Precise Planning

Wastewater Assessment: Proposed subdivision application of 95 Great Southern Road, Bargo, NSW

martens consulting engineers

ENVIRONMENTAL

WATER

WASTEWATER

GEOTECHNICAL

CIVIL

PROJECT MANAGEMENT

P1504741JR07V01
November 2016

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Document and Distribution Status

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Revision No.	Description	Status	Release Date	Document Location			
				File Copy	Precise Planning	-	-
1	Development application	FINAL	11/11/16	1P,1E	1P		

Distribution Types: F = Fax, H = hard copy, P = PDF document, E = Other electronic format. Digits indicate number of document copies.

All enquiries regarding this project are to be directed to the Project Manager.

Contents

1 Overview

1.1 Background

Martens & Associates has prepared this wastewater assessment to support an application for a proposed subdivision at 95 Great Southern Road, Bargo, NSW. This report documents a proposed on-site wastewater management strategy for the large lot (>5,000m^2) portion of the proposed subdivision, located on the eastern part of the site, as shown in the Zoning Concept Plan in Attachment A.

1.2 Development Proposal

This wastewater assessment has been prepared by MA as a preliminary study based on the understanding that the site will be subdivided into large lots (>5,000m^2) with individual wastewater treatment systems servicing future dwellings on each lot. It should be noted that the following wastewater study is calculated based on the assumption of a five bedroom dwelling on future lots. A detailed subdivision layout has not been provided at this stage.

This wastewater assessment is subject to change depending on the size of subdivided lots and dwellings constructed.

1.3 Relevant Guidelines/Standards

The assessment is prepared in accordance with the following guidelines:

- Australian/ New Zealand Standard 1547 (2012) - *On site Domestic Wastewater Management*
- Department of Local Government, NSW Environment Protection Authority, NSW Health Department, NSW Department of Land and Water Conservation and the NSW Department of Urban Affairs and Planning (1998) - *Environment and Health Protection Guidelines - On-site Sewage Management for Single Households.*
- Wollondilly Shire Council (2011) – On-site Sewage Management System and Greywater Re-use Policy

2 Site Description

2.1 Summary

A summarised site description is provided in Table 1. A site plan is provided in Attachment A.

Table 1: Site description summary.

Element	Description/Detail
Site Address	95 Great Southern Road, Bargo, NSW
Site Area	Approximately 28 ha. Area of the proposed large lot development in the eastern part of the site – approximately 8 ha
Lot/DP	Lot 1 DP996286
Existing site development	Rural, unused dilapidated dwelling and sheds.
Aspect	Northwest (in the proposed large lot development area)
Typical slopes	<5% in the vicinity of the proposed development.
Existing vegetation	Grass paddock with scattered trees.
Neighbouring environment	The site is bordered by Great Southern Road to the west, and Government Road to the east. Low density residential housing neighbours the site in the southwest corner. Grass paddocks neighbour the site on all other borders.
Local Government Area (LGA)	Wollondilly Shire Council
Easements	None based on site investigation and review of survey.
Drainage	Drainage occurs above ground along gullys present on site, flowing northeast, eventually leading into Dogtrap Creek (a minimum distance away of approximately 1000 m). One gully runs from south to north from the southern border of the site. The other gully runs from east to west from the eastern border of the site, meeting the first gully.
Groundwater	No groundwater was encountered during borehole or test pit investigations.

Geology	The Wollongong – Port Hacking 1:100,000 Geological Sheet 9029-9129 (1st Edition, 1985) indicates a presence of two underlying geologies at the site: i. Hawkesbury Sandstone consisting of medium to course grained quartz sandstone, very minor shale and laminate lenses. ii. Ashfield Shale consisting of laminite and dark grey siltstone.
Soil Landscape	The Wollongong 1:100,000 Soil and land Resource Series (1st edition, 1990) describes two underlying soil landscapes at the site: i. Blacktown consisting of shallow to moderately deep (>100 cm) hardsetting mottled texture contrast soils, red and brown podzolic soils on crests grading to yellow podzolic soils on lower slopes and in drainage lines. ii. Lucas Heights soil landscape consisting of moderately deep (50–150 cm), hardsetting yellow podzolic soils and yellow soloths.

