On-site Sewage Management Assessment Report
Proposed Rezoning

Location:

Lot 116 DP 856265
225 Terranora Road
Banora Point NSW 2486

Prepared for:

Planit Consulting

Report No:

HMC2019.232.01

December 2019

HMC environmental consulting pty ltd

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RE: Lot 116 DP 856265, 225 Terranora Road, Banora Point, NSW, 2486.

HMC Environmental Consulting Pty Ltd is pleased to present our report for On-site Sewage Management Design for the abovementioned site.

We trust this report meets with your requirements. If you require further information please contact HMC Environmental Consulting directly on the numbers provided.

Yours sincerely

Helen Tunks
(B.Env.Sc.)

Document Control Summary			
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Title:	**On-site Sewage Management Design Report**		
Job No:	**2018.232.01**		
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ABBREVIATIONS

AWTS	Aerated Wastewater Treatment System with current AWTS or STS accreditation by NSW Health
BOD_5	Biochemical oxygen demand over 5 day period
CFU	Colony forming unit
DIR	Design irrigation rate
DLR	Design loading rate
ETA	Evapo-Transpiration Absorption (ETA) ETA beds will be used in reference to the construction of shallow sub surface effluent disposal trenches that utilise the principles of evaporation, transpiration and absorption. The method of construction for the ETA bed referred to in this report is in accordance with a "Conventional Bed" provided in Figure L5 of AS/NZS 1547: 2012.
HMC	HMC Environmental Consulting Pty Ltd
LAA	Land application area
LTAR	Long term acceptance rate
OSSM	On-site sewage management
SDI	Subsurface Drip Irrigation
STS	Secondary Treatment System accredited under the "Secondary Treatment System Accreditation Guideline May 2018". STS are tested and product certified to Australian Standard AS1546.3:2017
TN	Total nitrogen
TP	Total phosphorus
TSS	Total suspended solids

1 INTRODUCTION

HMC Environmental Consulting Pty Ltd has been commissioned by the property owner to prepare an on-site sewage management (OSSM) assessment for the proposed part rezoning of Lot 116 DP 856265, 225 Terranora Road, Terranora, NSW, 2486.

The planning proposal will result in the augmentation of large lot residential zoned land within the existing property boundary. A site inspection was carried out on the 4th October 2019 & 19th November 2019 by Helen Tunks, Mark Tunks & Taylah Richards of HMC.

The site and soil were assessed for on-site wastewater disposal limitations. This report outlines the appropriate effluent treatment and land application methods and the area required for on-site wastewater disposal for future dwellings.

2 PROJECT INFORMATION

Proposal	Proposed Rezoning – Existing Lot 116 DP 856265
Total Area	10.19 ha
Address	225 Terranora Road Banora Point
Council Area/Approvals:	Tweed Shire Council Property Number - 37821
Water Supply	Reticulated Town Water Supply
Design Daily Hydraulic Load	**Up to 4-bedrooms Per Dwelling** @ 900L/day: conservatively 6 persons Based on 150L/p/day wastewater flow allowance (AS1547:2012)
Water Saving Devices	Recommended as standard in new dwellings to promote water conservation.

3 SUMMARY OF RECOMMENDED ON-SITE SEWAGE MANAGEMENT

Proposed OSSM Facility for future lots :
• Install an NSW Health Accredited Aerated Wastewater Treatment System or Secondary Treatment System • Install 400 linear metres of pressure compensated, non-drain dripperline lateral within a raised sub-surface irrigation bed of minimum 400m2 with side flanks of 1:3 batter.. • Bed Construction: bed is to be constructed by placing of fill to a total height of 300mm above the natural ground surface. Compaction should be minimised when installing the bed. The fill must be Loam to Sandy Loam with minimal clay content. Grass (turf) must be established over the raised bed immediately after completing construction. Site preparation required prior to placement of fill. • Reserve additional 200m2 for future land application in the event of duplication or expansion (reserve LAA)

4 SITE INFORMATION

Should conditions vary from those described below during any stage of installation, HMC is to be notified to ensure the recommendations of this report remain valid or alternative recommendations be made. The information relates to the general site.

