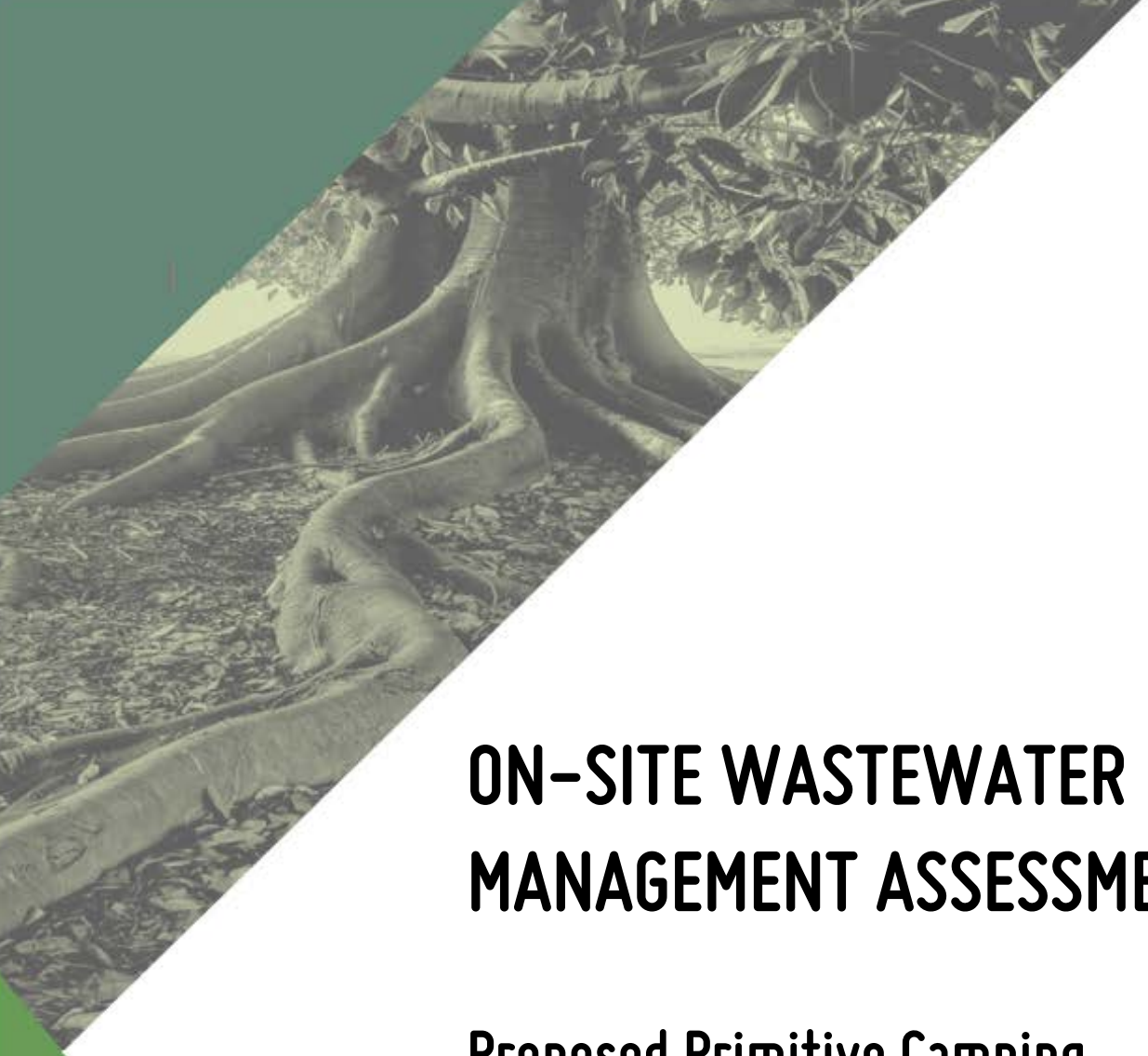

ON-SITE WASTEWATER MANAGEMENT ASSESSMENT

Proposed Primitive Camping
43 Synotts Lane, Ocean Shores

For: Bruns River Camp
Report no: 21070_ww1.docx
Date: November 2020

Greg Alderson Associates

Greg Alderson Associates

Contact Information

43 Main St
Clunes NSW 2480

Telephone: 02 6629 1552

office@aldersonassociates.com.au
www.aldersonassociates.com.au

Document Information

Project name	Proposed primitive campground
Reference	21070_ww1.docx
Revision summary	

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ATTACHMENTS

Exhibit No 1 - Site Location
Exhibit No 2 - Proposed Irrigation Detail
Exhibit No 3 - Proposed Irrigation Detail

1. INTRODUCTION

Greg Alderson and Associates have been commissioned by Bruns River Camp to prepare a wastewater feasibility assessment to support a development application for a proposed primitive campground at Lot 3 DP 710680, 43 Synotts Lane, Ocean Shores.

The proposed development will consist of a primitive campground within 10 designated sites, with capacity of 6 people per site.

The report describes the site, the tests and calculations undertaken and recommends an effluent treatment and disposal method which will minimise the environmental impact of the proposed primitive campground at this site.

The report is based on a peak loading using the following components for the new primitive campground:

- Compost toilets;
- Tank water supply;
- Hot showers;
- Basic facilities for kitchen;
- Passive wastewater management system consisting of subsurface flow wetland and ETA beds

1.1. Site Constraints

The site is constrained in regards to wastewater management by the following:

- High water table - water table measured
- Flooding - the site is subject to flooding
- Sandy soils - the soils of the site have a high permeability rate and low phosphorus sorption
- Proximity to sensitive areas

Although the site is constrained, the proposed wastewater management consisting of composting toilets and subsurface flow wetlands will reduce the nutrient and hydraulic loading at the site. Furthermore, the use of the site will encourage self contained campervans which will not use the facilities at the site.

2. SITE DESCRIPTION

The subject site is located towards the end of Synotts Lane, on the northern side of the lane. The site is relatively large and consists of lower lying areas and higher areas where the existing dwelling is located. The proposed primitive camping area is restricted to the south western portion of the site, being low lying and flat.

