On-site Wastewater Management Feasibility Assessment

Proposed Rural Tourist Facility and Function Centre

Lot 2 DP 1007622

72 Lawlers Lane, Bangalow

For: R. Mamone
Report no: 21529_ww.docx
Date: 12 October 2021

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Document Information

Project name	Proposed rural subdivision
Reference	21529_ww.docx
Revision Summary	.....

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1. INTRODUCTION

Greg Alderson and Associates have been commissioned by Ralph Mamone to provide an On-Site Wastewater Management feasibility assessment to accompany proposed rural tourist cabins and function centre at Lot 2 DP 1007622, 72 Lawlers Lane, Bangalow.

1.1. Proposed Development

The proposed development will consist of rural tourist cabins and a temporary function centre. The proposed development will be in two stages:

> Stage One: Construction of 12 x 1 bedroom cabins and an amenities building which will be for the use of cabin guests only. Total patronage will be 24 people in the cabins
>
> Stage Two: will be to use the amenities building as a 'temporary function centre'

The temporary function centre will be for 150 people and will be for no more than 1 event will be held at the function centre on any one weekend, and no more than 20 events will be held at the function centre in any period of 12 months.

The function centre will have a kitchen to allow for cooking on-site, however the initial use of the building will see prepared food being brought to the site and plated.

The following report provides information in regards to the site characteristics and the proposed feasibility of an On-site Sewage Management System (OSMS) to manage wastewater generated from the proposed development.

Figure 1: Subject Site and proposed development (Archimages, 2021)

1.2. Proposed On-Site Wastewater Management System

It is proposed that the development will have separate wastewater management systems which will consist of:

- Aerated Wastewater Treatment Systems (AWTS) to service four cabins (ie 3 AWTS for the 12 cabins);
- Trade waste system and Aerated Wastewater Treatment System for the proposed function centre

Exhibit No. 2 presents a site plan showing the location of the proposed development components.

1.3. Existing Development

The existing site contains a dwelling located to the south of the proposed development site. There is no proposed change to the existing dwelling and the existing wastewater management system will not be impacted by the proposed development. No further assessment is warranted for the existing wastewater management system.

2. SITE DESCRIPTION

Staff of this office investigated the subject property and the proposed wastewater management system location. The site is accessed via the existing driveway from Lawlers Lane and then currently an informal track to the proposed cabins, which also services other parts of the property. The proposed cabins and amenities building are proposed to be located to the north of the existing dwelling, on a side of a hill with a north westerly aspect.

The proposed layout will consist of a 'ring road' with the proposed cabins positioned on the outside of the ring road and the amenities building positioned within the middle of the road. Earth works are proposed for the development and it is understood extensive landscaping is also proposed.

The property is shown within its immediate locality on **Exhibit No. 1**.

2.1. Land Area

The land area of the allotment is 36 ha. There is suitable area available for wastewater management to avoid steep gradients, dense vegetation and drainage lines.

The disposal areas are shown on **Exhibit No. 2**.

2.2. Vegetation

Vegetation across the property consists of manicured lawns in the vicinity of the existing dwelling and dense vegetation to the north of the proposed development area. It is understood that the proposed development will have substantial landscaping and there is therefore opportunity to reuse the treated wastewater in the landscaped gardens for the development. However, at this feasibility stage, it is proposed that the disposal field will be located in a an area which contains the occasional tree, which will not impact the disposal field. Vegetation will not be restrictive to the installation of a large OSMS on the site.

2.3. Slope

The topography of the property consists of generally gentle slopes. The proposed disposal area is positioned on a gently sloping area of approximately 15% with a westerly facing aspect. This slope is not restrictive to the various wastewater disposal methods available. The area around the proposed development 20 % which is suitable for wastewater also, and this can be investigated further as part of the s68 if it were to be used for irrigation of landscaped areas.

2.4. Soil

The top soil layer which extends for about 200mm consisting of clay loam overlaying light clay. The soil of the site has The soil was well structured to the depth of the borehole, which was 800mm. The soils were well drained and were moderately structured.

The soil type in the proposed disposal area consists of red krasnozem in accordance with the Great Soil Group Classification. Below is the of the soil profile of the subject site.

SOIL ASSESSMENT

Horizon	Depth (mm)	Texture	Structure	Colour	Coarse Fragments	Soil pH	Dispersive Class
	0	Clay loam	Strong	Dark brown	None observed	6 (Morand, 1994)	No dispersion (Morand, 1994)
	200	Light clay	Strong	red	Few weathered rock fragments – less than 20%		
	800	Test terminated					

The site of the proposed wastewater disposal area is located on the 'Bangalow' Residual 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 Bangalow Soil Landscape description.

The following is a summary of the Morand (1994, p29).

Soil Landscape:	Residual Bangalow Landscape
Soils:	Moderately deep to deep (>100 cm), Krasnozems and brownish red well drained krasnozems on slopes.
Geology:	Lamington volcanics: Lismore Basalts – Tertiary basalts, with bore and minor agglomerate
Limitations:	Very acid soils with high aluminium toxicity potential. Steep slopes and mass movement and localised rock outcrop.
Permeability:	moderate to high.