4.1 Site Conditions

Inspected by	Helen Tunks, Mark Tunks & Taylah Richards
Date & Time of Inspection	Tuesday 19th November 2019. See Appendix 1 & 2 for site location and proposed boundaries, Appendix 7 for photos.
Soil Investigations	Geotechnical Investigations – 2018 – 14 testpits by mechanical excavagtion HMC – 2019 – 7 boreholes via hand auger
Weather	Weather – Warm, dry during inspection. ~20mm rainfall recorded 24 hours preceding inspection. Below average rainfall event for the month preceding site inspection totalling ~31.6mm according to BOM Stn 58056 Tweed Heads Golf Club.
Soil Type & Category	Sandy Clay Loam topsoil overlying Sandy or Silty Clay with shallow bed rock recorded in majority of site. Soil Category 5 (Table 5.1 AS/NZS1547:2012) See Appendix 5 for soil investigation information. Soil amendment is required: t is recommended to import 300mm of Clay Loam fill with neutral pH to be used throughout the proposed LAA.
Drainage	Restricted drainage. Shallow rock recorded throughout subject site, present from 400mm to 1000mm depth across site.
Climate	Annual rainfall: 1555mm Tyalgum (1971 – 1984) Annual evaporation: 1000-1200mm/year Warm, temperate. High volume, seasonal rainfall typical of region.
Terrain & Landform	Broad ridge
Ground cover/vegetation	Pasture grass with few mature trees
Environmentally Sensitive Areas	The property is located along the Terranora broad ridgeline and extends southwards down to the Tweed River. Remnant rainforest has been identified on the site.
Reserve LAA	50% nominated as minimum per Lot for the purposes of conservative design.

5 LAND APPLICATION AREA SIZING AND DESIGN

5.1 Assessed Design Inputs

Model Used: Draft Richmond Tweed On-Site Regional Strategy (Alderson, 1999). Daily Time Step	
Climate Data	Tyalgum – rainfall & evaporation 1971 – 1984. Mean annual rainfall 1555mm.
Design Occupancy	6 persons in 4-bedrooms
Wastewater Design Flow Allowance	150L/p/day
Wastewater Design Hydraulic Load	900L/day
Soil Type/Permeability*	Soil Category 5
Nitrogen (TN)	3.8 kg/person/year (Whelan & Titammis,1982) See Appendix 4.
TN System Nutrient Reduction	Secondary Effluent ~55% reduction achieved See Appendix 4
Vegetation Removal of TN	Conservative rate of 300 kg/ha/year. Note: Kikuyu up to 520kg/ha/year (NSW Agriculture 1997) See Appendix 4
Phosphorus (TP)	0.6 kg/person/year (Geary & Gardner, 1996) See Appendix 4
Vegetation Removal of TP	20 kg/ha/year (Myers et al 1994)
Phosphorus Adsorption	~10000 kg/ha/ based on field texture and work carried out by Morand, 1996
Maximum DIR	3mm/day
Proposed DIR	2.25mm/day
Long Term Acceptance Rate (LTAR)	6.5mm/day

5.2 Summary of Land Application Area Sizing

Analyte	**Land Application Area (LAA)** **Minimum Requirement (m2) Per Future Lot**
	Assumes up to 4 bedrooms, 6 person design occupancy.
Hydraulic Load	400
Nitrogen (TN)	342
Phosphorus (TP)	69
Design Hydraulic Load	900L/day
LAA size	400m2
LAA method	SDI

6 OVERALL EVALUATION

The village of Banora Point is serviced by reticulated town water however, there is no connection to sewer along the east facing Terranora ridge line.

The site is located along a broad ridge with steep westward sloping land majorly cleared of native vegetation. Physical site constraints include shallow bedrock at varying depths. To mitigate this constraint, it is proposed to construct raised subsurface irrigation beds with loam – sandy loam soil of minimum 300mm height above natural ground surface.

Based on the information presented in this report, it is considered that the recommendations listed below are sufficient to attain an acceptable level of environmental impact from the design wastewater flow generated by the future dwellings on the proposed lots.

7 RECOMMENDATIONS

RECOMMENDED ON-SITE SEWAGE MANAGEMENT FOR RESIDENTIAL ZONE

At subdivision approval stage:

- Provide minimum 600m2 effluent land application area (LAA) to be provided per dwelling site
- Construct a raised sub-surface irrigation bed of 400m2 surface area per dwelling site. The sub-surface irrigation bed is to be raised to a total heigh of 300mm above the natural ground surface. Batter slope to be maximum 1 (vertical) : 3 (horizontal)
- Fill Material: Loam to Sandy Loam with minimal clay content, and neutral pH.
- Site Preparation: site is to be cleared of all shrubs, trees and surface boulder. Trees are to be cut to ground level and the stump ground out to a depth of 300mm. Backfill with permeable material such as the natural topsoil or sand. Scarify the natural soils across the entire basal area to a minimum depth of 200mm taking care not to compact the basal are in the process. This scarification should extend to at least 1m beyond the bed perimeter.
- Bed Surface: Grass (turf) must be established over the raised bed immediately after completing construction.
- An earth bank diversion bund/bank must be constructed upslope of the raised irrigation bed to divert surface water run-on.

