ONSITE WASTEWATER REPORT

PROPOSED SUBDIVISION AT 1420 PATERSON RIVER ROAD, MOUNT RIVERS

GSL Environmental
Authored by: Simon Doberer B.Sc. (ENV)
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Date: 7th May 2025

GSL Environmental
Environmental Consultants

Limitations

This report has been developed based on agreed requirements between the client and GSL Environmental as understood by GSL Environmental at the time of investigation. This report only applies to the subject scope of works undertaken at the subject site. Other interpretations should not be made, including changes of scope or application to other projects. The contents of this report are based on a professional appraisal of the conditions that existed onsite at the time of this investigation. Where a subsurface soil investigation has been undertaken the results are only applicable to the specific sampling locations and the depths undertaken. Because of natural geological variability and possible anthropogenic influences, the subsurface conditions reported can change abruptly. Such changes can also occur after the site investigation has been undertaken. The accuracy of the results provided in this assessment is limited by these possible variations along with limitations by budget constraints imposed by others and by inadequate site accessibility.

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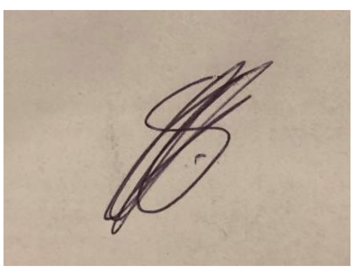

Simon Doberer
Principle Environmental Scientist
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Contents

1. Introduction

GSL Environmental has been commissioned by Adam and Jody Turner to assess the suitability of an on-site sewage management system for the proposed two allotment subdivision at 1420 Paterson River Road, MOUNT RIVERS NSW. This report will be submitted to Dungog Council in accordance with the relevant details in the 'Dungog Council Onsite Sewage DAF 2015'. Other guiding documents include,

- Australian Standard AS1547: 2012"On-site Domestic Wastewater Management"
- Dept. Local Government 1998, On-site Sewage Management for Single Households
- Water NSW, "Designing and Installing Onsite Wastewater Systems", 2019

This assessment is required to show that treated wastewater generated by the proposed two allotment subdivision can be sustainably managed on the site. Proposed lot 201 has a dwelling and is serviced by an AWTS followed by Subsurface irrigation. Proposed lot 202 is currently undeveloped with the wastewater report focusing on this allotment.

2. Site Description

The subject allotment is irregular in shape and is approximately 65.8 Ha in size. The proposed EDA is within a very gently inclined waning convexing mid slope landform. The closest significant water body, Guygallon Creek which meanders through the eastern third of the proposed allotment. There is a farm dam and a number of overland flowpaths traversing the large site.

According to the Dungog 1:100 000 Soil Map the proposed dispersal area onsite is underlain by "Lostock" residual soils. The Lostock Soil Landscape area generally consists of the lower slopes of steep hills along the Paterson River. Slope gradients are generally upto 18%. Underlying soils mostly consist of brown sandy loams traversing to brown clays.

Being at proposed allotment stage, the future dwelling has been designed as a five bedroom dwelling. Bedroom density on any future dwelling at DA stage may be altered subject to a site specific onsite wastewater assessment.

Figure 1: Subject Site, care of six maps showing property boundaries and associated landmarks.

3. Site Information

Site Address: 1420 Paterson River Road, MOUNT RIVERS

Water Supply: Tank

Proposed Development: Proposed subdivision

Equivalent Population: Up to 8 persons/day – 5 bedrooms

Wastewater Flow Allowance: 120L per person per day

Design Flowrate: 960L per day

Proposed Effluent Dispersal Type: Subsurface Irrigation

System Design: Aerated Wastewater Treatment System

Most restrictive Soil Texture: brown clays

Minimum Dispersal Area: 518m2

Buffer Distances: All required buffer distances with AS1547:2012 can be achieved.

4. Physical Site Assessment

A site inspection was undertaken on the 20th March 2025. The fieldwork included an assessment of the site's physical parameters as well as hand excavation of boreholes to determine the underlying soil structures. This was undertaken to delineate the most suitable location for the proposed dispersal area. Potential onsite limitations have been investigated and are discussed below.

4.1 Landform

Varying landforms pose differing potential limitations to an effluent dispersal area. Risk of run-on and runoff may be enhanced dependent on the site's landform.

The proposed EDA is within a very gently inclined waning convexing mid slope landform. To limit any potential runoff, spray irrigation has been ruled out. An upslope diversion drain is to be installed above EDA.

Limitation: **LOW**

4.2 Slope Gradient

Excessive slope within an EDA can potentially lead to effluent leaching away from the EDA.

The proposed EDA is within a very gently inclined waning convexing mid slope landform. The slope within the proposed EDA is approximately 6%. To limit any potential runoff, spray irrigation has been ruled out. An upslope diversion drain is to be installed above EDA.

Limitation: **LOW**

4.3 Exposure

Providing the EDA with maximum wind and sun exposure is preferable. This will enhance the evapotranspiration properties of the EDA and should add to the life of the EDA.

The proposed EDA is within an open area with very high levels of exposure.

Limitation: **LOW**

4.4 Flood Potential

All effluent dispersal areas are to be above the 1:20 flood level. In addition all electrical components, vents and inspection holes form the treatment system should be located above the 1:100-year flood level. Effluent dispersal areas being inundated via flood waters can become a public health issue during times of high rain.

Limitation: **LOW**

4.5 Vegetation

All effluent dispersal areas should be covered with vegetation or mulch-based covers. A vegetated EDA provides the possibility of that area in enhancing nutrient uptake and evapotranspiration. Low vegetation cover can cause effluent runoff and low nutrient and evapotranspiration uptake rates.

A dense cover of grassland vegetation is currently within the proposed EDA. The proposed EDA should be regularly mowed and maintained.

Limitation: **LOW**

4.6 Stormwater Run-on

Stormwater runoff through the EDA has the potential to transport effluent away from the EDA to more sensitive receivers.

There were no visible signs of stormwater entering the proposed EDA. The proposed EDA is within a very gently inclined waning convexing mid slope landform. The slope within the proposed EDA is approximately 6%. To limit any potential runoff, spray irrigation has been ruled out. An upslope diversion drain is to be installed above EDA.

Limitation: **LOW**

4.7 Site Drainage

Damp and wet areas should be avoided for EDAs. These areas indicate seepage of waters and could become a transport option for effluent if placed in these areas.

Site appears to be well drained with semi-permeable soils. No visible signs of wet/damp areas in the proposed EDA. The soil profile did not show evidence of water logging.

Limitation: **LOW**

4.8 Erosion Potential

Areas of visible soil movement and erosion should be avoided.

No visible signs of erosion within the EDA. Proposed EDA area is a very gently inclined landform and densely vegetated.

Limitation: **LOW**

4.9 Evidence of Fill

No evidence of fill was seen onsite or in the excavated boreholes. Soil logs are consistent of the description for underlying soils within the Lostock Soil Areas.

Limitation: **LOW**

4.10 Groundwater Depth

Groundwater not observed in bore holes.

Limitation: **LOW**

4.11 Surface Rock

No surface boulders or rock outcrops were observed within the proposed EDA. Whilst depth was found in boreholes excavated within the proposed EDA, if during installation a “floater” is found it is to be removed from the proposed EDA.

Limitation: **LOW**

4.12 Groundwater Bores

A search of Water’s all groundwater mapping was undertaken to determine the proximity of any bores to the EDA. There are no domestic registered bores within 250m of the proposed EDA

Limitation: **LOW**

4.13 Watercourse Proximity

The closest significant water body, Guygallon Creek which meanders through the eastern third of the proposed allotment. There is a farm dam and a number of overland flowpaths traversing the large site. All recommended setbacks will be adhered to.

Limitation: **LOW**

4.14 Stock Present

Stock can cause damage to irrigation systems and must be kept out of the EDA by fencing or other physical barrier.

4.15 Buffer Distances

All required buffer distances within AS1547:2012 can be achieved. All required buffer distances within the Dungog Council Onsite Sewage DAF 2015 can be met.

