

STORMWATER TECHNICAL NOTE AND HIGH-LEVEL SERVICING PLAN

DA & WAPC Subdivision Submission

Project Title	Proposed 9-Lot Survey Strata Development – 5 Caldervale Avenue, Ellenbrook WA
Street Address	5 Caldervale Avenue (Lot 9399), Ellenbrook WA 6069
Lot / Plan Reference	Lot 9399 on Deposited Plan 427059 (DP427059 9399)
Local Government	City of Swan
Applicant / Developer	Emergen Property Pty Ltd
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1. Introduction

This Stormwater Technical Note has been prepared by CENTRELINE Group on behalf of Emergen Property Pty Ltd in support of a Development Application (DA) and WAPC Survey Strata Subdivision application for the proposed nine (9)-lot residential development located at:

Lot 9399 (#5) Caldervale Avenue, Ellenbrook WA 6069 (DP 427059 9399)

The site is located within the City of Swan local government area. This document provides a high-level assessment of the proposed stormwater management strategy and servicing plan to demonstrate compliance with applicable policies, standards, and local government requirements.

Stormwater generated within the subdivision is proposed to be managed via on-site soakwells on each individual lot, consistent with City of Swan requirements and the site's demonstrated infiltration capacity.

2. Site Description

2.1 Location and Context

The subject site is situated at 5 Caldervale Avenue (Lot 9399), Ellenbrook WA 6069, located within the City of Swan local government area. From the aerial photography included in the Geotechnical Investigation (Perth Geotechnics, Ref: GI913726PG), the site is bounded by Coniston Drive to the north, Caldervale Avenue to the east, Strathmore Parkway to the south-east, and Coolamon Boulevard to the south-west. The surrounding area comprises established low-density residential development.

2.2 Site Area and Proposed Subdivision

The proposed subdivision will create nine (9) survey strata lots from the parent lot (Lot 9399, DP 427059). The proposed lot areas and common property are summarised below:

Lot / Area	Area (m ²)	Land Use / Description
Lot 1	221.5	Residential
Lot 2	234.9	Residential
Lot 3	265.6	Residential
Lot 4	240.8	Residential
Lot 5	235.0	Residential
Lot 6	256.6	Residential
Lot 7	228.7	Residential
Lot 8	230.7	Residential
Lot 9	225.3	Residential
Common Property	307.6	Driveway / Access
TOTAL	2446.7	—

2.3 Topography and Drainage Context

The site topography is generally flat to gently sloping, consistent with surrounding suburban development in the Swan Coastal Plain.

No surface water features (including waterways, drainage swales, or drainage easements) are identified within or immediately adjacent to the subject site. Existing drainage infrastructure in the surrounding road network is noted; the site is not proposed to connect to this system as stormwater disposal will be achieved via on-lot soakwells.

2.4 Soils and Geotechnical Conditions

A Geotechnical Investigation has been undertaken for the subject site by Perth Geotechnics (Ref: GI913726PG, dated 15 April 2026). The investigation comprised five (5) machine-auger boreholes (BH1–BH5) to a depth of 2.2 m, five (5) Perth Sand Penetrometer (PSP) tests, and two (2) field permeability tests (FPT1 and FPT2) using a Guelph Permeameter conducted at 1.2 m below ground level, in accordance with AS/NZS 1547-2012.

The key findings relevant to stormwater management are summarised as follows:

- **Soil Profile:** Dense SP Sand (fine to medium grained) identified consistently across all five boreholes from 0.0 m to 2.2 m (full investigation depth). The profile is uniform across the site.
- **Groundwater:** Groundwater was not encountered in any borehole to the investigation depth of 2.2 m below ground level (mBGL). Based on the Gnangara/Jandakot Groundwater System mound mapping, the maximum recorded groundwater level in the vicinity of the site for the 2019 survey period is estimated at 42.0 m AHD. With the site ground surface estimated at approximately 60.4 m AHD (consistent with the Ellenbrook plateau), the estimated minimum depth to the Seasonal High Groundwater Level (SHGWL) is approximately 18.4 m below existing ground level. This significantly exceeds the DWER minimum clearance requirement of 0.5 m between soakwell base and SHGWL.
- **Hydraulic Conductivity:** Field permeability testing returned hydraulic conductivity values of 6.3 m/day (FPT1) and 6.5 m/day (FPT2). A design hydraulic conductivity of 6.4 m/day is adopted for this assessment.
- **Site Classification:** AS 2870-2011 Site Class A (characteristic surface movement zero). Soil Suction Change depth of 2.5 m.

The field-measured hydraulic conductivity of 6.4 m/day is characteristic of highly permeable clean sands, well in excess of the DWER minimum threshold of 1 m/day for soakwell suitability. The soils are well-suited to stormwater disposal via on-site soakwell systems.

