ONSITE SEWAGE MANAGEMENT ASSESSMENT

**PROPOSED REZONING
THEN SUBDIVISION**

**No 1466 Lot 280 DP 1098732
Crescent Head Road
Crescent Head
NSW 2440**

CLIENT:

Campbell and Christine Moody

June 2015

41 Belgrave Street, Kempsey NSW 2440 – PO Box 353 Kempsey NSW 2440 – phone 0265631292 – fax 0265624851 – ABN 32098436812

1. INTRODUCTION

This report has been prepared on behalf of the owners on the subject site for a proposed subdivision on land known as No. 1466 Lot 280 DP 1098732 Crescent Head Road, Crescent Head.

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

Site investigations were carried out in November 2014 and May/June 2015 to determine site and soil conditions.

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

- AS/NZS 1547-2000 On-site domestic-wastewater management.
- NSW Government Environment and Health Protection Guidelines - On-site Sewage Management for Single Households.

NOTE

This report has been prepared with all reasonable skill, care and diligence.

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 sewage 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. SITE DESCRIPTION

The site is located at No. 1466 Lot 280 DP 1098732 Crescent Head Road, Crescent Head.

The site is located approximately 14.5km southeast of Kempsey. Travel south from the Kempsey CBD along the Pacific Highway and turn left onto the Crescent Head Road. Travel for 13.7 km till you reach Maria River Road and the subject site is on the corner.

All the above mention roads are public sealed roads.

The subject site is approximately 132 hectares in size.

Figure 1 and **Figure 2** below show the site location.

Figure 1: Topographical Map

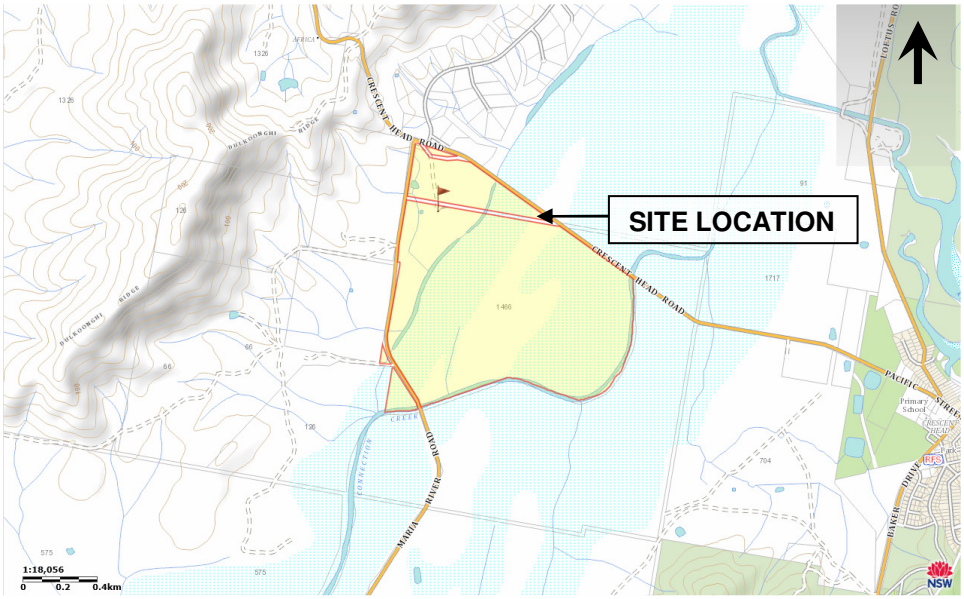
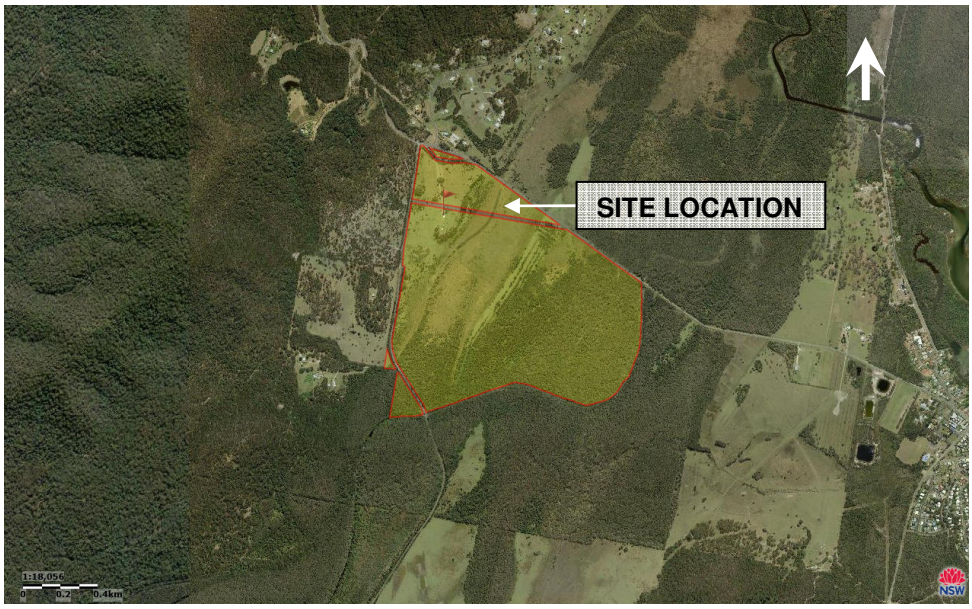


Figure 2: Aerial View



3. PROPOSED DEVELOPMENT

It is proposed to subdivide the lot into fourteen (14) separate lots.

See **Appendix 1** for subdivision layout.