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 2000mm in depth	✓		
DEPTH TO HIGH EPISODIC/ SEASONAL WATERTABLE	The water table was not intersected during borehole tests and no springs or other water discharges were observed. An allowance of 3 m to the watertable was used in order to size the disposal area based of phosphorous movements	✓		
SOIL PERMEABILITY	The sites soils were light clays which have an acceptable permeability.	✓		
COARSE FRAGMENTS	Non-observed in borehole	✓		
pH	Soil pH is generally acidic (6.0), and will require lime to be incorporated into the disposal area.	✓		
ELECTRICAL CONDUCTIVITY (dS/m)	Morand (1994) states that the Bangalow soil landscape has a very low electrical conductivity, there was no evidence of vegetation being affected by salt	✓		
PHOSPHOROUS SORPTION (kg/ha)	Morand (1994) states that the Bangalow soil landscape has a moderate to high phosphorous sorption rate of greater than 600mg/kg which is equivalent to greater than 10000kg/ha/year. 10 000kg/ha/year was used for the design of the disposal area	✓		
MODIFIED EMERSON AGGREGATE TEST	Morand (1994) states that the Bangalow soil landscape has a low dispersive percentage, there were no signs of dispersiveness when soil at site was examined	✓		

Overall EPA *et. al.* (1998) would class the soil as being a minor limitation for disposal of wastewater.

2.4.1. 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 (Table 2) 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 land of the proposed disposal areas is not subject to flooding.
SOIL TYPE	✓		Light clays which have adequate permeability
EXPOSURE	✓		Exposure to sun and wind is good.
SLOPE %	✓		Slope is 15% which is not restrictive to SSI disposal
LANDFORM	✓		The property is located on the side of a small rise.
EROSION POTENTIAL	✓		No signs of erosion present in disposal areas.
SUBSOIL DRAINAGE	✓		No visible signs of subsoil dampness in the proposed disposal area.
SURFACE DRAINAGE	✓		Catch drains can be installed and stormwater runoff can be diverted from the disposal area.
LAND FILLING	✓		No fill observed in the proposed disposal area.
LAND AVAILABLE FOR APPLICATION AREA AND BUFFERS	✓		There is in excess of 2000m^2 available, which is suitable for on-site wastewater treatment and disposal.
ROCKS AND ROCK OUTCROPS	✓		None observed in disposal area.
TREATMENT SYSTEM	✓		AWTS (Secondary Treatment)

BUFFERS	✓	All buffers are achieved a ground water bore is located on the site, to the south of the existing shed, which is located up hill and in excess of 100 m to the development area therefore 50 m setback is achieved for a bore upgradient of the disposal field

2.6. Site Constraints and Proposed Best Practice

Tables 1 & 2 presented site constraints that may occur following the BSC Design Guidelines for On-Site Sewage Management Policy (2004) and the Environment and Health Protection Guideline On-site Sewage Management for Single Households (EPA *et.* al, 1998). It can be seen that the site is generally not restrictive to wastewater treatment and disposal according to these tables.

There is a groundwater bore present on the site. The proposed disposal area would be located greater than 50m down slope from the bore, and therefore the buffer distance required under Byron Shire Council's on-site wastewater management guidelines (2004) is met.

3. WASTEWATER CHARACTERISATION

The 'strength' of the wastewater will vary from the wastewater generating proposed development on the subject site. Wastewater from the stage 2 when the amenities will be used as a function centre will most likely have high BOD, nutrients and fats, oils and grease (FOG), and therefore particular consideration will need to be taken for these constituents. BOD is of most concern from such a development when considering on-site treatment and disposal, as poor management of high BOD loads will lead to odour issues and biofilm build up in irrigation lines and can cause issues with the function of the Aerated Wastewater Treatment Systems.

Wastewater from the remainder of the proposed development will reflect that of expected domestic effluent. A description of the expected wastewater characteristics & constituents are given in the following sections.

3.1. Predicted Hydraulic Loading

Predicted hydraulic loadings are based on occupancy information provided by the client. Table 1 presents the calculated water volumes from the various development components present on the subject site.

Table 3: Hydraulic volumes estimated from the development on the site.

Source	Number of cabins	People/Cabin	No. of People	Loading per person (L/day)	Loading per source (L/day)
Cabins	12	2	24	140[1]	3360
Amenity Building Stage 1			24	15[2]	360
Function centre (change from amenity building)			150	25[3]	3750

[1] based on Byron Shire Council's On-site wastewater management strategy (2004) for tank water with standard water saving devices.

[2] based on AS 1547-2012 per customer tearooms/lunchbars with restroom facilities

[3] based on AS 1547-2012 per customer tearooms/lunchbars with restroom facilities

3.2. BOD Loading

The BOD loading from stage 2 when the function centre is in operation is expected to generate in excess of 300 mg/L, which is too high to be treated in an off the shelf Aerated Wastewater Treatment System.

3.3. Predicted Nutrient Loading

Nitrogen & Phosphorus are the nutrients of main concern when treating and disposing of wastewater on-site (Crites & Tchobanoglous, 1998). The predicted loadings of these two nutrients from the existing and proposed development on the subject site is discussed in the sections below.

