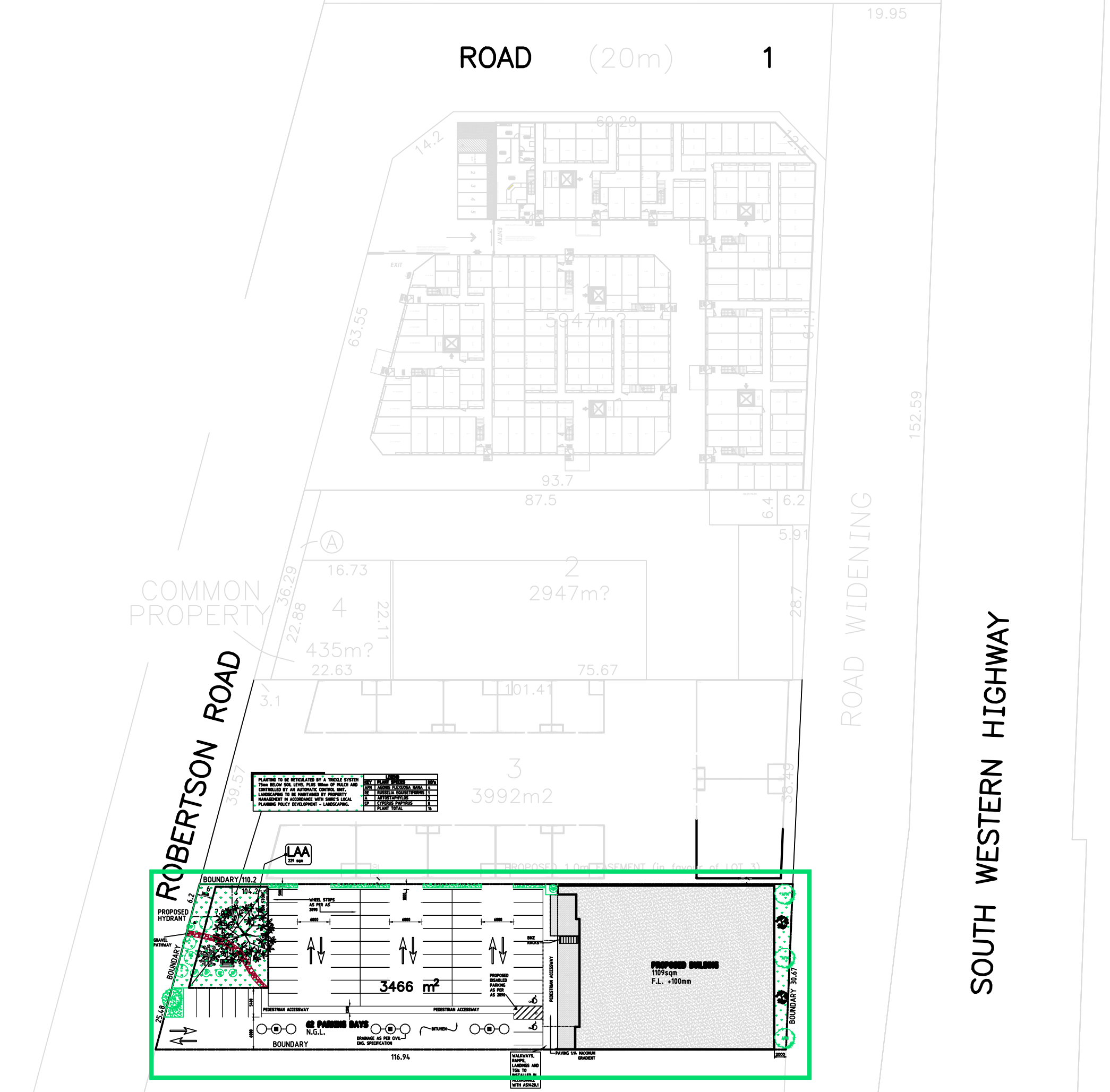


KEY PLAN

SCALE NTS

LOT 4 ROBERTSON ROAD BYFORD

CLIENT
CENTREPOINT HUB - BYFORD CAMPUS

Project
PROPOSED PUBLIC ASSEMBLY COMMUNITY HUB
LOT 128 (LOT 4) ROBERTSON ROAD BYFORD WA

Title
PROPOSED KEY PLAN

Rev.	Date	Comment
A	31.1.2022	ISSUE FOR COMMENT
B	23.5.2022	DEVELOPMENT APPROVAL
C	4.5.2023	DEVELOPMENT APPROVAL

Rev.	C
Drawn	PAH
Date	MAY 2023
Scale	AS SHOWN

Job No. **577-1**

Sheet 1 OF 5

ROBERTSON

PLANTING TO BE RETICULATED BY A TRICKLE SYSTEM 75mm BELOW SOIL LEVEL PLUS 100mm OF MULCH AND CONTROLLED BY AN AUTOMATIC CONTROL UNIT. LANDSCAPING TO BE MAINTAINED BY PROPERTY MANAGEMENT IN ACCORDANCE WITH SHIRE'S LOCAL PLANNING POLICY DEVELOPMENT - LANDSCAPING.

LEGEND		
KEY	PLANT SPECIES	NO's
AFN	AGONIS FLEXUOSA NANA	4
RE	RUSSELIA EQUISETIFORMIS	1
A	ARTOSTAPHYLOS	3
CP	CYPERUS PAPYRUS	8
	PLANT TOTAL	16

LAA
229 sqm

BOUNDARY 110.2

104.2

39.57

3
3992m2

PROPOSED 1.0m EASEMENT (in favour of LOT 3)

PROPOSED HYDRANT

GRAVEL PATHWAY

BOUNDARY

BENCH

BIN STORE

WHEEL STOPS AS PER AS 2890

6000 6000 6000

3466 m²

PROPOSED DISABLED PARKING AS PER AS 2890

BIKE RACKS

PEDESTRIAN ACCESSWAY

PEDESTRIAN ACCESSWAY

PEDESTRIAN ACCESSWAY

62 PARKING BAYS
N.G.L.

BITUMEN

DRAINAGE AS PER CIVIL ENG. SPECIFICATION

BOUNDARY

116.94

WALKWAYS, RAMPS, LANDINGS AND TGIs TO INSTALLED IN ACCORDANCE WITH AS1428.1

PAVING 1:14 MAXIMUM GRADIENT

PROPOSED BUILDING
1109sqm
F.L. +100mm

BOUNDARY 30.67

25.48

PARKING BAYS	62
AUDITORIUM	300 SEATS
	540sqm
BUILDING FOOTPRINT	1109sqm
LANDSCAPING	670sqm
LAND	3466sqm
CLASS	9A PUBLIC ASSEMBLEY
ZONE	MIXED BUSINESS / SERVICE COMMERCIAL

SOAKWELLS
6 No. CONCRETE SOAKWELLS 1800 x 1800mm
3 No. CONCRETE SOAKWELLS 1800 x 1800mm WITH GRATES
ALL TO HAVE TRAFFICABLE CONCRETE LIDS

SITE PLAN

SCALE 1:300

LOT 4 ROBERTSON ROAD BYFORD

LANDSCAPING

CLIENT
CENTREPOINT HUB - BYFORD CAMPUS

Project
PROPOSED PUBLIC ASSEMBLY COMMUNITY HUB
LOT 128 (LOT 4) ROBERTSON ROAD BYFORD WA

Title
PROPOSED SITE LOCATION

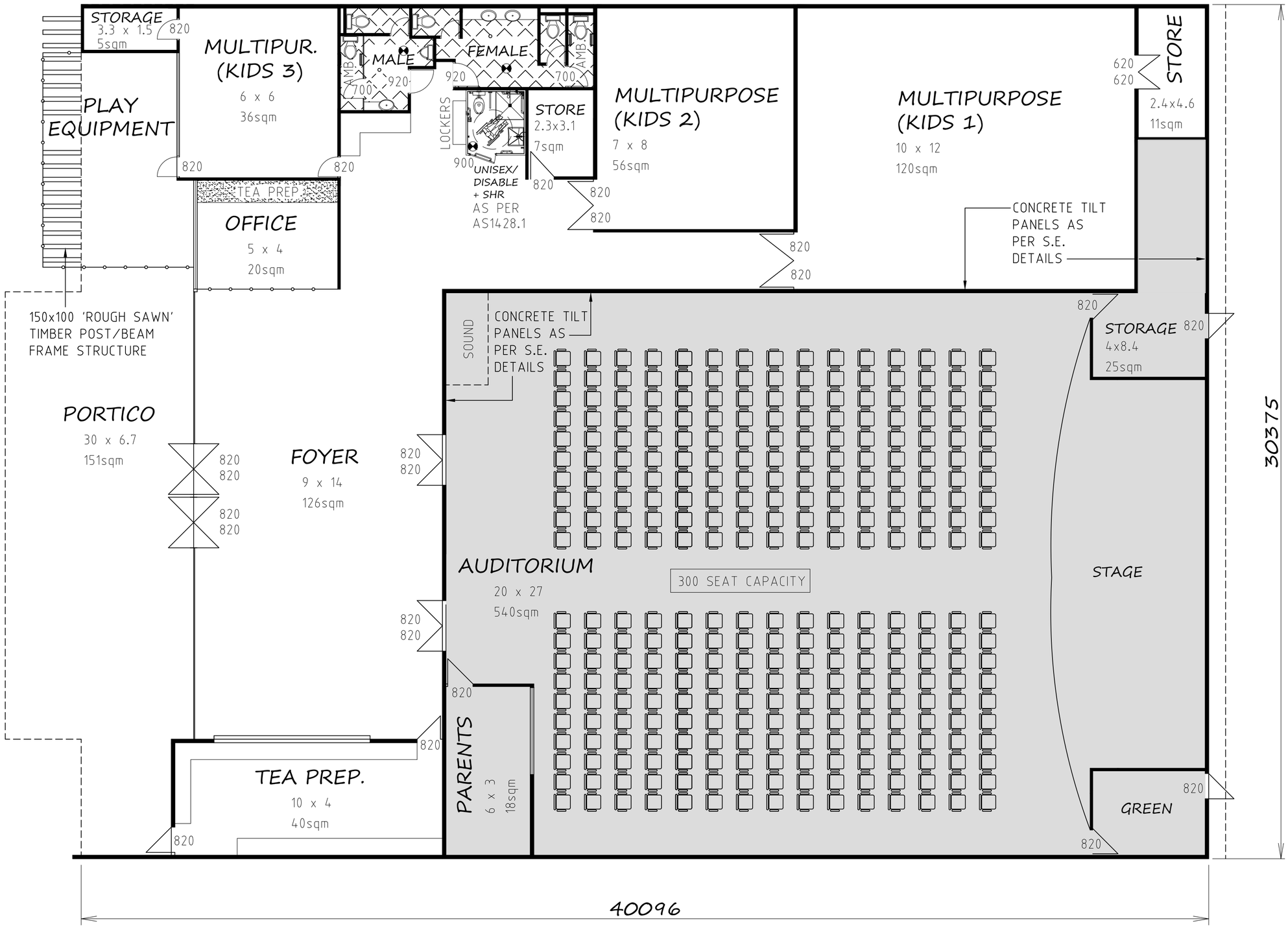
Rev.	Date	Comment
A	31.1.2022	ISSUE FOR COMMENT
B	23.5.2022	DEVELOPMENT APPROVAL
C	4.5.2023	DEVELOPMENT APPROVAL

Rev.	C
Drawn	PAH
Date	MAY 2023
Scale	AS SHOWN

Job No. **577-2**

Sheet 2 OF 5

A3 SHEET



FLOOR PLAN

SCALE 1:100

LOT 4 ROBERTSON ROAD BYFORD
3of5 (A2 SHEET)

