WEST SOIL & WATER

Site and Soil Evaluation

90 Walnut Road, Bickley, WA

Report Prepared for HHH Spirits

2 August 2023

Project Number: 20230412_90 Walnut Road SSE

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Executive Summary

This report outlines the Site and Soil Evaluation (SSE) of 90 Walnut Road, Bickley, WA (the site). The site is a residential property, with a current 2-bedroom residential building onsite. The client is proposing development of a gin distillery (with tastings) and accompanying restaurant.

As a part of this development, an SSE is required to assess wastewater disposal and how this should be implemented to accommodate wastewater produced on-site.

The site assessment summarised:

- General definition of site class is sand with some loams at depth.
- The field permeability tests (undertaken at 0.5 mbgl) indicated moderate to high permeability or hydraulic conductivity of the site.
- Based on site assessment, and in accordance with the Government Sewerage Policy a minimum separation distance of at least 2.0 metre for the site to groundwater exists (seasonal maximum).

An assessment of the overall land capacity determined for the site is agreeable, to accommodate on-site sewage treatment and disposal. The manner in which this will occur, consistent with the Government Sewerage Policy and AS 1547, is described in detail in Section 5 of this report. The approach for sewage management within the site includes:

- No setback distances are breached in this assessment based on the proposed land application area; under the assumption a reduced setback of 80+ m is appropriate for a possible seasonal water line where best management practises would include use of secondary treatment systems with nutrient removal.
- Depth to groundwater (0.9 m) presents a significant limitation in disposal options.
- Soils on site are classified as maximum Category 1 and have high levels of infiltration.
- The use of **conventional absorption trenches systems** will be preferred at this site, with the use of **amended soil**. To ensure a 2 m separation distance to groundwater.
- Ensuring sufficient space is available for treated sewage application within the site the Land Application Area is determined as a maximum required of 114.24 m^2 for primary treatment with an area of 930 m^2 defined as the available area for disposal of wastewater (with no setbacks breached).
- A suitably qualified installer should be utilised.
- The site is capable of receiving the proposed volumes of wastewater, with limitations overcome via design, and it is considered that **the site can accommodate onsite sewage disposal** with secondary treatment, including nutrient removal.

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1 Introduction

1.1 Background

West Soil and Water (WSW) was commissioned by HHH Spirits (the Client) to undertake a Site and Soil Evaluation (SSE) of 90 Walnut Road, Bickley, WA (the site). The site is a residential property, with a current 2-bedroom residential building onsite. The client is proposing development of a gin distillery (with tastings) and accompanying restaurant.

As a part of this development, an SSE is required to assess wastewater disposal and how this should be implemented to accommodate wastewater produced on-site.

1.2 Scope of Work

This SSE is undertaken to determine the capacity of the site to contain the proposed development and anticipated sewerage on-site, without compromising environmental and public health outcomes, and present the most appropriate treatment/on-site wastewater management system. In general, the following has been completed:

- An SSE based on the risk framework of AS/NZS 1547 On-site domestic wastewater management with reference to the Government Sewerage Policy (2019).

For the purpose of this report, this SSE is a 'general assessment', that is to:

- Undertake a site suitability assessment for onsite wastewater management;
- Recommend the type of onsite wastewater system for the proposed development;
- Support a future planning submission, and as such, include information pertaining to the Government Sewerage Policy (Setbacks and Land Applications Areas).

Whereby:

- Final system design and placement will be the responsibility of the client and their wastewater installer, in consultation with the City/DoH as required.

1.2.1 Objectives

- Determine capacity of site to contain proposed development and sewage on-site, without compromising environmental and public health outcomes.
- Advise on the treatment/on-site wastewater management system and land application area.
- Implement management and monitoring options if and where required.

1.2.2 Guidance

Preparation of an SSE allows on-site sewage disposal systems to be optimally designed. It allows for the most efficient use of land by facilitating the design of a system that is tailored to the specific characteristics of the site and the development, instead of being designed on the basis of conservative or generic criteria.

All project works were undertaken in general accordance, and with reference to the following standards and guidelines:

- Health (Treatment of Sewage and Disposal of Effluent and Liquid Waste) Regulations 1974.
- Standards Australia - AS/NZS1547:2012 On-site Domestic Wastewater Management.
- Department of Planning, Lands and Heritage 2019. Government Sewerage Policy.

1.3 Development Details

Preliminary development details are presented in Appendix A. ***All drawings/figures presented in this report are via discussions with owner, are preliminary and an estimation of the proposed development.*** In general, the development is as follows:

- Development of an in-house tasting room for a Gin-Distillery, and restaurant, to accommodate 70 person maximum, based on:
  - 50 seated restaurant patrons (restaurant).
  - 10 standing (tasting) patrons (distillery).
  - Maximum of 10 staff (restaurant and distillery).

An existing leach drain system for sewerage disposal, is currently attached to the residential building at the property and is discussed in later sections.

1.4 Site Evaluator Details

Table 1: Site Assessor Details.

Company	**West Soil and Water**
ABN	882 2415 7497
Name of Assessor	Sam Mueller
Qualifications/ Experience	Bachelor of Science (Bsc) Env Man/ Mar Sc (Murdoch University, 27/01/2010) 13+ years environmental consultancy experience/ contaminated sites assessments
Contact Details	Up to date contact information can be found at www.westsoilandwater.com.au

Table 2: Insurance Details

Insurer	Insurance	Limit	Expiry*	Policy Number
Allianz Australia Insurance Limited ABN 15 000 122 850 AFS Licence No. 234708 (Allianz)	Public Liability	$20,000,000	9/02/2024	109XN56700COM
Berkley Insurance Company ABN 53 126 559 706 AFSL 463129	Professional Indemnity	$5,000,000	1/11/2023	202111-1195 R1 BIA

*At the time of reporting.

2 Site Overview

2.1 Site Description

A Site summary is provided in the table below.

Table 3: Site Summary

Description	Lot 56	Lot 57
Land Description	Agricultural/bushland style property situated at street address: 90 Walnut Road, Bickley WA 6076	
Zoning	Rural Agriculture under the City of Kalamunda Scheme No. 3	
Volume/Folio	2583/678	
Plan/Diagram	43883	
Total Area	15.7325 ha / 157,325 m^2	
Street Address	90 Walnut Road	
Local Government	City of Kalamunda	
Sewerage Sensitive Area?	No	
Drinking Water Source Area?	Yes Protection Area - P2 Middle Helena Catchment Area	
Sewerage available for the property (via Water Corporation)	No	
Water Source	Scheme	
Anticipated Wastewater Volume	Sewerage (L/day) from proposed development: 2,100 Existing output on site (2-bedroom residential building) (L/day): 564	

2.2 Key Site Characteristics

2.2.1 Site Walkover

A site walkover was undertaken by West Soil and Water which confirmed the site slope (visual only), surface lithology and surrounding land-uses. Vegetation (mostly remnant bushland) are noted across the majority of the property. Cleared areas for rural/residential purposes are present both on the site and adjoining properties. The site is bordered by Walnut Road to the north. The site comprises of the main residential building, with a shed and semi-temporary shed structure with gravel car park areas at the frontage of the property. Photographs are presented in Appendix B. No surface waters were identified within the site boundary.

Table 4 below outlines the desktop review and site observations to the existing environment and general site characteristics.

Table 4: Key Site Characteristics.

Item	Summary	Comment on Constraint Potential	Additional Comment
SSE Assessment Criteria			
Climate / Evaporation	Historical Data: Mean Rainfall: 759.7 mm Lowest mean rainfall month: 0.0mm in Jan, Feb and March Highest mean rainfall month: 155.2 mm in July Mean evaporation of 2000 mm Evaporation Balance: 1,240.3 mm	Where evaporation exceeds rainfall, the stored water levels in the soil profile are reduced, thereby reducing the size of the land application area and generally reducing the risk of off-site effluent export, however some contaminants (e.g. nutrients) may build up in the soil profile. No significant constraint noted.	Sourced from BoM (Perth Airport Station) Department of Agriculture and Food (2003)
Exposure	Mean Solar Exposure: 19.0 $kWhm^{-2}$ (highest in December, lowest in June). The proposed disposal Area is generally cleared, with bushland, including large established trees located 30 m to the west and 40 m to the south. Additional established native trees are located on the north side of Walnut Road. The proposed disposal area generally free from shade from trees. The site generally sits on a significant slope within the southern portion of the property. The general area of the proposed disposal area is on a slight slope, discussed within later sections of this report.	High exposure to sun, low-moderate shade, good ventilation should assist with evapotranspiration of effluent. In general, this should have negligible impact on the winter and summer sun.	Solar exposure sourced from BoM (Perth Airport Station)
Vegetation	The majority of the site as a whole comprises of native vegetation. The developed areas, including the planned disposal areas are mostly cleared with grasses and weeds where infrastructure is not present.	No constraint noted.	Sourced from Landgate's Locate V5 Online Mapping Tool.

Landform/Topography	The site as a whole is elevated between 220-270 m AHD. The site landform sits within moderately dissected lateritic plateau on granite with deeply incised valleys, includes the Darling Scarp on the western margin. Soils are formed in laterite, lateritic colluvium & weathered in-situ granite & gneiss. With reference to the National Committee on Soil and Terrain (2009) the site is described as: - Crest (southern portion of site - Simple Slope (southern to northern portion of site) - Minimal mid slope (northern portion of the site on Walnut Road where development is located and the proposed disposal area is located. - The areas (offsite) to the north are located within a flat valley (north of Walnut Road). This general area is between two crests. No significant curvature is noted in the proposed application area (convex or concave). and it is assumed that this will not change with any future development. The site is within moderately dissected lateritic plateau on granite with deeply incised valleys. Soils are formed in laterite, lateritic colluvium & weathered in-situ granite & gneiss.	Some constraint noted.	Sourced from Landgate's Locate V5 Online Mapping Tool. With site reference to National Committee on Soil and Terrain (2009). Figure(s) 2 outline the topography in greater detail.
Slope	The proposed disposal area is elevated at 224-232 mAHD across a 60 m interval. This equates to a fall of 1.3m for every 10 m interval which equates to a 13% slope gradient.	Some constraint noted.	Nil
Fill	No fill material is noted within the soil horizons encountered on-site.	More detail on soils identified is presented in Section 2.3.	Nil
Rock/ gravel	Surface Gravel – Nil		Nil

	Surface protrusions of rock – prevalent across the site, but not within the proposed disposal area.		
Erosion Potential	No signs of erosion within the area of proposed wastewater disposal are noted. Area has a 13% slope, moderately compacted, with some minor grasses and weeds. Considered stable with low erosion potential. DPRD Land instability risk mapping indicates a moderate risk (10-30% of the map area with a moderate to high hazard to instability). This is mostly attributed to the site (as a whole) general slope. No rainfall run-off was noted on site within the proposed disposal area.	Mild constraint noted.	Sourced from Landgate MapViewer Plus.
Soil Landscape	Murray Valley System: Western Darling Range from the Avon Valley to Harvey. Deeply incised valleys with Red loamy earths, shallow duplexes and rock outcrop and Jarrah-marri-wandoo forest and woodland with mixed shrubland.	Detailed site soil information presented in Section 2.3.	Sourced from Landgate MapViewer Plus.
Flood Risk	DPIRD flood risk mapping indicates a low risk of flooding with <3% of the map unit has a moderate to high flood risk. A search of the DoW floodplain mapping did not indicate any nearby 1:10 (10%) floodplain areas within 5 km of the site boundary.	No constraint noted.	Sourced from Landgate MapViewer Plus and the DoW Floodplain mapping Tool.
Groundwater	No groundwater licences are noted at the site. The site is located outside of the Perth groundwater map data areas. The nearest available information is 1.1 km to the west of the site via review of DoW WIN sites which indicates 2 bores in the general vicinity of the site with varying drill depths. All sites are located approximately 1.1 km from the site (west of the site). While depth to groundwater is not presented in all available information, total drill depths provide insight, where total drill depths are recorded as: 1. 21.34 mbgl (DoW WIN site ID 61609052)	Discussed in Detail within this report. It is assumed that groundwater is shallow.	Sourced from DoW mapping tools.