2.2 Field Investigations

A site inspection was undertaken on 2 November 2016 which included:

- Walkover inspection of the eastern portion of the site to assess existing site conditions, local topography, geology, soil characteristics, hydrology and vegetation.
- Excavation of four test pits using an excavator to a maximum depth of 1.4m below ground level (mBGL) to allow for the characterisation of underlying soils and preliminary groundwater level assessment.
- Collection of representative soils samples from test pits for future reference.

Test pit locations are shown on the investigation site plan in Attachment A and detailed soil profiles are provided in Attachment B.

2.3 Sub-Surface Conditions

Test pit observations indicate the natural soil overlying the rock profile is generally comprised of three layers. Soil characteristics are summarised in Table 2 with detailed test pit logs in Attachment B.

Table 2: Summary of typical soil horizon characteristics for the site.

Layer	Depth (m) [1]	Agricultural Classification	Soil Permeability Category [2]
TOPSOIL: Loamy Sand	0.0 – 0.15	LS	2a
SUBSOIL: Sandy Clay	0.15 – 0.45	SC	4a
SUBSOIL: Light to Medium Clay	0.45 – 0.9[3]	LMC	5b

Notes:
[1] Depth varies – indicative only.
[2] In accordance with Table 8 of NSW Department of Local Government *et al*. (NSW DLG, 1998).
[3] Average depth to top of weathered rock from 4 test pits undertaken.

2.4 Climate Data

The nearest rainfall station with adequate data is at Buxton (Amaroo, rain station 068166, rainfall 1966 – present) and nearest station with evaporation records is Badgerys Creek (station 61351, 1967-1984 present).

These stations are considered representative of the site. A comparison of median rainfall and evaporation is provided in Table 3.

Table 3: Comparison of rainfall and Class A Pan evaporation data for the site.

Month	Median Monthly Rainfall (mm)	Median Monthly Class A Pan Evaporation (mm)	Rainfall Surplus Rainfall – Evap. (mm)
January	81.30	182.9	-101.6
February	82.30	151.2	-68.9
March	64.40	136.4	-72.0
April	43.10	99.0	-55.9
May	34.20	65.1	-30.9
June	35.60	51.0	-15.4
July	22.20	58.9	-36.7
August	21.00	89.9	-68.9
September	38.80	120.0	-81.2
October	55.80	142.6	-86.6
November	59.50	168.0	-108.5
December	63.00	201.5	-138.5
Annual	**602.20**	**1466.50**	**-865.1**

3 Wastewater Assessment

3.1 Proposed Treatment System and Design Effluent Quality

Each dwelling located on the future lots are to be serviced by a NSW Department of Health (DOH) approved aerated wastewater treatment system (AWTS). The AWTS is to be located to allow gravity drainage of sewage to the AWTS from the dwelling. Typical AWTS effluent quality is provided in Table 4. This information is also used for the nutrient balance assessment.

Table 4: Typical secondary AWTS effluent quality.

Parameter	Design Value
BOD_5 (mg/L)	20
Suspended Solids (mg/L)	30
Faecal Coliforms (CFU/100mL)	30
Total Phosphorus (mg/L)	10
Total Nitrogen (mg/L)	27

Treated effluent is to be disposed of via surface or shallow surface drip irrigation. Preliminary assessment of required area for each dwelling is discussed in Section 3.8.

3.2 Soil Capability Assessment

Soil capability assessment has previously been completed by MA on a neighbouring site (35 Government Road, Bargo, NSW). A comparison of subsurface conditions with the neighbouring site indicates similar soil profiles and soil chemical properties. Subsequently, soil chemical properties from laboratory analysis at 35 Government Road are considered representative of soils at 95 Great Southern Road and will be used for soil capability assessment.

A summary of soil chemical properties gathered from 35 Government Road are provided in Table 5, with laboratory report provided in Attachment D.

Table 5: Summary of soil assessment according to criteria specified in NSW Department of Local Government *et al.* (1998).

Parameter	Value	Limitations
pH_{CaCl}	4.0 – 4.6	Moderate/Major
EC (dS/m)[1]	0.015	Minor
Sodicity (cmol(+)/kg)[1]	0.42	Minor
CEC (cmol(+)/kg)[1]	15.1	Minor
P-sorption (mg/kg)[1]	688[2]	Minor

Notes:
[1] Values are calculated as a weighted average based on soil layer depths as described in section 2.3
[2] Equal to P-sorption of 9,292.5 kg/ha for 0.9 m of soil with bulk density 1.5 T/m^3

The limitation posed by pH is not considered significant as soils with this pH currently support excellent vegetation growth on the site. Application of treated effluent is not expected to significantly change the soil pH.

