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ON-SITE WASTEWATER MANAGEMENT REPORT

Local Government Act Section 68

Four cabins
1 x 2-bedroom and 3 x 1-bedroom

At
Lot 14 DP 755722 at 18 Alidenes Road, Wilsons Creek, NSW 2482

For:
Ricky Singh

Site and Soil Evaluation
+
Design of New OSMS

Date
10th May 2022

Report No:
18AlidenesRoad/WilsonsCreek/OSMS/Cabins

ABSTRACT / EXECUTIVE SUMMARY

Development: Proposed four cabins, 3 x 1-bedroom and 1 x 2-bedroom. This wastewater report is for the proposed cabins, a separate wastewater assessment for the 4-bedroom house has been conducted and proposed in a separate wastewater section 68 report.
Site: Lot 14 DP 755722, at 18 Alidenes Road, Wilsons Creek.
Owners/ Developer: Ricky Singh.
Property size: approximately 19ha
Soil Type/ Structure: Clay Loam.
Drinking water bores: Not present on or near site.
Limitations: hardsetting, erodible soils of low fertility. Steep slopes. Intermittent water courses.
Bedrooms/ equivalent persons for OSMS system for the four cabins: Collecting wastewater from four cabins, three are 1-bedroom and one is 2-bedroom. Full occupancy has been calculated as a safety factor therefore hydraulic load is calculated for 10.e.p.
Wastewater Load: 10 E.P. in total. The Total Daily Flow is calculated at 1150L/day (See Byron OSMS model).
Conclusion: Site is suitable for wastewater disposal; no major environmental constraints and a suitable system is designed to treat the wastewater from the four cabins.
Treatment System: Water saving devices installed in all cabins. Passive **treatment of the wastewater is proposed through collecting the wastewater in a 5000 litre NSW Health approved septic tank and then treated using 2 x Graham Concrete Reedbed cells** with 50% nitrogen reduction.
Land Application: 3 x ETA beds 18.60 m L x 2m W x 0.45m D.

Byron Environmental Consulting has been engaged by Ricky Singh to provide an On-Site Wastewater Management Report to accompany a DA for the prosed four cabins, of which three cabins are 1-bedroom and one cabin is 2-bedroom. An additional wastewater assessment by Byron Environmental Consulting has been prepared for the proposed 4-bedroom dwelling. 18 Alidenes Road is a large 19-hectare site and is predominantly and historically used for the grazing of cattle. The site has six intermittent water courses including arms and two permanent creeks being Yankee creek on the southern section of the lot and Mullumbimby Creek along the northern boundary. The property is elevated at 20m and predominantly sloping down to the east with the main house (south facing) and the cabins (north facing) both being located on a ridge. Secondary treatment for the wastewater is proposed by 2 x Graham Concrete Reedbed Cells followed by disposal via three ETA beds of 18.6m L X 2m W x 0.45m D. Exposure to wind and the sun on the land application area is excellent being directly north facing and is located 200m away from the intermittent watercourses.

Table of Contents

1.0 Introduction

Byron Environmental Consulting has carried out a site and soil evaluation at the subject site in order to provide a suitable design for the safe and environmentally sustainable on-site disposal of sewage effluent. The site is not connected to a centralized sewerage treatment system and will require approval for an on-site wastewater treatment system to service 4 Rural Tourist Cabins, 1 x 2-bedroom and 3 x 1-bedroom. The site inspection, field work and system inspection was completed by Taïsa Baars of Byron Environmental Consulting on the 23th of March 2022. A meeting was held on site with the owner to discuss the development. Discussions included appropriate wastewater systems and application areas for the new proposal and on-site wastewater management options. This assessment has been conducted to design a suitable system for the cabins and a separate wastewater report for the proposed 4-bedroom main house has been prepared. The purpose of this report is to demonstrate to Byron Shire Council that an appropriate wastewater system is designed and will be in place. Further investigation was undertaken to determine the soil profile of the site to accommodate the hydraulic load for the development. The investigation and on-site sewage system has been prepared in accordance with Byron Shire Councils requirements and Australian Standards AS/NZS1547:2012- *On-site domestic wastewater management.*

2.0 Desktop Research

The site is an approximately 19ha rural lot. The cabins are proposed on the northern side of the ridgeline and are accessible by Yankee Creek road. The sites elevation is approximately 40m at the highest point. Mullumbimby Creek runs along the northern boundary with a setback of approximately 200m away from the proposal. Setbacks from boundaries can all easily be met on this large rural property. It was also assessed as to whether the best outcome was to dispose of the wastewater via sub surface irrigation or ETA beds, ETA beds were chosen as subsurface irrigation fields can become blocked or damaged and require regular maintenance and service agreements. Furthermore, the northern rivers with high rainfall, and this site with its elevated sloping landscape facing north, allows for the perfect opportunity for the wind and the sun to help in the evapotranspiration process of the absorption beds.

Figure 1: Satellite image with contours and watercourses (Source: SiX Maps, 2022).