Table 6-8 Minimum Buffer Distances for On-site System Land Application Systems

System / Land Application Type	Limiting Factor	Minimum Buffer Distance (m)
All Land Application Systems	Permanent surface waters such as: Lakes, rivers, creeks and streams	➢ 100m
	Domestic groundwater wells and bores	➢ 250m
	Other waters such as: Farm dams, intermittent waterways and drainage channels	➢ 40m
	Retaining wall, embankments, escarpments and cuttings.	➢ 15
Surface Spray Irrigation (Standard Spray Heads)	Driveways and property boundaries	➢ 6m if area up gradient ➢ 3m if area down gradient
	Dwellings and buildings	➢ 15m
	Paths and walkways	➢ 3m
	Swimming pools	➢ 6m
	Retaining wall, embankments, escarpments and cuttings.	➢ 12m if area up gradient ➢ 3m if down gradient
Surface Drip and Trickle Irrigation	Dwellings and buildings, swimming pools, property boundaries and driveways. Retaining wall, embankments, escarpments and cuttings.	➢ 6m if area up gradient ➢ 3m if area down gradient
Subsurface Irrigation	Dwellings and buildings, swimming pools, property boundaries and driveways Retaining wall, embankments, escarpments and cuttings.	➢ 6m if area up gradient[1] ➢ 3m if area down gradient[1]
	Depth to Hardpan or Bedrock	➢ 0.6m below level of pipework[2]
Absorption System	*Property boundary* *Retaining wall, embankments, escarpments and cuttings.*	➢ 12m if area up gradient ➢ 6m if area down gradient
	Dwellings and buildings, swimming pools and driveways	➢ 6m if area up gradient ➢ 3m if area down gradient
	Depth to Hardpan or Bedrock	➢ 0.6m below base of trench/bed

Permanent Watercourse: *Any river, creek, stream or chain of ponds, whether artificially modified or not, in which water usually flows, either continuously or intermittently, in a defined bed or channel*
Intermittent Watercourse: *A low point with no or little defined bed or channel that carries water during rainfall events, but dries out quickly when rainfall stops. A gully or incised drainage depression is considered to be an intermittent watercourse.*

Limitation: **LOW**

5. Onsite Soil Assessment

During the site inspection 2 boreholes were hand excavated with a 100mm auger within the proposed EDA. The following are the results from the excavation. The auger holes were used to determine the underlying soil properties. No groundwater was observed in the excavated boreholes.

According to the Dungog 1:100 000 Soil Map the proposed dispersal area onsite is underlain by "Lostock" residual soils. The Lostock Soil Landscape area generally consists of the lower slopes of steep hills along the Paterson River. Slope gradients are generally upto 18%. Underlying soils mostly consist of brown sandy loams traversing to brown clays.

Borehole 1

0 – 350mm – brown sandy loams,
350 – 1000mm –brown clays,

Figure 3: Borehole 1 excavated onsite

Borehole 2

0 – 400mm – brown sandy loams,
400 – 1000mm –brown clays,

An insitu probe, tested the soil layers for pH and EC, results as below.

Ph and EC

Borehole 1

Depth	pH	EC_e (µS/cm)
0 – 350mm	5.7	442
350 – 1000mm	5.5	593

Borehole 2

Depth	pH	EC_e (µS/cm)
0 – 400mm	5.6	520
400 – 1000mm	5.3	1011

The pH of a soil influences its ability to supply nutrients to vegetation. If the soil is too acidic vegetative growth is inhibited. The electrical conductivity of the soil relates to the amount of salts present. A high salt concentration inhibits vegetative growth.

The electrical conductivity of the soils is less than 4 dS/m. This will not inhibit vegetative growth. The pH of the soil is between 5.3 and 5.7. A regular application of lime and gypsum is recommended to maintain healthy vegetation growth.

A Sample was sent to ALS Australia, a NATA accredited laboratory to determine the insitu reliability as well as the testing of further parameters. Results below and in appendix.

The sample tested at the laboratory was from borehole 1, 0-350mm.

Coarse fragments

Coarse fragments are those over 2 mm in diameter. They can pose limitations to vegetative growth by lowering the soil's ability to supply water and nutrients.

<2% course fragment was observed within the excavated soils onsite. There were some peds which could be crushed easily using fingers.

Limitation: **LOW**

Exchangeable Sodium Percentage

The exchangeable sodium percentage (ESP) measures the proportion of cation exchange sites occupied by sodium. Soils are considered sodic when the ESP is greater than 6, and highly sodic when the ESP is greater than 15.

ESP 4.3%, suggesting non sodic soils within the proposed EDA.

Cation Exchange Capacity

Cation exchange capacity (CEC) is a measure of the soil's ability to hold positively charged ions. It is a very important soil property influencing soil structure stability, nutrient availability, soil pH and the soil's reaction to fertilisers and other ameliorants. A figure above 15 meq/100g is preferred for plant production. You can improve CEC in weathered soils by adding lime and raising the pH.

CEC = 6.7 meq/100g

Once EDA is installed an annual maintenance application rate of the following is to be implemented.

Lime 0.5kg/m2 – Subject site calculation = A minimum 259kg across the proposed 518m2 EDAs.
Gypsum 0.5kg/m2 – Subject site calculation = A Minimum 259kg across the proposed 518m2 EDAs.

Phosphorus Sorption Index

The capacity of a soil to adsorb phosphorus is expressed as its phosphorus sorption capacity.

P sorb = 1120mg P sorbed/kg - laboratory
P sorb = 400mg P sorbed/kg – given figure within literature for clay loam soils

For nutrient balance calculations the lesser of value above is to be utilized.

Emerson Aggregate Test

The combination of slaking and dispersion caused a reduction in macroporosity and, therefore, lower infiltration rates and hydraulic conductivities as well as an increase in soil strength and other undesirable soil physical properties. This test classifies the behavior of soil aggregates, when immersed, on their coherence in water. This test was competed inhouse. Soils are divided into seven classes on the basis of their coherence in water, with one further class being distinguished by the presence of calcium-rich minerals.

EAT Class = 2(2). Some slight dispersion potential within underlying soils.

6. System Design/Selection

Effluent should be treated to a secondary level followed by subsurface dispersal. A number of dispersal options could be considered, subsurface irrigation, pressure dosed absorption bed and mounds. Subsurface irrigation was the dispersal method recommended and designed. Subsurface irrigation reduces the chance of human contact with the effluent and significantly reduces any potential public health risk.

Proposed Treatment Node

The proposal is to install a NSW Health accredited AWTS system onsite. An Aerated Wastewater Treatment System (AWTS) uses aerobic treatment to promote oxidation and microbiological consumption of organic matter by bacteria through facilitated biological processes.

Proposed Effluent Dispersal

The proposal is to install subsurface irrigation onsite. Subsurface irrigation reduces the chance of human contact with the effluent and significantly reduces any potential public health risk. By placing the effluent in the root zone of plants or grasses, beneficial reuse of both the hydraulic and nutrient components of the effluent is maximised, offering enhanced environmental benefits. There are also potential amenity benefits offered by subsurface irrigation, such as less chance of surface saturation and effluent runoff.

Hydraulic Sizing

As per section 6.4.3 of ''Dungog Council Onsite Sewage DAF 2015' the hydraulic sizing was calculated using the following formula.

$$LAA = q/(DLR - CAF)$$

LAA = EDA
Q = Design Daily Loading Rate (L/day)
DLR = Design Loading Rate (mm/day)
CAF = Climate Adjustment Factor (mm/day)

LAA = 960 / (2 – 0)

LAA = 480m2

Annual Nutrient Balance

A nutrient balance have been calculated to determine minimum dispersal sizing. Results below.

Minimum irrigation Areas, balances presented in appendix E below.

Minimum Area Required for Nitrogen Uptake: 467m2
Minimum Area Required for Phosphorus Uptake: **518m2**

As the P balance is the limiting factor and requires the greater area for calculated dispersal from N balance and Hydraulic balance calculations the minimum EDA size is to be 518m2.