3.3.1. Total Nitrogen

Total Nitrogen (TN) calculations for the subject site are based on both published loading figures for domestic sources and this offices experience for concentrations from commercial sources. Table 5 shows the calculated TN loadings per source.

Table 4: Estimated TN loading from the development on the site.

Source	No. of People	TN concentration (mg/L)	Loading per person (Kg/yr)	Loading per source (Kg/yr)
Function centre (stage 2)	150	120[1]	0.06	9[2]
Rural Tourist Cabins	24	-	4.2[3]	100.8

[1] based on this offices (GAA) experience from testing wastewater generated from restaurants/commercial kitchens within Byron Shire,

[2] Calculation = 120mg/L/1000000*3750L/day*20 days (for events),

[3] based on Byron Shire Council's On-site wastewater management strategy (2004) and no allowance for reduced occupancy rate

3.3.2. Total Phosphorus

Total Phosphorus (TP) calculations for the subject site are based on both published loading figures for domestic sources and this offices experience for concentrations from commercial sources. Table 6 shows the calculated TP loadings per source.

Table 5: Estimated TP loading from the development on the site.

Source	No. of People	TN concentration (mg/L)	Loading per person (Kg/yr)	Loading per source (Kg/yr)
Function centre (stage 2)	150	20[1]	0.01	1.5[2]
Rural Tourist Cabins	24	-	0.6[3]	14.4

[1] based on this offices (GAA) experience from testing wastewater generated from restaurants/commercial kitchens within Byron Shire,

[2] Calculation = 20mg/L/1000000*3750L/day*20 days (for events),

[3] based on Byron Shire Council's On-site wastewater management strategy (2004) and no allowance for reduced occupancy rate

3.4. Additional wastewater characteristics of concern

In this offices experience wastewater generated from restaurants or cafes can have high concentrations of Fats, Oils and Grease (FOG). From this offices experience in FOG concentrations from other restaurant/commercial kitchens in Byron Shire it is expected that a FOG concentration of 250mg/L should be designed for in the OSMS. Grease traps and septic tanks are sized to provide adequate FOG removal as it is expected that stage 2 for the function centre may experience high fats, oils and grease.

4. DESIGN OF ON-SITE WASTEWATER MANAGEMENT SYSTEM

This Section describes an OSMS design that would be feasible for treating and disposing of wastewater generated at the site.

It is proposed that a separate wastewater management system will be utilised for the proposed cabins and the function centre. This allows for flexibility and maintenance of the systems. The design of the wastewater management system for the amenities building will be based on the Stage 2 use of the building as a function centre and will be assessed as if food will be prepared on-site, therefore conservative assumption of higher BOD, FOG and nutrient loading than may actually occur.

It is proposed that septic tanks & Aerated Wastewater Treatment Systems (AWTS's) could be utilised for providing treatment of wastewater generated on the site, a separate AWTS will be used after the trade waste for the amenities/function centre and three AWTS are proposed to service the cabins, allowing for four cabins to be serviced by one AWTS. Therefore, in case of failure of a pump for example, only those cabins will not be able to be let in the short term, rather than the whole site if a combined AWTS was to be used. It is also proposed that a SubSurface Irrigation (SSI) field could be installed to dispose of all wastewater generated from the site.

4.1. Grease Arrestor for Function Centre

In accordance with the Liquid Trade Waste Management Guidelines (NSW DPI, 2021) a minimum 1000 L grease arrestor is required for the proposed function centre. This is to be installed to receive kitchen wastewater from the cellar door only, and will flow on to the AWTS, all other wastewater will flow directly to the AWTS. The grease trap will need to be maintained through regular waste removal by a pump out contractor. Normally a recommendation of having a series of septic tanks instead of a grease arrestor would be made for cafes connected to on-site systems as this office has found that a grease arrestor generally does not reduce the BOD/FOG loading sufficiently. However, given that the function centre will only be permitted to be used up to

20 times per year it is expected that the actual loading will be much lower than a typical café/restaurant with constant loading on the system all day, consecutive days.

4.2. Aerated Wastewater Treatment System

It is considered that Taylex ABS AWTS's are suitable for providing secondary treatment for wastewater generated from the cabins at subject site, it is proposed that one Taylex ABS will cater for four cabins (1120 L/day), therefore three Taylex ABS are required.

It is proposed that a Taylex ABS5000 will be used for the function centre in order to cater for the hydraulic load 3750 L/day peak loading from the use of the amenities in stage 2, but also the predicted usage by the occupants of the cabins 360 L/day.

4.3. Disposal Area Required

This section investigates the disposal area required based on the predicted hydraulic and nutrient loadings from the entire site, and environmental factors which influence the design. In order to ascertain the size of the disposal area, the model within the Byron Shire Council Design Guidelines for On-site Sewage Management for Single Households was used (referred to as 'the model') with the hydraulic and nutrient parameters calculated in this report used in the modelling.