4. SITE ASSESSMENT- NEW ONSITE SEWAGE MANAGEMENT SYSTEM

The following table outlines the major site features relevant to on-site sewage management for the proposed subdivision.

Table 1 – Site Assessment Results

Site Feature	Description	Limitation
Climate	Annual rainfall –1433mm (Crescent Head BOM) Annual pan evaporation –1597mm (BOM)	Moderate
Flood/inundation potential	All lots are above the 1 in 100 year flood with the exception of Lot 14 have dwelling envelopes above the 1 in 100 flood level. See **Appendix 1** for details of the 1 in 20 flood height	Moderate
Exposure	The subdivision site has a high level of sun and wind exposure	Minor
Slope %	The slopes in the subdivision range from 0-10%	Minor
Landform	The main part of the subdivision is located on either side of the hill	Minor
Run-on & upslope Seepage	All lots have a minor potential for run-off	Minor
Erosion Potential	No signs of erosion potential present	Minor
Drainage	Lot 14 is relatively low lying therefore adequate drainage is to be considered here.	Moderate
Fill	There is no evidence of fill on the site	Minor
Buffer Distances	Buffer distances are achievable.	Moderate
Land Area	Sufficient to cater for proposed systems	Minor
% Rocks and /or Outcrops	There were no rocks or rock outcrops viewed during the site assessment	Minor

There are few moderate limitations to onsite sewage management.

The relationship of rainfall to evaporation, flood potential and drainage has been identified as moderate limitation.

The above limitations will require attention in the detailed design of the onsite sewage management systems to service any dwelling of the proposed subdivision.

5. WASTE WATER CHARACTERISTICS AND GENERATION

Having regards to the domestic nature of the proposed subdivision, it is considered that low strength effluent will be generated following treatment.

In this regard the major sources, (in terms of volume and strength); of effluent will be the occupation of a dwelling being erected on each of the proposed lots.

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

Table 2 – Wastewater 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 from the proposed subdivision site is provided for in ***Table 3*** below.

It has been assumed that standard water reduction measures will be applied to any new dwelling as a result of compliance with the BASIX requirements.

Table 3 - Estimation of Effluent Generation

NUMBER OF BEDROOMS	NUMBER OF PERSONS	EFFLUENT – PERSON LITRES/PER DAY	PREDICTED EFFLUENT GENERATION - LITRES/DAY
3	5	150 L	750 L
5	8		1200 L

It is therefore considered that a total daily effluent production rate from the above table should be applied to the determination of the minimum onsite effluent disposal requirements for any new dwelling on the proposed lots dependant on the number of bedrooms.

Soil samples were taken at the site, in locations determined to represent the soil profiles that could exist on the subject property in the area identified as being suitable for onsite sewage management systems.

The location of the test pits were determined based upon lot layout and landform.

Due to the varying soil profiles, seven (7) test pits were dug on the subdivision site and were later examined by Midcoast Building and Environmental in November 2014.

The location of the test pits can be seen in **Appendix 2** and are considered as a representation of the soil types for the wastewater systems.

6. SOIL AND WASTEWATER ASSESSMENT FOR LOT 13

Soil permeability was established using field textural classification techniques. Field observations by Midcoast Building and Environmental indicated soil conditions on Test Pit 1 consisted of two (2) horizons being:

Test Pit 1

- Profile A – 0mm to 200mm
- Profile B – 200 to 500mm

Test Pit 1 was indicative for Lot 13.

Field observation and soil analysis information is presented in **Appendix 3**.

Generally the top soil, (Profile A), was a very dark greyish brown light clay. 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 less than 35 to 40%.

Profile B was underlain by a dark greyish brown 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 less than 40-55%.

Below these layers, a coffee rock material was encountered.

The following table outlines the major soil features relevant to on-site sewage management at the site.

Table 4 – Soil Assessment Results Lot 13

SOIL FEATURE	DESCRIPTION	LIMITATION
Depth to bedrock/hardpan	There was rock found suspected to be large floaters at approximately 700mm.	Minor
Depth to water table	The elevation of the subject land is such that the water table would be expected to be greater than 6m below ground level in most areas.	Minor
Soil permeability (Category)	Profile A – (light clay) Profile B – (medium clay)	Profile A – Moderate limitation Profile B – Moderate limitation
Soil structure	Profile A - Sub angular blocky Profile B - Sub angular blocky	Profile A - Minor Profile B - Minor
Course fragments%	Profile A – less than 20% Profile B – less than 20%	Minor Minor
pH	Profile A – 4.8 Profile B – 5.1	Minor Minor
Electrical conductivity	Profile A – 0.01 Profile B – 0.00	Minor Minor
Dispersability (Emerson Class)	Profile A – 7 Profile B – 2	Minor Moderate

Soil permeability - Depth to hardpan, permeability and Emerson Class were identified as moderate limitations to the wastewater system.

The above limitations will require attention in the detailed design of onsite sewage

management systems to service the subject site.

7. SOIL AND WASTEWATER ASSESSMENT FOR LOTS 1, 2, 3, and 8

Soil permeability was established using field textural classification techniques.

As stated above, field observations by Midcoast Building and Environmental indicated soil conditions in Test Pits 5 and 4 generally consisted of three (3) horizons being:

Test Pit 4

- Profile A – 0mm to 200mm
- Profile B – 200mm to 300mm
- Profile C – 300mm plus

Test Pit 5

- Profile A – 0mm to 200mm
- Profile B – 200mm TO 500mm
- Profile C – 550mm plus

Test Pit 4 was then considered representative for Lots 1, 2, 3 and 8.

Field observation and soil analysis information is presented in **Appendix 3**.