	2. 22.56 mbgl (DoW WIN site ID 61608834) Site comments provided within data details for WIN site ID 61608834 indicate that water is drawn from near a creek and water is noted as near to the surface when the pump is not in use.		
Surface Waters and Wetlands	No surface waters are located on the proposed disposal area. The nearest farm dam is located 230m to the west of the proposed disposal area. A hydro-line (with reference to Landgate data set "LGATE-018/16" is noted 80 m north of the site boundary, and approximately 84.5m north of the proposed disposal area. This dataset is noted as "Medium Scale Topo Water (Line)" which outlines "water features that relate to the interior of the country." No surface water is evident from visual inspection of the site's northern boundary. Assessment of this area against DWER data set "DWER-031" did not indicate that this linear hydro line is noted as a major/minor river, stream or tributary. It is assumed that this noted dataset may indicate drainage lines and/or possible seasonal water line related to the valley within which it sits. Uncertainty is presented here. It is considered this may warrant consideration as a surface water constraint, but may have less significant implications.	Some constraint noted.	Additional imagery presented in Image 1 within this section. This feature will be referred to here-in as a "possible seasonal surface water line"
Available Land Application Area	An area of approximately 930 m2 has been outlined as the proposed LAA.	Discussed in Detail within this report. Outlined within Figures in this report.	Nil
Other Considerations			
Environmental reserves/ sensitive areas	No Environmentally Sensitive Area is noted on or in proximity to the site.	No constraint noted.	Sourced from Landgate MapViewer Plus.
Geology/ Landform	**Bedrock:** Yilgarn Craton granites. Granitic rock, undivided; metamorphosed.	Discussed in Detail within this report.	Sourced from Landgate MapViewer Plus.

	Regolith: Residual or relict material; includes ferruginous, siliceous, and calcareous duricrust. **Dominant surface soil Groups**: Alkaline/Sandy Shallow Duplexes.		
Acid Sulfate Soils	The site is not located within a known risk area of Acid Sulfate Soils.	No constraint noted.	Sourced from Landgate MapViewer Plus.

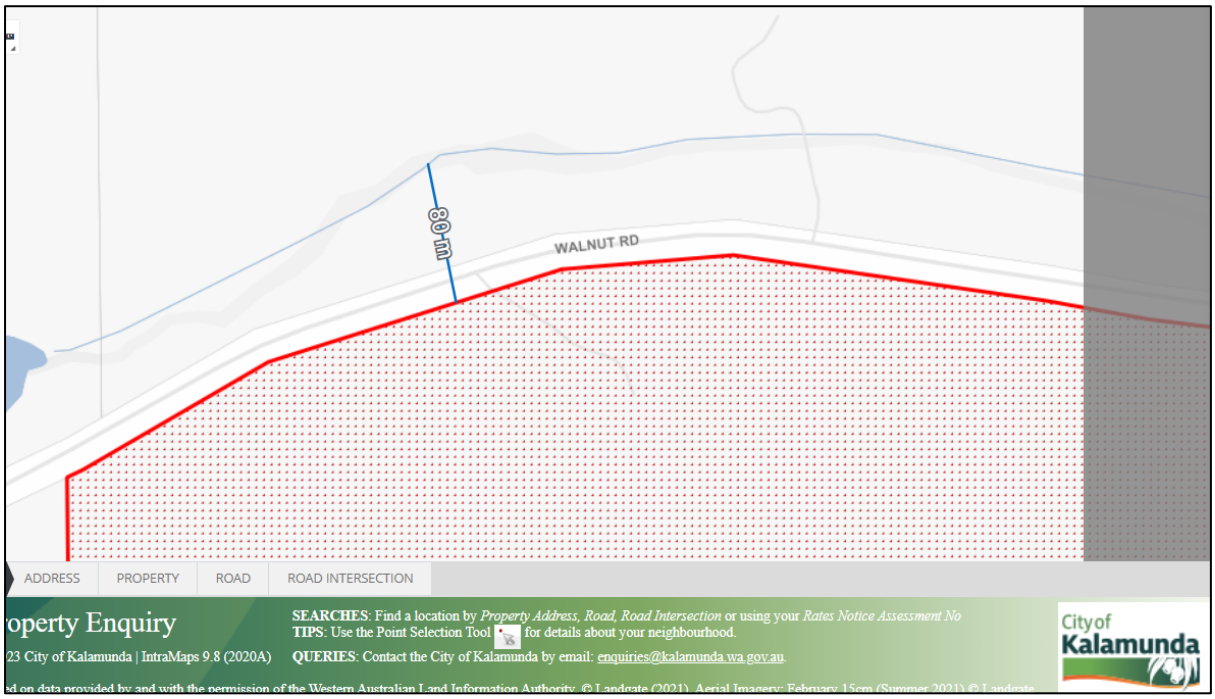


Image 1: City of Kalamunda Mapping Tool displaying Landgate Dataset "LGATE-018/0116" against site boundary.

2.3 Soil Characteristics

2.3.1 Field Investigation

The soil investigation was undertaken across the site. A total of 3 test pits (via excavator) were completed within the proposal land application area at the site to ascertain an appropriate review of soil conditions (Figure 4).

The proposed land application area is presented in Figures 1-4 and equates to a 930 m^2 area.

- TP1: Target test pit located within the proposed land application area, to a maximum depth of 2 mbgl.
- TP2: Target test pit located within the proposed land application area, to a maximum depth of 2 mbgl.
- TP3: Target test pit located within the proposed land application area, to a maximum depth of 0.5 mbgl where refusal was met. This was located near to exposed granite and bushland.

Investigations were undertaken on 16/06/2023 (within Winter months). For analysis completed, all laboratory certificates are presented in Appendix C. Samples were collected for the assessment of the following:

- Phosphorus Retention Index (PRI).
- Phosphorus Adsorption (mg/kg).
- Soil Classification by Particle Size Analysis (Sieve).
- Hydrometer and SPD analysis to "Yellow Book" specification – 4 analytes.
- pH and Electrical Conductivity EC1:5 (salinity).
- Sodicity (Exchange Sodium Percentage, ESP).

Samples were collected within the primary identified lithological horizon from each target test pit.

- TP1: Sample collected from soil between at 0.8-1.0 mbgl (sample reference "Walnut SSE S1").
- TP1: Sample collected from soil between at 1.8-2.0 mbgl (sample reference "Walnut SSE S2").

An infiltrometer was used to determine and indicative rate at which water infiltrates the soil at a depth of 0.5 mbgl immediately adjacent to Test Pit 1 and Test Pit 2 (results Appendix D). Investigations show that regional geological mapping (see Section 2.2) of the site was generally consistent with observed sub-soil conditions with the proposed disposal area displaying loamy earths. Geological field observations and inferred soil categories (AS/NZS 1547:2012) are summarised in Table 5.

Table 5: Field Soil Observations.

Test Pit /Location	Depth Range (m below surface)	Horizon	Description	Soil Category (AS/NZS 1547:2012)	Indicative Soil Permeability (AS/NZS 1547:2012)
TP1 / TP2	0.0-1.8 m	A	Brown coarse loamy sand with minor gravel inclusions. No ribbon of soil was possible when moulded. Slight coherence. Weakly Structured.	1	Structureless Gravels and sands (>3.0 Ksat m/day)
	1.8-2.0 m	**B**	Loamy, Brown coarse sand with minor clay inclusions. Slight ribbon could be moulded. Weakly Structured. No refusal met.	3	Loams (1.5-3.0 Ksat m/day)
TP2	0.0-0.5	**A**	Brown coarse loamy sand with minor gravel inclusions. No ribbon of soil was possible when moulded. Slight coherence. Weakly Structured.	1	Structureless Gravels and sands (>3.0 Ksat m/day)

2.3.2 Laboratory Testing

Laboratory analysis results are presented in Table 6, with soil particle analysis presented in Table 7.

Soils are generally of a neutral pH (slight acidic), with high phosphorus absorption capability throughout the soil profiles. Low Sodic soils, which are likely non-dispersive, are noted – and non-constraining.

Very low clay and silt fractions of soil particle analysis range bare noted. Soils, predominately, consist of coarse sands.

Upon inspection, minor seepage of groundwater was noted at 0.9 mbgl. This was minor, and not visible in collected photographs (Appendix B) but was noted in-field (no pooling in base of pit). It is noted here this is unlikely representative of standing groundwater levels, but seasonally perched groundwater likely sitting above Horizon B layers with some clay portions, and possible rock material (not identified <2mbgl) at further depths. The proposed disposal area is at the base of a granite crest, and this likely indicates perched run-off into nearby valley landforms.

Table 6: Laboratory Results.

Test Pit Location	Depth (m)	pH / EC (dS/m)	Phosphorus Sorption (mg P sorbed/kg)*	PRI	Soil Particle Density (g/cm3)	Sodicity (Exchangeable Sodium %)
TP1	1.0	6.8 / 0.011	699 (Acceptable)	16 (moderately Adsorbing)	2.48	4.0
TP1	2.0	6.5 / 0.024	2160 (Acceptable)	260 (very strongly Adsorbing)	2.12	2.4

*in accordance with DoH "Indicative Phosphorus Sorption uptake values" for Sandy Loams/Loams, Acceptable Psorp is 100-200 mgPsorp/kg.

Table 7: Soil particle analysis.

Test Pit	Depth	Clay (<2 µm)	Silt (2-20 µm)	Fine Sand (0.02-0.2 mm)	Coarse Sand (0.2-2.0 mm)	Gravel (>2mm)
		%				
TP1	1.0	15	5	10	50	20
TP1	2.0	26	13	16	30	15

2.3.3 Infiltration Testing

In-field infiltration testing was undertaken utilising a borehole (Talsma) Permeameter (modified method). This is undertaken to measure indicative field saturated hydraulic conductivity. Calculation is made by observing a volume of water infiltrate at scheduled intervals, calculating water flow, and determining saturated hydraulic conductivity (Ksat) of a known borehole diameter into soil.

This was undertaken immediately adjacent to 2 test pit locations at a depth of 0.5 mbgl, with results presented in Table 8 and Appendix D, generally consistent with AS/NZS 1547:2012 Ksat indications.

Table 8: Infiltration Results.

Test Pit	Calculated in-field Ksat (m/day)
TP1	5.10
TP2	2.74

3 Summary of Findings

Table 9 outlines the soil constraint summary and discussion from the soil investigations. Table 10 outlines the risk assessment of site characteristics per DoH guidance.

Table 9: Summary of Soil Constraints.

Feature	Assessment	Level of Constraint	Mitigation Measures/ Notes
Rock Fragments	No coarse rock fragments throughout the profile of the proposed infiltration area. Other areas within the site are expected to have exposed/shallow rock.	Low-Moderate	The general investigation area (and proposed disposal area) is indicative of loamy soils which were did not indicate any excavation limitations to 2 mbgl. However, other areas of the site, including the western boundary of the proposed disposal area indicate shallow granite that would pose limitations. Providing disposal is maintained within the general proposed disposal area, no major limitation is noted.
Soil Types Test Pits 1 and 2	**Horizon A:** Structureless Gravels and sands (>3.0 Ksat m/day) Soil Category 1. From approximately 0.0 – 1.8 m depth.	Low	Horizons of coarse sandy loam, with minimal dispersing potential, and insignificant fine clay particle portions noted under laboratory analysis, along with moderate-high infiltration rates noted in the field. Low constraint noted, with reference to Section 4.1.
	Horizon B: Loams (1.5-3.0 Ksat m/day) Soil Category 3. From approximately 1.8 - 2 m depth	Low	
Soil Types Test Pit 3	**Horizon A:** Structureless Gravels and sands (>3.0 Ksat m/day) Soil Category 1.	Low	
	Refusal	High	Granite refusal.
Water Table Depth	Groundwater is noted as likely shallow, expressed at perched groundwater at 0.9 mbgl within winter months.	High	As per the GSP – separation to groundwater in areas that are within a public drinking water source area is 2.0 m.

Phosphorus Retention	PRI and Phosphorus Absorption is high, which increases the potential for additional nutrients to be absorbed prior to infiltrating to groundwater.	Low	PRI and Phosphorus Absorption is high.
Sodic and dispersive soils	Sodicity is minimal.	Low	Some consideration needs to be given to soils with dispersion potential. Inlay of gravel materials may increase water flow and therefore increase surface area of absorption. This is not considered the case here.
pH	Neutral soils	Low	Acid soils (pH <5) or alkaline soils (pH>8) may provide an unsuitable environment for plant growth, and the use of ameliorants (such as lime and gypsum) may then be investigated. A pH of 6.5 and 6.8 was recorded, and this is not considered to be limiting.
Electrical Conductivity (salinity)	No significant results.	Low	Moderate (range) to high (range) salinity typically inhibits or limits growth of many plant species, thereby reducing plant uptake of nutrients and increasing the risk of erosion on the LAA and potential seasonal groundwater rise. No significant result is presented here.

Table 10: Risk Assessment of Site Characteristics.

