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Date: 8 December 2024
Project Ref: 24_011 revision 002

Onsite Wastewater Management Report - 17 Whimbrel Drive, Nerong NSW

Please find attached the Wastewater Management Report ("WMR") for a new On-site Sewage Management System (OSSM) to service the existing converted church residential dwelling at 17 Whimbrel Drive, Nerong NSW 2423 (the "Site"). This WMR has been prepared to demonstrate the capability for sustainable on-site sewage management (OSSM) for the Site, taking into consideration Council's policy requirements and DA conditions, and performance expectations for the Site.

In summary the recommended treatment and land application combination and mitigation measures are:

- Generated wastewater from the existing 1-2 bedroom converted church residential dwelling will be treated to a secondary standard (with disinfection) in a NSW Health accredited domestic secondary treatment system;
- Secondary treated effluent will be dispersed on-site via subsurface irrigation (SSI) and covered surface drip irrigation (CSDI) with a minimum land application area of 133m^2. A nutrient buffer is to be established directly downslope of the LAA to ensure the assimilation of phosphorus. The LAA must be located within the available EMA as denoted on the Site Plan (Figure 2);
- Due to shallow Site soils, the irrigation LAA must be raised by ~100-200mm of good quality soil (silty loam to clay loam) across the entire LAA footprint (~13.3-26.6m^3) to ensure that the minimum 600mm depth of separation between the point of effluent application (ground surface) and limiting layer is achieved;
- Application of lime during construction of the LAA and periodic dosing of the OSSM system to reduce soil sodicity;
- Suitable vegetation such as turf must be established over the LAA immediately after installation, with a minimum 50mm mulch cover over the CSDI lines;
- Stormwater run-on must be directed away from the proposed LAA;
- Suitable vegetation such as turf must be established over the LAA immediately after installation; and
- Vehicles must be prevented from entering the designated LAA.

Further details are provided in the attached WMR and appendices.

Regards,

Jasmin Kable

Principal Environmental Consultant

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1. DISCLAIMER, COPYRIGHT AND CONSIDERATIONS

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The suitability of the site for OSSM has been assessed, and recommendations provided for effluent treatment and land application areas. It is the responsibility of the owner to decide which of the recommended treatment systems and land application methods to install, and to include this information with the S68 application to Council to install the adopted system.

Any alterations affecting the proposed land application area will require a review of this report.

2. LEGISLATIVE REQUIREMENTS

This WMR has been undertaken in reference to the Site and soil assessment and OSSM design principles of the following:

- *AS/NZS 1547:2012* On-site Domestic Wastewater Management (Standards Australia/ Standards New Zealand, 2012);
- Environment & Health Protection Guidelines: On-site Sewage Management for Single Households (Department of Local Government, 1998);
- MidCoast Council, (2020) *On-site Sewage Development Assessment Framework* (DAF). Final Version, dated 13 October 2020; and
- MidCoast Council, (2020) *On-site Sewage Management Technical Manual*. Final Version, dated 1 September 2020.

3. SITE INFORMATION

Site Address: 17 Whimbrel Drive, Nerong	**Lot/DP:** 33/-/247531
Owner/developer: Jennifer Aitcheson - Owner	**Lot size (m²):** 602m²
Council area: MidCoast Council ("Council" or "MCC")	**Land Zoning:** RU5 'village'
Water Supply: On-site tank	**Sewer Connection Available:** No
Locality: The Site is bound by Whimbrel Drive to the south, with the Nerong Inlet and associated wetlands location >230m to the east of the Site. The east, west and north of the Site is bound by other small village	

properties. There is a Heritage Site identified 140m to the north east of the Site. Refer to Figure 1 (Appendix A) for the Site locality.

Catchment Area: The Site is not located within a drinking water catchment. It is located within the Myall Lakes Catchment area.

Development:

Existing improvements at the Site include an existing converted church that was transported to the Site and installed on raised footings. It is proposed that the Owner will submit a DA with MCC to renovate the existing converted church as a residential dwelling to contain 1-2 bedrooms. There is currently no other infrastructure on-site. The Site contains large mature trees that have been recently cleared, with the Site to be re-landscaped. The Owner proposes to install a new rainwater tank at the rear of the dwelling, a small garden shed within the north-west corner of the Site, and a driveway and carport along the western and front southern side of the dwelling as shown on the Site Plan.

Existing OSSM System:

There is currently not OSSM system or plumbing infrastructure installed at the Site.

4. SCOPE OF WORKS

The scope of works undertaken for this WMR include;

- Review of background information relevant to the Site;
- Assess site constraints relevant to OSSM;
- One (1) Site visit to undertake a detailed Site and soil assessment, including the excavation of one (1) soil test pits to assess the soil physical characteristics;
- Undertake in-house laboratory analysis of pH, electrical conductivity and Emerson Aggregate Class of the soil samples;
- Review published reference sources to establish suitable values for P-sorption, CEC and ESP for nutrient modelling and soil dispersion potential;
- Assess overall Site capability for OSSM and determine the preferred method of land application of effluent to overcome any Site constraints. Reference is made to the AS/NZS 1547:2012 Onsite Domestic Wastewater Management, Environmental Health Protection Guidelines: Onsite Sewage Management for Single Households (NSW DLG, 1998), and any relevant current Council policies or guidelines;
- Estimate proposed wastewater loads (quantity and quality) from the proposed development;
- Identify suitable OSSM treatment and land application options;
- Undertake hydraulic and nutrient balance modelling in accordance with the MCC DAF (2020) requirements to size a suitable land application area for the proposed development;
- Identify an appropriate location for the land application area on the Site Plan.
- Outline any required mitigation measures to address constraints (i.e. soil importation, soil amendment, stormwater diversion);
- Generalised outline on the operation and maintenance requirements of the preferred OSSM treatment system; and
- Preparation of a detailed Site Plan.

5. SITE EVALUATOR

Company: Kable Wastewater Consultancy Name: Jasmin Kable

This WMR has been prepared by Jasmin Kable who is the Principal Environmental Consultant with KWC, with more than 12 years' experience in on-site wastewater design and site and soil assessment. Jasmin holds a Bachelor of Science (Class 1 Honours) from the University of Newcastle (2012) and has completed the On-Site Wastewater Management professional short-course with the Centre for Environmental Training (CET). Jasmin has prepared WMR's for many developments across the Hunter, Central Coast, Port Stephens, Sydney, Blue Mountains and MidCoast regions.

Site and Soil Assessment:

A Site and soil assessment was undertaken on 21st November 2024. Section 6 and 7 of this WMR present the results of the assessment of the available effluent management area (EMA), with particular emphasis on the proposed land application area (LAA). A description of the constraints and the degree of limitation they pose to OSSM is provided as per the rating scale in Tables 4 and 6 of the NSW DLG (1998) and MCC DAF (2020).

6. SITE ASSESSMENT

Site Feature:		Limitation
Climate: Temperate climate with median annual rainfall of 1,092mm with average annual evaporation 1,405.7mm (Silo data drill -32.50, 152.20). Rainfall exceeds evaporation for 5 months of the year.		Moderate
Flood potential: Land application area above 1 in 20-year flood level? Land application area above 1 in 100-year flood level? Electrical components above 1 in 100-year flood level?	 Yes Yes Yes	 Minor Minor Minor
Flood detail: The Great Lakes LEP (2014) shows the Site is not flood prone.		
Vegetation and Exposure: The Site has been recently cleared of all vegetation, with numerous established trees removed and stumps ground down both within the front and rear of the Site. The only remaining vegetation on-site is turf lawn. The Owner proposes to re-landscape the Site with a combination of turf lawn and garden beds. The Myall Lakes National Park is located to the east, surrounding the Nerong township. The proposed LAA has good exposure to sun and wind.		Minor
Slope & Aspect: southerly aspect; 2-33% across the Site with the mean slope within the proposed LAA 13-17% based on NSW Spatial Services 1m DEM.		Moderate
Landform: Site landform is the lower convex planar slope of a ridgeline.		Minor
Seepage and Run-on: No seepage was observed within the proposed LAA, which is located upslope of the existing dwelling. Soils downslope of the existing dwelling in the front yard were moist at the surface, with moisture-tolerant vegetation observed. Any run-on from upslope will need to be diverted as per stormwater control measures detailed in Section 12 of this Report.		Minor

6. SITE ASSESSMENT

Site Feature:	Limitation
Erosion: Potential high soil erosion risk; however, the proposed LAA is located in a well vegetated lawn area with minimal observed erosion.	Minor
Site drainage: The Site drainage is to the south towards Whimbrel Drive.	Minor
Surface Waterways: The Site is located within the Myall Lakes Catchment area, with Nerong Inlet and associated wetlands location >230m to the east of the Site. The Site is located within the Coastal Zone as per the NSW SEPP Resilience and Hazards (2021).	Minor
Fill: None observed.	Minor
Surface rocks: No surface rocks were observed across the Site; however weathered sandstone fragments observed from >200mm depth within the soil boreholes.	Minor
Groundwater: (NSW Office of Water Groundwater Bore Registry) There are no registered domestic groundwater bores located within a 250m radius of the Site. GW200771 is located >500m to the north-east of the Site, noting a SWL at 12m AHD depth (2m SWL).	Minor
Available EMA: There is 133m^2 of available and suitable EMA identified within the northern portion of the Site, with reduced buffers to Site boundaries and driveways/pathways applied; as shown on the Site Plan (Figure 2).	Major

Site Assessment Summary:

Due to the existing development at the Site and the major Site constraints for OSSM, the best practical OSSM solution needs to be adopted. The identified limitations of Site slope and minimal available EMA concerns can be addressed or mitigated through the following measures:

- Available EMA: The Site is highly constrained for available EMA due to the property size. Refer to Section 10 of this WMR for buffer reduction justification. KWC recommend that the OSSM system and LAA be sized based on the available EMA, with the surplus effluent to be directed to a pump-out system.
- Site Slope: Effluent disposal methods are limited to subsurface and covered surface drip irrigation of effluent under a layer of mulch.