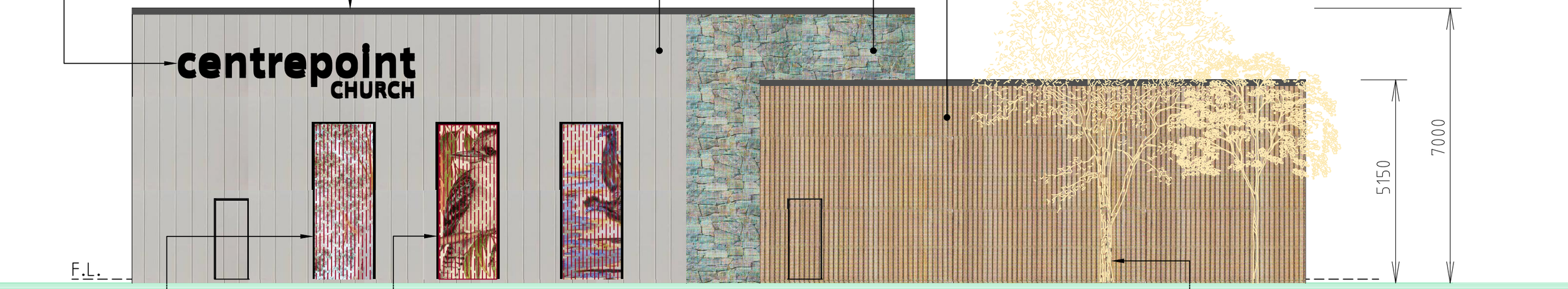
COLORBOND MONUMENT CAPPING

SIGNAGE 6000x1500 BLACK ACRYLIC GLOSS - 300 DEEP

HARDIE OBLIQUE CLADDING SURFMIST COLORBOND

ECO WAMBERAL STONE

MODINEX GROUP AUSTRATUS FLAT, HEMLOCK BATTENS (90X18mm) - 18mm SPACING. 300mm FORWARD OFFSET FROM WALL.



75x300 DEEP FRAME, COLORBOND MONUMENT FINISH.

3 OFF-4000x1500 ARTWORK - 'RUSTIC' FINISH. LOCAL ARTIST TO FINALISE SELECTION.

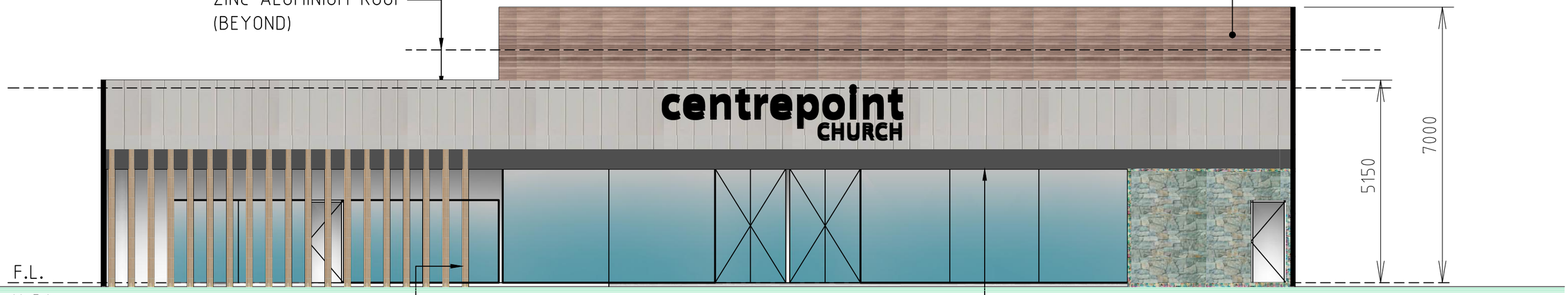
EXISTING EUCALYPTUS TREES (2 OFF) TO REMAIN.

EAST ELEVATION

SCALE 1:100
SOUTH WEST HIGHWAY

DECO CLAD V-GROOVE CLADDING IN DECOWOOD FINISH WEATHERED TIMBER

ZINC ALUMINIUM ROOF (BEYOND)



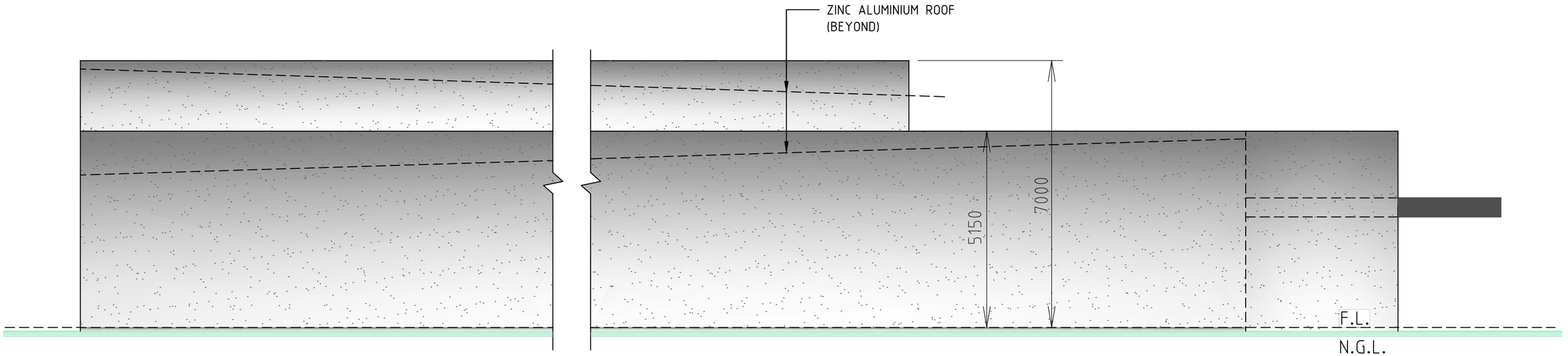
150x100 'ROUGH SAWN' TIMBER POST/BEAM

CANOPY COLORBOND MONUMENT FINISH

WEST ELEVATION

SCALE 1:100
ENTRANCE

LOT 4 ROBERTSON ROAD BYFORD
4of5 (A3 SHEET)



SIDE ELEVATION

SCALE 1:100

LOT 4 ROBERTSON ROAD BYFORD
5of5 (A3 SHEET)

Perth Geotechnics
ABN: 74 660 182 061
PO Box 165, Gosnells WA 6990
P: 08 6396 2675, M: 0430 130 677
E: info@perthgeotechnics.com.au
www.perthgeotechnics.com.au

Report
Site and Soil Evaluation for Onsite Wastewater Management
Lot 4, Robertson Road, Byford WA

Client:
Parsons Group Pty Ltd

Reference: SSE188823PG_Rev3
Date: 1 April 2023

Perth Geotechnics
ABN: 74 660 182 061
PO Box 165, Gosnells WA 6990
P: 08 6396 2675, M: 0430 130 677
E: info@perthgeotechnics.com.au
www.perthgeotechnics.com.au

Quality Information

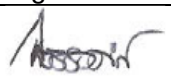
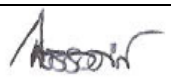
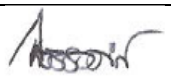
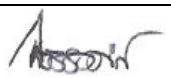
Document Report - Site and Soil Evaluation for Onsite Wastewater Management
Lot 4, Robertson Road, Byford WA

Project Ref SSE188823PG_Rev3

Date 1 April 2023

Prepared for Parsons Group Pty Ltd

Revision History

Rev.	Date	Details	Prepared by	Authorised	
				Name/Position	Signature
0	17/03/2023	Final Issue	RK	Mohammad Amzad Hossain Sr Geotechnical Engineer	
1	22/03/2023	Final Issue	RK	Mohammad Amzad Hossain Sr Geotechnical Engineer	
2	31/03/2023	Final Issue	RK	Mohammad Amzad Hossain Sr Geotechnical Engineer	
3	01/04/2023	Final Issue	RK	Mohammad Amzad Hossain Sr Geotechnical Engineer	

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APPENDICES

1.0 INTRODUCTION

1.1 Project Background

Perth Geotechnics (PG) was engaged by Parsons Group Pty Ltd to undertake a Site and Soil Evaluation (SSE) for on-site wastewater management for a proposed Church at Lot 4, Robertson Road, Byford WA (the site).

The size of the lot area (Lot 4) is approximately 3,466 m^2. This lot is a sublot of Lot 128 South Western Highway, Byford. Sublots 1, 2 and 3 are already developed with other commercial structures. This SSE report is prepared for sublot 4 of Lot 128 SW Highway. The site is proposed to be developed with a church building and car parks. The subdivided lot layout is included in **Appendix A**.

The site location map is presented in Figure 1.

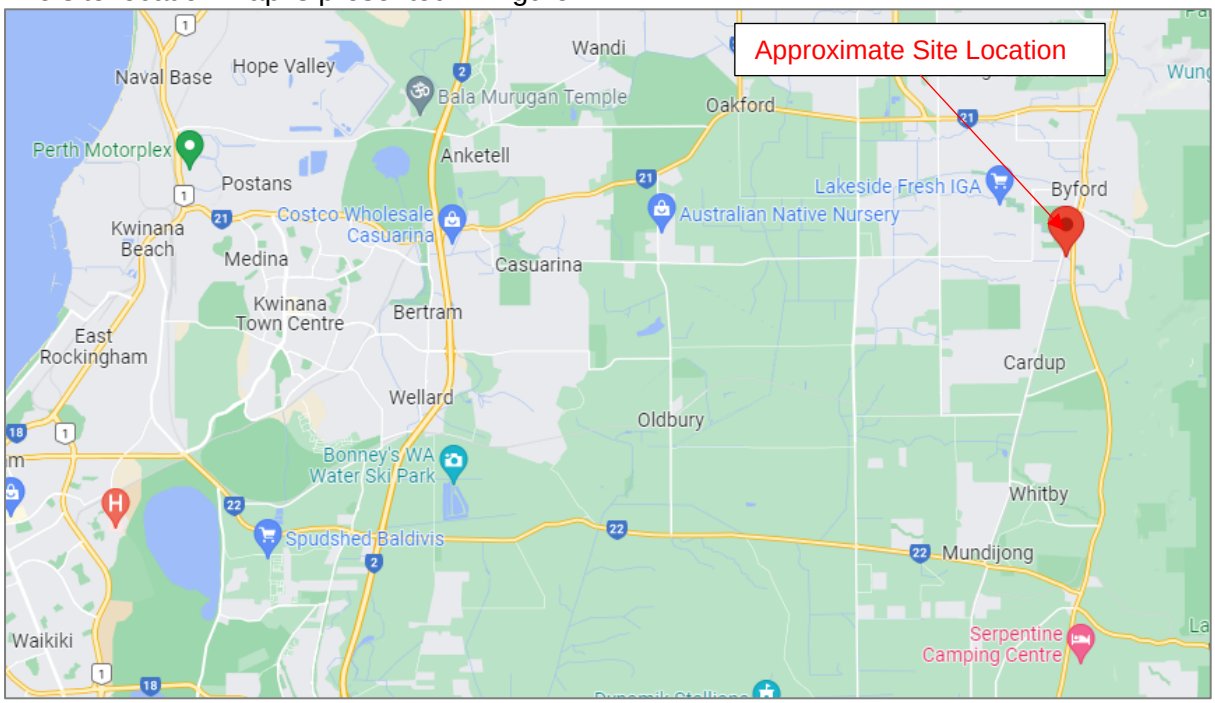

Figure 1. Site Location Map (Source: Google Maps)

1.2 Planning Context

The site is currently zoned as 'Urban Development Zone' under the Shire of Serpentine-Jarrahdale Town Planning Scheme No. 2 (Ref. Map No. LPSC Town Planning Scheme Map 1 of 7, Serpentine-Jarrahdale, Darling Downs Locality, dated 5 November 2021). Extract of the local growth planning scheme map is shown in Figure 2.