Generally the top soil, (Profile A), was a very dark greyish brown light clay. 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 less than 35-40%.

Profile B was underlain by a very dark greyish 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 less than 35-40%.

Profile C was a brown medium to heavy 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 less than 45-55%.

The following table outlines the major soil features relevant to on-site sewage management at the site.

Table 5 – Soil Assessment Results Lots 1, 2, 3 and 8

SOIL FEATURE	DESCRIPTION	LIMITATION
Depth to bedrock/hardpan	Bedrock/hardpan was not encountered in any test pits	Minor
Depth to water table	With the medium to heavy clay base water table was not considered an issue. It is noted that the recommends that the irrigation area is positioned in	Minor

	the higher area of the lots	
Soil permeability (Category)	Profile A – (light clay) Profile B – (light clay) Profile C – (medium to heavy clay)	Profile A - Moderate limitation Profile B - Moderate limitation Profile C – Major limitation
Soil structure	Profile A – Sub angular Blocky Profile B – Sub angular Blocky Profile C – Sub angular Blocky	Profile A - Minor Profile B - Minor Profile C - Minor
Course fragments%	Profile A – less than 20% Profile B – less than 20% Profile C – less than 20%	Minor Minor Minor
pH	Profile A – 4.9 Profile B – 5.0 Profile C – 4.4	Minor Minor Minor
Electrical conductivity	Profile A – 0.03 Profile B – 0.01 Profile C – 0.10	Minor Minor Minor
Dispersability (Emerson Class)	Profile A – 7 Profile B – 2 Profile C – 2	Minor Moderate Moderate

Soil permeability and Emerson Class was identified as moderate to major limitations to the wastewater system.

The above limitations will require attention in the detailed design of onsite sewage management systems to service the subject site.

SOIL AND WASTEWATER ASSESSMENT FOR LOTS 9, 10 and 14

Soil permeability was established using field textural classification techniques.

As stated above, field observations by Midcoast Building and Environmental indicated soil conditions in Test Pits 2, 3 and 4 generally consisted of three (3) horizons being:

Test Pits 3 and 4

- Profile A – 0mm to 200mm
- Profile B – 200mm to 300mm
- Profile C – 300mm plus

Test Pits 3 and 4 were considered representative for Lots 9, 10 and 14.

Field observation and soil analysis information is presented in **Appendix 3**.

Generally the top soil, (Profile A), was a very dark greyish brown light clay. 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 less than 35-40%.

Profile B was underlain by a very dark greyish 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 less than 35-40%.

Profile C was a brown medium to heavy 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 less than 45-55%.

The following table outlines the major soil features relevant to on-site sewage management at the site.

Table 6 – Soil Assessment Results Lots 9, 10 and 14

SOIL FEATURE	DESCRIPTION	LIMITATION
Depth to bedrock/hardpan	Bedrock/hardpan was not encountered in any test pits	Minor
Depth to water table	With the medium to heavy clay base water table was not considered an issue. It is noted that the recommends that the irrigation area is positioned in the higher area of the lots.	Minor
Soil permeability (Category)	Profile A – (light clay) Profile B – (light clay) Profile C – (medium to heavy clay)	Profile A - Moderate limitation Profile B - Moderate limitation Profile C – Major limitation
Soil structure	Profile A – Sub angular Blocky Profile B – Sub angular Blocky Profile C – Sub angular Blocky	Profile A - Minor Profile B - Minor Profile C - Minor
Course fragments%	Profile A – less than 20% Profile B – less than 20% Profile C – less than 20%	Minor Minor Minor
pH	Profile A – 4.9 Profile B – 5.0 Profile C – 4.4	Minor Minor Minor
Electrical conductivity	Profile A – 0.03 Profile B – 0.01 Profile C – 0.10	Minor Minor Minor
Dispersability (Emerson Class)	Profile A – 7 Profile B – 2 Profile C – 2	Minor Moderate Moderate

Soil permeability and Emerson Class were identified as moderate to major limitations to the wastewater system.

The above limitations will require attention in the detailed design of onsite sewage management systems to service the subject site.

SOIL AND WASTEWATER ASSESSMENT FOR LOTS 4, 5, 6, 7, 11 and 12

Soil permeability was established using field textural classification techniques. As stated above field observations by Midcoast Building and Environmental indicated soil conditions in Test Pits 6 and 7 generally consisted of three (3) horizons being:

Test Pits 6 and 7

- Top soil (Profile A) – 0mm to 200mm
- Profile B – 200mm to 550mm
- Profile C – 550mm plus

Test Pits 6 and 7 were considered representative for Lots 4, 5, 6, 7, 11 and 12.

Field observation and soil analysis information is presented in **Appendix 3.**

Generally the top soil, (Profile A), was a very dark greyish brown light clay. 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 less than 35-40%.

Profile B was underlain by a brown 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 being less than 40-55%.

Profile C was a yellowish brown medium to heavy 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 being less than 45-55%.

The following table outlines the major soil features relevant to on-site sewage management at the site.

Table 7 – Soil Assessment Results Lots 4, 5, 6, 7, 11 and 12

SOIL FEATURE	DESCRIPTION	LIMITATION
Depth to bedrock/hardpan	Bedrock/hardpan was not encountered in any test pits.	Minor
Depth to water table	The elevation of the subject land is such that the water table would be expected to be greater than 6m below ground level.	Minor
Soil permeability (Category)	Profile A – (light clay) Profile B – (medium clay) Profile C – (medium to heavy clay)	Profile A – Moderate limitation Profile B - Major limitation Profile C – Major limitation
Soil structure	Profile A - Sub angular Blocky Profile B – Sub angular Blocky Profile C – Sub angular Blocky	Profile A - Minor Profile B - Minor Profile C - Minor
Course fragments%	Profile A – less than 20% Profile B – less than 20% Profile C – less than 20%	Minor Minor Minor
pH	Profile A – 5.1 Profile B – 4.8 Profile C – 4.8	Minor Minor Minor

Electrical conductivity	Profile A – 0.00 Profile B – 0.00 Profile C – 0.00	Minor Minor Minor
Dispersability (Emerson Class)	Profile A – 7 Profile B – 2 Profile C – 2	Minor Moderate Moderate

Soil permeability was identified as moderate to major limitations to the wastewater system.

