

Site Assessment Report - Effluent Disposal



On site sewage management system – Proposed Detached Dual
Occupancy Dwelling (2 bedrooms) 126 Goremans Road, Eureka



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1. BACKGROUND

The following report provides details in relation to on site sewage management and disposal including the constraints associated with disposal of effluent on the subject site and criteria for the system design.

This report has been prepared to assist in the approval of a section 68 application for a new onsite sewage management system to cater for the proposed 2 bedroom dwelling (i.e. detached dual occupancy dwelling). There is an existing 4 bedroom dwelling with its OSSMS. The proposed development is located at 126 Goremans Road, Eureka. The site is located within an established rural residential area with sufficient land available for effluent disposal for the existing & proposed dwellings on site. The size of the lot is good in terms of area available for the treatment and disposal of effluent generated by the proposed development.

This report has been prepared in accordance with Section 8 Performance standards for rural settlement of the Byron Shire Council Rural Settlement Strategy and Draft policy on onsite sewage management. Other standards and guidelines taken into consideration in this report are; AS1547 - 2010, Environment & Health Protection Guidelines “On-site Sewage Management of Single Households” - Jan 1998, AS1726 & AS 2870.

The overall aim of this report is in accordance with that of Council being “ On-site domestic sewage management facilities operate in a manner which protect and enhance public health, achieve ecologically sustainable environmental standards for air, land and water, and are socially acceptable to the community.

2. EXECUTIVE SUMMARY

The wastewater management strategy for the proposed development involves **minimising the nutrient and hydraulic loads required to be treated by the proposed system**. This is to be achieved by providing a high level of treatment as well as incorporating water saving devices within the development.

In terms of the treatment and disposal of effluent generated by the proposed dwelling it is proposed to provide an **AWTS (aerated wastes water treatment system with nitrogen removal)** that will treat daily effluent generated from the subject development. The treated effluent will then be disposed of using SSI (sub surface irrigation). The current OSSMS (AWYS) which services the existing 4 bedroom dwelling will require a recent service report from a liscended plumber (or the AWTS supplier) to confirm it is operating adequately.

The new AWTS systems will be installed to be located downslope of the proposed dwelling as shown on the waste water management plan then pumped to an additional effluent disposal field capable of treating a combined volume of effluent generated per day at full occupancy which is the capacity of the nominated AWTS (Taylex ABS refer to specification in the appendix).

The total daily effluent generated by the proposed development is assumed to be 345litres. The site area is relatively good in terms of its capacity to dispose of effluent. It is considered that the site is capable of disposing the amount of effluent assumed to be generated by the existing and proposed development.

3. INTRODUCTION

The design objective of the effluent disposal system proposed for the subject development aims to achieve the best possible result environmentally and economically for this site.

The site assessment is as per the AS 1547 - 2010 and table 4 Environment & Health Protection Guidelines - 1998. The **borelog to minimum 100 cm** is included in the appendix as well as an assessment of nutrient and hydraulic loading, the climactic conditions and other conditions effecting loading of the system as per Appendix 6 - Environment & Health Protection Guidelines - 1998.

Wet weather storage requirements are addressed and associated details provided.

A **description of vegetation** including species list and location of vegetation proposed for the disposal area is also included.

The **operation and maintenance requirements of the system** are in the appendix.

✕ 3a. Design constraints

- A site plan showing the location and features relevant to liquid waste disposal is included in the appendix.
- Soil type is predominately red brown krasnozem clay loam to silty clay.
- The land nominated for the SSI area is gently to moderately sloping to the south.
- The water table is greater than 3 metres below existing ground levels.
- The area has a high annual rainfall (i.e.: approximately 1746 mm).
- The maximum surface slope in the area nominated for disposal of effluent is 10%. Minor earthworks will be required to be undertaken on the disposal area to ensure suitable site conditions.

✂ 3b. Design criteria

The above-mentioned constraints associated with the disposal of effluent on site mentioned above require the following criteria included in the design.

- Effluent quality considerations suitable for disposal as defined by the NSW Dept of Health for secondary levels
- The total daily flow required to be treated is 345 litres
- Town water is available to the site. It is intended that water supply will be supplemented by rain harvesting (from roof catchments made potable by the use of carbon filters).

4. SITE ASSESSMENT

4a. Climate

The subject site lies within a high rainfall area. Average and median rainfalls at Byron Bay are 1728 and 1682 mm respectively (ERM, 1996c). The temperature is generally above 15⁰ C (subtropical).

A precipitation analysis that includes historical rainfall data for the locality (40 year average) at an average **annual rainfall of 1863 mm, annual evaporation of 1507 mm** and evapotranspiration data is in the appendix (BSC OSM model). Over the twelve-month period rainfall exceeds evapotranspiration in the wetter months Jan - March. For details on wet weather storage requirements refer to section **6d. Wet Weather Storage**.