Characteristic	Level of Constraint			Assessed Level of Constraint for Site
	Low	Moderate	High	
General Characteristics				
Climate (difference between average annual rainfall and average pan evaporation, mm/year)	Excess of evaporation over rainfall in the wettest months	Rainfall approximates to evaporation	Excess of rainfall over evaporation in the wettest months	**Low**
Exposure to sun and wind	Full sun and/or high wind or minimal shading and North / North-East / North-West aspect	Dappled light East / West / South-East / South-West aspect	Limited patches of light and little wind to heavily shaded all day and South aspect	**Low**
Vegetation coverage over the site	Plentiful vegetation with healthy growth and good potential for nutrient uptake Turf or pasture	Limited variety of vegetation	Sparse vegetation or no vegetation, dense forest with little understorey	**Low**
Landslip (or landslip potential)	Nil	Low to moderate	High or Severe	**Low**
Slope Form (affects water shedding ability)	Hill crests, convex or divergent side-slopes and plains	Straight side-slopes and footslopes	Floodplains, concave or convergent side-slopes and incised channels	**Moderate**
Site Drainage (qualitative)	No visible signs or likelihood of dampness, even in wet season	Some signs or likelihood of dampness / Moist soil but no standing water in soil pit.	Wet soil, moisture-loving plants, standing water in pit; water ponding on surface	**Moderate**

Slope gradient (%):				
(a) for absorption trenches and beds	<5%	5-15%	>15%	**Moderate**
(b) for surface/ subsurface irrigation	<10%	10-20%	>20%	**Low**
Erosion (or potential for erosion)	Nil or Low	Moderate	Severe	**Low**
Fill (imported)	No fill at present or fill is good quality topsoil or minimal fill required.	Moderate coverage and good quality fill	Extensive poor-quality fill and variable quality fill	**Low**
Flood frequency (AEP)	Less than 1 in 100 years	Between 100 and 20 years	More than 1 in 20 years	**Low**
Private bore used for household/drinking water purposes	No bores onsite or on neighbouring properties	>30m to the nearest privet bore	<30m to the nearest privet bore	**Low**
Proximity to water resources	>100m	<100m but reduced setback is supported (refer to Section 5.2.2 of the GSP)	<100m and reduced setback is not supported (refer to Section 5.2.2 of the GSP)	**Moderate**
Groundwater (wettest time of the year)	>2m	2.0 – 0.6m need for fill to achieve setbacks	<0.6m fill is not practical to achieve setbacks	**Moderate**
Land area available for LAA	Exceeds the minimum required LAA size of AS1547 or Schedule 2 of the GSP	Meets the minimum required LAA size of AS1547 or Schedule 2 of the GSP	Insufficient area available for LAA as per AS1547 or Schedule 2 of the GSP	**Low**
Rock outcrops (% of surface)	<10%	10-20%	>20%	**Low (within the proposed area)**

Site Drainage (qualitative)	No visible signs or likelihood of dampness, even in wet season	Some signs or likelihood of dampness Moist soil but no standing water in soil pit.	Wet soil, moisture-loving plants, standing water in pit; water ponding on surface	**Moderate**
Stormwater run-on/run-off	Low likelihood of stormwater run-on/run-off	Moderate likelihood of stormwater run-on/run-off, need for diversionary structures	High likelihood of inundation by stormwater run-on/run-off, diversion not practical	**Moderate**
Soil profile characteristics				
Soil permeability Category (AS1547)	2 and 3	4 and 5	1 and 6	**Low**
Profile depth	>2m	2.0-1.0	< 1.0m	**Low**
Hardpan or bedrock	>1.5m	1.5-0.6m Special design requirements and distribution techniques or soil modification will be necessary, depends on quality of treated wastewater and type of LAS	<0.6m	**Low**
Presence of mottling	None		Extensive	**Low**
Course Fragments /gravels	< 10%	10-40%	>40%	**Low**
pH	6-8	4.5-6	<4.5, >8	**Low**
Electrical Conductivity (ECe)(dS/m)	<0.3	0.3-2	>2	**Low**
Sodicity ESP%	<3	6-8	>8	**Low/Moderate**

Phosphorus adsorption (mg/kg)	>500	200-500	<200	**Low**

4 General Assessment

4.1 Capability of Land to Receive Wastewater

4.1.1 Sitting and Terrain

The maximum slope suitable for on-site sewage systems is dependent upon the type of system proposed and ranges from 10% to 30% (Standards Australia and Standards New Zealand 2012), with surface application systems more sensitive to slope. The topography within the investigation area (excluding localised irregularities) is noted at 13%. Low flood risk is identified in the investigation areas.

The Government Sewerage Policy (DPLH 2019) stipulates that on-site systems are not to be located within 100 m from the outer edge of a **significant** wetland. No such significant wetland is identified. A similar separation distance is within the GSP for surface water bodies. As discussed in Section 2.2 Table 4:

- A hydro-line (with reference to Landgate data set "LGATE-018/16" is noted 80 m north of the site boundary, and approximately 84.5 m north of the proposed disposal area. This dataset is noted as "Medium Scale Topo Water (Line)" which outlines "water features that relate to the interior of the country."

- No surface water is evident from visual inspection of the site's northern boundary. Assessment of this area against DWER data set "DWER-031" did not indicate that this linear hydro line is noted as a major/minor river, stream or tributary. It is assumed that this noted dataset may indicate drainage lines and/or possible seasonal water line related to the valley within which it sits.

- Uncertainty is presented here. It is considered this may warrant consideration as a surface water constraint but may have less significant implications.

In any event, it is considered a conservative separation of 90m is achievable.

4.1.1.1 *WQPN 25*

Where a site is located within a PDWSA (P1, 2 or 3) the GSP refers to "Water quality Protection Note 25: Land use Compatibility Tables for Public Drinking Water Source Area" to determine some conditions to land use compatibility within these areas to protect water quality. For a winery, distillery or cidery (including wine tasting facilities) under a P2 area, this is considered incompatible, with reference to Conditions 8 and 28 below:

- Condition 8: Wine tasting facilities are acceptable; however, wineries or distilleries may not operate in conjunction with on-site taverns, restaurants or other incompatible land uses within a P2 area. The client has noted this Condition.

- Condition 28: This land use/activity may require assessment by this department under the Environmental Protection Act 1986. For a list of activities see the schedule 1 of the Environmental Protection Regulations 1987. For more information about licensing, refer to the Industry regulation guide to licensing. For activity-specific guidance, refer to the department's industry regulation factsheets.

- Note: The site is not considered to be required to be assessed as a prescribed premises under the Environmental Protection Regulations 1987 Schedule 1, whereby no production of 350 kL or more per year is proposed that would trigger a Category 25 "Alcoholic beverage manufacturing: premises on which an alcoholic beverage is manufactured and from which liquid waste is or is to be discharged onto land or into waters."

Further to this, the WQPN25 also states, with reference to a restaurant/café premises:

- Condition 35: These land uses are considered compatible, with conditions in P2 areas within the **Middle Helena** land use and water management strategy, provided that patron numbers don't exceed 50 and 'proposals for on-site sewage disposal should be consistent with the Government sewerage policy and will be assessed on an individual basis to consider site characteristics and management practices proposed' (Western Australian Planning Commission 2010).

It is therefore considered here, with reference to this site, that:

- A distillery and tasting facility is considered compatible with note to Conditions 8 and 28. And;
- A restaurant is also compatible within the same development within the Middle Helena P2 area, providing restaurant patron levels do not exceed 50.

Therefore, no change is made the expected sewerage volumes (Section 5.1) against the client's indicative development plans (Section 1.3).

Other conditions of note that may be relevant during due assessment of this SSE:

- The slope of the land on which sewage disposal is to occur should not exceed one in five (20% equivalent). It is considered here that the current 13% slope poses no limitation to WQPN 25.
- With reference to Effluent Management Guidelines for Australian Wineries and Distilleries 1998; distillation produces relatively small volumes of effluent, mainly rinsewater and spent (non-alcoholic) liquors.

4.1.2 Soils

General definition of site class (most limiting) is sands (>3.0 Ksat m/day). The field permeability tests (undertaken at 0.5 mbgl) confirmed a moderate-high permeability in accordance with the Ksat outlined by soil category in AS1547. It is further noted here that soils were generally consistent to 1.8 mbgl within the investigation area, with more limiting horizons noted +1.8 m.

The investigation area, also presented as the proposed disposal area, serves as the only practical area for disposal, where other areas exhibit visual rock outcrop, which would provide too stringent a constraint.

4.1.3 Groundwater

The site is located within a P2 Drinking water area. As such, minimum separation distances to groundwater apply. Based on the site assessment, and in accordance with the Government Sewerage Policy (2019) a minimum separation distance of 2.0 metres for the site to groundwater exists (seasonal/inferred maximum).

It is considered here engineering will be required to meet minimum vertical separation distance to groundwater.

4.1.4 Minimum Lot Sizes

Based on the Government Sewerage Policy, the following is relevant to this development (Table 11).

Table 11: GSP Minimum Lot Sizes.

Ref	Location/Landuse	Minimum Lot Size	Notes
1	Public drinking water source areas in rural, rural residential/rural living zones	One to four hectares	Minimum lot size dependent upon priority area (P1, P2 and P3) and zone. Refer to Water quality Protection Note 25: Land use Compatibility Tables for Public Drinking Water Source Areas for further guidance.

With reference to table 11, it is considered here that the total size of the current site is 15.7325 ha, which meets the minimum Lot size for reference 1 in respect to the GSP. With reference to WQPN25, it is noted minimum lot sizes are outlined for subdivisions only, which is not applicable in this instance.

The Government Sewerage Policy indicates that approval of on-site management of sewage may set a precedent for similar proposals in the local water catchment, and that the cumulative and environmental impacts should then be considered. In the same manner, a precedent may already be set locally based on the need for increased residential density, or other local or regional planning schemes.

This report aims to assess the sites' ability to receive wastewater, and assessment of this will be deferred to the City of Kalamunda and the Department of Health.

4.1.5 Other Setbacks

An on-site sewage system is not to be located within:

- a wellhead protection zone or on Crown land within a reservoir protection zone;
- 100 metres of the high-water mark of a reservoir or 100 metres of any bore used for public drinking water supply where: — a wellhead protection zone or reservoir protection zone has not been assigned; or — where existing lots would be rendered undevelopable by the wellhead protection zone;
- 30 metres of a private bore used for household/ drinking water purposes;
- 100 metres of a drainage system that discharges directly into a waterway or significant wetland without treatment; or
- any area subject to inundation and/or flooding in a 10 per cent Annual Exceedance Probability (AEP) rainfall event.

None of the above setbacks are noted to be breached in this assessment when considering the proposed infiltration area.

Horizontal distances required are presented in Appendix E. It is not considered these are breached, but it is noted that upon final development plans being drawn, these will need to be considered.

4.1.6 Noted Constraints

The constraints limiting to this SSE and the proposed disposal area are as follows:

- **Slope**: a 13% slope is noted in the general disposal area, which is below a 20% slope minimum required under the GSP but may need to be considered when determining the most appropriate type of disposal method (Section 5).

- **Separation to groundwater**:

    - Where the use of fill is proposed to achieve separation distances, proponents may be required to provide additional information to demonstrate that solutions are effective, do not impact on other lots through water diversion, are not cost prohibitive and will not compromise amenity or landscape values.

    - It is considered here that the client has assessed the potential for engineering to overcome any constraints and can provide further information if/when requested by approval bodies.

- **Separation to surface water**: As discussed within this Section and Section 2.2, a possible seasonal water line exists in the north of the proposed disposal area. It is considered here that a smaller setback (to a determined minimum of 80 m to the Site's northern boundary and 84.5 m to the proposed infiltration area conservatively) may be considered where:

    - This water line is not identified as a major/minor river, stream or tributary, nor of any significant ecological value, nor discharging to a significant wetland.

    - Secondary treatment (with optional nutrient removal) is required regardless.

    - A conservatively calculated separation distance of 90m can be achieved.

4.1.7 Consideration of the current development plan and status

At the time of this report, the development planning does not include any engineer drawn plans, nor formal application for planning approval (where warranted). The proposed disposal area is based on approximate plans provided by the client on-site at the time of the soil investigation. The proposed disposal area discussed in this SSE and presented in relevant figures is considered as:

- The extent of available area not restricted by rocky outcrops for disposal of wastewater.

- Located in an agreeable location to the client in respect to distances from source point of wastewater.

- Is situated with appropriate horizontal separation distances as outlined in the GSP (including any distances where reduced setbacks may be considered).

- Occupies as much practical space as is available to ensure that final calculated minimum Land Application Area (LAA) can be utilised **within** this space, while maintaining horizontal distances.

- Sufficient room to ensure that once final development plans are made, appropriate horizontal setback to buildings and boundaries can be achieved (per Appendix E).

