chloebia gouldiae</i>	VU	EN	Low	No
Grey Falcon	<i>Falco hypoleucos</i>	VU	VU	Low	No
Masked Owl (northern mainland)	<i>Tyto novaehollandiae kimberli</i>	VU	VU	Low	No
Mertens' Water Monitor	<i>Varanus mertensi</i>	VU	EN	Low	No
Mitchell's Water Monitor	<i>Varanus mitchelli</i>	VU	CR	Low	No
Northern Blue-tongued Skink	<i>Tiliqua scincoides intermedia</i>	-	CR	Low	No
Northern Brushtail Possum	<i>Trichosurus vulpecula arnhemensis</i>	-	VU	Low	No
Northern Quoll	<i>Dasyurus hallucatus</i>	CR	EN	Low	No
Northern Shrike-tit	<i>Falcunculus frontatus whitei</i>	-	VU	Low	No
Pale Field-rat	<i>Rattus tunneyi</i>	VU	-	Low	No
Partridge Pigeon (eastern)	<i>Geophaps smithii smithii</i>	VU	VU	Low	No
Red Goshawk	<i>Erythroriorchis radiatus</i>	VU	EN	Low	No
Victoria River Squat Snail	<i>Trachiopsis victoriana</i>	VU	-	Low	No
Yellow-spotted Monitor	<i>Varanus panoptes</i>	VU	-	Low	No

The Flora and Fauna Division considers the risk to threatened species arising from the proposal to be low, and therefore no targeted threatened species surveys are required. This is based on the subdivision being largely an administrative process with clearing restricted to the creation of firebreaks, the availability of suitable habitat elsewhere in the region, and the CNV – Clearing of Native Vegetation overlay applying to each of the proposed lots. Species for which the Flora and Fauna Division has made specific recommendations are discussed below. All other species are discussed in **Attachment 1**.

Ghost Bat: Roosting sites (particularly caves) are important for the survival of this species. Caves associated with sinkholes and rocky areas have the highest potential to support Ghost Bat roosting sites. The Land Suitability Assessments (Appendix D of the Statement of Effect) did not identify any sinkholes within NT Portion 7860, but areas of rock outcrop were located and mapped. This species has been recorded approximately 10km to the northwest and southeast of NT Portion 7860 and there is potential that Ghost Bats use the application area.

The risk to Ghost Bats from clearing foraging habitat is considered low due to the relatively low level of clearing permitted and the availability of intact foraging habitat in the surrounding area. However, the Flora and Fauna Division recommends restricting the use of barbed wire for fencing, as Ghost Bats are prone to being ensnared by the barbs when in flight.

It is unknown whether areas of rocky outcrop within NT Portion 7860 contain suitable roosting habitat for Ghost Bats. The Flora and Fauna Division recommends that areas of rock outcrop are incorporated wholly within individual lots where possible and are buffered from future development within the new lots as a precaution.

Victoria River Squat Snail: This species is associated with sinkholes and limestone outcropping. Areas of limestone outcropping identified within NT Portion 7860 have the potential to support the Victoria River Squat Snail. Therefore, the Flora and Fauna Division recommends that areas of rock outcrop are incorporated wholly within individual lots where possible and are buffered from future development within the new lots as a precaution.

Biodiversity

Sensitive and/or significant vegetation: DLPE mapping and interpretation of satellite imagery shows numerous streams throughout NT Portion 7860, with stream orders ranging from 1 to 3 (Bondi Creek). Sensitive and/or significant riparian vegetation may be associated with these streams. The Statement of Effect states that drainage lines have been incorporated wholly within individual lots where possible, and that where this has not been possible, lot boundaries cross these features as close to right angles as practicable, which is consistent with requirements of the Northern Territory Planning Scheme (NTPS). The Flora and Fauna Division supports the recommendations made in the Land Suitability Assessments (Appendix D of the Statement of Effect) that clearing in such areas is minimised.

The Flora and Fauna Division considers that the proposed subdivision of NT Portion 7860 poses a low risk to threatened species and biodiversity. The Flora and Fauna Division notes that the proposed subdivision is largely administrative with some clearing required for the establishment of firebreaks. Although the risk is low, the following recommendations are provided:

- Clearing for, and maintenance of, firebreaks through riparian areas is minimised and restricted to the minimum width legally required under relevant legislation;
- Areas of rock outcrop are incorporated wholly within individual lots where possible and are buffered from future development within the new lots;
- The use of barbed wire for fencing is restricted to minimise impacts to Ghost Bats; and
- Future clearing of native vegetation within the new lots is consistent with the NTPS associated NTPS Land Clearing Guidelines.