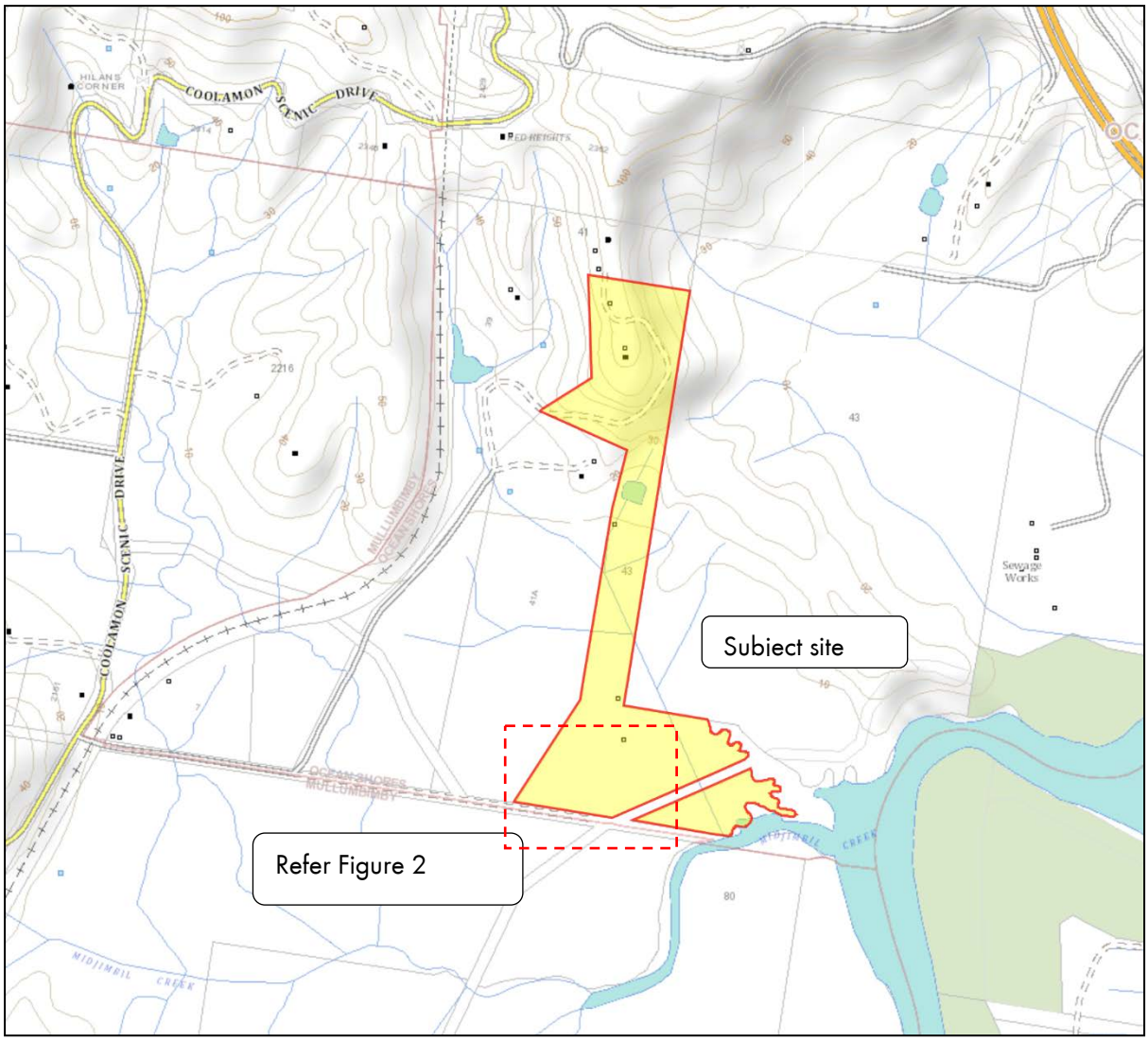


Figure 1: Subject Site

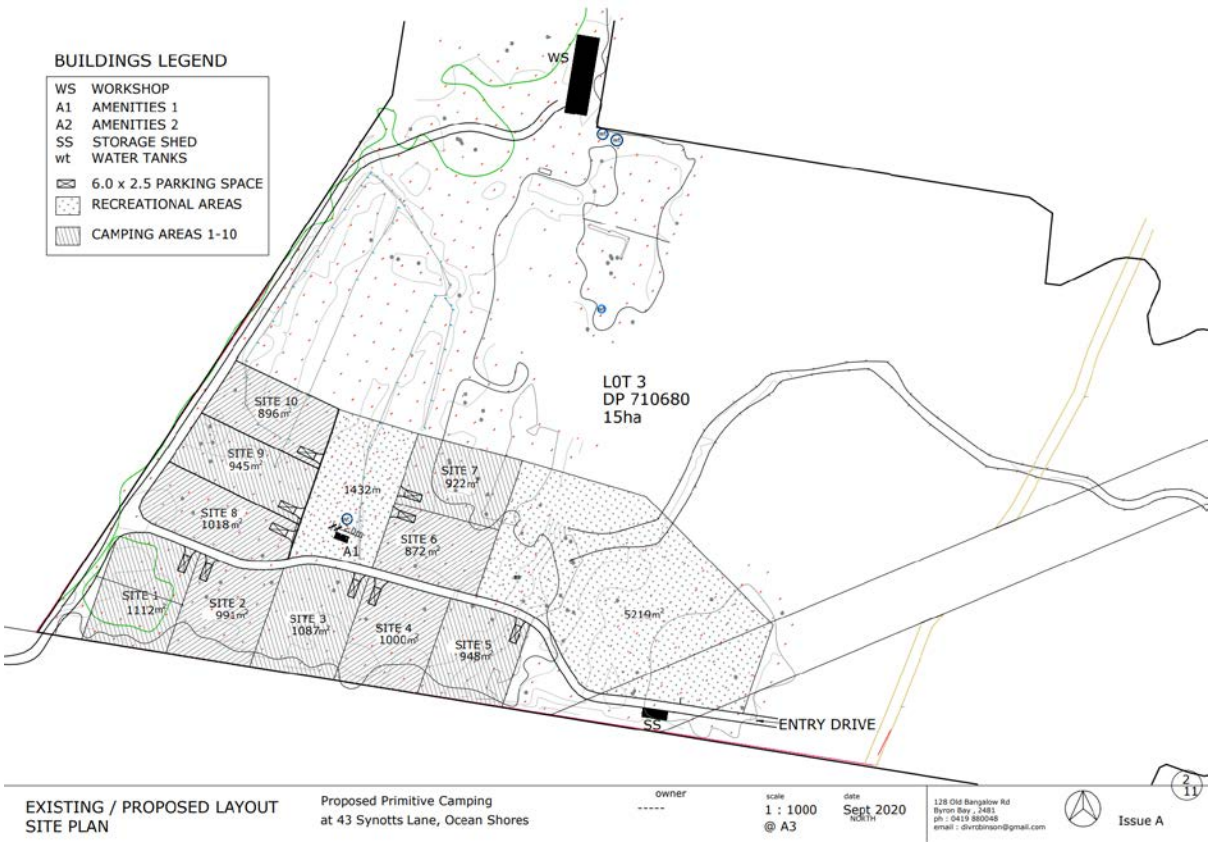


Figure 2: Subject Site

Table 1 provides a summary of the site description and characteristics of the proposed wastewater management area as determined from a desktop assessment and physical site inspection.

The locality of the subject site and OSMS is shown in Exhibits No. 1 & 2.

2.1. Site Constraints

The site is constrained in regards to wastewater management with the following:

- Areas of large trees;
- Sandy soils, which allow for high permeability, but have low phosphorus adsorption;
- High ground water (2 m to groundwater based on the survey information depicting top of bank along Midjumbil Creek);
- Flat site which requires a pump to transfer wastewater to the disposal field;
- Flood liable land with 1 in 20 year level approx. RL 2.3 m AHD and 1 in 100 year level approx. RL 2.7 m AHD;
- The ground level of the proposed development area is about 2.7 m AHD
- The disposal field is required to be above the 1 in 20 year flood level (electrical components to be above the 1 in 100 year);

2.2. Land Area

The subject site is 15 hectares however, not all of the site is suitable for wastewater management and the actual suitable area is much less than this, due to the existing vegetation, flood prone areas and proposed camping areas. The actual area available is in the order of about 10000 m^2 which is located in the cleared section of the site, as well as along the southern boundary, maximising the setback to the constructed drainage line along the northern boundary.

The on-site wastewater management system is presented in **Exhibit No.2**.

2.3. Vegetation

The site contains dense vegetation in the western portion of the property, scattered trees in the cleared section and vegetation around the perimeter. The proposed disposal area consists of mown grassed and no trees are required to be removed for the wastewater management system.