4.3.1. Four cabins

It is proposed that four cabins will be connected to one AWTS, therefore being 8 people. The following parameters were used in the Council's model:

- 8 people (hydraulic and nutrient values adjusted to match proposed loadings);
- Land area of 12000 m2 allowing for one third of the site due to there being a dwelling and the function centre;
- 1120L peak daily loading;
- 33.6 kg/TN/year;
- 4.8 kg/TP/year;
- 53% Nitrogen reduction with the use of Taylex ABS AWTS';
- 3m depth to water table;
- Red basaltic Soils & light clay strong structure;
- Mounded bed disposal area to allow for rainwater runoff due to the gradient of the site;
- SSI land application.

The disposal area required for the hydraulic and nutrient loadings is as follows:

Area Required for	Hydraulics:	393 m^2
	Nitrogen:	132 m^2
	Phosphorus:	94 m^2

Therefore, for the **12 cabins**, there will be three Taylex ABS and a **total disposal field required of 1179m²** (393 m2 x 3).

4.3.2. Function Centre

The design of the disposal field required for the amenities building is based on the peak daily load of the stage 2 use of the building as a function centre. The following parameters were used in the Council's model:

- 1 person in order to override calculations
- Land area of 12000 m2 allowing for one third of the site due to there being a dwelling and the cabins;
- 3750L peak daily loading;
- 9 kg/TN/year;
- 1.5 kg/TP/year;
- 20% Nitrogen reduction with the use of Taylex ABS5000;
- 3m depth to water table;
- Red basaltic Soils & light clay strong structure;
- Mounded bed disposal area to allow for rainwater runoff due to the gradient of the site;
- SSI land application.

The disposal area required for the hydraulic and nutrient loadings is as follows:

Area Required for	Hydraulics:	1315 m²
	Nitrogen:	0 m²
	Phosphorus:	29 m²

Therefore, for the function centre an area of 1315 m² is required. This is considered conservative as the site will only be operated at this higher daily level for 20 days.

Investigation could be made as part of the s68 application for storage of the wastewater and dispersion of the treated wastewater over a smaller area over several days (ie 5 days dispersion would be 263 m2) with the use of a holding tank and this would be considered suitable given the area required for just the use of the amenities without a function centre is 231 m².

4.4. Design of Subsurface Disposal Area

A detailed irrigation design will be required for Section 68 approval following Council approval of the proposed DA. A site plan showing a feasible layout of a SSI field is provided (Exhibit No. 2), however, it is possible that the irrigation area could partly be used for landscaping purposes, pending further investigation as part of the s68 assessment. It is also recommended that an irrigation tank, of at least 5000 L capacity is used to collect the treated wastewater after each AWTS and then pump from the irrigation tank to the subsurface irrigation area which would consist of one irrigation area, made up of up to six irrigation blocks, rather than irrigation An approved disposal system will consist of the following:

- The disposal area is to consist of **Pressurised SubSurface Irrigation**.
- All roof water is to be diverted away from the disposal field and a catch drain/mound will be constructed upslope of the area, as shown in **Exhibit No. 2**.

As part of a detailed irrigation design for Section 68 approval, the following is to be included:

- Dripper line spacing,
- Emitter spacing,
- Pipe sizes (delivery main and submains),
- Pump duties for all pumps,
- Dosages, irrigation time and number of blocks.

5. MAINTENANCE PLANS

The following is a maintenance check list is general, and it is expected that further maintenance plans are provided as part of the s68 application.

It is recognised that the site will be used for visitors, therefore it is encouraged that signage is place in the toilet and/or made available within the cabins to inform guests not to flush foreign objects down toilets.

5.1. General

- Bleach, bleach-based products, whiteners, nappy soakers and spot removers shall not be disposed of into the on-site system. They shall be disposed of on a disused area of a garden, well away from the disposal area.
- Wipes are not to be flushed down the toilet, as these will cause blockages, and must be disposed of into garbage bins in sealed plastic bags.
- Hygiene products, condoms, tampons, sanitary napkins, disposable nappies and cotton buds are not to 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.

5.2. AWTS

The following maintenance requirements are listed in Council's On-site Sewage & Wastewater Management Strategy (2013).

'Regular servicing and maintenance is required, commonly on a quarterly basis. The owner therefore must enter a service contract with a service agent.

A copy of the service report is forwarded to Council within 7 days from the date of service.

At each service, the treatment system and effluent disposal system should be checked, including:

- all pumps;
- the air blower, fan or air venturi:
- the alarm system:
- the operation of the sludge return system, where installed:
- pH from a sample taken from the irrigation chamber;
- check on sludge accumulation in the septic tank (primary treatment chamber) and the clarifier

- where appropriate;
- a thorough inspection & testing (if appropriate) of the effluent disposal field and all fixtures to
- ensure operation is in accordance with the approved design; and
- a sludge bulking test is required annually if activated sludge or contact aeration is used.

5.3. Grease Arrestor

The grease arrestors must be regularly maintained. It is not expected that there will be a high load of grease and oils, however, initially, the pump-out frequency should be set at 13 weeks and can then be expanded to suit the use of the site. The initial pump-out frequency is used as an interim guide when commencing the discharge. However, regular inspections may allow to determine the frequency of pump-outs. Records of pump-outs must be kept for on-site inspection. For further information on grease arrestors, including installation requirements and maintenance, refer to ss. F5.4 to F5.7 of Appendix F of Liquid trade Waste Management Guidelines (DPIE, 2021).