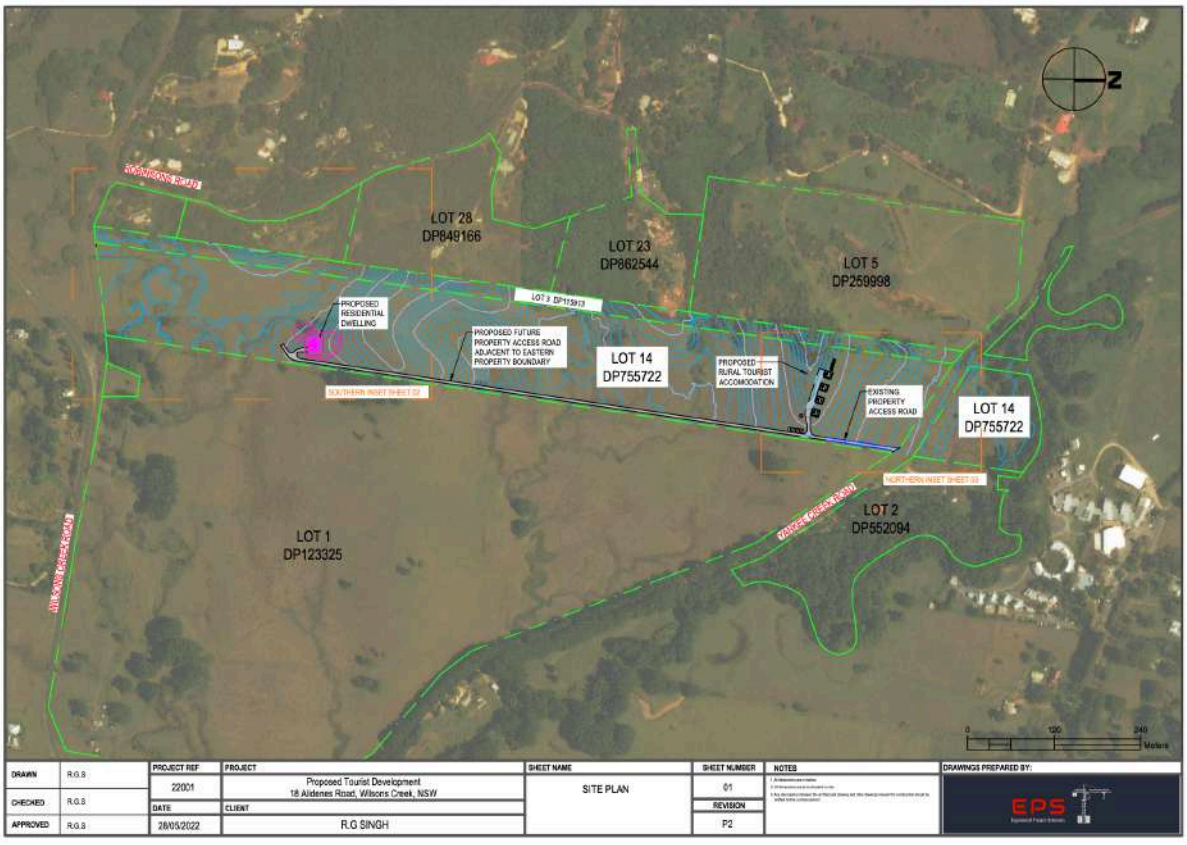


Figure 2: Proposed locations for cabins

3.0 Site Investigation

Fieldwork investigations were carried out by Byron Environmental Consultant, Taïsa Baars. The site investigation included the digging of two investigative holes to a depth of 1000mm at the proposed land application area. These soil samples have been used to conduct permeability testing on the soil. A soil sample was taken at 450mm (LAA disposal point) of depth and analysed for wastewater disposal. A visual inspection of the site and soil was also undertaken. Vegetation consists of open north facing down sloping grass lands at the proposed wastewater land application area. Table 1 shows findings during site inspection.

Table 1: Summary of site evaluation

Land Application Area Site Parameters	Description
Size	19ha
Vegetation	Open current grazing field at proposed LAA.
Slope	5 to 8% down to the north
Slope type (convex/ concave)	Concave
Aspect	Northern.
Exposure	Excellent sunlight with good wind exposure, around LAA mostly open field makes for excellent exposure.
Boulders /floaters/ rock out	Some boulders have been observed during site inspection.
Flooding potential	No
Run on and upslope seepage	Diversion swale recommended
Distance from water	Approximately 200m away from Mullumbimby Creek.
Site drainage	Due to sites elevated position, soil, aspect and exposure, good site drainage.
Surface Condition	Grass cover.
Fill	Nil apparent.
Erosion	Nil apparent.
Depth to groundwater	>1.0m no groundwater found during soil sampling as expected on elevated site.

4.0 Soil Landscape

The site is classified as part of the Billinudgel soil landscape in Morland (1994). Collected soil samples were analysed and were found to have similar properties to the Billinudgel soil landscape.

The following is a summary of the soil landscape descriptions.

Soil Landscape:	Billinudgel.
Landscape:	low rolling hills on metamorphics of the Nernleigh-Fernvale Group. Relief is 50-100m, slopes 10-20%. Partly cleared open eucalypt forest.
Soils:	Shallow to moderately deep (100cm), moderately well-drained Yellow Podzolic Soils and Yellow Podzolic Soil on crest and slopes.
Limitations:	hard setting, shallow, stony and erodible soils of low fertility. Steep slopes and localized mass movement.

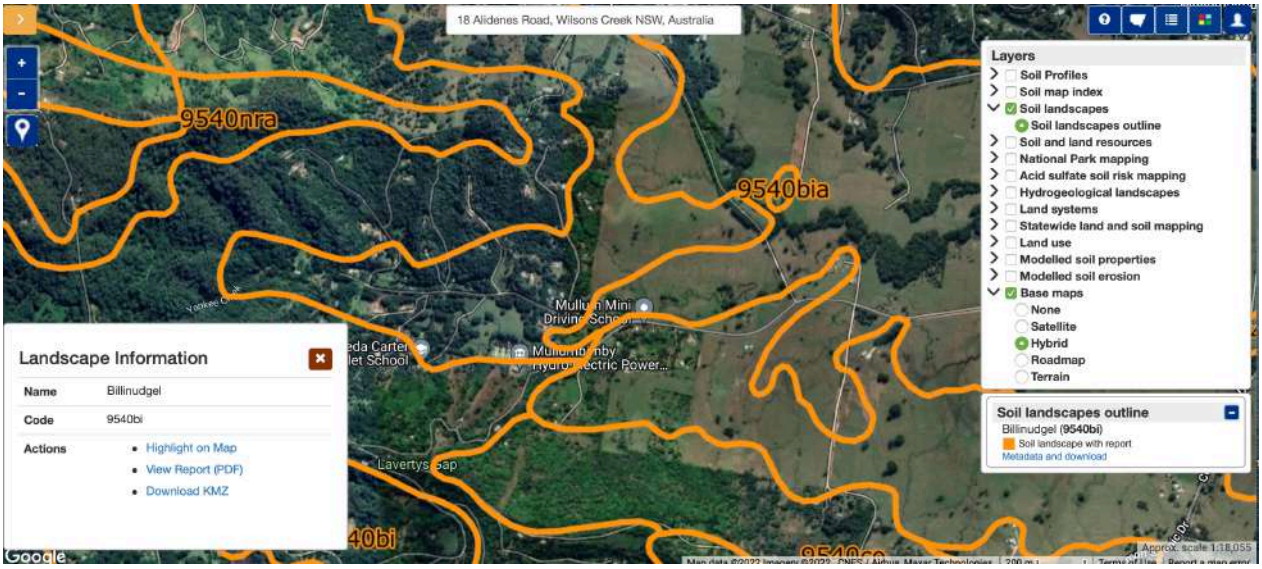


Figure 3: Soil profile mapping (eSPADE, 2022).

5.0 Soil Assessment

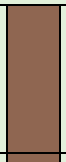
The soils consist of olive brown clay loam of strong structure.

Table 2: Summary of soil evaluation

Soil Parameter	Borehole 1	Borehole 2
Sample Depth	± 450mm	same
pH	5.0	5.5
Ribbon length	60mm	65mm
Soil Type	Clay Loam	Clay Loam
Colour	Olive Brown	Olive Brown
Structure	Moderate	Moderate
Dispersive	Class 2	Class 2
Slake	Class 2	Class 2

As shown, the soil comprised of an Olive Brown clay loam of moderate structure. This soil type is considered suitable for wastewater disposal and is classed as a soil category 4 according to AS/NZS 1547:2012.

Table 3: Borehole log

Soil Assessment			Soil Landscape: Billindugel (Morand 1994)		
Borehole 1 & 2					
Depth (cm)	Graphic Section	Colour	Soil pH	Course Fragments	Texture and Soil description
0-20cm		Olive Brown	5.0	Topsoil, grass cover.	Moderate to clay loam (5-20cm)
20-40cm		Olive Brown		Smooth to manipulate	Clay loam
40-60cm		Olive Brown		Smooth bolus	Clay loam
60-80cm		Dark Reddish		Smooth, stiffer to manipulate	Clay loam
80-100cm		Dark Brown		Smooth, stiff, sandy	Sandy Light Clay
100-120cm		Dark Brown		Stiff more clay content	Sandy Light Clay

6.0 Design Flows and hydraulic load

All four cabins have a toilet, handbasin, shower, kitchen and laundry.

