Broadcrest Consulting Pty Ltd

240 Powderworks Road, Ingleside

On-Site Wastewater Report

May 2022

REF: 1916-WW-A-01

1300 554 945 | contact@broadcrest.com.au | broadcrest.com.au

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DOCUMENT CONTROL

Approval and Authorisation

Title	240 Powderworks Road, Ingleside On-Site Wastewater Report
Authored by:	A. McAllister
Released on behalf of Broadcrest Consulting Pty Ltd by:	Kurtis Ferry Engineer | Environmental & Civil
Signed:	
Dated:	5/05/2022

Document Status

Date	Internal Reference	Document Status	Prepared by	Reviewed by
5/05/2022	1916-WW-A-01	For Release	A. McAllister	K. Ferry

CONTENTS

1 INTRODUCTION

1.1 Foreword

An On-Site Wastewater Report is a technical document which specifies how the sewage produced on-site will be managed, treated, and then disposed. An On-Site Wastewater Report carefully considers the environment, health, cost, and long-term management options for the on-site management of sewage.

1.2 Background

Broadcrest Pty. Ltd. was engaged by Tania Cvijetic to produce an On-Site Wastewater Management Report at 240 Powderworks Road, Ingleside (the site). The report will accompany plans to construct a single story addition to the existing dwelling. A site inspection was carried out on 2 May 2022 which involved a visual assessment of the site and soil sampling. The assessment of the results, system design and recommendations are detailed in this report.

1.3 Objectives

The performance objectives of the On-Site Wastewater Assessment are to:

- Protect human health
- Protect ground and surface water
- Maintain and enhance the quality of the land and vegetation
- Maintain and enhance community amenity
- Ensure maximum re-use of resources
- Promote an ecologically sustainable development.

1.4 Scope of Works

The scope of works included the following:

- A site inspection
- Soil sampling and analysis
- Wastewater management assessment
- Drafting of the proposed system
- Reporting in accordance with the associated legislations and guidelines.

1.5 Compliance

This report has been produced in accordance with the following guiding documents:

- DLG 1998, On-site Sewerage Management for Single Households
- SCA 2012, Designing and Installing On-Site Wastewater Systems
- Australian Standard AS 1289.3.8.1:2006 Methods for testing soils for engineering purposes
- Australian Standard AS 1546.1-3:2008 On-site domestic wastewater treatment units
- Australian Standard AS 1547:2012 On-site domestic wastewater management.

2 SITE ASSESSMENT & INVESTIGATION

2.1 Site Information

Address / Locality	240 Powderworks Road, Ingleside
Lot Area:	3055m^2
Council / LGA:	Northern Beaches Council
Intended Water Supply:	Town Water
Inspection Officer:	K. Ryan - 2/05/2022

2.2 General

The site occupies 3055 m^2 of land zoned RU2 Rural Landscape, within the Northern Beaches Council LGA. At the time of inspection, the site was occupied by a single residential dwelling and expansive lawn area. The existing AWTS system appeared to be functioning adequately. A suitable Effluent Management Area (EMA) location was identified immediately downslope of the existing residence in the lawn area (See Figure 2-1).

Figure 2-1: Northeast facing photograph over proposed development location & EMA

2.3 Assessment Methodology

The assessment methodology of this report follows that prescribed in DLG (1998), whereby the restriction imposed by a site/soil features are categorised by severity, and their impact forms the basis for subsequent system selection, design, and recommendations (Table 2.3.1).

Table 2.3.1 - Site / soil limitation assigned per DLG (1998)

Limitation	Description
Minor	This feature has been assessed and deemed to pose no obstacle to OSSM, given the recommended system and measures are implemented.
Moderate	This feature requires consideration. It may typically be overcome by site modifications or by appropriate selection, design and sizing of treatment / application systems.
Major	This feature precludes the use of a given treatment, land application method, or Effluent Management Area (EMA). Particular Major Limitations may prevent OSSM entirely, require an off-site management approach, or re-evaluation of the development scope.

2.4 Site Assessment Summary

A summary of limitations pertinent to the suitability of the site for On-Site Sewerage Management (OSSM) is provided in Table 2.4.1 below.

Table 2.4.1 – Assessment summary of site features

Factor Assessed	Description	Limitation
Climate	Monthly evaporation exceeds rainfall for majority of the year.	Minor
Temperature	Annual mean daytime maximum > 15°C.	Minor
Flood Potential	No flood study or flood levels have been provided. Site is located above any anticipated flood level.	Minor
Exposure	Excellent wind and solar exposure.	Minor
Slope	<10%	Minor
Landform	Linear Planar – Upper Slope	Minor
Run-on and Seepage	Site subject to significant stormwater run-on from upslope catchment	Moderate
Site-drainage	No signs of soil saturation or ponding observed	Minor
Erosion Potential	No erosion in proposed EMA identified.	Minor
Site and Soil Disturbances	No Site / Soil Disturbance Identified or anticipated	Minor
Groundwater Bores	Domestic groundwater bores have been identified within 100 m of the proposed EMA.	Minor
Rock Outcropping	No outcropping identified.	Minor
Geology / Regolith	No geological discontinuities, fractures, or highly porous regolith are expected within and surrounding the EMA	Minor
Buffer Distances & Available land area	All minimum required buffers have been satisfied	Minor

2.5 Climate

Ingleside has a temperate climate, with mild to hot summers, with a cooler wetter winter. Median annual rainfall is 1336.8 mm and evaporation 1423.5 mm. Monthly evaporation exceeds rainfall for 2/3 months of the year. (Appendix B1) (*Minor Limitation)*.