Water Resources Division

The application area (NT Portion 7860) is within the Daly Roper Water Control District. As such, permits are required for investigative drilling, bore construction, and work on any existing bores. Furthermore, a groundwater extraction licence will be required if water is to be used for any purpose other than stock or domestic where extraction exceeds 5 megalitres per year.

The proposed development intersects several waterways ranging from minor stream order 1 to 2 non-perennial waterways. If the works are likely to result in material impacts to the beds, banks, or flow of any of these waterways, the proponent may be required to submit an application to interfere with a waterway under section 41 of the *Water Act 1992*. Where such impacts are anticipated, it is recommended that the proponent contact the Water Resources Division to confirm whether an application is required and to discuss the necessary supporting information.

In addition, the proposed development is located over the Jinduckin Formation and the Tindall Limestone aquifers. The depth to the Tindall Limestone aquifer is variable across the proposed

development area, increasing to approximately 150m at the southern and south-western boundaries. The water quality from this aquifer is generally potable. However, where bores are drilled to depths exceeding 100m to access the Tindall Limestone aquifer, it is recommended that radiological analysis of the water be undertaken, as there may be levels of radium that exceed human drinking water guidelines.

Jinduckin Formation aquifers, which are separate from and overlie the Tindall Limestone aquifer, are also accessible across most of the proposed development area. Jinduckin Formation aquifers may yield adequate quantities of groundwater for stock and domestic use. However, water quality is variable with potentially high salinity and elevated sulphate concentrations in some parts of this aquifer, meaning that availability of potable supplies for human consumption cannot be assured.

Any bore drilled to target the Tindall Limestone aquifer by drilling through the Jinduckin Formation aquifers will need to adhere to specific construction requirements to isolate the different aquifers.

Land Resources Division

Land Assessment Branch

The Land Assessment Branch previously conducted a site inspection of this location in 2019 during an earlier subdivision of these portions. This inspection supported the land type and suitability mapping provided by the proponent. A review of current satellite imagery has confirmed the proponent's assessment that all 26 proposed lots contain at least one contiguous hectare of land unconstrained by drainage, soil salinity or acid sulfate soils.

Land Management Unit

Based on a desktop assessment the Land Management Unit provides the following advice.

Due to slope, presence of waterways and proximity of sensitive receiving environments, it is recommended that preparation and implementation of an Erosion and Sediment Control Plan (ESCP) be included as a condition on the Development Permit, in accordance with the wording below.

Conditions Precedent:

1. Prior to the commencement of works, a Type 2 Erosion and Sediment Control Plan (ESCP) must be developed in accordance with the Department of Lands, Planning and Environment (DLPE) Erosion and Sediment Control Plan (ESCP) Procedures (Note 1).

The ESCP must be certified by a suitably qualified and experienced professional (Note 2) and must be submitted to Development Assessment Services (via email: das.ntg@nt.gov.au).

General Conditions:

1. Should the certified Type 2 ESCP require amendment, the revised ESCP must be certified by a suitably qualified and experienced professional and submitted to Development Assessment Services (via email: das.ntg@nt.gov.au).
 2. All works relating to this permit must be undertaken in accordance with the certified Type 2 ESCP.
 3. At completion of works, certification must be provided by a suitably qualified and experienced professional regarding satisfactory implementation of permanent erosion and
-

sediment control measures and site stabilisation. This certification must be submitted to Development Assessment Services via email: das.ntg@nt.gov.au.

Permit Notes:

1. The DLPE Erosion and Sediment Control Plan (ESCP) Procedures factsheet is available at: <https://environment.nt.gov.au/rangelands/technical-notes-and-fact-sheets/land-management-technical-notes-and-fact-sheets>.
2. A suitably qualified and experienced professional in erosion and sediment control as defined by the International Erosion Control Association (IECA) Australasia – <https://austieca.com.au/esc-certification/suitably-qualified-professional>.
3. Information regarding erosion and sediment control can be obtained from the IECA Best Practice Erosion and Sediment Control 2008 books available at <https://austieca.com.au/home> and Land Management Factsheets available at <https://nt.gov.au/environment/soil-land-vegetation>. For further advice, contact the Development Coordination Branch: (08) 8999 4446.