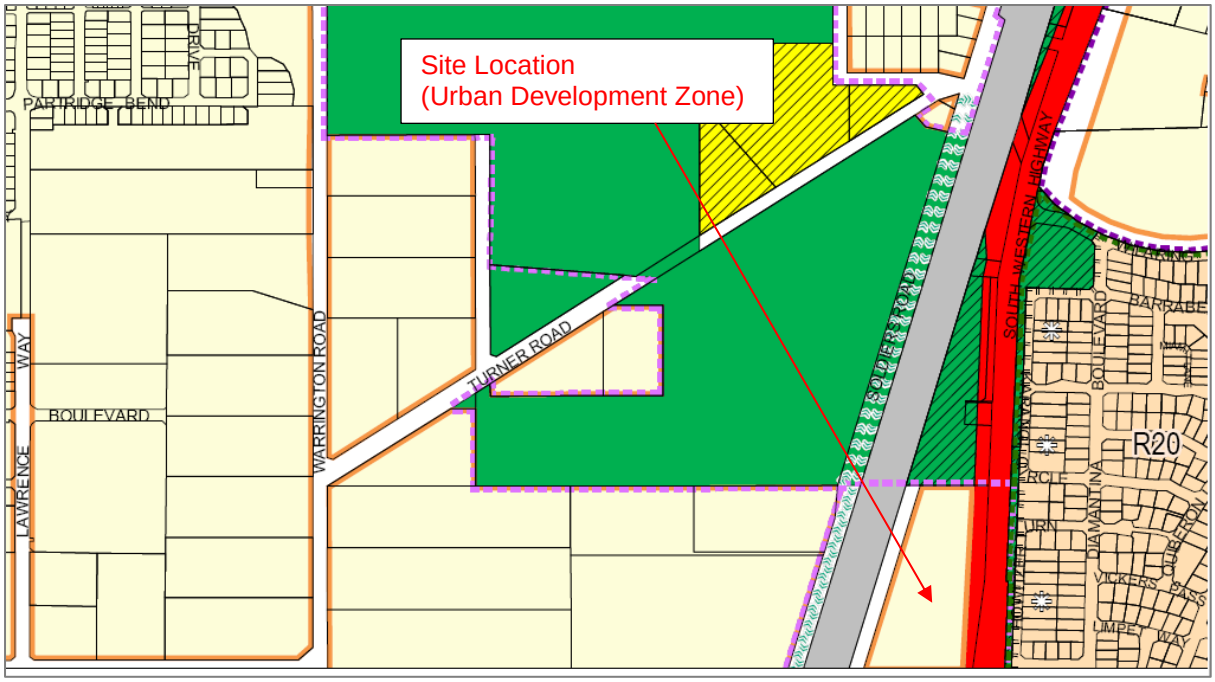

Figure 2. Extract of Shire of Serpentine-Jarrahdale's Town Planning Scheme 2

1.3 Proposed Development

The site is proposed to be developed with a single-story church building, carpark and associated structures. The proposed development layout/plan is included in **Appendix A**.

Reticulated sewage will not be available within the site and thus provision for the disposal of wastewater will need to be considered and accommodated on-site, consistent with the requirements of the *Government Sewerage Policy* (DPLH 2019), *AS/NZS 1547 On-site domestic wastewater management* (AS 1547) (Standards Australia and Standards New Zealand 2012) and other relevant guidelines.

1.4 Objective of this Report

The *Government Sewerage Policy* (DPLH 2019) requires that developments that will not be connected to reticulated sewer are required to prepare a site and soil evaluation (SSE) in accordance with AS1547 (Standards Australia and New Zealand 2012). This report is intended to satisfy this requirement.

The objective of this SSE report is to assess and guide on-site wastewater disposal to ensure sustainable and effective on-site sewage management, thereby protecting public health and the environment.

To support a development application, the SSE report includes:

- Estimating the capacity of the site to contain proposed development and sewage on-site
- Designing a treatment or on-site sewage management system, and
- Identifying management and monitoring options and defining adequate on-site sewage management locations (DoH 2019a).

2.0 SITE ASSESSMENT

2.1 Site Setting

The site is located at approximately 50 km south, south-east of the Perth City centre and 30 km east of the Rockingham City.

The site (Lot 4 Robertson Road) is approximately 3,466 m^2 in size and is bounded by Robertson Road and a railway line to the west, Lot 3 to the north, South Western Highway to the east and remaining lots to the south. Feature survey map of the site indicates that the existing surface sloped downward from east to west, from a RL of 58.65 m AHD to 56.20 m AHD.

The proposed site area was observed to be covered with gravelly-sandy fill material.

The site photograph was taken during the field investigation and are presented in **Appendix D.**

2.2 Climate

The closest Bureau of Meteorology (BoM) weather station to the site which records rainfall and temperature data is located in Jandakot Aero WA (Station No. 009172), situated approximately 20 km north-west of the site. Based on weather data collected from 1989 to 2023 at this weather station, the local area experiences an average of 817 mm of annual rainfall, mean annual maximum temperature of 24.6°C and a mean annual minimum temperature of 11.6°C (BoM 2023).

2.3 Topography

Regional topographic contours show that the site is gently sloped landforms associated with the local geology. Existing site surface elevations range from approximately 58.65 metres Australian height datum (m AHD) at the eastern boundary of the site to approximately 56.20 m AHD along western boundary of the site. Difference in elevation from east to west is approximately 2.45 m. Topographic contours over the site and within the vicinity are shown in the project aerial map and feature survey drawing.

2.4 Landforms and Soils (Geology)

A review of Environmental Geology Series Map of Armadale 1:50,000, Sheet 2033I and 2133 IV revealed that the site is underlain by Quaternary aged Colluvium Formation (Qc).

Gravelly Sandy Clay Unit (Csg) which belongs to Colluvium Formation is held at the proposed site. Gravelly Sandy Clay unit comprises variable, with lenses of silt and gravel, quartz sand, subangular with eolian rounded component, heavy minerals common, rounded gravel, of colluvial origin, buried lenses of cemented pisolite (ferricrete) may present.

The above described geological unit indicates that the landform may pose problems to specified land uses, especially for solid waste disposal and septic tank performance.

Figure 3 shows the extract of the site geology map.

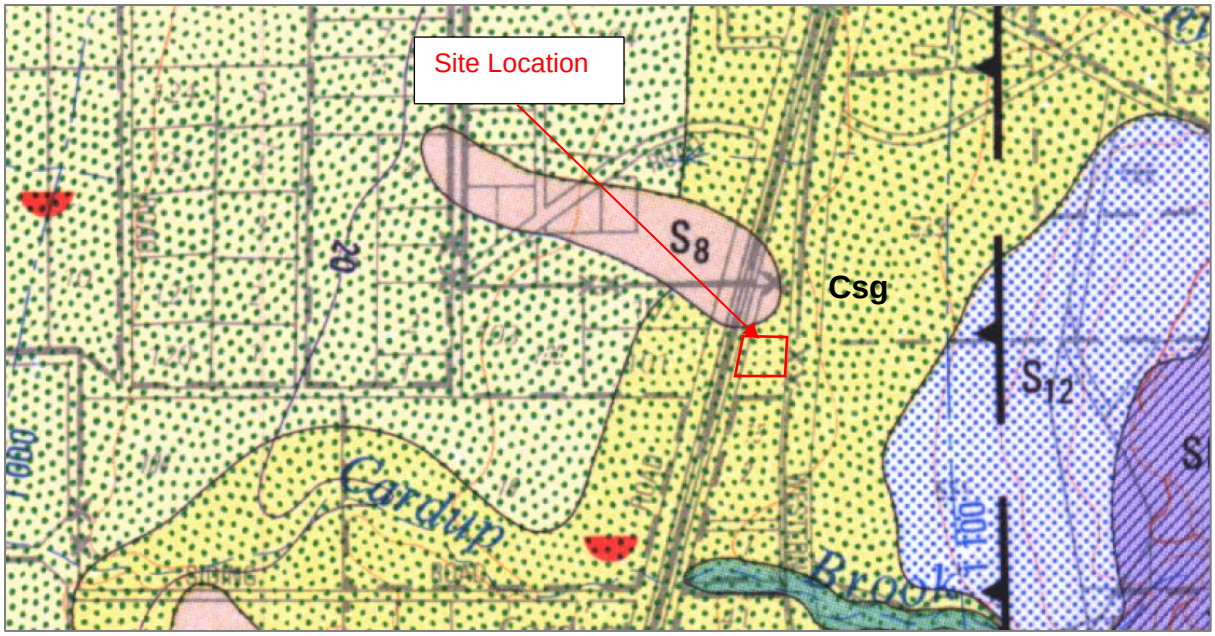

Figure 3. Extract of Site Geology Map

2.5 Acid Sulfate Soils

Acid sulfate soil (ASS) risk mapping prepared by the Department of Water (online mapping database) indicates that the site has a 'no known risk' of ASS occurring within 3 m of the natural soil surface. Extract of the site ASS map is shown in **Figure 4**.

Figure 4. Extract of ASS and Groundwater Contour Map

2.6 Groundwater Desktop Information

A review of the 'Online Perth Groundwater Atlas' of the Department of Water was carried out for this site. The site is located beyond the Perth groundwater database. It is therefore, no desktop information on groundwater depth is available for the site.

Extract of the Perth groundwater atlas information is shown in **Figure 4**.

SSE Report (2021) prepared by Water Installations Pty Ltd for 'Lot 128 South Western Highway, Byford (Sublot 2)' encountered groundwater at a depth of between 1.5 m in natural ground and at 2.2 m in the fill area.

2.7 Sewage Sensitive Areas

Sewage sensitive areas are proclaimed under the *Government Sewerage Policy* (DPLH 2019) to protect groundwater and surface water systems. A review of the *Government Sewerage Policy* dataset (DPLH 2021) indicates that the site is identified as a sewage sensitive area. This is due to the following causes:

- Estuary catchments on the Swan and Scott Coastal Plains (red hatch lines)
- Within 1 km of significant wetlands (green shaded)
- The subsoil geological profile is sand clay loam or clayey sand.
- The site has shallow groundwater/perched water.
- The groundwater gradient is unknown or seasonably variable.

Extract of the Sewage Sensitive Areas Map is shown in **Figure 5**.

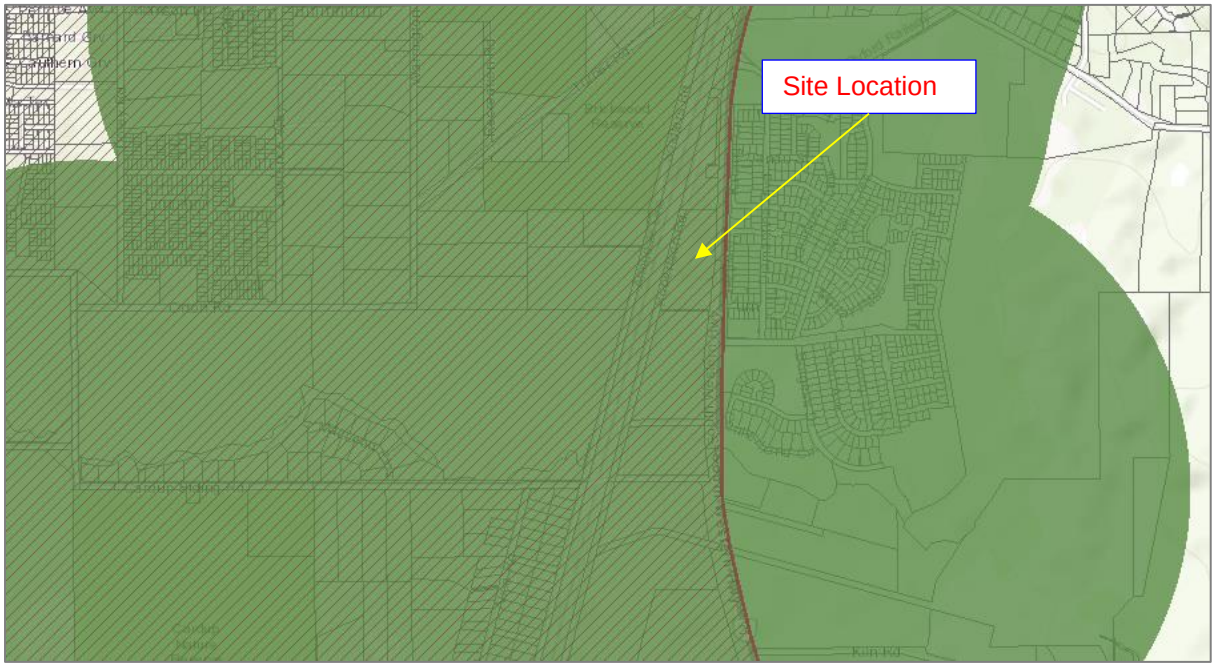

Figure 5. Extract of Sewage Sensitive Areas Map

2.8 Public Drinking Water Source Areas

Publicly available Public Drinking Water Source Area (PDWSA) mapping indicates that the site is not located within or adjacent to any declared PDWSA (DWER 2021d). The nearest PDWSA is the Wungong Reservoir/Dam.