Some trees will be within the proposed disposal field area as part of landscaping, however, the proposed subsurface irrigation area can be accommodated around the trees without significant impact.

Slope

The proposed disposal area is flat, which is typical to the site and will require a pumped wastewater management system.

2.4. Soil

Soil of the site consists of sandy soils as presented in the borehole description below. It is noted that Morand (1994) depicts the site as being on the Mullumbimby Landscape variant a, however, these are alluvial, clay soils. It is considered that the soil a the site is more typical to that of the Tyagarah landscape/

SOIL ASSESSMENT							
Horizon	Depth (mm)	Texture	Structure	Colour	Coarse Fragments	Soil pH	Dispersive Class
	0 500 1000	Fine to medium grained sand	Single grained Loose to medium dense, single grained	Brown to light grey	None observed	5	No dispersion

The site of the proposed wastewater disposal area is located on the 'Tyagarah' Aeolian soil landscape classes in accordance with the Soil Conservation Service 1:100,000 Soil Landscape Map. It is considered that the soil and characteristics of the property match the 'TY1' description of Morand (1994, p 161).

Morand (1994) describes the soil as coarse to medium grained sand to clayey sand, being single-grained. The soil is loose, often water repellent as topsoil with a rapid permeability (Morand, 1994). The other layer descriptions for the Tyagrah landscape within Morand do not match the site's soil.

2.5. Groundwater

It is expected that groundwater will be intersected within 2 m of the surface of the site. The proposed use of composting toilets, self contained systems in vans and the expected low occupancy for the site will reduce the potential impact on the groundwater table.

2.6. Flooding

Council's flood information presents that the site is subject to flooding with Flood liable land with 1 in 20 year level approximately RL 2.3 m AHD and the 1 in 100 year level approximately RL 2.7 m AHD. The ground level of the proposed development area is about 2.7 m AHD.

The proposed disposal field will be located towards the southern boundary at varying heights between RL 2.5 m and RL 2.6 m AHD, which the surface level is above the 1 in 20 year event.

The proposed septic tank, subsurface flow wetland and pump well will be required to have the lid/wetland lip above the 1 in 100 year ARI being 2.7 m AHD. The final location of these are to be determined on site. At no stage can electrical components (ie alarm, control panel etc) be below the predicted 1 in 100 year flood height.

2.7. Environment and Health Risk Assessment for the proposed disposal area

The following table is an assessment for the proposed disposal system in accordance with the *Environment and Health Protection Guideline On-site Sewage Management for Single Households* (EPA et al 1998).**Table 1: Soil Assessment for Wastewater Disposal in accordance to EHPG**

SOIL FEATURE	COMMENT	LIMITATION RATING		
		Minor	Moderate	Major
DEPTH OF SOIL	Soil depth is estimated to be greater than 2 m in depth, however groundwater is intersected within 2 m of the ground surface		✓	
DEPTH TO HIGH EPISODIC/ SEASONAL WATERTABLE	The water table is most likely within 2 m of the surface	✓		
SOIL PERMEABILITY	The sites soils are highly permeable sands	✓		
COARSE FRAGMENTS	Non-observed in borehole	✓		

SOIL FEATURE	COMMENT	LIMITATION RATING		
		Minor	Moderate	Major
pH	Soil pH is generally acidic (5.0), and will require lime to be incorporated into the disposal area.	✓		
ELECTRICAL CONDUCTIVITY (dS/m)	Morand (1994) states that the Tyagarah soil landscape has a low electrical conductivity, there was no evidence of vegetation being affected by salt and is not considered to be a constraint at the site	✓		
PHOSPHOROUS SORPTION (kg/ha)	Morand (1994) states that the Tyagarah soil landscape has a low phosphorous sorption rate and 1000 kg/ha/year.	✓		
MODIFIED EMERSON AGGREGATE TEST	Morand (1994) states that the Tyagarah soil landscape has a low dispersive percentage, there were no signs of dispersiveness when soil at site was examined	✓		

Overall the EHPG (1998) would class the soil as being a minor limitation for disposal of wastewater.

2.8. Improvements to Soil

Increased acidity affects cation exchange capacity and can lead to deficiencies in calcium and magnesium while mobilising aluminium, which is toxic to plant growth. Lime can be added to the soil profile when preparing the area for disposal to increase the pH to a range between 6.5 – 8.5, which will enable plants to take up nutrients, which will be within the wastewater.

Gypsum will be added to the soil on an annual basis at the rate of 0.5 tonne/hectare to prevent the soil from degrading from sodium application, which is contained in the wastewater.

2.5 Environment and Health Risk Assessment

The following is an environment and health risk assessment in accordance with the policy for *Design Guidelines for On-Site Sewage Management Systems* Byron Shire Council (December 2004).

Table 2: Environment and Health Risk Assessment for Proposed Disposal Area

	LIMITATION		
SITE FEATURE	NONE	MAJOR	REASONING
FLOOD POTENTIAL		✓	The site is subject to flooding, however the disposal field will be accommodated above the 1 in 20 year flood height and the treatment system will be above the 1 in 100 year flood height.
SOIL TYPE	✓		Sand.
EXPOSURE	✓		Exposure to sun and wind is good.
SLOPE %	✓		All disposal areas are less than 10% which is acceptable and it is proposed that a pressurised disposal field will be used, uitlising subsurface drip irrigation to provide for even distribution of wastewater
LANDFORM	✓		Flat, slight convex area, not subject to run-on of stormwater from other areas
EROSION POTENTIAL	✓		Minor impact from erosion processes
SUBSOIL DRAINAGE	✓		No visible signs of subsoil dampness in the proposed disposal areas.
SURFACE DRAINAGE	✓		stormwater runoff can be diverted from the disposal areas.
LAND FILLING	✓		No filling is proposed
LAND AVAILABLE FOR APPLICATION AREA AND BUFFERS	✓		The site is suitable for wastewater management and reserve areas are proposed The disposal field is proposed to be located at least 3 m from the southern boundary, given that the site is flat this is not considered to be a constraint.
ROCKS AND ROCK OUTCROPS	✓		No rock or rock outcrops were observed
TREATMENT SYSTEM	✓		Passive wastewater management consisting of composting toilet, septic tank and subsurface flow wetland

2.9. Site Constraints and Proposed Best Practice

Table 2 presents site constraints that occur following the BSC Design Guidelines for On-Site Sewage Management Policy. It is considered that the proposed wastewater management system which will consist of a combined wastewater management system for the primitive campground and guests rooms is best practice for this site.

3. PROPOSED ON-SITE WASTEWATER MANAGEMENT SYSTEM

The client proposes the use of two toilet blocks, each containing a composting toilet, shower and hand basin.

The layout of the treatment and disposal system is shown on **Exhibit No. 2**.

3.1. Occupancy rates

Information from Bruns River Camping presents that there will be 10 camp sites with 4 people per site, being 40 people per site. However, a proportion of the campers are expected to be fully self contained and not use the provided facilities on-site, this is in the order of 30 %.

Therefore this equates to: 10 sites x 4 people/site x 70 % use (ie 30 % use their own facilities) = 28 people

Allowing for an even use for the two amenity blocks, would be 14 people/toilet block.

3.2. Predicted Hydraulic Loading

The predicted hydraulic loads are based on the BSC Policy (December, 2004) using 'bathroom' only, which equates to 53.2 L/person/day. This is considered to be a conservative figure, given that some people may not shower at the site.