Vegetation Assessment Unit

The NTPS Clearing of Native Vegetation (CNV) Overlay applies to this land and will continue to apply to the proposed subdivided parcels. The clearing of native vegetation of more than one hectare in aggregate (including any area already cleared of native vegetation) on land subject to the CNV Overlay requires consent, (i.e. a development permit, issued under the *Planning Act 1999*¹). On land parcels of 100 hectares or greater, up to 10 hectares may be cleared without consent, provided the area does not contain significant vegetation.

For further advice on land clearing for land zoned Rural (R), Horticulture (H), Agriculture (A), and Unzoned land, please contact the Vegetation Assessment Unit on phone (08) 8999 3631 or via email landclearing.DLPE@nt.gov.au.

Weed Management Branch

A desktop assessment of the NT Weeds Database for the application area, surrounding parcels and roads has revealed current and or previous data records of the following:

Common Name	Botanical Name	Declared
Bellyache bush	<i>Jatropha gossypifolia</i>	Class A
Caltrop	<i>Tribulus cistoides</i>	Class B
Devils claw	<i>Martynia annua</i>	Class A
Gamba grass	<i>Andropogon gayanus</i>	Class B
Grader grass	<i>Themeda quadrivalvis</i>	Class B
Hyptis	<i>Mesosphaerum suaveolens</i>	Class B
Khaki weed	<i>Alternanthera pungens</i>	Class B
Mission grass - perennial	<i>Cenchrus setosus</i>	Class B
Neem	<i>Azadirachta indica</i>	Class B
Senna - Candle bush	<i>Senna alata</i>	Class B

¹ <https://legislation.nt.gov.au/en/Legislation/PLANNING-ACT-1999>

Common Name	Botanical Name	Declared
Senna - Sicklepod	<i>Senna obtusifolia</i>	Class B
Sida – Spiny head	<i>Sida acuta</i>	Class B
Sida - Flannel weed	<i>Sida cordifolia</i>	Class B
Sida - Paddy's lucerne	<i>Sida rhombifolia</i>	Class B

All land in the NT is subject to the *Weeds Management Act 2001* (WM Act). The WM Act describes the legal requirements and responsibilities that apply to all persons, owners and occupiers of land regarding declared and potential weeds. General duties described in Division 1 of the WM Act include the requirement for owners or occupiers of land to take all reasonable measures to prevent land being infested with a declared weed and to prevent a declared weed from spreading.

Bellyache bush, gamba grass, grader grass and neem are subject to statutory weed management plans. Management obligations outlined in these plans are legally binding on all owners and occupiers. Management requirements and copies of the statutory weed management plans are available online².

Bellyache bush and devils claw are declared weeds, Class A and are listed in the Katherine Regional Weeds Strategy 2021-2026 as Category 2 – priority weed for strategic control.

Gamba grass, grader grass and neem are declared weeds, Class B and are listed in the Katherine Regional Weeds Strategy 2021-2026 as Category 2 – priority weeds for strategic control.

Guidelines for the prevention of weed spread are outlined in '*Preventing Weed Spread is Everybody's Business*³', which highlights the areas of risk for all activities associated with weed spread. The document details the pathways through which weeds are spread and provides actions to reduce weed spread. Proponents seeking to develop land for any purpose should address these actions.

Further information regarding weed management requirements are available online⁴, or alternatively contact the Weed Management Branch for further advice on (08) 8999 4567.

Should this development application be approved, the Weed Management Branch recommends the following note to be included on the development permit:

Permit note:

All land in the Northern Territory is subject to the *Weeds Management Act 2001* (WM Act). The WM Act describes the legal requirements and responsibilities that apply to owners and occupiers of land regarding declared weeds. Division 1 general duties include the requirement to take all reasonable measures to prevent land being infested with a declared weed and to prevent a declared weed from spreading. There are additional duties including a prohibition on buying, selling, cultivating, moving or propagating any declared weed and the requirement to notify the Weed Management Branch of a declared weed not previously present on the land within 14 days of detection.

² <https://nt.gov.au/environment/weeds/weed-management-planning>

³ https://denr.nt.gov.au/_data/assets/pdf_file/0011/257987/preventing-weed-spread.pdf

⁴ <http://www.nt.gov.au/environment/weeds>

Bellyache bush, gamba grass, grader grass and neem are subject to statutory weed management plans. Management obligations outlined in these plans are legally binding on all owners and occupiers. Management requirements and copies of the statutory weed management plans are available online <https://nt.gov.au/environment/weeds/weed-management-planning>.