Wastewater Load for the 4 cabins is calculated for 10 E.P. in total. Full occupancy is calculated for all cabins, 2 people in each bedroom. Full occupancy has been assumed as a conservative measure and a daily effluent flow of 115L per person is used. The Total Daily Flow is calculated at 1150L/day (See Byron OSMS model).

The total design flow rate is 1150 litres per day to cater for the 4 cabins of 3 x 1-bedroom and 1 x 2-bedroom.

7.0 On-Site Wastewater Management System & Treatment of wastewater

The wastewater will be collected in a NSW Health approved septic tank and then treated by 2 x 7.2m^2 Graham Concrete reedbed cells (see specifications attached)

- Removes phosphates and nitrogen from wastewater.
- Improves water quality markers in the areas of biochemical oxygen demand, total suspended solids, dissolved oxygen levels and E coli counts
- Gravity fed ensures no ongoing power costs
- Requires no quarterly services by external agent

Two Graham Concrete reedbed cells treat the wastewater to secondary quality.

Site photograph: Proposed land application area.

8.0 Sizing of land application area

Sizing of ETA beds with Byron OSMS model

The Byron model calculates 3 x ETA beds of 18.6 m long.

It is proposed to install a land application area of 3 x 18.60m L x 2m w x 0.45m D ETA beds (find OSMS model outcome attached).

9.0 Setback distance for Land Application Area

The land application area on the lot needs to meet the following buffer distances to minimize environmental health impact.

Table 4: Setback distances

Site Feature	Available	Requirement	Requirement met if not how solved?
Permanent waters including rivers, creeks, wetlands, dams or lakes.	200m	100m	secondary treatment of wastewater by reedbed cells
Buffer from the centre-line of ephemeral water course (e.g. intermittent waterways, drainage channels and dry gullies).	200m	40m	✓
Domestic ground water well	None observed	250m	✓
Buildings	Yes	6m	✓
Swimming pools	n/a	6m	✓
Boundary	Yes	6m	✓
Other sensitive environments or contaminated land e.g cattle tick dip sites	None observed nearby	100m	✓

10.0 Planting of reeds

Bacteria, both aerobic and anaerobic, are among the most plentiful microorganisms in wetlands and are thought to provide the majority of the wastewater treatment. Aquatic plants used in constructed wetland systems can be divided in two general groups: microscopic and macroscopic. Most of the microscopic plants are algae, which can be either single cell (such as *Chlorella* or *Euglena*) or filamentous (such as *Spirulina* or *Spyrogyra*). These will naturally occur in the reed bed. Macroscopic (larger) plants can grow under water (submergent) or above water (emergent). Some grow partially submerged and some partially emerged. Aquatic plants can take up and sometimes metabolize water contaminants such as insecticides, benzene, fecal coliforms and heavy metals.

11.0 Planting of buffer

The planting of a vegetation buffer below the ETA beds is advised. See planting list below. The planting of native trees are encouraged.

Small trees	Trees	Ferns	Small plants	Reeds
Health Banksia	Blackwood	Bungwall	Cunjevoi Lily	Jointed Twigrush
Swamp Banksia	Lilly Pilly	Gristle Fern	Native Ginger	Rush
White Bottlebrush	Bangalow Palm	Binung	Wallum bottlebrush	Club Rush
Weeping Bottlebrush	Brown Kurrajong	Tree Fern	Palm Lilies	Sedges
Little Evodia	Umbrella Cheese Tree		River & Stream Lily	Tassel Sedge & Sedge
Creek Sandpaper Fig	Cottonwood Hibiscus		Blue Tongue	Cattails
Swamp Hibiscus	Cabbage Palm		Knotweeds	
Common Ti Tree	Swamp Box		Frogsmouth	Spike Rush
Lemon Ti Tree	Broad-leaved Paperbark		White Nettle	Sawsedge
Paperbark	Pink Euodia		Warrigal Greens	Reed
Prickly-leaved paperbark	Scrub Cherry			Salt Rush
Mangrove Boobialla	Water Gum			Grey Sedge
Bleeding Heart	Weeping Lilly Pilly			Creek & long Leaf Mat Rush

Native plants suitable for land application areas and buffers (Byron Shire Council, 2004).

12.0 Improvements to the soil

Acidic soil can be inhibiting for plant growth. Lime can be applied in the ETA bed to countereffect the acidity of the wastewater.

Gypsum is sometimes advised and often promoted as a 'clay breaker'. It does little to improve the structure of clays that are not sodic, soils where there is little or no clay dispersion, or the structure of soils containing only small amounts of clay. Sodic clay surface soils disperse in water. Dispersion of surface soil causes crusting. Sodicity also causes excessive swelling with water. The excessive swelling of a sodic subsoil closes large pores and reduces infiltration and drainage. Waterlogging may result.

Sodicity is most obvious in the soil surface, when clay dispersion leads to crusting. If your soil is prone to crusting, it could be dispersive, and could respond to gypsum. (Department of primary industries, 2021).

13.0 Responsibilities of developer/owner/ resident

On-site wastewater systems can have adverse impacts on the health of the environment and your family (including pets). They can spread disease by bacteria, viruses, parasites and other organisms. Wastewater can contaminate ground, surface waters and oceans. Everything that is disposed of into the drains will enter the environment. This system is designed to safely dispose of human waste (poo and urine) and grey water. However, wastewater is getting contaminated with a more complex cocktail of household chemicals, some of these chemicals do biodegrade, others bio-accumulate like heavy metals in tuna fish, some chemically react together, and others photodegrade like microbeads in some cosmetics and micro plastics in laundry waste water. It does not matter if your waste is getting disposed on site or into a sewerage treatment plant, these chemicals do enter our environment if entered into the drain. **This pollution can be reduced by keeping all toxic chemicals out of your drains as possible.** For longevity of the on-site sewage management system the following maintenance regime should be employed by the owner/ occupier of the dwelling.

Maintenance requirement for sub-surface flow wetland

- Quarterly maintenance checks by owner of the wetland area by checking water level, cleaning of drains and the elimination of weeds.
- Wetland plantings should be thinned or harvested annually to maintain the nutrient removal capacity of the system.

Maintenance requirements for ETA Beds

- Check for system failures which are generally indicated by:
  a) Plumbing fixtures and fittings not draining properly indicate a damaged or blocked pipe or possible septic tank failure.
  b) Surcharge of effluent at ground level either around the tank, or down the slope at the land application area/s.
  c) Foul odour emanating from the tank or land application area/s.

Problem solving

All on-site systems need to be maintained in order to function well. If problems are found, such as:

- Slow-draining wastewater:
- Unusual odours:
- Surcharging effluent from ETA beds (land application system):
- Poor vegetation growth on and around ETA bed.

