ONSITE WASTEWATER MANAGEMENT ASSESSMENT REPORT

Proposed Two (2) x Lot Subdivision

Lot 17 DP 818185
No 1022 Crescent Head Road
Crescent Head

Paul & Ariane Brose

November 2021

1.0 INTRODUCTION

This report has been prepared on behalf of the owners for a proposed two (2) x lot subdivision on land known as Lot 17 DP 818185 No 1022 Crescent Head Road, Crescent Head.

The report contains an assessment of soil and site conditions and provides recommendations for the most suitable types of onsite wastewater management systems that could be utilized.

Site investigations were carried out on the 15th July 2021 and 6th September 2021 to determine site and soil conditions.

The site and soil assessments, design details and calculations have been carried out in accordance with the following technical and regulatory documents:

- AS/NZS 1547-2012 Onsite domestic-wastewater management.
- NSW Government Environment and Health Protection Guidelines - Onsite Wastewater Management for Single Households.

NOTE

This report has been prepared with all reasonable skill, care and diligence and the information contained in this report has been gathered from the field survey and experience.

The report recognizes the importance of the correct installation of onsite wastewater management systems, coupled with ongoing appropriate and regular maintenance in ensuring that satisfactory environmental health outcomes are obtained and maintained into the future.

The report is confidential and the writer accepts no responsibility of whatsoever nature, to third parties who use this report, or part thereof is made known. Any such party relies on this report at their own risk.

2.0 SITE DECRIPTION

The site is located at Lot 17 DP 818185 No 1022 Crescent Head Road, Crescent Head and is situated within the Kempsey Shire Council Local Government Area.

Figure 1 –Topographical Map

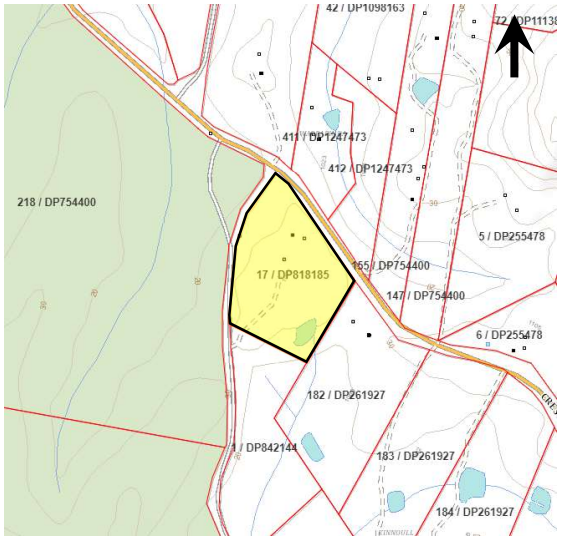


Figure 2 – Aerial Photograph

3.0 HISTORY AND PROPOSED DEVELOPMENT

There is an existing four (4) x bedroom dwelling with an onsite wastewater management system located on proposed Lot 1.

The existing system is located in an area that is to be subdivided and therefore a new system is required.

This report allows for a proposed four (4) x bedroom dwelling on proposed Lot 2.

The subject lot is approximately eight (8) hectares in size.

4.0 SITE ASSESSMENT

The following table outlines the major site features relevant to onsite wastewater management.

Table 1: Site Assessment Results

SITE FEATURE	DESCRIPTION	LIMITATION
Climate	Annual rainfall – 1453.8mm (Crescent Head BOM) Annual pan evaporation – 1597mm (BOM)	Moderate
Flood/inundation potential	It is assumed that the subject site is not flood prone	Minor
Exposure	The aspect of the site provides for high levels of wind and sun exposure	Minor
Slope	The slope in the area assessed on proposed Lot 1 runs from south to north with a gradient of approximately 7% The slope in the area assessed on proposed Lot 2 runs from east to west with a gradient of approximately 10%	Minor

Landform	The existing dwelling is positioned in the higher part of proposed Lot 1 The area assessed on proposed Lot 1 slopes from south to north towards Crescent Head Road. The proposed dwelling is to be located in the southern part of Lot 2 The area assessed on proposed lot 2 slopes from east to west towards Beranghi Road	Minor
Run-on & Seepage	Given the nature of the soil and the system recommended there is some chance of run-off	Moderate
Erosion Potential	No signs of erosion potential present	Minor
Drainage	The area assessed on proposed Lot 1 appears to be well drained with a slope running from south to north The area assessed on proposed Lot 2 appears to be well drained with a slope running from east to west	Minor
Fill	There is no evidence of fill in the area assessed for onsite wastewater management	Minor
Buffer Distances	Buffer distances are achievable, refer to ***Table 6***	Minor
Land Area	As indicated previously the lot size is approximately 8ha Lot 1 will be approximately 4ha Lot 2 will be approximately 4ha	Minor
% Rocks and /or Outcrops	There were no rocks or rock outcrops viewed during the site assessment	Minor

The relationship of rainfall to evaporation and the management of overland run-on and seepage from the effluent disposal areas have been identified as moderate limitations to the proposed system.