At dwelling construction approval stage:

- Install a Secondary Treatment System (STS) including Aerated Wastewater Treatment System (AWTS) with NSW Health Accreditation
- Install minimum 400m2 shallow ripped subsurface drip irrigation (SDI), pressure compensated, non-drain, non-siphoning. Dripperline laterals must be buried 100-150mm below the surface of the raised bed. Irrigation design to include pump performance, filters, air relief and check valves. A full hydraulic design is to be carried out as part of the installation approval at construction stage.
- Retain 200m2 for reserve effluent land application area, may be unfilled unless the design loading exceeds 900L/day

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7.1 Site Plan – OSSM – Soil Sampling Locations

SEE FOLLOWING PAGE

TP4
BH2
TP3
BH1
TP5
TP9
BH3
TP13
TP12
TP10
R 5
(Existing)
TP8
BH4
TP2
R 5
(Proposed)
BH5
BH6
TP14
TP6
TP11
TP1
BH7
TP7

Proposed R5 Zone

Lot Boundary

Soil Investigations:

HMC - 19.11.2019 Soil I (ShallowRock)

Geotech Investigations - 21.12.2018 (Shallow Rock)

Geotech Investigations - 21.12.2018 (Silty Clay)

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ONSITE SEWAGE MANAGEMENT ASSESSMENT - SOIL SAMPLING LOCATIONS

225 Terranora Road
Banora Point

Base Drawing Source: Planit Consulting HMC Ref: 2019.232

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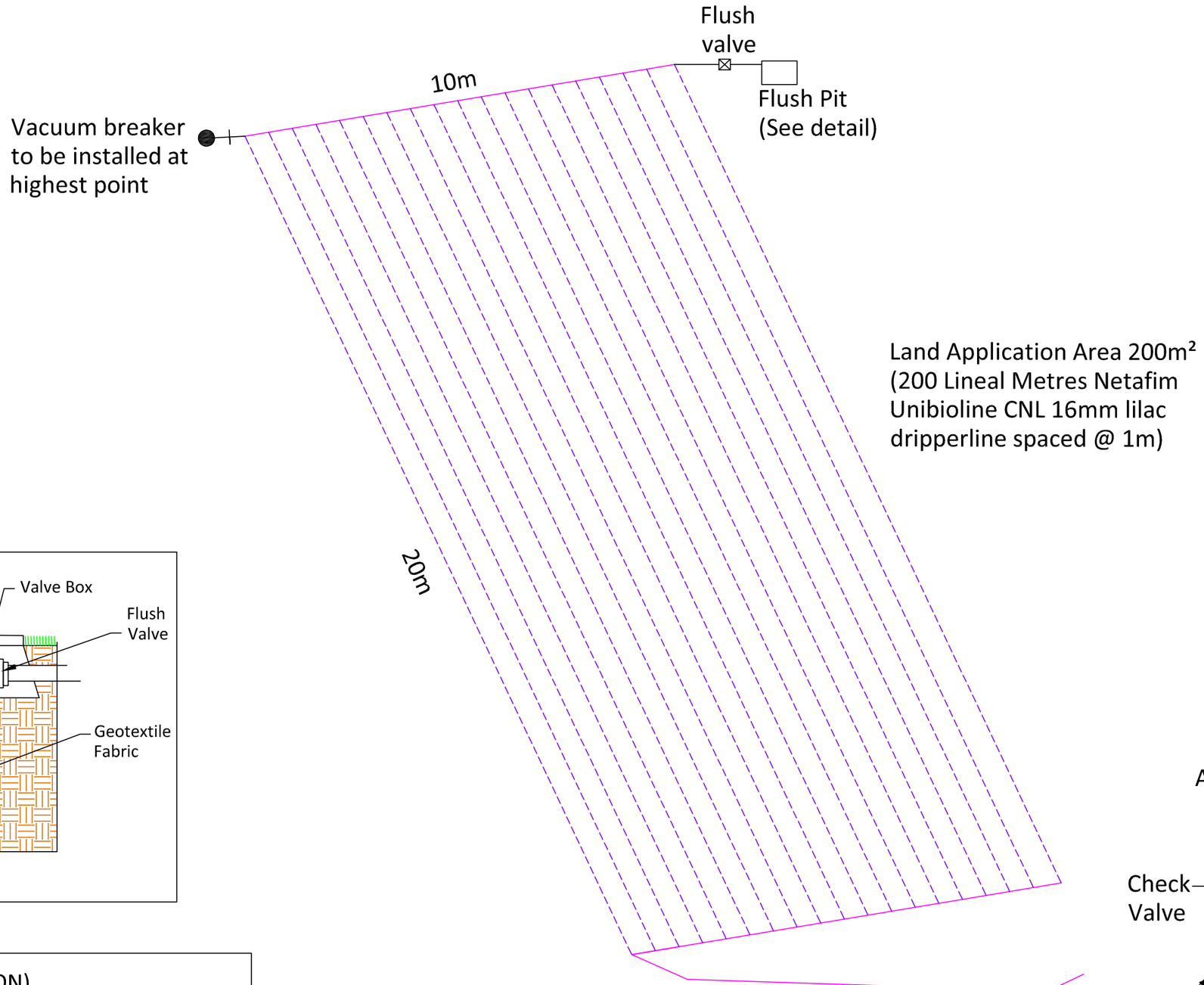
Date: 12/12/19
Revision Date: 03/02/2020