Average maximum and minimum temperatures range from 27.0 °C to 7.7 °C in January to July respectively. The mean annual daytime maximum of 22.0°C proves suitable for biological wastewater treatment systems (i.e. AWTS) (*Minor Limitation*).

2.6 Flood potential

No flood study or flood levels have been provided. The Site lies above any anticipated flood level *(Minor Limitation)*.

2.7 Exposure

The proposed effluent management area (EMA) is well exposed to sun and wind (*Minor Limitation*).

Landform Feature	Aspect	Solar Exposure	Wind Exposure	Limitation
A	-	Excellent	Excellent	Minor

2.8 Slope

Slope has the potential to become a restrictive landform feature for OSSM with increased slope increasing the risk of run-off and/or erosion. Slope within the proposed effluent management was determined to be <10% (*Minor Limitation).*

Landform Feature	Approximate Slope Tangent (%)	Slope Classification	Limitation
A	<10%	Gently Inclined	Minor

Table 2.8.1 - Percentage Slope and Land Application Limitations

Slope Range [%]	Slope Classification	Limitation				
		Surface Irrigation (Spray & Drip)	Absorption Systems	Mounds	Conventional Trenches & LPEDs	Sub-surface Irrigation
0 – 1	Level	Minor	Minor	Minor	Minor	Minor
1 – 3	Very Gently Inclined	Minor	Minor	Minor	Minor	Minor
3 – 10	**Gently Inclined**	**Minor**	**Minor**	**Minor**	**Minor**	**Minor**
10 – 15	Moderately Inclined	Major	Major	Moderate	Moderate	Minor
15 – 20		Major	Major	Major	Moderate [2]	Minor
> 20	Steeply Inclined	Major	Major	Major	Moderate [3]	Moderate [1]

[1] 30% maximum slope without specific design (AS 1547:2012, p.133)
[2] >15% slope increase difficulty in construction (AS 1547:2012, Table K1)
[3] >25% slope creates difficulty in trenching, risk of erosion during construction (AS 1547:2012, Table K1)

2.9 Landform

The landform describes the surface shape and topographic position at the proposed EMA. Typical landform descriptors per AS1547:2012 are detailed below.

Landform Feature	Slope Configuration	Limitation
A	Linear planar	Minor

2.10 Surface Water and Seepage

Surface water and seepage flow is determined by the catchment preceding the EMA and the prevailing landform features. General assessment of the likely surface water interaction with the landform and EMA has been provided.

Landform Feature	Catchment		Surface Flow		Soil Moisture	Seepage Potential	Limitation
	Size	Surface Coverage	Run-on	Run-off			
A	Minor	Grass	Moderate	Minor	Dry	Minor	Moderate

To mitigate the moderate limitation, it is proposed to construct an upslope diversion drain as located and detailed in Appendix A.

2.11 Site drainage

The proposed effluent management area appeared to consist of free draining soils with no soil saturation present, no noted presence of macrophytes were observed (i.e. sedges, ferns, juncus) *(Minor Limitation).*

2.12 Erosion potential

Erosion and surface soil movement results from the interaction of the existing landform, surface flows and surface coverage. The following existing erosion conditions were identified and assessed in proposing additional hydraulic loading in the form of effluent.

Landform Feature	Surface Flow Type	Erosion Hazard		Limitation
		Surface Flow	Wind	
A	Unconcentrated	Slight	Low	Minor

Note that soils are potentially erodible where surface cover is broken and as such, the EMA should be appropriately preserved and re-vegetated via Establishment of dense (>85% coverage) perennial groundcover prior to commissioning (*Minor Limitation*).

2.13 Site & Soil Disturbances

No Site / Soil Disturbance Identified or anticipated, ensure EMA is vegetated via dense surface coverage prior to commissioning *(Minor Limitation).*

2.14 Domestic Bore

WaterNSW Realtime data indicated no domestic potable groundwater bores located within a 250m radius of the site (Minor Limitation).

2.15 Rock Outcropping

No rock outcropping or surface boulders were identified (*Minor Limitation)*.

2.16 Geology / Regolith

No geological discontinuities, fractures, or highly porous regolith are expected within and surrounding the EMA (*Minor Limitation*).

2.17 Buffer Distances & Available Land Area

Minimum offset distances are designated by local approval authorities within their guiding documents to ensure the ongoing protection of community health, sensitive ecosystems, and the maintenance of community amenity. Where LGA guidance on a constraint is not available, appropriate offsets have been nominated in accordance with AS1547:2012 and Table 5 DLG (1998).

The site-specific constraints for the proposed EMA and land application method have been assessed as per Table 2.17.1.

Table 2.17.1 – Minimum buffer distances from sensitive site features

Site Feature	Minimum Setback		Proposed Setback: EMA Upslope/Downslope	Limitation
	If EMA is upslope of feature	If EMA is downslope / level with feature		
Dwellings	15m		15m	Minor
Property Boundaries	6m	3m	6/3m	Minor
Driveways	6m	3m	>6/3m	Minor
Buildings	6m	3m	>6/3m	Minor
Pools	6		NA	Minor
Watercourses	100m		>100m	Minor
Domestic Bore / Well	250m from high water level		>250m	Minor
Dam / Drainage Depression	40m from high water level		>40m	Minor

3 SOIL ASSESSMENT

3.1 Soil Assessment Summary

Investigation of the site for suitability for OSSM was accompanied by soil assessment within the proposed EMA. Soil sampling was conducted at the time of inspection with the soil characteristics assessed per AS 1547:2012, AS 1289.3.8.1:2006, and NSW DLG (1998) methodologies. The summary of the soil investigation is presented in Table 3.1.1.

