# Site and Soil Assessment for On-Site Effluent Management System

Assessment Site: 705 Kains Flat Road, Kains Flat NSW 2850

Client: John Grosse, 705 Kains Flat Road, Kains Flat NSW 2850

(Our Reference: 36296-ER02_A)

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# Disclaimer

This report has been prepared solely for John Grosse in accordance with the scope provided by the client and for the purpose(s) as outlined throughout this report.

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| | |
|---|---|
| **Project Name:** | Lot 21 DP255534,<br>705 Kains Flat Road, Kains Flat NSW 2850 |
| **Client:** | John Grosse |
| **Project No.** | 36296 |
| **Report Reference** | 36296-ER02_A |
| **Date:** | 13.05.2021 |
| **Revision:** | Revision A |

| **Prepared by:** | **Reviewed by:** |
|---|---|
| [redacted] | [redacted] |
| Jeremy Wiatkowski<br>Geotechnical Technician | Luke Morris<br>B.E. MIEAust CPEng (NPER)<br>Director |

# 1.0 SYSTEM OVERVIEW

The following table provides a summary of the information for a sustainable onsite effluent management system proposed at Lot 21 DP255534, 705 Kains Flat Road, Kains Flat NSW 2850. The following sections of this report provide site specific details justifying the section type.

Table 1: System Overview

| | |
|---|---|
| Site Assessor | Jeremy Wiatkowski |
| Client | John Grosse |
| Site Location | "Lot 21 DP255534", 705 Kains Flat Road, Kains Flat NSW |
| No. of Bedrooms | 4 Bedrooms |
| Water Source | Rainwater roof collection |
| Estimated Daily Flow (L/day) | 600L/Day based on 5 people by at 120L/person/day |
| Tank Recommendation | Standard Septic Tank |
| Tank Capacity | As per section 6.3 the minimum size tank required is 3200-3500L |
| Sub Soil Assessment Class | Field assessment and subsequent laboratory tests have classed the subsoil as category 5, as shown in section 3.5. |
| Sub Soil Recommended Hydraulic Loading mm/day (DIR/DLR) | Bed/trench systems in category 5 soils have a design-loading rate of 5mm/day. (Refer to Table 7) |
| Recommended Effluent Application Type | Due to the category 5 soil (Light Clays) it is recommended that an absorption bed be utilised to disperse onsite wastewater. |
| Effluent Design Criteria | *As per section 7.0 the minimum application area was determined by calculating the requirements of hydraulic loading. As shown 2 absorption bed of 20m long x 3m wide is required to dispose of the proposed hydraulic load.* |

# 2.0 INTRODUCTION

## 2.1 Overview

Barnson Pty Ltd on behalf of John Grosse has prepared this report for submission to Mid-Western Regional Council. This report provides direction for sustainable on-site effluent management for a 4-bedroom residence, on Lot 21 DP255534, at 705 Kains Flat Road, Kains Flat NSW (refer **Figure 1).**

## 2.2 Key References

The following key references were utilised as part of this assessment:

- AS/NZS 1547:2012. *On-site Domestic Wastewater Management;*
- NSW Government 1998. *On site Sewerage Management for Single Households* (The Silver Book/OSMSH);
- NSW Government 2000. *The Easy Septic Tank Guide.* Developed by Social Change Media for the NSW Department of Local Government;
- NSW Health, 2001. 'Septic Tank and Collection Well Accreditation Guidelines";
- Mid-Western Regional Council Local Environment Plan, 2012;
- Mid-Western Local Environment Plan, 2011;
- Murphy B.W. & Lawrie J.W. 1998. Soil Landscapes of the Dubbo 1:250 000 Sheet Report, DLWC.
- Sydney Catchment Management Authority, 2019. *Designing and Installing On-Site Wastewater Systems;*

## 2.3 Disposal System

**Figure 1 and 2** illustrates the site location. **Figure 3** illustrates the proposed buffer, setback areas and approved application area.

The proposed effluent disposal system for this site is via a standard septic tank into an absorption bed.