7. Recommendations

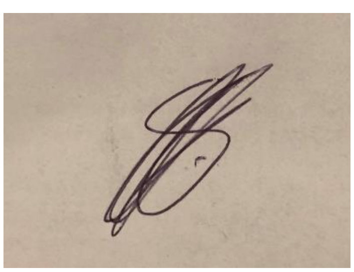
- Installation of a NSW Health accredited AWTS system onsite to treat the calculated flowrate of 960L/day.

- Installation of subsurface effluent dispersal field of a minimum 518m2.

- Maintain a dense grassland within the EDA once installed.

- Stock must be kept out of the EDA by fencing or other physical barrier.

- This design assumes at least three-star rated plumbing fixtures are used in any new development.



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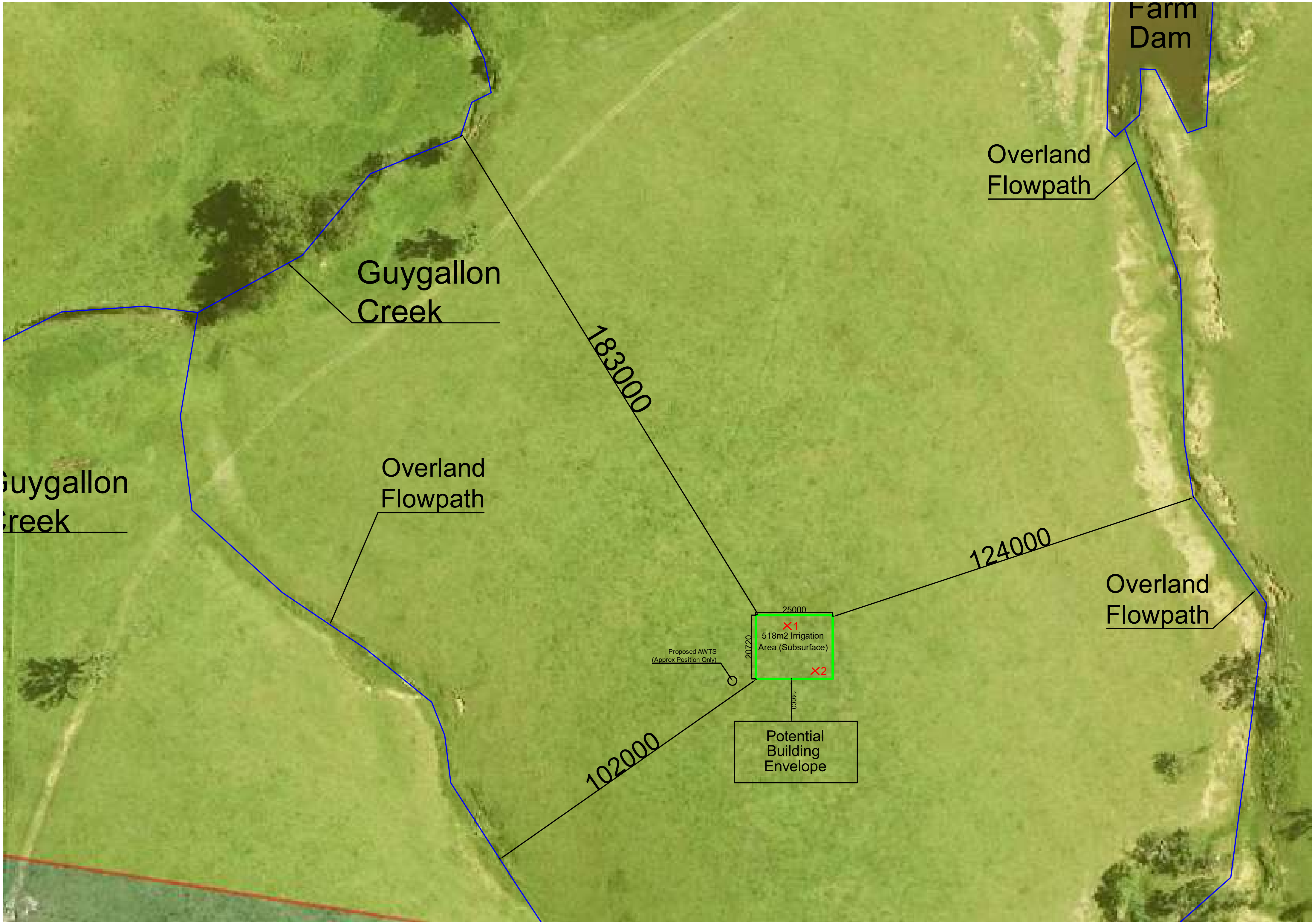
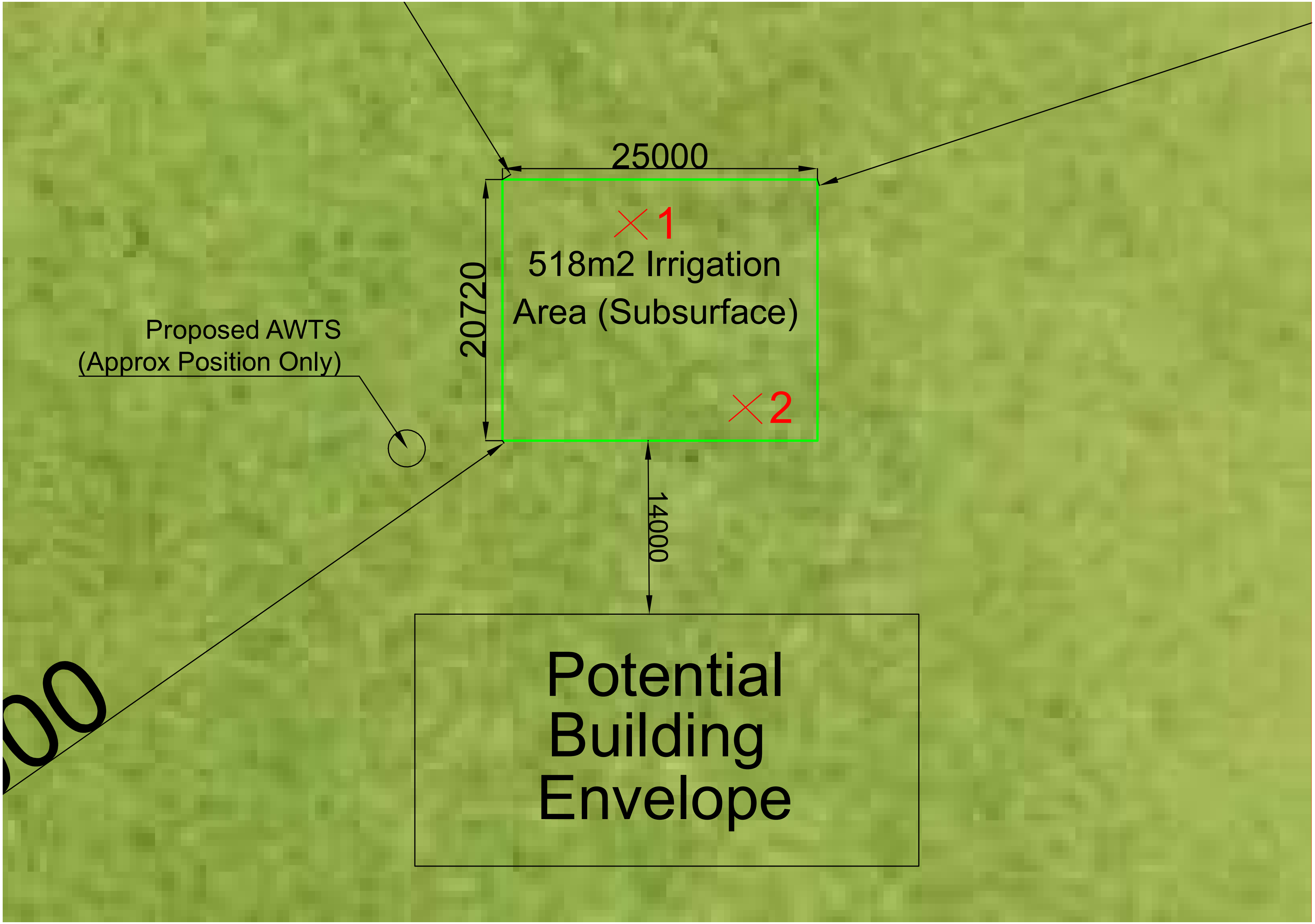
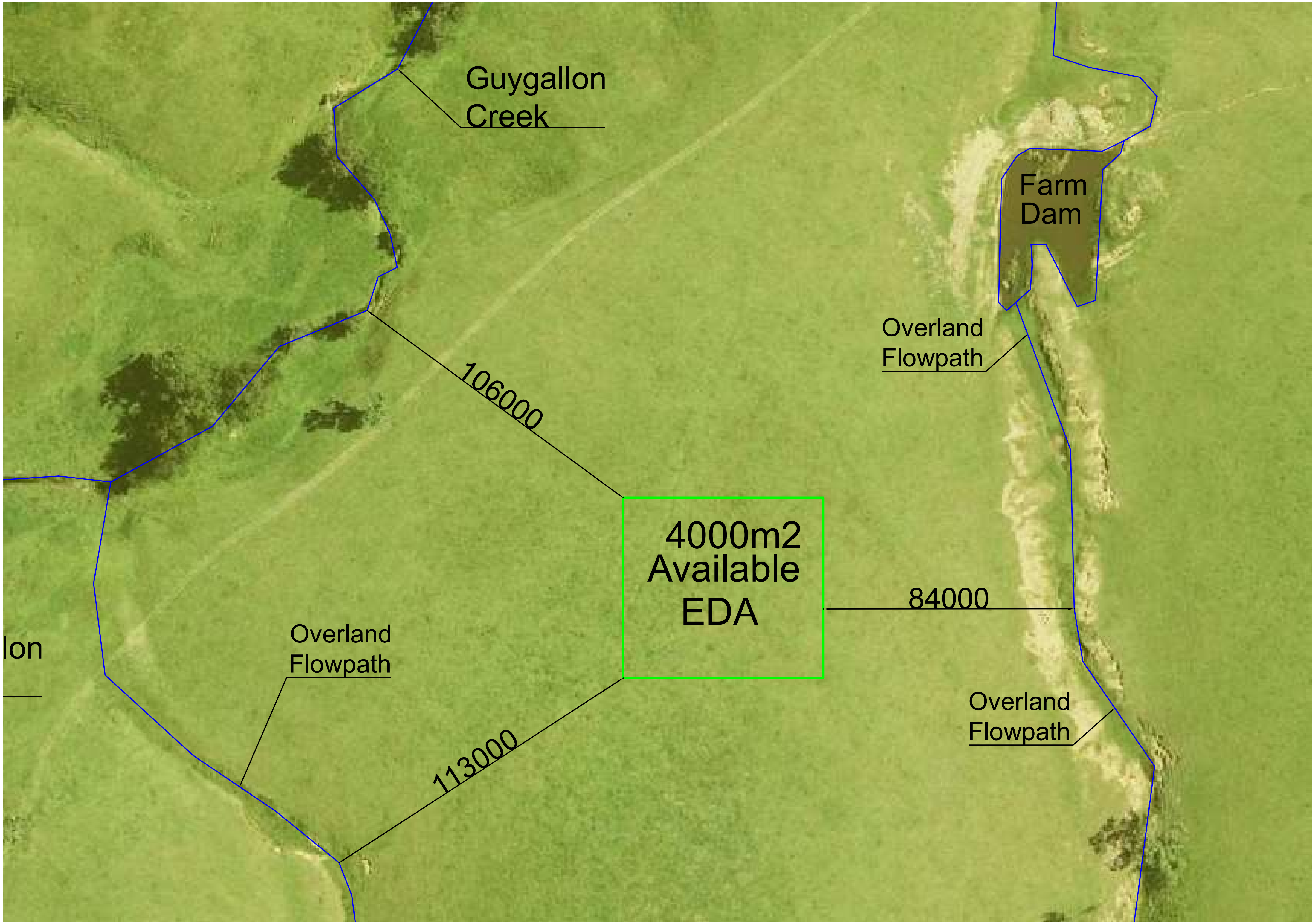
Appendix A – Site Plans