The above limitations will require attention in the design of the onsite wastewater management system.

5.0 SOIL TESTING

Proposed Lot 1

Soil samples were taken at sites determined to represent the soil profiles that would be expected to exist on the subject site.

Two (2) test pits were excavated at each of the sites.

The two (2) test pits on proposed Lot 1 were very similar soil profiles.

The test pits on proposed Lot 1 were excavated to a depth of approximately 1050mm.

Observations of soil characteristics were made and noted with soil samples being taken from test pit two (2). The soil samples that have been taken are considered to be representative of the various soil profiles on the site.

The aerial location of the test pits and approximate effluent location is shown in **Appendix 1**.

The two test pits were very similar soil types with very little variations in the profile depths.

Samples were analysed for a range of characteristics relevant to onsite wastewater management.

Soil permeability was established using field textural classification techniques.

Field observations indicated soil conditions over the site consist of three (3) horizons being:

- Top soil (Profile A) – 0mm to 150mm
- Profile B – 150mm to 450mm
- Profile C – 450mm to 1050mm

Field observations indicated that the soils within the study area generally consist of clay loam topsoil, with a light clay extending below Profile A then into medium clay to a depth of greater than 450mm.

Field observation and soil analysis information is presented in **Appendix 2**.

Generally the top soil, (Profile A), was a dark brown clay loam. Profile A had a smooth texture with few, (<20%), small course fragments with a sub angular blocky ped structure and an estimated clay content of 30 to 35%.

Profile B was underlain by a yellowish red light to medium clay. Profile B had a smooth texture with few, (<20%), small course fragments with a sub angular blocky ped structure and an estimated clay content of greater than 35%.

Profile C was underlain by a reddish yellow medium clay. Profile C had a smooth texture with few, (<20%), small course fragments with a sub angular blocky ped structure and an estimated clay content of 45 to 55%.

Photo 1 – Shows the soils profiles observed during site investigations

Proposed Lot 2

The two test pits on proposed Lot 2 were very similar soil profiles.

The test pits on proposed Lot 2 were excavated to a depth of approximately 750mm where resistance to auger was encountered.

Observations of soil characteristics were made and noted with soil samples being taken from test pit one (1). The soil samples that have been taken are considered to be representative of the various soil profiles on the site.

The aerial location of the test pits and approximate effluent location is shown in **Appendix 1**.

The two (2) test pits were very similar soil types with very little variations in the profile depths.

Samples were analysed for a range of characteristics relevant to onsite wastewater management.

Soil permeability was established using field textural classification techniques.

Field observations indicated soil conditions over the site consist of three (3) horizons being:

- Top soil (Profile A) – 0mm to 150mm
- Profile B – 150mm to 400mm
- Profile C – 400mm to 750mm

Field observations indicated that the soils within the study area generally consist of clay loam topsoil, with a light clay extending below Profile A then into medium clay to a depth of greater than 400mm.

Field observation and soil analysis information is presented in **Appendix 2**.

Generally the top soil, (Profile A), was a dark greyish brown clay loam. Profile A had a rough texture with an estimated 20% small course fragments with a sub angular blocky ped structure and an estimated clay content of 30 to 35%.

Profile B was underlain by a light yellowish brown light clay. Profile B had a smooth texture with few, (<20%), small course fragments with a sub angular blocky ped structure and an estimated clay content of 35 to 40%.

Profile C was underlain by a light olive brown medium clay. Profile C had a smooth texture with few, (<20%), small course fragments with a sub angular blocky ped structure and an estimated clay content of 45 to 55%.

The following table outlines soil features relevant to onsite wastewater management with the characteristics of the test pits very similar and therefore one sample was used for the detailed assessment.