3.3 Land Capability Assessment for Effluent Re-Use

Suitability for on-site effluent re-use is assessed according to Tables 4 and 6 of the NSW Department of Local Government *et al.* (NSW DLG *et al.*, 1998) and summarised in Table 6.

Table 6: Site suitability for on-site effluent management systems, according to NSW Department of Local Government *et al.* (1998).

Feature	Details of Irrigation Areas	Limitation Rating
Flood potential	>1 in 20 yr flood level	Minor
Sun and wind exposure	High	Minor
Slope (%)	Typically <10% (in proposed lots)	Minor
Landform	Upper slopes	Minor
Erosion potential	None (in proposed lots)	Minor
Site drainage	No visible signs of surface dampness	Minor
Fill	None observed	Minor
Rock outcrop	<10% (in proposed lots)	Minor
Geology	No major discontinuities	Minor
Depth to bedrock (m)	0.8 – 1.05	Moderate
Depth to water table (m)	>1.0 m	Minor
Soil permeability Category	2a, 4a and 5b	Minor/Moderate
Coarse fragments (%)	Generally 0 – 20%	Minor

Notes:
[1] Estimates based on local experience and soil landscape book.

The land capability assessment revealed most site features represent a minor limitation to effluent disposal. Based on field investigations topsoil and subsoil material is generally suitable for effluent irrigation.

Moderate limitations posed by depth to bedrock and soil permeability categories will be taken into account with water balance and nutrient modelling assessment as discussed in Section 3.6.

3.4 Hydraulic Load Estimations

Design hydraulic load for a typical dwelling development scenario is noted in Table 7 and has been calculated using allowances from Table H1 of AS/NZS 1547 (2012) and two persons for the first bedroom and one person per bedroom thereafter. The proposed development design scenario is based on a five bedroom dwelling. We note that it is assumed the site will be connected to reticulated water supply.

Table 7: Design wastewater loads for option one.

Bedrooms	Design Occupants	Recommended Wastewater Flow Allowance (L/p/d)[1]	Design Wastewater Load (L/day)
5	6	150	900

Notes:
[1] Based on reticulated water supply (Table H1, AS/NZS 1547, 2012).

3.5 Effluent Application Rates for Sub-Surface Irrigation

Soil properties and corresponding recommended design irrigation rates (DIRs) according to Table M1 of AS/NZS 1547 (2012) are given in Table 8.

Table 8: DIR and soil properties for the site.

Soil Category	Depth (m) [1]	Texture	Structure	Indicative Permeability (K_{sat}) (m/d)	Design Irrigation Rate (DIR) (mm/day)
TOPSOIL	0.0 – 0.15	Loamy sand	Weakly structured	>3.0	5
SUBSOIL	0.15 – 0.45	Sandy clay	Moderately structured	0.5 – 1.5	3.5
DESIGN					3.5[2]

Notes:
[1] Depth of soil horizons varies across the site.
[2] Design irrigation rate based on moderately structured sandy clay.

Based on a daily hydraulic load of 900 L/day and a design irrigation rate of 3.5 mm/day, a design area of 257 m^2 is required for the primary irrigation field in accordance with AS/NZS 1547 (2012). A reserve area of 257 m^2 is to be provided for each system.

3.6 Soil, Water and Nutrient Modelling Summary

Details of the model outputs are summarised in Attachment C of this report. Sustainable irrigation areas are summarised in Table 9.

Table 9: Modelling summary: area required for sustainable irrigation.

Parameter	Area Required (m^2)
Water Balance [1]	519
Nitrogen Uptake	443
Phosphorus Saturation	146
AS/NZS 1547:2012	257 (514 including reserve)
Adopted Design Area	**519**

Notes:
[1] Area where no wet weather storage is required.
[2] AS/NZS 1547 (2012) recommends that a reserve field of 100% of the primary field area be retained available for use should it be required.

3.7 Buffer Setbacks for Effluent Reuse Area

Irrigation field areas are located with buffers in accordance with AS/NZS 1547 (2012) *Table R1*, with recommended buffers summarised in Table 10.

Table 10: Adopted buffer setbacks in accordance with AS/NZS 1547 (2012).