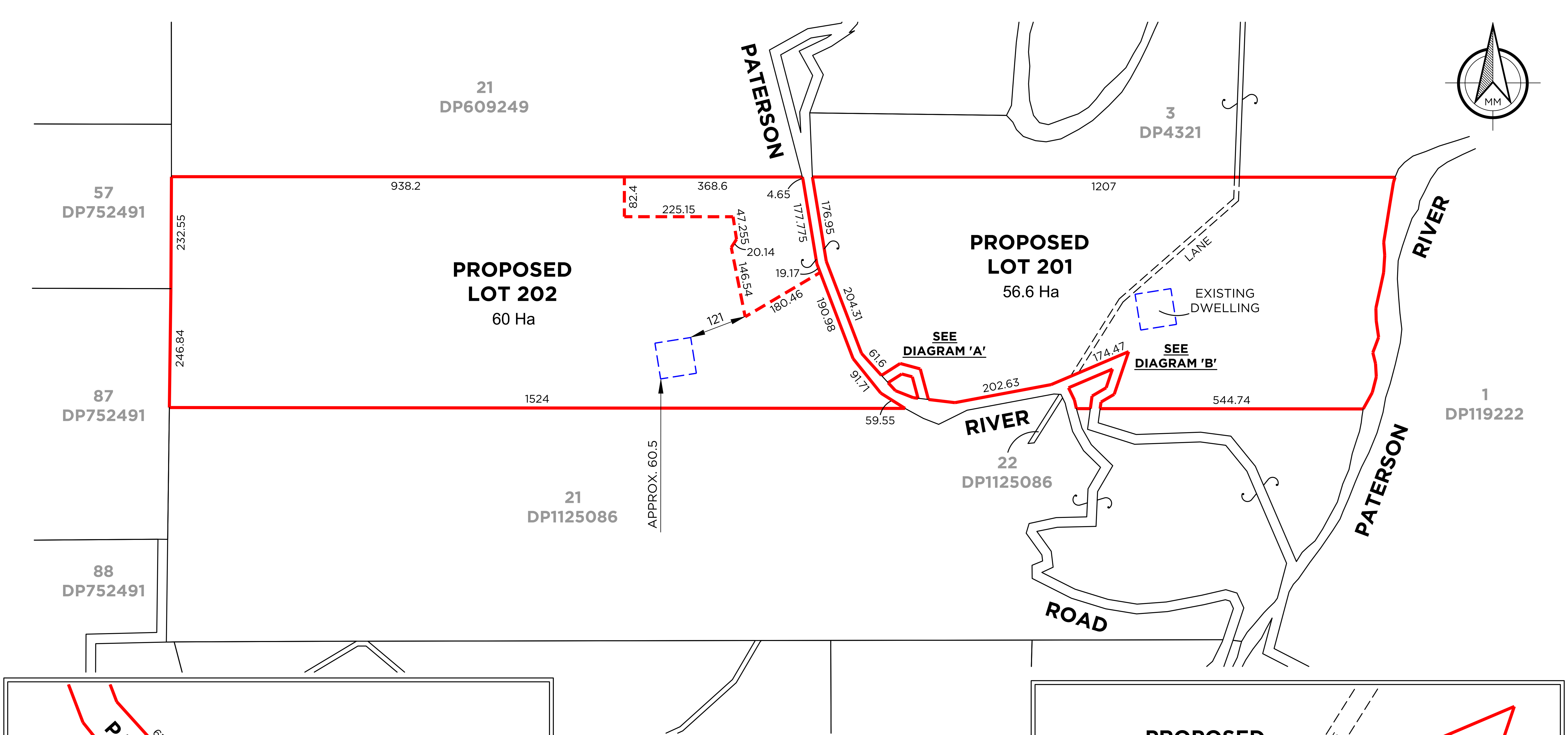
Farm Dam
Overland Flowpath
Guygallon Creek
183000
Guygallon Creek
Overland Flowpath
124000
Overland Flowpath
25000
×1
518m2 Irrigation Area (Subsurface)
20720
×2
Proposed AWTS (Approx Position Only)
14000
102000
Potential Building Envelope