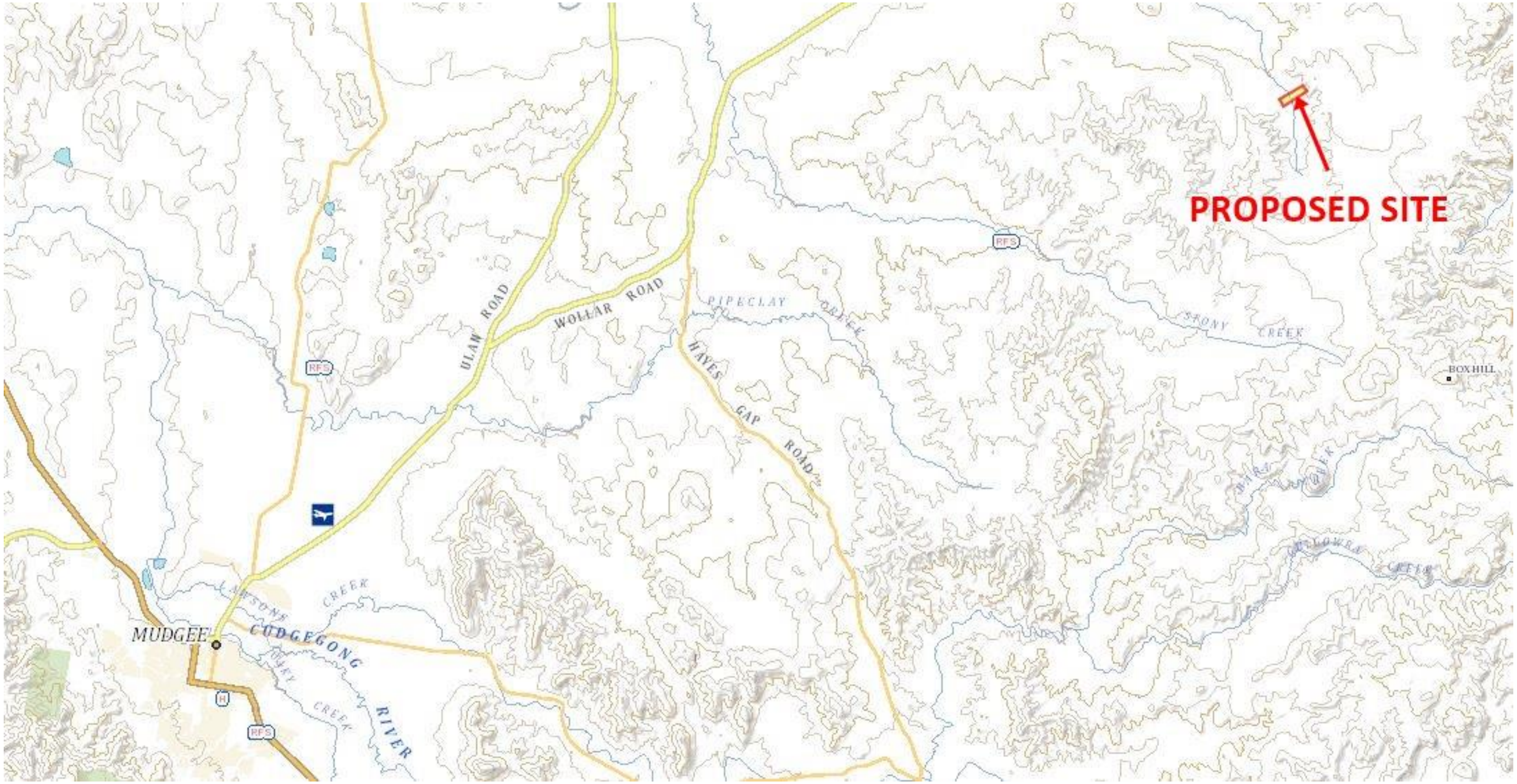


Figure 1 – Site Location Plan

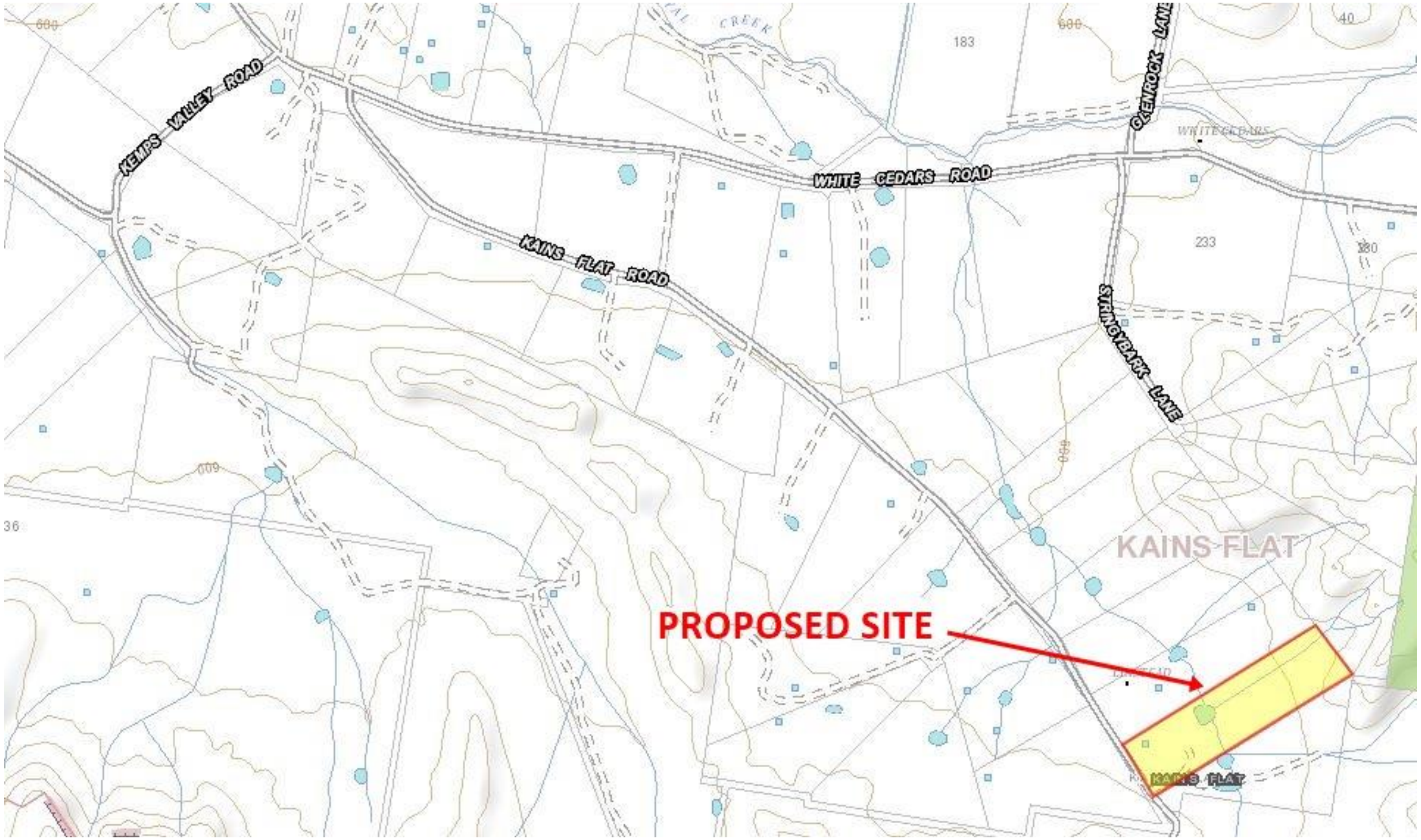


Figure 2 – Site Location Plan

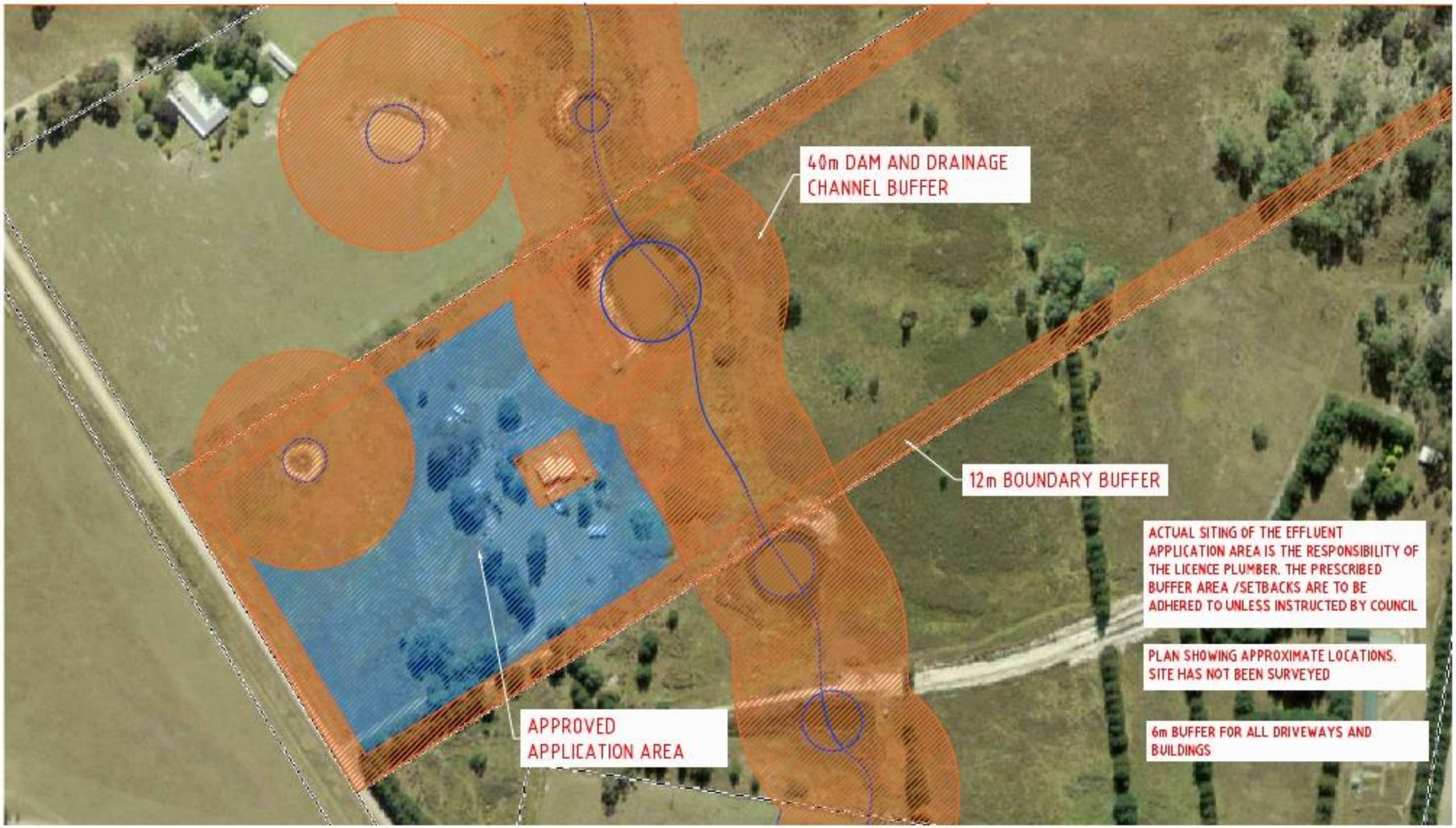


Figure 3 – Buffer and Setback Plan

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1300 BARNSON (1300 227 676)
generalenquiry@barnson.com.au
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Project: EFFLUENT MANAGEMNT SYSTEM PROPOSED EXTENSION
Drawing Title: BUFFER ZONE PLAN
Drawn: JW
Check: LM
Original Sheet Size = A4
Drawing Number: 36296-GD02
Revision: A

# 3.0 SITE AND SOIL EVALUATION

## 3.1 Site Evaluators Details

The following table provides an overview of the evaluator’s particulars.

Table 2: Details

| | |
|---|---|
| Name / Role | Jeremy Wiatkowski |
| Role/ Qualifications | Geotechnical Technician |
| Company | Barnson Pty Ltd |
| Company Address | 1/36 Darling Street Dubbo NSW 2830 |
| Contact Details | 1300 BARNSON |
| Date of Assessment | 30/03/2021 |

## 3.2 Site Information

The following table provides an overview of the site information.

Table 3: Site Particulars

| | |
|---|---|
| Address/Locality | 705 Kains Flat Road, Kains Flat NSW<br>Lot 21 DP255534 |
| Local Government Area | Mid-Western Regional Council |
| Owner | John Grosse |
| Developer/Builder | Owner/Builder |
| Block Configuration | Approximately 10.47ha |
| Intended Water Supply | rainwater roof collection supplied |
| Intended Power Supply | Supplied |
| Local Experience | Care needs to be taken to minimise runoff and erosion. Systems commonly malfunction due to lack of ongoing maintenance. The system is to be inspected and maintained regularly in accordance with manufacturer details, Council requirements, and prescriptions identified in this report. |

## 3.3 Desktop Assessment

The following information was obtained via desktop review of the site.

Table 4: Desktop Assessment Details

| | | |
|---|---|---|
| Climate Overview[1] | | Annual Average Rainfall for Mudgee is 659.1mm. Warm summers with large evaporative deficit, cool winters with small evaporative deficit. The mean summer monthly rainfall (January) is 64.6mm. The mean winter rainfall (July) is 43.4mm. |
| Soil Landscape Reference[2] | Area has been mapped within the "Ulan" Landscape Group. Yellow Podzolic Soils and Yellow Solodic Soils are common in the area. | |
| | Surface Conditions | Gravelly or Hardsetting |
| | Drainage | Imperfectly drained |
| | Available water holding capability | Moderate |
| | Water table depth | Occassionally seasonal waterlogging |
| | Depth to bedrock | 60 to >100cm |
| | Flood hazard | Nil |
| | Expected Nutrient deficiencies | Nitrogen, Phosphorous, Sulphur |
| | Soil Salinity | Low |
| | Erosion Hazard | Moderate |
| Underlying Geology[3] | | *"Massive quartz sandstone, flaggy sandstone, siltstone, shale."*. |
| Groundwater Review | | One water bore was found within 500m of the proposed site, as illustrated in **Figure 4.** The area is mapped as being groundwater vulnerable as per the Mid-Western Western Regional Council LEP map GRV_006 **Figure 5.** |

[1] Bureau of Meteorology online Climate Data website

[2] NSW Soil and Land Information System

[3] New South Wales 1:1000000

## 3.4 Groundwater Review

One water bore was identified as occurring within the general area of the allotment. Information relating to historic groundwater report details on water bearing zones and standing water levels is provided in the table below.

**Table 5: Groundwater Review**

| Groundwater Bore Reference | Total Depth (m) | Water Bearing Zones (m) | Standing Water Level (m) | Yield (L/s) | Salinity Yield |
|---|---|---|---|---|---|
| GW070873<br>Stock, Domestic<br>Approx. 350m South West From Proposed Application Area | 47.20 | 34.70-35.00<br>41.10-41.70 | 18.30 | 0.760 | N/a |

Using available groundwater information from local bores, it can be determined that in the local vicinity the standing water level is greater than 18.30m below the ground surface and the water bearing zones are greater than 34.70m below the ground surface.

No groundwater was encountered during the site investigation. From this information it can be determined that in this locality, subsequent contamination by secondary treated effluent is not a risk factor.

## 3.5 Surface Water Review

The site drains to the Cooyal creek passing through the centre of the lot.