Site feature	Recommended setback range (m)
Drainage channels	40
Site boundaries, and roads (upslope)[1]	6
Site boundaries, and roads (downslope) [1]	3
Dwellings and buildings	6^x / 3^y

Notes:
[1]. Sub-surface set-back.
[x/y]. upslope / downslope of the feature.

These buffer setbacks shall be used for subdivision design purposes.

3.8 Irrigation Requirements

Irrigation areas for individual systems are recommended to be either large drop sprinklers (such as wobblers) for surface irrigation, or if subsurface irrigation is to be used, pressure compensating shallow drip irrigation lines with laterals installed parallel to site contours at 1 m intervals in accordance with AS/NZS 1547 (2012). Appropriate delivery mains with non-return valves and flushing lines would need to be installed in the irrigation system.

Where surface irrigation, areas would be required to be fenced off and sign posted to restrict public access. Scattered trees (that are to be retained) in irrigation areas should be managed by appropriate exclusion zones from the base of trunks and careful hand excavations (where subsurface irrigation is used).

3.9 Summary and Recommendations

The proposed wastewater option and irrigation requirements have been assessed against site soil properties and land capability constraints in accordance with relevant guidelines. The proposed option was assessed using nutrient, soil and water balance models provided in Attachment B.

The sustainable area for effluent disposal is 519 m^2 which is based on water balance requirements, this shall be used as the adopted design area and shall be used for subdivision design purposes.

This assessment is considered preliminary and a more detailed wastewater management assessment is recommended for each lot at dwelling approval stage.

4 References

Australian / New Zealand Standard 1547 (2012), *On-site domestic wastewater management*

Department of Local Government, NSW Environment Protection Authority, NSW Health Department, NSW Department of Land and Water Conservation and the NSW Department of Urban Affairs and Planning (1998), *Environment and Health Protection Guidelines - On-site Sewage Management for Single Households*

NSW Department of Primary Industries, The Wollongong Port Hacking 1:100,000 Geological Series (1985)

NSW Office of Environment and Heritage, Soil Landscapes of the Wollongong-Port Hacking 1:100,000 Sheet Map (1990)

Wollondilly Shire Council (2011) – On-site Sewage Management System and Greywater Re-use Policy

5 Attachment A – Figures

ZONING CONCEPT PLAN

MGA GRID BOUNDARY CO_ORDINATES

1:	E: 277 180.050	N: 6 204 416.164
2:	E: 277 182.770	N: 6 204 405.667
3:	E: 277 214.134	N: 6 204 321.096
4:	E: 277 261.670	N: 6 204 184.572
5:	E: 277 279.753	N: 6 204 127.524
6:	E: 277 638.587	N: 6 204 199.697
7:	E: 278 179.885	N: 6 204 306.592
8:	E: 278 121.253	N: 6 204 602.437

NOTE
PROPOSED SUBDIVISION IS SUBJECT COUNCIL APPROVAL.
ALL BOUNDARIES, DIMENSIONS AND AREAS ARE TO BE CONFIRMED BY FINAL SURVEY.

REV.	DATE	DESCRIPTION	BY
C	9/11/16	AMEND ZONING	BW
B	7/09/16	AMEND ZONING	BW
A	23/07/16	INITIAL ISSUE	PB

FEATURES LEGEND

- E2 ENVIRONMENTAL CONSERVATION ZONE
- R2 LOW DENSITY RESIDENTIAL ZONE WITH 700m² MINIMUM LOT SIZE
- R5 LARGE LOT RESIDENTIAL ZONE WITH 5000m² MINIMUM LOT SIZE

0 50 100 150 METRES
SCALE: 1:1500

sydney land surveyors
Consulting Surveyors
Ph (02) 9967 0511
152 Sailors Bay Road
Northbridge NSW 2063

IN ASSOCIATION WITH:
AustralianSurveySolutions
ABN 54 146 524 585
PO Box 498
BOWRAL 2576 NSW
T: 1300 49 39 79
M: 0417 49 39 79
enquiry@aussurvey.com.au
www.aussurvey.com.au

THIS PLAN MUST NOT BE USED FOR CONSTRUCTION UNLESS SIGNED AS APPROVED BY PRINCIPAL CERTIFYING AUTHORITY.