7. SOIL ASSESSMENT

Soil Feature:	Limitation

Soil landscape unit:

According to the NSW Planning, Industry and Environment eSpade, the Site is located within the Nerong (no) soil landscape as described below.

Nerong 'no' soil landscape:

Undulating low hills with local relief to 30m and slopes <15%. Broad crests, gently to moderately inclined side slopes and narrow drainage lines. Underlain by thickly bedded grey lithic sandstones of the McInnes Formation.

Based on the natural soil profile observed during the Site and soil inspection, the Site soils are consistent with imperfectly drained Yellow Podzolic Soils of the Nerong soil landscape. Comprised of 100mm sandy

7. SOIL ASSESSMENT	
loam, overlying up to 250mm sandy clay loam overlying up to 1,000mm medium sandy clay on sandstone parent material. Soil depth is variable <1m. Soil landscape limitations include: high erosion hazard, rock outcrop (localised), shallow soils (localised), seasonal waterlogging (localised), low soil fertility. Reference: C.L Murphy, 1995, Soil Landscapes of the Port Stephens 1:100,000 Sheet.	
Soil Depth (mm): Weathered sandstone bedrock in the proposed LAA is expected to be at >500mm based on soil landscape descriptions and weathered sandstone fragments observed at 500mm depth within BH1. Reference: C.L Murphy, 1995, Soil Landscapes of the Port Stephens 1:100,000 Sheet and soil borehole observations.	Major
Soil Profiles: One (1) soil boreholes was augered at the Site due to minimal available EMA, with the soil profile as follows: BH1: • A_1 horizon: 0-200mm of sandy clay loam (SCL) topsoil, dark brown, weak structure, overlying; • A_2 horizon: 200-350mm of sandy clay (SC), light orange brown, weak structure and 10-15% coarse fragments (<20mm), overlying; • B horizon: 350-500mm of sandy clay (SC) with a higher sand content, grey light orange brown, gleying, 10-30% coarse fragments increasing with depth, weathered sandstone bedrock refusal. Reference: Soil borehole observations	Moderate
Design Irrigation/ Loading Rate: 3mm/day for moderately structured sandy clay.	Moderate
Coarse fragments (%): Typically, 10-15% within the topsoil. Increased coarse fragment content of 30% observed within the subsoil. Coarse fragments typically fine gravel with weathered sandstone fragments <20mm.	Moderate
Depth to high soil watertable (m): The depth to the permanent watertable is expected to be >500mm based on the depth of soil. Minor gleying was observed within the subsoil. Nerong Inlet is located ~12m AHD downslope of the proposed LAA located at 15m AHD, with sufficient slope gradient. NSW groundwater bore GW200771 located at 14m AHD along the Nerong Inlet foreshore states a standing water level of 2m at 12m AHD.	Minor
Soil Chemistry:	**Limitation**
pH: 5. Strongly acidic. No impact to vegetation growth observed. Reference: Nerong no4 (C.L Murphy, 1995, Soil Landscapes of the Port Stephens 1:100,000 Sheet).	Moderate
Electrical conductivity (ECe dS/m): 0.47. Non saline. Reference: Nerong no4 (C.L Murphy, 1995, Soil Landscapes of the Port Stephens 1:100,000 Sheet).	Minor

7. SOIL ASSESSMENT	
Modified Aggregate Class (EAT): Class 3(1), 3(2) topsoil and 6 subsoil. Slightly to none dispersive Reference: Nerong no4 (C.L Murphy, 1995, Soil Landscapes of the Port Stephens 1:100,000 Sheet).	Minor
Cation Exchange Capacity (CEC me/100g): 15.5. Moderate fertility. Reference: Nerong no4 (C.L Murphy, 1995, Soil Landscapes of the Port Stephens 1:100,000 Sheet).	Minor
Exchangeable Sodium Percentage (ESP %): 9. Sodic. Reference: Nerong no4 (C.L Murphy, 1995, Soil Landscapes of the Port Stephens 1:100,000 Sheet).	Moderate
P-sorption (mg/kg): 526. High p-sorption capacity. Reference: Nerong no4 (C.L Murphy, 1995, Soil Landscapes of the Port Stephens 1:100,000 Sheet).	Minor

Soil Assessment Summary:

- Soil limitations: Coarse fragments, shallow soil, soil sodicity.
- Limiting soil permeability: <0.06-0.12m/day (sandy clay (Cat 5))
- Hydraulic loading rate: 3mm/day with secondary treated effluent (Table M1 *AS/NZS 1547:2012)*
- Soil amendment required: Suitable fill to raise the soil depth to a minimum of 600mm below the point of effluent application. Imported soil to be a good quality clay loam to loam which will improve soil structure and mitigation soil sodicity. Refer to Section 12 of this WMR for details.

Field Photos

Photo 1: Front of relocated church dwelling from road looking north. Old caravan to be transported off-site.

Photo 2: Rear of dwelling within the backyard looking southwards towards available EMA and proposed rear deck.

Photo 3: Rear of dwelling looking northwards towards rear boundary and neighbouring property.

Photo 4: BH1 soil profile.

8. Wastewater Generation

Number of Bedrooms:

One (1) bedroom within the existing converted church, with the aim to include an additional loft for accommodation. Assumed 1-2 bedrooms.

Design Occupancy (Equivalent Population (EP)):

Two persons for the 1st and 2nd bedroom and one person for each additional bedroom as per *AS/NZS 1547:2012* and Section 6.2 MCC DAF (2020). However, due to the unique structure of the converted church to residential dwelling, an EP of 3 persons is recommended.

Wastewater Generation (L/person/day):

From Table H1 of *AS/NZS 1547:2012* and Table 30 MCC DAF (2020) for residential premises with on-site water supply; 120L/p/day.

Design Hydraulic Load (L/day):

360 (3EP x 120L/day)

9. OSSM SYSTEM SELECTION

Recommended Treatment System:

Given the identified Site and soil constraints, specifically shallow soil depth, slope and minimal available EMA, primary treatment systems (i.e. septic tanks) are not recommended as they significantly limit effluent reuse options and pose a higher risk to human and environmental health compared to secondary or tertiary treatment systems. Therefore, a minimum effluent quality standard of 'secondary' treatment (with disinfection) is recommended.

Treatment System Specification:

A minimum effluent quality standard of secondary treatment (with disinfection) is recommended for the Site. The NSW Ministry of Health ("NSW Health") provides accreditation for domestic secondary treatment systems in NSW, with the selected system for the Site to hold a current accreditation, with details provided to Council along with the S68 application.

Appropriate secondary treatment technologies include (but are not limited to) the following: Aerated wastewater treatment systems (AWTS); Media/ textile filter systems; and aerobic sand filters (site-specific design required).

A detailed list of NSW Health accredited secondary treatment systems can be found at:

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

The exact positioning of the OSSM treatment system will depend on the slope and level controls and can be determined in consultation with a licensed OSSM installer (plumber) and Council prior to obtaining consent for the installation of the OSSM system. An indicative location is shown in the Site Plan (Figure 2, Appendix A). The OSSM system must permit sufficient fall from drainage outlets within the existing development and be located a minimum of 2.5m from the building (*AS/NZS 1547:2012*).

Installation of the OSSM must comply with the manufacturer's recommendations, *AS/NZS 3500.2:2003* Plumbing and Drainage Part 2 Sanitary Plumbing and Drainage and Council requirements.

Successful performance of OSSM system relies on periodic monitoring and maintenance, which will be the responsibility of the owner. The selected treatment system must be serviced by a suitably qualified technician at the prescribed intervals.