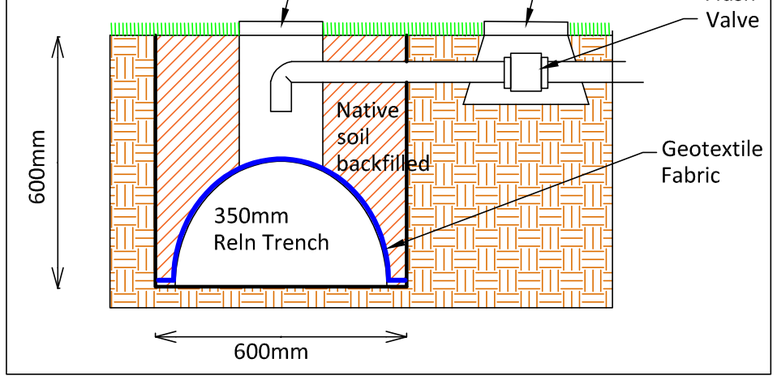
7.2 General Subsurface Drip Irrigation Components

SEE NEXT PAGE

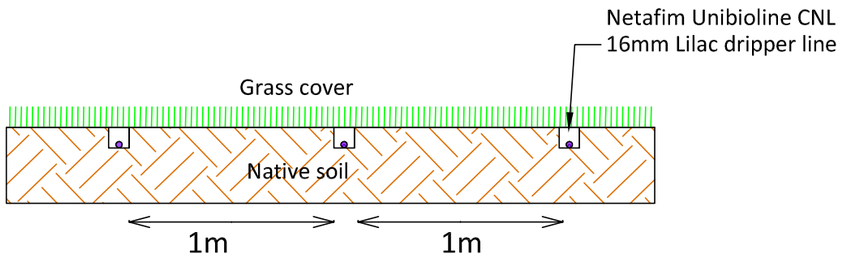


- Disk Filter
- Tech Filter
- Air Release/vacuum breaker
- Flush Valve
- Netafim DNL check valve
- 25/32mm Ø lilac LDPE
- 16mm Netafim Unibioline CNL dripperline 1.6L/hr emitters @ 0.4m spacing

FLUSH PIT - DETAIL



SUB-SURFACE DRIP IRRIGATION - (SECTION)



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EXAMPLE SUB-SURFACE DRIP IRRIGATION LAYOUT & SECTION DETAIL

8 REFERENCES

- Alderson, G. & Associates Pty Ltd (1999) "Draft Richmond Tweed On-site Regional Wastewater and Sewage Management Strategy".
- AS/NZS 1547: 2012 On-site Domestic Wastewater Management
- Australian Guidelines for Water Recycling: Managing Health and10 Environmental Risks (Phase 1) 2006
- Dept. Of Climate Change & Energy Efficiency (DCCEE) Your Home: Australia's Guide to Environmentally Sustainable Homes, 5th edition. http://www.yourhome.gov.au/water/reducing-water-demand
- Department of Local Government, EPA (NSW), NSW Health, Land and Water Conservation and Department of Urban Affairs and Planning (1998) "*Environment & Health Protection Guidelines – On-site Sewage Management for Single Households*".
- eSPADE V2.0 NSW Office of Environment and Heritage https://www.environment.nsw.gov.au/eSpade2WebApp
- Lismore City Council, (2013)"Revised On-site Sewage and Wastewater Management Strategy," Lismore.
- Morand. (1996) *Soil Landscapes of Murwillumbah -Tweed 1:100000 Sheet Map and Report* NSW Department of Land and Water Conservation
- Munsell Soil Color Charts (2000), Gretag Macbeth, New Windsor, NY, USA.
- WaterNSW(2012) "Designing and Installing On-site Wastewater Systems. A WaterNSW Current Recommended Practice", 2019
- Whelan, B.R. And Titammis, Z.V. (1982) "Daily chemical variability of domestic septic tank effluent". *Water, Air and Soil Pollution* ***17***, 131-139

9 LIMITATIONS

The information within this document is and shall remain the property of HMC Environmental Consulting Pty Ltd.