25000
20720
1
518m2 Irrigation
Area (Subsurface)
2
Proposed AWTS
(Approx Position Only)
14000
Potential
Building
Envelope



Guygallon Creek
Farm Dam
Overland Flowpath
106000
4000m2 Available EDA
84000
lon
Overland Flowpath
113000
Overland Flowpath

Appendix B – Proposed Plans



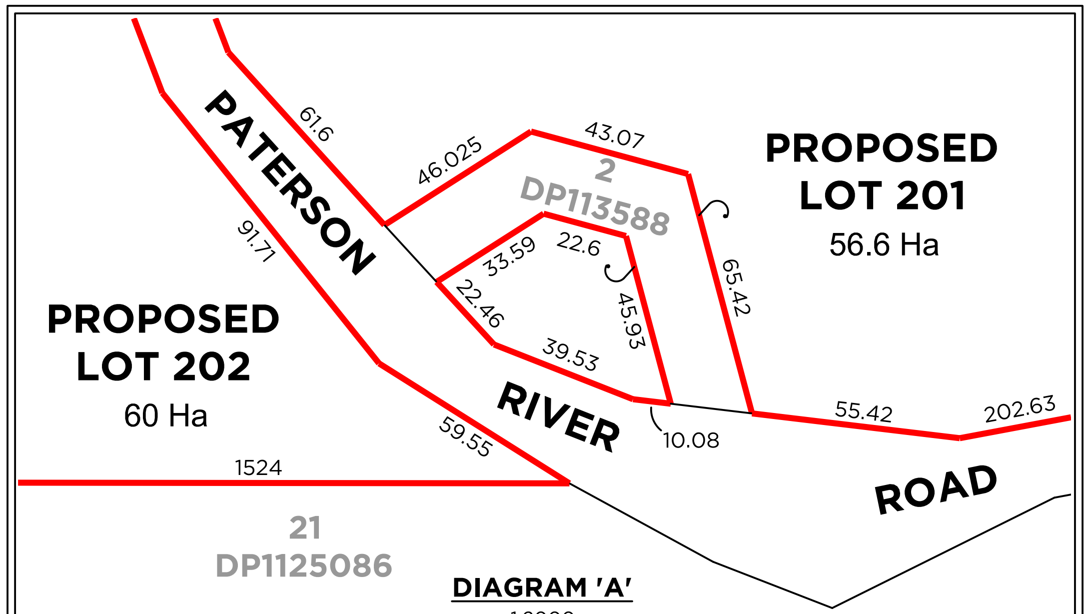


DIAGRAM 'A'
1:2000

NOTES:

1. FEATURES SHOWN TO SCALE ACCURACY.
2. THIS PLAN IS SUITABLE FOR DETAILED PLANNING AND DESIGN AT THE SCALE/S STATED. THE PLAN MAY NOT BE SUITABLE FOR ANY OTHER PURPOSE OR FOR USE AT ANY OTHER SCALE/S.
3. THE BOUNDARIES SHOWN ARE APPROXIMATE ONLY. THE BOUNDARIES SHOWN HAVE BEEN COMPILED FROM THE RELEVANT DEPOSITED PLANS.
4. ALL DIMENSIONS AND AREAS ARE SUBJECT TO FINAL SURVEY, COUNCIL APPROVAL AND REGISTRATION AT NSW LAND REGISTRY SERVICES.

LEGEND

- BOUNDARY LINE
- PROPOSED BOUNDARY
- ADJACENT BOUNDARY
- INDICATIVE BUILDING ENVELOPE (75m x 75m)

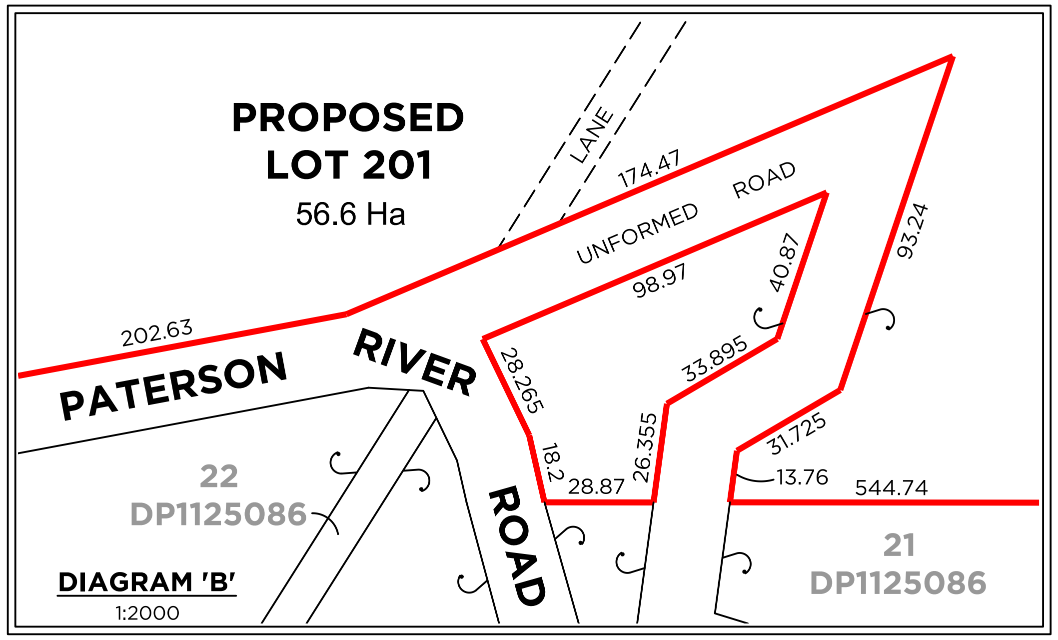


DIAGRAM 'B'
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REV.	DATE	AMENDMENT(S)	SUR	DFT	CHK
A	13.03.25	ORIGINAL ISSUE	--	TC	TC
B	15.04.25	INDICATIVE BUILDING ENVELOPES ADDED	--	TC	TC
C	2.05.25	PROPOSED BOUNDARY AMENDED	--	TC	TC
D	5.05.25	PROPOSED BOUNDARY AMENDED	--	TC	TC

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PROPOSED SUBDIVISION OF LOT 20 DP1125086

SITE ADDRESS:
1420 PATERSON RIVER ROAD
MOUNT RIVERS

CLIENT:
ADAM & JODY TURNER

CAD REF: 25109_Subdivision Plan_Rev D

POSITION DATUM: ASSUMED
ORIENTATION: MAGNETIC
EASTING: --
NORTHING: --
CLASS: -- PU: --
HEIGHT DATUM: --
CLASS: -- PU: --
RL: -- DATE: --

SURVEYED	DRAFTED	CHECKED
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Appendix C – Operation and Maintenance Guideline

ON-SITE SEWAGE MANAGEMENT SYSTEMS

If you live in or rent a house that is not connected to the main sewer then chances are that your yard contains an on-site sewage management system. If this is the case then you have a special responsibility to ensure that it is working as well as it can.

The aim of this pamphlet is to introduce you to some of the most popular types of on-site sewage management systems and provide some general information to help you maintain your system effectively. You should find out what type of system you have and how it works.

More information can be obtained from the pamphlets:

Your Septic System
Your Aerated Wastewater Treatment System
Your Composting Toilet
Your Land Application Area

You can get a copy of these pamphlets from your local council or the address marked on the back of this pamphlet.