5.4. Irrigation Area

The subsurface irrigation 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.

- Run-off 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.
- Regular soil tests are to be taken in the irrigation area and corrective measures taken as necessary;
- Vegetation will be harvested frequently;
- Any vegetation which shades the disposal area to be trimmed as required;
- 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.

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 holding tank to relieve the need for effluent disposal to the subsurface irrigation area.

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

5.5. Maintenance for dripper lines

Dripper lines should be maintained in accordance with the irrigation designers specifications, this includes cleaning the filter and also flushing the dripper lines.

6. CONCLUSION

An onsite sewage management system has been designed for the proposed staged development, consisting of 12 x one bedroom cabins and amenities building, with stage 2 being conversion of the amenities building to a wedding function centre. The proposed cabins will accommodate two people each and the guests will have the use of the amenities building. In stage 2, the conversion of the amenities building to a function centre will allow for the use of the building in addition, for 150 guests at a wedding, up to 20 times per year.

It is feasible to accommodate the proposed development at the site with an associated on-site wastewater management system, which conforms to the environmental and health objectives of BSC Policy (December, 2004) and of the NSW state guidelines found in EPA *et al* (1998). Further details are to be provided to Council as part of the s68 application, including a detailed subsurface irrigation plan.

It is recommended that the on-site wastewater management system consists of the following:

- Proposed Cabins (12 x one bedroom)
  - Taylex ABS AWTS to service four cabins (8 people);
  - Irrigation area of 393 m^2
  - Total for cabins will be:
    - Three Taylex AWTS
    - Total irrigation area 1179 m^2

- Proposed Amenities
  - Design based on Stage 2 use as function centre, but installed as part of Stage 1
  - Taylex ABS 5000 AWTS to service the building;
  - Irrigation area of 1315 m^2 (or reduced to 263 m^2 if pumped over 5 days)
- A s68 application is required to be lodged detailing the irrigation layout
- A plan of management as per Section 5 is to be undertaken by the manager of the site