These symptoms should be investigated by a licensed plumber.

14.0 Recommendation

- Installation of an NSW Health approved 5000L NSW Health approved septic tank with effluent filter installed on outlet collecting wastewater from all 4 cabins.
- Installation of water saving features in all the cabins.
- The installation of 2 Graham Concrete Reedbed Cells.
- The installation of a distribution box.
- The installation of a land application areas of 3 x 18.6m L x 2.0 W x 0.45m D ETA beds

Specifications:

1. System is gravity fed.
2. Two-metre (2m) separation between beds.
3. All wastewater to be treated on-site.
4. ETA trench width 2m (double pipe)
5. System needs to be installed by a suitably qualified plumber.
6. Upslope run-on diversion swale to be installed to drain storm water run-off away from LAA.
7. Installation to comply with AS3500 & AS1547:2012.
8. >6m from all boundaries, >6 m from dwellings and driveways, >200m away from Mullumbimby Creek.
9. The ETA beds are to be constructed in accordance with AS1547:2012. The construction of the bed will involve the excavation of the natural soil to a depth of 450mm. Soil will be scarified and sand placed on this interface for a covering of about 50mm thick. Aggregate of 6-25mm diameter is placed on this to a depth of 200mm. One central distribution pipe is placed on this layer. Topsoil consisting of sandy loam is to cover the aggregate to a depth of 200mm. Geotextile fabric is to be placed between the aggregate and the topsoil. An inspection point of (being slotted and capped PVC pipe) will be installed in each bed. The ETA beds will allow the wastewater to be available to the root zone of plants where the majority of activity takes place, therefore allowing water and nutrient uptake.
10. Planting of a buffer below ETA bed.
11. Improvement to the soil by lime application

References

Australian Standard AS/NZS 1547- 2012 On-site domestic wastewater management.

Byron Shire Council (December, 2004). Design Guidelines for On-site Sewage Management for Single Households. Protecting the Environment and Health of Byron Shire.

Morland, D.T. (1994) Soil Landscapes of the Lismore-Ballina 1:100,000 Sheet report, Soil Conservation Service of NSW, Sydney.

Morland, D.T. (1994) Soil Landscapes of the Lismore-Ballina 1:100,000 Sheet Map, Soil Conservation Service of NSW, Sydney.

Geary, P & Saunders, M & Whitehead, J 2016 Centre for Environmental Training, Onsite wastewater Management Training Course, Tweed Heads, NSW 24-26 August 2016, course booklet.

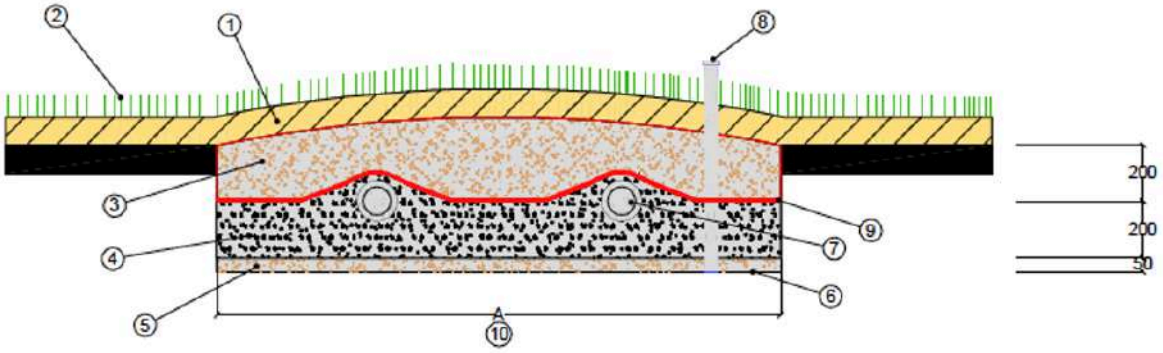
Headley, T. & Davison, L. 2003. Design models for the removal of BOD and Total Nitrogen in Reed Beds. In proceedings of On-site '03 Conference, Future Directions for On-site Systems: Best Management Practice. Lanfax Laboratories, Armidale, NSW, Australia.

Sydney Catchment Authority and NSW Government (2012). Designing and installing Onsite Wastewater Systems, A Sydney Catchment Authority Current Recommended Practice.

EPA NSW (1998) Environment & Health Protection Guidelines On-site sewage management for single households.

Appendix A: AUSTRALIAN STANDARD AS/NZS 1547:2012 ETA BED

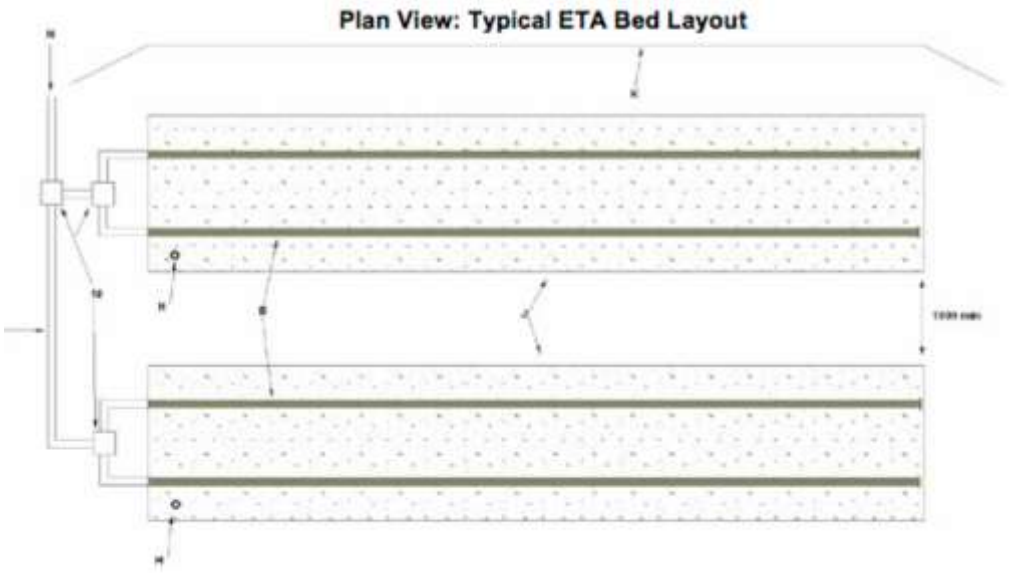
ETA Trench (Two distribution pipes) - SECTION VIEW

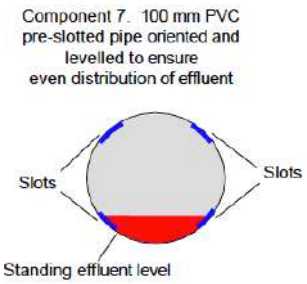


ETA BEDS- Minimum Components and Design Requirements

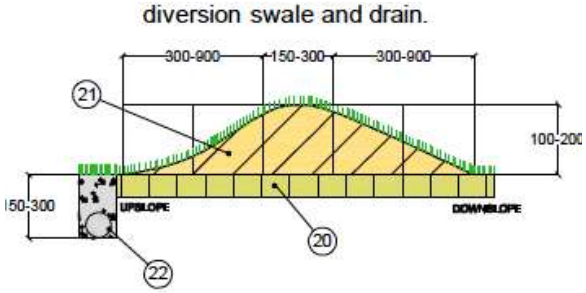
1. 100mm of topsoil or backfilled local soils, mounded to reduce surface water infiltration.
2. Grass or other suitable cover.
3. 100-200 mm of coarse packed sand.
4. 100-200 mm thick layer of 10-20 mm aggregate.
5. 50 mm thick sand cushion. Interface by raking existing soils prior to placing sand.
6. Flat base ETA bed to ensure equal distribution of effluent.
7. 90-100 mm pre-slotted sewer grade PVC pipe.
8. Inspection port to be placed on downhill side of each trench. Typically, a 50 mm PVC piezometer perforated in gravel and sand zone. Inspection ports must be kept visible, accessible and suitably protected to prevent damage by mover or other maintenance.
9. Geotextile filter cloth.
10. ETA trench width 2000mm.