It is important to keep in mind that maintenance needs to be performed properly and regularly. Poorly maintained on-site sewage management systems can significantly affect you and your family's health as well as the local environment.

What is an on-site sewage management system?

A domestic on-site sewage management system is made up of various components which - if properly designed, installed and maintained - allow the treatment and utilisation of wastewater from a house, completely within the boundary of the property.

Wastewater may be blackwater (toilet waste), or greywater (water from showers, sinks, and washing machines), or a combination of both.

Partial on-site systems - eg. pump out and common effluent systems (CES) - also exist. These usually involve the preliminary on-site treatment of wastewater in a septic tank, followed by collection and transport of the treated wastewater to an off-site management facility. Pump out systems use road tankers to transport the effluent, and CES use a network of small diameter pipes.

How does an on-site sewage management system work?

For complete on-site systems there are two main processes:

1. treatment of wastewater to a certain standard
2. its application to a dedicated area of land.

The type of application permitted depends on the quality of treatment, although you should try to avoid contact with all treated and untreated wastewater, and thoroughly wash affected areas if contact does occur.

Treatment and application can be carried out using various methods:

Septic Tank
Septic tanks treat both greywater and blackwater, but they provide only limited treatment through the settling of solids and the flotation of fats and greases. Bacteria in the tank break down the solids over a period of time. Wastewater that has been treated in a septic tank can only be applied to land through a covered soil absorption system, as the effluent is still too contaminated for above ground or near surface irrigation.

AWTS
Aerated wastewater treatment systems (AWTS) treat all household wastewater and have several treatment compartments. The first is like a septic tank, but in the second compartment air is mixed with the wastewater to assist bacteria to break down solids. A third compartment allows settling of more solids and a final chlorination contact chamber allows disinfection. Some AWTS are constructed with all the compartments inside a single tank. The effluent produced may be surface or sub-surface irrigated in a dedicated area.

Composting Toilets
Composting toilets collect and treat toilet waste only. Water from the shower, sinks and the washing machine needs to be treated separately (for example in a septic tank or AWTS as above). The compost produced by a composting toilet has special requirements but is usually buried on-site.

These are just some of the treatment and application methods available, and there are many other types such as sand filter beds, wetlands, and amended earth mounds. Your local council or the NSW Department of Health have more information on these systems if you need it.

Regulations and recommendations

The NSW Department of Health determines the design and structural requirements for treatment systems for single households. Local councils are primarily responsible for approving the installation of smaller domestic septic tank systems, composting toilets and AWTSs in their area, and are also responsible for approving land application areas. The NSW Environment Protection Authority approves larger systems.

The design and installation of on-site sewage management systems, including plumbing and drainage, should only be carried out by suitably qualified or experienced people. Care is needed to ensure correct sizing of the treatment system and application area.

Heavy fines may be imposed under the Clean Waters Act if wastewater is not managed properly.

Keeping your on-site sewage management system operating well

What you put down your drains and toilets has a lot to do with how well your system performs. Maintenance of your sewage management system also needs to be done well and on-time. The following is a guide to the types of things you should and should not do with your system.

DO

- ✓ Learn how your sewage management system works and its operational and maintenance requirements.
- ✓ Learn the location and layout of your sewage management system.
- ✓ Have your AWTS (if installed) inspected and serviced four times per year by an approved contractor. Other systems should be inspected at least once every year. Assessment should be applicable to the system design.
- ✓ Keep a record of desludgings, inspections, and other maintenance.
- ✓ Have your septic tank or AWTS desludged every three years to prevent sludge build up, which may 'clog' the pipes.
- ✓ Conserve water. Conservative water use around the house will reduce the amount of wastewater which is produced and needs to be treated.
- ✓ Discuss with your local council the adequacy of your existing sewage management system if you are considering house extensions for increased occupancy.

DON'T

- ✗ Don't let children or pets play on land application areas.
- ✗ Don't water fruit and vegetables with effluent.
- ✗ Don't extract untreated groundwater for cooking and drinking.
- ✗ Don't put large quantities of bleaches, disinfectants, whiteners, nappy soakers and spot removers into your system 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 put fats and oils down the drain and keep food waste out of your system.
- ✗ Don't install or use a garbage grinder or spa bath if your system is not designed for it.

Reducing water usage

Reducing water usage will lessen the likelihood of problems such as overloading with your septic system. Overloading may result in wastewater backing up into your house, contamination of your yard with improperly treated effluent, and effluent from your system contaminating groundwater or a nearby waterway.

Your sewage management system is also unable to cope with large volumes of water such as several showers or loads of washing over a short period of time. You should try to avoid these 'shock loads' by ensuring water use is spread more evenly throughout the day and week.

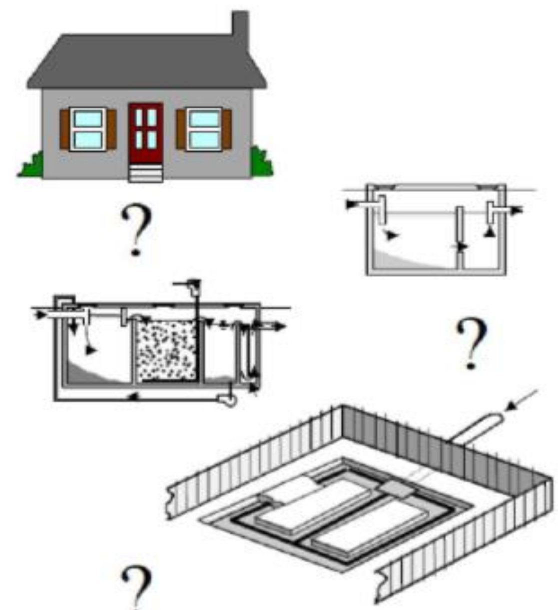
HELP PROTECT YOUR HEALTH AND THE ENVIRONMENT

Poorly maintained sewage management systems are a serious source of water pollution and may present health risks, cause odours and attract vermin and insects.

By looking after your management system you can do your part in helping to protect the environment and the health of you and your community.

For more information please contact:

Managing Wastewater In Your Backyard



Aerated Wastewater Treatment Systems (AWTS)

In unsewered areas, the proper treatment and utilisation of household wastewater on-site is critical in preserving the health of the public and the environment. AWTS have been developed as a way of achieving this.

What is an AWTS?

An AWTS is a purpose built system used for the treatment of sewage and liquid wastes from a single household or multiple dwellings.

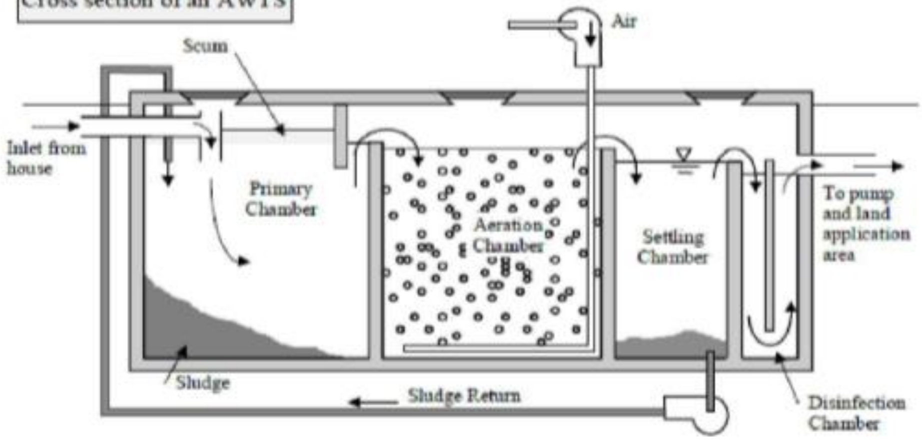
It consists of a series of treatment chambers combined with an irrigation system. An AWTS enables people living in unsewered areas to treat and utilise their wastewater.

How does an AWTS work?

Wastewater from a household is treated in stages in several 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 (as shown) 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.