The Wungong Brook Catchment Area boundary is located approximately 5 km east of the site, i.e., >100 m separation, OK. Extract of the PDWSA Map is shown in **Figure 6**.

Figure 6. Extract of PDWSA Map (Source: Dept. of Water Maps)

2.9 Flood Potential

Figure 6 shows the DWER flood mapping for the site with floodplain and flood fringe zone.

The 1 in 100 (1%) annual exceedance probability (AEP) flood is typically recommended as the defined flood event (DFE) for land use planning and development controls in Western Australia.

The site is located outside of the defined flood event (DFE) floodplain. However, a minimum building floor level of 0.50 m above the adjacent DFE flood level is recommended.

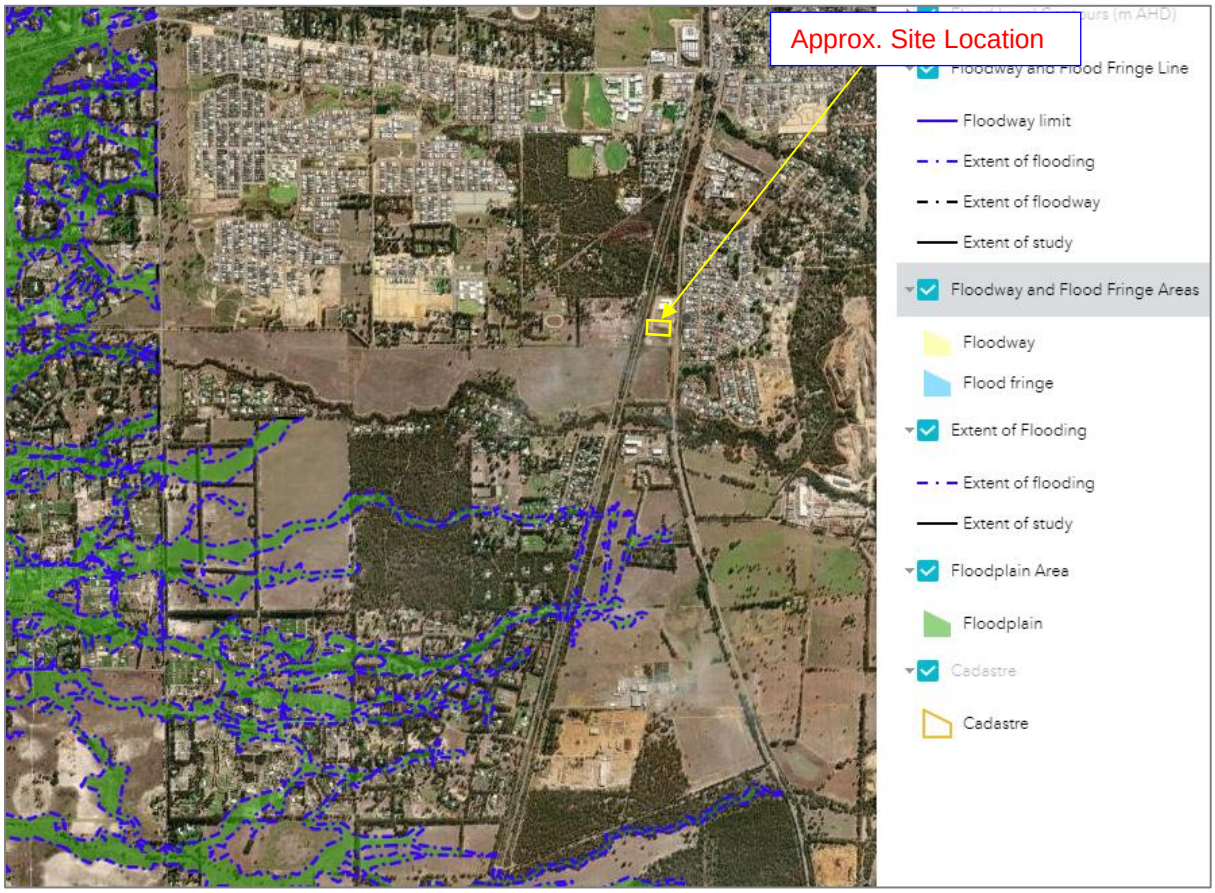

Figure 7. Floodplain Mapping for the Site (Ref. DoW online Maps)

2.10 Hydrology

A review of published data was used to assess any possible constraints about the site, and then to make recommendations of appropriate wastewater treatment and land application areas (Ref. SSE Report (2021 by Water Installations). In particular, the Government Sewerage Policy (GSP) requires that an onsite sewage system is not to be located within any area subject to inundation and/or flooding in a 10 percent Annual Exceedance Probability (AEP) rainfall event.

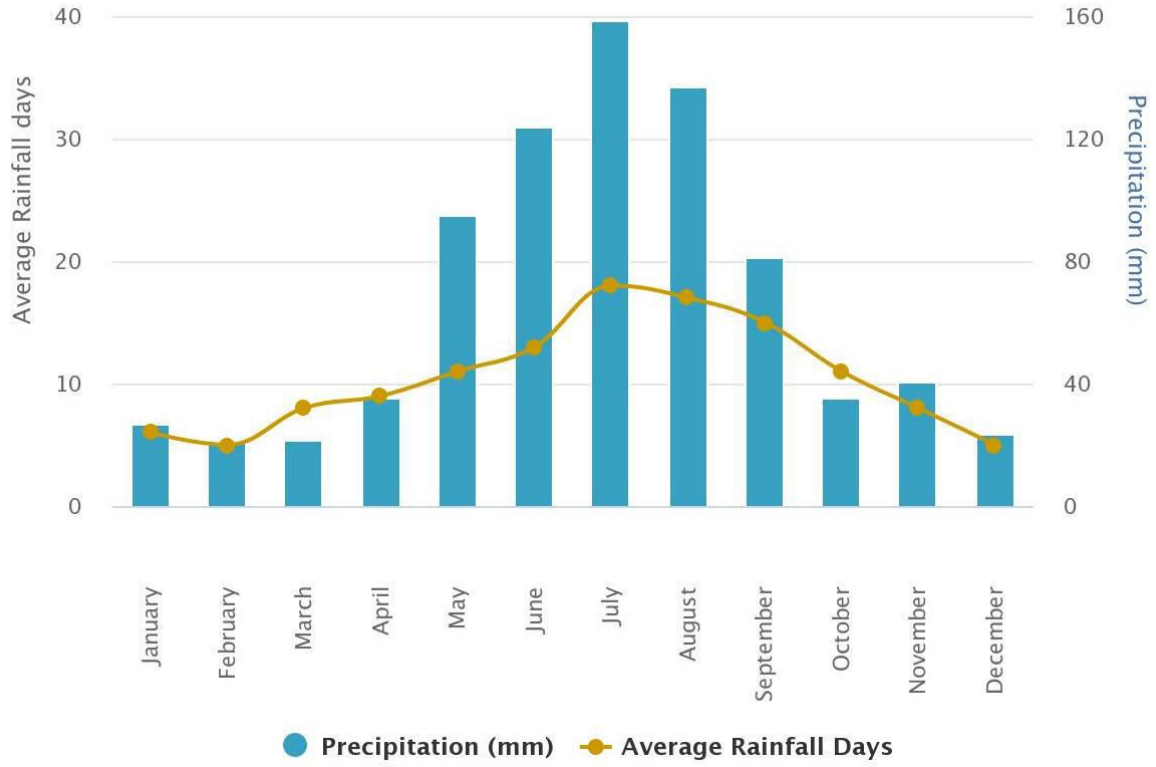

Figure 8. Annual Rainfall for Byford.

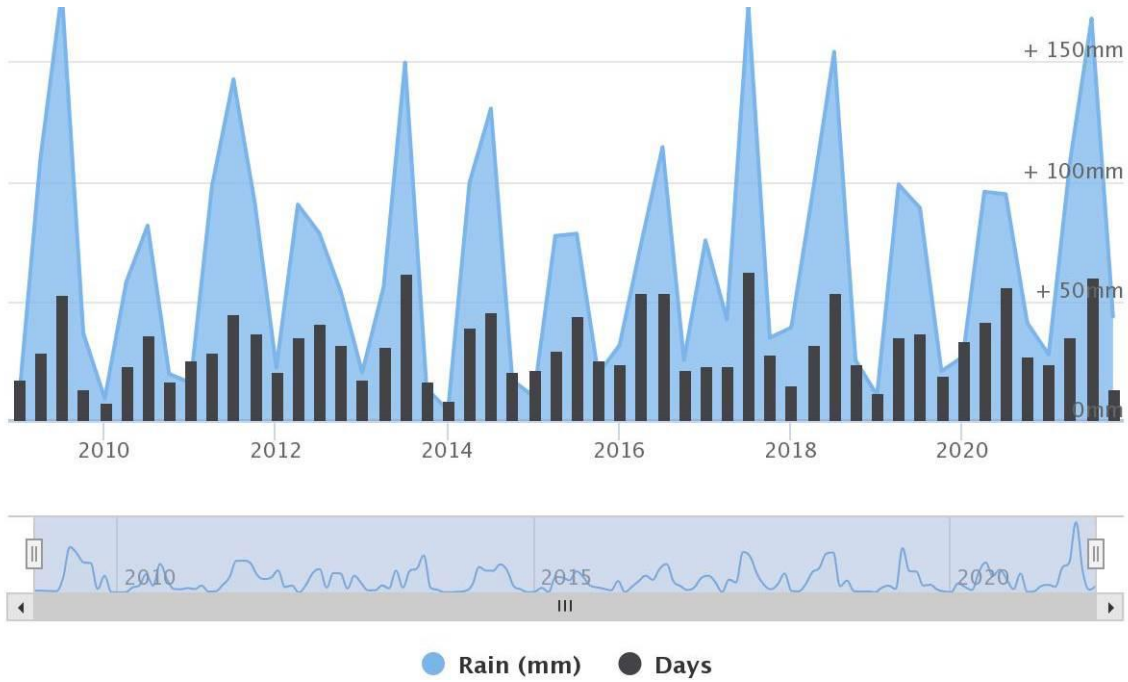

Figure 9. Typical rainfall amount and rainy days for Byford

Byford Long-Term Averages

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Mean Max (°C)	31.4	31.5	29.6	25.8	22.0	19.1	18.0	18.7	20.2	22.9	26.4	29.3	24.5
Mean Min (°C)	16.8	17.1	15.6	12.5	9.3	7.5	7.1	7.3	8.3	9.9	12.7	14.8	11.5
Mean Rain (mm)	15.8	18.1	17.2	42.0	105.9	151.6	174.8	127.4	84.4	47.8	28.6	10.4	812.6
Mean Rain Days	2.5	2.4	3.9	7.3	12.3	15.4	17.9	15.7	13.6	9.0	6.1	3.3	108.9

Figure 10. Long-term Climate Averages for Byford

From **Figures 8, 9 and 10** it is clear that most rainfall falls in winter but rainfall does fall in every month, and this pattern is consistent from year to year. Furthermore, even in winter, the number of rainy days does not exceed 18 or about two-thirds of each month. Annual rainfall 812 mm, number of rainy days = 109.