The impact of storm intensity on effluent absorption has been taken into the consideration in the design by including system failure and surcharge management strategies (i.e.: alarms, cutoff switch, pump out). The operations and maintenance of the system details are in the appendix.

4b. Topography

Attached is a site plan, which approximates the contours of the site. Grades are fairly consistent throughout the property and are generally in the range of 5 - 10% in the area designated for the LAS disposal area. As a maximum surface slope of 15% is recognised as a limiting factor in the use of Subsurface irrigation beds, this development falls within the bounds of this constraint. The land is at its highest point along the Northwestern corner of the site (AHD 150 m) and falls generally over the length of the site toward the on the south eastern corner to approximately 120 m AHD. The site is mainly grass covered with some scattered trees associated with the existing established landscaping.

4c. Hydrology & Water Quality

The land could be described as waxing divergent, which is good for drainage and is the best water shedding type surface which accelerates and spreads runoff. The area proposed for the LAS is within the waxing divergent areas of the site. The use of bunds will still be required on the upslope side of the Land Application System (LAS). The drainage of the land is well defined and falls in a generally south direction. In relation to the flood potential of the area designated for effluent disposal it is not subject to flooding ie: the Land Application Area is above 1 in 100 year flood level as well as any electrical components required by the proposed system.

Diversion drains to divert runoff and subsurface seepage will also be constructed and maintained on the upslope side of all building envelopes and parking areas. To ensure that erosion does not occur a soil and water management plan will be implemented prior to commencement of construction.

The existence of groundwater is known in the vicinity but the depth to high soil watertable is greater than 3 m.

For details on the treated effluent quality proposed to be disposed to the LAS refer to section **6c. Waste Water Quality**.

4d. Vegetation

The site has been disturbed by vegetation clearance during the early part of the century for timber and cattle grazing. The site was further disturbed in the recent times for rural subdivision and further farming including cattle grazing and growing potatoes.

The site of the proposed development is cleared. The construction of the SSI beds will not require the removal of any trees. All other trees are to be retained and embellished through a landscape program.

The areas proposed for development on the property has minimal habitat significance. The most significant areas will remain unaffected by this proposed development. The isolated tree stands, combine to provide areas of local habitat significance only. Bird and mammal populations in this area consist of native and introduced species frequenting tree stands and pasture.

4e. Geographic Location

The horizontal distance to any known groundwater well used for horse and cattle water supply is greater than 250 metres.

Other buffer distances from the proposed Wastewater Management System is as follows:

Permanent waters (m): >100

Other waters (m): > 40

Other sensitive environments (m): 100

Boundary of buildings (m): > 3

Swimming pools (m): > 3m

The size of the lot is above average for a rural residential property, so the level of treatment as proposed will enable sufficient land area for the land application system to service the existing & proposed development.

5. SOIL ASSESSMENT

5a. Soil Profile

The depth to bedrock or hardpan is > 1.5 m. The test holes revealed a uniform soil profile. Minor cut and fill works, as part of the development will be required to be undertaken on the site. The profile at the borehole locations was variable topsoil and organics layer then red brown clay loam to silty clay that continued to the termination depth of the test hole. The soil type in the area nominated for the disposal of effluent (refer to site plan) is Krasnozems. The soil profile varies from clay loam topsoil to medium clay subsoil. The clay type is Kaolinite, which has the lowest cation exchange capacity and swells and shrinks the least. Its tendency to disperse depends on the pH. This tendency increases as pH increases but is generally lower than the other clay types such as montmorillonite or illite. (Applying gypsum to sodic clay soils will help prevent dispersion).

The presence of surface rock was not noted, but at the time of excavation of the disposal area contractor/plumber should ensure risk of effluent loss due to presence of rock in the vicinity of the area is minimised.

5b. Permeability

A textural classification was undertaken in accordance with AS1547 –2010 to determine relevant soil characteristics. The soils encountered are generally acceptable for effluent disposal and will work without effluent escaping and or polluting if built in accordance with Australian Standards and to local authority requirements. Over time Krasnozems will tend to clog, especially when receiving a constant rate of wastewater, when they resemble more like a silty clay than a loam clay.

The hydraulic loading recommended for soil absorption system is 5 mm/day. For details on the hydraulic loading rate refer to BSC design Model in the appendix.

5c. Soil Type

Breaking of clods required little force and resulted in undefined cleavage. Due to the percentage clay the soil could be classified as well structured. The prevalent colour of the soil is red brown, which can be taken as reasonable absorption qualities.

Liquid and plastic limits were not undertaken but observations by field identification and feel resulted in a **class M** classification (moderately reactive).