Information regarding weed management is available on the DLPE website: <https://nt.gov.au/environment/weeds>, or alternatively contact the Weed Management Branch for further advice on (08) 8999 4567.

Environment and Heritage Division

Heritage Branch

The search has found that there are no nominated, provisionally declared or declared heritage places or objects within the subject site.

The search has found that there are no recorded Aboriginal or Macassan archaeological places and objects within the subdivision area. Regional archaeological studies across the Jindara, Tagoman, and Blain Land Systems (impacted by the proposed subdivision) have recorded protected Aboriginal places, including artefact scatters, knapping floors, and Aboriginal quarries. The likelihood of unrecorded Aboriginal and Macassan archaeological places existing within the subdivision area has been assessed as possible.

As a minimum risk management measure, the Heritage Branch recommends that an Unexpected Finds Protocol be developed and that suitable heritage induction materials be provided to all personnel working on site. A template can be provided by the Heritage Branch on request.

However, as this subdivision involves staged ground disturbing works, the Heritage Branch recommends that the proponent consider undertaking an archaeological survey. An archaeological survey is the most effective way to manage project risks to protected Aboriginal archaeological places within the boundaries subject to land clearing. The commissioning of an archaeological survey may also assist purchasers of the subdivision lots to manage future development applications subject to the *Heritage Act 2011*. The Heritage Branch can work with the applicant to develop a suitable scope of works for an archaeological survey on request.

Context of Heritage Branch Advice

The NT Government's Heritage Branch administers the *Heritage Act 2011* and provides authoritative advice about obligations under the *Heritage Act 2011*, including steps to take to manage the impact of proposed work on Aboriginal and Macassan archaeological places and objects.

It is important that advice given by the Heritage Branch is followed. A failure to follow advice received from the Heritage Branch may be considered as evidence in an investigation if damage occurs to a declared heritage place, an Aboriginal or Macassan archaeological place or object.

Relevant parts of the NT's *Heritage Act 2011*

1. All provisionally declared and declared heritage places and objects are protected under the *Heritage Act 2011*;
2. All Aboriginal or Macassan archaeological places and objects are automatically protected - this includes places and objects not previously recorded;

3. Places and objects include an artefact or thing given shape by a person - examples include stone tools, stone arrangements, fish traps, rock art, modified trees, and shell middens;
4. Ancestral remains are also protected;
5. Underwater Cultural Heritage is protected, up to three nautical miles from the coast; and
6. There is an obligation to notify of the discovery of Aboriginal or Macassan archaeological places or objects.

Conditions of advice

This advice is based on the description of the works provided to the Heritage Branch. If the work expands or changes significantly seek further advice.

In preparing this advice, the Heritage Branch has referred to the NT Heritage Register and the Heritage Branch archaeological database which includes information about Aboriginal and Macassan archaeological places and objects in the NT. However, the database only includes information about known archaeological places. The fact that there are no known archaeological places recorded may be because no archaeological surveys have been conducted in that particular area and is not necessarily an indication they do not exist.

Environmental Regulation Division

Based on the information provided, the development does not appear to trigger the licensing requirements of an Environment Protection Approval (EPA) under the *Waste Management and Pollution Control Act 1998* (WMPC Act). Activities requiring authorisation are listed in Schedule 2 of the WMPC Act.

Under the WMPC Act, all persons have statutory obligations to take all reasonable and practicable measures to prevent or minimise pollution and environmental harm, and to reduce the amount of waste generated. This is known as the General Environmental Duty, set out in section 12 of the WMPC Act. The proponent is responsible for ensuring that their activities comply with these obligations.

Guidelines to assist proponents to avoid environmental impacts are available on the Northern Territory Environment Protection Authority (NT EPA) website⁵.

The proponent is advised to take notice of this non-exhaustive list of environmental issues that should be considered to help satisfy General Environmental Duty:

1. **Dust:** The proponent must ensure that nuisance dust and/or nuisance airborne particles are not discharged or emitted beyond the boundaries of the premises.
2. **Noise:** The proponent must ensure that noise levels from the premises comply with the latest version of the Northern Territory Noise Management Framework Guideline⁶.

If the proposal is situated where there are existing activities nearby that may already generate noise, please see the Guideline: Recommended Land Use Separation Distances⁷.