7. References

Australian Standard AS 1547 - 2012 *On-Site Domestic-Wastewater Management.*

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

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

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End of Report

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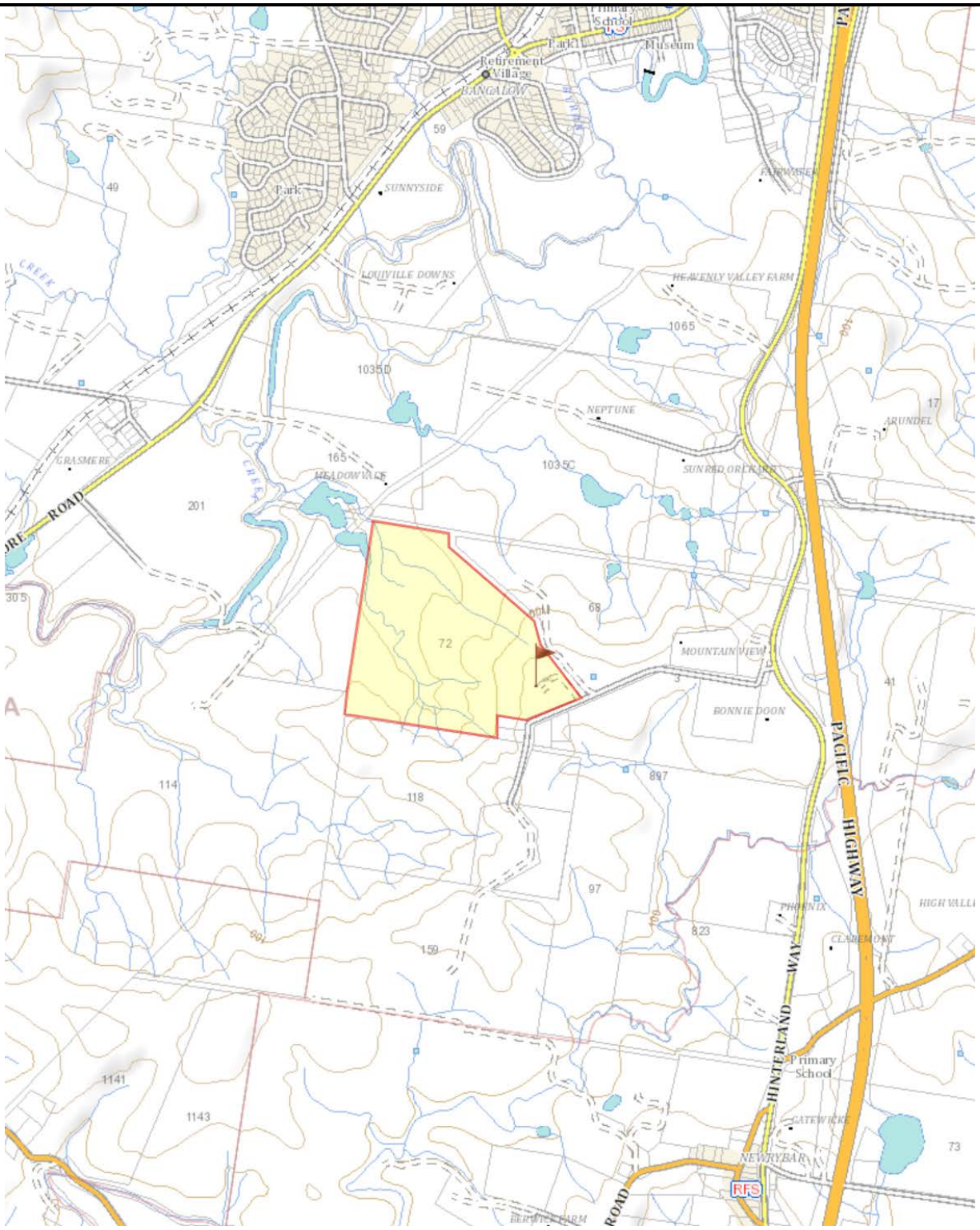
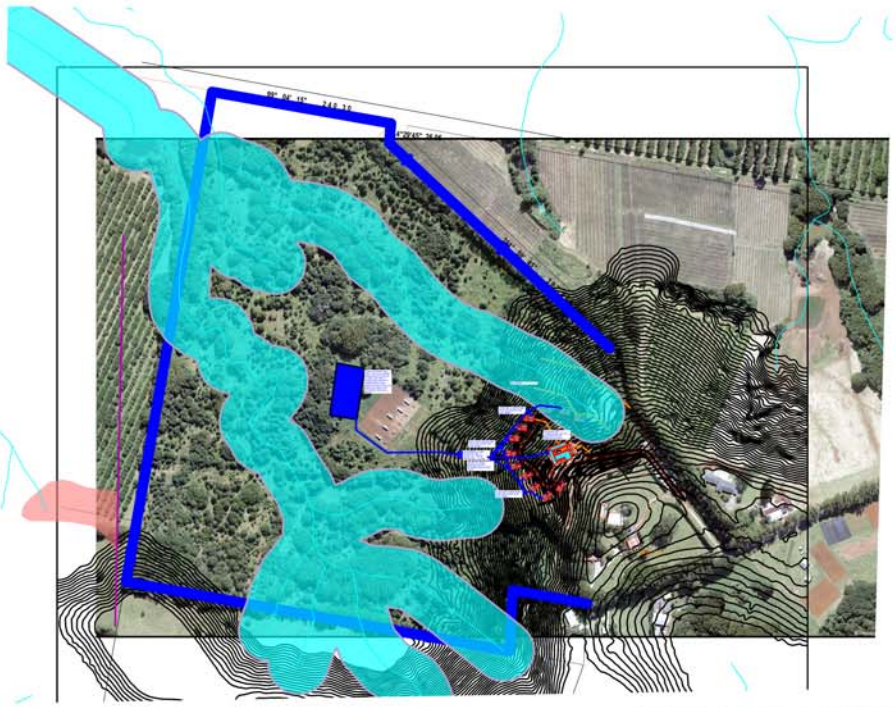


Source: NSW LPI Spatial Information Exchange (2021) Date 21/06/2021 Project No. 21529_ww.docx Scale: NTS	**GREG ALDERSON AND ASSOCIATES** **ABN 58 594 160 789** 43 Main Street, Clunes NSW 2480 Phone: (02) 6629 1552 Email: office@aldersonassociates.com.au	Exhibit No. 1. SITE LOCATION



SUBJECT SITE 1:10000

ON-SITE WASTEWATER MANAGEMENT FEASIBILITY

Proposed Cabins (12 x one bedroom)

- Taylex ABS AWTS to service four cabins (8 people);
- Irrigation area of 393 m2
- Total for cabins will be:
  - Three Taylex AWTS
  - Total irrigation area 1179 m2

Proposed Amenities

- Design based on Stage 2 use as function centre, but installed as part of Stage 1
- Taylex ABS 5000 AWTS to service the building;
- Irrigation area of 1315 m2 (or reduced to 263 m2 if pumped over 5 days)

· Recommended to use an irrigation tank for collection of all treated wastewater to pump to one large irrigation area in up to six blocks