Data for floodplain mapping, the groundwater map (Dept Water website) and Sewage sensitive areas (Dept Planning, Lands and Heritage) are shown in the previous subsections.

IFD Design Rainfall Depth (mm)

Issued: 23 November 2021

Rainfall depth for Durations, Exceedance per Year (EY), and Annual Exceedance Probabilities (AEP).
FAQ for New ARR probability terminology

Table | Chart

Unit: mm

	Annual Exceedance Probability (AEP)						
Duration	**63.2%**	**50%#**	**20%***	**10%**	**5%**	**2%**	**1%**
1 min	1.85	2.04	2.68	3.14	3.61	4.26	4.79
2 min	3.26	3.57	4.58	5.31	6.07	7.11	7.96
3 min	4.36	4.78	6.17	7.18	8.21	9.64	10.8
4 min	5.26	5.78	7.51	8.75	10.0	11.8	13.2
5 min	6.02	6.63	8.65	10.1	11.6	13.7	15.3
10 min	8.68	9.62	12.7	14.9	17.1	20.2	22.7
15 min	10.5	11.6	15.3	17.9	20.6	24.4	27.4
20 min	11.8	13.1	17.2	20.2	23.2	27.5	30.8
25 min	12.9	14.3	18.8	22.0	25.3	29.9	33.6
30 min	13.9	15.4	20.2	23.6	27.1	32.0	36.0
45 min	16.3	17.9	23.4	27.3	31.4	37.1	41.7

Figure 11. Rainfall depth for duration for Annual Exceedance Probabilities (AEP)

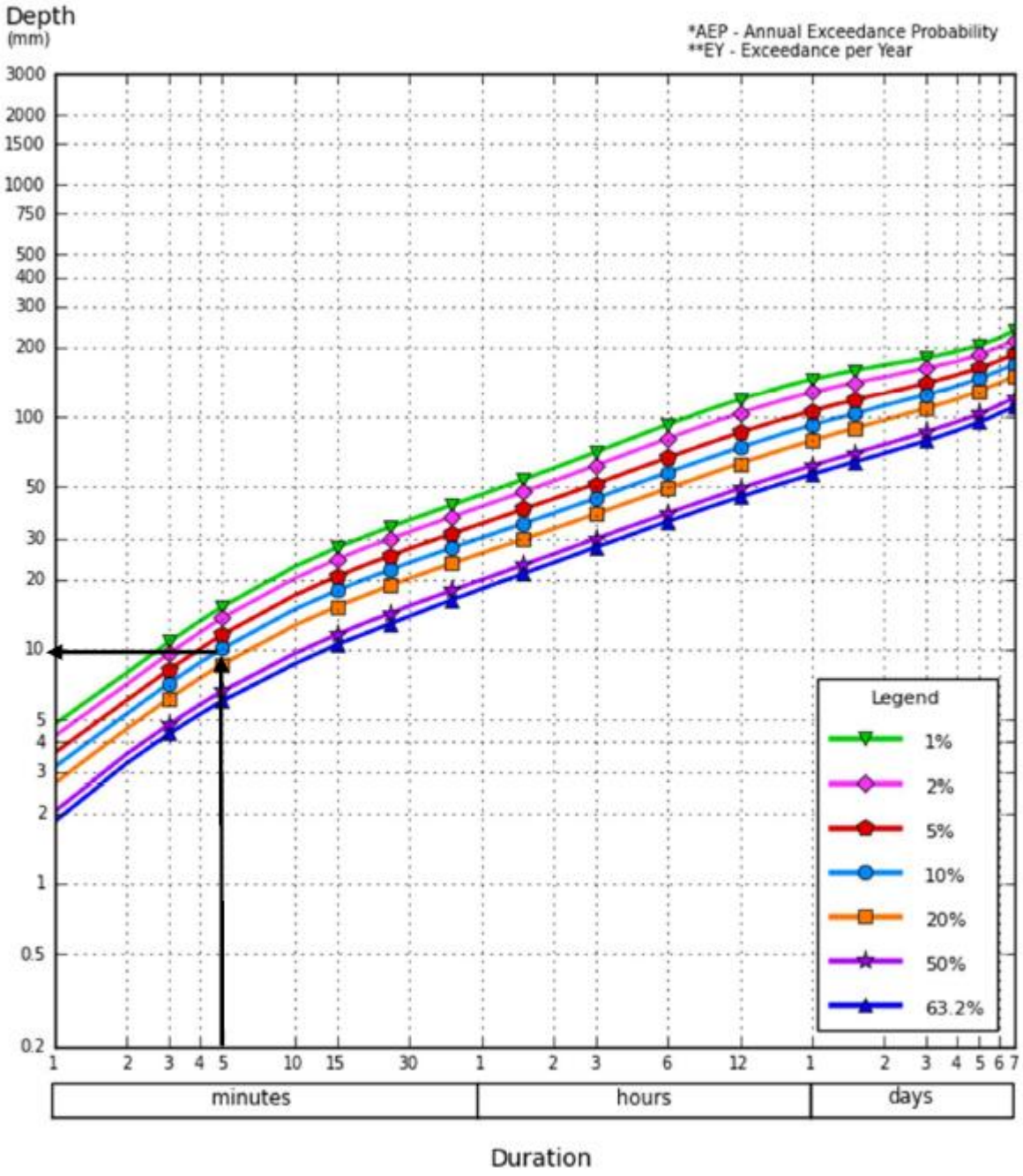

Figure 12. Graph of Design Rainfall Depth (mm) at various AEP levels

Peak flows for various ARI events - the Intensity Frequency Duration (IFD) data - for Byford is shown in **Figures 11 and 12**. Taking the duration as 5 minutes and the probability of a severe rainfall event as 10% (AEP 10), then the graph and table suggest a Design Rainfall Depth of about 10 mm. This is consistent with the anticipated maximum rainfall intensity for Byford. Maximum rainfall about 175 mm for July = 9.7 mm/day average for the 18 rain days in that month.

Given an AEP of 10% and storm duration of 5 minutes then the anticipated rainfall intensity is 121 mm/hr as calculated below. Using this value and the runoff coefficient for a grassed area (**Figure 13**) then a runoff flow value can be calculated. The catchment area is deemed to be about the size of the LAA so that the impact of a severe rainfall event can be determined.

Rainfall intensity = Design rainfall depth (mm)/ Duration (hrs)

Where, Duration = 5 mins = 0.0833 hr, and Rainfall depth = 10.1 mm.

- Rainfall Intensity = 10.1/0.0833 = 121 mm/hr.

COEFFICIENT OF RUNOFF = RUNOFF / RAINFALL

SOIL TEXTURE	COEFFICIENT OF RUNOFF
Concrete, Roof, or Asphalt	1.00
Clay – Bare	0.70
Clay – Light Vegetation	0.60
Clay – Dense Vegetation	0.50
Gravel – Bare	0.65
Gravel – Light Vegetation	0.50
Gravel – Dense Vegetation	0.40
Loam – Bare	0.60
Loam – Light Vegetation	0.45
Loam – Dense Vegetation	0.35
Sand – Bare	0.50
Sand – Light Vegetation	0.40
Sand – Dense Vegetation	0.30
Grass Areas	0.35

Runoff flow (L/s) = CIA/3600

Where, C = Coefficient of runoff, I = Rainfall Intensity (mm/hr), A = Catchment Area (m^2)

- C = 0.35 (grass areas),
- I = 121 mm/hr and
- A= 200 m^2 (one zone/half of proposed LAA)

- Flow = (0.35 x 121 x 200) /3600 = 2.35 L/s

With a slope of about 1%, the velocity of water movement across the sandy loam grassed-covered landscape would be about 1 m/s (assuming width of irrigation area 10 m and 10 mm depth of water).

This poses no threat to the land application area (LAA), as water will be able to drain away through the natural ground.

Figure 13. Runoff coefficients for soils and Runoff flow estimate.

2.11 Bush Forever and Wetlands

No records of Bush Forever and Wetlands sites found within the site.

2.12 Horizontal and Vertical Setback Distances

The siting plan of on-site wastewater system, setbacks is provided and shown on the site map in **Appendix A**. The horizontal distance to relevant features (e.g., property boundaries, watercourses, wetlands and other water bodies, buildings) from both proposed Aerobic Treatment Units (ATU) and LAA is shown in below **Table 1.** Vertical setback from PDWSA and sensitive water resource areas are shown in **Table 2**.

Table 1. Horizontal Setback Distances

Site Feature	Horizontal Setback (m)
Treatment tanks to buildings, property boundaries, driveways, paths and other tanks	1.2
Trenches, beds and soak wells to boundary, building, tanks and other land application systems	1.8
Trenches, 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

Site Feature	Horizontal Setback (m)
Trenches, beds and soak wells to subsoil drainage or open drainage channel (a separation of 100 m is required if there is discharge into a waterway or significant wetland without treatment of the discharge, see Section 5.2.2 of the Government Sewerage Policy 2019 (GSP))	6.0
Spray Irrigation: • Boundaries, buildings, driveways etc • Sub-soil and open drain • Swimming pool • Treatment tanks	 1.8 6.0 3.0 1.2
Subsurface Dripper: • Boundaries, buildings, treatment tanks, driveways etc • Sub-soil and open drain • Swimming pool • Garden bore	 0.5 3.0 2.0 10.0
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.	

Note: GSP= Government Sewerage Policy 2019.

Table 2. Vertical Setback Distances

Site Feature	Vertical Setback Distance(m)
Discharge point of the on-site wastewater system to the highest known groundwater level: • PDWSA • Sensitive water resource areas • All other areas - ○ Sands ○ Gravels ○ Loams and heavy soils	 2.0 1.5 1.5 1.0 0.6
Hardpan or bedrock (depends on quality of treated wastewater and type of LAS)	0.6-1.5

2.13 Available Land Application Area (LAA)

The size of the land application area was determined in accordance with the conversion factors prescribed in Table 2 and AS/NZS 1547 On-site domestic wastewater management as follows:

- Hydraulic load (L/day) = occupancy rate (persons) x design loading rate (L/person/day)
- Land application area (m^2) = hydraulic load (L/day) x conversion factor (ref. Table 2 of GSP2019).

Corresponding Hydraulic Loading and LAA for the adopted dwelling types is presented in **Sections 4.1** and **4.3.**

3.0 SOIL ASSESSMENT

3.1 General

Perth Geotechnics (PG) undertook a geotechnical investigation at the 'Land Application Area (LAA)' of the site on 1 March 2023. The geotechnical site investigation plan is included in **Appendix A** and Borehole (BH) logs and Field permeability or Infiltration Test (FPT) report are included in **Appendix B**.

The geotechnical site investigation comprised of following:

- Drilling of hand auger boreholes at 3 locations (BH1 to BH3), extending to depth of 2 m or refusal or hole collapse;
- 1 x Field Permeability Test (FPT1) was undertaken at 1 m bgl at the proposed leach drain area of the site.
- Collection of soil samples for laboratory testing.

The following sections describe soil's texture, categories, permeability and physical and chemical characteristics based on the investigation data.