Table 3.1.1 – Assessment summary of site features

Factor Assessed	Description	Limitation
Depth to bedrock / hardpan	400-700 mm.	Moderate
Depth to high watertable	NIL free water or waterlogging characteristics	Minor
Coarse Fragments	< 10% across all upper strata	Minor
pH	>5.5 across all samples	Minor
Electrical Conductivity (EC)	< 4 dS/m across all samples.	Minor
Dispersiveness (EAT_m)	3+. Non-critical with respect to OSSM	Minor

3.2 Soil Landscape Map

1:100,000 Soil Landscape Mapping indicates the site occurs on the Oxford Falls Fluvial Soil Landscape. The Landscape features – hanging valleys on Hawkesbury Sandstone. Local relief <80 m, slopes <15%. Occasional broad benches and broken scarps, valley floors are relatively wide, gently inclined, and often poorly drained. Low eucalypt woodland, scrub, heathland and sedgeland.

Soils typically moderately deep to deep (50–>150 cm) Earthy Sands, Yellow Earths, Siliceous Sands on slopes; deep (>200 cm) Leached Sands, Podzols and Grey Earths on valley floors. Dominant Soil Materials include:

- of1–Dark brown, loose loamy sand
- of3–Bleached loose sandy loam
- of4–Earthy yellowish-brown clayey sand

Site landscape assessment conformed to the mapping.

3.3 Depth to Bedrock / Hardpan

Soil depth was ascertained via three bore holes within the potential EMA's identified. Borehole Samples were extracted via direct push tube, the samples ranged from 400-700mm depth before encountering refusal on underlying hardpan layer (*Moderate Limitation)*. Surface irrigation has been proposed to maximise offset from limiting layer. Increase total soil depth to 600mm minimum per Section 4.

3.4 Depth to High Watertable

No visible free water, soil saturation, grey mottling or similar was encountered within the sampling depth *(Minor Limitation).*

3.5 Soil Permeability Category

Soil permeability has been assigned per Table 5.2 of AS1547:2012 for the excavation site(s) most representative of the EMA location. The hydraulically limiting strata for the application system is bolded within Table 3.7.1 below.

Table 3.5.1: Soil permeability and Design Irrigation Rate

Excavation #		BH3		
Lower Depth (mm)	Field Texture	Structure	Indicative Permeability K_{sat} (m/day)	Design Irrigation Rate (DIR) (mm/day)
150	Sandy Loam	Weak	>3.0	5.0
700	**Sandy Clay Loam**	**Weak**	**0.12 – 0.5**	**3.5**

3.6 Soil Profiles

Table 3.6.1						
Excavation #	BH1	Sample size:	50	[mm]	Date Completed:	2/05/2022
Inspection Method:	Thin Wall Tube Sample				Water-table Encountered:	No

Layer Horizon	Lower Depth [mm]	Moisture	Colour	Field Texture	Structure	Coarse Fragment
1	200	Moist	Brown	Sandy Loam	Weak	<5%
2	400	Moist	Brown	Sandy Clay Loam	Weak	<5%
Refusal:	Refusal encountered on underlying hardpan layer					
Photo:						

Table 3.6.2						
Excavation #	BH2	Sample size:	50	[mm]	Date Completed:	2/05/2022
Inspection Method:	Thin Wall Tube Sample				Water-table Encountered:	No

Layer Horizon	Lower Depth [mm]	Moisture	Colour	Field Texture	Structure	Coarse Fragment
1	100	Moist	Brown	Sandy Loam	Weak	<5%
2	650	Moist	Brown	Sandy Clay Loam	Weak	<5%
Refusal:	Refusal encountered on underlying hardpan layer					
Photo:						

Table 3.6.3						
Excavation #	BH3	Sample size:	50	[mm]	Date Completed:	2/05/2022
Inspection Method:	Thin Wall Tube Sample				Water-table Encountered:	No

Layer Horizon	Lower Depth [mm]	Moisture	Colour	Field Texture	Structure	Coarse Fragment
1	200	Moist	Light Brown	Sandy Loam	Weak	<5%
2	700	Moist	Sand	Sandy Clay Loam	Weak	<5%
Refusal:	Refusal encountered on underlying hardpan layer					
Photo:						

3.7 Soil Chemistry

One sample from each horizon of the most descriptive excavation site was tested for acidity, Electrical Conductivity, and Dispersiveness (pH, EC, and EAT_m) by Broadcrest Consulting. The results were as follows:

Table 3.7.1: Soil Chemistry results

Excavation #		BH2			
Sample Depth (mm)	Test	Result	Description	Limitation	Recommendations
150	pH	6.85	Neutral	Minor	-
	EC (dS/cm)	0.55	Non-Saline	Minor	-
	EAT_m	3+	Non-critical	Minor	-
500	pH	6.25	Moderately Acidic	Minor	-
	EC (dS/m)	0.25	Non-Saline	Minor	-
	EAT_m	3+	Non-critical	Minor	-

Tested soil parameters indicated no restrictive properties to OSSM within the sample location.