It is considered here that this assessment is based on the sites current condition. Future development factors may include the use of fill material in the general vicinity of the site, and slight alterations to the footprint may occur. With this considered:

- This SSE proposes to define the sites' ability to receive wastewater, and display that appropriate separations distances and apparatus requirements are met *in principle* (within the limits of the proposed application area); and

- Once final plans have been developed, this SSE should be revised to ensure final plans correspond with the outcomes of:

    - This report

    - Any decisions or conditions imposed by the City of Kalamunda and/or the DoH.

4.1.8 Results

An assessment of the overall land capacity for the site - is generally agreeable to accommodate on-site sewage treatment and disposal, **with engineering solutions required** to allow a 2 m separation to groundwater.

It is further noted that treatment will be required to utilise a secondary treatment system with nutrient removal, based on:

- Locality within a public drinking water source area.
- Proximity to a possible seasonal surface water line (<100m), where an 84.5 m separation is provided.

The manner in which this will occur, consistent with the Government Sewerage Policy and AS 1547, is described in the following sections.

5 Sewerage Management

5.1 Expected Sewerage Volumes

The expected hydraulic loads for various land uses are detailed in the fact sheet: Supplement to Regulation 29 – Wastewater system loading rates (DoH 2019). Specific hydraulic load is noted for "Public Building (Frequent Use)", which is applicable to this SSE, when assessing the development plans (Table 12). The development details are outlined in Section 1.3.

Table 12: Human Waste Hydraulic Loading Rates, per Supplement to Regulation 29 (DoH)

Type of Premises	Equivalent Use	Combined Flow (L/Person/Day)
Public Building (Frequent use)	Restaurants sit in customers (per sitting) Winery sit in customers – Café and food catering facilities (per sitting)	30
Total number of persons		**70**
Total sewerage volume (L/day)		**2,100**

5.2 Disposal method

5.2.1 Consideration of Options

Table 13 below considers the disposal method in accordance with findings on the site from this investigation, and common disposal options (DoH).

Table 13: Consideration of disposal methods.

System	Considerations
Conventional Absorption Trench and Beds	Only requires primary effluent treatment, secondary treatment holds extra benefit. Cheaper to install than other methods, and not influenced by climatic factors. Requires deep soil, generally > 1.5 m, above limiting layers (e.g. bedrock or seasonal water tables). Treatment by absorption trench may be impeded due to high % of coarse fragments. Soil supplementation may be an option to improve absorptive capacity. Sodic soils may lose permeability over life of system; larger trench lengths required. Ideal for sites with little to no constraints in terms of soil depth, rock content, waterlogging, inundation or shallow water tables.

Amended soil and Mounds	Beneficial for shallow soils, high rock contents, or highwater tables Requires an above-ground mound for effluent absorption that contains imported sand/soil. Treatment will not be limited by soil absorption capacity, and less influenced by sodic soils as new soil can be imported. Not influenced by climatic factors.
Subsurface Irrigation	Secondary treatment is required prior to irrigation. Suitable for areas of high exposure with high evaporation rates (limited during wet season). Suitable for sites with shallow soils. Not suitable for areas that are seasonally inundated or waterlogged. Sodic soils may lose permeability over life of system; but sodicity generally lower in surface soils than subsoils. Can be hindered by high rock or gravel content.

With reference to Table 13, it is considered that **amended soil** (such as leach drains within infill soil to meet vertical separation limitations or mounds) presents the best system options with consideration to the below site details, where:

- **Beneficial for shallow soils, high rock contents, or highwater tables:** noted at this site as a limiting factor (groundwater).
- **Requires an above-ground mound for effluent absorption that contains imported sand/soil:** This engineering has the potential to negate separation distances not achievable in natural soils and observed shallow water tables.
- **Treatment will not be limited by soil absorption capacity, and less influenced by sodic soils as new soil can be imported:** shallow saturated soil, though benefited by good phosphorus adsorption capability and infiltration rates. As such, infill of new soil can negate some of these limitations, and provide additional benefit to favourable soil conditions, within a PDWSA.
- **Not influenced by climatic factors**: Climatic factors are generally favourable for this site regardless.
- **Also considered:** a relatively moderate quantity of wastewater for peak occupancy calculations, which means that constraints in budget and construction of mounds may be reduced. As secondary treatment (with nutrient removing capability) will also be required, additional consideration of higher quality wastewater is relevant to the limitation noted within natural soils, and the location of the site within a PDWSA.
- **Per Table K1 of AS/NZS 1547:2012:** Mounds can be specifically designed to overcome shallow water tables. It is considered here the same applies for amended soil installations (such as around leach drains.

In addition, favourable factors do exist for **Conventional Absorption Trench and Beds,** where:

- **Only requires primary effluent treatment, secondary treatment holds extra benefit:** Secondary is required at this site, adding extra benefit.

- **Cheaper to install than other methods, and not influenced by climatic factors:** Given the need for some engineering of infill soil, cost may be reduced overall.
- **Requires deep soil, generally > 1.5 m, above limiting layers (e.g. bedrock or seasonal water tables):** Not the case here, with consideration to amended soil being required.
- **Treatment by absorption trench may be impeded due to high % of coarse fragments:** Favourable, as not a limiting factor at this site within the proposed disposal area.
- **Soil supplementation may be an option to improve absorptive capacity:** Considered as the primary option for this site.
- **Sodic soils may lose permeability over life of system; larger trench lengths required**: Not significantly limiting to this site.
- **Ideal for sites with little to no constraints in terms of soil depth, rock content, waterlogging, inundation or shallow water tables:** Not the case here, with consideration to amended soil being required due to limitations.

5.3 Land Application Area

5.3.1 Overview

The land application area is the designated area of land within a building envelope where the effluent from a treatment system (primary or secondary) is applied into or onto the ground. Land-application systems fall into two broad categories;

- Soil absorption systems (e.g., leach drains – or absorption trenches or mounds as referred to in AS 1547).
- Irrigation systems (e.g., covered surface drip irrigation, shallow subsurface irrigation, or above ground spray irrigation).

Based on AS1547 Land application system limitations (T*able K1 of the standards*), and client preference, it is proposed that **conventional absorption trenches systems** will be preferred at this site, with the use of **amended soil**.

Secondary treatment is required at this site.

5.3.2 Method to Determine an Indicative Size of Land Application Area

Calculations are made on a Category 1 soil type, noted at the site as the primary soil horizon encountered to 1.8 m with consideration to amended soil being added to the disposal area. Hydraulic/Design Loading Rate From AS/NZS 1547:2012, Tables L1 of ASNZS 1547, calculate the maximum loading/irrigation rate for **Soil Category 1** and are used in these calculations.

- Design Loading Rate (DLR) Trenches and beds (Table L1)

  = 50 mm/day (secondary treated).

Calculation for LAA is as follows:

> Calculate land application area (m2) = hydraulic load (L/day) ÷ DIR

Additional calculations are presented with reference to the GSP explanatory notes sample calculation for the proposed disposal area:

- Determining the land application area for a secondary treatment system in soil Categories 1 and 2, where;
- Leach drain size is taken into consideration.

It is further considered here that soak wells or flatbed systems may provide a larger space saving alternative to leach drains and should be considered.

5.3.3 Calculations

LAA Calculations are presented in Table 14.

Table 14: LAA Calculations.

Disposal Option	Treatment Type	Calculated Loading (L/day)	Land Application Area (m^2)
Subsurface, with amended soil to achieve groundwater separation of 2 m.	Secondary with nutrient removal	2,100	42

5.3.3.1 *Further Assessment of Options*

It is noted here that leach drains may have both horizontal and vertical infiltration areas, which would increase the total effective infiltration area available per leach drain. Calculations will depend on final leach drain used (to be advised by your wastewater supplier) with a note that leach drains require separation distances outlined in Appendix E.

Example calculations are provided below for leach drains, with reference to the GSP Explanatory notes "Sample Calculation for determining the land application area for a single house with primary treatment system in soil categories 1 and 2". This is done to display there is adequate space available on the site currently to accommodate disposal. A conservative infiltration area of 1.5 m2/m is utilised with reference to the approved DoH leach drain list (https://www.health.wa.gov.au/Articles/A_E/Approved-leach-drains) with a perceived width of 0.4 m per leach drain. This is provided as a working example only.

Table 15: Approximate calculation of required space for leach drains with secondary treatment.

Item	Result
Hydraulic Loading (L/day)	2,100
/ design loading rate	50
/ infiltrative area per m2 of leach drain system (1.5)	28
/number of leach drains (nominally x3) to achieve each leach drain length	10 (rounded up from 9.33)
Summary	3 x 10 m leach drains
Width of infiltration area required, including: 1.2 m separation each side of IA of 1.8 m (3.6 m total for length of IA) Separation between leach drains installed of 1.8 m (8.4 m total) Nominal width of leach drain 0.4 m	Length of IA required: 13.6 m Width of IAA required: 8.4 m

Total available area required	114.24 m2

5.3.4 Ability of Development to Accommodate LAAs

Based on the proposed development plans for the site provided in Appendix A and the proposed infiltration area (930 m^2) with no horizontal setback distances breached based on sites current layout, (with consideration to reduced distances being acceptable to possible seasonal water line), it is considered that adequate space is available for the installation of the disposal options presented in this section.

It is noted here that, if utilised, should the chosen leach drains have a larger infiltration area, less may be required. Soak wells or flat beds may provide a better alternative.

The infiltration areas will require elevation via the use of amended soil, whereby the disposal apparatus is situated 1.1 m above ground level to ensure a 2 m vertical separation to groundwater.

5.3.5 Notes

The following is noted regarding the land application area:

- This information is based on current available site outlay and should be ground-truthed on-site by the appropriate installer, with consideration made to final development plans. **Your wastewater installer should advise**.
- If leach drains are approved and utilised, re-calculation based on specific leach drains used will be warranted to determine final LAA. **Your wastewater installer should advise**.
- Land application systems in the soils outlined in Section 5 require design by a suitably qualified and experienced person. **Your wastewater installer should advise**.
- Note that setback distances from boundaries, buildings, septic tanks, trafficable areas, surface irrigation disposal area and other structures and buildings on the boundary alignment will apply dependant on the final system installed. Note Appendix E. **Your wastewater installer should advise**.

5.4 Capability of land to accommodate sewerage application.

5.4.1 Cumulative impacts

The potential cumulative impact of onsite effluent disposal considers the following:

- No horizontal setbacks to sensitive receptors are noted as resulting in disposal of wastewater to land not being possible at the site. Consideration has been made to possible seasonal water line.
- The sites position within a PDWSA requires minimum vertical separation distances, and secondary treatment with nutrient removal.
- It is noted that a pre-existing residence exists on the property, which includes leach drains (historical, pre-approved where applicable at the time they were installed, with available details provided in Appendix A). With reference to Supplement to Regulation 29 – Wastewater system loading rates (DoH 2019b) – a standard 2-bedroom residential dwelling would have an output of 564 L/day. Specific details of these leach drains are not known.
- The post new-development peak cumulative hydraulic load is estimated to be approximately 2,100 L per day.

- If both the new development and pre-existing residential structure are considered (total of 2,664 L/day) is spread across 15.7325 ha / 157,325 m^2 total land area that makes up the site as a whole. Key factors influencing how much of this hydraulic load reaches any surface water or groundwater environment and the potential cumulative impact of the attendant nutrients and other pollutants are:
    - The type of treatment system used.
    - The setback distances in place; and
    - The density of development.

The Government Sewerage Policy indicates that approval of on-site management of sewage may set a precedent for similar proposals in the local water catchment, and that the cumulative impact should then be considered.

It is noted that the land uses surrounding the site currently consists of general rural land use. Notwithstanding, the key factors that determine the impact of on-site sewage management (for the site and cumulatively in the catchment) have been addressed in this SSE (with reference to Section 4.1.4 and Section 4.1.1.1). The response to these factors in the management of the site has been based on the overarching Government Sewerage Policy and AS1547, which has formed the basis for the SSE as a whole. **As such the specific assessment of the cumulative impact summary are not repeated within this section, and it is not considered existing leach drains on the site warrant further investigation.**

5.4.2 Setback distance and Application Areas

No setback distances are breached in this assessment based on the proposed land application area; under the assumption a reduced setback of 80+ m is appropriate for a possible seasonal water line where best management practises would include use of secondary treatment systems with nutrient removal.

The current proposed land application area totals 930 m^2, for a maximum require LAA (Table 14) of 114.24 m^2.

As long as disposal is maintained in these areas no significant setback distances will be breached.

5.4.3 Density of development

The proposed development is presented in Section 1.3 of this report with current wastewater systems presented in Appendix A.