Figure 4 – Groundwater Bore Locations

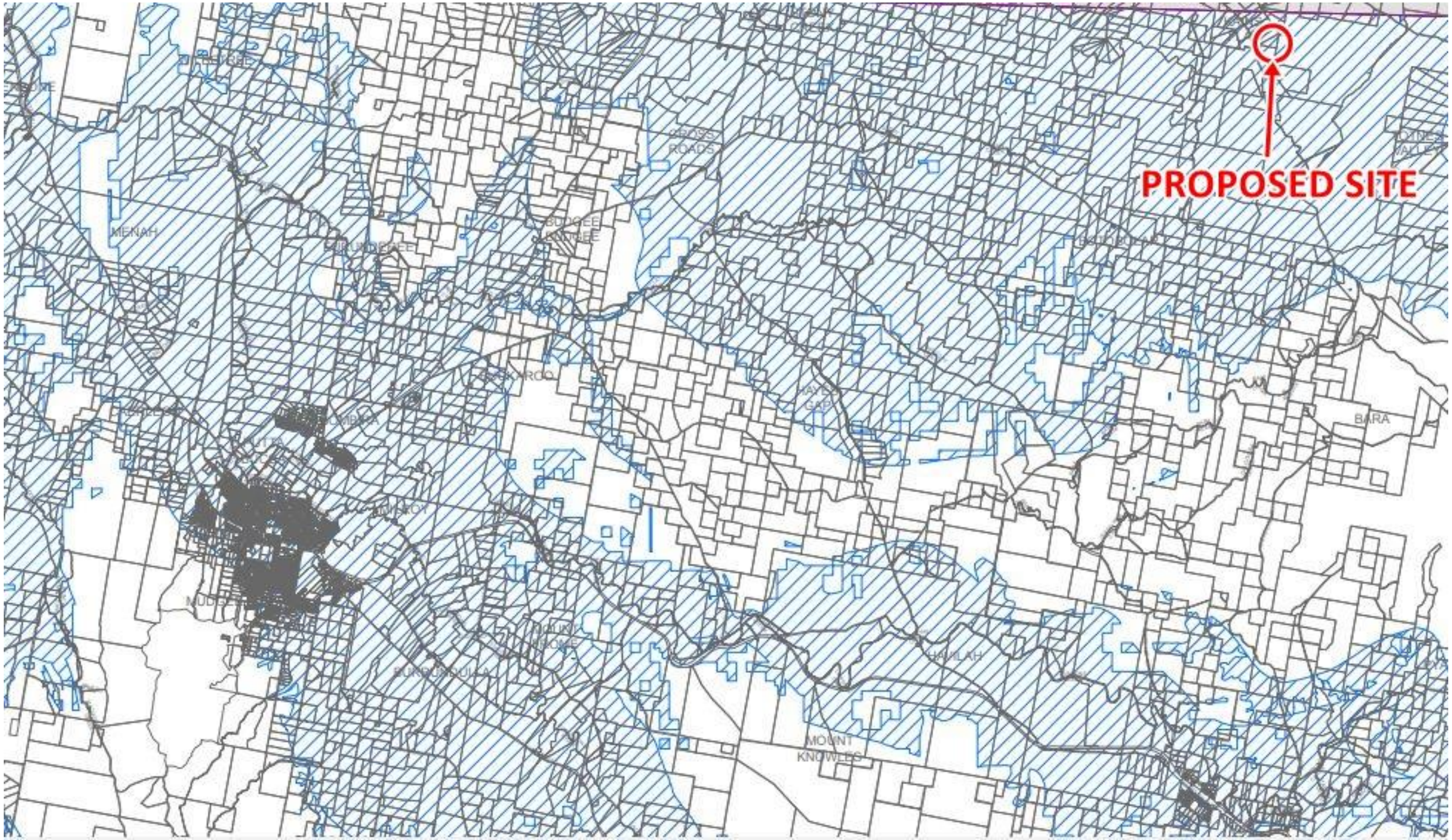



Figure 5 – Groundwater Vulnerability Map GRV_006

## 3.6 Field Assessment Information

A field inspection was conducted on 30/03/2021. The following table provides detail on the site assessment as well as the field and laboratory results.

Table 6: Site Assessment Details

<table>
<tr><td colspan="2">Water Balance Attached</td><td>See Appendix A</td></tr>
<tr><td colspan="2">Exposure</td><td>Good exposure.</td></tr>
<tr><td colspan="2">Slope</td><td>The site is sloping moderately to west</td></tr>
<tr><td colspan="2">Elevation</td><td>Approximately 614m.</td></tr>
<tr><td colspan="2">Run-On</td><td>None</td></tr>
<tr><td colspan="2">Seepage</td><td>None</td></tr>
<tr><td colspan="2">Erosion Potential</td><td>Low due to vegetation cover.</td></tr>
<tr><td colspan="2">Site Drainage</td><td>The site drains to the Cooyal creek passing through the centre of the lot.</td></tr>
<tr><td colspan="2">Fill</td><td>None encountered</td></tr>
<tr><td colspan="2">Surface rock/Outcrops</td><td>None encountered</td></tr>
<tr><td rowspan="2">Is there sufficient land area for:</td><td>Application system, including buffers</td><td>Yes</td></tr>
<tr><td>Reserve application system</td><td>Yes</td></tr>
</table>

## 3.7 Soil Assessment

A soil sample was taken and returned to Barnson Pty Ltd for analysis on 30/03/2021. The sample was collected to a depth of 800mm during the site investigation as per AS1289.1.2.1.6.5.3. Laboratory and results are provided at Appendix B. Field assessment parameters were also obtained. The following table provides detail on both field and laboratory assessment results.

Table 7: Soil Assessment Details

| | | |
|---|---|---|
| **Depth to bedrock or hardpan via field assessment** | | >1.5m |
| **Depth to high soil water table via field assessment** | | >1.5m |
| Soil Analysis | pH – subsoil $CaCl_2$ (lab), subsoil | 5.90 |
| | Emerson Test Result –subsoils (Lab) | 6 |
| | Liquid Limit, Plastic Limit, Plasticity Index, Linear Shrinkage. (%) | LL = 43<br>PL = 15<br>PI = 28<br>LS = 12<br>See Borelog in **Appendix B** |
| | Estimated Soil Category–topsoil, subsoil A, subsoil B, | 4,5,5 |
| | Structure massive, weak, high, moderate, strong (Field) | Strongly Structured |
| | Soil Profile description | See Borelog in Appendix B |
| | Sub soil Permeability (from table 5.2 of AS 1547:2012) | 0.12-0.5($k_{sat}$) (m/d) 5-20.8 (mm/hr)<br>(Infiltration is Moderatly Slow) |
| | Recommended Hydraulic Loading for disposal system (from Table 5.2 of AS 1547:2012) | 5mm per day (For effluent disposal beds/trenches) |

# 4.0 SITE AND SOIL LIMITATION ASSESSMENT

The following two limitation tables are a standardised guide to the site and soil characteristics which may limit the suitability of the site for effluent disposal and which require attention through specific management practises. The tables have been reproduced from the NSW Government endorsed '*On-Site Sewerage Management for Single Households*' (1998), Tables 8 and 9. The highlighted categories represent site and soil conditions of the land covered in this report.

Table 8: Site Limitation Assessment

| Site Feature | Relevant System | Minor Limitation | Moderate Limitation | Major Limitation | Restrictive Feature |
|---|---|---|---|---|---|
| Flood Potential | All land application systems | > 1 in 20 years | | Frequent below 1 in 20 years | Transport in wastewater off site |
| | All treatment application systems | Components above 1 in 100 years | | Components below 1 in 100 years | Transport in wastewater off site system failure |
| Exposure | All land application systems | High sun and wind exposure | | Low sun and wind exposure | Poor evaporation transpiration |
| Slope % | Surface Irrigation | 0-6 | 6-12 | >12 | Runoff, erosion potential |
| | Sub-surface irrigation | 0-10 | 10-20 | >20 | Runoff, erosion potential |
| | Absorption | 0-10 | 10-20 | >20 | Runoff, erosion potential |
| Landform | All systems | Hillcrests, convex side slopes and plains | Concave side slopes and foot slopes | Drainage plains and incised channels | Groundwater pollution hazard, resurfacing hazard |
| Run-on and upslope seepage | All land Application Areas | None-low | Moderate | High, diversion not practical | Transport of wastewater off site |
| Erosion potential | All land application systems | No sign of erosion potential | | Indications of erosion e.g. rils, mass failure | Soil degradation and off-site impact |
| Site drainage | All land application systems | No visible signs of surface dampness | | Visible signs of surface dampness, such as moisture-tolerant veg | Groundwater pollution hazard, resurfacing hazard |
| Fill | All systems | No fill | Fill present | | Subsidence |
| Land area | All systems | Area available | Area not available | | Health and pollution risk |
| Rock and rock outcrop | All land application systems | <10% | 10-20% | >20% | Limits system performance |
| Geology | All land application systems | None | | Major geological discontinuities, fractured or highly porous regolith | Groundwater pollution hazard |

Table 9: Soil Limitation Assessment

| Soil feature | Relevant system | Minor limitation | Moderate limitation | Major limitation | Restrictive feature |
|---|---|---|---|---|---|
| Depth to bedrock or hardpan (m) | Surface and sub-surface irrigation | > 1.0 | 0.5-1.0 | < 0.5 | Restricts plant growth |
| | Absorption | > 1.5 | 1.0-1.5 | < 1.0 | Groundwater pollution hazard |
| Depth to seasonal water table (m) | Surface and sub-surface irrigation | > 1.0 | 0.5-1.0 | < 0.5 | Groundwater pollution hazard |
| | Absorption | > 1.5 | 1.0-1.5 | < 1.0 | Groundwater pollution hazard |
| Permeability Category | Surface and sub-surface irrigation | 2b, 3 and 4 | 2a, 5 | 1 and 6 | Excessive runoff and waterlogging |
| | Absorption | 3, 4 | | 1, 2, 5, 6 | Percolation |
| Coarse fragments % | All systems | 0-20 | 20-45 | >40 | Restricts plant growth, affects trench installation |
| Bulk density (g/cc)<br>SL<br>L, CL<br>C | All land application systems | <br>< 1.8<br>< 1.6<br>< 1.4 | <br>> 1.8<br>> 1.6<br>>1.4 | | restricts plant growth, indicator of permeability |
| pH | All land application systems | > 6.0 | 4.5-6.0 | - | Reduces plant growth |
| Electrical conductivity (dS/m) | All land application systems | <4 | 4-8 | >8 | Restricts plant growth |
| Sodicity (ESP) | Irrigation 0-40cm; absorption 0-1.2mtr | 0-5 | 5-10 | > 10 | Potential for structural degradation |
| CEC mequiv/100g | Irrigation systems | > 15 | 5-15 | < 5 | Nutrient leaching |
| P sorption kg/ha | All land application systems | > 6000 | 2000-6000 | < 2000 | Capacity to immobilise P |
| Modified Emerson Aggregate Test – depressiveness | All land application systems | Classes 3-4 | Class 2 | class1 | Potential for Structural degradation. |

# 5.0 SYSTEM REQUIREMENTS

## 5.1 Mid-Western Regional Council Setback Requirements

The Mid-Western Regional Council 'On-Site Sewage Management Plan' (2008), provides recommended buffer distances. For this design, the following must be taken into consideration.

### All Land Application Systems

- 80m to permanent surface waters (e.g. river, streams, lakes, etc.);
- 50m to domestic groundwater well on applicant's property and 200m to any groundwater well located on a neighbouring property;
- 40m to other waters (e.g. farm dams, intermittent waterways and drainage channels, etc.)

### Absorption Systems

- 12m if area up-grade and 6m if area down gradient of property boundary;
- 6m if area is up-gradient and 3m if area is down gradient of swimming pools, driveways and building.

Other site setback requirement as per AS/NZS 1547:2012 are provided in Appendix C.