CLIENT: Common Ground Property NSW
PROJECT ADDRESS: 95 Great Southern Road, Bargo

Drawing Title: CONCEPT ZONING PLAN OVER LOT 1 DP 996286

Drawing Number: 190713

L.G.A.: Wollondilly	Surveyed: PB/ RL	Drawn: PB	Approved: PB
Datum: A.H.D.	Origin: PM 60494	Date Of Survey: 23 JULY 2016	

Rev: C | Size: A1 | Scale: 1: 1 500 | Sheet : 1 Of 1

REV	DESCRIPTION	DATE	DRAWN	DESIGNED	CHECKED	APPRVD
A	FOR PSI	9/11/2016	KT	RM		

SCALE
0 20 40 60 80 100 120 140 160 180 200 METRES
A1 (A3) 1:2,000 (1:4,000)

GRID	DATUM	PROJECT MANAGER
MGA		JF

CLIENT
PRECISE PLANNING

PROJECT NAME/PLANSET TITLE
PRELIMINARY SITE INVESTIGATION
95 GREAT SOUTHERN ROAD, BARGO, NSW

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DRAWING TITLE
INVESTIGATION SITE PLAN
SOURCE: NEARMAP (2016)

PROJECT NO.	PLANSET NO.	RELEASE NO.	DRAWING NO.	REVISION
P1504741	PS02	R01	PS02-J100	A

PRINTED: 09/12/2016 - USER: KTUN
A1 / A3 LANDSCAPE (A1LC_v02.0.01)
DRAWING ID: P1504741-PS02-R01-J100

6 Attachment B – Test Pit Logs

CLIENT	Precise Planning		COMMENCED	02/11/2016	COMPLETED	02/11/2016	**REF TP201**
PROJECT	Wastewater Assessment		LOGGED	BM/RM	CHECKED	JF	Sheet 1 OF 1
SITE	95 Great Southern Road, Bargo, NSW		GEOLOGY	Sandstone/Shale	VEGETATION	Grass	PROJECT NO. P1504741
EQUIPMENT		Excavator	EASTING		RL SURFACE	m	DATUM AHD
EXCAVATION DIMENSIONS		Ø600 mm x 1.00 m depth	NORTHING		ASPECT	West	SLOPE <5%

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	AG SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
E		Not Encountered	0.5	*0.15*				LS	Loamy SAND, fine, dark brown, with rootlets.			TOPSOIL
								SC	Sandy CLAY, moderately structured, brown/ orange.			RESIDUAL SOIL
				0.45				LMC	Light to medium CLAY, low to medium plasticity, moderately structured, brown/ orange with grey mottles.	D		
				0.80					SANDSTONE, extremely weathered, orange/ red with grey mottles, inferred very low strength.			WEATHERED ROCK
			1.0	*1.00*					Test Pit terminated at 1.00 m (Target depth reached)			1.00: TP terminated on inferred low strength sandstone.
			1.5									

EXCAVATION LOG TO BE READ IN CONJUCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

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Engineering Log - TEST PIT

CLIENT	Precise Planning		COMMENCED	02/11/2016	COMPLETED	02/11/2016	**REF TP202**
PROJECT	Wastewater Assessment		LOGGED	BM/RM	CHECKED	JF	Sheet 1 OF 1
SITE	95 Great Southern Road, Bargo, NSW		GEOLOGY	Sandstone/Shale	VEGETATION	Grass	PROJECT NO. P1504741
EQUIPMENT		Excavator	EASTING		RL SURFACE	m	DATUM AHD
EXCAVATION DIMENSIONS		Ø600 mm x 1.40 m depth	NORTHING		ASPECT	West	SLOPE <5%

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	AG SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
E		Not Encountered	0.5	*0.15*				LS	Loamy SAND, fine, dark brown, with rootlets.	D		TOPSOIL
								SC	Sandy CLAY, moderately structured, brown/ orange.			RESIDUAL SOIL
				0.35				LMC	Light to medium CLAY, low to medium plasticity, moderately structured, brown/ orange with grey mottles.			
			1.0	*0.90*					SHALE, extremely weathered, grey, clay like properties, inferred extremely low strength.			WEATHERED ROCK
				1.40					Test Pit terminated at 1.40 m (Target depth reached)			1.40: TP terminated on inferred low strength shale.
			1.5									

EXCAVATION LOG TO BE READ IN CONJUCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