3.2 Inferred Ground Conditions, i.e., Soil Layers

The following generalised subsurface profile for the Land Application Area (LAA) was inferred based on the SSE investigation data:

- **Gravelly Clayey Sand (SC)** – fine to medium grained, grey at topsoil, yellowish brown, orange, loose to medium dense, low to medium plasticity clay fines, with fine to coarse grained gravel, extending from the surface to a depth of between 1.2 m and 1.4 m, overlying,
- **SAND (SP)** - fine to medium grained, yellowish brown, grey, yellow, trace gravel, extending to the maximum investigated depth of 2.0 m

3.3 Groundwater Level and Vertical Setback Distance

During the time of site investigation in March 2023, water was encountered in all 3 BHs at a depth of between 1.8 m and 1.9 m below ground level. However, the water level can be fluctuated subjected to seasonal changes, water recharge and pump out, rainfall, dry, flood etc events.

SSE Report prepared by Water Installations Pty Ltd dated 2 December 2021 on 'Lot 128 (sublot 2) South Western Highway, Byford' encountered groundwater at a depth of between 1.5 m in natural ground and at 2.2 m in fill area.

Based on the foregoing discussions, PG recommends to adopt the depth of static groundwater table (GWT) at 1.5 m below existing ground level. Vertical setback distance of 1.5 m from the disposing point of the treated effluent is satisfied. This means, further backfilling of the existing ground surface will not be required.

The site was observed to be developed in an engineered way maintaining its grades and levels. The site was assessed to be protected from any 1% AEP flood and 10% AEP flood events that is caused by rainfall.

3.4 Impact on Hydrology and Environmental Values:

If the required horizontal offsets as referred in Table 1 and vertical setback distance of 1.5 m from the disposing point of the treated effluent are maintained, the resultant impact on hydrology and environmental values were assessed to be minimal or none.

3.5 Inferred Soil Properties

Soil properties for the site were inferred on the basis of the site investigation data, generalised subsoil units and are presented in **Table 3.**

Table 3. Inferred Geotechnical Design Parameters for Generalised Subsoil Model

Depth (m)	Soil Layer Description	γ (kN/m^3)	c_u/c' (kPa)	ϕ' (°)	E_u/E' (MPa)	k (m/day)
0 – 1.4	Clayey SAND(SC) - Loose to Medium dense	19	-	32	-/15	0.63
1.4 – 2.0	Sand (SP) -Medium dense	19	-	34	-/25	0.63

Notes:

γ = Bulk unit weight of soil, c_u = Undrained shear strength, c' = drained cohesion, ϕ' = Effective friction angle, E_u & E' = Undrained and Drained Young's Modulus, k = Coefficient of Permeability.
Depth and thickness provided in the table should be considered as valid for a generalised subsoil model only. BH logs can be reviewed for better understanding.

3.6 Soil Characteristics from Laboratory and Field Test Data

Infiltration testing was conducted at 1 location using a Guelph Permeameter constant head method by PG and is summarised in **Table 4**.

Table 4. Summary of Field Permeability Test Results

Permeability Test ID	Test Depth (m)	Soil Description	Average Permeability Rate	
			cm/sec	m/day
FPT1 (Geotech Investigation)	1	Sand/ Clayey Sand	7.3×10^{-4}	0.63

It should be noted that the test was done on the surficial soil layer. The coefficient of permeability or hydraulic conductivity tested on sand/ clayey sand layer was 0.63 m/day.

Soil Chemical Characteristics for SSE were tested in laboratory and presented in **Table 5.** Chemical laboratory test results are included in **Appendix C**.

Table 5. Summary of Chemical Test Results

Sample ID	Soil Type	pH	EC, (µS/cm)	Sodicity (%)	Phosphorus adsorption (mg P/kg)
BH1(1-1.2 m)	Clayey Sand (SC)	8.6	134	0.9%	1650

Note: EC = Electrical Conductivity (salinity), Sodicity = Exchangeable Sodium Percentage – ESP, P-sorption =Phosphorus adsorption.

Soil Chemical Characteristics for SSE are interpreted as follows:

- pH values are greater than 5, which indicate that tested soils are alkaline soil.
- Electrical Conductivity (salinity) value of 134 µS/cm indicates to be an equivalent freshwater (i.e., <1500 µS/cm).
- The sodicity (= Exchangeable Sodium Percentage – ESP) of the tested sample reported to be 0.9%. An ESP of 15% is generally recognised as a limit above which the soils are characterised as sodic (alkali) (Richards, 1954). The higher level soidicity (>15%) may cause soil structural degradation, waterlogging and reduced permeability. The test results showed ESP of less than 15%. That means sample shows no sodicity hazard (i.e., none to slight).
- The tested soil sample have P-sorption (Phosphorus adsorption) capacity of 1650 mg/kg, which is considered to be high. The higher P-sorption value, i.e., P-sorption>450 mg/kg, indicates that the soil can absorb excess phosphorus not taken up by plant. The effectiveness of this depends not only on sorption capacity but also, the depth and permeability of the soil and current saturation level.

Soil Phosphorus Retention Index (PRI) test results are presented in **Table 6**. Phosphorous Retention index (PRI) is the ratio of adsorbed phosphorus to the equilibrium concentration. Phosphorus is extracted using KCl and determined colourimetrically. Result value is used to calculate PRI as per Allen and Jefferey.

Table 6. Phosphorus Retention Index (PRI) Test Results

SL No.	Sample ID	Soil Type	Phosphorus Retention Index (PRI)
1	BH1(1-1.2 m)	Clayey Sand (SC)	230

The results of the soil chemistry testing and the values associated with level of constraint (as outlines in AS1547-2012) are presented in **Table 7.**

Table 7. Soil Chemistry Summary

Chemical Feature	SSE Test Results	Level of Constraints/Risk (AS1547[1])		
		Low	Medium	High
pH	8.6	6 - 8	4.5 - 6	<4.5, >8
Electrical Conductivity (dS/m)	0.134	<0.3	0.3 - 2	>2
Phosphorus Retention Index (PRI)[1]	230	>20	5 - 20	<5

Note 1: Phosphorus Retention Index (PRI) requirements are based on our interpretation of the Department of Primary Industries and Regional Development Standards for Land Resource Mapping (2005), as this is not specified in AS1547.

- Phosphorus Retention Index (PRI) and electrical conductivity values indicate '**Low**' level of site constraint and pH value indicates '**High**' level of site constraint.

The results summarised in **Table 7** and in above dot points indicate a "**Low to High Risk**" to the site on the basis of pH, Phosphorus Retention Index (PRI) and electrical conductivity potential. The soil onsite or at the LAA will not require any treatment or improvement. If any imported backfill material is required to further raise the site, the backfill should be comprised of SAND with a minimum PRI of 20.

3.7 Soil's Texture, Categories and Permeability

The site is underlain by Gravelly Clayey Sand (SC) and Sand (SP). According to AS/NZS 1547-2012, soil's texture, categories and permeability are estimated and presented in **Table 8.**

Table 8. Soil's Texture, Categories and Permeability

Item	Values/ Classification
Soil-terrain Unit	Gravelly Clayey Sand – Flat to slightly sloped
Soil Category	3
Soil Texture	Sandy Loam or loam
Soil Structure	Weakly structured or massive
Indicative Permeability (m/day)	0.50 to 1.50 *(Insitu test results = 0.63 m/day)*
Clay Content	10% - 25%
Abundance of coarse fragments	Common, 10% - 25%
Size of coarse fragments	Fine to Coarse gravel, 2-30 mm.

3.8 Concluding Remarks

The soil-terrain unit determined for the site is Gravelly Clayey Sand – flat to slightly sloped and **Soil Category of 3**. The site has shallow groundwater. Prevention of groundwater pollution can be achieved through special design of the sewage system as per the recommendations of AS 1547.

Based on the above soil assessment and through provision of the setbacks and the additional considerations for the shallow groundwater, the site is able to accommodate on-site sewage treatment and disposal system.

4.0 SEWAGE MANAGEMENT

4.1 Expected Sewage Volume

The expected hydraulic loads for various land uses are detailed in the fact sheet: *Supplement to Regulation 29 – Wastewater system loading rates* (DoH 2019b). The rate of 10 L/day per worshipper has been adopted for calculations in this SSE based on the published rates from the Department of Health (DoH) which corresponds to a day-only occupant. The sewage disposal system for the site will be designed to accommodate this loading. This is in line with the approach outlined in the *Government Sewerage Policy* (DPLH 2019) which advocates a conservative approach and AS 1547 which requires design of the sewage disposal system to be able to manage the hydraulic load during peak occupancy. The following hydraulic loading (sewage volume) has been estimated for the proposed Church Building. It has been estimated that the church building will facilitate 300 people.

Table 9. Estimated Hydraulic Loading

User Type	Number of Person	L/person/day	Total
Place of Worship (no meal)	300	10	3,000
Allowance for Effluent from Sink in Tea Prep Area & Sunday service	1	300	300
Total			**3,300 Lpd**

An onsite sewage management system in the lot is required to be designed and commissioned to treat a minimum of 3,300 litres of sewage per day.

Recommended system size is 4,000 L (=4KL).

4.2 Appropriate Treatment Technology and Onsite Sewage Management Systems

As discussed in **Section 2.7**, the site is situated within a sewage sensitive area. The *Government Sewerage Policy* (DPLH 2019) mandates that where on-site disposal is proposed within a sewage sensitive area that **a secondary treatment system** (such as an Aerobic Treatment Units (ATUs)) with nutrient removal capability is to be used. The performance requirements of primary treatment systems and secondary treatment systems with nutrient removal are described in Section 7 of the *Government Sewerage Policy* (DPLH 2019).

Secondary treatment systems must be approved by DoH for use in Western Australia. An online list of currently approved systems, including those approved for nutrient removal, is maintained by DoH (2021). It is expected that due to the total capacity that the treatment units are required to accommodate, a custom-built commercial treatment system will need to be used. This system will need to be approved for use by DoH as a secondary treatment system with nutrient removal and follow the requirements as detailed within this SSE.

As the site is experiencing high groundwater level and is underlain by **Category 3** Sandy Loams (see **Section 3.6**), the disposal system should be specially designed to prevent groundwater pollution as per the recommendations of AS-NZS 1547. As per *Government Sewerage Policy* (GSP, DPLH 2019) a vertical setback distance of 1.5 m from the groundwater is required for disposing the treated effluent.

A **4 KL ATU** system is recommended to allow for any shock loads or other issues that occasionally arise. Flatbed leach drains may be appropriate for this site as a disposal option. If needed, the LAA can be raised (say backfilled approximately 300 mm with SAND) to maintain a vertical setback distance of 1.5 m from the groundwater to the bottom of the embedded flatbed cells.

Effluent dosing by a pumped distribution system should be used to minimise groundwater pollution risk. Other risk mitigation approaches should be adopted where possible, which may include amendment of receiving soils and planting of vegetation with high nutrient requirements.

Secondary treatment systems are to be installed and operated in accordance with the *Health Regulations 1974 (Treatment of Sewage and Disposal of Effluent and Liquid Waste)*, the *Code*

of Practice for the Design, Manufacture, Installation and Operation of Aerobic Treatment Units (DoH 2015) and AS 1547 (Standards Australia and Standards New Zealand 2012). Treatment systems must be serviced by an authorised service person on a regular basis (usually quarterly) as per the conditions of product approval issued by DoH.

4.3 Hydraulic/Design Loading Rate (DLR)

From AS/NZS 1547: 2012, Tables L1 and M1, loading rate for Soil Category 3, weakly structured sandy loams are:

- Design Loading Rate (DLR) for Trenches and beds (Table L1) = 30 mm/d for Secondary Treated Effluent.
- Design Irrigation Rate (DIR) for Drip or spray irrigation (Table M1) = 4 mm.

4.4 Land Application Area (LAA) Requirements

The land application area is the area where the treated sewage from a treatment system (primary and/or secondary) is applied into or onto the ground. Land-application systems typically either discharge treated sewage via soil absorption systems (e.g., flatbed leach drains) or irrigation systems (e.g., subsurface irrigation or surface irrigation). The method by which treated sewage is dispersed to the land should be determined based on this site conditions and may influence the land area required for disposal.