**Actual siting of the effluent application area is the responsibility of the licenced plumber. The prescribed buffer areas/setbacks are to be adhered to.**

## 5.2 Design Allowances – AS/NZS1547:2012 Table H1

In accordance with AS/NZS1547:2012 Table H1, the recommended design flow allowance for use in Australia, using on site rainwater roof collection supply is 120L/person/day. Given the proposed residence is 4 bedrooms in total, the number of persons is calculated at 5.

# 6.0 SEPTIC TANK SELECTION AND CALCULATION

## 6.1 Silver Book/ NSW Health Guidelines

The '*On-Site Sewerage Management for Single Households*' (1998) guideline is based on the NSW Health guideline for septic tank capacity. Therefore, the calculation is the same.

Primary effluent treated will be provided by a NSW Health accredited septic tank. The NSW Health '*Septic Tank and Collection Well Accreditation Guidelines*' (2001), set a sludge allowance of 1550L irrespective of the number of persons or which the septic tank is to be designed. It should be noted that in accordance with this guideline, a septic tank designed for a minimum of 5 persons needs to be de-sludge approximately every 4 years.

The general formula to calculate the minimum septic tank capacity in litres is:

$$S + (DF\ x\ N) = C$$

$$Sludge + (Daily\ Flow\ X\ No.of\ Persons) = Capacity\ of\ the\ tank$$

Residence - When DF = 120L/per person/per day and N =5, therefore DF x N =**600L**

$$1550L + 600L = 2150L$$

*Table 2* in the NSW Health Guidelines provides a minimum of 2300L tank capacity.

## 6.2 AS/NZS 1547:2012 Requirements

A more conservative approach is outlined in AS/NZS1547:2012, Appendix J. A more conservative figure of 200L per person for all waste tanks is provided, giving a daily flow volume of 1000L for the residence. Therefore, a minimum capacity tank of **3200-3500L** is required for a residence with a design flow of <1000L. This conservative rate is to ensure that the unit has capacity to cope with peak discharge rates or for temporary or unusual overloads and includes no allowance for food waste disposal units. This tank design capacity also allows for the storage of sludge and scum at a rate of 80L/person/year. It should be noted that the higher cost of installing a larger septic tank may be offset by a reduced pump out frequency. Too frequent pump out removes microorganisms needed for degradation of wastewater solids. The longer pump out interval has beneficial implications for conservation of resources in that the volume of seepage requiring treatment and disposal can be reduced significantly.

## 6.3 System Recommendations

The following table provides details on the system selection.

Table 10: System Selection Details

| | | |
|---|---|---|
| Consideration of connection to centralised sewerage system | Distance to sewer | >10km |
| | Potential for future connection? | None planned |
| | Potential for reticulated water? | None planned |
| Expected Wastewater volume (litres/day) | **Residence** – 4-bedroom residence, potential occupancy of 5 people. Typical wastewater design flow is 120L/person per day in accordance with Table H3 of AS/NZS1547:2012 for households with full water reduction facilities, supplied by rainwater roof collection supply. Therefore, 5 people at 120L per person per day gives a total load of 600L/day | |
| Type of Treatment system best suited | 3200-3500L septic tank system– as per NSW Health accredited system - http://www.health.nsw.gov.au/environment/domesticwastewater/Pages/stcw.aspx<br>with primary treated effluent to be distributed to an Absorption Bed | |

Water conservation measures should be adapted to the greatest extent possible in the proposed residence, particularly in relation to the high-water use activities of showering, clothes washing and toilet flushing. AAA rated plumbing appliances and fittings should be used. Measures including use of front-loading washing machines, low volume shower roses and dual flush toilets can reduce water usage by 30-40%. Detergents low in phosphorous and sodium should be used as much as possible. Following these measures will ensure the greatest lifespan for this effluent treatment and disposal system.

# 7.0 EFFLUENT MANAGEMENT

Barnson Pty Ltd has analysed the proposed on-site waste management system in accordance with the NSW Government endorsed *'Silver Book'* (1998) and the ANZ Standard 1547:2012 On-site Domestic Wastewater Management', with additional advice sought from the Sydney Catchment Management Authority '*Designing and installing On-site Wastewater Systems'* 2019 guideline. For this site, given the climate and soil constraints, absorption is considered the most appropriate effluent management device.

## 7.1 Hydraulic Loading Calculation

Given the proposed residence will be connected by rainwater roof collection supply, the daily flow (Q) for the system is calculated as 600L/per day.

The required bed area shall be determined from the following relationship:

$$\boxed{Length\ of\ Absorption\ Bed\ = (Q)\ /\ (DLR\ x\ W)}$$

### Proposed Extension Residence

Where Q = 600L, DLR =5 mm/day (Table L1 AS 1577:2012 –Conservative Rate),

W (Width) = 3m

$$Length\ of\ Bed = (\frac{600}{5\ x\ 3m})$$
$$= 40m$$

***Therefore, from the above calculation, 2 x 20m long, 3m wide beds will be required for the proposed 4-bedroom residence.***

## 7.2 Design Recommendations

Common failures of beds/trenches are often caused by poor installation practices. In addition to specifications outlined in AS/NZS 1547:2012, the following points should also be considered in the bed/trench design/construction which to meet the *minimum* dimensions of ***2 beds, 20m long and 3m wide with a minimum of 1.0m spacing between beds.***

- Beds/trenches are to be built along the contour to ensure even distribution and avoid any section being over loaded;
- Avoid cutting beds into weakened ground;
- Construction is to take place during fine weather. If it rains beds are to be completely covered to protect them from rain damage;
- Where the beds/trenches are dug by an excavator in clay soils, the bed walls are to be scarified to remove any smearing caused by the excavator bucket;
- All distribution pipes and arches should be laid in accordance with the manufactures instructions;
- If two beds or more are utilised, ensure effluent is distributed evenly via a splitter box or sequencing valve or other appropriate method;
- All distribution pipes and arches should be laid in accordance with the manufactures instructions;
- Consideration can be given to using a pressure dosed system, which would allow for a better, more even distribution of effluent along the trench, and prolong trench life;
- Inspection ports shall be provided for the beds/trenches system. The inspection port shall be installed so as to facilitate monitoring of the effluent level in each trench;
- Trenches/Beds may be gravity fed or pressure dosed using pumps or dosing siphons;
- Vegetation cover must be well maintained to ensure strong growth for maximum update of transpiration. The surrounding landscape and vegetation must also be maintained to minimise shading and maximise exposure.
- The beds/trenches should be in an enclosed area, with and no exposed to vehicle movement or stock that can cause compaction and premature trench failure;
- The beds/trenches are to be constructed along the contour via laser levelling to ensure the base is exactly level;
- A diversion berm/bank/drain should be built upslope of the trench. This will reduce run on. A design sketch is provided at Appendix D.

# 8.0 RECOMMENDATIONS & CONCLUSIONS

As per the '*On-Site Sewerage Management for Single Households'* (1998) publication, stakeholders should be aware that all on site systems and components have a finite life and at some point will require replacement. Septic tanks and AWTS' generally require replacement every 25 years, whereas effluent disposal systems can have an expected life between 5-15 years. The owner is encouraged to obtain a copy of the NSW Government "The Easy Septic Guide" (2000) available from - http://www.olg.nsw.gov.au/sites/default/files/Easy-septic-guide.pdf

****As stated in AS1547-2012 section 5.5.3.4, a reserve application area of similar size to the current design should be considered as part of the risk management process to be available on a site for expansion or for resting of the land application system.*

The option provided in this report is a primary treatment septic fed into absorption beds. This is to be designed to accept the discharge from the wastewater treatment unit and it convey it securely and evenly to the land application area. The aim is to ensure uniform distribution of the effluent over the design area to help achieve effective aerobic/anaerobic decomposition within the soil. Typical design sketches for a bed/trench system as per AS 1547:2012 and *Design and Installation of On-Site Wastewater Treatment (*2012) are provided at ***Appendix D*.**

Installation instructions shall be provided by the manufacturer or designer. Barnson will not be liable for the incorrect installation and/or construction of the system unless when inspected by Barnson the installation and construction of the system holds true to the design featured in this report. Installation should be in accordance with the prescriptions within AS 1547:2012.

Barnson has not verified the accuracy or completeness of this data, except otherwise stated in this report. The recommendations for the proposed system as suggested in this report are based on historical data obtained for the area. Barnson will not be liable in relation to incorrect recommendations should any information provided by the client be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed.

The accuracy of geotechnical engineering advice provided in this report may be limited by unobserved variations in ground conditions across the site in areas between and beyond test locations and by any restrictions in the sampling and testing which was able to be carried out, as well as by the amount of data that could be collected given the project and site constraints.

These factors may lead to the possibility that actual ground conditions and materials behaviour observed at the test locations may differ from those which may be encountered elsewhere on the site.

If the sub-surface conditions are found to differ from those described in this report, we should be informed immediately to evaluate whether recommendations should be reviewed and amended if necessary.

Please do not hesitate to contact the undersigned if you have enquires regarding this report.

Yours Faithfully

Jeremy Wiatkowski
Laboratory Technician

Reviewed By

[redacted]

Luke Morris
B.E. MIEAust CPEng (NPER)
Director

# Appendix A – Water Balance Calculation

| | | |
|---|---|---|
| **Barnson Job No** | 36296-ER02_A | |
| **Location :** | Kains Flat | |

| | | | |
|---|---|---|---|
| **Design Wastewater Flow** | **Q** | **l/day** | 600 |
| **Design Loading Rate** | **R** | **mm/day** | 5 |

| | | |
|---|---|---|
| **Climate Zone** | 3 C | *As per Soil Landscapes of Dubbo 1:250 000*<br>**Dropbox** |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | |
|---|---|---|---|---|---|---|---|---|---|
| **Month** | **Pan evap E (mm)** | **Evapo Transpiration Et (ET=0.75E)mm** | **Rainfall R (mm)** | **Retained Rainfall Rr (Rr=0.75R) mm** | **DLR per Month (mm)** | **Disposal Rate (3-5+6) mm** | **uent applied per mo (L)** | **Size of Area (8/7) m²** | **Days In Month** |
| **Jan** | 229 | 171.75 | 94 | 70.5 | 155 | 256.25 | 18600 | 72.58536585 | **31** |
| **Feb** | 178 | 133.5 | 86 | 64.5 | 145 | 214 | 17400 | 81.30841121 | **29** |
| **Mar** | 155 | 116.25 | 76 | 57 | 155 | 214.25 | 18600 | 86.81446908 | **31** |
| **Apr** | 104 | 78 | 64 | 48 | 150 | 180 | 18000 | 100 | **30** |
| **May** | 51 | 38.25 | 70 | 52.5 | 155 | 140.75 | 18600 | 132.1492007 | **31** |
| **Jun** | 46 | 34.5 | 75 | 56.25 | 150 | 128.25 | 18000 | 140.3508772 | **30** |
| **Jul** | 41 | 30.75 | 60 | 45 | 155 | 140.75 | 18600 | 132.1492007 | **31** |
| **Aug** | 58 | 43.5 | 66 | 49.5 | 155 | 149 | 18600 | 124.8322148 | **31** |
| **Sep** | 89 | 66.75 | 60 | 45 | 150 | 171.75 | 18000 | 104.8034934 | **30** |
| **Oct** | 130 | 97.5 | 81 | 60.75 | 155 | 191.75 | 18600 | 97.00130378 | **31** |
| **Nov** | 165 | 123.75 | 78 | 58.5 | 150 | 215.25 | 18000 | 83.62369338 | **30** |
| **Dec** | 229 | 171.75 | 96 | 72 | 155 | 254.75 | 18600 | 73.01275761 | **31** |
| | | | | | | | **Mean area** | 102.4m² | |