The above limitations will require attention in the detailed design of onsite sewage management systems to service the subject site.

9. SYSTEM DESIGN ASSUMPTIONS

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

Table 8: Design Parameters

DESIGN PARAMETER	DESIGN ASSUMPTION
Soil Permeability	0.06 – 0.12 m/d
Hydraulic Loading - Number of persons	5 persons (3 Bedroom Dwelling) and 8 persons (5 Bedroom Dwelling)
Hydraulic Loading - Expected Wastewater Quantity	150 L/p/d
Crop Factor	0.75
Rainfall	1433mm
Design Irrigation Rate (DIR)	20mm/week

It is noted that the permeability of the soils on the subject site is such that the soil is generally unsuited to absorption based disposal systems.

10. ONSITE SEWAGE MANAGEMENT SYSTEMS

10.1 Primary Treatment

It is recommended that the wastewater from all lots be treated by an Aerated Wastewater Treatment System approved by the NSW Department of Health. It is further recommended that in consideration of the adjoining sensitive areas Lots 7 and 14 are to have Advanced Secondary Treatment to facilitate the removal of nutrients from the system.

10.2 Disposal Area

A design irrigation rate (DIR) of 20 was considered representative for the site. This DIR was used in the calculation for representative irrigation area size.

Surface and Subsurface Irrigation Systems

For a 5 persons (3 bedroom dwelling) a minimum irrigation of 265m² is required. See Appendix 4.

For an 8 persons (5 bedroom dwelling) a minimum irrigation of 421m² is required. See Appendix 4.

Either a below or above ground system would need to be constructed.

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 storm water is to be directed away from the disposal area. This includes the stormwater from any proposed 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.

Surface Irrigation Area

Improvement of the soil within the irrigation area is to be carried out to ensure no run-off. The soil should be rotary hoed or ripped to a depth of 200mm and lime or gypsum added, (at a rate of 200g/m²). This will also raise the pH and improve the emersion class rating. The provision of garden beds, benched areas and importing absorbent soils are likely to be required to ensure that any run-off is in accordance with 4.2C5.3 of AS 1547: 2000.

Components of this system would include:

- A designated surface 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 surface irrigation areas is to comply with Appendix 4.5D of Australian Standard 1547 – 2000.

In order to comply with the department of Health requirements the following requirements will need to be incorporated into the construction of the irrigation area:

1. Sprinklers are to be evenly distributed throughout the irrigation area.
2. The main irrigation line is to be buried.
3. Irrigation area to have boundaries clearly delineated by appropriate vegetation or other types of borders.
4. Storm water is to be diverted away from the irrigation area.
5. Signage is to be provided in accordance with Department of Health approval.

The irrigation area sizing is based on hydraulic loading without consideration of a nutrient balance calculation. It is considered that nutrient build up in the soil within the effluent disposal area will be minimized due to the natural filtration process that occurs in clay soils.

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

The positioning of the irrigation area is to be determined on site.

Subsurface Irrigation Area

Sub-surface systems include

a. Shallow subsurface drip irrigation

Shallow subsurface drip irrigation shall be installed at 100-150 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.

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 4.5D of Australian Standard 1547 – 2000.

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:

(a) Water tolerant

(b) Appropriate for site conditions; and

(c) Planted at an appropriate density for evapotranspiration.

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

The positioning of the irrigation area is to be determined on site.

Possible sites have been identified in **Appendix 5.**

It is noted Lot 10 & 14 do have drainage issues in wet times and it is likely soils needs to be imported for the irrigation area.

10.3 Buffer Distances

The following table shows the buffer distance requirements as per AS 1547-2012.

Table 9 - Recommended Buffer Distances for Onsite Sewage Management Systems in accordance with AS 1547 - 2012

Site Feature	**Setback distance range (m)** ***Horizontal setback distance (m)***	**Site constraint items of specific concern (Table R2 or AS1547:2012)**
Property boundary	1.5 - 50	A, D, J
Buildings/houses	2.0 - >6	A, D, J
Surface water	15 – 100	A, B, D, E, F, G, J
Bore, well	15 – 50	A, C, H, J
Recreational areas (Children's play areas, swimming pools and so on)	3 – 15	A, E, J
In-ground water tank	4 – 15	A, E, J
Retaining wall and Embankments, escarpments, cuttings	3.0m or 45° angle from toe of wall (whichever is greatest)	D, G, H
	Vertical setback distance (m)	
Groundwater	0.6 - > 1.5	A, C, F, H, I, J
Hardpan or bedrock	0.5 - ≥ 1.5	A, C, J

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) 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 10 - Recommended Buffer Distances for Onsite Sewage Management as per On-site Sewage Management for Single Households

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 Spray Irrigation Systems	• 6m between irrigation area and property boundaries/driveways if area up gradient and 3m if down gradient • 15m to dwellings or other buildings • 3m to paths and walkways • 6m to swimming pools
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
Absorption Trenches and Evapotranspiration/ Absorption Systems	• 12m if the disposal area is upslope of property boundaries • 6m if the disposal area is down slope of property boundaries • 6m between disposal area and swimming pools, sheds dwellings driveways if disposal area is upslope • 3m between disposal area and swimming pools, sheds dwellings driveways if disposal area is down slope

It is recommended that the minimum buffer distance be provided in accordance with the Environment and Health Protection Guidelines "On-site Sewage Management for Single Households".