The soil structure is moderately pedal. The soil texture is light to medium clay. The test holes revealed a consistent soil profile (which may vary depending upon the location of the test hole). The profile at the location is topsoil and organics then clay loam to silty clay loam that continued to the termination depth of the test hole.

5d. Physiological Characteristics

The percentage of coarse fragments is generally 5 - 10 %. The bulk density (and texture) (g/cm^3) is clay 1.4 g/cm^3 . The pH is approximately 5.8, in order to optimise plant growth and nutrient uptake in the effluent disposal areas lime should be applied to increase pH levels to between 6 - 7.

The tolerance of vegetation species to soil salinity varies among vegetation. The specifications required for the

proposed disposal areas will have an $E_{Ce} < 4 \text{ ds/m}$ (Electrical conductivity (dS/m)).

The exchangeable sodium percentage (ESP) of the soil is 5%. Because of the elevated levels of sodium in domestic wastewater, gypsum should be put on the application areas each year.

The cation exchange capacity (cmol^+/kg)⁶ is moderate in the range of 5 - 15. The Phosphorus sorption ability of these soils is generally high. The conservative P sorption value used is 10,000 kg P Sorption/Ha.

The presence of discontinuities and fractured subsoil was not observed.

6. EFFLUENT CHARACTERISTICS AND SYSTEM SELECTION

Connection to a centralised sewerage system based on the distance to the nearest feasible connection point means that potential for future connection to centralised sewerage is low.

6a. Treatment & Disposal System

Primary & Secondary Treatment

The main source of microbiological organisms is from human faecal matter. To reduce this source of microorganisms all the blackwater & greywater will be directed to the AWTS tanks.

An AWTS is purpose built system used for the treatment of sewage and liquid wastes from a single household or multiple dwellings. It consists of a series of treatment chambers combined with an irrigation system. Wastewater from a household is treated in stages in separate chambers. The first chamber is similar to a conventional septic tank. The wastewater enters the chamber where the solids settle to the bottom and are retained in the tank forming a sludge layer. Scum collects at the top, and the partially clarified wastewater flows into a second chamber. Here the wastewater is mixed with air to assist bacteria to further treat it. A third chamber allows additional clarification through the settling of solids, which are returned for further treatment to either the septic chamber or to the aeration chamber. The clarified effluent is disinfected in another chamber (usually by chlorination) before irrigation can take place. Bacteria in the first chamber break down the solid matter in the sludge and scum layers. Material that cannot be fully broken down gradually builds up in the chamber and must be pumped out periodically. The treated effluent is then pumped and distributed over the land application system.

Wastewater from the development will be treated to a secondary quality suitable for disposal within the development to dedicated land areas. The 2 treatment systems will be an AWTS (Fuji Clean model CRX1500)

Maintaining your AWTS

The effectiveness of the system will, in part, depend on how it is used and maintained. The following is a guide on good maintenance procedure that you should follow:

- Have your AWTS inspected and serviced four times per year by an approved contractor. Assessment should be applicable to the system design.
- Have your system service include assessment of sludge and scum levels in all tanks, and performance of

irrigation areas.

- Have all your tanks desludged at least every three years.
- Have your disinfection chamber inspected and tested quarterly to ensure correct disinfectant levels.
- Keep a record on pumping, inspections, and other maintenance
- Learn the location and layout of your AWTS and land application area.
- Use biodegradable liquid detergents such as concentrates with low sodium and phosphorous levels.
- Conserve water.
- Don't put bleaches, disinfectants, whiteners, nappy soakers and spot removers in large quantities into your AWTS via the sink, washing machine or toilet.
- Don't allow any foreign materials such as nappies, sanitary napkins, condoms and other hygiene products to enter the system.
- Don't use more than the recommended amounts of detergents. Don't put fats and oils down the drain and keep food waste out of your system.
- Don't switch off power to the AWTS, even if you are going on holidays.

The treated effluent is then pumped and distributed over the land application system. Further details of the proposed system configuration including the maintenance schedule for the system are in the appendix.

Land Application System –

The secondary treated effluent from the AWTS will be pumped from the AWTS to a centralized Sub Surface Irrigation comprising an area of 144 sqm as nominated on the waste water management plan.

The design has taken into consideration the site constraints mentioned above including site area and nutrient reduction, the model available in the BSC OSSMS policy guide was used to calculate the effluent disposal area required for the existing & proposed development which recommended 144 sqm and is included in the appendix. Monitoring of system performance by a licensed operator will determine if any additional treatment or alterations are necessary.