This report aims to assess the sites' ability to receive wastewater, and assessment of this will be deferred to the City of Kalamunda and the Department of Health for assessment of the ability of the proposed lot to receive wastewater.

6 Conclusions

6.1 Site and Soil Evaluation

The sewage management strategy for the site, as outlined in this SSE, has been developed to be consistent with the approach and requirements detailed the Government Sewerage Policy (DPLH 2019) and AS/NZS 1547 On-site domestic wastewater management. This is completed to determine capacity of site to contain proposed development and sewage on-site, without compromising environmental and public health outcomes. The approach for sewage management within the site includes:

- No setback distances are breached in this assessment based on the proposed land application area; under the assumption a reduced setback of 80+ m is appropriate for a possible seasonal water line where best management practises would include use of secondary treatment systems with nutrient removal.
- Depth to groundwater (0.9 m) presents a significant limitation in disposal options.
- Soils on site are classified as maximum Category 1 and have high levels of infiltration.
- The use of **conventional absorption trenches systems** will be preferred at this site, with the use of **amended soil**. To ensure a 2 m separation distance to groundwater.
- Ensuring sufficient space is available for treated sewage application within the site the Land Application Area is determined as a maximum required of 114.24 m^2 for primary treatment with an area of 930 m^2 defined as the available area for disposal of wastewater (with no setbacks breached).
- A suitably qualified installer should be utilised.
- The site is capable of receiving the proposed volumes of wastewater, with limitations overcome via design, and it is considered that **the site can accommodate onsite sewage disposal** with secondary treatment, including nutrient removal.

7 Assumptions, Limitations and Liabilities

The conclusions drawn and recommendations made here have been developed on the assumption that the data collected accurately represents the conditions at the site. Uncertainties pertaining to the data collected include the following:

- West Soil and Water are working on the assumption that the client understands that submission of an application does not constitute certainty of approval. Regulating bodies, at their discretion, may request further information, including site works, which may be outside of the Scope of Work outlined in this report.
- Temporal uncertainty: site conditions/soils may not have been present in the tested medium at the time of sampling but may be present within the site at other times.
- Albeit unlikely, the potential for isolated small pockets of alternate soil types to occur elsewhere within the site cannot be fully discounted. No perfect strategy exists which can conclusively confirm the type of all soils at any site at one time.
- Groundwater depth is unknown but inferred from regional information and visual assessment of infield conditions. However, as highlighted above, uncertainties exist, and without a formal groundwater investigation the depth and/or quality of groundwater beneath the site is unknown.
- West Soil and Water takes no responsibility for the accuracy of data presented in this report (including any other reports undertaken for the site) or the assumptions or conclusions made.
- Installation and operation of a waste management system should by guided and undertaken by a suitably qualified individual/entity.
- The client will take note of separation distances presented in Appendix E once final plans are known.

8 References and Resources

The following DoH resources may provide an understanding of the application process and regulatory commitments:

- https://ww2.health.wa.gov.au/Articles/F_I/Guidance-on-applying-for-approval-of-installation-of-a-commercial-onsite-wastewater-system
- https://ww2.health.wa.gov.au/~/media/Files/Corporate/general%20documents/water/Wastewater/Site-Soil-Evaluation.pdf
- https://www.wa.gov.au/government/publications/government-sewerage-policy-2019

Mapping tools:

- Department of Water – Water Information Reporting tool, https://www.water.wa.gov.au/maps-and-data/maps
- Government of Western Australia, Landgate. Locate Mapping Tool. https://www0.landgate.wa.gov.au/maps-and-imagery/interactive-maps/locate

All project works were undertaken in general accordance, and with reference to the following standards and guidelines:

- Department of Health (DoH) 2019a, Guidance on Site-and-soil evaluation for on-site sewage management, Perth.
- Department of Health (DoH) 2019b, Supplement to Regulation 29 and Schedule 9 - Wastewater system loading rates.
- Western Australian Government (1974) Health (Treatment of Sewage and Disposal of Effluent and Liquid Waste) Regulations 1974. Version 06-m0-00, as of 01 Jul 2021.
- Department of Planning, Lands and Heritage (DPLH) 2019, Government Sewerage Policy, Perth.
- Environmental Protection Regulations (1987) – Environmental Protection Act 1986.
- Standards Australia 2012, AS/NZS 1547:2021. Onsite domestic wastewater management. www.standards.com.au.

Other:

- Allen DG, Jeffery RC (1990). Methods of analysis of phosphorus in Western Australian soils. Report of Investigation No. 37. Chemistry Centre (WA), East Perth.
- Department of Agriculture Western Australia (2003). Evaporation Data for Western Australia. Resource Management Technical Report No. 65.
- National Committee on Soil and Terrain 2009 Australian Soil and Land Survey Field Handbook. Third Edition, CSIRO Publishing.
- Patterson, R. (2020) Emerson Aggregate Stability Test for Wastewater: An interpretation for consultants and regulators, Technical Note: T20-1. Lanfax Laboratories Armidale NSW. 15th December 2020.

Figures

Figure 1: Locality

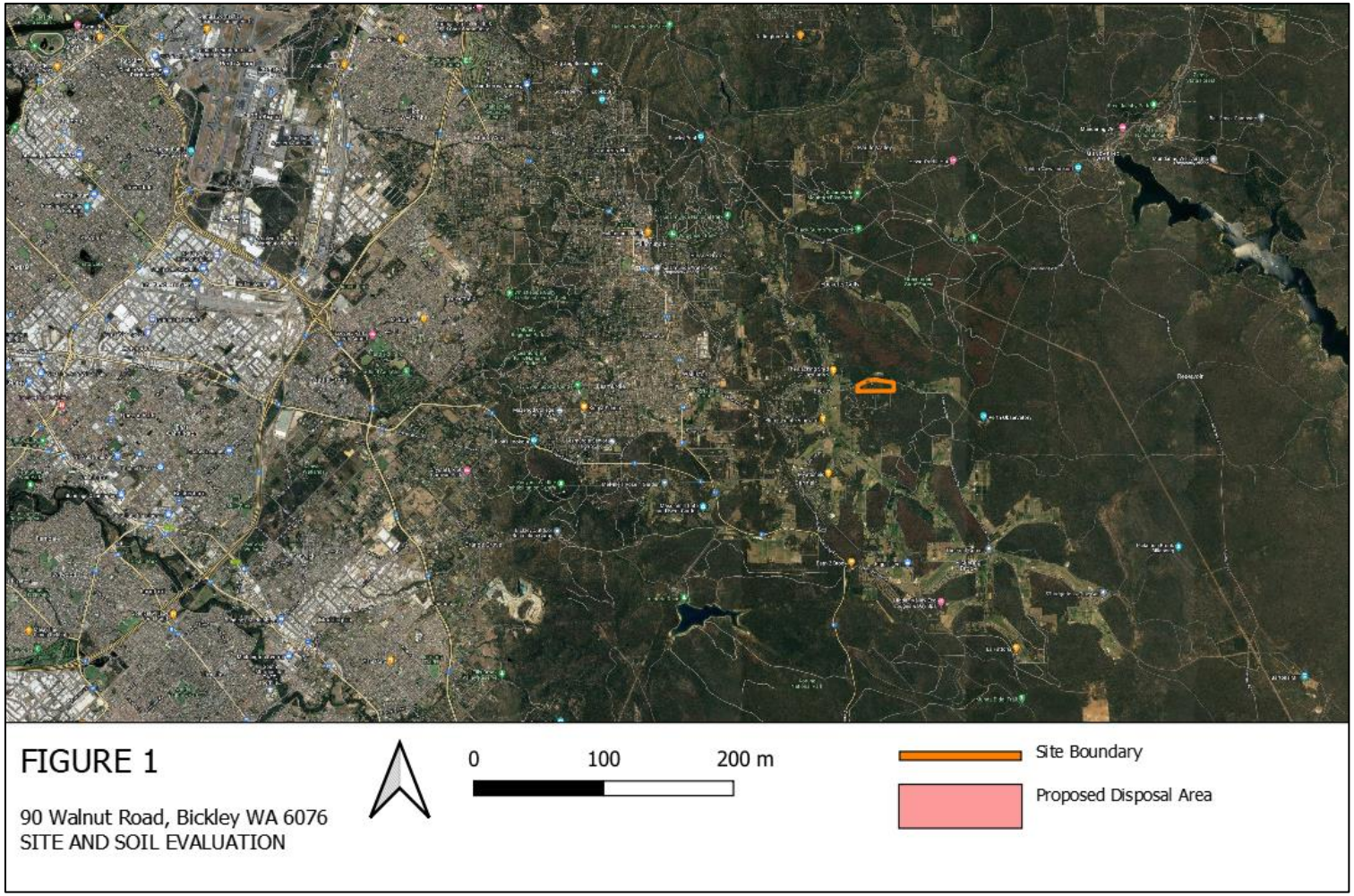


Figure 2: Local Contours and Landform.

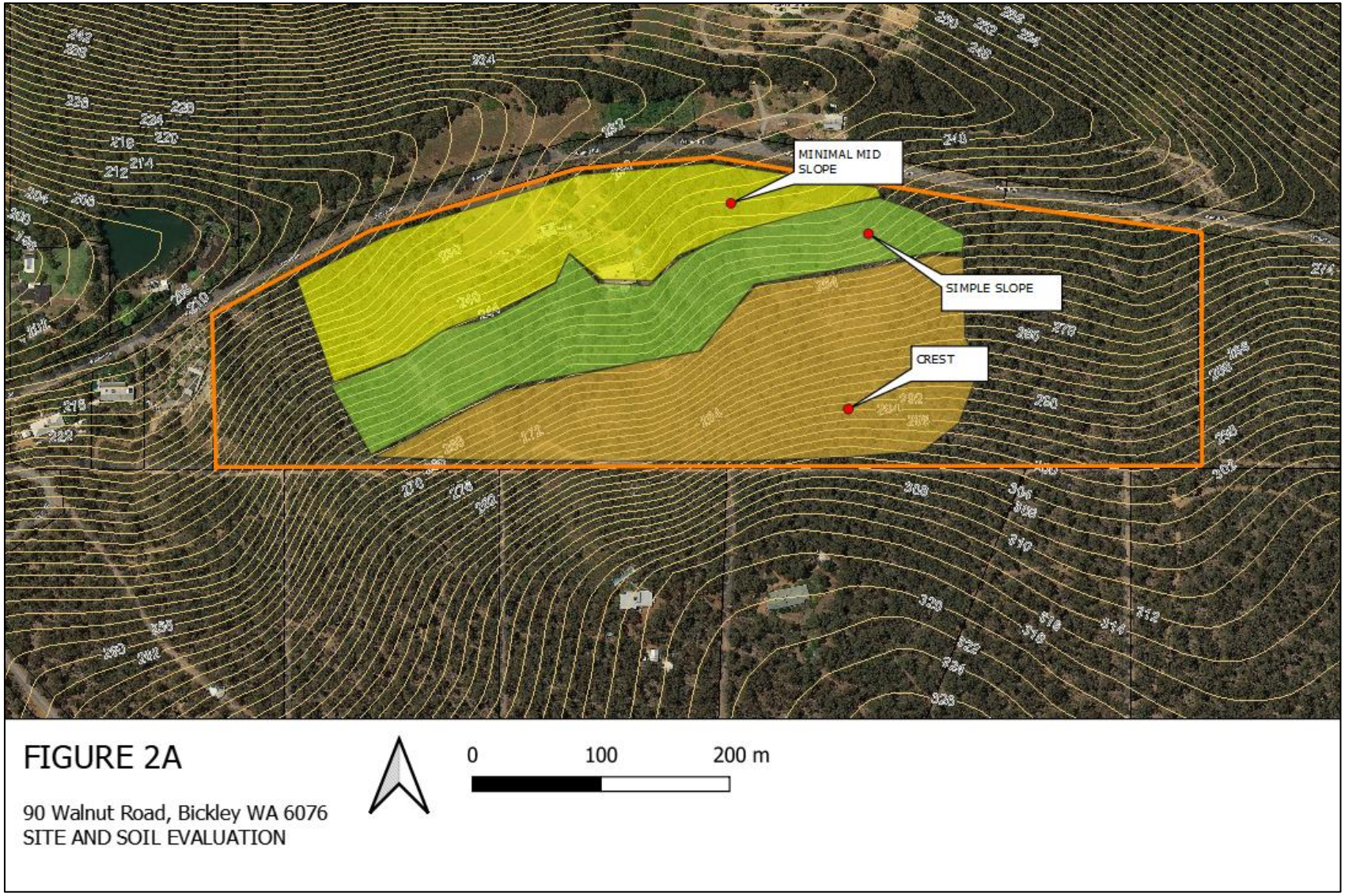


Figure 3: Site Specific Contours.