This document was prepared for the sole use of client and the regulatory agencies that are directly involved in this project, the only intended beneficiaries of our work. No other party should rely on the information contained herein without the prior written consent of HMC Environmental Pty Ltd and client. The report and conclusions are based on the information obtained at the time of the assessment. Your report is based on the assumption that the site conditions as revealed through selective point sampling are indicative of actual conditions throughout an area. This assumption cannot be substantiated until project implementation has commenced and therefore your report recommendations can only be regarded as preliminary.

Because a report is based on conditions which existed at the time of the subsurface exploration, decisions should not be based on a report whose adequacy may have been affected by time, natural processes and the activities of man. Changes to the subsurface, site or adjacent site conditions may occur subsequent to the investigation described herein, through natural processes or through the intentional or accidental addition of contaminants, and these conditions may change with space and time.

The findings of this report are based on the objectives and scope of work outlined within. HMC performed the services in a manner consistent with the normal level of care and expertise exercised by members of the environment assessment profession. No warranties or guarantees, expressed or implied, are made. Subject to the scope of work, HMC's assessment is limited strictly to identifying typical environmental conditions associated with the subject property, and does not include evaluation of any other issues. This report does not comment on any regulatory obligations based on the findings, for which a legal opinion should be sought. This report relates only to the objectives and scope of the work stated, and does not relate to any other works undertaken for the Client. All conclusions regarding the property area are the professional opinions of the HMC personnel involved with the project, subject to the qualifications made above. While normal assessments of data reliability have been made by HMC, HMC assume no responsibility or liability for errors in any data obtained from regulatory agencies, or information from sources outside HMC's control, or developments resulting from situations outside the scope of this project.