Table 2: Soil Assessment Results

Proposed Lot 1

SOIL FEATURE	DESCRIPTION	LIMITATION
Depth to bedrock/hardpan	Bedrock/hardpan was not encountered in any test pits	Minor
Depth to water table	The water table was not encountered in any test pits	Minor
Soil permeability (Category)	Profile A – (Clay Loam) Profile B – (Light to Medium Clay) Profile C – (Medium Clay)	Minor Moderate Moderate
Soil structure	Profile A - Sub angular blocky Profile B - Sub angular Blocky Profile C - Sub angular Blocky	Minor Minor Minor
Course fragments%	Profile A – less than 20% Profile B – less than 20% Profile C – less than 20%	Minor Minor Minor

pH	Profile A – 5.4 Profile B – 4.9 Profile C – 4.6	Minor Minor Minor
Electrical conductivity	Profile A – 0.72 Profile B – 0.36 Profile C – 0.77	Minor Minor Minor
Dispersability (Emerson Class)	Profile A – 8 Profile B – 7 Profile C – 8	Moderate Moderate Moderate

Soil permeability and dispersibility were identified as moderate limitations to the proposed system.

Proposed Lot 2

SOIL FEATURE	DESCRIPTION	LIMITATION
Depth to bedrock/hardpan	Bedrock/hardpan was not encountered in any test pits	Minor
Depth to water table	The water table was not encountered in any test pits	Minor
Soil permeability (Category)	Profile A – (Clay Loam) Profile B – (Light Clay) Profile C – (Medium Clay)	Minor Minor Moderate
Soil structure	Profile A - Sub angular blocky Profile B - Sub angular Blocky Profile C - Sub angular Blocky	Minor Minor Minor
Course fragments%	Profile A – Est. 20% Profile B – less than 20% Profile C – less than 20%	Moderate Minor Minor
pH	Profile A – 6.5 Profile B – 5.9 Profile C – 5.2	Minor Minor Minor
Electrical conductivity	Profile A – 0.28 Profile B – 0.33 Profile C – 0.67	Minor Minor Minor
Dispersability (Emerson Class)	Profile A – 8 Profile B – 7 Profile C – 8	Moderate Moderate Moderate

Soil permeability, dispersibility and small course fragments were identified as moderate limitations to the proposed system.

The above limitations will require attention in the detailed design of onsite wastewater management systems.

6.0 WASTEWATER CHARACTERISTICS AND GENERATION

Having regards to the domestic nature of the occupation of both the existing dwelling and the proposed dwelling it is considered that low strength effluent will be generated following treatment.

Assumed characteristics of effluent which requires disposal would therefore be as follows:

Table 3: Effluent Characteristics

PARAMETER	STRENGTH
Total Nitrogen	<50mg/L
Total Phosphorus	<10mg/L
BOD	<40mg/L
TDS	<500mg/L

For the purposes of this report the volume of wastewater which is predicted to be produced is provided for in ***Table 4***.

It has been assumed that standard water reduction measures will be installed as a result of compliance with the BASIX requirements.

Table 4: Estimation of Effluent Generation

USAGE	OCCUPANCY RATE	EFFLUENT – LITRES PER PERSON PER DAY	PREDICTED EFFLUENT GENERATION - LITRES/DAY
4 Bedroom Dwelling	6 Persons	120	720

It is therefore considered that a daily effluent production rate of 720 litres should be applied to the determination of the minimum onsite effluent disposal requirements for both the existing dwelling and the proposed dwelling.

7.0 SYSTEM DESIGN ASSUMPTIONS

The following design assumptions have been adopted for the purposes of investigating system design options.

Table 5: Design Parameters

DESIGN PARAMETER	DESIGN ASSUMPTION
Soil Permeability	0.06 m/d
Hydraulic Loading - Number of persons	6 persons (4 Bedroom Dwelling)
Hydraulic Loading - Expected Wastewater Quantity	120 L/p/d
Crop Factor	0.75
Rainfall	1453.8mm
Design Loading Rate (DLR)	14mm/day

A DLR of 14mm/day was adopted for proposed Lot 1 due to the medium clay soils observed during site investigations.

A DIR of 14mm/week was adopted for proposed Lot 2 due to the resistance to auger at a depth of approximately 750mm.

8.0 ONSITE WASTEWATER MANAGEMENT SYSTEM

Based on the above site assessment, the type of treatment proposed for the effluent, and the likely quantity and quality of wastewater to be generated it is considered that the site is suitable

for disposal of effluent by the following:

8.1 Primary and Secondary Treatments

A Department of Health approved Aerated Wastewater Treatment System and Subsurface Irrigation has been proposed for onsite wastewater management for both the existing dwelling and the proposed dwelling.