| **Month** | **First trial area** | **Application rate** | **Disposal rate** | **mm** | **Increase in Depth of Stored Effluent** | **th of Effluent for Mo** | **Increase in Depth of Effluent** | **Computed** | **Reset if Et<0** | **Equiv Storage** |
|---|---|---|---|---|---|---|---|---|---|---|
| **Dec** | 120m² | 155 | 254.75 | -99.75 | -332.5 | 0 | -332.5 | -332.5 | 0 | 0 |
| **Jan** | | 155 | 256.25 | -101.25 | -337.5 | 0 | -337.5 | -337.5 | 0 | 0 |
| **feb** | | 145 | 214 | -69 | -230 | 0 | -230 | -230 | 0 | 0 |
| **Mar** | | 155 | 214.25 | -59.25 | -197.5 | 0 | -197.5 | -197.5 | 0 | 0 |
| **Apr** | | 150 | 180 | -30 | -100 | 0 | -100 | -100 | 0 | 0 |
| **May** | | 155 | 140.75 | 14.25 | 47.5 | 0 | 47.5 | 47.5 | 47.5 | 5700 |
| **Jun** | | 150 | 128.25 | 21.75 | 72.5 | 47.5 | 120 | 120 | 120 | 14400 |
| **Jul** | | 155 | 140.75 | 14.25 | 47.5 | 120 | 167.5 | 167.5 | 167.5 | 20100 |
| **Aug** | | 155 | 149 | 6 | 20 | 167.5 | 187.5 | 187.5 | 187.5 | 22500 |
| **Sep** | | 150 | 171.75 | -21.75 | -72.5 | 187.5 | 115 | 115 | 115 | 13800 |
| **Oct** | | 155 | 191.75 | -36.75 | -122.5 | 115 | -7.5 | -7.5 | 0 | 0 |
| **Nov** | | 150 | 215.25 | -65.25 | -217.5 | 0 | -217.5 | -217.5 | 0 | 0 |
| **Dec** | | 155 | 254.75 | -99.75 | -332.5 | 0 | -332.5 | -332.5 | 0 | 0 |
| **Jan** | | 155 | 256.25 | -101.25 | -337.5 | 0 | -337.5 | -337.5 | 0 | 0 |
| **Feb** | | 145 | 214 | -69 | -230 | 0 | -230 | -230 | 0 | 0 |
| **Mar** | | 155 | 214.25 | -59.25 | -197.5 | 0 | -197.5 | -197.5 | 0 | 0 |
| **Apr** | | 150 | 180 | -30 | -100 | 0 | -100 | -100 | 0 | 0 |
| **May** | | 155 | 140.75 | 14.25 | 47.5 | 0 | 47.5 | 47.5 | 47.5 | 5700 |

| | |
|---|---|
| **Estimated area of effluent drainfield** | 120m² |
| **Maximum depth of stored effluent (must not exceed 350mm)** | 187.5mm |
| **Bed/Trench dimensions** | 3000mm |
| **Length of bed/trench required** | 40m |
| **<20m lengths of bed/trench** | 2 |

| | |
|---|---|
| **Trench Depth** | 450 |

# Appendix B - Borehole Logs & Laboratory Testing Results

Barnson
1/36 Darling Street
Dubbo NSW 2830
Telephone: 1300 227 676

# BOREHOLE NUMBER 4

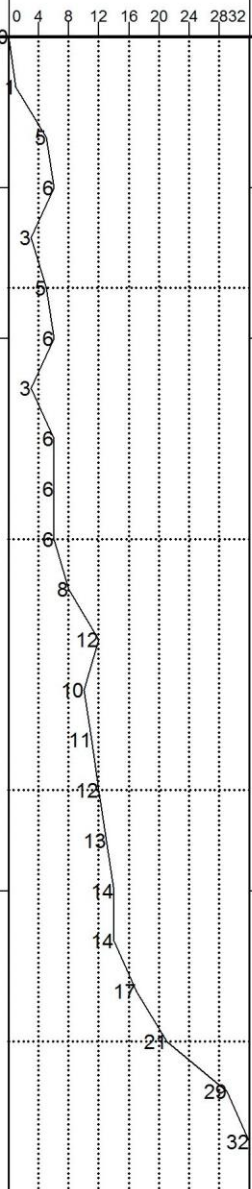


**CLIENT** John Grosse
**PROJECT NAME** Site Classification
**PROJECT NUMBER** 36296
**PROJECT LOCATION** 705 Kain's Flat Road, Kains Flat NSW

**DATE STARTED** 30/3/21 **COMPLETED** 30/3/21
**R.L. SURFACE** **DATUM**
**DRILLING CONTRACTOR** Barnson
**SLOPE** 90° **BEARING** ---
**EQUIPMENT** GT-10 Drill Rig
**HOLE LOCATION** Borehole 4 - Proposed Extension
**HOLE SIZE** 90mm
**LOGGED BY** HC **CHECKED BY** NR
**NOTES**

| Method | Samples | Depth (m) | Classification Symbol | Material Description | Additional Observations |
|---|---|---|---|---|---|
| Flight Auger & Tungsten Carbide (T.C) Bit | | 0.0 – 0.3 | | LOAM: black | TOPSOIL |
| | | 0.3 – 0.6 | CL | Sandy Silty CLAY: brown: slightly moist: stiff to very stiff: medium plasticity | RESIDUAL |
| | Disturbed Sample LS = 11.0% | 0.6 – 1.7 | CL | Sandy Silty CLAY: orange mottled grey: slightly moist: very stiff to hard: medium plasticity | RESIDUAL |
| | Disturbed Sample LS = 9.0% | 1.7 – 3.0 | CL | Silty CLAY: brown mottled grey: slightly moist: hard: medium plasticity | RESIDUAL |

Dynamic Cone Penetrometer Blows / 100mm




Borehole 4 terminated at 3m

Barnson
1/36 Darling Street
Dubbo NSW 2830
Telephone: 1300 227 676

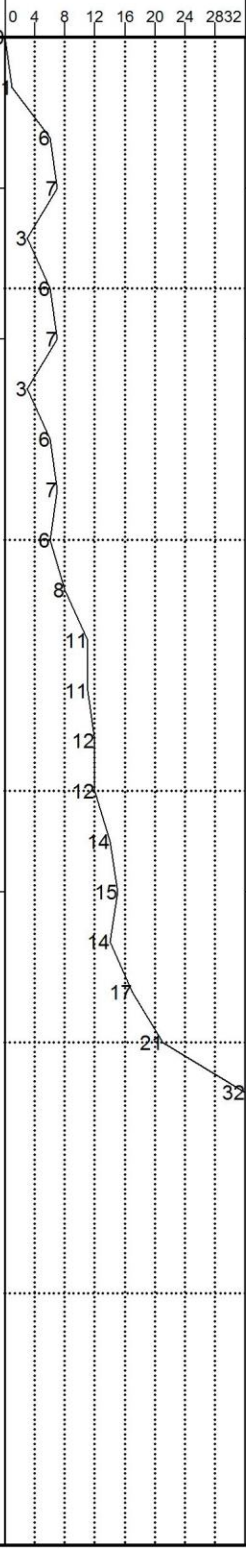
# BOREHOLE NUMBER 5



**CLIENT** John Grosse
**PROJECT NAME** Site Classification
**PROJECT NUMBER** 36296
**PROJECT LOCATION** 705 Kain's Flat Road, Kains Flat NSW

**DATE STARTED** 30/3/21 **COMPLETED** 30/3/21
**R.L. SURFACE** 
**DATUM** 
**DRILLING CONTRACTOR** Barnson
**SLOPE** 90°
**BEARING** ---
**EQUIPMENT** GT-10 Drill Rig
**HOLE LOCATION** Borehole 5 - Proposed Extension
**HOLE SIZE** 90mm
**LOGGED BY** HC
**CHECKED BY** NR
**NOTES** 

| Method | Samples | Depth (m) | Graphic Log | Classification Symbol | Material Description | Dynamic Cone Penetrometer Blows / 100mm | Additional Observations |
|---|---|---|---|---|---|---|---|
| Flight Auger & Tungsten Carbide (T.C) Bit | | 0.0–0.3 | | | LOAM: black | | TOPSOIL |
| | | 0.3–0.6 | | CL | Sandy Silty CLAY: brown: slightly moist: stiff to very stiff: medium plasticity | | RESIDUAL |
| | | 0.6–1.7 | | CL | Sandy Silty CLAY: orange mottled grey: slightly moist: very stiff to hard: medium plasticity | | RESIDUAL |
| | | 1.7–3.0 | | CL | Silty CLAY: brown mottled grey: slightly moist: hard: medium plasticity | | RESIDUAL |




Borehole 5 terminated at 3m

# BOREHOLE NUMBER 6

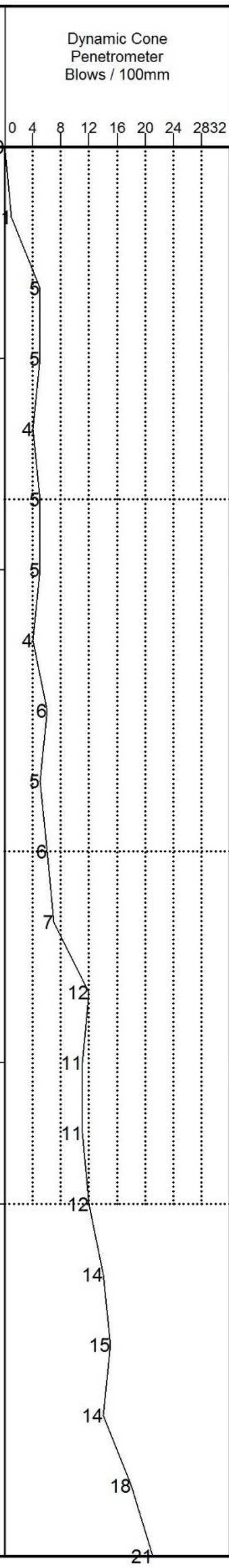


Barnson
1/36 Darling Street
Dubbo NSW 2830
Telephone: 1300 227 676

**CLIENT** John Grosse
**PROJECT NAME** Septic Design
**PROJECT NUMBER** 36296
**PROJECT LOCATION** 705 Kain's Flat Road, Kains Flat NSW