10.4 Reserve Area

Over time the operation and performance of the disposal area can become compromised by the effects of wastewater on the soil characteristics within the disposal area.

In accordance with AS 1547-2000 a reserve area of 100% of the design area shall be available on site. A reserve area is available for the site.

As per the site investigations, it is noted that 100% of the design area is available for future use if required.

10.5 Mitigation Measures

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

- Installation of up-slope surface water (and subsurface) drainage to divert run-on and seepage water from the land application area. The diversion system is to be designed and constructed in accordance with the technical requirements of the Kempsey Shire Council.

- The soils within the effluent disposal area are to be rotary hoed or ripped to a depth of 200mm to improve moisture retention.
- Irrigation areas are to be planted with suitable vegetation to assist in nutrient uptake and improve effluent disposal through evapo-transpiration.

10.6 Flooding Considerations

It is considered that all wastewater systems can be positioned above the 1 in 20 flood level.

11. 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.

12. CONCLUSIONS

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

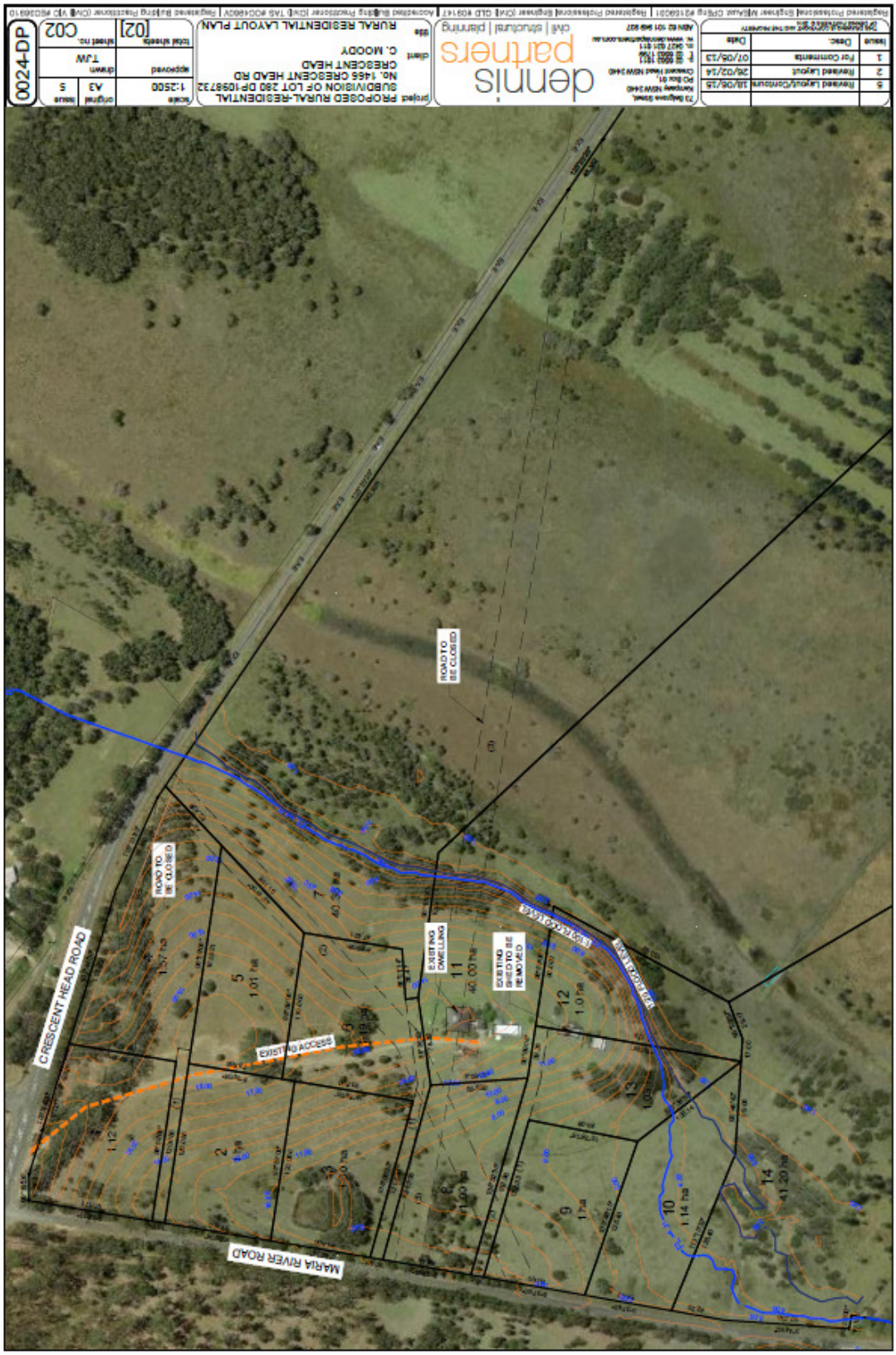
In this regard the mitigation measures outlined in Section 10.5 of this report must be implemented in respect of the system utilized.