The loading per amenity block is therefore considered to be:

14 people x 53.2 L/person/day = **744.8 L/day**

Or 1489.6 L/day for the campground.

3.3. Predicted Nutrient Loading

Nutrient loading would be relatively low for the site due to the use of composting toilets. The 'bathroom' only fixture was used in Council's model which determines total nitrogen to be 0.2 kg/person/year for TN and 0.004 kg/person/year for TP. It is expected that there would be less nutrients then this due to the low occupancy rates over the year.

3.4. Disposal Area Required

This section investigates the disposal area required based on the predicted hydraulic and nutrient loadings from the establishment, and environmental factors which influence the area design.

The area is based on the Byron Policy (December, 2004), using the following factors:

- 14 people per amenities building (2 amenities buildings at the site)
- 744.8 L/day per amenities building
- Land area of 50000 m^2 to take into account the other amenities and the dwelling
- Bathroom only (ie composting toilet and no kitchen)
- TP loading of 0.06 kg/year and TN loading of 2.76 kg/year

- 2 m to water
- Sandy loams, podzols
- Mounded bed – ETA beds must be mounded to shed stormwater

The area required for the nutrients and hydraulics was:

TP	=	14 m^2
TN	=	0 m^2
Hydraulics	**=**	**198 m^2**

The limiting factor is hydraulic loading, which is based on the peak daily use, when on average this would be less than the calculated figure. Based on Council's model, the 198 m^2 area requires four evapotranspiration/absorption beds each 18.4 m x 2 m x 0.45 m.

The following section describes the wastewater management requriements.

4. DETAILS OF ON-SITE WASTEWATER MANAGEMENT SYSTEM

The following section provides details of the components of the proposed wastewater management system for each amenities block.

4.1. Septic tank

A septic tank with a minimum volume of 5000L is proposed to be installed, which is in accordance with table J2 of AS 1547-2012. Furthermore, an outlet filter is to be installed in the septic tank to further increase primary treatment.

4.2. Subsurface Flow Wetland

The wetland is used to reduce nutrients (predominantly nitrogen and some phosphorous) and reduce BOD and pathogens in the system. A wetland treatment surface area of 7.2m^2 has been used for the modelling of the wastewater management system.

4.2.1. Construction of Subsurface Flow Wetland

To achieve this required wetland surface area for each of the amenities blocks it is recommended that a single Grahams Concrete wetland cell should be used to construct the wetland. These cells are 3m x 2.4m x 0.7m, providing 7.2 m^2 in surface area. Based on the surface area required, it is considered that one prefabricated cell will be suitable as they will provide 7.2m^2 of disposal area.

Construction of the wetland is to be as follows:

- In general, blue metal aggregate will be placed within the cell to a height of 0.7m and the inlet will be set at a height of 500mm, and outlet of 450mm;
- The inlet area should contain coarse gravel/cobble with a diameter of 40mm to 60mm, the remainder of the bed should consist of gravel or aggregate of between 10 - 20mm in diameter;
- Media should be washed before placing in the cells to dispose of any fines that may cause components of the trough to clog;
- Wetlands are to be planted with soft tissue macrophytes such as *Phragmites australis* (common reed) and sedges or similar species, a species list is contained in **Exhibit No. 3**;
- Both inlet and outlets are to be fitted with PVC mesh to allow cleaning and prevent stones entering the pipes. The inlet and outlets will both be of 100mm PVC or polyethylene;
- Required fall of the Subsurface Flow Wetland was determined through Manning's Equation as less than 0.01% slope. It is proposed that the slope of the bottom of the bed will be **0.1%**.

The design of the subsurface flow wetland is contained in **Exhibit No. 4**.

4.3. Holding tank

A holding tank will be installed between the wetland cell and ETA beds. Council's on-site wastewater management strategy states that holding tanks have to be sized in accordance with the NSW Department of Health *Septic Tank & Collection Well Accreditation Guideline* (2001). Using this guideline and a single pump arrangement the equation for sizing the holding tank is:

daily flow (per person) * No. of people (min of 5) * 2 = Holding tank capacity

or

53.2L * 14 * 2 = 1490L capacity

It is proposed that additional capacity will be provided in a 5000 L holding tank. This will allow for additional freeboard in case of pump failure.

The holding tank will have a submersible pump (or self priming land standing pump) that will be set to 200L doses. A float switch which will allow 200L doses 3-4 times a day will be installed which equates to the hydraulic loading calculated for the OSMS. A concrete distribution box on a concrete plinth will distribute the 200L doses to the four proposed ETA beds per disposal bed. It is recommended that 40 mm diameter, PN 12.5 PE 100 (poly pipe for effluent) is used and a Davey D25A submersible pump is recommended.

The pump well must be secured to prevent the tank from 'floating' when pumped. Additional weight within the tank (ie concrete) or ring is required. A plastic tank is not recommended, unless specifically designed for such situations.

4.4. Wet Weather Storage

It is proposed that wet weather storage will not be installed at this site, in accordance with BSC Policy (December, 2004). It is proposed that no wet weather storage is used based on the following:

- the disposal area is sized on the daily model where no cumulative storage is required;
- the size of the disposal area is conservative (i.e. higher absorption rates and lower hydraulic load application rates expected)

Furthermore, Council's Policy (2004) states: *The NSW guidelines (E&HPG, 1998) highlight the desirability of not irrigating effluent during wetweather, as this may lead to occasional surcharging and contamination of run-off waters with effluent. Byron Shire Council agrees with this sentiment but believes that, for single domestic applications, the expense, difficulty and increased risks to householders of contacting the effluent often outweigh the potential health and environmental risks of effluent-contaminated run-off during very wet periods. These Design Guidelines do not therefore mandate that wet-weather effluent storage must occur in single domestic installations, but designers should consider wet-weather storage a useful potential tool for improving environmental security on highly constrained sites (e.g. flood-prone lands or those over shallow groundwaters).*

Although the subject site is considered to be flood prone at times the disposal field is proposed to be at RL 2.5 m AHD which is above the required planning height for disposal fields being the 1 in 20 year flood as per Council's Policy (Section 5.1.8 Flooding Potential) which is RL 2.3 m AHD for this site. Therefore, there will be no requirement for wet weather storage

5. COMPOSTING TOILETS

Composting toilets are proposed to be installed at each of the amenities buildings. As this is a commercial venture, NSW Health accredited systems are not required to be used, however, it is proposed that Clivus Multrum CM14 or similar will be utilised for the site. All excess liquid is to be piped to the septic tank.

Any openings to the compost toilet must be above the 1 in 100 year flood height of RL 2.7 m AHD.

6. MAINTENANCE PLANS

The following is a maintenance check list to be undertaken by the manager of the site, and it is recommended that information for the use of the compost toilets and on-site system is developed as part of the management plan and is provided to campers and/or put on in the amenities blocks.

6.1. System Use

- Bleach, bleach-based products, whiteners, nappy soakers and spot removers shall not be disposed of into the compost toilets or sink. They shall be disposed of on a disused area of a garden, well away from the disposal area.
    - Hygiene products, condoms, tampons, sanitary napkins, disposable nappies and cotton buds shall not be disposed of via the on-site disposal system. They should be disposed of into garbage bins in sealed plastic bags.
    - Only the recommended amounts of disinfectants should be used. Biodegradable products for septic systems are recommended

6.2. Septic Systems & Effluent Filter

The septic tanks should be regularly checked and is to be pumped every 3 to 5 years or as required, with wastes being removed by a licensed septic pumping company. The effluent filter should also be cleaned out at this time.