8.2 Disposal Area, Irrigation

Subsurface Irrigation System (Secondary Treatment)

The irrigation lines will need to be spaced a minimum of one (1) metre apart to allow for appropriate soakage.

The irrigation area will require deep ripping to 300mm with lime or gypsum added at a rate of 200g/m². This will raise the pH and to improve the Emerson Class.

The irrigation area is to be planted with suitable vegetation (shrubs or lawns) to assist in nutrient uptake and improve effluent disposal through evapotranspiration.

All stormwater is to be directed away from the disposal area and this includes the stormwater from any dwelling and any ground water run-off.

The irrigation area sizing is based on hydraulic loading without consideration of a nutrient balance calculation.

It is considered nutrient build up in soil within the effluent disposal area will be minimised due to the natural filtration process that occurs in clay soils.

Plantings in the irrigation area will also help with the nutrient uptake.

Subsurface Irrigation Area

A minimum Subsurface Irrigation area of 510m² is recommended for both the existing dwelling and the proposed dwelling. See Appendix 3 **for Irrigation Area calculations.**

Sub-surface systems include:

a. Shallow subsurface drip irrigation

Shallow subsurface drip irrigation shall be installed at 100-150mm depth into 150 to 250mm of top soil in grassed or other suitably vegetated areas. Secondary treated effluent shall be distributed from a system of pressure compensating drip emitters into the topsoil layer.

b. Covered subsurface drip irrigation

In systems using subsurface drip irrigation, effluent shall be applied directly to the surface of the soil under a cover of mulch or other approved cover material, which shall be held in place by durable bird resistant mesh netting pinned securely to the ground surface. Secondary treated effluent shall be distributed from pressure compensating drip emitters to achieve effective coverage of the design area.

An example of layout components subsurface irrigation is shown in **Appendix 4**.

Components of a sub-surface system would include:

- A designated subsurface irrigation area.
- Irrigation area to contain suitable vegetation to assist effluent disposal through evapotranspiration.
- The positioning of the disposal area is to comply with the requirements of Kempsey Shire Council.

- The installation of the irrigation area is to comply with the Kempsey Shire councils technical standards.
- The design and construction of subsurface irrigation areas is to comply with Appendix M of Australian Standard 1547 – 2012.

In general with regards to irrigation systems:

(a) Care shall be taken that the application rate does not lead to:

(i) Adverse effects on soil properties and plant growth through excess salt accumulation in the root zone during extended dry periods;

(ii) Harmful long term environmental effects to the soil of the land application system or the adjacent surface water and ground water; or

(iii) Increased risk to public health from surface ponding in the land application area or channelling or seepage beyond the land application area.

(b) All irrigation systems shall be designed to promote evapotranspiration. The irrigation area is to be planted with suitable vegetation (shrubs or lawns) to assist in nutrient uptake and improve effluent disposal through evapotranspiration. Care shall be taken to ensure that the irrigation is well planted with plant species that are:

i. Water tolerant;

ii. Appropriate for site conditions; and

iii. Planted at an appropriate density for evapotranspiration.

All stormwater is to be directed away from the disposal area and this includes the stormwater from any dwelling and any ground water run-off.

The positioning of the irrigation area is to be determined on site however an indicative position is nominated in **Appendix 1.**

8.3 Buffer Distances

Appropriate buffer zones can be provided.

The Subsurface irrigation area is to be kept at a minimum distance of 6m up gradient and 3m down gradient from the property boundaries, driveways, swimming pools and any dwellings.

The irrigation area is to be located at least 40m from any dams and drainage channels.

Table 6: Recommended Buffer Distances for Onsite Wastewater Management

SYSTEM	BUFFER DISTANCES
All Systems	• 100m to permanent surface waters (rivers, creeks, lakes etc.). • 250m to domestic ground water supplies • 40m to other waters (farm dams, intermittent creeks/drainage depressions, drainage channels etc.)
Surface Drip/Trickle Irrigation Systems Shallow Subsurface Irrigation Systems	• 6m between irrigation area and property boundaries/driveways, swimming pools, dwellings and buildings if area up gradient and 3m if down gradient

8.4 Reserve Area

A reserve area is not required for systems that utilise secondary treatment.