**DATE STARTED** 30/3/21 **COMPLETED** 30/3/21
**R.L. SURFACE** **DATUM**
**DRILLING CONTRACTOR** Barnson
**SLOPE** 90° **BEARING** ---
**EQUIPMENT** GT-10 Drill Rig
**HOLE LOCATION** Borehole 6
**HOLE SIZE** 90mm
**LOGGED BY** HC **CHECKED BY** NR
**NOTES**

| Method | Samples | Depth (m) | Graphic Log | Classification Symbol | Material Description | Additional Observations |
|---|---|---|---|---|---|---|
| Flight Auger & Tungsten Carbide (T.C) Bit | | 0.3 | | | LOAM: black | TOPSOIL |
| | | 0.5, 0.6 | | CL | Sandy Silty CLAY: brown: slightly moist: stiff to very stiff: medium plasticity | RESIDUAL |
| | Disturbed Sample LS = 12.0% P I = 28% | 1.0, 1.3 | | CL | Sandy Silty CLAY: orange mottled grey: slightly moist: very stiff to hard: medium plasticity | RESIDUAL |
| | | 1.5 | | SC | Clayey SAND: grey: slightly moist: very dense: low to medium plasticity | RESIDUAL |
| | | 2.0 | | | Borehole 6 terminated at 1.5m | |



# Material Test Report

| | |
|---|---|
| **Report Number:** | **36296-1** |
| **Issue Number:** | 1 |
| **Date Issued:** | 19/04/2021 |
| **Client:** | John Grosse |
| | 705 Kain's Flat Road, Kain's Flat NSW 2850 |
| **Contact:** | John Grosse |
| **Project Number:** | 36296 |
| **Project Name:** | Site Classification & Septic Design |
| **Project Location:** | 705 Kain's Flat Road, Kains Flat NSW |
| **Work Request:** | 4537 |
| **Sample Number:** | D21-4537D |
| **Date Sampled:** | 30/03/2021 |
| **Dates Tested:** | 31/03/2021 - 07/04/2021 |
| **Sampling Method:** | AS 1289.1.2.1 6.5.3 - Power auger drilling |
| **Sample Location:** | **Borehole 4, Depth: 800mm** |
| **Material:** | Orange Mottled Grey Sandy Silty CLAY |

barnson
DESIGN.PLAN.MANAGE
Barnson Pty Ltd
Dubbo Laboratory
16 L Yarrandale Road Dubbo NSW 2830
Phone: 1300 BARNSON
Email: jeremy@barnson.com.au

Accredited for compliance with ISO/IEC 17025 - Testing

NATA
WORLD RECOGNISED ACCREDITATION

Approved Signatory: Jeremy Wiatkowski
Geotechnical Technician

NATA Accredited Laboratory Number: 9605

| Linear Shrinkage (AS1289 3.4.1) | | Min | Max |
|---|---|---|---|
| Sample History | Oven Dried | | |
| Preparation Method | Dry Sieve | | |
| Moisture Condition Determined By | AS 1289.3.1.2 | | |
| Linear Shrinkage (%) | 11.0 | | |
| Cracking Crumbling Curling | None | | |

# Material Test Report

| | |
|---|---|
| **Report Number:** | **36296-1** |
| **Issue Number:** | 1 |
| **Date Issued:** | 19/04/2021 |
| **Client:** | John Grosse |
| | 705 Kain's Flat Road, Kain's Flat NSW 2850 |
| **Contact:** | John Grosse |
| **Project Number:** | 36296 |
| **Project Name:** | Site Classification & Septic Design |
| **Project Location:** | 705 Kain's Flat Road, Kains Flat NSW |
| **Work Request:** | 4537 |
| **Sample Number:** | D21-4537E |
| **Date Sampled:** | 30/03/2021 |
| **Dates Tested:** | 31/03/2021 - 07/04/2021 |
| **Sampling Method:** | AS 1289.1.2.1 6.5.3 - Power auger drilling |
| **Sample Location:** | **Borehole 4, Depth: 2.0m** |
| **Material:** | Brown Mottled Grey Silty CLAY |

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DESIGN.PLAN.MANAGE
Barnson Pty Ltd
Dubbo Laboratory
16 L Yarrandale Road Dubbo NSW 2830
Phone: 1300 BARNSON
Email: jeremy@barnson.com.au

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NATA
WORLD RECOGNISED ACCREDITATION

Approved Signatory: Jeremy Wiatkowski
Geotechnical Technician

NATA Accredited Laboratory Number: 9605

| Linear Shrinkage (AS1289 3.4.1) | | Min | Max |
|---|---|---|---|
| Sample History | Oven Dried | | |
| Preparation Method | Dry Sieve | | |
| Moisture Condition Determined By | AS 1289.3.1.2 | | |
| Linear Shrinkage (%) | 9.0 | | |
| Cracking Crumbling Curling | None | | |

# Material Test Report

| | |
|---|---|
| **Report Number:** | **36296-1** |
| **Issue Number:** | 1 |
| **Date Issued:** | 19/04/2021 |
| **Client:** | John Grosse |
| | 705 Kain's Flat Road, Kain's Flat NSW 2850 |
| **Contact:** | John Grosse |
| **Project Number:** | 36296 |
| **Project Name:** | Site Classification & Septic Design |
| **Project Location:** | 705 Kain's Flat Road, Kains Flat NSW |
| **Work Request:** | 4537 |
| **Sample Number:** | D21-4537F |
| **Date Sampled:** | 30/03/2021 |
| **Dates Tested:** | 31/03/2021 - 07/04/2021 |
| **Sampling Method:** | AS 1289.1.2.1 6.5.3 - Power auger drilling |
| **Sample Location:** | **Borehole 6, Depth: 800mm** |
| **Material:** | Brown Mottled Grey Silty CLAY |

barnson
DESIGN.PLAN.MANAGE
Barnson Pty Ltd
Dubbo Laboratory
16 L Yarrandale Road Dubbo NSW 2830
Phone: 1300 BARNSON
Email: jeremy@barnson.com.au

Accredited for compliance with ISO/IEC 17025 - Testing

NATA
WORLD RECOGNISED ACCREDITATION

Approved Signatory: Jeremy Wiatkowski
Geotechnical Technician

NATA Accredited Laboratory Number: 9605

| Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1) | | Min | Max |
|---|---|---|---|
| Sample History | Oven Dried | | |
| Preparation Method | Dry Sieve | | |
| Liquid Limit (%) | 43 | | |
| Plastic Limit (%) | 15 | | |
| **Plasticity Index (%)** | **28** | | |

| Linear Shrinkage (AS1289 3.4.1) | | Min | Max |
|---|---|---|---|
| Moisture Condition Determined By | AS 1289.3.1.2 | | |
| Linear Shrinkage (%) | 12.0 | | |
| Cracking Crumbling Curling | None | | |

| Emerson Class Number of a Soil (AS 1289 3.8.1) | | Min | Max |
|---|---|---|---|
| Emerson Class | **6** | | |
| Soil Description | Brown Mottled Grey Silty CLAY | | |
| Nature of Water | Distilled | | |
| Temperature of Water ($^{o}$C) | 21 | | |

# Appendix C – Site Setback Requirements

**TABLE R1**
**GUIDELINES FOR HORIZONTAL AND VERTICAL SETBACK DISTANCES**
(to be used in conjunction with Table R2)

| **Site feature** | **Setback distance range** (m)<br>(See Note 1) | **Site constraint items of specific concern**<br>(from Table R2)<br>(see Note 1) |
|---|---|---|
| | ***Horizontal setback distance*** *(m)* | |
| **Property boundary** | 1.5 – 50 (see Note 2) | A, D, J |
| **Buildings/houses** | 2.0 – > 6 (see Note 3) | A, D, J |
| **Surface water** (see Note 4) | 15 – 100 | A, B, D, E, F, G, J |
| **Bore, well** (see Notes 5 and 6) | 15 – 50 | A, C, H, J |
| **Recreational areas (Children's play areas, swimming pools and so on)** (see Note 7) | 3 – 15<br>(see Notes 8 and 9) | A, E, J |
| **In-ground water tank** | 4 – 15 (see Note 10) | A, E, J |
| **Retaining wall and Embankments, escarpments, cuttings** (see Note 11) | 3.0 m or 45° angle from toe of wall (whichever is greatest) | D, G, H |
| | ***Vertical setback distance*** *(m)* | |
| **Groundwater**<br>(see Notes 5, 6, and 12) | 0.6 – > 1.5 | A, C, F, H, I, J |
| **Hardpan or bedrock** | 0.5 – ≥ 1.5 | A, C, J |

NOTES:

1 The overall setback distance should be commensurate with the level of risk to public health and the environment. For example, the maximum setback distance should be adopted where site/system features are on the high end of the constraint scale. The setback distance should be based on an evaluation of the constraint items and corresponding sensitive features in Table R2 and how these interact to provide a pathway or barrier for wastewater movement.

2 Subject to local regulatory rules and design by a suitably qualified and experienced person, the separation of a drip line system from an upslope boundary, for slopes greater than 5%, may be reduced to 0.5 m.