6.3. Holding Tank

The pump in the holding tank should be checked regularly to ensure the system is functioning adequately.

6.4. Plan of Management for the Subsurface Flow Wetland

It is proposed that the system be checked regularly for adequate plant growth, that plants have no signs of disease and there is a full vegetated cover in the system. Revegetation of wetland cells is required if vegetation dieback occurs. Plants should be cutback at least every quarter of the year. Up to 1/3 of the plant material can be removed which will encourage new plant growth which will inturn encourage additional uptake of water and nutrients.

Checking for blockages near the inlet and outlet of the system should be undertaken regularly, such as every three months. Gravel around the inlet and outlet can become clogged over time leading to surface ponding and surcharging from the wetland cells. If this occurs gravel will require replacement or removal and washing before being reinstated. Gloves should be worn when cleaning the system.

6.5. Evapotranspiration Absorption Field

The disposal system is designed in a manner that will allow the system to be maintained and repaired quickly if part of the system happens to fail.

- Runoff diversion banks to be inspected annually and maintenance as required undertaken to ensure that surface runoff is diverted around each of the disposal areas;
- No vehicular, stock or regular pedestrian access should be made across the disposal field.
- Vegetation will be harvested frequently up to 2 times a year can be undertaken, this will encourage regrowth and in turn will increase uptake of nutrients and water;
- Plant clippings shall be removed from the site to decrease amount of nutrients returning to the wastewater system;
- Effluent from disposal system should not be discharged to the stormwater system or over the ground;

- The effluent distribution pipes are to be inspected for blockage etc. when the aggregate is cleaned and flush cleaned or replaced as required.

Some signs of the disposal system failure are listed below, if any of these occur contact the plumber who installed the system and arrange for immediate pump out of the septic tank to relieve the need for effluent disposal to the disposal area.

- Surface ponding and run-off of treated wastewater;
- degradation of soil structure - eg. sheet and rill erosion, surface crusts, or hard surfaces are evident;
- poor vegetation growth;
- unusual odours.

6.6. Composting Toilet

Proper maintenance of Waterless Composting Toilets is important for the effectiveness of the biological breakdown of the waste materials. Important factors to be taken into consideration are:

- Minimal use of water and disinfectants in cleaning ;
- Do not deposit any inorganic substances into the compost pile;
- Always keep the lid down when not in use;
- Added organic matter is required, can be in the form of newspaper, wood shavings and any other absorbent materials;
- Ensure material is evenly spread over the compost heap;
- Ensure fan is working;
- Remove compost from barrel and enclosure area when required, and bury on-site in garden areas as required;
- Ensure no rainwater enters enclosed area surrounding compost toilet barrel.

7. CAMPERVAN WASTE

Campervan waste is not to be disposed of on-site as the site will not have a designated 'dump point'. This waste must be the responsibility of the campervan driver and be removed and disposed of at a legal dump point elsewhere.

8. CONCLUSION

It is proposed that a primitive campground will be constructed on the site consisting ten sites, accommodating 4 people per site, being 40 people total. The developers propose to use two amenities blocks, which will contain a compost toilet, shower and basin.

It is possible that an on-site wastewater management can be achieved for the proposed development at the subject site which conforms to the environmental and health objectives of the BSC Policy (December, 2004), provided the following is undertaken for each of the amenities:

- Use compost toilets in the amenities (recommended to use Clivus Multrum CM14 or similar), with openings to be above the 1 in 100 year flood level RL 2.7 m;
- Collect excess liquid from the toilet and greywater from showers and handbasin in 5000 L septic tank with outlet filter;
- Flow to one 7 m^2 Grahams concrete wetland cell;
- Wastewater collected into float secured, 5kL pump well fitted with Davey 25A or similar pump on 200 L doses, pump to disposal field
- Disposal field consists of 4 ETA beds each 18.4 m x 2 x 0.45 m
- A maintenance program listed in Section 6.0 will be undertaken by the manager of the site

9. REFERENCES

Australian Standard AS 1547 - 2012 *Onsite Domestic Wastewater Management.*

Byron Shire Council (December, 2004). *Design Guidelines for On-site Sewage Management Systems.* Protecting the Environment and Health of Byron Shire. Technical Guidelines for System Designers.

Central Mapping Authority (1986). Land Information Centre, NSW Department of Lands, Bathurst.

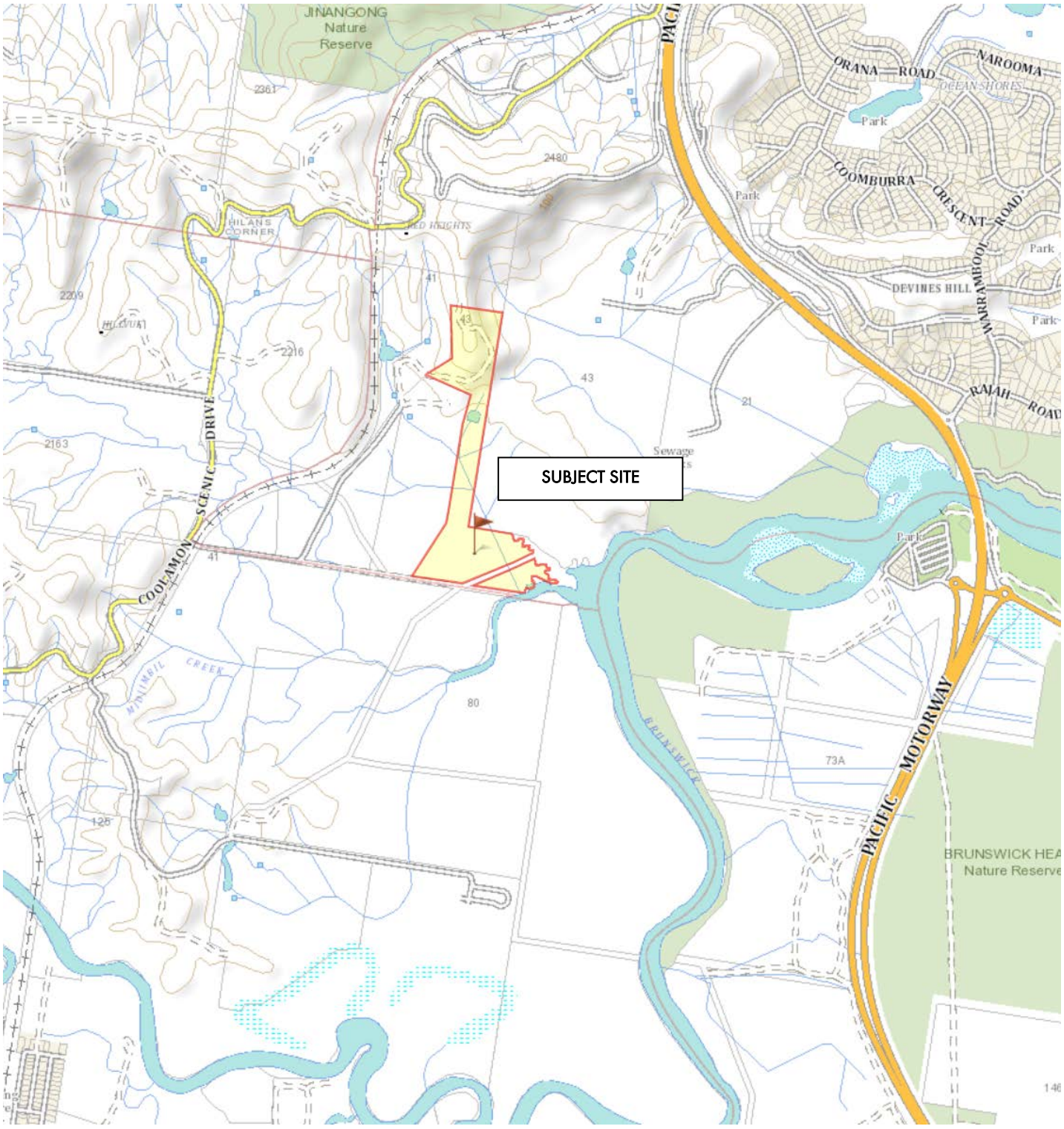
Environment Protection Authority, Dept. of Local Government, Department of Land & Water Conservation and NSW Department of Health (Feb 1998). *Environment and Health Protection Guidelines - On-Site Sewage Management Systems for Single Households*.