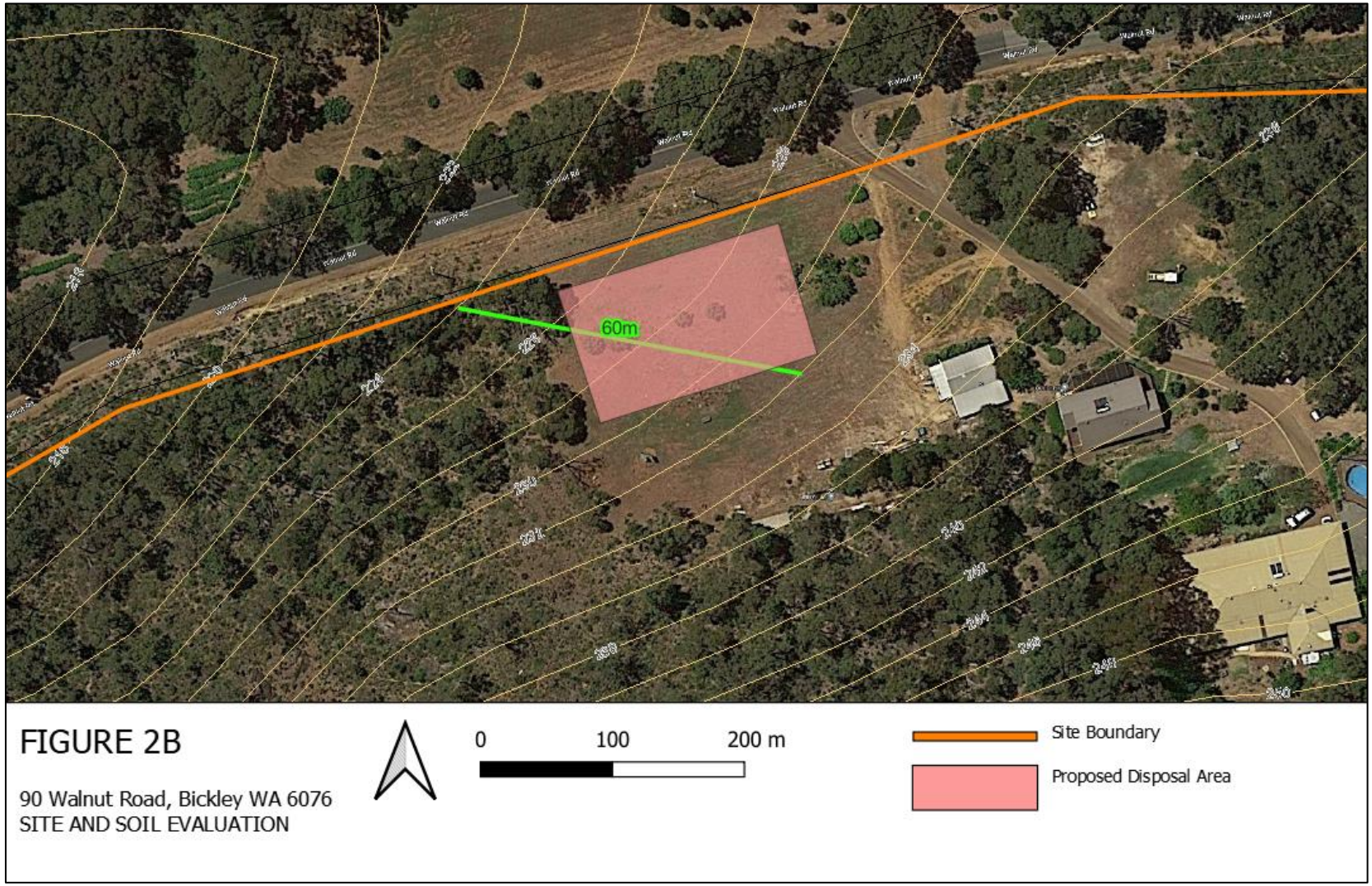


Figure 4: Local Contours.

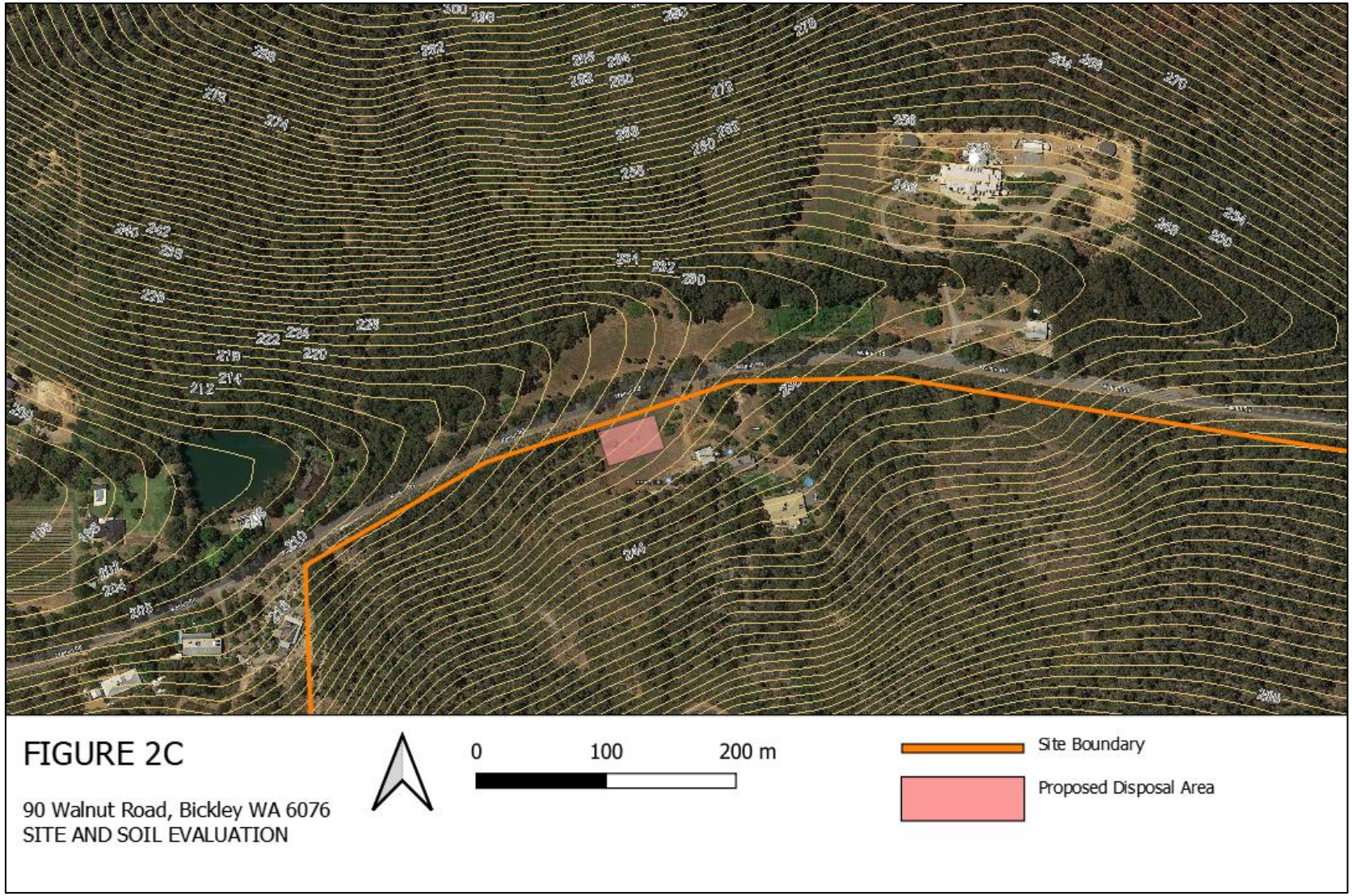


Figure 5: Separation Distances - A

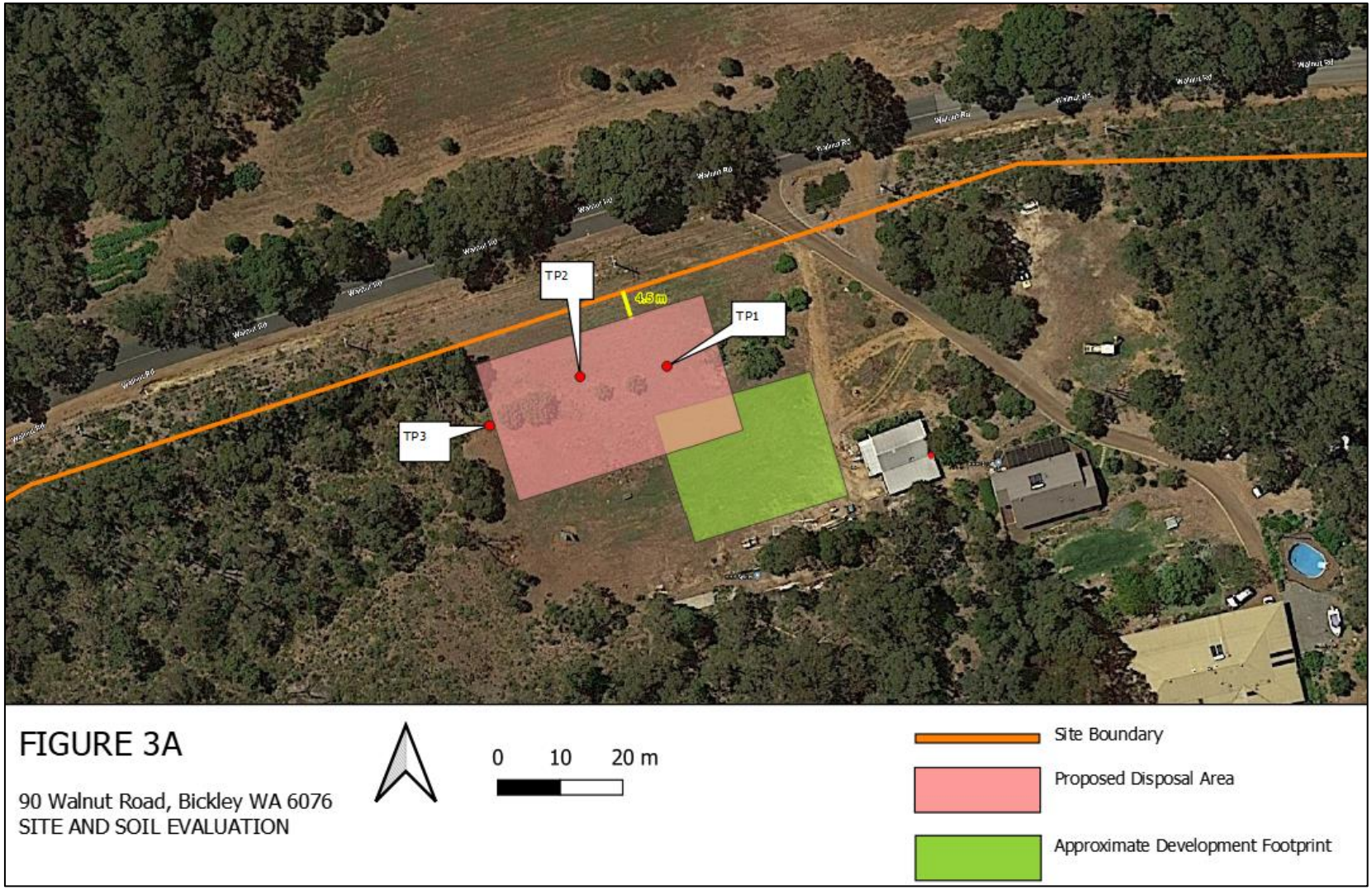
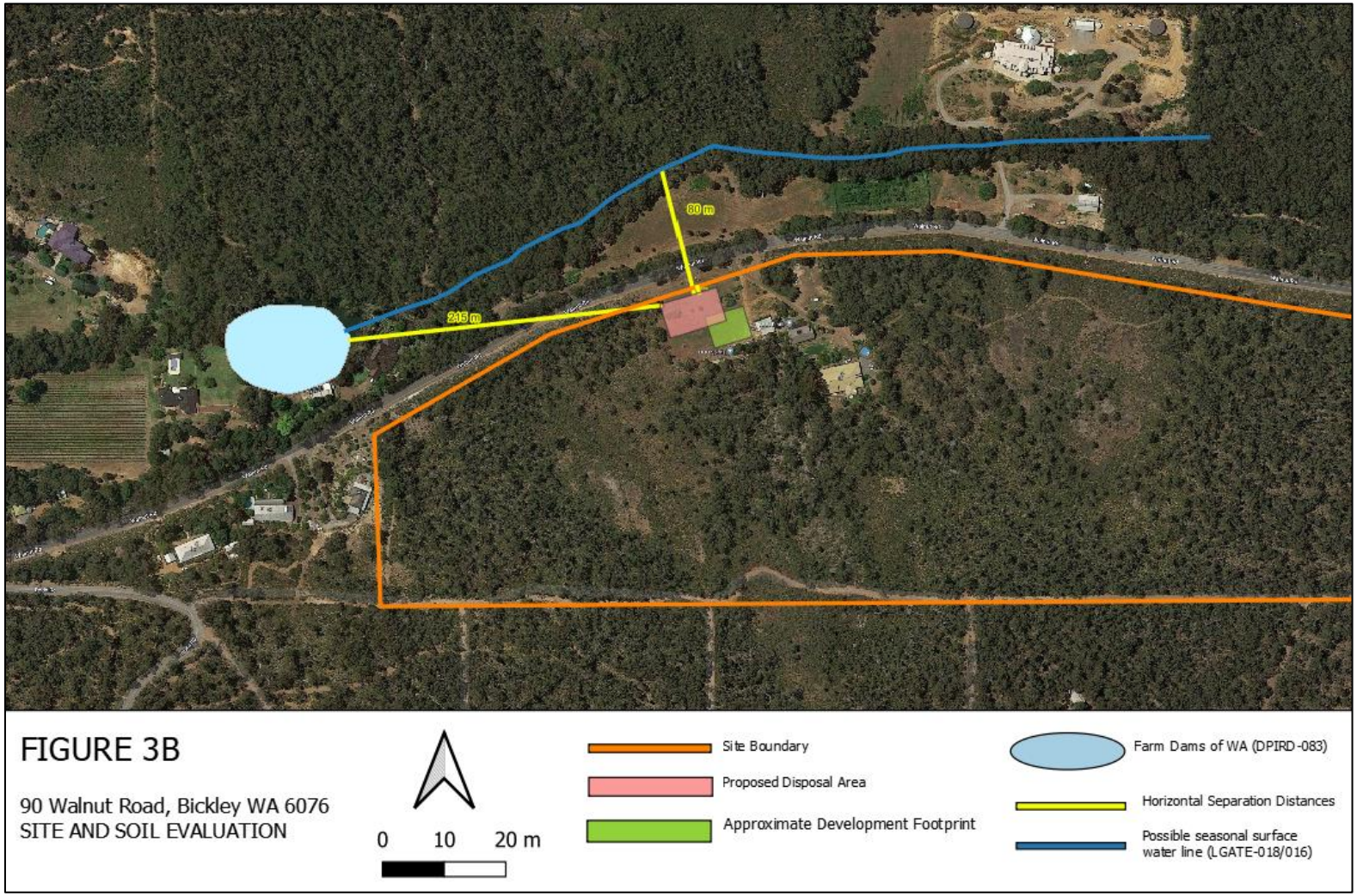