8.5 Mitigation Measures

The following mitigation measure is necessary to ensure the sustainability of the recommended onsite wastewater management system:

- Installation of up-slope surface water (and subsurface) drainage to divert run-on and seepage water from the land application areas. The diversion system is to be designed and constructed in accordance with the technical requirements of Kempsey Shire Council.
- The areas for the irrigation will require deep ripping to 300mm with lime or gypsum added at a rate of 200g/m².
- Irrigation areas are to be planted with suitable vegetation to assist in nutrient uptake and improve effluent disposal through evapo-transpiration.

9.0 FLOODING

It is assumed that the subject site is not flood prone.

10.0 RECOMMENDATIONS

With the introduction of the new system the following recommendations should be implemented:

- Be water wise.
- Use low sodium washing detergents.
- Use 'septic friendly' cleaning agents.

11.0 CONCLUSIONS

The site and soil characteristics of the allotment are suitable for the use of the onsite wastewater management systems identified in this report.

In this regard the Mitigation Measures outlined in Section 8.5 of this report must be implemented in respect of the system utilized.

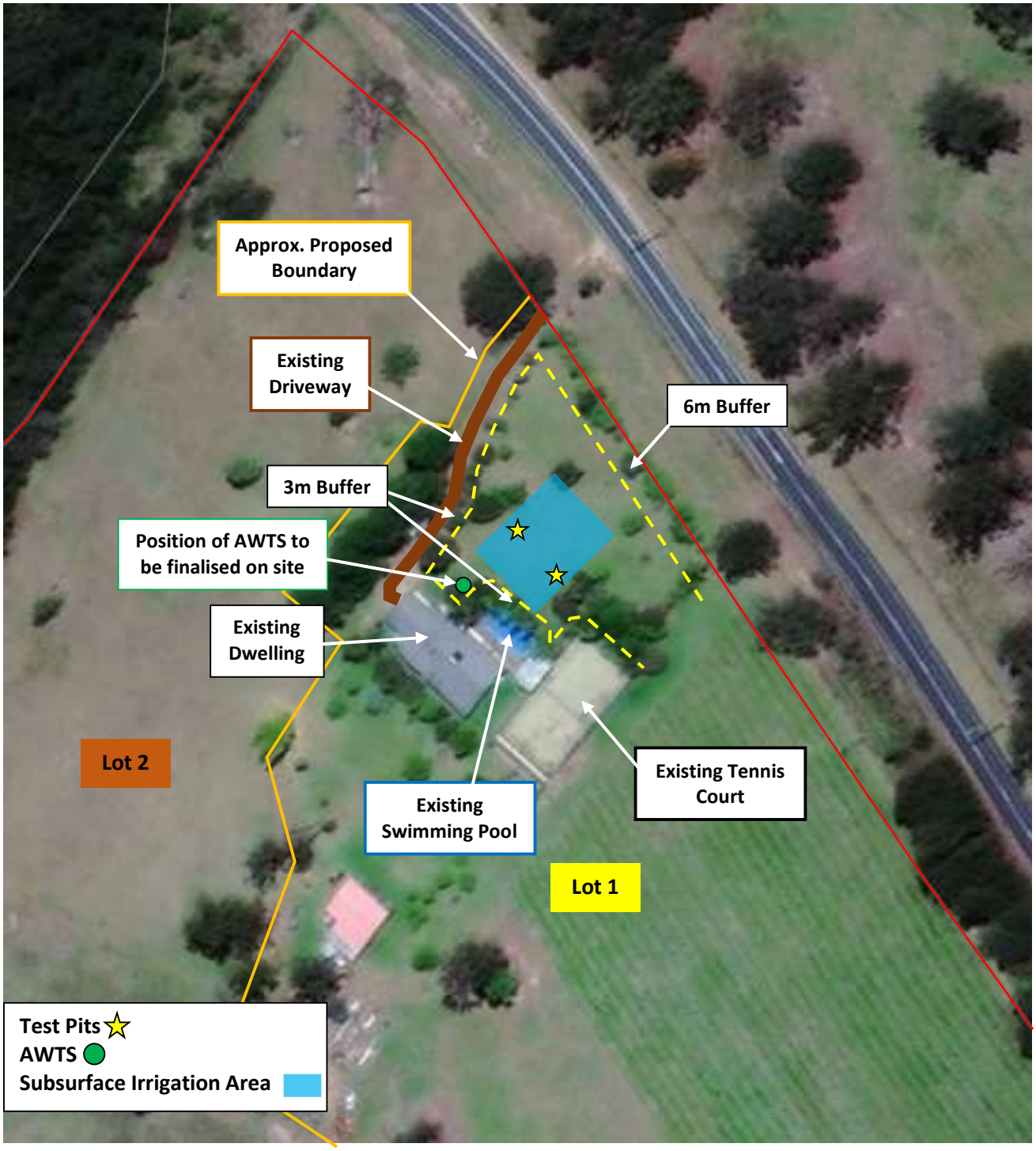
It must however be recognized that the sustainable disposal of effluent is heavily reliant upon the correct installation of onsite wastewater management systems coupled with ongoing appropriate and regular maintenance if satisfactory environmental health outcomes are obtained and maintained into the future.