4 NOMINATED WASTEWATER MANAGEMENT

4.1 Proposed OSSM Summary

Site and soil constraints were evaluated in selection of appropriate treatment and effluent management method. A summary of the recommended OSSM system and application sizing is presented below:

PROPOSED OSSM SYSTEMS:

Treatment	→	Effluent Management
AWTS + disinfection or equivalent	(Pumped dosing)	995 m^2 Surface Movable Irrigation

SITE WASTEWATER LOADING:

I.D	Equivalent Bedrooms [1]	Population per Bedroom [1]	Equivalent Population [Persons]	Water Supply	Wastewater Generation Rate per Capita [L/Person/Day]	Design Wastewater Loading [L/Day]
Primary Res	5	2	10	Town water	150	1500

[1] Note: Design occupancy estimates per LGA & Industry standard.

4.2 Wastewater Treatment

It is proposed to treat all wastewater generated by the development to a Secondary standard with disinfection via the existing NSW health accredited Aerated Wastewater Treatment System (AWTS). The unit should be inspected by a qualified and experienced plumber to ensure it is operating correctly and capable of sustainably treating the design wastewater loading to the secondary treatment targets (per DLG 1998) detailed in Table 4.2.1.

If the existing AWTS requires replacement, one should be obtained from the list of accredited AWTS systems available on the NSW Health website:

http://www.health.nsw.gov.au/environment/domesticwastewater/Pages/awts.aspx

Table 4.2.1: - Secondary Treatment Targets (per DLG 1998)

Biochemical Oxygen Demand (BOD^5)	Suspended Solids (TSS)	Total Nitrogen (TN)	Total Phosphorus (TP)	Faecal coliforms		Dissolved Oxygen (DO)
				Non-disinfected effluent	Disinfected effluent	
< 20 mg/L	< 30 mg/L	25 - 50 mg/L	10 - 15 mg/L	Up to 10^4 cfu/100 mL	< 30 cfu/100 mL	> 2 mg/L

4.3 Effluent Management

Given the development proposed and site and soil conditions encountered, it is proposed to dispose of effluent from the treatment system servicing the proposed residence via **Surface Movable Irrigation.**

Sizing of the application method was undertaken via water and nutrient balance in accordance with DLG 1998 (see Appendix B), with a minimum **irrigation area of 995 m^2 required.**

Notes:

- A minimum of 600mm depth is required for surface irrigation.
- Where depth is less than 600mm, Loam Virgin Excavated Natural Material (VENM) must be imported (less than $100m^3$).

The irrigation field should be positioned within the EMA nominated in Appendix A.

Justification of the proposed treatment method is as follows:

- Irrigation maximises the surface disposal area and evapo-transpiration.
- An irrigation area is available onsite meeting the minimum buffer distances.
- Irrigation is a suitable OSSM method for the site landform and soil properties.

4.4 Recommended Site Modifications

To address present site constraints, the following modifications are recommended:

- Following the implementation of the EMA, the field is to be maintained with dense grass coverage and excluded from vehicle and livestock traffic.
- To reduce surface water run-on, it is proposed to construct an upslope diversion drain as located and detailed in Appendix A.

5 ADDITIONAL INFORMATION

5.1 Pipework Detail

All associated plumbing / drainage work is to be in accordance with AS 3500.2:2015 *Sanitary Plumbing Drainage*. Positioning of the receiving treatment system is to ensure drainage from internal plumbing fixtures achieves the minimum grade and cover of the excerpts below.

Table 6.1 – Excerpts of AS3500.2:2015

Nominal Pipe Diameter (DN)	Minimum Grade	
(mm)	(%)	(Ratio)
65	2.50	1:40
80	1.65	1:60
100	1.65*****	1:60*****
125	1.25	1:80
150	1.00	1:100

*Drains from treatment plants may be 1.00% Min.

	Minimum depth of cover (mm)	
Location	Cast iron & Ductile iron	Other materials
Subject to vehicular loading	300	500
All other locations	NIL	300

5.2 Licensing

Operating a system of sewage management is a Prescribed Activity under the Local Government Act 1993 and clause 45 of the Local Government (Approvals) Regulation 1999. This means that an 'Approval to Operate' a system of sewage management must be obtained from Council.