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

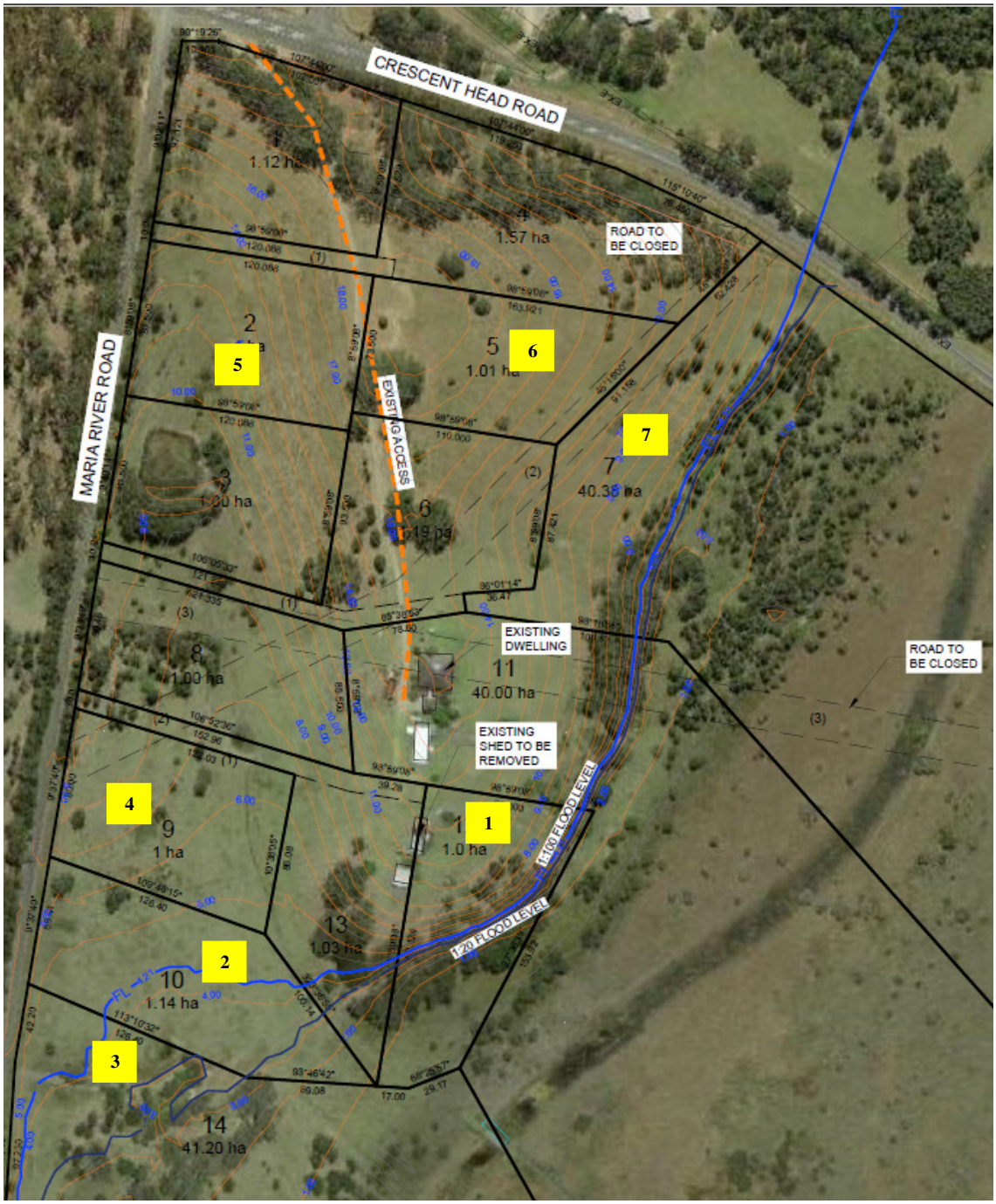
Regards

Tim Mecham
Midcoast Building and Environmental

APPENDIX 1 - Subdivision Layout



Appendix 2 - Test Pits Location



3 **Test Pit**

APPENDIX 3 – Soil Profile Descriptions

Test Pit 1

Sample	Test hole layer	Ped Structure	pH (1:5) soil/water	Emerson Class	EC (dS/m)	Salinity
A	0mm-200mm	Sub Angular Blocky	4.8	7	0.01	Low
B	200mm-500mm	Sub Angular Blocky	5.1	2	0.00	Low

Sample	Texture class	Approximate % of clay	Course Fragments %	Soil Colour	Munsel Colour
A	Light Clay	35-40%	<20%	Very Dark Greyish Brown	10YR 3/2
B	Medium Clay	40-55%	<20%	Dark Greyish Brown	10YR 4/2

Test Pit 2

Sample	Test hole layer	Ped Structure	pH (1:5) soil/water	Emerson Class	EC (dS/m)	Salinity
A	0mm-150mm	Sub Angular Blocky	4.9	7	0.00	Low
B	150mm-400mm	Sub Angular Blocky	4.9	2	0.00	Low
C	400mm plus	Sub Angular Blocky	5.0	2	0.01	Low

Sample	Texture class	Approximate % of clay	Course Fragments %	Soil Colour	Munsel Colour
A	Light Clay	35-40%	<20%	Dark Greyish Brown	10YR 4/2
B	Medium Clay	40-55%	<20%	Greyish Brown	10YR 5/2
C	Medium to Heavy Clay	45-55%	<20%	Greyish Brown	10YR 5/2

Test Pits 3 and 4

Sample	Test hole layer	Ped Structure	pH (1:5) soil/water	Emerson Class	EC (dS/m)	Salinity
A	0mm-200mm	Sub Angular Blocky	4.9	7	0.03	Low
B	200mm-300mm	Sub Angular Blocky	5.0	2	0.01	Low
C	300mm plus	Sub Angular Blocky	4.4	2	0.10	Low