Appendix B: AUSTRALIAN STANDARD AS/NZS 1547:2012 ETA BED continued





1. Spacing between ETA trenches (spacing between trenches should be at least 1000 mm).
2. Trench dispersal area (m^2). If greater than 1 m between trenches, calculate dispersal area as trench basal area plus 500 mm each side.
3. Downslope surface runoff collection drain. May be required if close to sensitive feature downstream.
4. Upslope run-on diversion and/or drain, required on all sloped sites.
5. Manifold distribution box, to be built from moulded PVC or pre-cast concrete, housed within 600mm x 600mm stormwater pit with solid pit. Distribution box must be placed and levelled on 1000mm x 1000mm pre-cast slab or bedded in concrete.
6. Feeder pipe, typically 100 mm PVC pipe. Effluent should be intermittently dosed, either by gravity through dosing siphon or by pumped application.
7. Splitter box, to be built from moulded PVC or pre-cast concrete. Box must be placed and levelled on 600mm x 600mm pre-cast slab or bedded in concrete.
8. End caps.
9. Existing soil.
20. Imported clean fill or local soil.
21. Agricultural distribution pipe in 100-150mm wide diversion drain, filled with 10-20mm gravel.



Attachments: Detailed Site Plan

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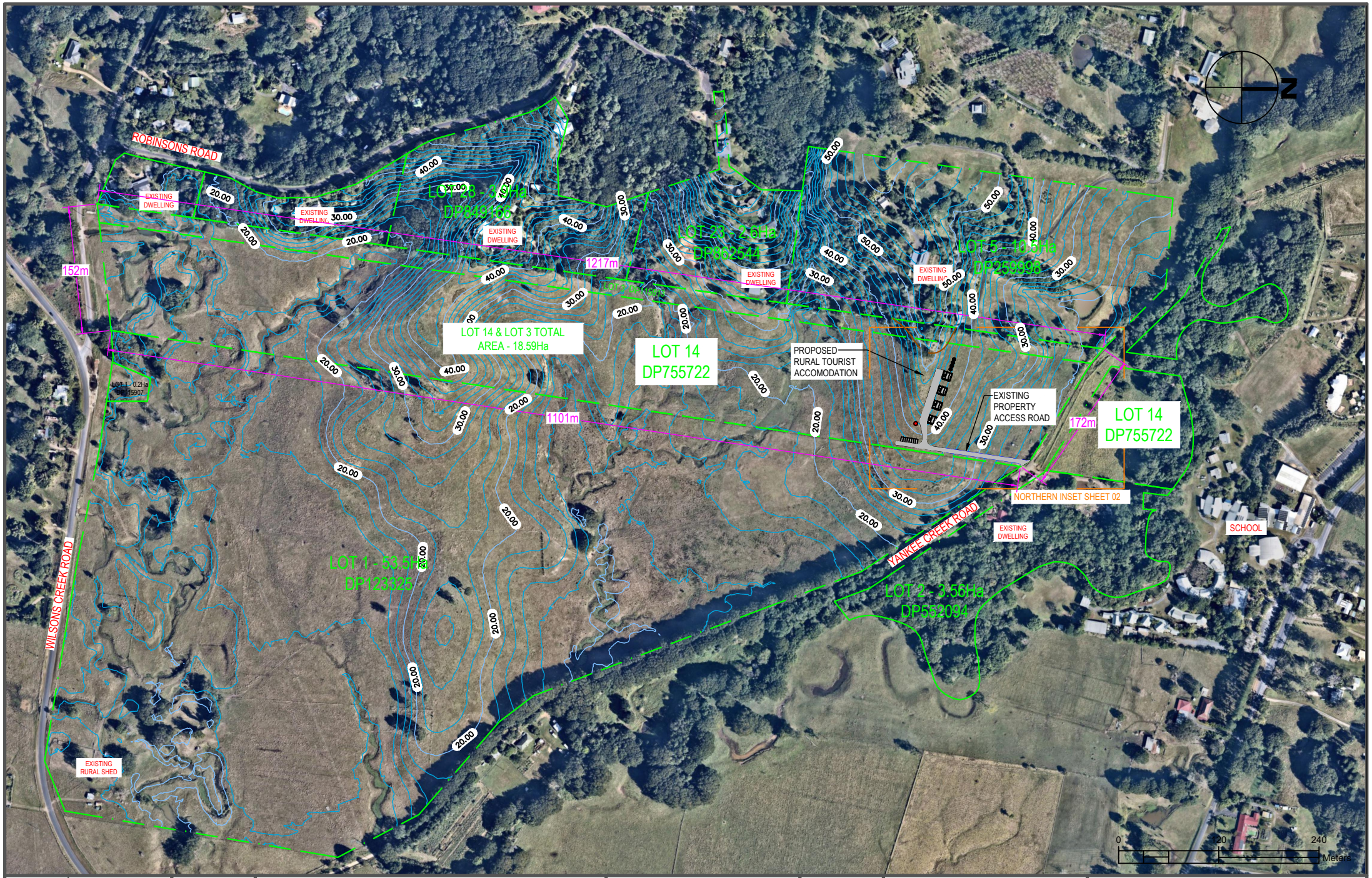


DRAWN	R.G.S	PROJECT REF	PROJECT	SHEET NAME	SHEET NUMBER	NOTES	DRAWINGS PREPARED BY:
CHECKED	R.G.S	22001	Proposed Tourist Development 18 Alidenes Road, Wilsons Creek, NSW	SITE PLAN	01	1. All dimensions are in metres. 2. All dimensions are to be checked on site. 3. Any discrepancy between the architectural drawing and other drawings relevant for construction should be notified before commencement.	EPS Engineered Project Solutions
APPROVED	R.G.S	DATE	CLIENT		REVISION		
		2/11/2022	R.G SINGH		P4		

Byron OSMS Design Model *Version:* e201821531-byron-osms-design-model-final-version-for-distribution-with-design-guidelines-491834 (4).xlsm ***Period of Rainfall & Evaporation Record: 01/07/1980 - 30/06/2001***