Figure 6: Separation Distances - B.

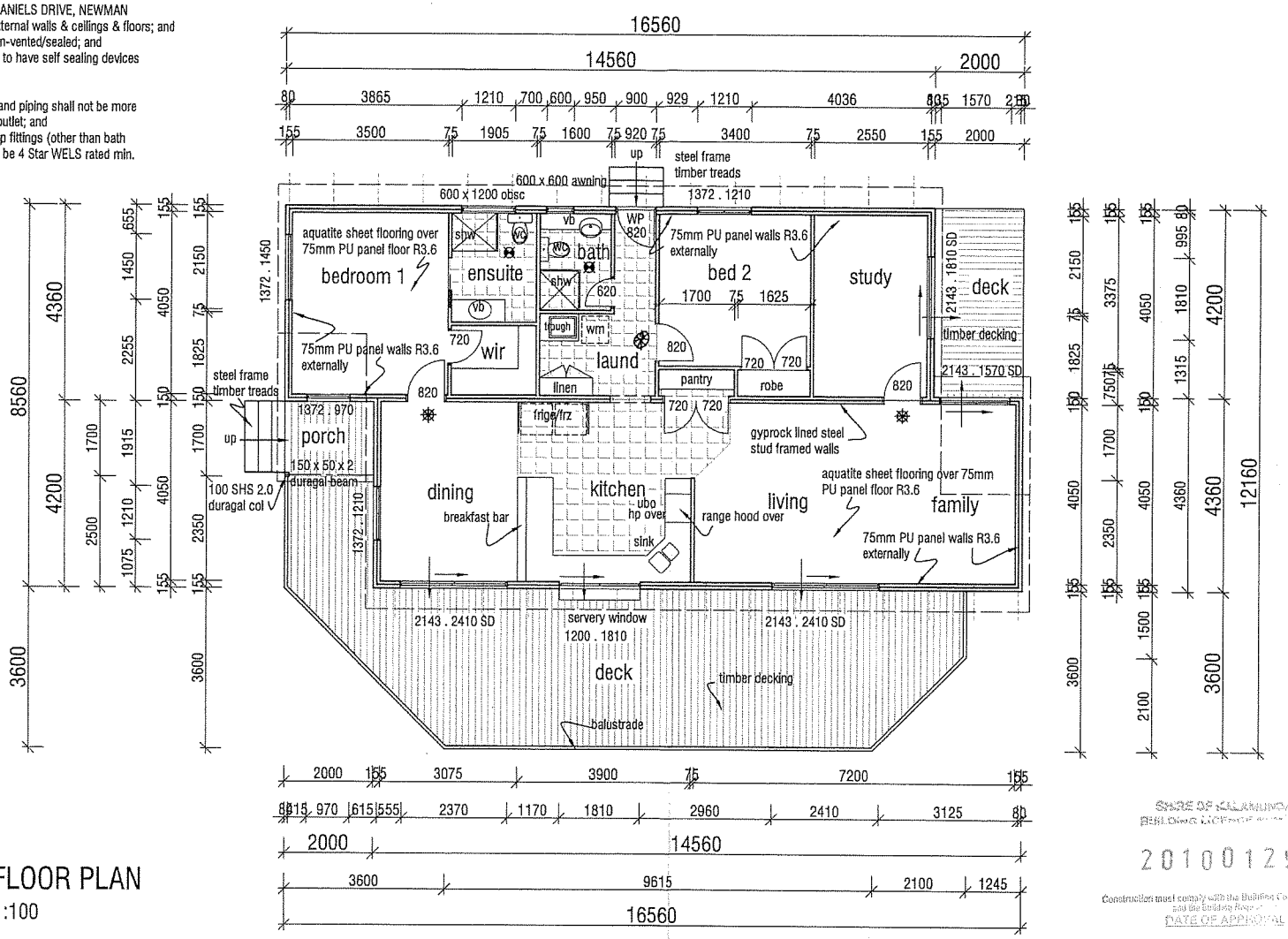


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APPENDIX A
Site Drawings

ENERGY NOTES - LOT 241 DANIELS DRIVE, NEWMAN

* R3.6 Insulated panels to external walls & ceilings & floors; and
* All recessed lights to be non-vented/sealed; and
* Exhaust fans, flues & ducts to have self sealing devices dampers; and
* Roof cavity to be ventilated
* HWS to have 5 Star rating and piping shall not be more than 20m to the furtherest outlet; and
* WC pans & cisterns & all tap fittings (other than bath outlets & garden taps) shall be 4 Star WELS rated min.



FLOOR PLAN
1:100

STATE OF WESTERN AUSTRALIA
BUILDING LICENCE

20100129

Construction must comply with the Building Code of Australia and the Building Regulations

DATE OF APPROVAL

29 MAR 2010

22.1.10

PROPOSED RESIDENCE TO BE BUILT ON LOT 1, #90
WALNUT ROAD BICKLEY FOR J.R & E.R. WALSH.

YORK

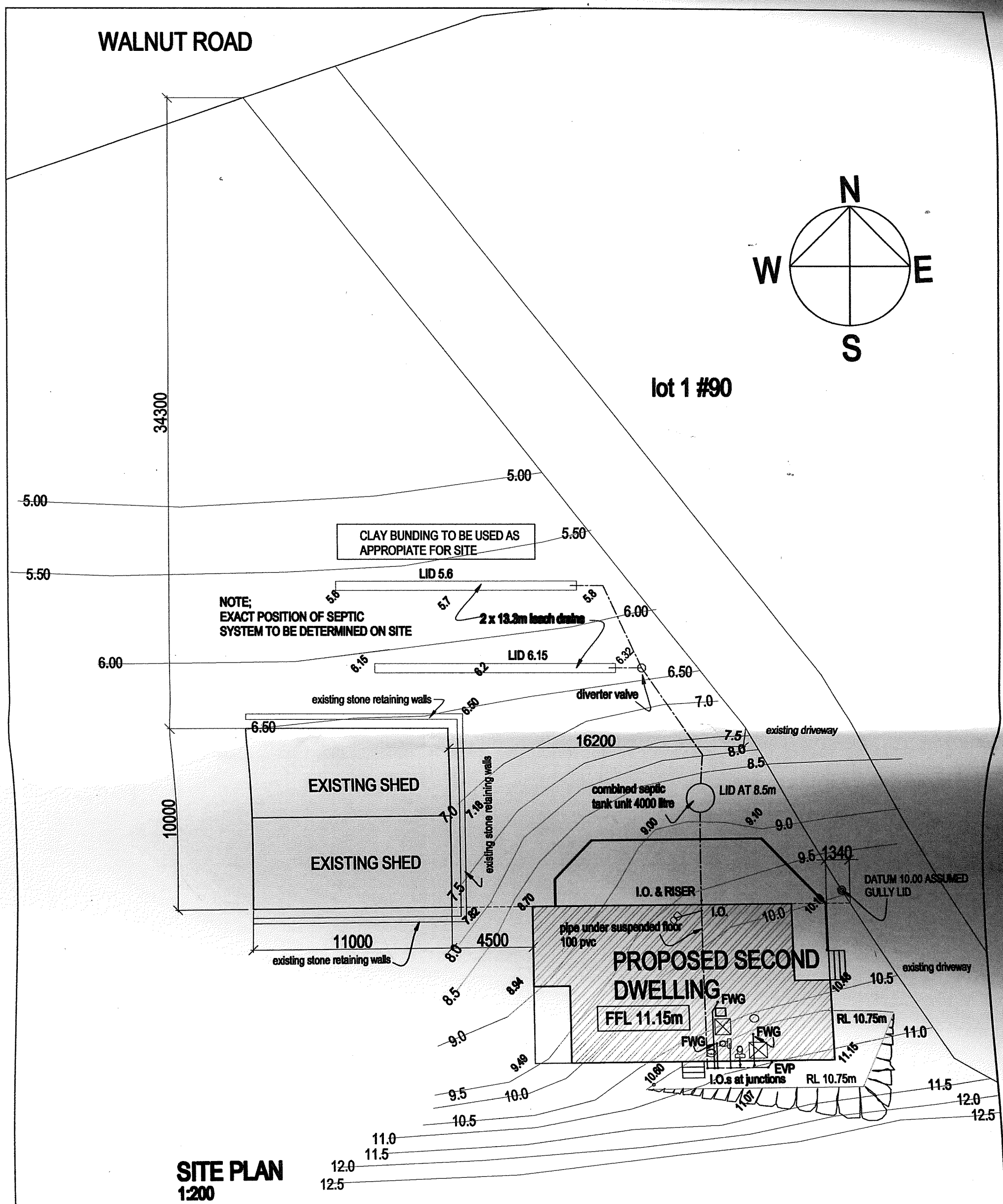
FLOOR PLAN

Thermal Comfort Homes Pty Ltd
& A.T. van der Meer Reg Builder No 7255
131 Kelvin Road,
MADDINGTON W.A. 6100
Tel: Brett Lawrence 04 18 628 873
Earle Lawrence 04 09 088 135

Structural Focus Design Pty Ltd
CONSULTING ENGINEERS
10 Hepworth Road, TRIGG 6029
Tel: 04 03 463 591
Date 7/1/10
A. T. Van der Meer
B. E. (Hons) M. Eng. Sc., M. I. E. Aust., C. P. Eng;
PRINCIPAL ENGINEER

Country Drafting & Design
BUILDING DESIGNERS
7 Binns Court
North Fremantle
telephone 9433 2419
facsimile 9433 5482
designed by; E. Lawrence

date 15-1-2010
sheet No. 3
Job No. 0908



SITE PLAN
1:200

PROPOSED RESIDENCE TO BE BUILT ON LOT 1, #90 WALNUT ROAD BICKLEY FOR J.R & E.R. WALSH.