Cross section of an AWTS



Regulations and recommendations

Local councils are primarily responsible for approving the smaller, domestic AWTSs in their area. The Environment Protection Authority (EPA) approves larger units, whilst the NSW Department of Health determines the design and structural requirements for all AWTSs.

At present AWTSs need to be serviced quarterly by an approved contractor at a cost to the owner. Local councils should also maintain a register of the servicing of each system within their area.

AWTSs should be fitted with an alarm having visual and audible components to indicate mechanical and electrical equipment malfunctions. The alarm should provide a signal adjacent to the alarm and at a relevant position inside the house. The alarm should incorporate a warning lamp which may only be reset by the service agent.

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 procedures that you should follow:

DO

- ✓ 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.
- ✓ Have your grease trap (if installed) cleaned out at least every two months.
- ✓ Keep a record of 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

- ✗ 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

Reducing water usage

Reducing water usage will lessen the likelihood of problems such as overloading with your AWTS. Overloading may result in wastewater backing up into your house, contamination of your yard with improperly treated effluent, and effluent from your system entering a nearby river, creek or dam.

Conservative water use around the house will reduce the amount of wastewater which is produced and needs to be treated.

Your AWTS is also unable to cope with large volumes of water such as several showers or loads of washing over a short period of time. You should try to avoid these 'shock loads' by ensuring water use is spread more evenly throughout the day and week.

Warning signs

You can look out for a few warning signs that signal to you that there are troubles with your AWTS. Ensure that these problems are attended to immediately to protect your health and the environment.

Look out for the following warning signs:

- Water that drains too slowly.
- Drain pipes that gurgle or make noises when air bubbles are forced back through the system.
- Sewage smells, this indicates a serious problem.
- Water backing up into your sink which may indicate that your system is already failing.
- Wastewater pooling over the land application area.
- Black coloured effluent in the aerated tank.
- Excess noise from the blower or pumping equipment
- Poor vegetation growth in irrigated area.

Odour problems from a vent on the AWTS can be a result of slow or inadequate breakdown of solids. Call a technician to service the system.

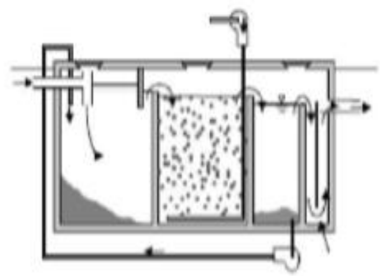
HELP PROTECT YOUR HEALTH AND THE ENVIRONMENT

Poorly maintained AWTSs are a serious source of water pollution and may present health risks, cause odours and attract vermin and insects.

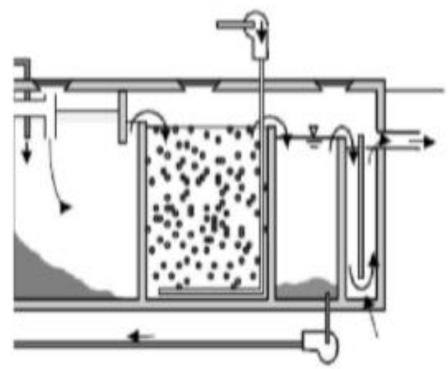
By looking after your treatment system you can do your part in helping to protect the environment and the health of you and your family.

If you would like more information please contact:

Your Aerated Wastewater Treatment System



Your Aerated /astewater Treatment System



- Black coloured effluent in the aerated tank.
- Excess noise from the blower or pumping equipment
- Poor vegetation growth in irrigated area.

LAND APPLICATION AREAS

The reuse of domestic wastewater on-site can be an economical and environmentally sound use of resources.

What are land application areas?

These are areas that allow treated domestic wastewater to be managed entirely on-site.

The area must be able to utilise the wastewater and treat any organic matter and wastes it may contain. The wastewater is rich in nutrients, and can provide excellent nourishment for flower gardens, lawns, certain shrubs and trees. The vegetation should be suitably tolerant of high water and nutrient loads.

How does a land application area work?

Treated wastewater applied to a land application area may be utilised or simply disposed, depending on the type of application system that is used. The application of the wastewater can be through a soil absorption system (based on disposal) or through an irrigation system (based on utilisation).

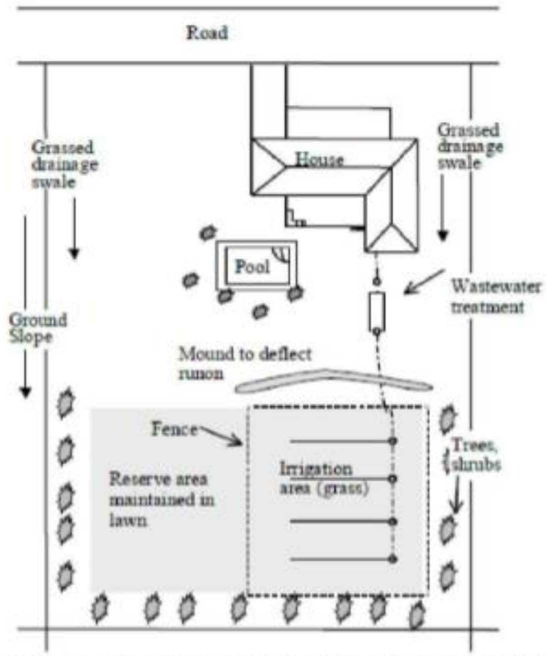
Soil absorption systems do not require highly treated effluent, and wastewater treated by a septic tank is reasonable as the solids content in the effluent has been reduced. Absorption systems release the effluent into the soil at a depth that cannot be reached by the roots of most small shrubs and grasses. They rely mainly on the processes of soil treatment and then transmission to the water table, with minimal evaporation and up-take by plants. **These systems are not recommended in sensitive areas as they may lead to contamination of surface water and groundwater.**

Irrigation systems may be classed as either subsurface or surface irrigation. If an irrigation system is to be used, wastewater needs to be pre-treated to at least the quality produced by an aerated wastewater treatment system (AWTS).

Subsurface irrigation requires highly treated effluent that is introduced into the soil close to the surface. The effluent is utilised mainly by plants and evaporation.

Surface irrigation requires highly treated effluent that has undergone aeration and disinfection treatments, so as to reduce the possibility of bacteria and virus contamination.

Typical Site Layout (not to scale)



The effluent is then applied to the land area through a series of drip, trickle, or spray points which are designed to eliminate airborne drift and run-off into neighbouring properties.

There are some public health and environmental concerns about surface irrigation. There is the risk of contact with treated effluent and the potential for surface run-off. Given these problems, subsurface irrigation is arguably the safest, most efficient and effective method of effluent utilisation.

Regulations and recommendations

The design and installation of land application areas should only be carried out by suitably qualified or experienced people, and only after a site and soil evaluation is done by a soil scientist. Care should be taken to ensure correct buffer distances are left between the application area and bores, waterways, buildings, and neighbouring properties.

Heavy fines may be imposed under the Clean Waters Act if effluent is managed improperly.

At least two warning signs should be installed along the boundary of a land application area. The signs should comprise of 20mm high Series C lettering in black or white on a green background with the words:

RECLAIMED EFFLUENT
NOT FOR DRINKING
AVOID CONTACT

Depending on the requirements of your local council, wet weather storage and soil moisture sensors may need to be installed to ensure that effluent is only irrigated when the soil is not saturated.

Regular checks should be undertaken of any mechanical equipment to ensure that it is operating correctly. Local councils may require periodic analysis of soil or groundwater characteristics

Humans and animals should be excluded from land application areas during and immediately after the application of treated wastewater. The longer the period of exclusion from an area, the lower the risk to public health.

The householder is required to enter into a service contract with the installation company, its agent or the manufacturer of their sewage management system, this will ensure that the system operates efficiently.

Location of the application area

Treated wastewater has the potential to have negative impacts on public health and the environment. For this reason the application area must be located in accordance with the results of a site evaluation, and approved landscaping must be completed prior to occupation of the building. Sandy soil and clayey soils may present special problems.