Regards

Tim Mecham
Midcoast Building and Environmental

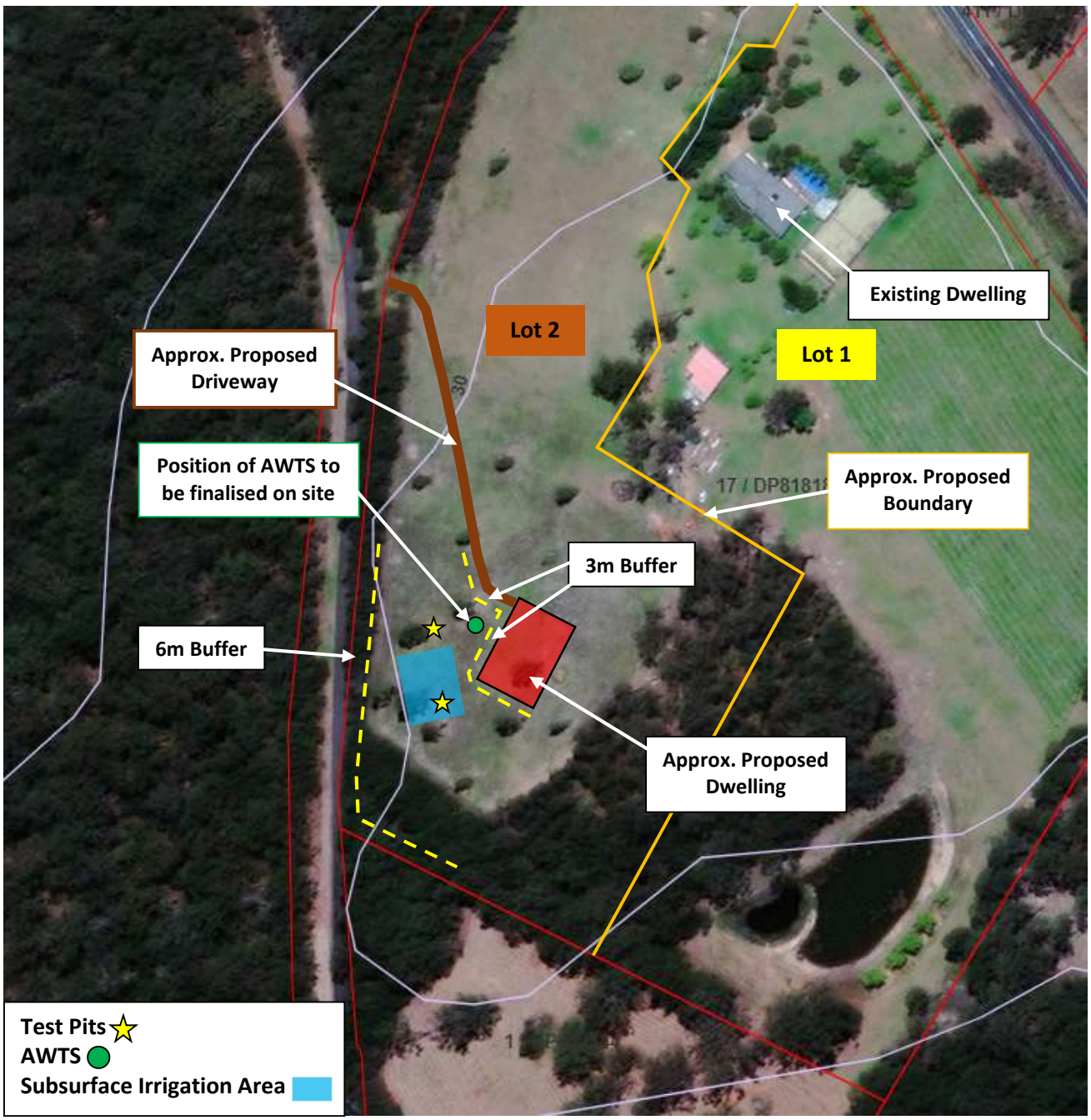
APPENDIX 1 - Aerial test pits and approximate effluent location