⁵ <https://ntepa.nt.gov.au/publications-and-advice/environmental-management>

⁶ https://ntepa.nt.gov.au/_data/assets/pdf_file/0004/566356/noise_management_framework_guideline.pdf

⁷ https://ntepa.nt.gov.au/_data/assets/pdf_file/0006/453192/guideline_recommended_land_separation_distances_oct.pdf

3. **Erosion and Sediment Control (ESC):** The proponent must ensure that pollution and/or environmental harm do not result from soil erosion.

ESC measures must be employed prior to and throughout the construction stage of the development. Larger projects should plan, install and maintain ESC measures in accordance with the current International Erosion Control Association (IECA) Australasia guidelines⁸.

Where sediment basins are required by the development, the NT EPA recommends the use of at least Type B basins, unless prevented by site specific topography or other physical constraints.

Basic advice for small development projects is provided by the NT EPA document: Guidelines to Prevent Pollution from Building Sites⁹.

4. **Storage:** Where an Environmental Protection Approval or Environmental Protection Licence is required, the proponent must act in accordance with that authorisation.

If an Environment Protection Approval or Environment Protection Licence is not required, the proponent must store liquids only in secure bunded areas in accordance with VIC EPA Publication 1698: Liquid storage and handling guidelines¹⁰. Where these guidelines are not relevant, the storage must be at least 110% of the total capacity of the largest vessel in the area.

5. **Site Contamination:** If the proposal relates to a change of land use or if the site is known to be contaminated, a contaminated land assessment may be required in accordance with the National Environment Protection (Assessment for Site Contamination) Measure (ASC NEPM). The proponent is encouraged to refer to the information provided on the NT EPA website¹¹, and the NT Contaminated Land Guidelines¹².

6. **Waste Management - Import and Export of Fill:** The proponent must ensure all fill imported or exported as part of the activity must be certified virgin excavated natural material (VENM) in accordance with the NSW EPA guidelines¹³.

All imported fill material must be accompanied by details of its nature, origin, volume, testing and transportation details. All records must be retained and made available to authorised officers upon request. The proponent should also consider the following NT EPA Fact Sheet: Illegal Dumping - What You Need to Know¹⁴.

7. **Odour or Smoke:** The proponent must ensure that nuisance odours or smoke are not emitted beyond the boundaries of the premises.

If the proposal is situated where there are existing activities nearby that may already generate odour or smoke, please see the Guideline: Recommended Land Use Separation Distances¹⁵.

⁸ <https://www.austieca.com.au/publications/best-practice-erosion-and-sediment-control-bpesc-document>

⁹ https://ntepa.nt.gov.au/_data/assets/pdf_file/0010/284680/guideline_prevent_pollution_building_sites.pdf

¹⁰ <https://www.epa.vic.gov.au/about-epa/publications/1698>

¹¹ <https://ntepa.nt.gov.au/your-environment/contaminated-land>

¹² https://ntepa.nt.gov.au/_data/assets/pdf_file/0020/434540/guideline_contaminated_land.pdf

¹³ <https://www.epa.nsw.gov.au/your-environment/waste/classifying-waste/virgin-excavated-natural-material>

¹⁴ https://ntepa.nt.gov.au/_data/assets/pdf_file/0008/285740/factsheet_illegal_dumping_what_you_need_know.pdf

¹⁵ https://ntepa.nt.gov.au/_data/assets/pdf_file/0006/453192/guideline_recommended_land_separation_distances_oct.pdf

8. **Water:** The proponent must ensure stormwater is not polluted, refer to water management in the NT EPA guidelines to Prevent Pollution from Building Sites¹⁶.

If this activity requires the discharge of waste to water or could cause water to be polluted, then a waste discharge licence under the *Water Act 1992* (NT) may be required. Please refer to the Guidelines on Waste Discharge Licensing under the Northern Territory *Water Act 1992*¹⁷.

Should you have any further queries regarding these comments, please contact the Development Coordination Branch by email DevelopmentAssessment.DLPE@nt.gov.au or phone (08) 8999 4446.