10 APPENDICES

APPENDIX 1 Site Location

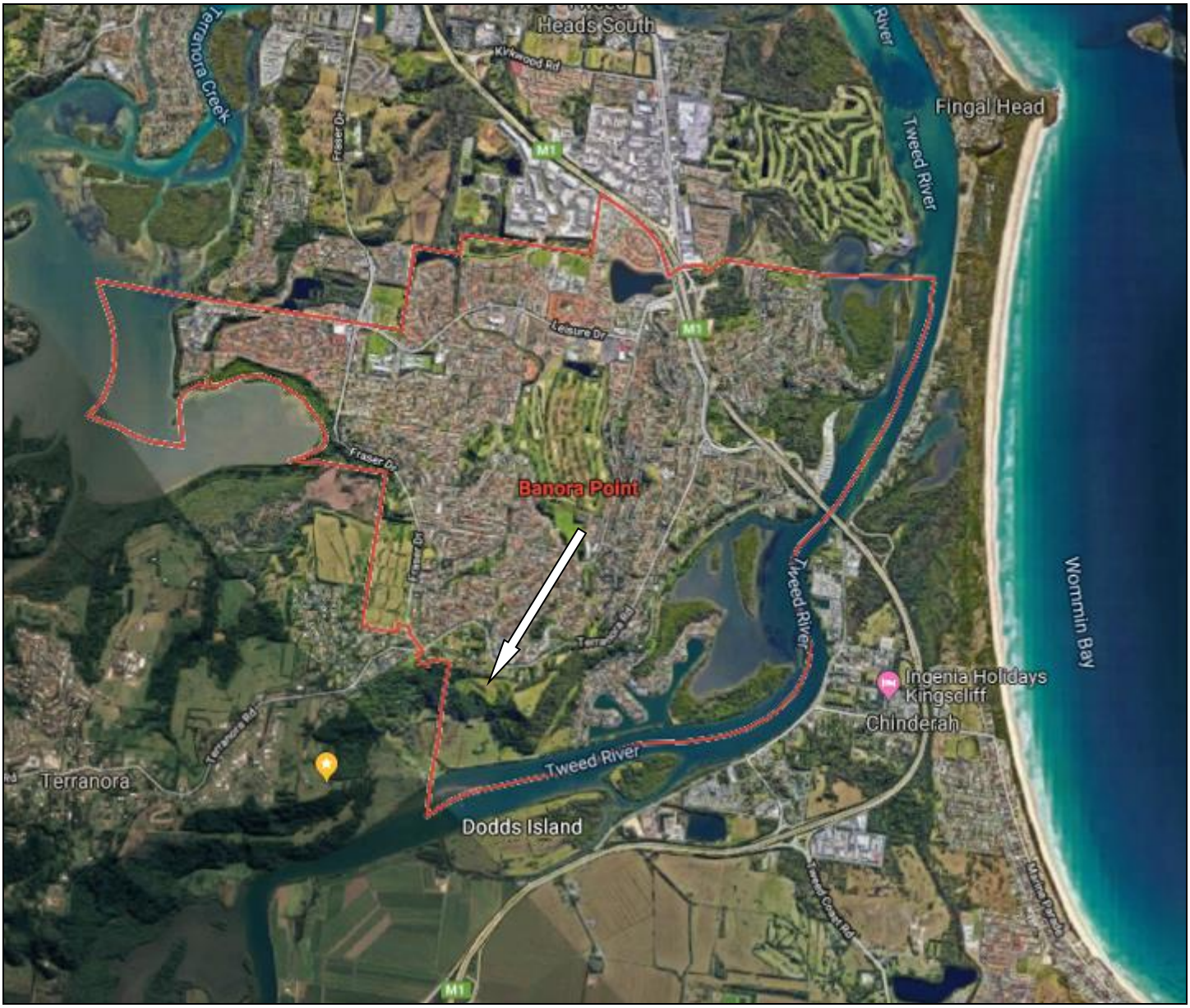

Figure 1 - Site Location (Google Earth 2014)

APPENDIX 2 Property Boundary

Site Boundary: Source: NSW LPI

APPENDIX 3 Modelling

Subsurface Drip Irrigation for up to 4-bedroom dwelling

Daily Effluent Disposal Model using Boughton Water Balance Model - Tyalgum			
Greg Alderson & Associates Pty Ltd			
Period of Rainfall & Evaporation Record: 01/01/1971 - 31/12/1984			
Client:	Planit Consulting	AWTS + SDI field	
Site:	225 Terranora Road, Banora Point		
Number of Persons	6	equivalent persons	
Daily Flow =	900	l/day	
Nitrogen Volume per year	22.8 kg/year	3.80	kg N /p/year - See Table 7 & table 8
Denitrification reduce to	10.26 kg/year	55.00	% reduction rate
Plant Uptake rate (N) =	300	kg/ha/year - See Table 6	
Phosphorus in Effluent (Ip) =	3.6 kg/year	0.6	kg P /person/year - see Table 11
P Uptake by plants (Hp) =	20	kg/ha/year - P which is taken up by vegetation, Table 9	
P sorption (Ps) =	10000	kg/ha/m depth - soil sorption capacity, Table 10	
Water Table Depth (Wtd) =	3	m - measured depth to the water table at the disposal site	
Buffer to W table (Bwt) =	0.5	m - adopted buffer to be set above water table	
Time for accumulation of P =	50.00	years	
Min. planted disposal area =	**342**	m^2 (based on N loading)	
Min. planted disposal area =	**69**	m^2 (based on P loading)	
Hydraulic Area	**400**	m^2 (ignored if less than Min. planted disposal area)	
Crop factor =	1.00	See Table 3 and Section- B2.8	
% Effective Rainfall =	75%	See Table 2	
Drainage below root zone/ Percolation =	6.5	mm/day - LTAR	
% of storage depth at which percolation occurs =	50%	See Section–B2.3	
Depth of topsoil/ Depth of trench =	0.45	m	
Available water/ Void space ratio =	0.139	Available water from Table 1 (m/m)	
Soil Moisture Holding Capacity/ Trench storage =	62.55	mm	
Permissible days overflow =	20	days/year	
Minimum effluent application =	2.25	$mm/day/m^2$	
Max cum stor =	11.25	mm	
Required permissible storage =	0.00	m^3	
Max cum stor =	4.50	m^3	

APPENDIX 4 Nutrient Loading

In consideration of nutrients such as nitrogen and phosphorus, a mass balance was used to estimate the application rate and long term management of the on-site sewage management system based on effluent quality, wastewater volume and land application system, plant uptake, site and soil characteristics.

In determination of LAA sizing regarding TN the following data was used.

Table 1 Nitrogen Production Data

Study	Mean Annual Loading
Witt et al. 1974	2.2 kg/person/year
Whelan & Titammis 1982	3.8kg/person/year
Sarac, K et al 2001	4.0kg/person/year (based on 6 dwellings within tank)
Davison et al., 2002	4.2 kg/person/year (based on two dwellings within tank)
Patterson, R.A 2004	4.38 kg/person/year (using mean of 85.8mg/L^{-1} at 140L/person/day)
Mean of listed studies	3.73kg/person/year
Realistic annual loading rate based on above listed studies	3.8 kg/person /year (as per Whelan & Titammis 1982)

The mean of the above studies provides a TN of approximately 3.7kg/person/year therefore the previously quoted figure of 3.8kg/person/year by Whelan & Titammis, 1982, is considered realistic for this domestic installation.