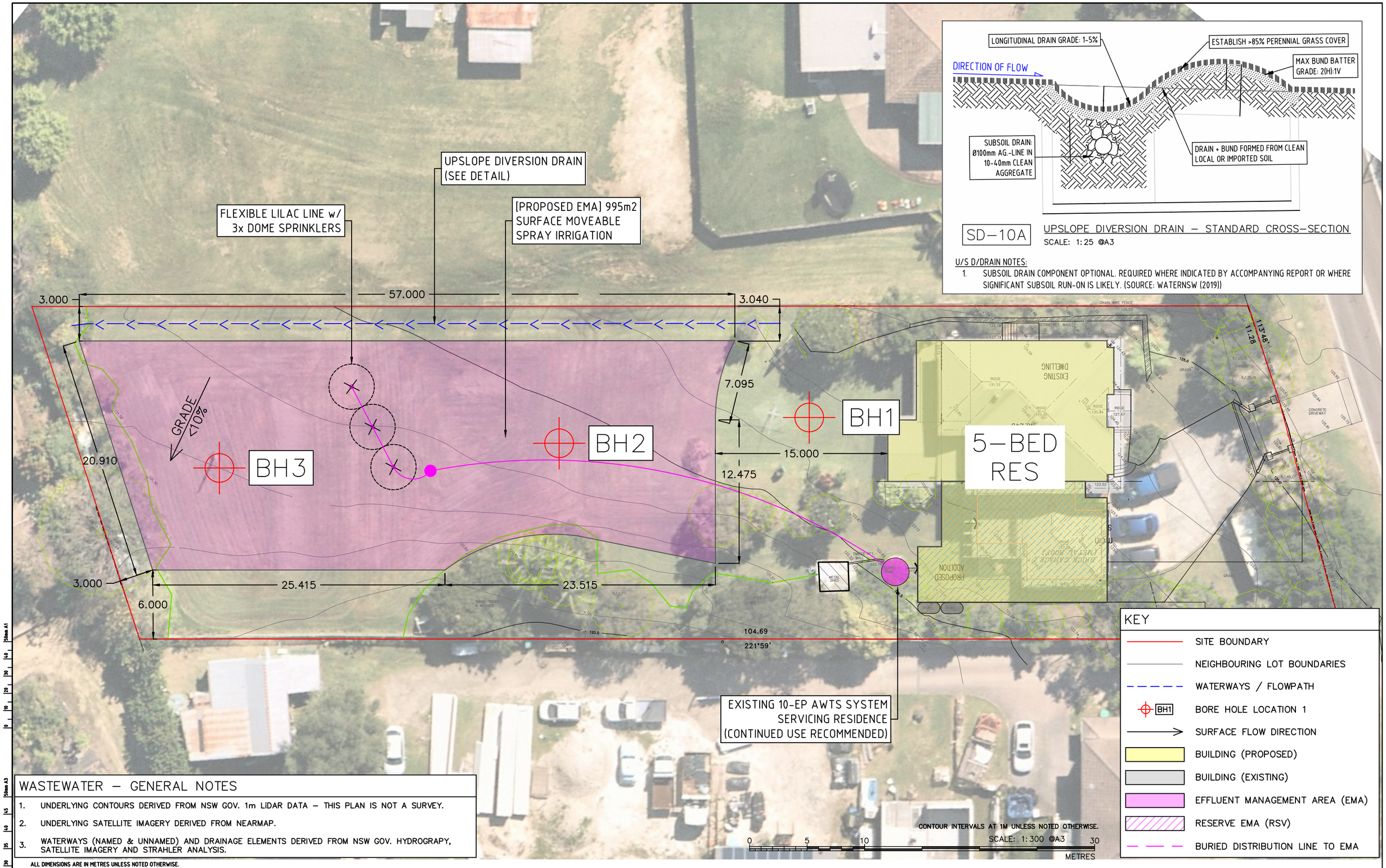
5.3 Detailed Design

A detailed system design may still be requested at the 'Application to Install' stage. This design will include the size and location of all system components including tanks, distribution lines, valves, etc. These additional requirements will be furnished by the nominated treatment system suppliers / licensed installers. Additional information for the property owner is available in Appendix C.

6 CONCLUSION

- It is proposed to construct single story addition to the existing dwelling at 240 Powderworks Road, Ingleside
- The anticipated wastewater loading rates generated by the residence is calculated to be **1500 L/day.**
- It is proposed to treat all wastewater generated by the development to a Secondary standard with disinfection using the existing NSW health accredited Aerated Wastewater Treatment System (AWTS).
- Application of the effluent is proposed via **995 m^2 Surface Movable Irrigation** within the area(s) nominated in Appendix A. Some soil importation is required to increase the soil depth to 600mm across the EMA.
- The residences are to be fitted with standard-water reductive fixtures.

APPENDIX A: SITE PLAN



SD-10A UPSLOPE DIVERSION DRAIN – STANDARD CROSS-SECTION

SCALE: 1:25 @A3

U/S D/DRAIN NOTES:

1. SUBSOIL DRAIN COMPONENT OPTIONAL. REQUIRED WHERE INDICATED BY ACCOMPANYING REPORT OR WHERE SIGNIFICANT SUBSOIL RUN-ON IS LIKELY. (SOURCE: WATERNSW (2019))

KEY

- SITE BOUNDARY
- NEIGHBOURING LOT BOUNDARIES
- WATERWAYS / FLOWPATH
- BH1 BORE HOLE LOCATION 1
- SURFACE FLOW DIRECTION
- BUILDING (PROPOSED)
- BUILDING (EXISTING)
- EFFLUENT MANAGEMENT AREA (EMA)
- RESERVE EMA (RSV)
- BURIED DISTRIBUTION LINE TO EMA

WASTEWATER – GENERAL NOTES

1. UNDERLYING CONTOURS DERIVED FROM NSW GOV. 1m LiDAR DATA – THIS PLAN IS NOT A SURVEY.
2. UNDERLYING SATELLITE IMAGERY DERIVED FROM NEARMAP.
3. WATERWAYS (NAMED & UNNAMED) AND DRAINAGE ELEMENTS DERIVED FROM NSW GOV. HYDROGRAPY, SATELLITE IMAGERY AND STRAHLER ANALYSIS.

ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE.