Yours sincerely



Maria Wauchope
Executive Director Land Resources

Attachment 1 – Flora and Fauna Division - Species identified as being at low risk of impact by the project (**Table 1**)

¹⁶ https://ntepa.nt.gov.au/media/waste-and-pollution/pdf/guidelines/guideline_prevent_pollution_building_sites.pdf

¹⁷ https://ntepa.nt.gov.au/data/assets/pdf_file/0005/950603/guidelines-waste-discharge-licensing.pdf

Attachment 1: Species identified as being at low risk of impact by the project (Table 1)

Bare-rumped Sheath-tailed Bat; Black-footed Tree-rat; Grey Falcon; Masked Owl; Northern Brushtail Possum; Northern Quoll; Northern Shrike-tit; Partridge Pigeon; Red Goshawk: These species are typically associated with woodland habitats, and it is possible that they occur onsite. Suitable habitat is widespread and extensive through the region. The risk to each of these species is low due to the relatively low level of clearing that is permitted to occur on each parcel following the subdivision. The Flora and Fauna Division also notes that cane toads are a key threat to the Northern Quoll and the proposed subdivision is unlikely to exacerbate this threat.

Gouldian Finch: NT Portion 7860 is approximately 2km south of the Yinberrie Hills Site of Conservation Significance. This is a key site for Gouldian Finches as it is used by relatively large numbers and supports the largest known breeding population. Given this close proximity, there is some potential for the property to periodically host Gouldian Finch. The likelihood of a significant impact on the local population from the proposed subdivision is low due to the availability of broader areas of suitable habitat in the region.

Pale Field-rat: These species occur in a wide range of habitats, with a preference for areas with a dense understorey, which are often associated with areas that experience cooler and less frequent fires. Fire history mapping (North Australia Fire Information – NAFI) shows that NT Portion 7860 has a relatively low fire frequency, suggesting that suitable habitat for these species may exist onsite, particularly along drainage lines. The Flora and Fauna Division considers that the risk to these species is low due to the relatively low level of clearing that is permitted to occur following the subdivision.

Mertens' Water Monitor; Mitchell's Water Monitor; Northern Blue-tongued Skink; Yellow-spotted Monitor: These species occur in a wide variety of habitats including that found within NT Portion 7860. Potentially suitable habitat for these species is extensive throughout the surrounding region and the impact of any habitat loss from the subdivision is likely to be minimal at a regional scale. The proposed subdivision is unlikely to exacerbate the primary threat to these species (i.e. cane toads). The risk to these species is considered to be low.

Phone 1800 245 092

Web powerwater.com.au

Record number: D2026/131000

Container number: NE000/7860

Your Ref: PA2026/0137

Daniel Herlihy
Development Assessment Services
GPO Box 1680
Darwin NT 0801

Dear Daniel

Re: NT Portion 7860 (745) Edith Farms Road Edith – Katherine region

In response to your letter of the above proposal for the purpose of subdivision to create 26 lots (25 new lots and the balance parcel) in 3 stages, Power and Water Corporation (PWC) advises the following with reference to electricity enquiries.

1. Portion 7860 does not have power service from PWC existing electricity distribution network which is around 4.5km away and ends at Portion 3213 (No. 245) on Edith Farm Road.
2. A Caution Note or equivalent notice on new land titles stating "There is no available electricity grid network in the area. Landowner shall be responsible for owned power supply requirements." shall be required to inform all potential land purchases.
3. Power clearance for the subdivision shall be actioned after receiving:
 - Copy of the Development Permit;
 - Copy of survey plan showing correct new lot numbers and
 - Evident record from the licensed surveyor's action with Land Titles Office on the Caution Note or equivalent notice compliance.

If you have any further queries, please contact the undersigned on 8924 5729 or email:

PowerDevelopment@powerwater.com.au

Yours sincerely



Thanh Tang
Manager Distribution Development

12 May 2026



Container No: LD000/7860

DLPE - Development Assessment Services
GPO Box 1680
Darwin NT 0801

Dear Daniel Herlihy

RE: PA2026/0137 - N.T. Portion 07860 - 745 Edith Farms Road, Edith - Subdivision to create 26 lots (25 new lots and the balance parcel) in 3 stages

In response to the above proposal for development application purposes, Power and Water Corporation (Water Services) advise the following with reference to water and sewer enquiries:

1. Reticulated water and sewer services are currently unavailable in the area. The developer must contact relevant authorities to discuss servicing requirements for the proposed development.
2. Power and Water have no objections or requirements for the proposed development.

If you have any further queries, please contact the undersigned on 08 9463 2089, or email developer.concierge@powerwater.com.au

Yours sincerely

Craig Thomas

Craig Thomas
Services Development

11 May 2026

cc: Brad Cunnington
email: brad@crtpc.com.au