Sample	Texture class	Approximate % of clay	Course Fragments %	Soil Colour	Munsel Colour
A	Light Clay	35-40%	<20%	Very Dark Greyish Brown	10YR 3/2
B	Light Clay	35-40%	<20%	Very Dark Greyish Brown	10YR 3/2
C	Medium-Heavy Clay	45-55%	<20%	Brown	10YR 5/3

Test Pit 5

Sample	Test hole layer	Ped Structure	pH (1:5) soil/water	Emerson Class	EC (dS/m)	Salinity
A	0mm-200mm	Sub Angular Blocky	5.0	7	0.00	Low
B	200mm – 550mm	Sub Angular Blocky	4.8	2	0.00	Low
C	550mm plus	Sub Angular Blocky	4.4	2	0.00	Low

Sample	Texture class	Approximate % of clay	Course Fragments %	Soil Colour	Munsel Colour
A	Light Clay	35-40%	<20%	Very Dark Greyish Brown	10YR 3/2
B	Light Clay	35-40%	<20%	Dark Greyish Brown	10YR 4/2
C	Medium to Heavy Clay	45-55%	<20%	Brown	10YR 5/3

Test Pits 6 and 7

Sample	Test hole layer	Ped Structure	pH (1:5) soil/water	Emerson Class	EC (dS/m)	Salinity
A	0mm-200mm	Sub Angular Blocky	5.1	7	0.00	Low
B	200mm – 550mm	Sub Angular Blocky	4.8	2	0.00	Low
C	550mm plus	Sub Angular Blocky	4.8	2	0.00	Low

Sample	Texture class	Approximate % of clay	Course Fragments %	Soil Colour	Munsel Colour
A	Light Clay	35-40%	<20%	Very Dark Greyish Brown	10YR 3/2
B	Medium Clay	40-55%	<20%	Brown	10YR 4/3
C	Medium to Heavy Clay	45-55%	<20%	Yellowish Brown	10YR 5/4

APPENDIX 4 - Surface irrigation area for a 3 bedroom dwelling

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

Design Wastewater Flow (Q):	l/day	750
Design Percolation Rate (R):	mm/wk	20

Surface Irrigation Area from a Secondary Treatment System
Design Irrigation Rate 20

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	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	149.9	189.0	0.75	141.75	88.57	230.32	132.9	97.42	85.58	218.48	-11.85	0.00
Feb	28	166.9	154.0	0.75	115.5	80.00	195.50	155.7	39.80	85.58	241.28	45.78	45.78
Mar	31	184.5	147.0	0.75	110.25	88.57	198.82	151.8	47.02	85.58	237.38	38.55	84.33
Apr	30	168.4	111.0	0.75	83.25	85.71	168.96	115.5	53.46	85.58	201.08	32.11	116.44
May	31	126.6	98.0	0.75	73.5	88.57	162.07	92.3	69.77	85.58	177.88	15.80	132.25
Jun	30	127.7	70.0	0.75	52.5	85.71	138.21	96.8	41.41	85.58	182.38	44.16	176.41
Jul	31	57.7	73.0	0.75	54.75	88.57	143.32	66.5	76.82	85.58	152.08	8.75	185.16
Aug	31	65.2	98.0	0.75	73.5	88.57	162.07	61.6	100.47	85.58	147.18	-14.90	170.26
Sep	30	56.2	129.0	0.75	96.75	85.71	182.46	56.3	126.16	85.58	141.88	-40.59	129.68
Oct	31	92.9	160.0	0.75	120	88.57	208.57	79.6	128.97	85.58	165.18	-43.40	86.28
Nov	30	119.9	173.0	0.75	129.75	85.71	215.46	94.3	121.16	85.58	179.88	-35.59	50.69
Dec	31	117.2	195.0	0.75	146.25	88.57	234.82	110.4	124.42	85.58	195.98	-38.85	11.85
Total	365	1433.1	1597		1197.75	1042.86	2240.61	1213.7	1026.91	1026.91	2240.61	-	-

Irrigation Area (L) m2 **262.93**

Storage (V) **largest M mm** **185.16**
(VxL)/1000 m3 **48.68**

RAINFALL BOM Crescent Head
EVAPORATION BOM Crescent Head

C=0.75
P (r) = 1.0

Surface Irr

Surface irrigation area for a 5 bedroom dwelling

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

Design Wastewater Flow (Q):	l/day	1200
Design Percolation Rate (R):	mm/wk	20

Surface Irrigation Area from a Secondary Treatment System
Design Irrigation Rate 20

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	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	149.9	189.0	0.75	141.75	88.57	230.32	132.9	97.42	85.58	218.48	-11.85	0.00
Feb	28	166.9	154.0	0.75	115.5	80.00	195.50	155.7	39.80	85.58	241.28	45.78	45.78
Mar	31	184.5	147.0	0.75	110.25	88.57	198.82	151.8	47.02	85.58	237.38	38.55	84.33
Apr	30	168.4	111.0	0.75	83.25	85.71	168.96	115.5	53.46	85.58	201.08	32.11	116.44
May	31	126.6	98.0	0.75	73.5	88.57	162.07	92.3	69.77	85.58	177.88	15.80	132.25
Jun	30	127.7	70.0	0.75	52.5	85.71	138.21	96.8	41.41	85.58	182.38	44.16	176.41
Jul	31	57.7	73.0	0.75	54.75	88.57	143.32	66.5	76.82	85.58	152.08	8.75	185.16
Aug	31	65.2	98.0	0.75	73.5	88.57	162.07	61.6	100.47	85.58	147.18	-14.90	170.26
Sep	30	56.2	129.0	0.75	96.75	85.71	182.46	56.3	126.16	85.58	141.88	-40.59	129.68
Oct	31	92.9	160.0	0.75	120	88.57	208.57	79.6	128.97	85.58	165.18	-43.40	86.28
Nov	30	119.9	173.0	0.75	129.75	85.71	215.46	94.3	121.16	85.58	179.88	-35.59	50.69
Dec	31	117.2	195.0	0.75	146.25	88.57	234.82	110.4	124.42	85.58	195.98	-38.85	11.85
Total	365	1433.1	1597		1197.75	1042.86	2240.61	1213.7	1026.91	1026.91	2240.61	-	-