REV	DATE	DES.	DRN.	APP.	REVISION DETAILS
A-01	5/05/22	AM	AM	----	ISSUE FOR RELEASE

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broadcrest.com.au | contact@broadcrest.com.au | 1300 554 945
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BROADCREST CONSULTING PTY LTD | ACN 622 508 187

PROJECT DESCRIPTION: RESIDENTIAL EXTENSION	SHEET: APPENDIX A - SITE LAYOUT PLAN
PROJECT SITE: 240 POWDERWORKS RD, INGLESIDE NSW	PLAN: ON-SITE WASTEWATER MANAGEMENT PLAN
LGA: NORTHERN BEACHES COUNCIL	CLIENT: TANIA CVIJETIC

PROJECT ID: 1916-WW
SCALE: 1:300 @ A3 - @ A1
SHEET NO.: 1 OF 1

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APPENDIX B: CLIMATE DATA

B1. - Climate Statistics

Table B1.1. Weather Stations

Statistic	Station No.	Station Name	Distance from site [km]
Temperature	66059	TERREY HILLS AWS	4.11
Precipitation	66183	INGLESIDE (ANIMAL WELFARE LEAGUE NSV	1.93
Evaporation	66131	RIVERVIEW OBSERVATORY	18.62

Figure B.1 - Monthly Cimate Statistics

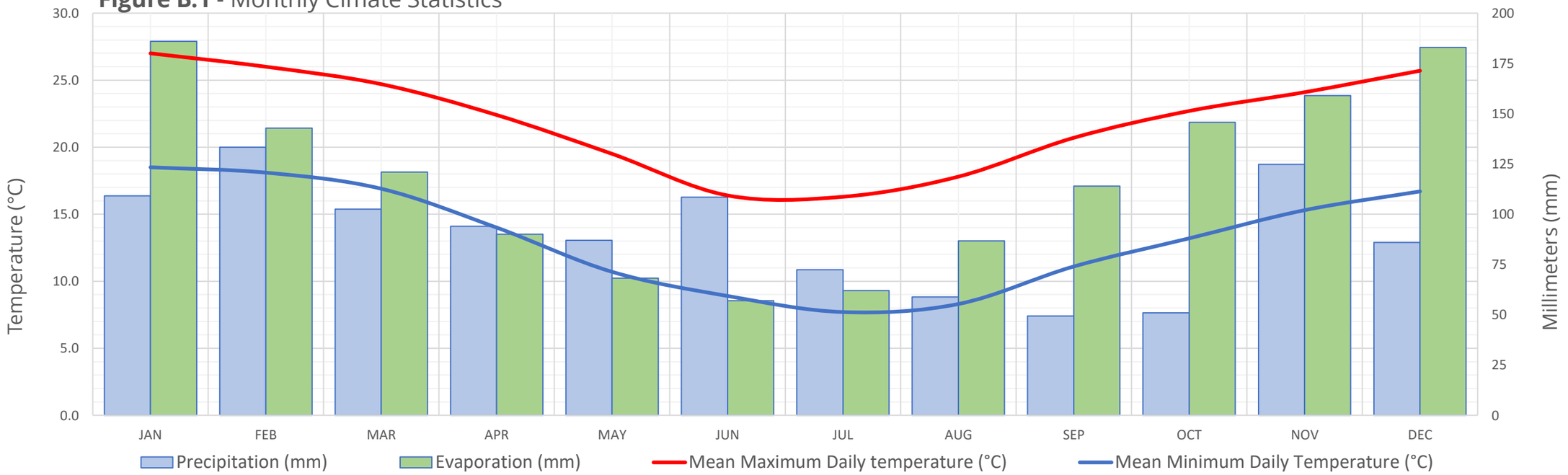


Table B1.2. Site Climate Statistics

Site Factors	Symbol	Units	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
Mean Max. Temperature	[T]	[°C]	**27.0**	26.0	24.7	22.4	19.5	16.4	16.3	17.8	20.7	22.7	24.1	25.7	22.0
Mean Min. Temperature	[T]	[°C]	18.5	18.1	16.9	14.0	10.7	8.9	**7.7**	8.3	11.1	13.2	15.3	16.7	13.3
Days	[D]		31	28	31	30	31	30	31	31	30	31	30	31	365
Precipitation[1]	[P]	[mm/month]	109.1	133.4	102.6	94	87	108.4	72.4	58.9	49.4	51	124.8	85.9	1336.8
Evaporation	[E]	[mm/day]	6	5.1	3.9	3	2.2	1.9	2	2.8	3.8	4.7	5.3	5.9	3.9
		[mm/month]	186	142.8	120.9	90	68.2	57	62	86.8	114	145.7	159	182.9	1423.5
Natural Site Balance[2]	[P-E]	[mm/month]	-76.9	-9.4	-18.3	4	18.8	51.4	10.4	-27.9	-64.6	-94.7	-34.2	-97	

[1] Median historic precipitation. Note: total is not equivalent to annual median.