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

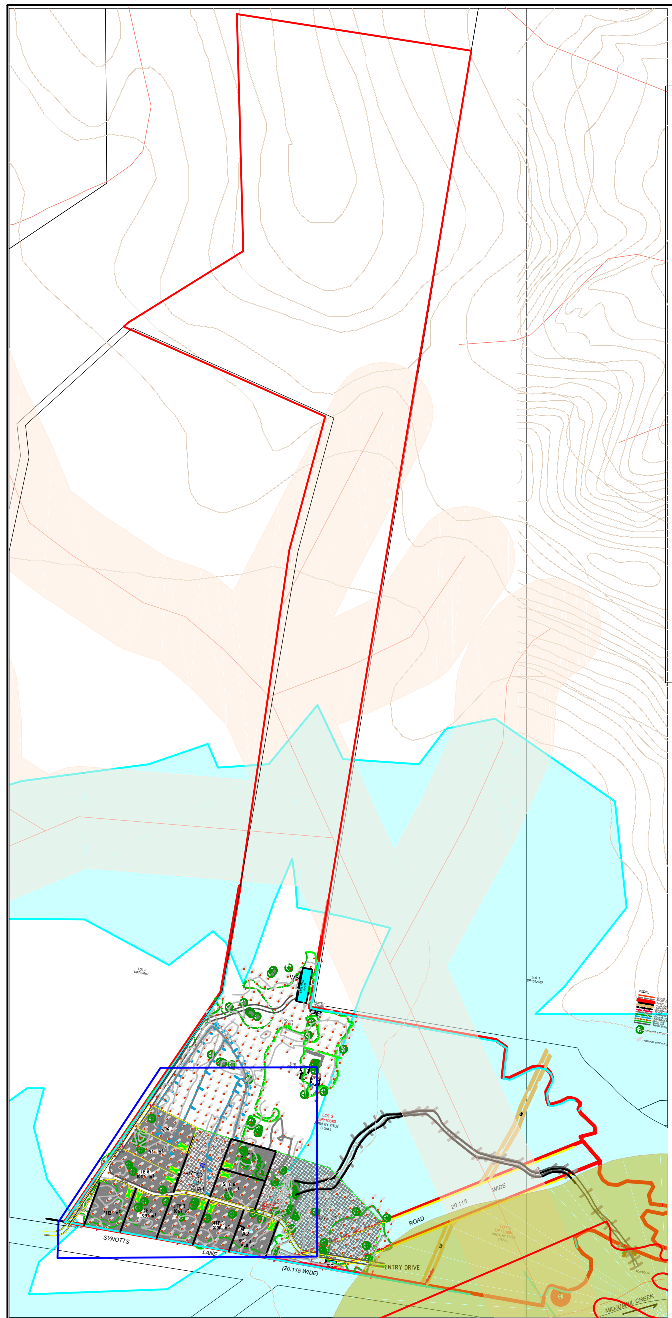
End of Report

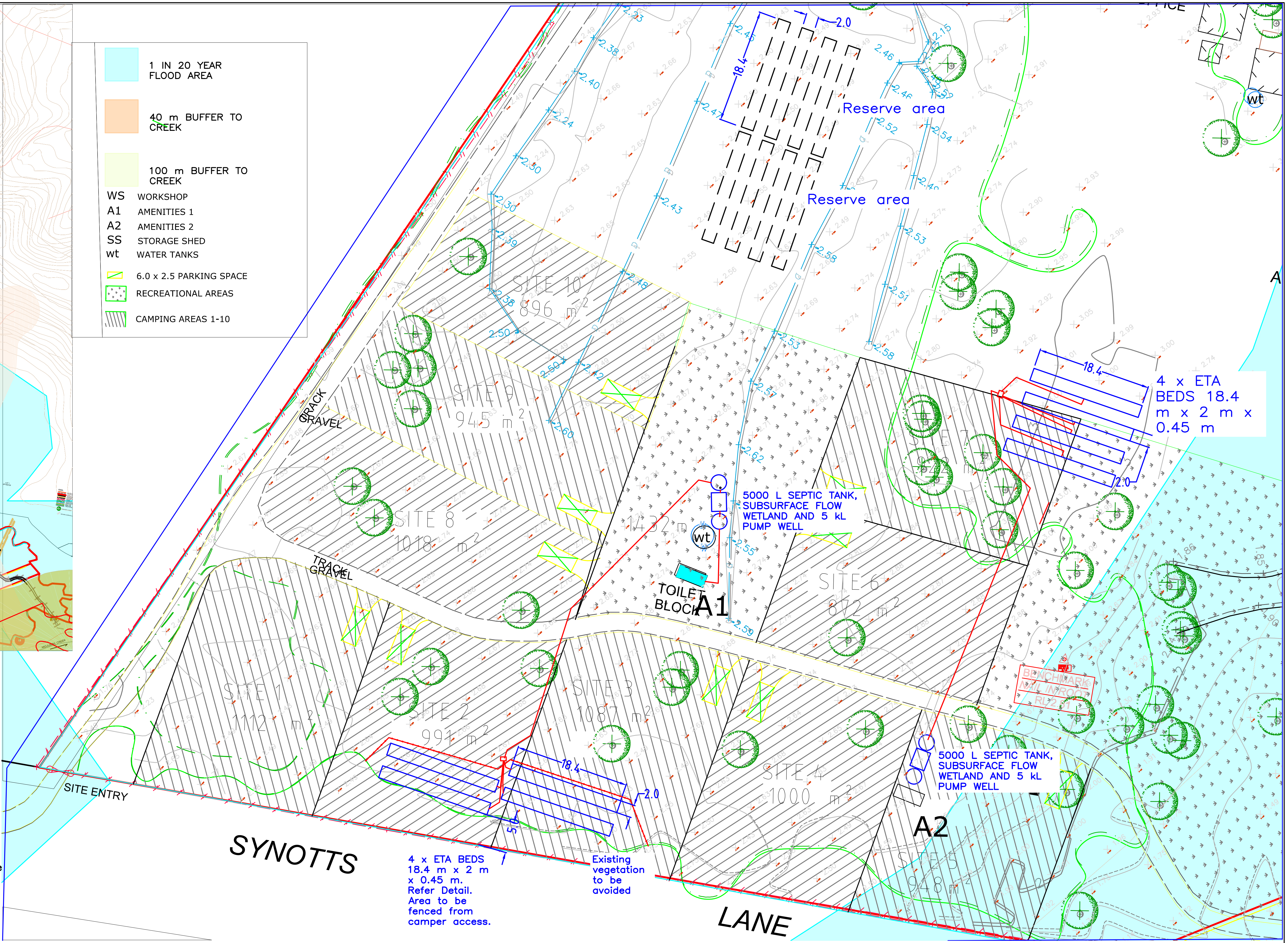
Greg Alderson & Associates

Chartered Professional Engineers



Source: NSW LPI Spatial Information Exchange (2018) Project No. 21070_ww1.docx Scale: NTS	**GREG ALDERSON AND ASSOCIATES** **ABN 58 594 160 789** 43 Main Street Clunes NSW 2480 Phone: (02) 6629 1552 Email: office@aldersonassociates.com.au	**Exhibit No. 1.** **SITE LOCATION** Lot 3 DP 710680, 43 Synotts Lane, Ocean Shores