The calculation of the minimum required land disposal area is described in Schedule 2 of the *Government Sewerage Policy*. Calculation of the land disposal area is determined by multiplying the estimated hydraulic load (see **Section 4.1**) by a conversion factor. The appropriate conversion factor is determined by selection of the proposed treatment type and the soil category (Table 2 of Schedule 2 from the *Government Sewerage Policy*). The land disposal area when other methods of application are proposed is calculated based on loading rates defined for varying systems in AS 1547 (Table 5.2).

The following outlines options for the wastewater irrigation systems. These are provided as examples of appropriate system sizing.

- Anticipated daily volume = 3,300 L

Based on the results of the site and soil assessment, Health Regulation 49 that describes the surface area of drains and the calculations listed above, the overall land capability of the proposed onsite sewage system is as follows:

<u>ATU or STS</u>

A 4 KL ATU system is recommended to allow for any shock loads or other issues that occasionally arise.

- For a 4 KL ATU system installation, an area of 8.5 m x 2.5 m will be required for a primary tank, secondary aeration tank and a clarification & discharge tank.
- Total Area required = 8.5x2.5 = 22 m^2.

<u>Dripline Irrigation Option:</u>

- Area = 3300 ÷4 = 825 m^2.

<u>Leach Drains Option:</u>

- 3300÷ (1.5x30) = 74 m. Assumed DLR = 30 mm/d, SA drains 1.5 m^2. Proposal of 4 drains of 20 m length, 1.8 m separation between drains.
- Total Area required = 20x(1.5x4+1.8x3) = 228 m^2.

Flatbed Leach Drain Option:

- 3300 ÷ (30 x 2.1) = 53m. Assumed DLR = 30 mm/d. Proposal of 4 bed x 15 m long. Flatbed Leach Drains are 2.1 m wide and requires 1.8m separation between each bed.
- Total Area required = 15x(2.1x4+1.8x3) = 207 m^2.

As conventional leach drains require greater depth of burial and have a smaller surface area, the space restriction (width-wise) may be a limiting factor. Furthermore, there may not be enough vertical separation from the water table. Flatbed drains are a better proposition as their wider dimensions and will fit in the allocated space. There doesn't appear to be enough landscaping area for dripline due to the mount of infrastructure proposed.

- Estimated Land Application Area (**LAA**) for the 4 KL ATU system plus the 4 Flatbeds = 22 m^2 + 207 m^2 = **229 m^2** (excluding setbacks requirements).

4.5 Capability of Land to Accommodate Sewage Application

The site size is approximately 3,466 m^2

The land area required for on-site disposal of treated sewage is **229 m^2** (excluding any setbacks requirements) as detailed in **Section 4.4**. The disposal area will be able to be accommodated within the lot area.

Site plan with exclusions zone is presented in **Appendix A.**

The provision of the required disposal area which will be located above the identified groundwater setbacks and use of secondary treatment units with nutrient retention and other groundwater pollution risk mitigation approaches will ensure that sewage can be safely effectively treated and disposed of within the site.

4.6 Cumulative Impacts

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 have a low density of development. And therefore, the cumulative impacts of the (similarly zoned) catchment are considered to be low.

Based on the assessment and approach described in this SSE, the potential cumulative impact of effluent management in the catchment, as an extrapolation of the strategy proposed for the site, is considered to be low.

4.7 Monitoring and Maintenance

The Code of Practice for the Design, Manufacture, Installation and Operation of Aerobic Treatment Units (DoH 2015) details minimum standards for the design, manufacture, installation and operation of secondary treatment and application systems (i.e., ATUs), and provides guidance to local government as to how to assess the installation and ongoing operation requirements. Adherence to the Code is considered to be sufficient to ensure the risks associated with treatment and application of sewage on-site are mitigated.

The Government Sewerage Policy notes that the State adopts a 'cautious approach' to the use of secondary treatment systems (DPLH 2019). A small number of studies and surveys have identified difficulties associated with the installation, maintenance, auditing and education requirements associated with secondary treatment system implementation (McGrath et al. 2015). If unchecked, these difficulties can increase the risk of system failure and subsequent health and environmental hazards.

The applicant will be responsible for the installation, maintenance and monitoring of the sewage system, which will be completed in compliance with The Code of Practice for the Design, Manufacture, Installation and Operation of Aerobic Treatment Units and other relevant guidelines and policies.

It is expected that an appropriate auditing procedure will be implemented by the Shire of Serpentine Jarrahdale to ensure maintenance of secondary treatment system is occurring as required. Treatment system manufacture and installation companies typically offer an annual maintenance service with a certificate of completion that can be provided to demonstrate compliance. The owner of the system is responsible for continuing maintenance and providing any required documentation to the Shire for auditing.

4.8 Conclusions

The sewage management strategy for the site, as outlined in this SSE report, has been developed to be consistent with the approach and requirements detailed in the Government Sewerage Policy (DPLH 2019) and AS/NZS 1547 On-site domestic wastewater management (Standards Australia and New Zealand 2012). The approach for sewage management within the site includes:

- Using a secondary treatment system with nutrient removal.
- Appropriate sizing of land disposal area based on geotechnical studies, water balance for zero storage and classification of the one soil-terrain unit.
- Ensuring sufficient space is available for treated sewage application within the site.
- Special design of the disposal system to reduce any risk of groundwater pollution as per AS 1547.
- Setting the disposal point of the system at 1.5 m higher than the average groundwater level or probable perched water.
- Locating the sewage system such that it is not subject to inundation within a 10% AEP rainfall event.
- Providing the appropriate setbacks for systems outlined in **Section 2.11**, where applicable.
- Ensuring appropriate installation, monitoring and maintenance of systems is conducted.

The above management responses demonstrate that the site is able to accommodate the on-site treatment and disposal of sewage within the site, and that this can be achieved in a way that mitigates potential risks to receiving environments or the public.

5.0 REFERENCES

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Perth Geotechnics

APPENDIX – A

Site Development GA Plan and SSE Investigation Plan

Perth Geotechnics
ABN: 74 660 182 061
Tel: 08 6396 2675; M: 0430 130 677
PO Box 165, Gosnells WA 6990
E: info@perthgeotechnics.com.au
www.perthgeotechnics.com.au

Project: Site Soil Evaluation (SSE)
Location: Lot 4, Robertson Road, Byford WA

Client: Parson Group Pty Ltd

Reference: SSE188823PG | **Scale:** N.T.S.

Date: 17/03/2023 | **Drawn By:** MH

Site Plan:
Bore Hole (BH) and Field Permeability Test (FPT) Locations

Drawing No.: 188823_Rev0

Perth Geotechnics

APPENDIX – B

SSE Investigation BH logs & Permeability Certificates

Perth Geotechnics

BORE HOLE LOG

Perth Geotechnics
ABN: 74 660 182 061
Tel: 08 6396 2675; M: 0430 130 677
PO Box 165, Gosnells WA 6990
E: info@perthgeotechnics.com.au
www.perthgeotechnics.com.au

Reference:	SSE188823PG	**Client:**	Parson Group Pty Ltd
Project:	Site Soil Evaluation (SSE)	**Bore Hole ID:**	BH1
Location:	Lot 4, Robertson Road, Byford WA	**Date Commenced:**	1/03/2023
Easting:	50 406 218 **Co-ordintes:** GDA94	**Equipment Type**	Machine Auger
Northing:	6 433 026	**Logged By:**	MH
Sampling Type:	B - Bulk Sample	**Checked By:**	SI

Scale (m)	Depth (m)	GWT (m)	Sampling Type/Depth	Graphic Log	UCS Symbol	Sample ID	Soil Description	Moisture Condition	Density	Remarks/Field observations
					SP		**Gravelly SAND-** fine to medium grained, grey, pale brown, with gravel up to 30mm (FILL)	D		
	0.15				SC		**Gravelly Clayey SAND-** fine to medium grained, yellow, yellowish brown, orange, low to medium plasticity, with gravel up to 25mm	D-SM		
	0.5									
	0.6									
1.0			BH1					SM		
	1.2									
	1.25				SP		**SAND-** fine to medium grained, dark grey, grey, with few gravels			
	1.5						changes colour to yellowish brown, yellow, grey	M-W		
	1.8	▽					groundwater was encountered			
2.0							**Terminated at the target depth of 2.0m**			
3.0										
4.0										
5.0										

Remarks:
Sampling Type:
B - Bulk Sample (/Disturbed),
U - Undisturbed Sample

Moisture Condition:
D - Dry, **M** - Moist, **W** - Wet
SM- Slightly Moist
▽ **= Water Table**

Density:
VL = Very Loose, **L** = Loose,
MD = Medium Dense
D = Dense, **VD** = Very Dense

VS = Very Soft
F = Firm
St = Stiff

VSt = Very Stiff
H = Hard
R = Refusal

Perth Geotechnics

BORE HOLE LOG

Perth Geotechnics
ABN: 74 660 182 061
Tel: 08 6396 2675; M: 0430 130 677
PO Box 165, Gosnells WA 6990
E: info@perthgeotechnics.com.au
www.perthgeotechnics.com.au

Reference:	SSE188823PG	**Client:**	Parson Group Pty Ltd
Project:	Site Soil Evaluation (SSE)	**Bore Hole ID:**	BH2
Location:	Lot 4, Robertson Road, Byford WA	**Date Commenced:**	1/03/2023
Easting:	50 406 211 **Co-ordintes:** GDA94	**Equipment Type**	Machine Auger
Northing:	6 433 029	**Logged By:**	MH
Sampling Type:	B - Bulk Sample	**Checked By:**	SI

Scale (m)	Depth (m)	GWT (m)	Sampling Type/Depth	Graphic Log	UCS Symbol	Sample ID	Soil Description	Moisture Condition	Density	Remarks/Field observations
					SP		**Gravelly SAND-** fine to medium grained, grey, pale brown, grey, with gravel up to 30mm (FILL)	D		
	0.25				SC		**Gravelly Clayey SAND-** fine to medium grained, yellow, yellowish brown, orange, low to medium plasticity, with gravel up to 25mm	D-SM		
	0.5									
1.0								D-SM		
	1.2				SP		**Gravelly SAND-** fine to medium grained, brown, grey, with gravel up to 30 mm			
	1.5							M-W		
	1.6						changes colour to yellowish brown, yellow, grey			
	1.9	▽					groundwater was encountered			
2.0							**Terminated at the target depth of 2.0m**			
3.0										
4.0										
5.0										

Remarks:
Sampling Type:
B - Bulk Sample (/Disturbed),
U - Undisturbed Sample

Moisture Condition:
D - Dry, **M** - Moist, **W** - Wet
SM- Slightly Moist
▽ = **Water Table**

Density:
VL = Very Loose, **L** = Loose,
MD = Medium Dense
D = Dense, **VD** = Very Dense

VS = Very Soft
F = Firm
St = Stiff

VSt = Very Stiff
H = Hard
R = Refusal

Perth Geotechnics

BORE HOLE LOG

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ABN: 74 660 182 061
Tel: 08 6396 2675; M: 0430 130 677
PO Box 165, Gosnells WA 6990
E: info@perthgeotechnics.com.au
www.perthgeotechnics.com.au

Reference:	SSE188823PG	**Client:**	Parson Group Pty Ltd
Project:	Site Soil Evaluation (SSE)	**Bore Hole ID:**	BH3
Location:	Lot 4, Robertson Road, Byford WA	**Date Commenced:**	1/03/2023
Easting:	50 406 203 **Co-ordintes:** GDA94	**Equipment Type**	Machine Auger
Northing:	6 433 036	**Logged By:**	MH
Sampling Type:	B - Bulk Sample	**Checked By:**	SI