In accordance with the Australian Standards consideration should be given to vegetation in the adoption of Land Application Areas. In this case kikuyu grass will be irrigated within the LAS which will be mowed regularly to assist with further nitrogen removal as nitrogen and phosphorus will be further removed by plant uptake. This has taken into the consideration Nitrogen as a limiting factor in the calculation of the minimum land application area based on the total effluent disposal system being able to treat nutrients to the necessary levels.

The main design strategy used was **to decrease the hydraulic load and nutrient load**. The implementation of waste water and nutrient reduction initiatives such as the use of low phosphate detergents, dual flush toilets, effluent recycling, and water saving devices such as shower heads, taps and appliances can lead to significant reduction in irrigation area and wet weather storage requirements.

6b. Expected Mean and Peak Hydraulic Loads

The expected mean hydraulic load from the dwelling and proposed farmstay cabins is 345 **litres per day**. The selected systems combined design capacity of 2940 litres per day still requires the use of full water saving devices providing a reduction in water use as per note 3 in appendix 4.2 D TYPICAL DOMESTIC WASTEWATER FLOW DESIGN ALLOWANCES AS 1547 - 2010.

The peak hydraulic load is expected to occur during weekends and holiday periods and could be up to an additional 20%. For this reason the size of the disposal area has been calculated assuming the full hydraulic load of 345 litres per day. This is to overcome the periods when rainfall exceeds evaporation system and avoid a compromise of the system performance. The owner/occupier of the system should take the necessary steps to ensure the risk of this scenario occurring is reduced. Depending upon regular evaluation of the systems performance additional wet weather storage can be provided additional to that recommended in this report.

6c. Waste Water Quality

For details on the design wastewater quality considerations refer to the Dept of Natural resources requirements for secondary treatment levels below. For the purpose of this assessment and given the circumstances of the case, it is appropriate to require that effluent discharged onto the subject site be treated to standards required secondary treatment.

• BOD	20 (mg/L)
• Suspended Solids	30 (mg/L)
• Total N	30 (mg/L)
• Total P	10 (mg/L)

Source: Dept of Natural Resources (1999) *Interim code of practice for on site sewage facilities*

6d. Wet Weather Storage

It is proposed that the effluent treatment systems and disposal field area will provide wet weather storage. If performance of the overall system in this regard is determined to be under performing then additional storage can be provided. The system should have an annual inspection by a suitably qualified and experienced person suitable to council. In accordance with Byron Shire Council Policy the subject site is capable of disposing of minimum 1740 litres per day.

6e. Key assumptions

- ◆ Average daily effluent per person for the dwelling as per AS1547 - 2010 = 115 Litres.
- ◆ Full water reduction devices AAA specified for use in the development.
- ◆ Total design daily effluent generated from the existing dwelling and proposed development is 1035 litres
- ◆ Harvest rainwater for drinking purposes & household use, etc.to supplement town water supply

7. CONCLUSION

After investigation and due consideration of the local and statutory requirements including AS/NZS1547 - 2010, the tests carried out on the subject site recommend a combined treatment and disposal strategy which includes

Primary & Secondary Treatment

An aerated waste water treatment system (Taylex ABS) to service the proposed 2 bedroom dwelling

Land Application System

The land application system most favoured is Sub Surface Irrigation Beds. The size of this area should be not less 144 square metres (12 m x 12 m) as shown on site plan and constructed in accordance with Australian Standards and local authority requirements. It is possible that the development can dispose of treated effluent on site taking into consideration the sites most limiting features and the level of treatment.

It is proposed to dispose of additional 345 litres on average per day assuming an 100 % occupancy for the proposed 2 bedroom dwelling.

The main wastewater management strategy used is to decrease the hydraulic and nutrient loads. To reduce hydraulic and nutrient loads generated and improve effluent quality the strategies in this report should be taken as the minimum required for the site and performance of the system monitored for adequacy. The system will be built in accordance with the findings and recommendations of this report and all local and statutory requirements.

Stabilisation works on the site will need to be implemented to protect surface water quality and prevent land degradation both during and after construction in accordance with the soil and water management plan for the site (NSW Dept of Housing Soil and Water Management for Urban Development - Jan 1993). Drainage and earthworks will need to be undertaken on the upslope side of the building envelope, retaining walls and disposal areas. Soil permeability may vary from the locations tested.

Sun and wind exposure on land application areas will be maximised to enhance LAS performance. Factors effecting exposure include the geographical aspect of the area, vegetation and buildings near the area. Evapotranspiration may be reduced by up to two thirds in some locations by a poor aspect or overshadowing and sheltering by topography, building or vegetation.

8. APPENDIX

- Soils Assessment Sheet – 126 Goremans Rd, Eureka
- BSC OSM Model results – Nutrient & Water balance calculations
- Wastewater management plan
- Operation & Maintenance Requirements of the treatment and disposal system