Land Application Area Options:		
Land Application Area	**Suitable**	**Reasoning**
Absorption Trenches/ Beds	No	Secondary trenches/beds (Table L1) are not considered suitable due to the slope, soil depth and minimal available EMA.
ETA Beds	No	Secondary trenches/beds (Table L1) are not considered suitable due to the slope, soil depth and minimal available EMA.
Mounds	No	Mounds are not considered suitable due to substantial cost, Site slope and minimal available EMA for configuration.
Surface Irrigation (SI)	Yes, conditional	SI subject to MCC approval; however, required setbacks are not achievable within the proposed LAA. Covered surface drip irrigation (CSDI) with a mulch cover considered suitable for the Site.
Subsurface Irrigation	Yes	Considered suitable for Cat 5 soils, maximising evapotranspiration and effluent reuse opportunities (AS/NZS 1547:2012). Will need to be coupled with CSDI to maximise the available EMA.

Recommended Land Application Area:

KWC consider subsurface irrigation (SSI) coupled with covered surface drip irrigation (CSDI) in combination with secondary treated (disinfected) effluent to be the most appropriate OSSM system for the existing development.

10. BUFFERS

Prescribed Buffer Distances to LAA: **Buffers Achievable:**

(NSW DLG, 1998 and Table 37 MCC DAF (2020)

Buffers applicable to subsurface irrigation LAAs from:

Permanent waters	100m	N/A
Intermittent Waterways	40m	N/A
Domestic Groundwater Bore	3m upslope/6m downslope	N/A
Site Boundary	3m upslope/6m downslope	No; 1.5m achievable
Buildings	3m upslope/6m downslope	Yes
Driveways and paths	3m upslope/6m downslope	No; 1.5m achievable
Pool	3m upslope/6m downslope	N/A
Tank	1.5m	Yes

Is there sufficient land area available for:

OSSM system (including buffer distances): All of the required buffer distances achieved; except for the 3m buffer from the Site boundaries and proposed driveway/carport as shown on the Site Plan (Figure 2, Appendix A).

Buffer Risk Assessment: There is practically no available EMA due to the small lot size. Strict application of the prescribed buffers would effectively exclude the entire Site from OSSM. The minimum buffer from Table R1 in *AS/NZS1547:2012* to the Site boundaries and proposed driveway/carport is 1.5m. As such, a 1.5m buffer distance from Site boundaries and proposed driveway/carport to the proposed LAA is considered suitable given the subsurface application and only practical OSSM solution for the Site. As discussed in Section 7 above, the groundwater bores located to the east are located on different landforms and gradient aspects, with groundwater extracted at depth within a sandstone aquifer. This will allow for OSSM and not relying on a pump-out system.

A 50% reserve area (including buffer distances): There is no sufficient available EMA on the Site to accommodate any reserve area.

11. LAA DESIGN

LAA Sizing:

The size and design of the required SSI/CSDI LAA to manage the hydraulic and nutrient loads from the existing development has been determined as per the method detailed in the MCC DAF and Technical Manual (2020) and *AS/NZS 1547:2012*.

Hydraulic Sizing:

The hydraulic sizing equation method detailed in Section 6.5 MCC DAF (2020) and Section 9.2 MCC Technical Manual (2020) and NSW DLG (1998) was used to confirm the minimum hydraulic LAA sizing for the proposed development at the Site.

$$LAA = \frac{Q}{DIR}$$

Where:

Q: design hydraulic load of 360L/day.

DIR: 3mm/day for sandy clay (Cat 5) soil (AS/NZS 1547:2012 Table M1). The minimum LAA required for hydraulic sizing for the existing 1-2-bdr dwelling at the Site is 120m².

Annual Nutrient Balance:

Annual nutrient modelling was undertaken, with the procedures generally following the DLG (1998) guidelines.

Data Parameter	Units	Value	Comments
Hydraulic load	L/day	360	(3EP x 120L/day) refer to Section 8.
Effluent total nitrogen concentration	mg/L	30	Conservative, expected nutrient loading from an AWTS from NSW DLG (1998).
Effluent total phosphorus concentration	mg/L	12	Conservative, expected nutrient loading from an AWTS from NSW DLG (1998).
Soil phosphorus sorption capacity	mg/kg	526	Nerong no4 (C.L Murphy, 1995, Soil Landscapes of the Port Stephens 1:100,000 Sheet).
Results			
Area required for nitrogen	m²	121	

11. LAA DESIGN

Area required for phosphorus	m^2	204	Limiting

Land Application Area (LAA) Requirements:

Based on the hydraulic and nutrient modelling outcomes for the proposed development, the phosphorus area requirement is confirmed as the limiting factor for LAA sizing. Due to the limited available EMA at the Site, it is recommended that a minimum 133m^2 SSI/CSDI LAA be installed at the Site. It is recommended that vegetation is maintained downslope of the LAA to provide a vegetated nutrient buffer to assimilate additional phosphorus. This can be achieved within the setback to the proposed rear deck and downslope of the cottage It is recommended that organic matter (compost) is incorporated into the imported soil to raise the soil depth to assist with phosphorus assimilation.

LAA Specification:

The final plumbing and hydraulic design will be the responsibility of a certified plumber/installer and must adhere to relevant codes and standards as described in Appendix M of *AS/NZS 1547:2012*. The detailed hydraulic plan should include details on the type, capacity, operation and maintenance of all equipment, pumps, distribution pipework, cleaning and flush valves, controllers, filters and distribution valves. Procedures for irrigation scheduling should also be discussed to ensure that effluent is not irrigated when soils are saturated. General specifications for SSI/CSDI land applications systems are appended in Appendix D.

An example of a SSI/CSDI layout is included as Figure 3, Appendix A. Final LAA positioning must be located within the prescribed areas as identified in Figure 2, Appendix A. Mitigation measures for ensuring sufficient soil depth (minimum 600mm below point of effluent application) also need to be followed.

The Owner has recently cleared the Site and has not yet confirmed landscaping plans. KWC recommend that a lawn area be established with SSI and CSDI lines with a minimum 50mm mulch cover within ornate garden beds.

12. MITIGATION AND DESIGN SPECIFICATIONS

Vegetation:

Vegetation that is suited to the application of effluent, preferably with high water and nutrient requirements (such as turf) should be established over and along the perimeter of the LAA and following construction. A complete vegetation cover is important to reduce the erosion hazard and optimise water and nutrient uptake. Plants must be selected that will not be so large as to shade the LAA once fully grown and vegetation clippings should be removed from the LAA and mulched elsewhere to maximise nutrient assimilation.

Suitable vegetation for establishment within LAAs listed in Appendix 7 of DLG (1998). The Owner proposes to establish a combination of turf within the SSI LAA and ornate species within the CSDI areas.

Soil Amendment:

As per AS/NZS 1547:2012 and Section 6.5.2 MCC DAF (2020), >600mm of soil must be provided between the point of application and limiting layer. As per Section 7, the soil depth is ~500mm within the proposed LAA, terminating on weathered sandstone bedrock. To ensure this requirement is met and effluent is sustainably managed on-site, the SI LAA must be raised by a minimum 100-200mm of good quality soil across the entire LAA footprint. It is also recommended to incorporate organic matter (compost) into the imported soil to assist with phosphorous assimilation.

The following recommendations apply:

- Scarify (lightly till) the proposed LAA footprint;
- Remove any surface rocks from the LAA footprint;
- Add good quality topsoil to the LAA in 'lifts' of 50-100mm until a finished soil profile depth of 600mm is achieved;
- Install the SSI/CSDI system across the LAA footprint;
- Finish perimeter of the 'raised' LAA with a 3 (horizontal): 1 (vertical) batter slope;
- Revegetate with a suitable groundcover species; and
- A stormwater cut-off drain would be required on the upslope side of the raised LAA.

The good quality topsoil should be a silty loam to clay loam texture. VENM certified soil must be imported, ensuring it is free of any fill, sticks and rocks. It is estimated that ~13.3-26.6m^3 of good quality topsoil fill will be required for LAA construction.

Lime should be applied to the base of the LAA during construction and periodically dosed to the LAA system on a regular basis to reduce the risk of soil sodicity in the soil induced by the continued application of effluent which is high in sodium levels (NSW DLG 1998). The application rates are: lime 0.1kg/m^2; and gypsum 0.5kg/m^2.

Stormwater:

The performance of the OSSM treatment system and LAA can be adversely affected if stormwater is allowed to run onto these areas. Stormwater diversion devices should be designed and constructed to collect, divert and dissipate collected run-on away from the LAA. The outlet must be stabilised and must discharge water in a safe location where it will not create an erosion hazard or impact on structures or neighbouring properties. The structure should be installed by a suitably qualified professional and be compliant with relevant guidelines and standards.

Similarly, rainwater tank overflow should be directed to a subsurface level spreader downslope of the proposed LAA.

13. OWNER OSSM 'SAFE' PRACTICES

There are many ways that the Owner can optimise OSSM system performance and minimise the cumulative impacts of effluent disposal on Site soils within the LAA. The Owner should install water reduction fittings where possible to reduce potable water usage. It is recommended that the Owner uses 'septic safe' products instead of chemical based products and outlined below.