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Engineering Log - TEST PIT

CLIENT	Precise Planning		COMMENCED	02/11/2016	COMPLETED	02/11/2016	**REF TP203**
PROJECT	Wastewater Assessment		LOGGED	BM/RM	CHECKED	JF	Sheet 1 OF 1
SITE	95 Great Southern Road, Bargo, NSW		GEOLOGY	Sandstone/Shale	VEGETATION	Grass	PROJECT NO. P1504741
EQUIPMENT		Excavator	EASTING		RL SURFACE	m	DATUM AHD
EXCAVATION DIMENSIONS		Ø600 mm x 1.40 m depth	NORTHING		ASPECT	West	SLOPE <5%

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	AG SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
E		Not Encountered	0.5	*0.15*				LS	Loamy SAND, fine, dark brown, with rootlets.			TOPSOIL
								SC	Sandy CLAY, moderately structured, brown/ orange.			RESIDUAL SOIL
				0.50				LMC	Light to medium CLAY, low to medium plasticity, moderately structured, brown/ orange with grey mottles.	D		
			1.0	*1.00*					SANDSTONE, extremely weathered, orange/ red with grey mottles, inferred very low strength.			WEATHERED ROCK
				1.40					Test Pit terminated at 1.40 m (Target depth reached)			1.40: TP terminated on inferred low strength sandstone.
			1.5									

EXCAVATION LOG TO BE READ IN CONJUCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

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Engineering Log - TEST PIT

CLIENT	Precise Planning		COMMENCED	02/11/2016	COMPLETED	02/11/2016	**REF TP204**
PROJECT	Wastewater Assessment		LOGGED	BM/RM	CHECKED	JF	Sheet 1 OF 1
SITE	95 Great Southern Road, Bargo, NSW		GEOLOGY	Sandstone/Shale	VEGETATION	Grass	PROJECT NO. P1504741
EQUIPMENT		Excavator	EASTING		RL SURFACE	m	DATUM AHD
EXCAVATION DIMENSIONS		Ø600 mm x 1.25 m depth	NORTHING		ASPECT	West	SLOPE <5%

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	AG SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
E		Not Encountered	0.5	*0.10*				LS	Loamy SAND, fine, dark brown, with rootlets.	D		TOPSOIL
								SC	Sandy CLAY, moderately structured, brown/ orange.			RESIDUAL SOIL
				0.50				LMC	Light to medium CLAY, low to medium plasticity, moderately structured, brown/ orange with grey mottles.			
			1.0	*1.05*					SANDSTONE, extremely weathered, orange/ red with grey mottles, inferred very low strength.			WEATHERED ROCK
				1.25					Test Pit terminated at 1.25 m (Target depth reached)			1.25: TP terminated on inferred low strength sandstone.
			1.5									

EXCAVATION LOG TO BE READ IN CONJUCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

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Engineering Log - TEST PIT

7 Attachment C – Nutrient and Water Balance Models

Effluent Disposal Field - Annual Nutrient Balance Assessment

Method ST-14 Revised 20.3.2007

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PROJECT DETAILS

Project	95 Great Southern Road, Bargo, NSW			Ref. No.	P1504741
Author	RM	Reviewed	JF	Date Created	4/11/2016

STEP 1 : ENTER SITE AND FIELD CHARACTERISTICS

FACTOR	Enter Data	Unit	
Treatment System	AWTS	-	
Effluent flow rate	900	L/day	
Effluent N	27.0	mg/L	
Effluent P	10.0	mg/L	
Design soil depth	0.90	m	
Soil P-sorption	344.0	mg/kg	50% of P-sorption value is used as a conservative measure as per DLG et al. (1998)
Plant N uptake	200.0	kg/ha/year	
Plant P uptake	20.0	kg/ha/year	

STEP 2 : ASSESSMENT

NITROGEN BUDGET FOR RE-USE FIELD

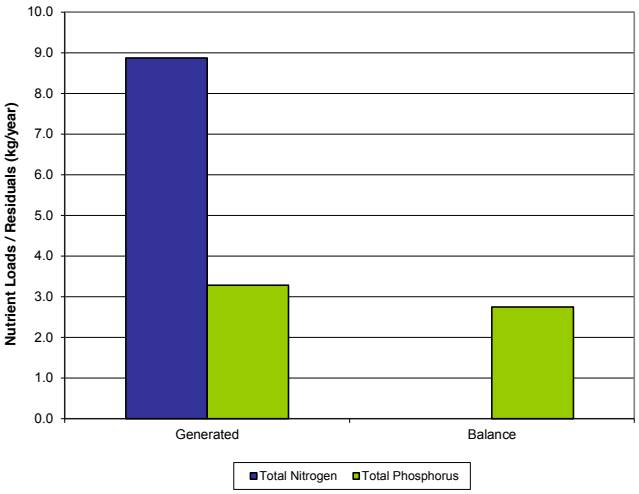
N generated	8.87	kg/year
N consumed	8.87	kg/year
N balance	0.00	kg/year
Min Area	443	m^2