Irrigation Area (L) m2 **420.68**

Storage (V) **largest M mm** **185.16**
(VxL)/1000 m3 **77.89**

RAINFALL BOM Crescent Head
EVAPORATION BOM Crescent Head

C=0.75
P (r) = 1.0

Surface Irr

Sub-surface irrigation area for a 3 bedroom dwelling

Minimum Area Method Water Balance and Wet Weather Storage Calculations

Design Wastewater Flow (Q):	l/day	750
Design Percolation Rate (R):	mm/wk	20

Sub-Surface Irrigation Area from a Secondary Treatment System
Design Irrigation Rate (DIR) = 20

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	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	149.9	189.0	0.75	141.75	88.57	230.32	146.9	83.42	62.87	209.77	-20.55	0.00
Feb	28	166.9	154.0	0.75	115.5	80.00	195.50	168.5	27.00	62.87	231.37	35.87	35.87
Mar	31	184.5	147.0	0.75	110.25	88.57	198.82	183.8	15.02	62.87	246.67	47.85	83.71
Apr	30	168.4	111.0	0.75	83.25	85.71	168.96	170.8	-1.84	62.87	233.67	64.70	148.42
May	31	126.6	98.0	0.75	73.5	88.57	162.07	133.6	28.47	62.87	196.47	34.40	182.81
Jun	30	127.7	70.0	0.75	52.5	85.71	138.21	138.5	-0.29	62.87	201.37	63.15	245.96
Jul	31	57.7	73.0	0.75	54.75	88.57	143.32	78.7	64.62	62.87	141.57	-1.75	244.21
Aug	31	65.2	98.0	0.75	73.5	88.57	162.07	80.4	81.67	62.87	143.27	-18.80	225.41
Sep	30	56.6	129.0	0.75	96.75	85.71	182.46	56.6	125.86	62.87	119.47	-63.00	162.41
Oct	31	92.9	160.0	0.75	120	88.57	208.57	94.2	114.37	62.87	157.07	-51.50	110.91
Nov	30	119.9	173.0	0.75	129.75	85.71	215.46	114.8	100.66	62.87	177.67	-37.80	73.11
Dec	31	117.2	195.0	0.75	146.25	88.57	234.82	119.4	115.42	62.87	182.27	-52.55	20.55
Total	365	1433.5	1597		1197.75	1042.86	2240.61	1486.2	754.41	754.41	2240.61	-	-

Irrigation Area (L) m2 **357.90**

Storage (V) **largest M mm** **245.96**
(VxL)/1000 m3 **88.03**

RAINFALL BOM (Crescent Head)
EVAPORATION BOM

C=0.75
P (r) = 1.0

Surface Irr

Sub-surface irrigation area for a 5 bedroom dwelling

Minimum Area Method Water Balance and Wet Weather Storage Calculations

Design Wastewater Flow (Q):	l/day	1200
Design Percolation Rate (R):	mm/wk	20

Sub-Surface Irrigation Area from a Secondary Treatment System
Design Irrigation Rate (DIR) = 20

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	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	149.9	189.0	0.75	141.75	88.57	230.32	146.9	83.42	62.87	209.77	-20.55	0.00
Feb	28	166.9	154.0	0.75	115.5	80.00	195.50	168.5	27.00	62.87	231.37	35.87	35.87
Mar	31	184.5	147.0	0.75	110.25	88.57	198.82	183.8	15.02	62.87	246.67	47.85	83.71
Apr	30	168.4	111.0	0.75	83.25	85.71	168.96	170.8	-1.84	62.87	233.67	64.70	148.42
May	31	126.6	98.0	0.75	73.5	88.57	162.07	133.6	28.47	62.87	196.47	34.40	182.81
Jun	30	127.7	70.0	0.75	52.5	85.71	138.21	138.5	-0.29	62.87	201.37	63.15	245.96
Jul	31	57.7	73.0	0.75	54.75	88.57	143.32	78.7	64.62	62.87	141.57	-1.75	244.21
Aug	31	65.2	98.0	0.75	73.5	88.57	162.07	80.4	81.67	62.87	143.27	-18.80	225.41
Sep	30	56.6	129.0	0.75	96.75	85.71	182.46	56.6	125.86	62.87	119.47	-63.00	162.41
Oct	31	92.9	160.0	0.75	120	88.57	208.57	94.2	114.37	62.87	157.07	-51.50	110.91
Nov	30	119.9	173.0	0.75	129.75	85.71	215.46	114.8	100.66	62.87	177.67	-37.80	73.11
Dec	31	117.2	195.0	0.75	146.25	88.57	234.82	119.4	115.42	62.87	182.27	-52.55	20.55
Total	365	1433.5	1597		1197.75	1042.86	2240.61	1486.2	754.41	754.41	2240.61	-	-

Irrigation Area (L) m2 **572.64**

Storage (V) **largest M mm** **245.96**
(VxL)/1000 m3 **140.85**

RAINFALL BOM (Crescent Head)
EVAPORATION BOM

C=0.75
P (r) = 1.0

Surface Irr

Appendix 5 – Possible Building and Irrigation Areas