[2] Negative value indicates monthly mean evaporation > precipitation

B2. - Water Balance

Table B2.1. Site & Soil Parameters

Parameter	Symbols	Values	Units
Design Wastewater Flowrate	Q	1,500	L/day
Soil Texture		Sandy Clay Loam	
Soil Structure		Weak	
Indicative Permeability	K_{sat}	0.5 to 1.2	m/day
Design Irrigation Rate	DIR_{day}	3.5	mm/day

Table B2.2. Effluent water balance

Site Factors	Symbol	Units	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
Days per Month	D	days	31	28	31	30	31	30	31	31	30	31	30	31	365
Crop Factor	C		0.8	0.8	0.8	0.7	0.6	0.55	0.5	0.55	0.65	0.75	0.8	0.8	0.69167
Run-off Coefficient	C_{RO}		0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Effluent Irrigation	(Q x D)	mm/month	46500	42000	46500	45000	46500	45000	46500	46500	45000	46500	45000	46500	547500
Evapotranspiration	(E xC)	mm/month	148.8	114.24	96.72	63	40.92	31.35	31	47.74	74.1	109.275	127.2	146.32	984.588
Design Irrigation Rate	DIR_{Month}	mm/month	108.5	98	108.5	105	108.5	105	108.5	108.5	105	108.5	105	108.5	1277.5
Minmum Area Required	$A_{wb.min}$	m^2	242	318	324	403	478	**631**	484	385	301	248	286	229	375

Table B2.3. Water Balance Minimum Area Requirement

	Symbols	Area m^2
Minimum Area Required to Satisfy Water Balance:	A_{wb}	**631**

B3. - Nutrient Balance & Minimum irrigation area

Table B3.1. Nitrogen Balance

Parameter	Symbols	Values	Units
Design Wastewater Flowrate	Q	1,500	L/day
Surface Vegetation	Lawn - fully managed (clippings removed)		
Effluent Total Nitrogen (TN) Concentration[1]	TN	20	mg/L
Critical TN Loading Rate[2]	$L_{n.sfc}$	66	$mg/m^2/day$
Minimum Application Area	$A_{n.sfc}$	**456**	m^2

[1.] Nominal ATWS Nutrient Concerntrations (DLG 1998, AS1547.3:2012)

[2.] Appendix 6, 'On-site sewage management for single households' (DLG 1998, AS1547.3:2012)

Table B3.2. Phosphorus Balance

Parameter	Symbols	Values	Units
Design Wastewater Flowrate	Q	1500	L/day
Surface Vegetation	Lawn - fully managed (clippings removed)		
Effluent Total Phosphorus (TP) Concentration[1]	TP	10	mg/L
Phosphorus Generated 50_{YR}	P_{gen}	273.75	kg
Soil Phosphorus Sorption Capacity	P_{sorp}	3,750	kg/Ha
Phosphorus Absorped 50_{YR}	P_{absorb}	0.125	kg/m^2
Critical TP Loading Rate[2]	$L_{p.sfc}$	8	$mg/m^2/day$
Phosphorus Uptake 50YR	$P_{uptake.sfc}$	0.150	kg/m^2
Minimum Application Area	$A_{p.sfc}$	**995**	m^2

[1.] Nominal ATWS Nutrient Concerntrations (DLG 1998, AS1547.3:2012)

[2.] Appendix 6, 'On-site sewage management for single households' (DLG 1998, AS1547.3:2012)

B4. - Minimum Effluent Irrigation Areas

Table B4.1. Minimum Irrigation Area Requirement

Balance	Area Required (m^2)
Water	631
Nitrogen	456
Phosphorus	995
Minimum Irrigation Area	**995**

APPENDIX C: INFORMATION FOR THE PROPERTY OWNER

Aerated Wastewater Treatment Systems (AWTS)

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

What is an AWTS?

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

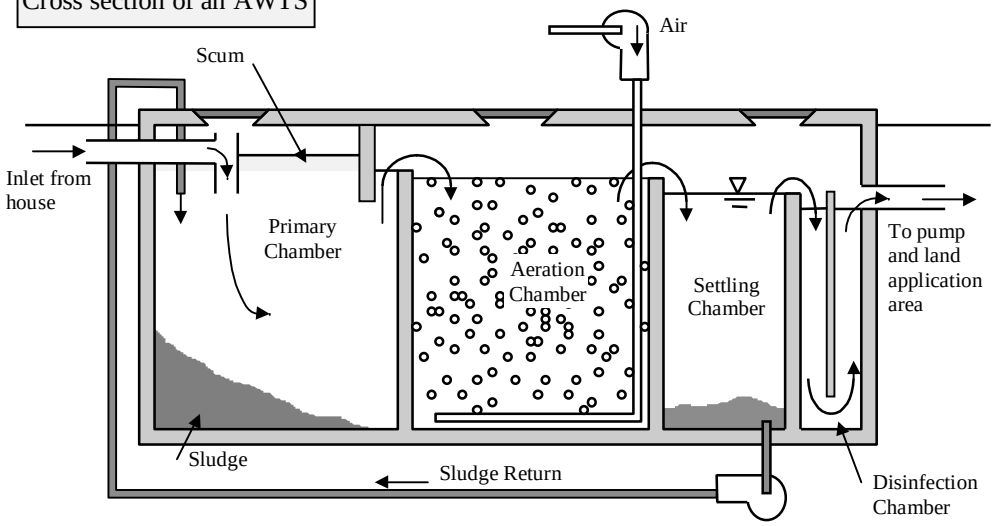
It consists of a series of treatment chambers combined with an irrigation system. An AWTS enables people living in unsewered areas to treat and utilise their wastewater.

How does an AWTS work?