APPENDIX 5 Soil Investigation

Soil Landscape

NSW DLWC 1:100,000 Soil Landscape Map (Morand, 1996)	Billinudgel (bi) soil landscape (Expected), Yellow and Red Podzolics (GSG) or Chromosols (ASC).
Geology	Neranleigh Fernvale Group – shales, siltstones, sandstones, greywacke and agglomerates

HMC Soil Profiles

Soil Profile - HMC bore logs 19th November 2019							
Borehole no.	**Depth (mm)**	**Field Texture Determination**	**Structure**	**Colour - Moist MUNSELL**	**pH**	**Coarse Fragments**	**Modified Emerson Aggregate Test**
1	0-400	Sandy Clay Loam	Strong	Dark Yellowish Brown 10YR 3/4 Moist	4.5	Yes, fine gravels <20%	Class 3/6 Not limiting
2	0-400	Silty Loam	Strong	Dark Yellowish Brown 10YR 3/4 Moist	4.5	Yes, fine gravels <20%	Class 3/6 Not limiting
3	0-350	Clay Loam	Moderate	Dark Brown 7.5YR 3/4 Dry	5.0	Yes, fine gravels <20%	Class 8 No slaking Not limiting
4	0-750	Sandy Clay	Moderate	Dark Brown 7.5YR 3/4 Dry	5.5	Yes, fine gravels <20%	Class 3/6 Not limiting
	750-850	Sandy Clay Loam	Strong	Strong Brown 7.5YR 4/6 Dry	5.0	Yes, fine gravels <20%	Class 3/6 Not limiting
	850-1000	Sandy Clay	Single grained	Yellowish Brown 10YR 5/4 Dry	6.5	Yes, fine gravels >20%	_
5	0-450	Sandy Clay	Weak	Dark Yellowish Brown 10YR 3/4 Dry	4.5	Nil	Class 3/6 Not limiting
	450-850	Sandy Clay Loam	Moderate	Dark Yellowish Brown 10YR 3/4 Moist	4.5	Yes, fine gravels <20%	Class 3/6 Not limiting

6	0-200	Fine Sandy Clay Loam	Single grained	Dark Yellowish Brown 10YR 3/4 Dry	6.5	Yes, fine gravels <20%	Class 3/6 Not limiting
	200-350	Sandy Clay	Single grained	Black 2.5YR 2.5/1 Dry	9.0	Yes, fine gravels <20%	_
7	0-200	Sandy Clay	Strong	Dark Yellowish Brown 10YR ¾ Dry	7.0	Yes, fine gravels <20%	Class 3/6 Not limiting

Modified Emerson Aggregate Test

As described by Robert Patterson Lanfax Labs Technical Note T14-1 (November 2014)

"The modified Emerson test can be reported and interpreted, with respect to domestic wastewater application as:

Class 1 - *Severe dispersion, maybe related to high sodicity which forces the clay particles apart in water. Amelioration with lime or gypsum may improve structural stability by increasing EC. Class 1 soils have a major limitation to wastewater application because of reduced permeability and potential to compact as the pores block.*

Class 2 - *Moderate dispersion, may be related to high sodicity. Amelioration may be effective by increasing EC. Without amelioration, this class has a major limitation to waste water application as for class 1.*

Classes 3-6 -*Remoulding, and 1:5 soil:water suspension tests are irrelevant to wastewater assessment, but one can report the test results with degree of slaking as:*

Slake 1 (slight), slake 2 (moderate) or slake 3 (completely slumped). Slake 1, 2, or 3 – no limitation to wastewater application, but may benefit from additional organic matter for surface irrigated soils.

Classes 7 and 8 - *these soils are water stable, but may swell (Class 7) or retain original size and shape (Class 8). Neither of these classes is a limitation to wastewater application."*

Maz Lab Soil Profiles

Soil Profile-Maz Lab 19th November 2019					
Borehole no.	**Depth (mm)**	**Field Texture Determination**	**Structure**	**Colour**	**Coarse Fragments**
1	0-400	Clay Fine grained sand		Brown/red brown Moist	NIl
	400-750	Cobbles & gravel, pockets of clay		Brown/red brown Moist	Cobbles & gravel
	750	Rock		_	No penetration
2	0-150	Clay Fine grained sand		Brown/red brown Moist	Nil
	150-400	Silty Clay Fine sand		Grey brown Moist/dry	Nil
	400-500	Siltstone	Moderately dense	Grey Dry	Dense, slow drilling
3	0-350	Clay Fine sand		Brown/red brown Moist	Nil
	350-900	Clay Fine sand		Brown/red brown Moist	Fine gravels
	900-1000	Gravel/fractured rock	Moderate/ Hard	_	Gravels & rock
4	0-350	Clay Fine sand		Brown/red brown Moist	Nil
	350-750	Clay Fine sand		Brown/red brown Moist	Fine to medium coarse gravel (blue rock)
	750-900	Cobbles & Gravel	Hard	_	Yes Coarse gravel & cobbles
	900-1000	Rock		_	Yes
5	0-850	Clay Fine grained sand		Brown/red brown Moist	Nil
	850-950	Rock	Moderate/ hard	_	Yes
6	0-200	Clay Fine grained sand		Brown/red brown Moist	Nil
	200-400	Clayey gravel		Brown Dry	Fine/medium & coarse sized gravel
	400-550	Rock	Moderate/ hard	_	Yes