PHOSPHORUS BUDGET FOR RE-USE FIELD

P generated	3.29	kg/year
P consumed	0.54	kg/year
P balance	2.75	kg/year
P sorption	137.4	kg P/design soil depth
Field life (for P)	50.0	Years
Min Area	269	m^2

MINIMUM NUTRIENT ASSIMILATION AREA

Minimum Area	**443**	m^2



Effluent Disposal Field - Water Balance Assessment

Method ST-XX Revised 11.8.2010

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PROJECT DETAILS

Project	95 Great Southern Rd, Bargo, NSW			Ref. No.	P1504741
Author	RM	Reviewed	JF	Date Created	7/11/2016

STEP 1 : ENTER SITE AND FIELD CHARACTERISTICS

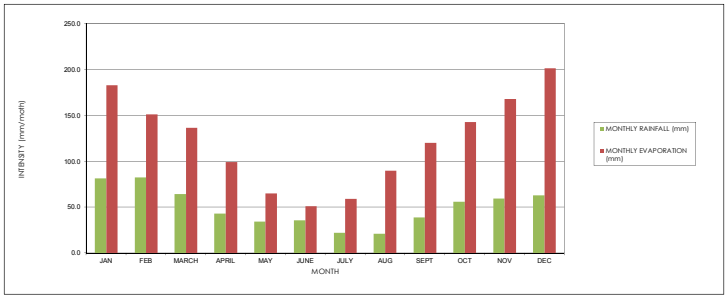
FACTOR	Enter Data	Unit	Notes			
Runoff Factor - RF	0.35	%		Design Irrigation Rate - DIR	1.7	mm/day
Daily Effluent Load - DEL	900	L	- Based on 1000L/day	Wet-Weather Storage (KL)	0.0	
Effluent Disposal Area - A	519.0	m^2				
Design Percolation Rate (DPR)	1.4	mm/day				

STEP 2 : ENTER CLIMATE DATA

Source(s): Evaporation data - Badgerys Creek (061351) 1967 - 1984

Rainfall data - Buxton (Amaroo) NSW (068166) 1966 - 2013

MONTH	MONTHLY RAINFALL (mm) Enter Data	MONTHLY EVAPORATION (mm) Enter Data
JAN	81.30	182.90
FEB	82.30	151.20
MARCH	64.40	136.40
APRIL	43.10	99.00
MAY	34.20	65.10
JUNE	35.60	51.00
JULY	22.20	58.90
AUG	21.00	89.90
SEPT	38.80	120.00
OCT	55.80	142.60
NOV	59.50	168.00
DEC	63.00	201.50