**TABLE R1**

**GUIDELINES FOR HORIZONTAL AND VERTICAL SETBACK DISTANCES**

(to be used in conjunction with Table R2) (continued)

| | |
|---|---|
| 3 | Setback distances of less than 3 m from houses are appropriate only where a drip irrigation land application system is being used with low design irrigation rates, where shallow subsurface systems are being used with equivalent low areal loading rates, where the risk of reducing the bearing capacity of the foundation or damaging the structure is low, or where an effective barrier (designed by a suitably qualified and experienced person) can be installed. This may require consent from the regulatory authority. |
| 4 | Setback distance from surface water is defined as the areal edge of the land application system to the edge of the water. Where land application areas are planned in a water supply catchment, advice on adequate buffer distances should be sought from the relevant water authority and a hydrogeologist. Surface water, in this case, refers to any fresh water or geothermal water in a river, lake, stream, or wetland that may be permanently or intermittently flowing. Surface water also includes water in the coastal marine area and water in man-made drains, channels, and dams unless these are to specifically divert surface water away from the land application area. Surface water excludes any water in a pipe or tank. |
| 5 | Highly permeable stony soils and gravel aquifers potentially allow microorganisms to be readily transported up to hundreds of metres down the gradient of an on-site system (see R3, Table 1 in Pang et al. 2005). Maximum setback distances are recommended where site constraints are identified at the high scale for items A, C, and H. For reading and guidance on setback distances in highly permeable soils and coarse-grained aquifers see R3. As microbial removal is not linear with distance, data extrapolation of experiments should not be relied upon unless the data has been verified in the field. Advice on adequate buffer distances should be sought from the relevant water authority and a hydrogeologist. |
| 6 | Setback distances from water supply bores should be reviewed on a case-by-case basis. Distances can depend on many factors including soil type, rainfall, depth and casing of bore, direction of groundwater flow, type of microorganisms, existing quality of receiving waters, and resource value of waters. |
| 7 | Where effluent is applied to the surface by covered drip or spray irrigation, the maximum value is recommended. |
| 8 | In the case of subsurface application of primary treated effluent by LPED irrigation, the upper value is recommended. |
| 9 | In the case of surface spray, the setback distances are based on a spray plume with a diameter not exceeding 2 m or a plume height not exceeding 0.5 m above finished surface level. The potential for aerosols being carried by the wind also needs to be taken into account. |
| 10 | It is recommended that land application of primary treated effluent be down gradient of in-ground water tanks. |
| 11 | When determining minimum distances from retaining walls, embankments, or cut slopes, the type of land application system, soil types, and soil layering should also be taken into account to avoid wastewater collecting in the subsoil drains or seepage through cuts and embankments. Where these situations occur setback clearances may need to be increased. In areas where slope stability is of concern, advice from a suitably qualified and experienced person may be required. |
| 12 | Groundwater setback distance (depth) assumes unsaturated flow and is defined as the vertical distance from the base of the land application systems to the highest seasonal water table level. To minimise potential for adverse impacts on groundwater quality, minimum setback distances should ensure unsaturated, aerobic conditions in the soil. These minimum depths will vary depending on the scale of site constraints identified in Table R2. Where groundwater setback is insufficient, the ground level can be raised by importing suitable topsoil and improving effluent treatment. The regulatory authority should make the final decision in this instance. (See also the guidance on soil depth and groundwater clearance in Tables K1 and K2.) |

### TABLE R2

### SITE CONSTRAINT SCALE FOR DEVELOPMENT OF SETBACK DISTANCES

(used as a guide in determining appropriate setback distances from ranges given in Table R1)

| Item | Site/system feature | Constraint scale (see Note 1) LOWER ← → HIGHER Examples of constraint factors (see Note 2) | | Sensitive features |
|---|---|---|---|---|
| A | Microbial quality of effluent (see Note 3) | Effluent quality consistently producing ≤ 10 cfu/100 mL *E. coli* (secondary treated effluent with disinfection) | Effluent quality consistently producing ≥ $10^6$ cfu/100 mL *E. coli* (for example, primary treated effluent) | Groundwater and surface pollution hazard, public health hazard |
| B | Surface water (see Note 4) | Category 1 to 3 soils (see Note 5) no surface water down gradient within > 100 m, low rainfall area | Category 4 to 6 soils, permanent surface water <50 m down gradient, high rainfall area, high resource/environmental value (see Note 6) | Surface water pollution hazard for low permeable soils, low lying or poorly draining areas |
| C | Groundwater | Category 5 and 6 soils, low resource/environmental value | Category 1 and 2 soils, gravel aquifers, high resource/environmental value | Groundwater pollution hazard |
| D | Slope | 0 – 6% (surface effluent application)<br>0 – 10% (subsurface effluent application) | > 10% (surface effluent application), > 30% subsurface effluent application | Off-site export of effluent, erosion |
| E | Position of land application area in landscape (see Note 6). | Downgradient of surface water, property boundary, recreational area | Upgradient of surface water, property boundary, recreational area | Surface water pollution hazard, off-site export of effluent |
| F | Drainage | Category 1 and 2 soils, gently sloping area | Category 6 soils, sites with visible seepage, moisture tolerant vegetation, low lying area | Groundwater pollution hazard |
| G | Flood potential | Above 1 in 20 year flood contour | Below 1 in 20 year flood contour | Off-site export of effluent, system failure, mechanical faults |
| H | Geology and soils | Category 3 and 4 soils, low porous regolith, deep, uniform soils | Category 1 and 6 soils, fractured rock, gravel aquifers, highly porous regolith | Groundwater pollution hazard for porous regolith and permeable soils |
| I | Landform | Hill crests, convex side slopes, and plains | Drainage plains and incise channels | Groundwater pollution hazard, resurfacing hazard |
| J | Application method | Drip irrigation or subsurface application of effluent | Surface/above ground application of effluent | Off-site export of effluent, surface water pollution |

NOTES:

1 Scale shows the level of constraint to siting an on-site system due to the constraints identified by SSE evaluator or regulatory authority. See Figures R1 and R2 for examples of on-site system design boundaries and possible site constraints.

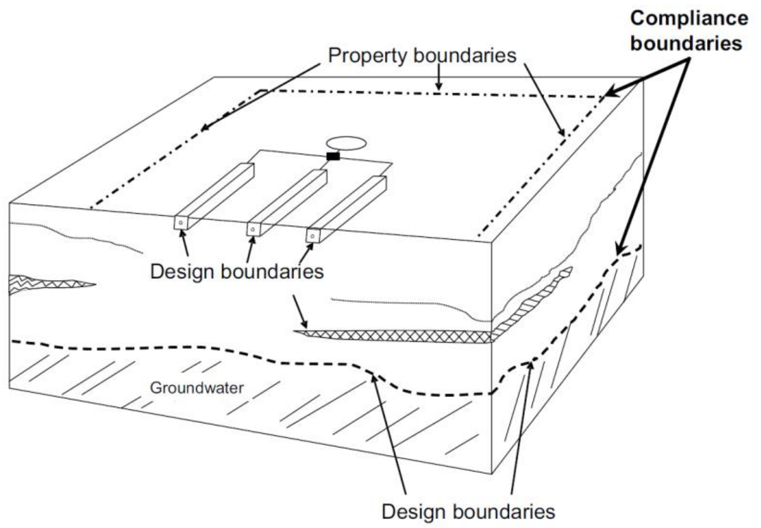
2 Examples of typical siting constraint factors that may be identified either by SSE evaluator or regulatory authority. Site constraints are not limited to this table. Other site constraints may be identified and taken into consideration when determining setback distances.

**TABLE R2**

**SITE CONSTRAINT SCALE FOR DEVELOPMENT OF SETBACK DISTANCES**

(used as a guide in determining appropriate setback distances from ranges given in Table R1) (continued)

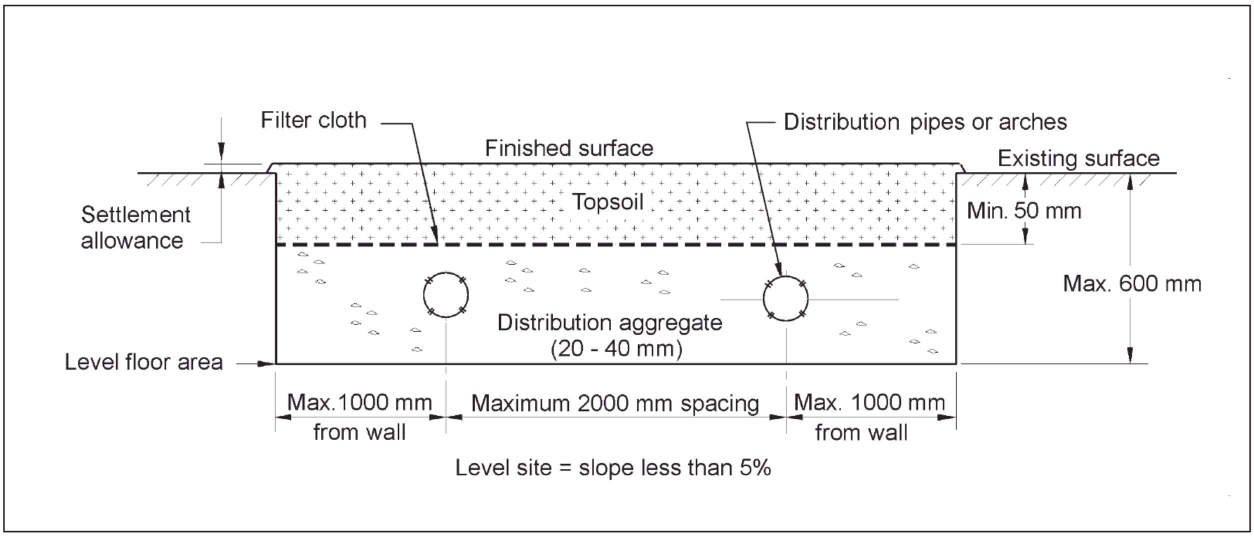
| | |
|---|---|
| 3 | The level of microbial removal for any on-site treatment system needs to be determined and it should be assumed that unless disinfection is reliably used then the microbial concentrations will be similar to primary treatment. Low risk microbial quality value is based on the values given in ARC (2004), ANZECC and ARMCANZ (2000), and EPA Victoria *(Guidelines for environmental management: Use of reclaimed water* 2003). |
| 4 | Surface water, in this case, refers to any fresh water or geothermal water in a river, lake, stream, or wetland that may be permanently or intermittently flowing. Surface water also includes water in the coastal marine area and water in man-made drains, channels, and dams unless these are to specifically divert surface water away from the land application area. Surface water excludes any water in a pipe or tank. |
| 5 | The soil categories 1 to 6 are described in Table 5.1. Surface water or groundwater that has high resource value may include potable (human or animal) water supplies, bores, wells, and water used for recreational purposes. Surface water or groundwater of high environmental value include undisturbed or slightly disturbed aquatic ecosystems as described in ANZECC and ARMCANZ (2000). |
| 6 | The regulatory authority may reduce or increase setback distances at their discretion based on the distances of the land application up or downgradient of sensitive receptors. |




(Adapted from USEPA 2002)