The system must allow even distribution of treated wastewater over the land application area.

Maintaining your land application area

The effectiveness of the application area is governed by the activities of the owner.

DO

- ✓ Construct and maintain diversion drains around the top side of the application area to divert surface water.
- ✓ Ensure that your application area is kept level by filling any depressions with good quality top soil (not clay).
- ✓ Keep the grass regularly mowed and plant small trees around the perimeter to aid absorption and transpiration of the effluent.
- ✓ Ensure that any run off from the roof, driveway and other impermeable surfaces is directed away from the application area.
- ✓ Fence irrigation areas.
- ✓ Ensure appropriate warning signs are visible at all times in the vicinity of a spray irrigation area.
- ✓ Have your irrigation system checked by the service agent when they are carrying out service on the treatment system.

DON'T

- ✖ Don't erect any structures, construct paths, graze animals or drive over the land application area.
- ✖ Don't plant large trees that shade the land application area, as the area needs sunlight to aid in the evaporation and transpiration of the effluent.
- ✖ Don't plant trees or shrubs near or on house drains.
- ✖ Don't alter stormwater lines to discharge into or near the land application area.
- ✖ Don't flood the land application area through the use of hoses or sprinklers.
- ✖ Don't let children or pets play on land application areas.
- ✖ Don't water fruit and vegetables with the effluent.
- ✖ Don't extract untreated groundwater for potable use.

Warning signs

Regular visual checking of the system will ensure that problems are located and fixed early.

The visual signs of system failure include:

- surface ponding and run-off of treated wastewater
- soil quality deterioration
- poor vegetation growth
- unusual odours

Volume of water

Land application areas and systems for on-site application are designed and constructed in anticipation of the volume of waste to be discharged. Uncontrolled use of water may lead to poorly treated effluent being released from the system.

If the land application area is waterlogged and soggy the following are possible reasons:

- Overloading the treatment system with wastewater.
- The clogging of the trench with solids not trapped by the septic tank. The tank may require desludging.
- The application area has been poorly designed.
- Stormwater is running onto the area.

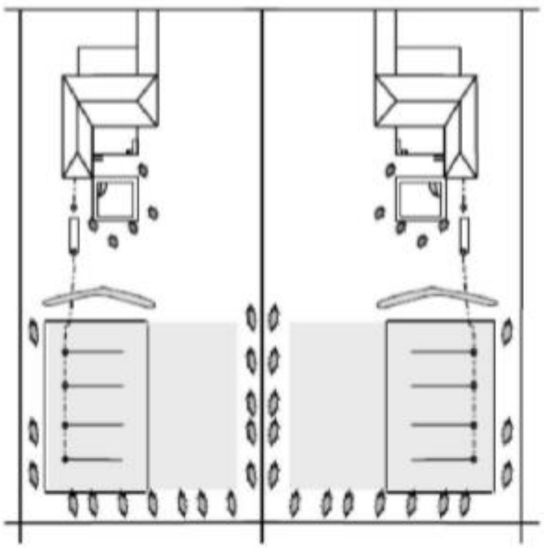
HELP PROTECT YOUR HEALTH AND THE ENVIRONMENT

Poorly maintained land application areas are a serious source of water pollution and may present health risks, cause odours and attract vermin and insects.

By looking after your sewage management system you can do your part in helping to protect the environment and the health of you and your family.

For more information please contact:

Your Land Application Area



Appendix D – Laboratory Results

CERTIFICATE OF ANALYSIS

Work Order	: **EW2501576**	Page	: 1 of 3
Client	: **GSL Environmental**	Laboratory	: Environmental Division NSW South Coast
Contact	: Simon Doberer	Contact	: Mechelle Sahyoun
Address	: 71 Moona Creek Road Vincentia	Address	: 1/19 Ralph Black Dr, North Wollongong 2500 NSW Australia
Telephone	: ----	Telephone	: 02 42253125
Project	: Paterson River Road, MOUNT RIVERS	Date Samples Received	: 24-Mar-2025 10:00
Order number	: 162525	Date Analysis Commenced	: 25-Mar-2025
C-O-C number	: ----	Issue Date	: 31-Mar-2025 13:55
Sampler	: Client - Simon Doberer		
Site	: ----		
Quote number	: EW23GSLENV0001		
No. of samples received	: 1		
No. of samples analysed	: 1		

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

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Senior Chemist - Inorganics	Sydney Inorganics, Smithfield, NSW
Dian Dao	Senior Chemist - Inorganics	Sydney Inorganics, Smithfield, NSW

General Comments

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

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

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

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

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

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

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

- ED007 and ED008: When Exchangeable Al is reported from these methods, it should be noted that Rayment & Lyons (2011) suggests Exchange Acidity by 1M KCl - Method 15G1 (ED005) is a more suitable method for the determination of exchange acidity (H+ + Al3+).

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	TP1	----	----	----	----
			Sampling date / time	20-Mar-2025 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit	EW2501576-001	--------	--------	--------	--------
				Result	----	----	----	----
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	**5.7**	----	----	----	----
EA010: Conductivity (1:5)								
Electrical Conductivity @ 25°C	----	1	µS/cm	**26**	----	----	----	----
ED007: Exchangeable Cations								
Exchangeable Calcium	----	0.1	meq/100g	**3.2**	----	----	----	----
Exchangeable Magnesium	----	0.1	meq/100g	**3.0**	----	----	----	----
Exchangeable Potassium	----	0.1	meq/100g	**0.2**	----	----	----	----
Exchangeable Sodium	----	0.1	meq/100g	**0.3**	----	----	----	----
Cation Exchange Capacity	----	0.1	meq/100g	**6.7**	----	----	----	----
Exchangeable Sodium Percent	----	0.1	%	**4.3**	----	----	----	----
EK072: Phosphate Sorption Capacity								
Phosphate Sorption Capacity	----	250	mg P sorbed/kg	**1120**	----	----	----	----

Inter-Laboratory Testing

Analysis conducted by ALS Sydney, NATA accreditation no. 825, site no. 10911 (Chemistry / Biology).

(SOIL) EA010: Conductivity (1:5)

(SOIL) EA002: pH 1:5 (Soils)

(SOIL) EK072: Phosphate Sorption Capacity

(SOIL) ED007: Exchangeable Cations

Appendix E – Nutrient Balance

Nutrient Balances

Parameters	Symbol	Value
Daily Wastewater (L/Day)	Q	960
Total Nitogen in Effluent (mg/L)	TN	40
Total Phosphorus in Effluent (mg/L)	TP	12
Design Life of System (Years)	L	50
P Sorption Soil Capacity (mg/kg)	Psorp	400
P Sorption Soil Capacity Field Coefficient (%)	PsorpC	0.5
Soil Depth for P Sorption	D	0.8
Bulk Density of Soil (g/cm3)	B	1.6
Nitrogen Plant Uptake (kg/Ha/year)	NPU	240
Phosphorus Plant Uptake (kg/Ha/year)	PPU	30

Model Inputs

Applied Total Nitrogen (kg/year)	TN_A	14.02	TN_A = (Q*TN*365)/1,000,000
Applied Total Phosphorus (kg/year)	TP_A	4.20	TPA = (Q*TP*365)/1,000,000

Model Outputs

Subsoil Nitrogen Soil Losses (kg/year)	NL	2.80	NL = TN_A*20%
Phosphorus Sorption by Soil (kg/m2)	PS	0.26	PS = ((Psorp/1,000,000)*(B*1,000))*D*PsorpC
Phosphorus Plant Uptake Over Design Life (kg/m2)	PPU_L	0.15	PPU_L = (PPU/10,000)*L

Model Results

Minimum Area Required for Nitrogen Uptake (m2)	NUA_N	467	NUA_N ((TN_A-NL)/NPU)*1,000
Minimum Area Required for Phosphorus Uptake (m2)	NUA_P	518	(TP_A*L)/(PS+PPU_L)
Maximum Area for Nutrient Uptake (m2)	NUA	518	Max Value of NUA_N and NUA_P