- Products containing bleaches and disinfectants inhibit biological OSSM systems by killing bacteria and other microorganisms that colonise and provide treatment of the wastewater.
- Liquid laundry detergents are preferred to reduce the sodium levels in the wastewater. Soil sodicity impacts soil structure, permeability and plant growth.
- Products with low phosphorus to ensure the designed OSSM system and LAA can sustainable assimilate phosphorus to prevent runoff and potential waterway pollution.
- Fats and oils, organic matter and grease should not be disposed of into the wastewater stream. It is recommended that kitchen waste containing these products be appropriately disposed within the solid garbage.
- Other chemicals, such as degreasers, cosmetics, lotions, antibiotics, herbicides, petrol, pain, oil etc., should never be disposed of to the OSSM system.

Appendix A
Figures

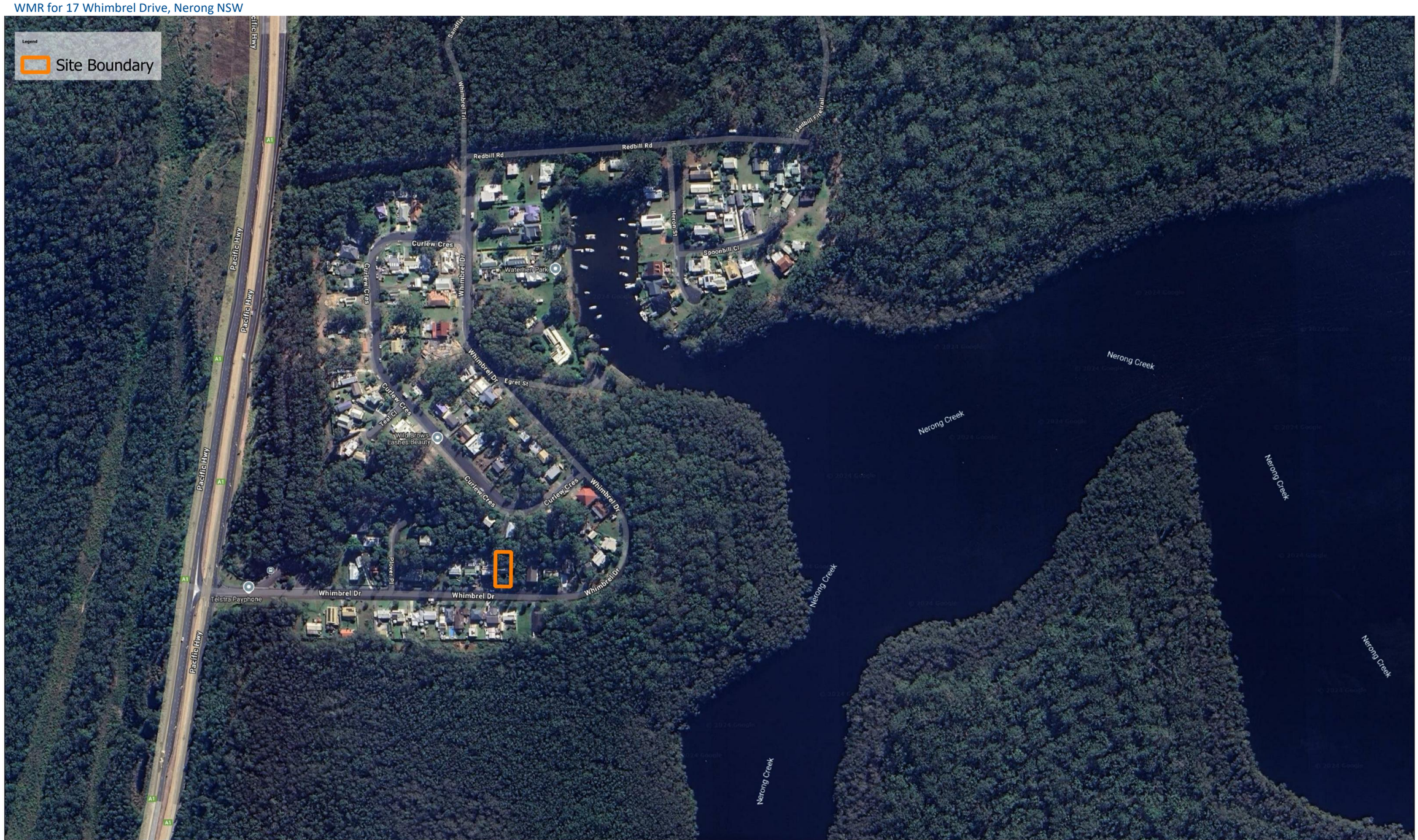

Figure 1: Site Locality

0 100 200 300 400 500 m (Approx Scale)

Revision	001
Date	08/12/2024

24_011: 17 Whimbrel Drive, Nerong - WMR

KWC Kable Wastewater Consultancy

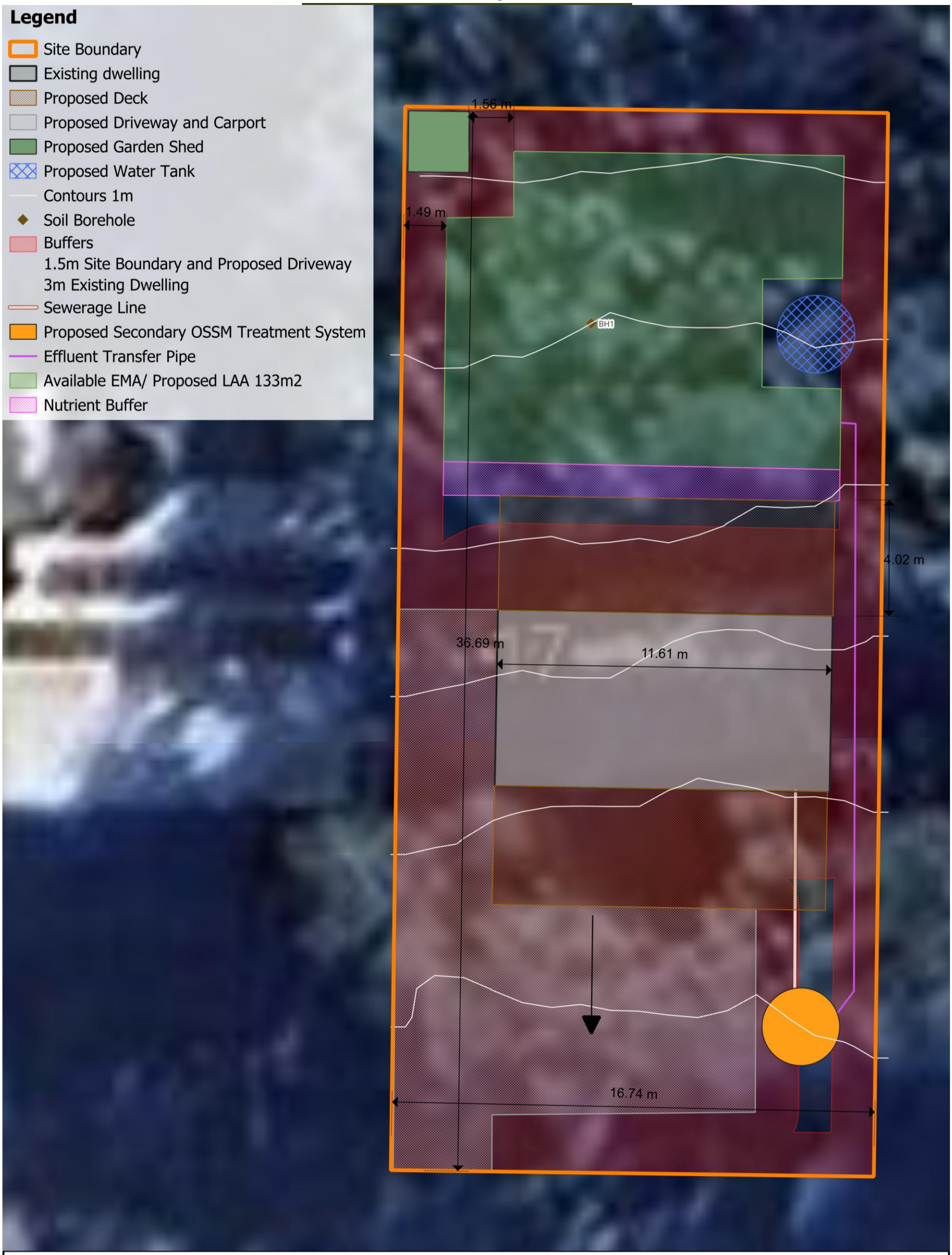

Figure 2: Site Plan

0 2 4 6 8 m

(Approx Scale)