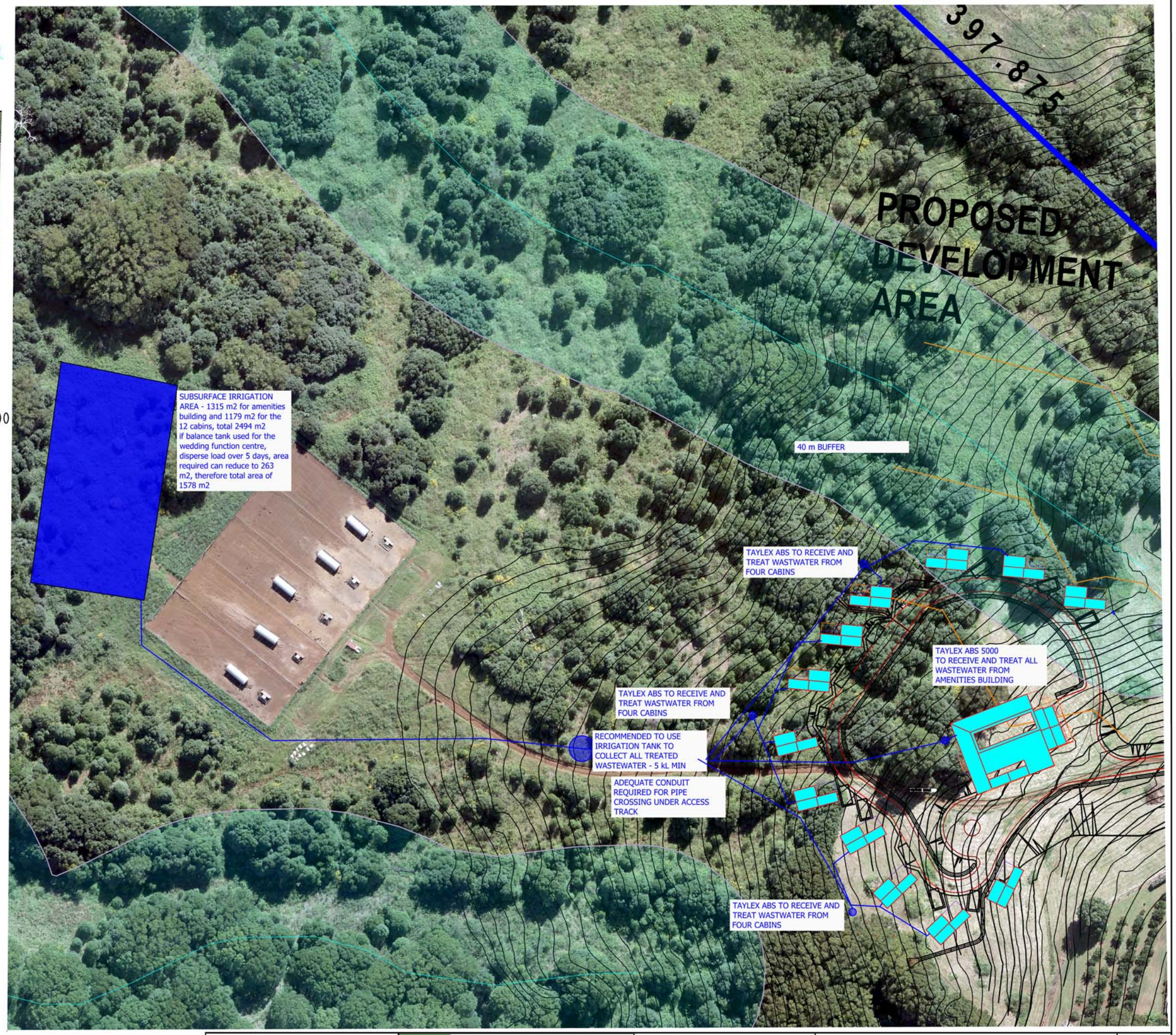
· A s68 application is required to be lodged detailing the irrigation layout

· A plan of management as per Section 5 is to be undertaken by the manager of the site

WASTEWATER DISPOSAL FIELD

40 m BUFFER TO DRAINAGE LINE

CABIN



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Client: R. Mamone

Site address: Lot 2 DP 1007622 72 Lawlers Lane Bangalow

FEASIBILITY ASSESSMENT

Drawn: WA

Source: LIDAR, P. LUCENA, ARCHIMAGES

Project: PROPOSED CABINS, AMENITIES BUILDING AND STAGE 2 FUNCTION CENTRE

Scale: 1:1250 Original Size: A3 Job Number: 21529

EXHIBIT NO: 2

Date: 31/8/17

Revision: –

Byron OSMS Design Model *Version:* function centre.xls

Set Defaults

bedrooms
persons
STEP 1

# persons (Grp 1)	1 (STEP 2)	STEP 3	Block size (m2) (STEP 4) 120000				
# persons (Grp 2)		Buffer to permanent water / Buffer to intermittant water	100				
Total Daily Flow (L/day) *	3750	Daily Effluent Flow per person (L/day)	3750	% black to tot WW in a full system	32%		
TN production per year (kg/year)	4.20	N prod. per capita (kg/person/yr)	4.20	% black to tot WW in a full system: TN	70%		
TN reduced by all N loss (kg/year) *	1.58	N loss in treatment system (% reduction)	53%	N loss in disposal bed (% reduction)	20%		
N Plant Uptake rate (kg/ha/year)	200						
Phosphorus in effluent (Ip) (kg/yr) *	0.60	P prod. per person per yr (kg/person/yr)	0.60	wastewater in a full system: TP	40%		
P uptake by plants (Hp) (kg/ha/yr)	10	N plant uptake (kg/yr)	1.58	Total N-load 1.58kg/yr			
P soil sorption (Ps) (kg/ha/m depth)	10000	N load exceedence	0.00				
Water Table/ Bedrock Depth (m) (STEP 10)	3.00	N load percolated (kg/yr)	0.00				
Buffer to Water Table (Bwt) (m)	0.5	N released (perc+exceed.) (kg/yr)	0.00				
Time for accumulation of P(years)	50	Enviro.N limit (kg/yr)	10.00				
Final area (m^2)	**1315**	Nitrogen area (m^2)	0				
Phosphorus area (m^2)	12	Hydraulic area (m2)	1315				
Water balance area (m^2)	1315						
Specific Crop Coeff.(grass=1.00)	1.00						
% Effective Rainfall	65%						
Percolation (mm/d)	4						
Avg depth of root zone (m)	0.30	Effective porosity of root zone	0.37	Avail.Water Capacity (AWC) of root zone	0.15		
Avg depth bluemetal (etc) in trench below root zone (m)	0.00	Effective porosity of bluemetal in trench below root zone	0.00	Default AWC of bluemetal in trench below root zone	0.00	Trench under root zone <-	
Soil Moisture Holding Capacity: saturation & AWC (mm)	111.00	45.00					
Permissible percentile exceedence	5.00%	SSI laterals pipe separation (m)	0.60				2.00 (STEP 15)
Minimum effluent application (mm/day/m^2)	2.85				110		
Exceedence (L)	0.00000						