WASTEWATER NOTES:

1. Design for one amenities, based on use of 14 people per amenities per day
2. Composting toilet (Clivus Multrum CM 14 or similar), shower and basin
3. 14 people/day 735 L/day per amenities, (ie accommodate 28 people per day total for two amenities
4. Wastewater from showers, basin and excess liquid from compost toilet to be collected in 5kL septic tank (with outlet filter), flow to one Graham's concrete wetland cell (3 m x 2.4 m) treated wastewater collected in 5kL pump well (to be secured against 'floating')
5. Use Davey 25A pump on 200 L doses or similar to transfer treated wastewater to ETA beds for disposal
6. four ETA beds are required each
7. four ETA beds required each 18.4 m x 2 m x 0.45 m
8. Areas are to be excluded from access by campers

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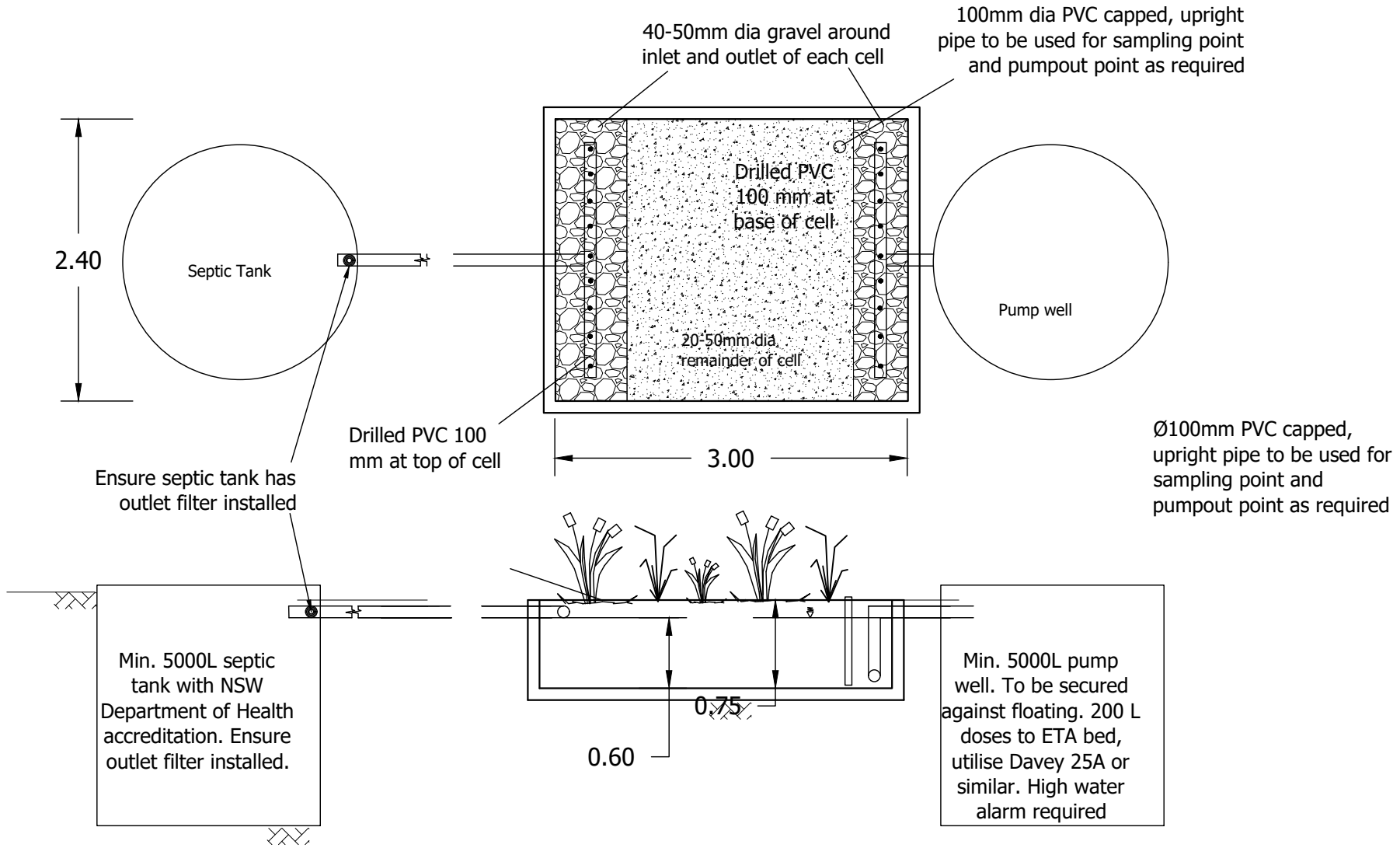
Greg Alderson Associates
43 Main Street, CLUNES NSW 2480
PO Box 12344, CLUNES NSW 2480
P:(02) 6629 1552 E:office@aldersonassociates.com.au
W:aldersonassociates.com.au ABN 58 594 160 789

Client: Bruns River Camp

Site address: 43 SYNOTTS LANE OCEAN SHORES

ON-SITE WASTEWATER MANAGEMENT FOR PRIMITIVE CAMPING

Drawn:	Source:	EXHIBIT NO: 2	Date:
WA			17-11-20
Scale: 1:100	Original Size: A3	Project: PRIMITIVE CAMPING	Revision: -
Job Number: 21070			



Notes:
1. Prefabricated cells to be positioned with fall of 0.1%.
2. Each cell to be positioned 50mm below previous cell
3. Distribution of wastewater at base of bed, using slotted Ø100mm PVC pipe
4. Concrete prefabricated cells recommended and depicted in drawing shown.
5. Pump out of wetlands when required through PVC inspection points in each bed
6. Species for planting provided within report.