Scale (m)	Depth (m)	GWT (m)	Sampling Type/Depth	Graphic Log	UCS Symbol	Sample ID	Soil Description	Moisture Condition	Density	Remarks/Field observations
					SP		**Gravelly SAND-** fine to medium grained, grey, pale brown, grey, with gravel up to 30mm (FILL)	D		
	0.3				SC		**Gravelly Clayey SAND-** fine to medium grained, yellow, yellowish brown, orange, low to medium plasticity, with gravel up to 25mm	D-SM		
1.0								D-SM		
	1.4				SP		**SAND-** fine to medium grained, yellowish brown, grey, yellow, with few gravels	M-W		
	1.5									
	1.9	▽					groundwater was encountered			
2.0							**Terminated at the target depth of 2.0m**			
3.0										
4.0										
5.0										

Remarks:
Sampling Type:
B - Bulk Sample (/Disturbed),
U - Undisturbed Sample

Moisture Condition:
D - Dry, **M** - Moist, **W** - Wet
SM- Slightly Moist
▽ = **Water Table**

Density:
VL = Very Loose, **L** = Loose,
MD = Medium Dense
D = Dense, **VD** = Very Dense

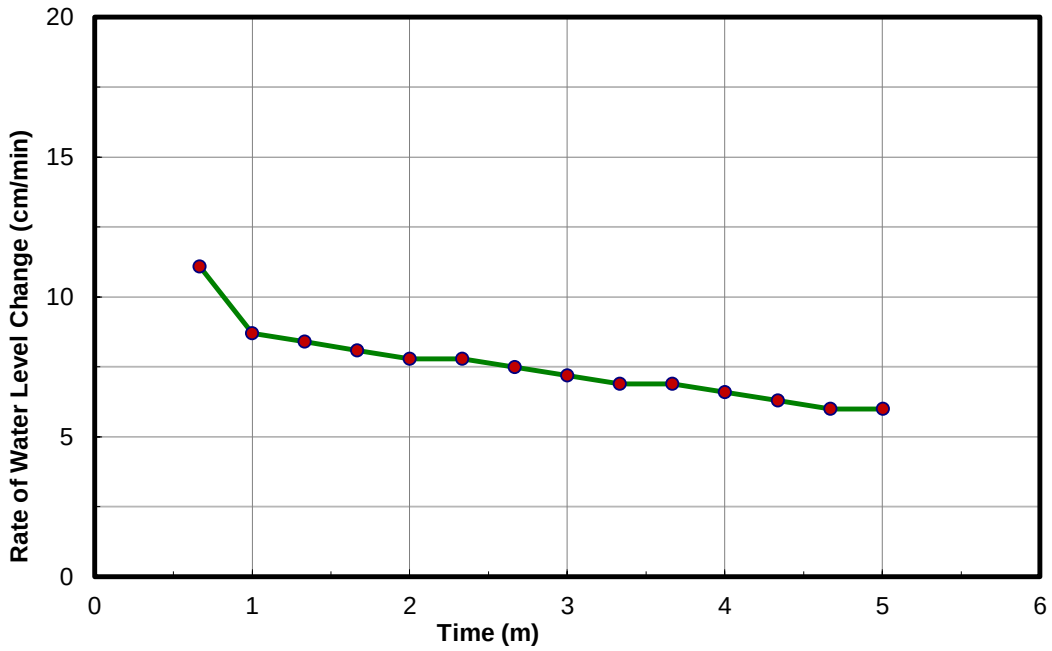
VS = Very Soft
F = Firm
St = Stiff

VSt = Very Stiff
H = Hard
R = Refusal

PERTH GEOTECHNICS

Test ID	FPT1	Reference	SSE188823PG
Project	Site Soil Evaluation (SSE)	Client	Parson Group Pty Ltd
Location	Lot 4, Robertson Road, Byford WA	Soil Type	Gravelly Clayey Sand
Co-ordinates	Easting: 50 406 207 Northing: 6 433 028	Test Depth	1.0 m below ground level
Instrument Name	Guelph Permeameter	Date Tested	1/03/2023

PERMEABILITY TEST CERTIFICATES
(ASTM D 5126-90)



Water Hydraulic conductivity K_{fs}: **7.3E-04** **cm/sec**

6.3E-01 **m/day**

Tested By: *Mohammad Amzad Hossain* Date: 10/03/2023

Perth Geotechnics
Tel: 08 6396 2675; M: 0430 130 677
PO Box 165, Gosnells WA 6990
www.perthgeotechnics.com.au

Perth Geotechnics

APPENDIX – C

Chemical Laboratory Test Certificates

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EP2302622**	Page	: 1 of 3
Client	: **PERTH GEOTECHNICS**	Laboratory	: Environmental Division Perth
Contact	: MOHAMMAD AMZAD HOSSAIN	Contact	: Customer Services EP
Address	: 19 SILKIE LINK PERTH SOUTHERN RIVER 6110	Address	: 26 Rigali Way Wangara WA Australia 6065
Telephone	: 63962675	Telephone	: +61-8-9406 1301
Project	: SSE188823 Lot 4, Robertson Road, Byford WA	Date Samples Received	: 02-Mar-2023 12:00
Order number	: 01	Date Analysis Commenced	: 07-Mar-2023
C-O-C number	: ----	Issue Date	: 13-Mar-2023 15:49
Sampler	: MOHAMMAD AMZAD HOSSAIN		
Site	: ----		
Quote number	: EN/222/18		
No. of samples received	: 1		
No. of samples analysed	: 1		

ilac-MRA NATA
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
Efua Wilson	Metals Chemist	Perth Inorganics, Wangara, WA

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.

- EK072 and EK072-AES conducted by ALS Sydney, NATA accreditation no. 825, site no 10911.
- 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	**BH1 = 1.0-1.2 m**	**----**	**----**	**----**	**----**
			Sampling date / time	01-Mar-2023 07:30	----	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*	**EP2302622-001**	**--------**	**--------**	**--------**	**--------**
				Result	----	----	----	----
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	**8.6**	**----**	**----**	**----**	**----**
EA010: Conductivity (1:5)								
Electrical Conductivity @ 25°C	----	1	µS/cm	**134**	**----**	**----**	**----**	**----**
ED007: Exchangeable Cations								
Exchangeable Calcium	----	0.1	meq/100g	**8.0**	**----**	**----**	**----**	**----**
Exchangeable Magnesium	----	0.1	meq/100g	**0.7**	**----**	**----**	**----**	**----**
Exchangeable Potassium	----	0.1	meq/100g	**0.1**	**----**	**----**	**----**	**----**
Exchangeable Sodium	----	0.1	meq/100g	<0.1	**----**	**----**	**----**	**----**
Cation Exchange Capacity	----	0.1	meq/100g	**9.0**	**----**	**----**	**----**	**----**
Exchangeable Sodium Percent	----	0.1	%	**0.9**	**----**	**----**	**----**	**----**
EK072: Phosphate Sorption Capacity								
Phosphate Sorption Capacity	----	250	mg P sorbed/kg	**1650**	**----**	**----**	**----**	**----**

Page	:	3 of 3
Work Order	:	EP2302622
Client	:	PERTH GEOTECHNICS
Project	:	SSE188823 Lot 4, Robertson Road, Byford WA

Inter-Laboratory Testing

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

(SOIL) EK072: Phosphate Sorption Capacity

Envirolab Services (WA) Pty Ltd trading as MPL Laboratories
ABN 53 140 099 207
16-18 Hayden Court Myaree WA 6154
ph +61 8 9317 2505 fax +61 8 9317 4163
lab@mpl.com.au
www.mpl.com.au

Certificate of Analysis PEC0307

Client Details

Client	Perth Geotechnics Pty Ltd
Contact	Mohammad Amzad Hossain

Sample Details

Your Reference	Soil Analysis
Number of Samples	1 Soil
Date Samples Received	03/03/2023
Date Samples Registered	03/03/2023

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.
Samples were analysed as received from the client. Results relate specifically to the samples as received.
Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Report Details

Date Results Requested by	15/03/2023
Date of Issue	15/03/2023

Accredited for compliance with ISO/IEC 17025. Tests not covered by NATA are denoted with *.

Authorisation Details

Results Approved By	Michael Hall, Inorganics & Metals Supervisor
Laboratory Manager	Michael Kubiak

Certificate of Analysis PEC0307

Samples in this Report

Envirolab ID	Sample ID	Depth	Matrix	Date Sampled	Date Received
PEC0307-01	BH 1	1.00-1.20Meters	Soil	01/03/2023	03/03/2023

Certificate of Analysis PEC0307

PBI/PRI (Soil)

Envirolab ID	Units	PQL	PEC0307-01
Your Reference			BH 1
Date Sampled			01/03/2023
Depth			1.00-1.20
Phosphorus Retention Index	-		230

Perth Geotechnics

APPENDIX – D

SITE PHOTOGRAPH

Perth Geotechnics
ABN: 74 660 182 061
Tel: 08 6396 2675; M: 0430 130 677
PO Box 165, Gosnells WA 6990
E: info@perthgeotechnics.com.au
www.perthgeotechnics.com.au

Photo 1: Proposed LAA is looking from eastern side

Photo 2: Proposed LAA, looking from south-west side

Photo 3: Proposed LAA, looking from north-west side

Photo 4: Subsurface probing by auger at BH1 location

Photo 5: Soil from borehole BH1

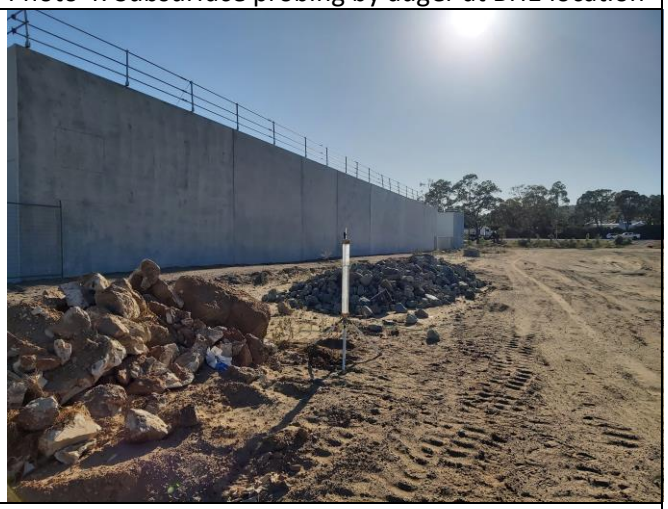


Photo 6: Conducting Field Permeability Test at FPT1

centrepoint CHURCH

Terms and Conditions of Hire

1. All external surroundings areas, car parks, verges and parklands to be left clean and tidy.
2. All areas must be left in the same condition in which it was found. Both indoor and outdoor facilities must be left in a clean and tidy condition. Cleaning charges may apply.
3. Make sure all fans/air conditioning/heating and lighting is switched off
4. Sweep all floors that were used & spot mop any spillage.
5. Wipe, dry, and stack tables and chairs then return to designated storage areas.
6. Place all rubbish in bins.
7. It is the responsibility of the hirer to remove all excess rubbish from the premises.
8. All unused food and drink must be removed from the premises unless otherwise arranged with Bookings Officer.
9. All hiring will be a minimum of one (1) hour with 30 min increments allowed thereafter.
10. No Alcohol to be consumed on the premises.
11. Keys will not be issued to the hirer. The venue will be opened and locked up at the agreed times.
12. Responsible adult supervision must be provided at all times.
13. No Smoking is permitted within the premises.
14. Hirers are not permitted to access any rooms and/or areas not specified in the agreement.
15. All local council noise restrictions must be adhered to at all times.

(Insert organisation name here) _____
understands that the conditions of the use of the College facilities will be observed. The organisation I represent will be held responsible for any damages or loss incurred. For ongoing bookings failure to observe these conditions will result in the termination of the arrangement.

Signed: _____ Date: _____/_____/_____