APPENDIX 6 Effluent Treatment

The method of land application chosen to suit the dwelling size and site will determine the treated effluent quality target criteria. It is proposed to construct evapo-transpiration/absorption (ETA) beds and subsurface drip irrigation fields to receive the recommended secondary treated effluent which remains in accordance with NSW Health recommendations.

Table 2 Effluent Quality Criteria

NSW Health Advisory Note 4 – January 2017 "Sewage Management Facility Accreditation Criteria Based on the Final Application of Treated Effluent and Risk of Disease Transmission".

Treatment	Standard	Recommended Final Use / Application
Primary Treatment (sewage or greywater) e.g., septic tank, greywater tank, wet composting closet system, greywater diversion device	Solids separation and digestion- no effluent standard	Sub-soil at greater than 300mm depth below finished ground level e.g., absorption trenches, mounds, and evaporation-transpiration beds.
Secondary Treatment without Disinfection	• BOD < 20 mg/L • TSS < 30 mg/L • Service person performs compliance inspection and reports condition of land application system • Local council develops risk management monitoring strategy	• Sub-soil > 300mm depth • Sub-surface (300 mm to 150 mm) • LPED • Shallow Sub-surface Drip Irrigation
Secondary Treatment with Disinfection	• BOD < 20 mg/L • TSS < 30 mg/L • *E. coli* <30 cfu/100mL	• Sub-soil > 300mm depth • Sub-surface (300 mm to 150 mm) • * LPED • Shallow sub-surface drip irrigation • Surface and spray irrigation (100 mm to above GL)
Advanced Secondary Treatment without Disinfection	• BOD < 10 mg/L • TSS < 10 mg/L • Service person performs compliance inspection and reports condition of land application system • Local council develops risk management monitoring strategy	• Sub-soil > 300mm depth • Sub-surface (300 mm to ground level (no spray) • * LPED • ** Shallow Sub-surface drip irrigation

Advanced Secondary Treatment with Disinfection	• BOD < 10 mg/L • TSS < 10 mg/L • *E. coli* <10 cfu / 100mL	• Sub-soil > 300mm depth • Sub-surface (300 mm to 150 mm) • * LPED • ** Shallow sub-surface drip irrigation • Surface and spray irrigation (100 mm to above GL) • Greywater may be used for toilet flushing and washing machines
From NSW Health AdNote 4 (4 January 2017) *Low Pressure Effluent Distribution (LPED) Irrigation Lines if installed in accordance with AS/NZS 1547:2012 On-site domestic wastewater management; Appendix M**Shallow sub-surface drip irrigation if installed in accordance with AS/NZS 1547:2012 On-site domestic wastewater management; Appendix M		

Table 3 Characteristics of Typical Untreated Domestic Wastewater

Parameter	Loading	Greywater %	Blackwater %
Flow – Non reticulated Water Supply	100 - 140 L/p/d	65	35
Flow – Reticulated Water Supply	150 – 300 L/p/d	65	35
Biochemical oxygen demand	200-300 mg/L	35	65
Suspended solids	200 – 300 mg/L	40	60
Total Nitrogen	20 - 100 mg/L	20 – 40	60 – 80
Total Phosphorus	10 – 25 mg/L	50 – 70	30 – 50
Faecal coliforms	$10^2 – 10^{10}$ cfu/100 mL	Medium – high	high

Source:, The Environment & Health Protection Guidelines – On-site Sewage Management for Single Households, 1998.

Table 4 Expected Effluent Quality – Secondary Treatment System

Final Effluent Quality (taken from any random grab sample)	
Biological Oxygen Demand 5 Day (BOD5)	<30mg/L
Total Suspend Solids (TSS)	<45mg/L
E. coli	<100cfu/100mL
Free residual chlorine	> 0.2mg/L and < 2.0mg/L

Source: NSW Health Secondary Treatment System Accreditation Guideline 2018.

APPENDIX 7 Site Photos

Photo 1 View S and downslope over existing lot.

Photo 2 View W and across slope.

Photo 3 View NE and upslope.

Photo 4 View W and downslope.