Proposed Lot 1



Note: Measurements and positions are indicative, approximate and not to scale

Proposed Lot 2



Note: Measurements and positions are indicative, approximate and not to scale

APPENDIX 2 - Soil Profile Descriptions

Proposed Lot 1

Sample	Test hole layer	Ped Structure	pH (1:5) soil/water	Emerson Class	Acidity level	ECe	Salinity
A	0-150mm	Sub Angular Blocky	5.4	7	Minor	0.72	Low
B	150-450mm	Sub Angular Blocky	4.9	7	Minor	0.36	Low
C	450-1050mm	Sub Angular Blocky	4.6	8	Minor	0.77	Low

Sample	Texture class	Approximate % of clay	Course Fragments %	Soil Colour	Munsel Colour
A	Clay Loam	30-35%	<20%	Dark Brown	10YR 3/3
B	Light to Medium Clay	>35%	<20%	Yellowish Red	5YR 4/6
C	Medium Clay	45-55%	<20%	Reddish Yellow	5YR 7/6

Proposed Lot 2

Sample	Test hole layer	Ped Structure	pH (1:5) soil/water	Emerson Class	Acidity level	ECe	Salinity
A	0-150mm	Sub Angular Blocky	6.5	8	Minor	0.28	Low
B	150-400mm	Sub Angular Blocky	5.9	7	Minor	0.33	Low
C	400-750mm	Sub Angular Blocky	5.2	8	Minor	0.67	Low

Sample	Texture class	Approximate % of clay	Course Fragments %	Soil Colour	Munsel Colour
A	Clay Loam	30-35%	Est. 20%	Dark Greyish Brown	10YR 4/2
B	Light Clay	35-40%	<20%	Light Yellowish Brown	10YR 6/4
C	Medium Clay	45-55%	<20%	Light Olive Brown	2.5Y 5/3

APPENDIX 3 – Subsurface Irrigation Area Calculations

Minimum Area Method Water Balance and Wet Weather Storage Calculations (Crescent Head BOM)

Design Wastewater Flow (Q):	l/day	720
Design Percolation Rate (R):	mm/wk	14

Subsurface Irrigation Area from a Secondary Treatment System

Design Irrigation Rate 14

Parameters					Outputs			Inputs					
Month	Days (D)	Precipitation (P)	Evaporation (E)	Crop factor (C)	Evapotranspiration (ET)	Percolation (B)	Total Outputs (ET+B)	Retained Precipitation P=1.0	Possible Effluent Irrigation (W)	Actual Effluent Production (I)	Inputs	Storage (S)	Cumulative Storage (M)
	days	mm/month	mm/month	-	mm/month	mm/month	mm/month	mm/month	mm/month	mm/month	mm/month	mm/month	mm
Jan	31	147.4	189.0	0.75	141.75	62.00	203.75	147.4	56.35	42.69	190.09	-13.66	0.00
Feb	28	167.1	154.0	0.75	115.5	56.00	171.50	167.1	4.40	42.69	209.79	38.29	38.29
Mar	31	192.9	147.0	0.75	110.25	62.00	172.25	192.9	-20.65	42.69	235.59	63.34	101.63
Apr	30	160.0	111.0	0.75	83.25	60.00	143.25	160.0	-16.75	42.69	202.69	59.44	161.06
May	31	120.7	98.0	0.75	73.5	62.00	135.50	120.7	14.80	42.69	163.39	27.89	188.95
Jun	30	125.0	70.0	0.75	52.5	60.00	112.50	125.0	-12.50	42.69	167.69	55.19	244.14
Jul	31	56.2	73.0	0.75	54.75	62.00	116.75	56.2	60.55	42.69	98.89	-17.86	226.28
Aug	31	61.6	98.0	0.75	73.5	62.00	135.50	61.6	73.90	42.69	104.29	-31.21	195.06
Sep	30	55.3	129.0	0.75	96.75	60.00	156.75	55.3	101.45	42.69	97.99	-58.76	136.30
Oct	31	92.8	160.0	0.75	120	62.00	182.00	92.8	89.20	42.69	135.49	-46.51	89.79
Nov	30	115.0	173.0	0.75	129.75	60.00	189.75	115.0	74.75	42.69	157.69	-32.06	57.73
Dec	31	121.5	195.0	0.75	146.25	62.00	208.25	121.5	86.75	42.69	164.19	-44.06	13.66
Total	365	1453.8	1597		1197.75	730.00	1927.75	1453.8	512.25	512.25	1927.75	-	-