Revision	002
Date	18/04/2025

24_011: 17 Whimbrel Drive, Nerong - WMR

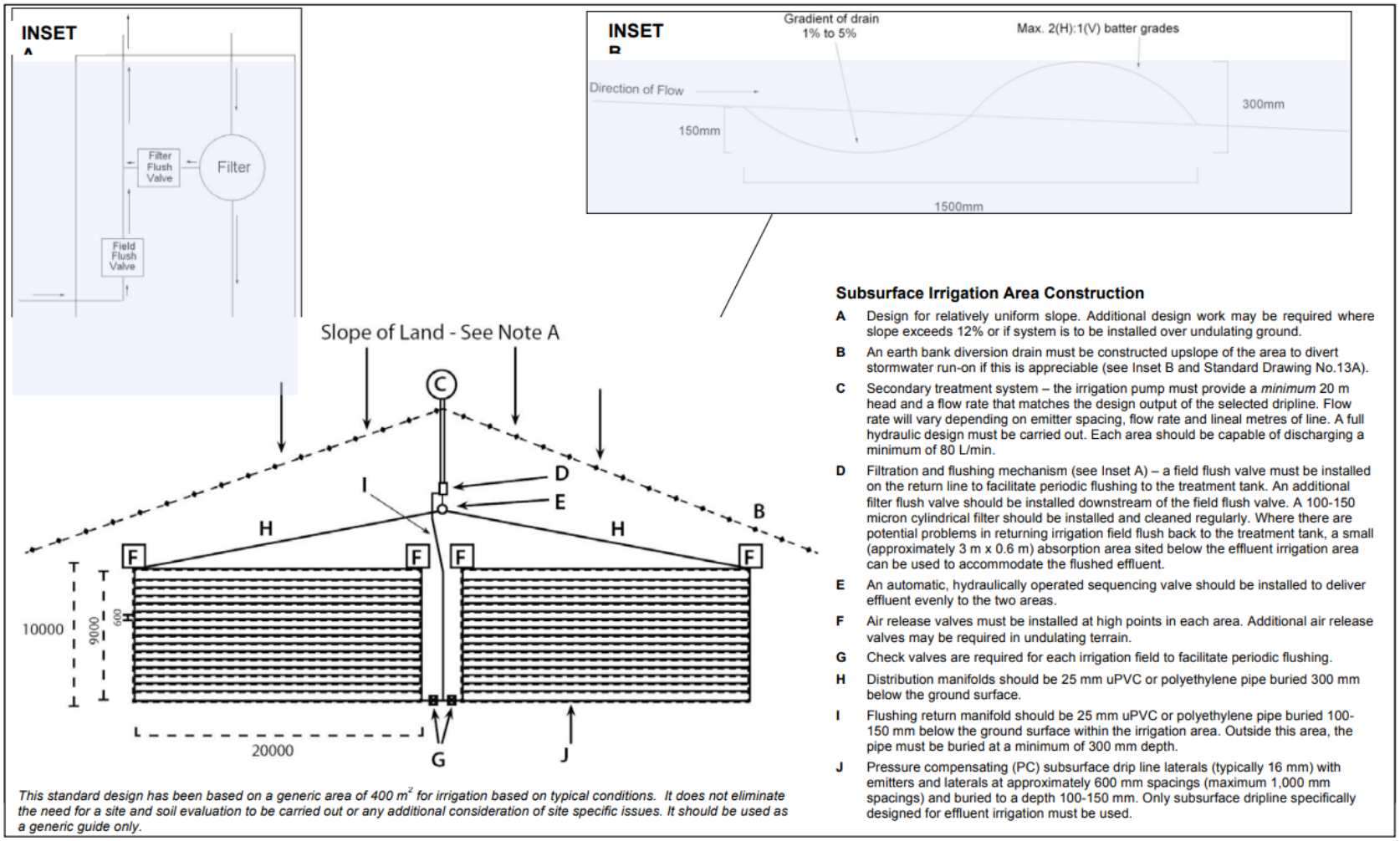

Figure 3: SSI Standard Drawing as per SCA Guidelines (2012).

Appendix B
Soil Data

APPENDIX 7.2.4 PHYSICAL ANALYSIS TEST RESULTS (cont.)

Soil mat	Data card	Lab No. we9054 Sample	Aust Grid Ref East	Aust Grid Ref North	Depth Range cm	Soil Hor-izon	WholeSampleFSA Cl %	WholeSampleFSA Si %	WholeSampleFSA FS %	WholeSampleFSA CS %	WholeSampleFSA Gr %	NonDisperseFSA Cl %	NonDisperseFSA Si %	NonDisperseFSA FS %	NonDisperseFSA CS %	NonDisperseFSA Gr %	FinEarthFSA Cl %	FinEarthFSA Si %	FinEarthFSA FS %	FinEarthFSA CS %	EAT Class	DP %	VE %	LS %	USCS Class	KFact USLE	CFact USLE (min)	PC %	PWP %	Plant AWC %	Plant AWC-RA %	Plant RA&BCe %	Approx HyCon (mm/d)
hn3	117 3	51	411300	6373100	100-130	B	2	1	13	84	0						2	1	13	84	nt	0	0		SW	0.001	1.00	3	2	2			4000
hn4	117 4	52	411300	6373100	130-250	BC	1	1	1	97	0						1	1	1	97	nt	0	0		SW	0.000	1.00	1	1	0			4000
jh1	30 1	102	436950	6403600	0-14	A	5	10	29	17	39						8	16	48	28	8	29	8		PT	Peaty	0.43	93	42	51	28	28	2000
jh2	30 2	103	407700	6397700	14-50	B1	11	15	16	9	49						22	29	31	18	3(1)	48	sh	3.50	ML-CL	0.038	0.43	40	18	22	12	12	300
lp1	147 1	41	415100	6383400	0-10	A1	2	0	11	87	0						2	0	11	87	nt	100	2	0.00	SP	0.000	1.00	11	6	5			4000
lp2	147 2	42	415100	6383400	10-75	A2	0	1	14	85	0						0	1	14	85	nt	100	0	0.00	SP	0.000	1.00	3	1	2			4000
lp3	147 3	43	415100	6383400	75-120	BH	6	1	17	76	0						6	1	17	76	8	0	5		SM	0.013	1.00	16	8	8			3000
lp4	147 4	44	415100	6383400	120-135	C	2	0	11	86	1						2	0	11	87	6	0	0		SW	0.000	1.00	6	2	3			4000
mg1	151 1	59	410800	6393600	0-10	A1	10	16	40	27	7						11	17	43	29	8	28	0		ML-CL	0.016	1.00	39	15	24			2000
mg2	151 2	60	410800	6393600	10-15	A2	27	19	24	21	9						29	21	26	24	3(2)	32	0		ML-CL	0.030	1.00	30	9	20			2000
mg3	150	61	412200	6393400	25-45	B	18	20	43	19	0						18	20	43	19	3(3)	54	0		CL-ML	0.055	1.00	36	12	23			300
mg4	151 3	62	410800	6393600	15-85	B	57	19	18	5	1						58	19	18	5	3(3)	37	19		MH-CH	0.017	1.00	65	28	36			40
mh1	244 1	109	432400	6403750	0-40	A	11	20	21	21	27						15	27	29	29	8	36	0		ML	0.029	1.00	48	20	28			
mp1	243 1	87	409000	6378800	0-10	A1	12	16	30	41	1						12	16	30	41	8	67	sh	1.50	ML	0.027	0.85	37	9	29	26	26	2000
mp2	243 2	88	409000	6378800	10-28	A2	24	12	28	21	15						28	14	33	25	8	34	sh	0.50	ML	0.036	0.85	31	7	24	22	22	300
mp3	243 3	89	409000	6378800	28-180	B	10	22	19	44	5						11	23	20	46	6	100	16		CH	0.049	0.85	60	27	33	31	31	100
mr1	255 1	16	428850	6403700	0-22	A1	29	19	41	11	0						29	19	41	11	8	3	2		OL	Peaty	1.00	57	27	30			1000
mr2	255 2	17	428850	6403700	22-130	B	41	22	32	5	0	0	59	36	5	<1	41	22	32	5	6	0	3		CL	>0.069	1.00	54	26	28			300
mr3	226 1	18	429000	3403650	0-20	O	25	27	44	4	0						25	27	44	4	8	9	sh	8.00	OL	Peaty	1.00	105	40	64			300
mr4	226 2	19	429000	3403650	20-100	B	36	34	28	2	0						36	34	28	2	2(2)	4	sh	nt	CH	0.010	1.00	72	32	41			300
nc1	59 1	20	409950	6384500	0-6	A1	11	26	31	29	3						12	27	32	30	8	58	sh	2.00	ML-CL	0.036	1.00	45	10	36			2000
nc2	59 2	21	409950	6384500	6-27	A2	11	29	29	31	0						11	29	29	31	6	72	sh	16.00	ML-CL	0.051	1.00	32	7	25			300
nc3	59 3	22	409950	6384500	27-60	B	51	14	13	21	1						51	14	13	22	6	14	13		CH	0.024	1.00	47	25	22			40
nc4	156	105	409650	6388750	40-80	A2	14	18	51	17	0						14	18	51	17	5	19	6		ML	0.043	1.00	32	15	17			3000
nc5	156	106	409650	6388750	80-110	B	8	4	32	56	0						8	4	32	56	3(1)	40	3		ML	0.025	1.00	14	8	6			300
ng1	133 1	36	416150	6400250	0-3	A1	4	29	62	5	0						4	29	62	5	8	40	0		ML	>0.045	1.00	63	14	49			2000
ng2	133 2	37	416150	6400250	3-40	A2	8	44	43	5	0						8	44	43	5	2(2)	90	0	2.50	ML-CL	>0.079	1.00	34	7	27			100
ng3	133 3	38	416150	6400250	40-100	B	2	52	42	4	0						2	52	42	4	2(2)	89	0	3.50	CL-ML	>0.093	1.00	38	10	28			24
no1	101 1	133	426800	6403350	0-3	A1	14	20	38	28	0						14	20	38	28	3(1)	50	5	3.00	SM	0.034	1.00	44	11	33			2000
no2	101 2	134	426800	6403350	3-35	A2	19	19	32	30	0						19	19	32	30	3(2)	58	3	3.50	SM	0.038	1.00	37	12	25			300
no3	101 3	135	426800	6403350	35-85	B	49	19	25	7	0						49	19	25	7	3(4)	67	13	16.50	CL	0.027	0.68	72	30	42	35	35	40
no4	99	12	426900	6403450	25-95	B	51	14	14	19	2						52	14	14	20	6	41	7		CH	0.021	1.00	56	29	27			40
nw1	145 1	45	420400	6396200	0-10	A	39	23	36	2	0						39	23	36	2	8	33	nt	nt	OH	Peaty	1.00	88	36	51			300
nw2	145 2	46	420400	6396200	10-100	B	50	28	21	1	0						50	28	21	1	3(3)	33	11		CH	0.025	1.00	65	35	30			40
nw3	144 1	47	420200	6390400	0-15	A1	34	20	8	38	0						34	20	8	38	8	32	4	9.00	CH-MH	0.017	1.00	52	22	30			2000
nw4	144 2	48	420200	6390400	15-100	B	40	22	11	27	0						40	22	11	27	8	33	4	8.50	CH	0.026	1.00	47	23	24			40
pr1	65 1	82	414750	6395000	0-2	A1	16	21	48	12	3						16	22	49	12	8	30	1		ML	0.019	1.00	68	22	46			2000
pr2	65 2	83	414750	6395000	2-20	A2	15	16	46	23	0						15	16	46	23	8	43	sh	1.50	ML	0.047	1.00	38	11	27			300
pr3	103	84	424400	6400800	35-110	B22	54	14	15	12	5						57	15	16	13	6	7	21		CH	0.025	1.00	57	28	29			300
pr4	103	85	424400	6400800	110-185	B23	50	18	15	14	3	0	45	33	19	3	52	19	15	14	6	2	14		CH	>0.090	1.00	47	23	25			300
pr5	65 3	86	414750	6395000	20-40	B	12	15	22	37	14						14	17	26	43	2(3)	100	3	9.50	CH	0.041	1.00	58	22	36			100
rf1	116 1	78	407450	6402900	0-3	A	13	19	52	10	6						14	20	55	11	8	50	sh	1.00	CL-ML	0.047	1.00	48	10	38			3000
rf2	110 1	79	407750	6393420	0-15	A2	9	32	55	4	0						9	32	55	4	8	39	2		CL-ML	>0.032	1.00	80	16	64			300