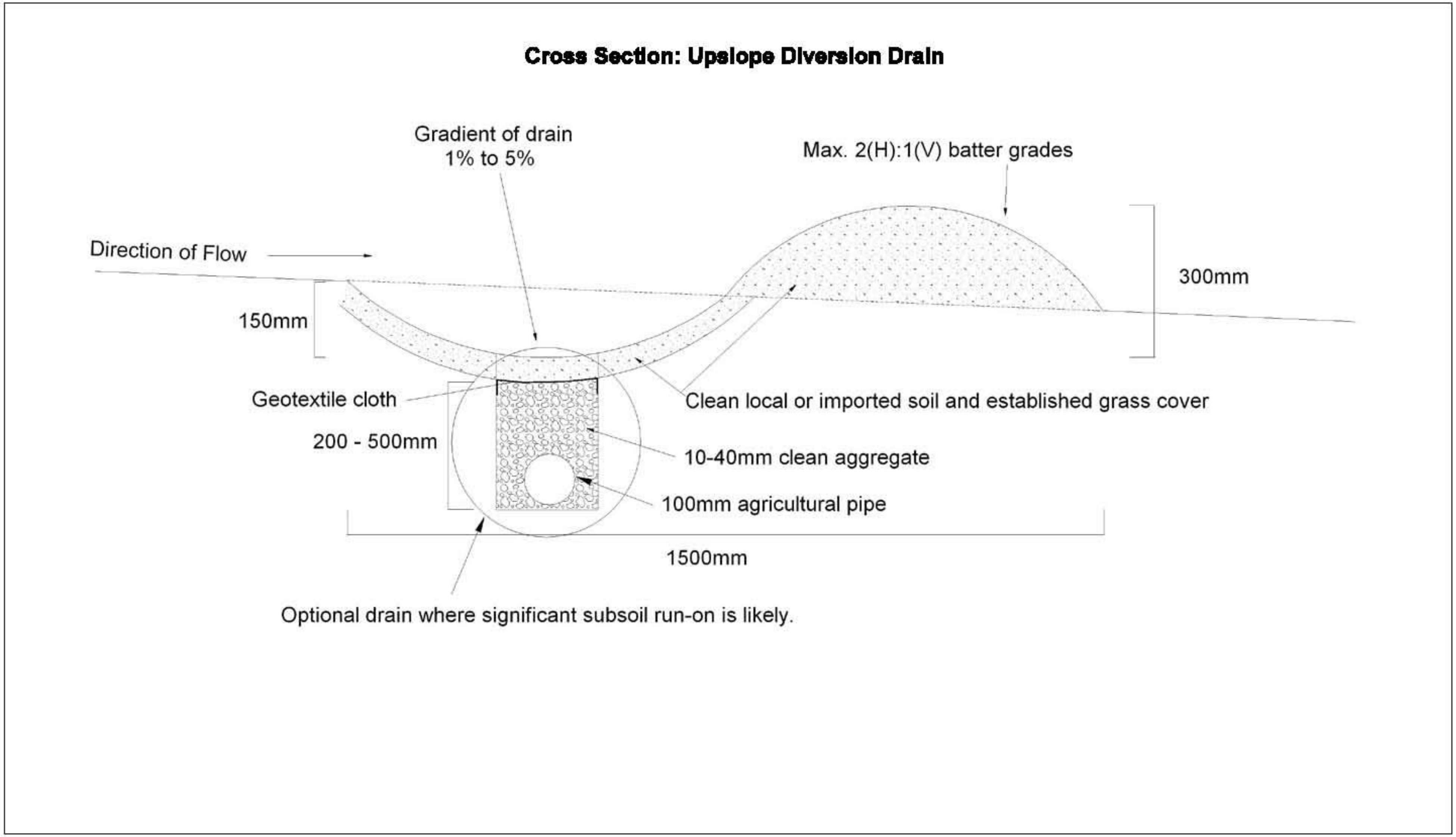
**FIGURE R1 EXAMPLE OF DESIGN AND COMPLIANCE BOUNDARIES FOR APPLICATION OF SETBACK DISTANCES FOR A SOIL ABSORPTION SYSTEM**

# Appendix D -Absorption Bed Concept Plans



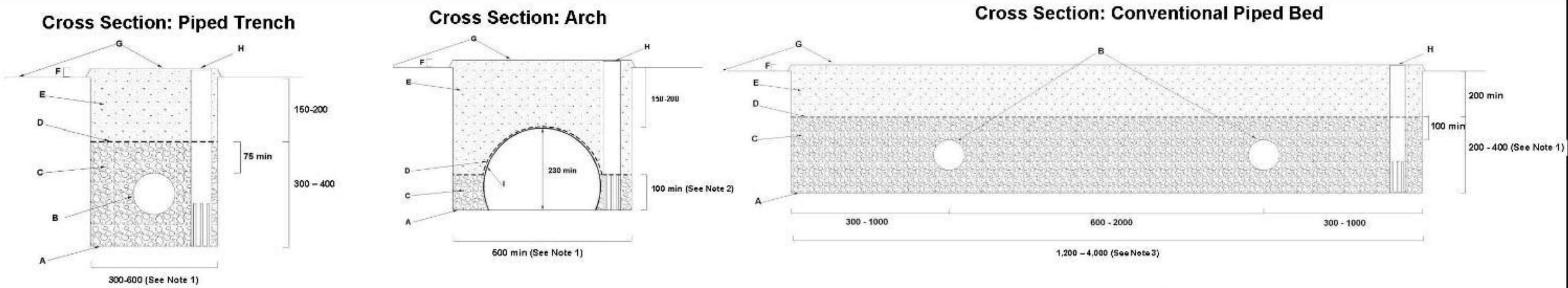

NOTE: LPED lines can be used instead of distribution pipes when dose loading effluent into beds.

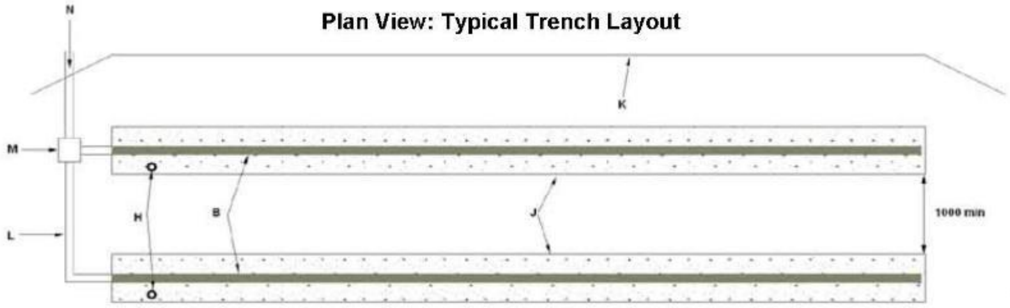
**FIGURE L5 CONVENTIONAL BED**

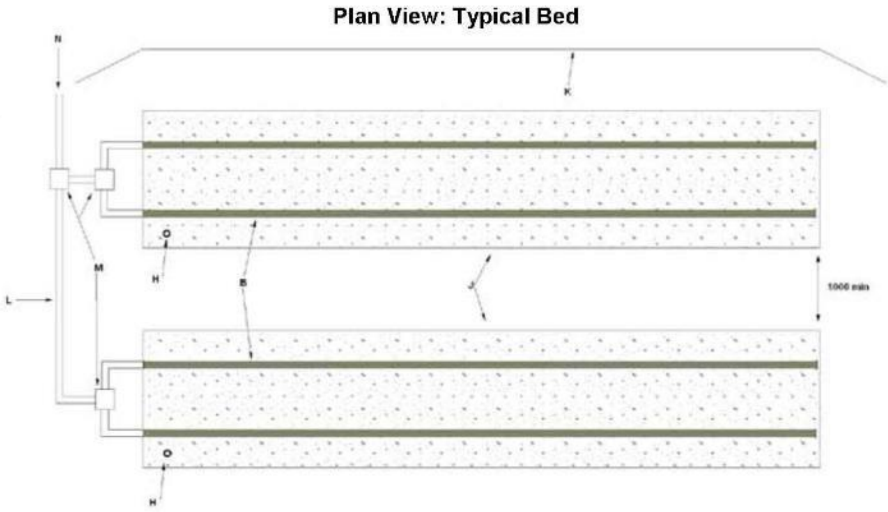



**Standard Drawing 10A - Upslope Diversion Drain**

(not to scale)




## Absorption Trench / Bed

**A** The base of the trench must be level to ensure even distribution of effluent. Base levels should be checked with a dumpy / laser level.

**B** 90-100 mm slotted PVC pipe.

**C** 20-40 mm distribution aggregate.

**D** Geotextile filter cloth.

**E** Clean local or imported topsoil (sandy loam to clay loam).

**F** Allowance for settling after backfilling.

**G** Grass must be established across the construction area as soon as possible. Trench / bed surface must be slightly mounded.

**H** Inspection port on downhill side of trench / bed. Made from 50 mm PVC pipe with perforations in the aggregate level of the trench / bed.

**I** Self supporting arch trench that complies with AS/NZS1547:2012.

**J** Trench / bed dimensions are an example only. The basal area of the land application area must be determined according to the procedures set out in AS/NZS1547:2012 and this document. The location and orientation of the area should be based on a site and soil assessment by a suitably qualified person. The system may comprise a single trench / bed or multiple smaller trenches / beds. It is essential that effluent is distributed evenly to all units on a daily basis.

**K** Upslope stormwater diversion drain (see Standard Drawing No.9A for design detail). Subsoil drainage may be necessary on particular sites.

**L** 90-100 mm PVC gravity dosing pipe.

**M** Gravity splitter box to distribute effluent evenly between two to four separate trenches / beds. Should also be used to evenly dose multiple pipework within a single trench / bed.

**N** Gravity or pump fed effluent from treatment system.

## Notes

**1** Trenches should be a maximum of 600 mm (piped trench) or 1,000 mm (arch trench) wide. Optimum width will balance storage requirements against footprint and required trench length.

**2** 100 mm of aggregate is the minimum depth. Depth can be increased to provide more storage if required, however, a minimum 150-200 mm of topsoil must exist above the top of the arch trench material. Alternative proprietary void / support materials are available to provide a substitute for both aggregate and arch trench.

**3** Consideration should be given to maintaining a level base when determining an appropriate width.

Gravity-fed beds are generally not suitable for sites with highly permeable soils due to difficulties in maintaining even distribution. Primary-treated effluent should not be dosed; effluent should at least be secondary-treated. Pressure dosing should be used in such soils.

## Standard Drawing 10B - Absorption Trench / Bed

(not to scale)

# LIST OF PLATES

**Plate 1 – Overview of proposed site**