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Greg Alderson Associates
43 Main Street, CLUNES NSW 2480
PO Box 12344, CLUNES NSW 2480
P:(02) 6629 1552 E:office@aldersonassociates.com.au
W:aldersonassociates.com.au ABN 58 594 160 789

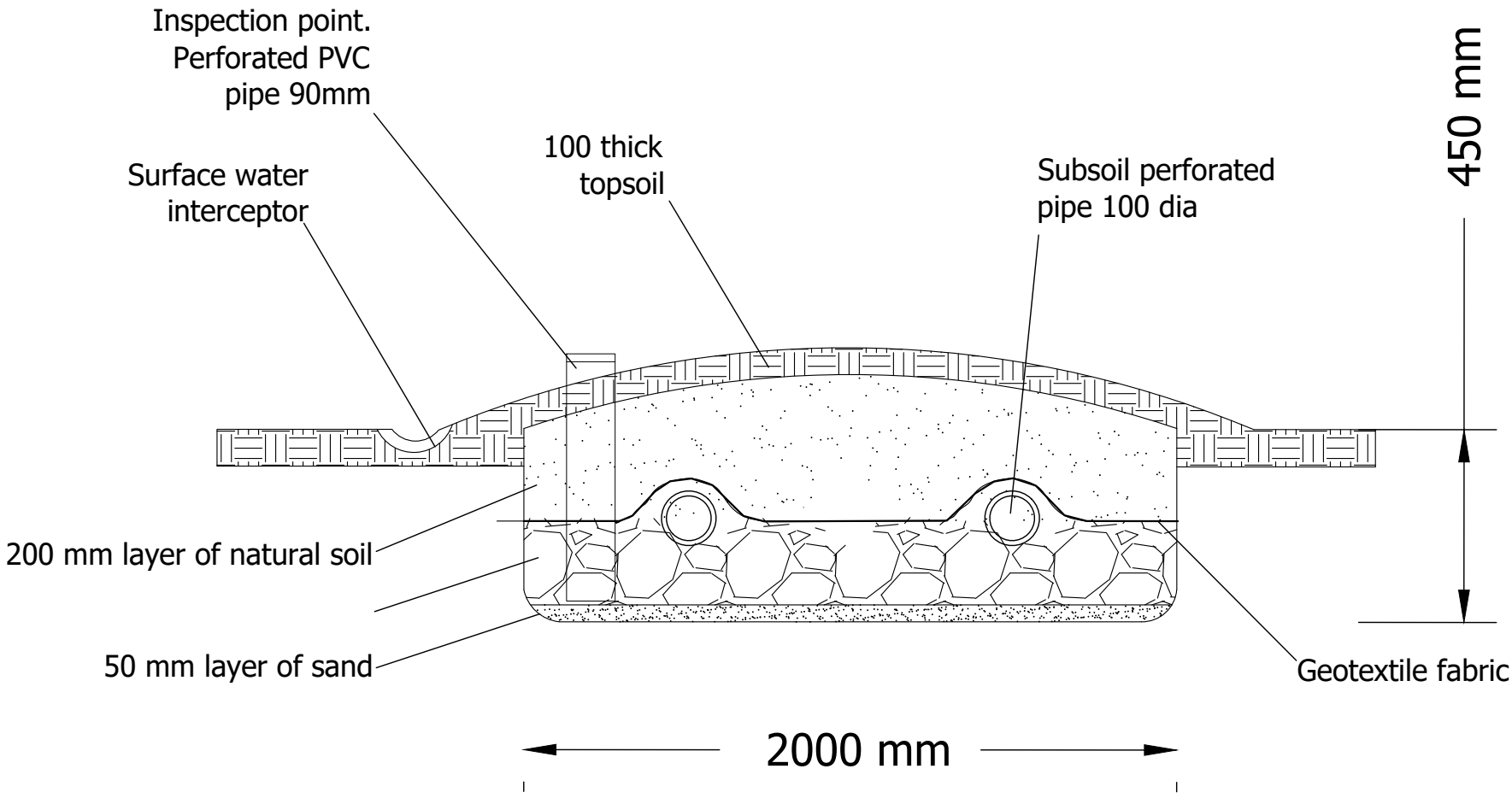
Client: Bruns River Camp

Site address: 43 SYNOTTS LANE OCEAN SHORES

SUBSURFACE FLOW WETLAND DETAIL

Drawn: WA	Source:	EXHIBIT NO: 4	Date: 17-11-20
Scale: NTS	Original Size:	Project: PRIMITIVE CAMPING	Revision: -
Job Number: 21070			

Note, it is recommended that the ETA beds be mounded to allow some settlement of soil. This should provide run-off of stormwater



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Greg Alderson Associates
43 Main Street, CLUNES NSW 2480
PO Box 12344, CLUNES NSW 2480
P:(02) 6629 1552 E:office@aldersonassociates.com.au
W:aldersonassociates.com.au ABN 58 594 160 789

Bruns River Camp

Site address:
43 SYNOTTS LANE
OCEAN SHORES

EVAPOTRANSPIRATION/ABSORPTION BED CROSS SECTION

Drawn: WA	Source:	EXHIBIT NO: 5	Date: 17-11-20
Scale: 1:100	Original Size: NTS	Project: PRIMITIVE CAMPING	Revision: -
Job Number: 21070			

Byron OSMS Design Model *Version:* camp_area_28_people_NO KITCHEN_WETLAND_NO CAP.xlsm

Set Defaults

STEP 1 — bedroom / persons

STEP 2 — # persons (Grp 1): 14; # persons (Grp 2):

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

STEP 4 — Block size (m2): 50000; 40

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	☐	☐
Bathroom	☑	☐
Laundry	☐	☐
Kitchen	☐	☐

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. ~ 10 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

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 22.0%

Reed bed area (m2) 6.2

BOD target of 20mg/L is equiv. to ~0.0% TN

Current Outlet BOD conc. ~ 8 mg/L.

STEP 10 — Water Table/ Bedrock Depth (m): 2.00

Total Daily Flow (L/day)	744.8
TN production per year (kg/year)	2.76
TN reduced by all N loss	1.72
N Plant Uptake rate (kg/ha/year)	200
Phosphorus in effluent (Ip) (kg/yr)	0.06
P uptake by plants (Hp) (kg/ha/yr)	10
P soil sorption (Ps) (kg/ha/m depth)	1000
Water Table/ Bedrock Depth (m)	2.00
Buffer to Water Table (Bwt) (m)	0.5
Time for accumulation of P(years)	50
Final area (m^2)	**198**
Phosphorus area (m^2)	**14**
Water balance area (m^2)	198
☑ Specific Crop Coeff.(grass=1.00)	1.00
% Effective Rainfall	65%
Percolation (mm/d)	5
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)	117.70
Permissible percentile exceedence	5.00%
Minimum effluent application (mm/day/m^2)	3.77

Daily Effluent Flow per person (L/day)	140
N prod. per capita (kg/person/yr)	4.20
N loss in treatment system (% reduction)	22%
P prod. per person per yr (kg/person/yr)	0.60
Effective porosity of root zone	0.37
Effective porosity of bluemetal in trench below root zone	0.43
Lateral seepage width (m)	0.300
ETA trench separation	2.00

Nitrogen Report

N plant uptake (kg/yr)	1.72
N load exceedence	0.00
N load percolated (kg/yr)	0.00
N released (perc+exceed.) (kg/yr)	**0.00**
Enviro.N limit (kg/yr)	**9.93**
Nitrogen area (m^2)	**0**
Hydraulic area (m2)	**198**
total ETA trench area	147.20
ETA trench length (m)	18.40
number of ETA beds	4
beds total plus separating spaces:	X Y dimensions = 19.0m x 14.6m Area =277 m2

Total N-load 1.72kg/yr

% 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%
Avail.Water Capacity (AWC) of root zone	0.15
Default AWC of bluemetal in trench below root zone	0.00

Trench under root zone <-

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)

STEP 13 — Land Application Type: SSI / ETA

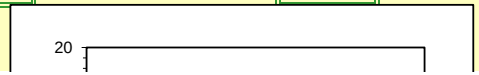
STEP 14 — Calculate (or Cntl- q)

STEP 15 — 2.00

ETA trench width (m): 2.00

4

ETA bed separation 1.40



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ABN 58 594 160 789

43 Main Street

Clunes NSW 2480

T: 02 6629 1552

office@aldersonassociates.com.au

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