Irrigation Area (L) m2		**506.00**
Storage (V)	**largest M mm**	**244.14**
	(VxL)/1000 m3	**123.53**

RAINFALL	BOM Crescent Head
EVAPORATION	BOM

APPENDIX 4 - Subsurface Irrigation Example of Layout Components

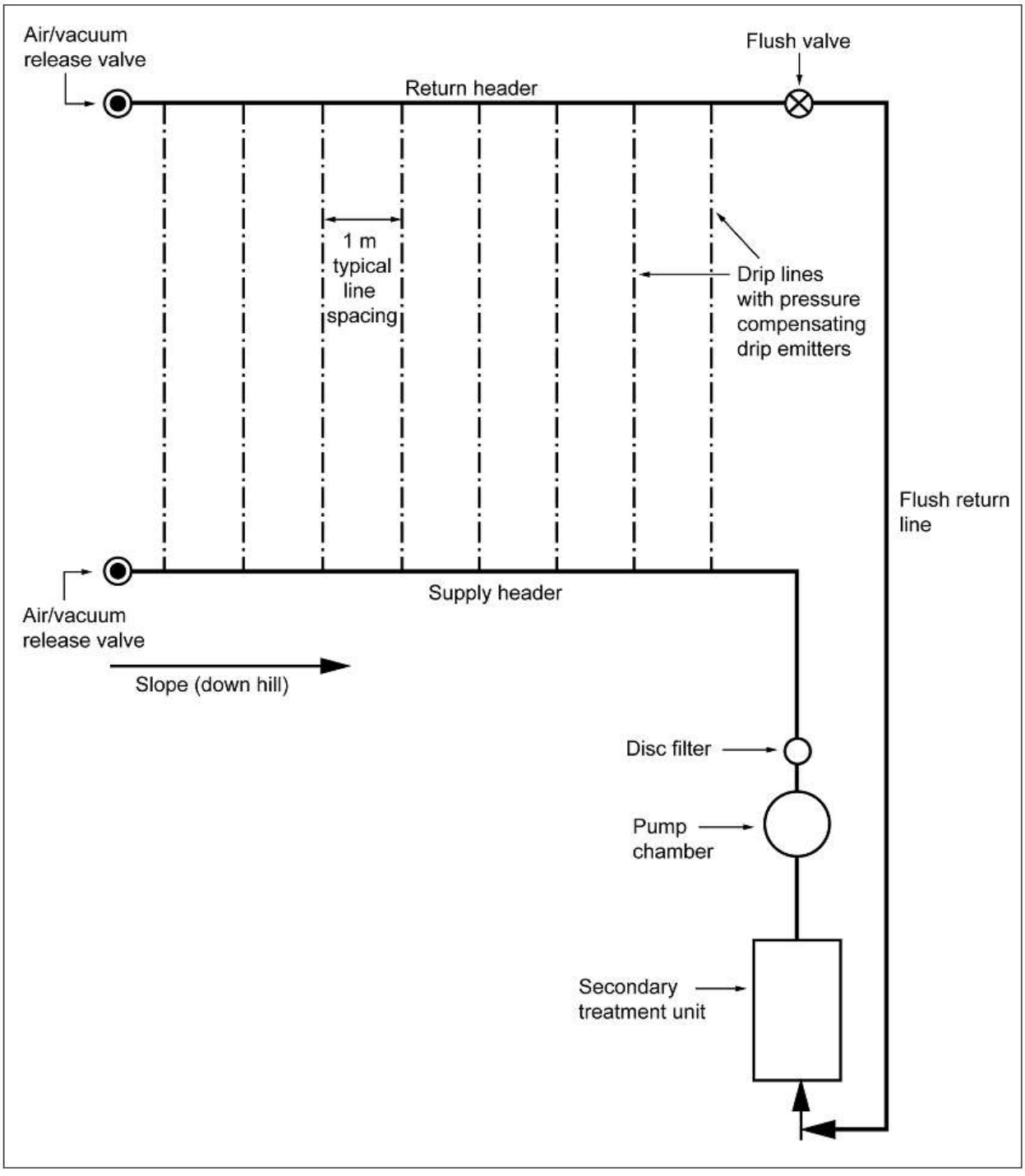


FIGURE M1 DRIP IRRIGATION SYSTEM – EXAMPLE LAYOUT OF COMPONENTS