APPENDIX 7.2.7 CHEMICAL ANALYSIS/INTERPRETATION TEST RESULTS (cont.)

Soil mat	Data card		SSS Lab 93/051	Aust Grid Ref East	Aust Grid Ref North	Depth Range cm	Horizon	pH H_2O	pH $CaCl_2$	Exp Buf Cap	Max Lime t/ha	OC %	OM %	Bray P mg/kg	Bray P (RA)	P Sorpt mg/kg	P Sorpt (RA)	EC dS/m	ECe dS/m	Acid	Alk	pH Buf Cap	OM	Avail P	Avail P RA	P Sorpt	P Sorpt RA	ECe	Rust Hazard	Cncrt Corr Hazard
hn2	117	2	50	411300	6373100	15-100	A2	5.70	5.00	2		0.10	0.17	nd		nd		0.10	0.25	M		VL	EL	VL		L		VL		
hn3	117	3	51	411300	6373100	100-130	B	5.20	4.60	6		0.24	0.42	4		7		0.10	0.25	St		VL	EL	VL		L		VL		
hn4	117	4	52	411300	6373100	130-250	BC	5.60	4.90	2		0.50	0.90	2		nd		0.40	1.02	M		VL	EL	VL		L		VL	Hazd	
jh1	30	1	102	436950	6403600	0-14	A	6.50	6.60	110		13.67	23.92	4	2	718	396	0.44	6.11	Sl		VH	VH	VL	VL	VH	MH	M	Hazd	
jh2	30	2	103	407700	6397700	14-50	B1	5.20	4.80	37		2.09	3.65	1	1	470	260	0.70	0.63	St		M	H	VL	VL	H	MH	VL		
lp1	147	1	41	415100	6383400	0-10	A1	8.00	5.90	10		0.82	1.43	4		nd		0.70	1.50		M	VL	L	VL		L		VL	Hazd	
lp2	147	2	42	415100	6383400	10-75	A2	6.90	6.00	1		0.12	0.21	1		nd		0.10	0.25	N	N	VL	EL	VL		L		VL		
lp3	147	3	43	415100	6383400	75-120	BH	6.60	5.30	26		1.82	3.19	5		28		0.22	5.01	N	N	L	H	L		L		M	Hazd	
lp4	147	4	44	415100	6383400	120-135	C	4.60	4.20	7	0.68	0.44	0.77	5		nd		0.61	13.78	VSt		VL	VL	VL		L		H	Hazd	
mg1	151	1	59	410300	6393600	0-10	A1	5.50	4.60	54		4.55	7.97	5		102		0.70	0.93	St		M	VH	VL		L		VL	Hazd	
mg2	151	2	60	410300	6393600	10-15	A2	5.30	4.30	64		1.53	2.67	2		nd		0.70	0.64	St		M	M	VL		L		VL		
mg3	150		61	412200	6393400	25-45	B	4.90	4.00	40	1.92	0.63	1.10	2		406		0.11	0.92	VSt		M	L	VL		H		VL	Hazd	
mg4	151	3	62	410300	6393600	15-85	B	4.80	3.90	117	2.03	0.38	0.67	1		402		0.18	1.57	VSt		VH	VL	VL		H		VL	Hazd	
mh1	244	1	109	432400	6403750	0-40	A	5.00	4.50	42		2.78	4.86	1		279		0.80		VSt		M	H	VL		MH				
mp1	243	1	87	409000	6378500	0-10	A1	5.00	4.10	35	3.28	1.52	2.66	2	2	173	157	0.40	0.54	VSt		M	M	VL	VL	M	M	VL		
mp2	243	2	88	409000	6378500	10-28	A2	5.00	4.00	52	0.30	0.59	1.03	3	3	79	72	0.30	0.28	VSt		M	VL	VL	VL	L	L	VL		
mp3	243	3	89	409000	6378500	28-180	B	5.10	4.00	21		0.15	0.27	2	2	368	355	0.13	0.74	St		L	EL	VL	VL	MH	MH	VL		
mr1	255	1	16	428850	6403700	0-22	A1	3.70	3.50	125	8.72	9.10	15.92	4		842		0.94	8.10	Ext		VH	VH	VL		VH		H	Hazd	Hazd
mr2	255	2	17	428850	6403700	22-130	B	3.70	3.40	90	3.05	1.00	1.75	1		674		1.29	11.07	Ext		H	L	VL		VH		H	Hazd	
mr3	226	1	18	429000	3403650	0-20	O	4.60	4.30	126		10.28	17.99	4		924		2.19	18.87	VSt		VH	VH	VL		VH		VH	Hazd	Hazd
mr4	226	2	19	429000	3403650	20-100	B	4.50	4.20	93		2.78	4.87	10		620		1.24	10.62	VSt		H	H	L		VH		H	Hazd	
nc1	59	1	20	409950	6384500	0-6	A1	5.70	4.30	36		1.74	3.05	2		nd		0.40	0.58	M		M	M	VL		L		VL		
nc2	59	2	21	409950	6384500	6-27	A2	5.10	4.10	27	0.54	0.61	1.07	2		nd		0.10	1.44	St		L	VL	VL		L		VL	Hazd	
nc3	59	3	22	409950	6384500	27-60	B	5.10	4.10	106	2.45	0.47	0.82	1		593		0.50	0.30	St		H	VL	VL		H		VL	Hazd	
nc4	156		105	409650	6388750	40-80	A2	5.00	4.60	38		1.42	2.48	2		203		0.40	0.96	VSt		M	M	VL		M		VL	Hazd	
nc5	156		106	409650	6388750	80-110	B	4.90	4.40	20		0.57	1.00	2		257		0.20	0.20	VSt		L	VL	VL		MH		VL		
ng1	133	1	36	416150	6400250	0-3	A1	6.10	5.50	32		3.31	5.79	26		nd		0.11	1.05	Sl		M	VH	VH		L		VL	Hazd	
ng2	133	2	37	416150	6400250	3-40	A2	8.70	7.80	21		0.51	0.89	3		nd		1.06	9.11		St	L	VL	VL		L		H	Hazd	
ng3	133	3	38	416150	6400250	40-100	B	9.10	8.40	4		0.60	0.11	nd		nd		0.87	7.50		VSt	VL	EL	VL		L		M	Hazd	
no1	101	1	133	426500	6403350	0-3	A1		4.30	44	1.46	2.22	3.88	4		283		0.60	0.83	VSt		M	H	VL		MH		VL	Hazd	
no2	101	2	134	426500	6403350	3-35	A2		4.20	46	1.85	1.06	1.86	4		434		0.40	0.38	VSt		M	L	VL		H		VL		
no3	101	3	135	426500	6403350	35-55	B		4.90	106		1.11	1.93	2	2	591	488	0.10	0.58	M		H	L	VL	VL	H	H	VL	Hazd	
no4	99		12	426900	6403450	25-95	B	5.00	3.80	107	6.89	0.74	1.30	1		526		0.80	0.47	VSt		H	L	VL		H		VL	Hazd	
mw1	145	1	45	420400	6396300	0-10	A	5.20	4.30	129		6.81	11.91	13		617		0.19	1.61	St		VH	VH	M		VH		VL	Hazd	
mw2	145	2	46	420400	6396300	10-100	B	5.10	4.30	126		3.62	6.34	2		629		0.25	1.43	St		VH	VH	VL		VH		VL	Hazd	
mw3	144	1	47	420200	6390400	0-15	A1	5.50	4.40	101		4.43	7.75	2		505		0.90	0.85	St		H	VH	VL		H		VL	Hazd	
mw4	144	2	48	420200	6390400	15-100	B	5.60	4.40	99		2.62	4.58	1		308		0.11	0.65	M		H	H	VL		MH		VL	Hazd	
pr1	65	1	82	414750	6395000	0-2	A1	5.20	4.40	69		5.01	8.76	6		356		0.12	1.62	St		M	VH	L		MH		VL	Hazd	
pr2	65	2	83	414750	6395000	2-20	A2	5.20	4.10	40		1.31	2.29	2		436		0.60	0.56	St		M	M	VL		H		VL		
pr3	103		84	424400	6400800	35-110	B22	4.60	3.90	110	9.55	0.25	0.45	1		474		0.80	0.59	VSt		H	EL	VL		H		VL	Hazd	
pr4	103		85	424400	6400800	110-185	B23	4.30	3.70	101	11.10	0.15	0.27	1		725		0.40	0.23	Ext		H	EL	VL		VH		VL	Hazd	
pr5	65	3	86	414750	6395000	20-40	B	5.40	4.10	27		0.43	0.75	2		352		0.17	0.97	St		L	VL	VL		MH		VL	Hazd	
rr1	116	1	78	407450	6402900	0-3	A	5.30	4.40	39		1.75	3.07	3		251		0.50	1.13	St		M	M	VL		MH		VL	Hazd	