STEP 3 : ASSESSMENT

MONTH	NUMBER OF DAYS	MONTHLY RAINFALL (mm)	RETAINED RAINFALL	MONTHLY EVAPORATION	CROP FACTOR	EVAPO-TRANSPIRATION RATE	DESIGN PERCOLATION	AVAILABE IRRIGATION CAPACITY	EFFLUENT APPLIED	APPLICATION RATE	INCREASE IN PONDING DEPTH OF EFFLUENT	CUMULATIVE PONDING DEPTH OF EFFLUENT FROM PREVIOUS MONTH	DEPTH OF EFFLUENT	PONDING DEPTH OF EFFLUENT	WET-WEATHER STORAGE REQUIRED
-	(days)	(mm/month)	(mm/month)	(mm/month)	-	(mm/month)	(mm/day)	(mm/month)	(L/month)	(mm/month)	(mm)	(mm)	(mm/month)	(mm)	(KL)
-	DAY	R	RR = R x (1 - RF)	E	CF	ETR = E x CF	DP = DPR x DAYS	AIC = ETR - RR +DP	EA = DEL x DAY	AR = EA / A	D = (AIC - AR)	CPD = PD from previous month	DE = D + CPD	PD	WWS
JAN	31	81.30	52.8	182.90	0.80	146.3	43.4	136.9	27900	53.8	-83.1	0.0	-83.1	**0.0**	**0.0**
FEB	28	82.30	53.5	151.20	0.80	121.0	39.2	106.7	25200	48.6	-58.1	0.0	-58.1	**0.0**	**0.0**
MARCH	31	64.40	41.9	136.40	0.80	109.1	43.4	110.7	27900	53.8	-56.9	0.0	-56.9	**0.0**	**0.0**
APRIL	30	43.10	28.0	99.00	0.80	79.2	42.0	93.2	27000	52.0	-41.2	0.0	-41.2	**0.0**	**0.0**
MAY	31	34.20	22.2	65.10	0.65	42.3	43.4	63.5	27900	53.8	-9.7	0.0	-9.7	**0.0**	**0.0**
JUNE	30	35.60	23.1	51.00	0.65	33.2	42.0	52.0	27000	52.0	0.0	0.0	0.0	**0.0**	**0.0**
JULY	31	22.20	14.4	58.90	0.65	38.3	43.4	67.3	27900	53.8	-13.5	0.0	-13.5	**0.0**	**0.0**
AUG	31	21.00	13.7	89.90	0.65	58.4	43.4	88.2	27900	53.8	-34.4	0.0	-34.4	**0.0**	**0.0**
SEPT	30	38.80	25.2	120.00	0.80	96.0	42.0	112.8	27000	52.0	-60.8	0.0	-60.8	**0.0**	**0.0**
OCT	31	55.80	36.3	142.60	0.80	114.1	43.4	121.2	27900	53.8	-67.5	0.0	-67.5	**0.0**	**0.0**
NOV	30	59.50	38.7	168.00	0.80	134.4	42.0	137.7	27000	52.0	-85.7	0.0	-85.7	**0.0**	**0.0**
DEC	31	63.00	41.0	201.50	0.80	161.2	43.4	163.7	27900	53.8	-109.9	0.0	-109.9	**0.0**	**0.0**

8 Attachment D – Lab Results

Department of Primary Industries
Soil Conservation Service

SOIL TEST REPORT

Scone Research Centre

REPORT NO:	SCO15/250R1
REPORT TO:	Grant Taylor Martens & Associates Pty Ltd Suite 201, 20 George St Hornsby NSW 2159
REPORT ON:	Four soil samples Your Ref: P1504741 15 Government Road, Bargo, NSW
PRELIMINARY RESULTS ISSUED:	Not issued
REPORT STATUS:	Final
DATE REPORTED:	27 January 2016
METHODS:	Information on test procedures can be obtained from Scone Research Centre

TESTING CARRIED OUT ON SAMPLE AS RECEIVED

SR Young
(Laboratory Manager)

Scone Research Centre, PO Box 283 Scone 2337, 709 Gundy Road Scone 2337
Ph: 02 6545 1666 Fax: 02 6545 2520

SOIL CONSERVATION SERVICE
Scone Research Centre

Report No: SCO15/250R1
Client Reference: Grant Taylor
Martens & Associates Pty Ltd
Suite 201, 20 George St
Hornsby NSW 2159

Lab No	Method	C1A/5	C2A/4	C2B/4	C5A/4 CEC & exchangeable cations (cmol (+)/kg)						C5A/4	C8B/1	P9B/2
	Sample Id	EC (dS/m)	pH	pH ($CaCl_2$)	CEC	Na	K	Ca	Mg	Al	ESP (%)	P sorp (mg/kg)	EAT
1	4741/102/0.4-0.5/S/01	0.02	5.8	4.3	14.3	0.5	0.1	0.5	3.9	5.7	4.8	650	5
2	4741/103/0.1/S/01	0.01	5.5	4.6	8.8	0.1	0.1	1.2	2.3	1.2	1.8	660	5
3	4741/103/0.3-0.4/S/01	0.01	5.5	4.0	19.5	0.4	0.1	0.4	4.2	12.0	2.3	750	5
4	4741/104/0.15/S/01	<0.01	6.0	4.6	8.2	0.3	<0.1	1.8	2.7	1.1	5.0	700	5

Lab No	Method	P18B/3 (%) Available water capacity		
	Sample Id	FC (0.3 bar)	WP (15 bar)	AWC
1	4741/102/0.4-0.5/S/01	25	11	14
2	4741/103/0.1/S/01	28	10	18
3	4741/103/0.3-0.4/S/01	27	17	10
4	4741/104/0.15/S/01	31	12	19

Field capacity (FC), wilting point (WP) and available water capacity (AWC) = moisture content (%) by weight

END OF TEST REPORT