Set Defaults

STEP 1 — bedroom / persons

STEP 2

# persons (Grp 1)	10	
# persons (Grp 2)	0	
Total Daily Flow (L/day)	1150	Daily Effluent Flow per person (L/day) 115
TN production per year (kg/year)	42.00	N prod. per capita (kg/person/yr) 4.20
TN reduced by all N loss	16.80	N loss in treatment system (% reduction) 50%
N Plant Uptake rate (kg/ha/year)	600	
Phosphorus in effluent (Ip) (kg/yr)	6.00	P prod. per person per yr (kg/person/yr) 0.60
P uptake by plants (Hp) (kg/ha/yr)	10	
P soil sorption (Ps) (kg/ha/m depth)	10000	
Water Table/ Bedrock Depth (m)	3.00	
Buffer to Water Table (Bwt) (m)	0.5	
Time for accumulation of P(years)	50	
Final area (m^2)	**150**	
Phosphorus area (m^2)	**118**	
Water balance area (m^2)	150	
☑ Specific Crop Coeff.(grass=1.00)	1.00	
% Effective Rainfall	85%	
Percolation (mm/d)	27	
Avg depth of root zone (m)	0.15	
Avg depth bluemetal (etc) in trench below root zone (m)	0.15	
Soil Moisture Holding Capacity: saturation & AWC (mm)	117.71	28.23
Permissible percentile exceedence	5.00%	
Minimum effluent application (mm/day/m^2)	7.67	
Exceedence (L)	0.00000	94.52%

STEP 3 — Buffer to permanent water / Buffer to intermittant water

STEP 4 — Block size (m2): 190000; 100

STEP 5 — Daily effluent flow accord. water supply type

- Reticulated supply (bore,spring,creek) 180L/p.d
- Reticulated + std. water saving devices 145L/p.d
- Roof water harvesting 140L/p.d
- Roof water harvesting + std. water sav. 115L/p.d

STEP 6 — Wastewater stream

Grp1	Grp 2
☑ Toilet	☐ Toilet
☑ Bathroom	☐ Bathroom
☑ Laundry	☐ Laundry
☑ Kitchen	☐ Kitchen

% black to tot WW in a full system: 32%

% black to tot WW in a full system: TN: 70%

N loss in disposal bed (% reduction): 20%

Proportion black to total wastewater in a full: 40%

STEP 7 — Treatment system

- Septic (primary teatment only)
- AWTS
- Septic + single pass sandfilter (SPF)
- Septic + SPF, 25% septic return flow
- Septic + recirculating sandfilter
- Septic + reedbed

Current Inlet BOD conc. ~ 250 mg/L

STEP 8 — P soil sorption accord. soil type

- "Alluvial"Soils 1 (dp,mu,my,te) 10,000 kg/ha/m
- "Alluvial"Soils 2 (cr) 2,000 kg/ha/m
- Red Basaltic Soils (bg,ca,co,el,ew,mb,ro,wo) 10,000 kg/ha/m
- Duplex Soils (ba, bi,bu,mi, ni) 8,000 kg/ha/m
- Podzol Soils (ab,bo,br,eb,fh,ki,ku,og,po,ty,wy) 1,000 kg/ha/m

Nitrogen Report

N plant uptake (kg/yr)	9.00	Total N-load 16.80kg/yr	
N load exceedence	0.00		
N load percolated (kg/yr)	7.80		
N released (perc+exceed.) (kg/yr)	7.80		
Enviro.N limit (kg/yr)	10.00		
Nitrogen area (m^2)	113		
Capped H area 150m2. Hydraulic area (m2)	56		
total ETA trench area	111.78		
ETA trench length (m)	18.63		
number of ETA beds	3		
beds total plus separating spaces:	X Y dimensions = 19.2m x 10.6m	Area =204 m2	

STEP 9 — Soil texture & structure beneath system

- Gravels,Sands Ksat >3.0m/d
- Sandy loams - weakly structured Ksat >3.0m/d
- Sandy loams - massive Ksat 1.4 - 3.0m/d
- Loams - high/moderate structured Ksat 1.5 - 3.0m/d
- Loams - weakly structured or massive Ksat 0.5 - 1.5m/d
- Clay loams - high/mod structured Ksat 0.5 - 1.5m/d
- Clay loams - weakly structured Ksat 0.12 - 0.5m/d
- Clay loams - massive structured Ksat 0.06 - 0.12m/d
- Light clays - strongly structured Ksat 0.12 - 0.5m/d
- Light clays - moderately structured Ksat 0.06 - 0.12m/d
- Light clays - weak. structured or massive Ksat <0.06m/d
- Med. to heavy clays - strong. struct. Ksat 0.06-0.5m/d
- Med. to heavy clays - mod. structured Ksat <0.06m/d
- Med. to hvy clays - weak. struct. or massive Ksat<0.06m/d
- DISPERSIVE soil (Modified Emerson Aggregate test)

Wetted depth(m)	0.50
TN% removal	50.0%
Reed bed area (m2)	**18.1**
BOD target of 20mg/L is equiv. to ~68.0% TN	Current Outlet BOD conc. ~ 68 mg/L

STEP 10

STEP 11 — % Effective Rainfall

- Mounded bed
- Level bed with grass

STEP 12 — Soil texture in root zone

- Coarse Sand
- Fine sand, Sandy loam
- Loams,Clay loams,Silt
- Clay (light,med,heavy)

Effective porosity of root zone	0.37	Avail.Water Capacity (AWC) of root zone	0.15
Effective porosity of bluemetal in trench below root zone	0.43	Default AWC of bluemetal in trench below root zone	0.00

Trench under root zone <-

Land Application Type

- SSI
- ETA

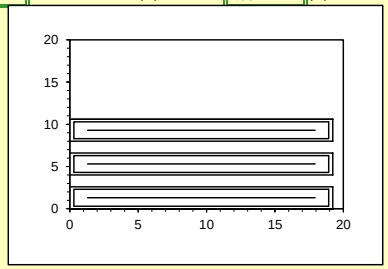
STEP 13 — ETA trench width (m): 2.00

STEP 14 — Calculate (or Cntl- q)

Lateral seepage width (m): 0.300

ETA trench separation: 3

STEP 15 — ETA bed separation: 2.00



- : Wastewater Notes : -

DETAILS FOR DWELLING

- Installation of an NSW Health approved 3500L NSW Health approved septic tank with an effluent filter
- installed on outlet collecting wastewater from the 4-bedroom house.
- Installation of water-saving features in the house.
- The installation of 2 Graham Concrete Reedbed Cells.
- The installation of a distribution box.
- The installation of a land application areas of 2 x 17.2m L x 2.0 W x 0.45m D ETA beds.