APPENDIX 7.2.9 EXCHANGEABLE CATION ANALYSIS (cont.)

Soil	Data		SSS Lab	Aust Grid Ref		Depth		CBC		eCEC	Σ Bases (CEC)			Base	Exchangeable Cations (me/100g)																
unit	card		93/081 No	East	North	Range cm	Horizon	me/100 g	RA		me/100 g Soil	RA	Base Status	Sat %	Ca	Ca RA	Ca/ CEC%	Mg	Mg RA	Mg/ CEC%	K	K RA	K/ CEC%	Na	Na RA	ESP (%)	Al	Al RA	Al/ CEC%	ExCa/ ExMg	ExMg/ ExK
gh3	239	3	96	429250	6397400	20-65	B	16.8	13.9	12.9	8.6	7.1	68	51	1.0	0.8	6	6.6	5.5	39	0.3	0.2	2	0.7	0.6	4	4.3	3.6	26	0.2	22.0
hn1	117	1	49	411300	6373100	0-15	A1	5.5		4.7	4.7		na	85	3.1		56	1.1		20	0.1		2	0.4		7	nd			2.8	11.0
hn2	117	2	50	411300	6373100	15-100	A2	1.9		1.4	1.4		na	74	0.5		26	0.5		26	0.1		5	0.3		16	nd			1.0	5.0
hn3	117	3	51	411300	6373100	100-130	B	2.0		1.2	1.2		40.2	60	0.4		20	0.4		20	0.1		5	0.3		15	nd			1.0	4.0
hn4	117	4	52	411300	6373100	130-250	BC	1.7		1.2	1.2		na	71	0.3		18	0.5		29	0.1		6	0.3		18	nd			0.6	5.0
jh1	30	1	102	436950	6403600	0-14	A	37.1	20.5	35.9	35.9	19.8	608.2	97	29.6	16.3	80	5.1	2.8	14	0.6	0.3	2	0.6	0.3	2	nd			5.8	8.5
jh2	30	2	103	407700	6397700	14-50	B1	4.9	2.7	4.9	4.9	2.7	49.0	100	1.5	0.8	31	2.8	1.5	57	0.3	0.2	6	0.3	0.2	6	nd			0.5	9.3
lp1	147	1	41	415100	6383400	0-10	A1	7.0		5.4	5.4		168.7	77	2.0		29	2.0		29	0.3		4	1.1		16	nd			1.0	6.7
lp2	147	2	42	415100	6383400	10-75	A2	1.1		1.3	1.3		na	118	0.4		36	0.6		55	0.1		9	0.2		18	nd			0.7	6.0
lp3	147	3	43	415100	6383400	75-120	BH	8.9		7.8	7.8		81.5	88	2.3		26	3.4		38	0.2		2	1.9		21	nd			0.7	17.0
lp4	147	4	44	415100	6383400	120-138	C	2.3		2.1	1.5		53.3	65	0.3		13	0.6		26	0.1		4	0.5		22	0.6		26	0.5	6.0
mg1	151	1	59	410300	6393600	0-10	A1	11.1		9.7	9.7		55.5	87	5.0		45	3.7		33	0.5		5	0.5		5	nd			1.4	7.4
mg2	151	2	60	410300	6393600	10-15	A2	6.7		5.4	5.4		13.0	81	2.1		31	2.4		36	0.4		6	0.5		7	nd			0.9	6.0
mg3	150		61	412200	6393400	25-45	B	12.6		9.8	7.8		25.3	62	2.0		16	4.7		37	0.5		4	0.6		5	2.0		16	0.4	9.4
mg4	151	3	62	410300	6393600	15-85	B	29.0		25.6	22.7		22.5	78	2.8		10	17.0		59	0.8		3	2.1		7	2.9		10	0.2	21.2
mh1	244	1	109	432400	6403750	0-40	A	9.7		7.2	7.2		49.2	74	3.9		40	2.6		27	0.3		3	0.4		4	nd			1.5	8.7
mp1	243	1	87	409000	6378500	0-10	A1	5.1	4.6	5.4	2.8	2.5	14.3	55	1.1	1.0	22	1.1	1.0	22	0.3	0.3	6	0.3	0.3	6	2.6	2.4	51	1.0	3.7
mp2	243	2	88	409000	6378500	10-28	A2	3.6	3.3	1.3	1.1	1.0	3.4	31	0.2	0.2	6	0.6	0.5	17	0.1	0.1	3	0.2	0.2	6	0.2	0.2	6	0.3	6.0
mp3	243	3	89	409000	6378500	28-180	B	13.3	12.8	9.4	9.0	8.7	57.9	68	0.3	0.3	2	6.7	6.5	50	0.3	0.3	2	1.7	1.6	13	0.4	0.4	3	0.0	22.3
mr1	255	1	16	428850	6403700	0-22	A1	13.4		13.0	6.1		13.9	46	1.0		7	3.2		24	0.5		4	1.4		10	6.9		51	0.3	6.4
mr2	255	2	17	428850	6403700	22-130	B	12.4		11.5	8.7		14.0	70	1.0		8	4.9		40	0.6		5	2.2		18	2.8		23	0.2	8.2
mr3	226	1	18	429000	3403650	0-20	O	22.0		21.0	20.5		51.3	93	5.0		23	10.3		47	0.6		3	4.6		21	0.5		2	0.5	17.2
mr4	226	2	19	429000	3403650	20-100	B	16.7		13.7	13.5		23.2	81	3.2		19	7.0		42	0.7		4	2.6		16	0.2		1	0.5	10.0
nc1	59	1	20	409950	6384500	0-6	A1	6.3		3.7	3.7		19.8	59	1.3		21	1.7		27	0.2		3	0.5		8	nd			0.8	8.5
nc2	59	2	21	409950	6384500	6-27	A2	4.3		3.2	2.6		15.0	60	0.6		14	1.2		28	0.2		5	0.6		14	0.6		14	0.5	6.0
nc3	59	3	22	409950	6384500	27-60	B	13.0		8.9	6.5		7.6	50	1.2		9	4.1		32	0.4		3	0.8		6	2.4		18	0.3	10.2
nc4	156		105	409650	6388750	40-80	A2	9.9		8.4	8.4		31.8	85	5.3		54	2.6		26	0.2		2	0.3		3	nd			2.0	13.0
nc5	156		106	409650	6388750	80-110	B	5.7		3.9	3.7		25.8	65	1.7		30	1.6		28	0.1		2	0.3		5	0.2		4	1.1	16.0
ng1	133	1	36	416150	6400250	0-3	A1	12.7		11.0	11.0		143.5	87	6.4		50	4.2		33	0.2		2	0.2		2	nd			1.5	21.0
ng2	133	2	37	416150	6400250	3-40	A2	8.3		7.2	7.2		55.2	87	2.3		28	2.8		34	0.1		1	2.0		24	nd			0.8	28.0
ng3	133	3	38	416150	6400250	40-100	B	10.7		9.2	9.2		322.3	86	3.8		36	3.8		36	0.1		1	1.5		14	nd			1.0	38.0
no1	101	1	133	426300	6403350	0-3	A1	5.2		5.6	4.3		18.9	83	1.3		25	2.0		38	0.5		10	0.5		10	1.3		25	0.7	4.0
no2	101	2	134	426300	6403350	3-35	A2	5.5		4.7	3.1		10.5	56	0.4		7	1.8		33	0.4		7	0.5		9	1.6		29	0.2	4.5
no3	101	3	135	426300	6403350	35-55	B	14.9	12.3	14.1	12.8	10.6	15.1	86	1.6	1.3	11	9.2	7.6	62	0.6	0.5	4	1.4	1.2	9	1.3	1.1	9	0.2	15.3
no4	99		12	426900	6403450	25-95	B	15.5		13.1	7.4		9.4	48	0.9		6	4.5		29	0.8		5	1.2		8	5.7		37	0.2	5.6
nw1	145	1	45	420400	6396300	0-10	A	25.4		22.1	21.4		29.5	84	9.7		38	9.9		39	0.4		2	1.4		6	0.7		3	1.0	24.8
nw2	145	2	46	420400	6396300	10-100	B	22.2		16.7	16.7		18.3	75	7.2		32	7.9		36	0.2		1	1.4		6	nd			0.9	39.5
nw3	144	1	47	420200	6390400	0-15	A1	15.9		11.2	11.2		17.6	70	5.4		34	4.9		31	0.3		2	0.6		4	nd			1.1	16.3
nw4	144	2	48	420200	6390400	15-100	B	14.9		11.3	11.3		15.7	76	4.6		31	5.4		36	0.1		1	1.2		8	nd			0.9	54.0
pr1	65	1	82	414750	6396000	0-2	A1	15.5		11.3	11.1		39.6	72	5.8		37	4.1		26	0.7		5	0.5		3	0.2		1	1.4	5.9