Wastewater from a household is treated in stages in several separate chambers. The first chamber is similar to a conventional septic tank. The wastewater enters the chamber where the solids settle to the bottom and are retained in the tank forming a sludge layer. Scum collects at the top, and the partially clarified wastewater flows into a second chamber. Here the wastewater is mixed with air to assist bacteria to further treat it. A third chamber allows additional clarification through the settling of solids, which are returned for further treatment to either the septic chamber (as shown) or to the aeration chamber. The clarified effluent is disinfected in another chamber (usually by chlorination) before irrigation can take place.

Bacteria in the first chamber break down the solid matter in the sludge and scum layers. Material that cannot be fully broken down gradually builds up in the chamber and must be pumped out periodically.

Cross section of an AWTS



Regulations and recommendations

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

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

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

Maintaining your AWTS

The effectiveness of the system will, in part, depend on how it is used and maintained. The following is a guide on good maintenance procedures that you should follow:

DO

- ✓ Have your AWTS inspected and serviced four times per year by an approved contractor. Assessment should be applicable to the system design.
- ✓ Have your system service include assessment of sludge and scum levels in all tanks, and performance of irrigation areas.
- ✓ Have all your tanks desludged at least every three years.
- ✓ Have your disinfection chamber inspected and tested quarterly to ensure correct disinfectant levels.
- ✓ Have your grease trap (if installed) cleaned out at least every two months.
- ✓ Keep a record of pumping, inspections, and other maintenance.
- ✓ Learn the location and layout of your AWTS and land application area.
- ✓ Use biodegradable liquid detergents such as concentrates with low sodium and phosphorous levels.
- ✓ Conserve water.

DON'T

- ✘ Don't put bleaches, disinfectants, whiteners, nappy soakers and spot removers in large quantities into your AWTS via the sink, washing machine or toilet.
- ✘ Don't allow any foreign materials such as nappies, sanitary napkins, condoms and other hygiene products to enter the system.
- ✘ Don't use more than the recommended amounts of detergents.
- ✘ Don't put fats and oils down the drain and keep food waste out of your system.
- ✘ Don't switch off power to the AWTS, even if you are going on holidays

Reducing water usage

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

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

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

Warning signs

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

Look out for the following warning signs:

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

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

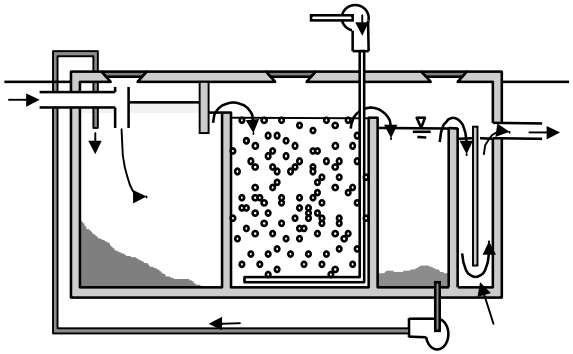
HELP PROTECT YOUR HEALTH AND THE ENVIRONMENT

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

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

If you would like more information please contact:

Your Aerated Wastewater Treatment System



LAND APPLICATION AREAS

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

What are land application areas?

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

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

How does a land application area work?

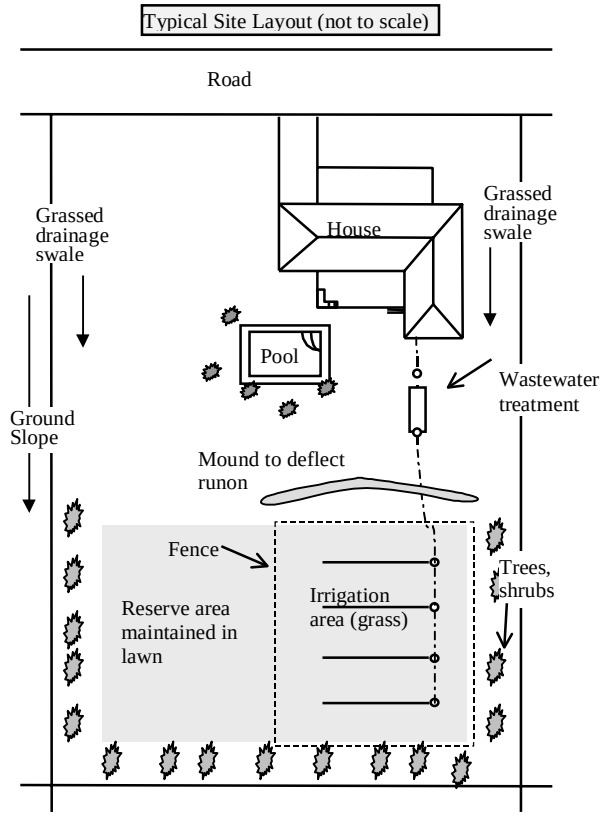
Treated wastewater applied to a land application area may be utilised or simply disposed, depending on the type of application system that is used. The application of the wastewater can be through a soil absorption system (based on disposal) or through an irrigation system (based on utilisation).

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

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

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

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



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

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

Regulations and recommendations

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

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

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

RECLAIMED EFFLUENT
NOT FOR DRINKING
AVOID CONTACT

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

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

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

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

Location of the application area

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

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

Maintaining your land application area

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

DO

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

DON'T

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

Warning signs

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

The visual signs of system failure include:

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

Volume of water

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

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

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

HELP PROTECT YOUR HEALTH AND THE ENVIRONMENT

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

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

For more information please contact:

Your Land Application Area