SPECIFICATIONS

1. The system is gravity fed.
2. Two-metre (2m) separation between beds.
3. All wastewater to be treated on-site.
4. ETA trench width 2m (double pipe)
5. The system needs to be installed by a suitably qualified plumber.
6. Upslope run-on diversion swale to be installed to drain storm water run-off away from LAA.
7. Installation to comply with AS3500 & AS1547:2012.
8. >6m from all boundaries, >6 m from dwellings and driveways, >200m away from Yankee Creek.
9. The ETA beds are to be constructed in accordance with AS1547:2012. The construction of the bed will involve the excavation of the natural soil to a depth of 450mm. Soil will be scarified and sand placed on this interface for a covering of about 50mm thick. Aggregate of 6-25mm diameter is placed on this to a depth of 200mm. One central distribution pipe is placed on this layer. Topsoil consisting of sandy loam is to cover the aggregate to a depth of 200mm. Geotextile fabric is to be placed between the aggregate and the topsoil. An inspection point of (being slotted and capped PVC pipe) will be installed in each bed. The ETA beds will allow the wastewater to be available to the root zone of plants where the majority of activity takes place, therefore allowing water and nutrient uptake.
10. Planting of a buffer below ETA bed.
11. Improvement to the soil by lime application.

OSMS FOR CABINS

- Installation of an NSW Health approved 5000L NSW Health approved septic tank with effluent filter installed on outlet collecting wastewater from the 4-bedroom house.
- Installation of water saving features in all the cabins.
- The installation of a distribution box.
- The installation of a land application areas of 3 x 18.6m L x 2.0 W x 0.45m D ETA beds.

SPECIFICATIONS

1. The system is gravity fed.
2. Two-metre (2m) separation between beds.
3. All wastewater to be treated on-site.
4. ETA trench width 2m (double pipe)
5. System needs to be installed by a suitably qualified plumber.
6. Upslope run-on diversion swale to be installed to drain storm water run-off away from LAA.
7. Installation to comply with AS3500 & AS1547:2012.
8. >6m from all boundaries, >6 m from dwellings and driveways, >200m away from Mullumbimby Creek.
9. The ETA beds are to be constructed in accordance with AS1547:2012. The construction of the bed will involve the excavation of the natural soil to a depth of 450mm.Soil will be scarified and sand placed on this interface for a covering of about 50mm thick. Aggregate of 6-25mm diameter is placed on this to a depth of 200mm. One central distribution pipe is placed on this layer. Topsoil consisting of sandy loam is to cover the aggregate to a depth of 200mm. Geotextile fabric is to be placed between the aggregate and the topsoil. An inspection point of (being slotted and capped PVC pipe) will be installed in each bed. The ETA beds will allow the wastewater to be available to the root zone of plants where the majority of activity takes place, therefore allowing water and nutrient uptake.
10. Planting of a buffer below ETA bed.
11. Improvement to the soil by lime application.

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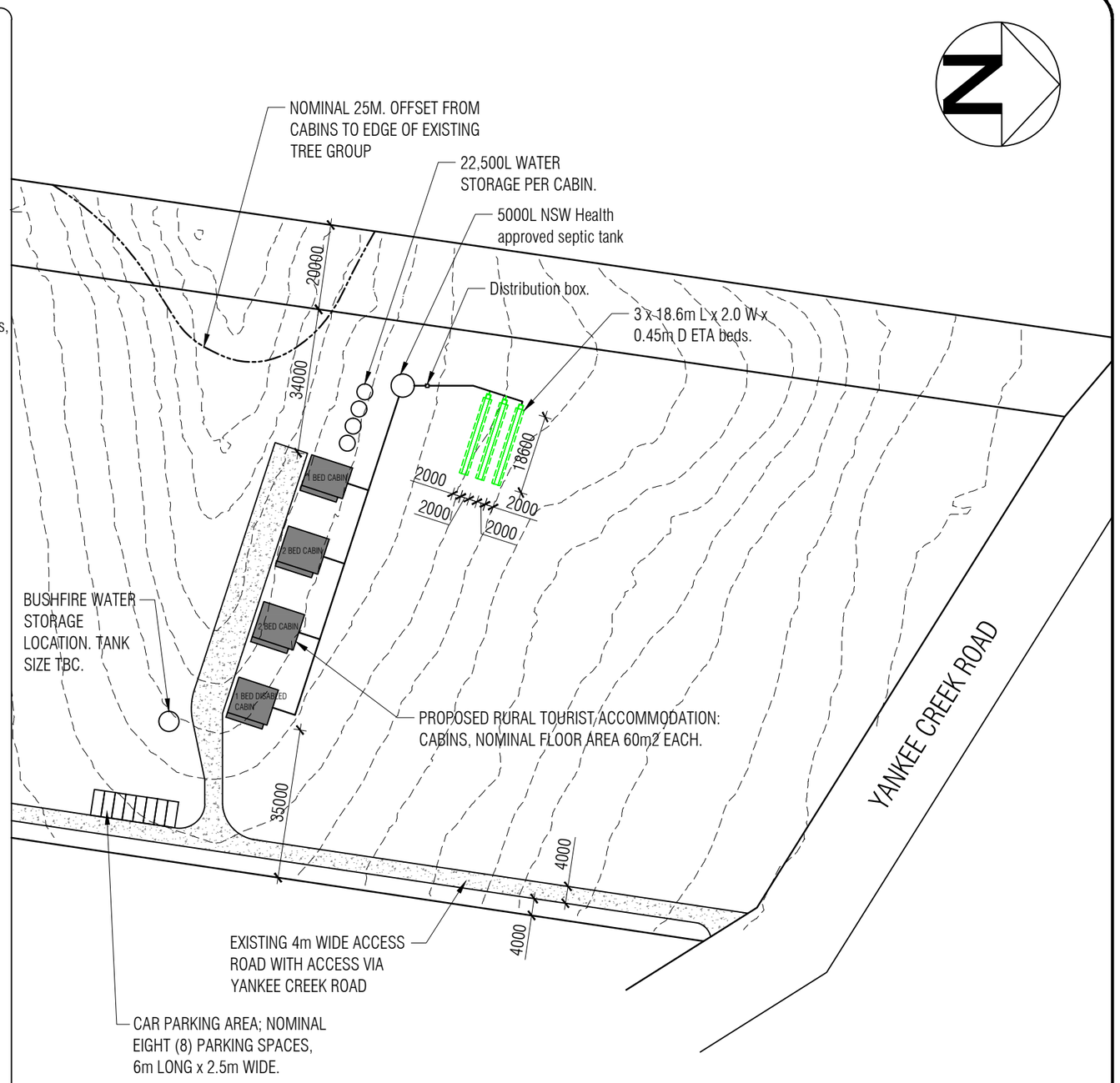

BYRON ENVIRONMENTAL CONSULTING	BYRON ENVIRONMENTAL CONSULTING ABN: 31 322 380 628 E: taisa@byronenvironmental.com.au W: www.byronenvironmental.com.au Ph: 0428 480511	Date : 22-08-2022 Drawn by : CCS Scale : 1:1200 Amendment :	LOT 14 DP 755722 18 Alidenes Road, Wilsons Creek, NSW 2482 ON-SITE WASTEWATER LAYOUT (17-08-2021)	Drawing No. (of: 1) Drawing Size : A3

- : Wastewater Notes : -

OSMS FOR CABINS

- Installation of an NSW Health approved 5000L NSW Health approved septic tank with effluent filter installed on outlet collecting wastewater from all cabins.
- Installation of water saving features in all the cabins.
- The installation of 2 Graham Concrete Reedbed Cells.
- The installation of a distribution box.
- The installation of a land application areas of 3 x 18.6m L x 2.0 W x 0.45m D ETA beds.