Appendix C
LAA Design

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Annual Nutrient Balances - Nitrogen and Phosphorus

Site: 17 Whimbrel Drive, Nerong

Design Wastewater Flow	**360** L/day

Minimum Area for Nutrient Uptake (zero buffer)	
Nitrogen	**121** m^2
Phosphorus	**204** m^2

Nutrient Buffer Zone Requirement for Nominated Land Application Area (LAA)		
Nominated LAA Size	**133**	m^2
Predicted N Export from LAA	-0.30	kg/year
Predicted P Export from LAA	0.55	kg/year
Phosphorus Longevity for LAA	27	Years
Minimum Buffer Required for excess nutrient	71	m^2

Nitrogen Balance		
TN Effluent Concentration	**30**	mg/L
TN Load	10,800	mg/day
	3,942,000	mg/year
Percentage Lost to Soil Processes (Geary & Gardner 1996)	**0.20**	
TN Loss to Soil[2]	2,160	mg/day
Remaining TN Load after soil loss	8,640	mg/day
Crop Uptake TN[1]	**260**	kg/ha/yr
	71.23	mg/m^2/day

Phosphorus Balance		
TP Effluent Concentration	**12**	mg/L
Design Life of System[4]	50	years
Crop Uptake TP[3]	**30**	kg/ha/year
	8.22	mg/m^2/day
P-sorption of soils		
P-sorption Result	**526**	mg/kg
	4,734	kg/ha
Percentage of Predicted P-sorption	0.5	decimal
Soil Depth for P-sorb	**0.6**	m
Soil Bulk Density	**1.5**	g/cm^3
Step 1: Nominated LAA Method Calculation		
Nominated LAA Size	133	m^2
Daily P Load	0.00432	kg/day
P generated over the life of the system	78.84	kg
Daily P Uptake	0.00109315	kg/day
P vegetative uptake for life of the system	0.150	kg/m^2
Measured P-sorption capacity	0.4734	kg/m^2
Assumed P-sorption capacity	0.237	kg/m^2
Site P-sorption capacity	31.48	kg
Desired Annual P Application Rate	0.003	kg/day
P-load to be sorbed	1.18	kg/year

Site specific data should be used where possbile; otherwise data should be obtained from reliable sources

1 - Nitrogen uptake rate by plants. Based on values for Kikuyu in Table 4.2 in the NSW Environmental Guidelines: Use of Effluent by Irrigation (DEC, 2004).

2 - Nitrogen lost to soil processes (denitirification and volatilisation). Geary & Gardner (1996).

3 - Phosphous uptake rate by plants. Based on values for Kikuyu in Table 4.2 in the NSW Environmental Guidelines: Use of Effluent by Irrigation (DEC, 2004).

4 - Design life of system (for nutrient management). Reasonable minimum service life for system.

Appendix D
Treatment System and LAA General Specifications

SSI and CSDI General Specifications:

- Effluent must be applied evenly across the LAA by dosing one (1) zone of ~133m^2. However, if CSDI and SSI is installed, then they would be treated as two separate zones totalling 133m^2;
- *AS/NZS 1547:2012* requires a minimum depth of 600mm of soil to exist from the bottom of the irrigation line to the limiting layer (bedrock or weathered rock) or water table;
- Ø19-25mm flexible, lilac coloured irrigation pipe with appropriate warning labelling to be used above ground;
- Driplines are to be installed (minimum) 100 – 150mm below the surface of LAA for SSI and under 50mm of mulch for CSDI;
- Lateral pipes should be spaced to provide good and even coverage of the area they service. Generally, they should be no more than 1m apart, roughly parallel and along the contour as close as possible;
- PCSD line specifically designed for effluent irrigation (e.g., Toro Drip-in, Netafim Dripnet PC AS XR or Safe-T-Flo) shall be installed. 1.6-2.1 litres per hour emitters should be used;
- An in-line 120µm disc filter may be installed to minimise the amount of solids entering the pipelines and emitters. This must be removed and cleaned regularly (at least at 3-monthly intervals). Alternately, a flush main may be installed to periodically clean-out the irrigation lines to provide effective long-term performance. Either manual or automatic flush valves may be installed, with flush water directed back to the treatment system;
- Higher head, low flow pumps are required to service drip irrigation systems as they typically need an operating pressure at the emitter of 10-40m (head) to maintain pressure compensation;
- Air release valves will be installed at the high points in individual irrigation areas to prevent soil particles being sucked into the lines at the end of pump cycles as pipelines depressurise;
- An 'as-built' layout of the OSSM system (treatment and LAA) shall be provided to Council and the system Owner by the installer upon completion;
- Effluent pipe installed beneath a trafficable area (driveway) must be buried at a minimum depth of 500mm to prevent damage from compaction *(AS/NZS3500.2*);
- No structures should be built or placed within the identified irrigation area;
- Vehicles and grazing livestock must be prevented from entering the designated LAA;
- The CSDI LAA should be clearly delineated and restricted form public access by landscaping; and
- Warning signs should be erected around the LAA boundary of CSDI indicating the use of effluent for irrigation in compliance with *AS1319.*

Operation and Maintenance:

Monthly:

- cut and remove grass from the EMA to reduce mulching and remove nutrients;
- regular inspection of the CSDI LAA to ensure the system is not oversaturating the soil and distributing effluent evenly.

Quarterly:

- have the AWTS serviced by a qualified service agent, including operation of the high-water alarm for AWTS;
- check and replace chlorine disinfection tablets;
- flush disk filter and irrigation lines.

Annually:

- check sludge accumulation levels within the AWTS chambers. Pump-out as needed.