YORK

SITE PLAN

SEPTIC SYSTEM PLAN

Thermal Comfort Homes Pty Ltd
& A.T. van der Meer Reg Builder No 7255
131 Kelvin Road,
MADDINGTON W.A. 6100
Tel: Mal Simmonds 0421 1500 22

Country Drafting & Design
BUILDING DESIGNERS
7 Binns Court
North Fremantle
telephone 9433 2419
facsimile 9433 5482
designed by; E. Lawrence

date 15-2-2010
sheet No. 1SP
Job No. 0908

APPENDIX B
Photographs

	
General Proposed Land Application Area	General Proposed Land Application Area



TP1



TP1





TP1	TP2
	
TP3	

APPENDIX C
Laboratory Certificates of Analysis

Page 1 of 1

Project Reference	Walnut Rd SSE
Site	Walnut Rd
Sample Type	Soil
Scientist(s)	S.Mueller
Results:	sam@westsoilandwater.com.au
Invoice:	sam@westsoilandwater.com.au

WEST SOIL & WATER

p: 0424021264
e: sam@westsoilandwater.com.au
w: www.westsoilandwater.com.au

	SAMPLE ID.	DATE	PRESERVATION		ANALYSIS SUITES										COMMENTS	LAB ID
			Ice	None	pH	Phosphorus Retention Index	Soil Classification by Particle Size Analysis (Sieve Hydrometer and SPD analysis to "Yellow Book" specification – 4 analytes No graphs)	Electrical Conductivity EC1:5 (salinity)	Sodicity (Exchange Sodium Percentage, ESP)	Phosphorus Adsorption (mg/kg			Total # of Bags	Total # of Soil Jars		
1	Walnut SSE S1	16/06/2023	x		x	x	x	x	x	x			1	1		
2	Walnut SSE S2	16/06/2023	x		x	x	x	x	x	x			1	1		

Relinquished by	S.Mueller
Organisation	WS&W
Date	16/06/2023
Time	PM

Signature

Notes:

Quote #:

Total # of Containers:	
Received by	ALS 16/6 1530
Organisation	
Date	
Time	
Condition upon reciept	

Total # of Eskies: 1

Environmental Division
Perth
Work Order Reference
EP2308167

Telephone . -- 61-8-9406 1301

CERTIFICATE OF ANALYSIS

Work Order	: **EP2308167**	Page	: 1 of 3
Client	: **West Soil & Water**	Laboratory	: Environmental Division Perth
Contact	: Sam Mueller	Contact	: Customer Services EP
Address	: 3/194 Holbeck Street Doubleview 6018	Address	: 26 Rigali Way Wangara WA Australia 6065
Telephone	: ----	Telephone	: +61-8-9406 1301
Project	: Walnut Rd SSE	Date Samples Received	: 16-Jun-2023 15:30
Order number	: ----	Date Analysis Commenced	: 23-Jun-2023
C-O-C number	: ----	Issue Date	: 10-Jul-2023 17:46
Sampler	: ----		
Site	: Walnut Rd		
Quote number	: EPBQ/025/22		
No. of samples received	: 2		
No. of samples analysed	: 2		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Senior Chemist - Inorganics	Sydney Inorganics, Smithfield, NSW
Canhuang Ke	Inorganics Supervisor	Perth Inorganics, Wangara, WA
Chris Lemaitre	Laboratory Manager (Perth)	Perth Inorganics, Wangara, WA
Vincent Emerton-Bell	Laboratory Technician	Newcastle - Inorganics, Mayfield West, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contract for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- EA150H: Soil particle density results fell outside the scope of AS1289.3.6.3. for sample EP2308167-002. Results should be scrutinised accordingly.
- ED007 and ED008: When Exchangeable Al is reported from these methods, it should be noted that Rayment & Lyons (2011) suggests Exchange Acidity by 1M KCl - Method 15G1 (ED005) is a more suitable method for the determination of exchange acidity (H+ + Al3+).

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	Walnut SSE S1	Walnut SSE S2	----	----	----
			Sampling date / time	16-Jun-2023 00:00	16-Jun-2023 00:00	----	----	----
Compound	CAS Number	LOR	Unit	EP2308167-001	EP2308167-002	--------	--------	--------
				Result	Result	----	----	----
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	**6.8**	**6.5**	**----**	**----**	**----**
EA010: Conductivity (1:5)								
Electrical Conductivity @ 25°C	----	1	µS/cm	**11**	**24**	**----**	**----**	**----**
EA150: Soil Classification - National Committee on Soil and Terrain (2009)								
Clay (<2 µm)	----	1	%	**15**	**26**	**----**	**----**	**----**
Silt (2-20 µm)	----	1	%	**5**	**13**	**----**	**----**	**----**
Fine Sand (0.02-0.2 mm)	----	1	%	**10**	**16**	**----**	**----**	**----**
Coarse Sand (0.2-2.0 mm)	----	1	%	**50**	**30**	**----**	**----**	**----**
Gravel (>2mm)	----	1	%	**20**	**15**	**----**	**----**	**----**
EA152: Soil Particle Density								
Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3	**2.48**	**2.12**	**----**	**----**	**----**
ED007: Exchangeable Cations								
Exchangeable Calcium	----	0.1	meq/100g	**1.6**	**8.4**	**----**	**----**	**----**
Exchangeable Magnesium	----	0.1	meq/100g	**1.2**	**4.7**	**----**	**----**	**----**
Exchangeable Potassium	----	0.1	meq/100g	**0.2**	**0.6**	**----**	**----**	**----**
Exchangeable Sodium	----	0.1	meq/100g	**0.1**	**0.3**	**----**	**----**	**----**
Cation Exchange Capacity	----	0.1	meq/100g	**3.1**	**14.1**	**----**	**----**	**----**
Exchangeable Sodium Percent	----	0.1	%	**4.0**	**2.4**	**----**	**----**	**----**
EK072: Phosphate Sorption Capacity								
Phosphate Sorption Capacity	----	250	mg P sorbed/kg	**699**	**2160**	**----**	**----**	**----**

Inter-Laboratory Testing

Analysis conducted by ALS Newcastle, NATA accreditation no. 825, site no. 1656 (Chemistry) 9854 (Biology).

(SOIL) EA150: Soil Classification - National Committee on Soil and Terrain (2009)

(SOIL) EA152: Soil Particle Density

Analysis conducted by ALS Sydney, NATA accreditation no. 825, site no. 10911 (Chemistry) 14913 (Biology).

(SOIL) EK072: Phosphate Sorption Capacity

GOVERNMENT OF WESTERN AUSTRALIA

ChemCentre

Scientific Services Division

Report of Examination

Resources and Chemistry Precinct
Cnr Manning Road and Townsing Drive
Bentley
WA 6102
T +61 8 9422 9800
F +61 8 9422 9801
www.chemcentre.wa.gov.au
ABN 40 991 885 705

Purchase Order: 620970
Your Reference:
ChemCentre Reference: 22S4606 R0

Australian Laboratory Services Pty Ltd
26 Rigali Way
WANGARA WA 6065

Attention: Client Services

Final Report on 2 samples of soil received on 20/06/2023

LAB ID	Client ID and Description
22S4606 / 001	EP2308167_001 Walnut SSE S1
22S4606 / 002	EP2308167_002 Walnut SSE S2

Analyte		P
Method		PRI
Unit		mL/g
Lab ID	**Client ID**	
22S4606/001	EP2308167_001	16
22S4606/002	EP2308167_002	260

Analyte	Method	Description
P	PRI	Phosphorus Retention Index by method S15

Results are based on a air-dry (40C) , < 2 mm basis. Stones (>2mm) if present are reported on an air dry whole sample basis.The results apply only to samples as received. This report may only be reproduced in full. Unless otherwise advised, the samples in this job will be disposed of after a holding period of 30 days from the report date shown below.

Phosphorus Retention Index (PRI) is a measure of the ability of soil to retain or leach applied phosphate.

PRI is defined as the ratio P ads : P eq where P ads is the amount of phosphorus adsorbed by soil (µg P/g soil) .

The phosphorus fixation properties of soil may be described by the following PRI values:

PRI

negative	desorbing (P leaching)
0 - 2	weakly adsorbing
2 - 20	moderately adsorbing
20 - 100	strongly adsorbing
>100	very strongly adsorbing

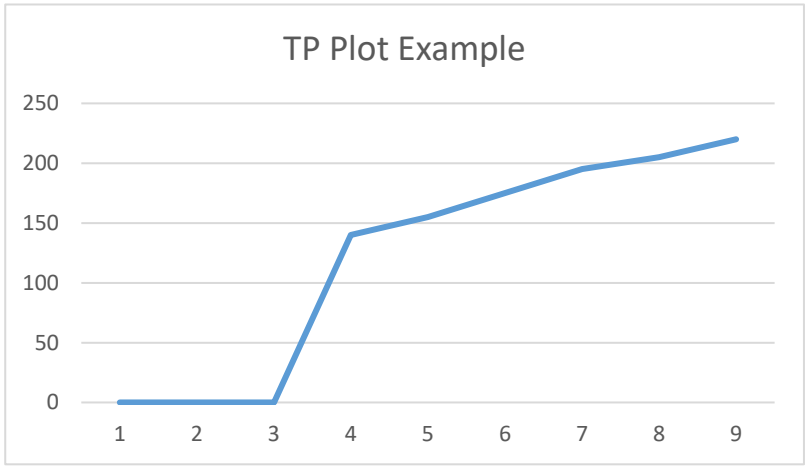
*Analysis not covered by scope of ChemCentre's NATA accreditation.



Barry Price
Senior Scientist
Scientific Services Division
23-Jun-2023

APPENDIX D
Field Results

Field Readings - 16/06/2023	TP1		TP2	
	Reading	Observed difference (mm)	Reading	Observed difference (mm)
Data outliers (initial readings generally) are removed so that plotted rate is noted to be constant (note below) - and representative of saturated flow rate. Field recording may cease when flow is observed to be steady and sufficient readings have been taken.			140	
	130		155	15
	170	40	175	20
	200	30	195	20
	225	25	205	10
	240	15	220	15
	265	25	230	10
	290	25	240	10
	310	20	245	5
	325	15		
	Average (cm)	2.4375	Average (cm)	1.3125
Time constant (min)	1.5			
Measuring device diameter	3.5			
Radius of measuring device	1.75			
Area of measuring device	9.62			
Borehole diameter	7.5			
Borehole base area	44.18			
Pi	3.14159			
Device factor (internal area of the measuring cylinder) (DF)	9.621119375			
Calculate water flow cubic cm/min (Q)	15.63431898		8.418479453	
Calculated flow into soil - hydraulic conductivity (Ksat cm/min)	**0.35**		**0.19**	
Calculated flow into soil - hydraulic conductivity (Ksat m/day)	**5.10**		**2.74**	



APPENDIX E
DoH Separation Distances

Site Feature	Setback Distance, m
Horizontal setback distances	
Treatment tanks to buildings, property boundaries, driveways, paths and other tanks	1.2
Tranches, beds and soak wells to boundary, building, tanks and other land application systems	1.8
Tranches, beds and soak wells to trafficable areas	1.2
Any land application system to wells, stream, private bores or underground source of water intended for human consumption	30
Tranches, beds and soak wells to subsoil drainage or open drainage channel (as per **Section 5.2.2 of the GSP** a separation of 100m is required if there is discharge into a waterway or significant wetland without treatment of the discharge)	6.0
Spray Irrigation: • Boundaries, buildings, driveways etc • Sub-soil and open drain • Swimming pool • Treatment tanks	 1.8 6.0 3.0
Subsurface Dripper: • Boundaries, buildings, treatment tanks, driveways etc • Sub-soil and open drain • Swimming pool • Garden bore	 0.5 3.0 2.0
On-site wastewater system to water resources (for more details refer to **Section 5.2.2 of the GSP**)	100
On-site wastewater system must not be located within any area subject to inundation and/or flooding in a 10 per cent Annual Exceedance Probability (AEP) rainfall event	
Vertical setback distances	
Discharge point of the on-site wastewater system to the highest known groundwater level:	
• PDWSA	2.0
• Sensitive water resource areas	1.5
• All other areas -	
○ Sands	1.5
○ Gravels	1.0
○ Loams and heavy soils	

Hardpan or bedrock (depends on quality of treated wastewater and type of LAS)	0.6-1.5

West Soil and Water
ABN: 88224157497

P: 0424 021 264
E: sam@westsoilandwater.com.au

www.westsoilandwater.com.au