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

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

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

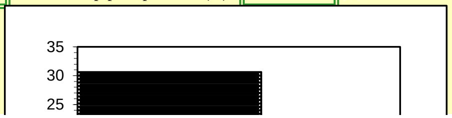
STEP 9 — Soil texture & structure beneath system
- Gravels,Sands Ksat >3.0m/d
- Sandy loams - weakly structured Ksat >3.0m/d
- Sandy loams - massive Ksat 1.4 - 3.0m/d
- Loams - high/moderate structured Ksat 1.5 - 3.0m/d
- Loams - weakly structured or massive Ksat 0.5 - 1.5m/d
- Clay loams - high/mod 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)

STEP 11 — % Effective Rainfall
- Mounded bed
- Level bed with grass

STEP 12 — Soil texture in root zone
- Coarse Sand
- Fine sand, Sandy loams
- Loams,Clay loams,Silt
- Clay (light,med,heavy)

STEP 13 — Land Application Type
- SSI
- ETA

STEP 14 — Calculate (or Cntl- q)



Byron OSMS Design Model *Version:* ww cabins.xls

Set Defaults

STEP 1: bedrooms / persons

STEP 2: # persons (Grp 1) 8

persons (Grp 2)

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

STEP 4: Block size (m2) 120000

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: Grp1: Toilet, Bathroom, Laundry, Kitchen (checked) — Grp 2: Toilet, Bathroom, Laundry, Kitchen

Wastewater stream

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

Total Daily Flow (L/day) *	1120	Daily Effluent Flow per person (L/day)	140	% black to tot WW in a full system	32%
TN production per year (kg/year)	33.60	N prod. per capita (kg/person/yr)	4.20	% black to tot WW in a full system: TN	70%
TN reduced by all N loss (kg/year) *	12.63	N in treatment system (% reduction)	53%	N loss in disposal bed (% reduction)	20%
N Plant Uptake rate (kg/ha/year)	200				
Phosphorus in effluent (Ip) (kg/yr) *	4.80	P prod. per person per yr (kg/person/yr)	0.60	wastewater in a full system: TP	40%

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

P uptake by plants (Hp) (kg/ha/yr)	10	N plant uptake (kg/yr)	7.86	Total N-load 12.63kg/yr
P soil sorption (Ps) (kg/ha/m depth)	10000	N load exceedence	0.00	
Water Table/ Bedrock Depth (m) (STEP 10)	3.00	N load percolated (kg/yr)	4.78	
Buffer to Water Table (Bwt) (m)	0.5	N released (perc+exceed.) (kg/yr)	4.78	
Time for accumulation of P(years)	50	Enviro.N limit (kg/yr)	10.00	
Final area (m^2)	**393**	Nitrogen area (m^2)	132	
Phosphorus area (m^2)	94	Hydraulic area (m2)	393	
Water balance area (m^2)	393			
Specific Crop Coeff.(grass=1.00)	1.00			
% Effective Rainfall	65%			
Percolation (mm/d)	4			

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)

STEP 11: **% Effective Rainfall**
- Mounded bed
- Level bed with grass

STEP 12: **Soil texture in root zone**
- Coarse Sand
- Fine sand, Sandy loams
- Loams,Clay loams,Silt
- Clay (light,med,heavy)

Avg depth of root zone (m)	0.30	Effective porosity of root zone	0.37	Avail.Water Capacity (AWC) of root zone	0.15
Avg depth bluemetal (etc) in trench below root zone (m)	0.00	Effective porosity of bluemetal in trench below root zone	0.00	Default AWC of bluemetal in trench below root zone	0.00
Soil Moisture Holding Capacity: saturation & AWC (mm)	111.00	45.00			
Permissible percentile exceedence	5.00%	SSI laterals pipe separation (m)	0.60		
Minimum effluent application (mm/day/m^2)	2.85				
Exceedence (L)	0.00215				

Trench under root zone <-

STEP 13: **Land Application Type**
- SSI
- ETA

STEP 14: Calculate (or Cntl- q)

STEP 15: 2.00

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Ecology