SPECIFICATIONS

1. The system is gravity fed.
2. Two-metre (2m) separation between beds.
3. All wastewater to be treated on-site.
4. ETA trench width 2m (double pipe)
5. System needs to be installed by a suitably qualified plumber.
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10. Planting of a buffer below ETA bed.
11. Improvement to the soil by lime application.

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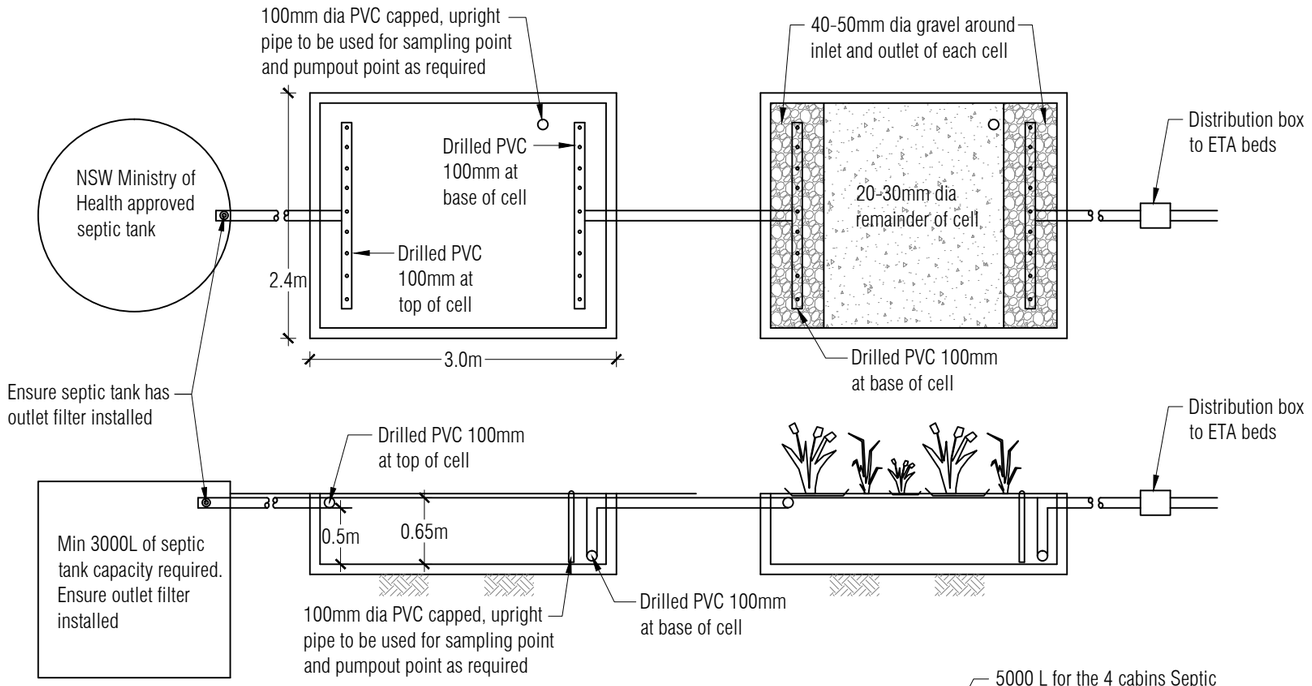
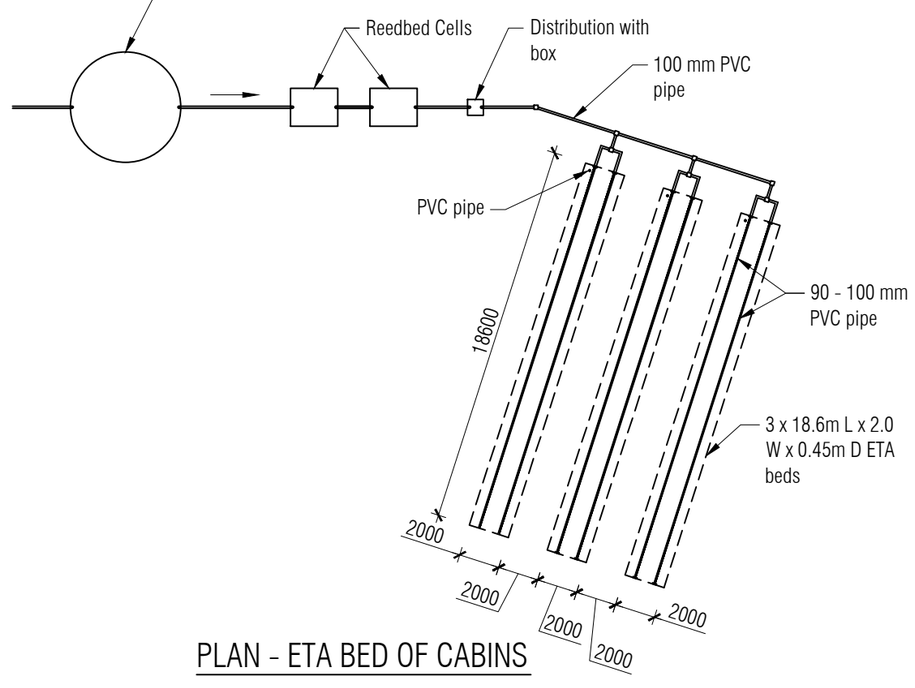
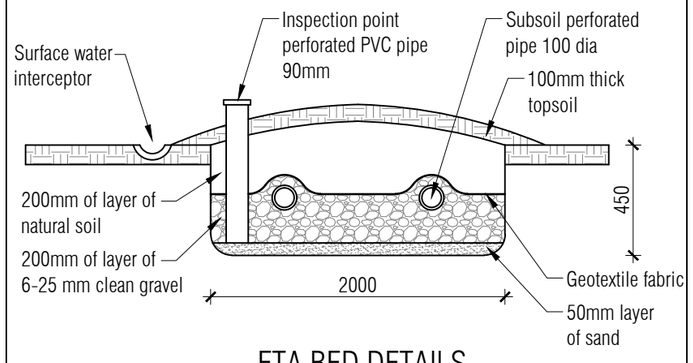


REEDBED CELLS DETAILS



PLAN - ETA BED OF CABINS

Note, it is recommended that the ETA beds slope with the natural slope of the land, with a slight mound to allow some settlement of soil. This should provide run-off of stormwater, and a catch drain must be installed.



ETA BED DETAILS

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Date : 24-08-2022 Drawn by : CCS
Scale : 1:300
Amendment :

LOT 14 DP 755722
18 Alidenes Road, Wilsons Creek, NSW 2482

ON-SITE WASTEWATER LAYOUT (17-08-2021)

Drawing No.
(of: 1)

Drawing Size : A3