The estimated minimum depth to SHGWL of 18.4 m (based on Gnangara/Jandakot maximum 2019 recorded level of 42.0 m AHD versus estimated site ground level of ~60.4 m AHD) provides exceptional clearance well in excess of the DWER minimum 0.5 m requirement. Soakwells installed to a maximum depth of 1.8 m below ground level will maintain a minimum clearance of approximately 16.6 m to the SHGWL. No groundwater impact from stormwater infiltration is anticipated.

Reference: Perth Geotechnics, 'Geotechnical Investigation — Lot 9399 (#5) Caldervale Avenue, Ellenbrook WA', Ref: GI913726PG, dated 15 April 2026. (Refer Appendix C)

2.5 Existing Services

Existing underground services have been identified within and adjacent to the site based on available utility information and survey. Soakwell locations will be coordinated with service providers and set back in accordance with AS/NZS 3500.3 minimum clearance requirements. The site is adequately serviced to permit the installation of proposed drainage infrastructure without conflict.

3. Regulatory Framework & Design Standards

This assessment has been prepared in accordance with the following policies, standards, and guidelines:

- State Planning Policy 2.9 – Planning for Water (WAPC, Draft 2021)
- DWER Decision Process for Stormwater Management in Western Australia (2017)
- DWER Stormwater Management Manual for Western Australia (current edition)
- City of Swan Handbook of Stormwater Drainage Design (AUS-SPEC D5, April 2022)
- City of Swan Design Specification D5 – Stormwater Drainage Design
- City of Swan Design Specification D7 – Erosion Control and Stormwater Management
- Australian Rainfall & Runoff 2019 (ARR 2019)
- AS/NZS 3500.3:2018 – Plumbing and Drainage: Stormwater Drainage

The key stormwater management principle applicable to this site is that all stormwater runoff generated from impervious surfaces within the subdivision is to be retained and/or detained on-lot for a minimum 1-year, 1-hour ARI design event (equivalent to approximately 16 mm of rainfall depth on the Swan Coastal Plain), consistent with DWER and City of Swan requirements.

For major storm events (1-in-10 year ARI and greater), overland flow paths are to be maintained such that excess runoff is directed safely to the street without causing nuisance flooding or property damage.

4. Hydrology & Design Rainfall

4.1 Design Rainfall

Design rainfall intensities are based on the City of Swan Handbook of Stormwater Drainage Design (AUS-SPEC D5, April 2022), which specifies LPIII intensity-frequency-duration (IFD) relationships for Swan urban areas (Midland region). Adopted design rainfall parameters are as follows:

Parameter	Minor Event (On-lot Retention)	Minor Drainage System	Major System
Design ARI	1-Year	5-Year	10 to 100-Year
Duration	1-Hour	Critical duration	Critical duration
Rainfall Depth / Intensity	16 mm (CoS adopted)	Per CoS IFD (15.9 mm/hr)	Per CoS IFD table
Reference	CoS D5 Handbook / DWER	CoS D5 Handbook	CoS D5 Handbook

4.2 Runoff Coefficients

Runoff coefficients are adopted per Table 3 of the City of Swan Handbook of Drainage Design (AUS-SPEC D5, April 2022). For the proposed residential development:

- Residential development: C10 = 0.56 (55% impervious)
- Roads and paved areas: C10 = 0.63 (64% impervious)

For on-lot soakwell sizing, the impervious area contributing to each soakwell is calculated based on the contributing roof, driveway, and other hardstand areas for each individual lot.

4.3 Catchment Areas

The subject site is self-contained with respect to stormwater management. No external catchment areas drain onto or through the site. The development is not located within a flood-prone catchment area.

5. Stormwater Management Strategy

5.1 Strategy Overview

The proposed stormwater management strategy for the nine (9)-lot survey strata subdivision is based on full on-site retention of the design minor storm event via individual soakwell systems on each lot. This approach is consistent with:

- City of Swan soakwell requirements for residential lots $\geq 300 \text{ m}^2$;
- DWER on-site retention objectives for the 1-year 1-hour ARI event; and
- Demonstrated geotechnical suitability for infiltration-based disposal.

No connection to the City of Swan reticulated stormwater system is proposed or required.

5.2 On-Lot Soakwell Systems

5.2.1 Soakwell Sizing Method

Soakwells are sized to contain the design storm volume in accordance with the City of Swan methodology:

$$V = C \times I \times A / 1000$$

Where:

- V = required soakwell volume (m³)
- C = runoff coefficient (dimensionless) — adopted per land use
- I = design rainfall depth (mm) — adopted as 16 mm (1-year 1-hour ARI)
- A = total contributing impervious area per lot (m²)

5.2.2 Soakwell Sizing Summary

The following table summarises the soakwell sizing for each lot and the common property driveway. A conservative impervious fraction of 90% (C = 0.90) has been applied to all residential lots at DA stage, consistent with the compact lot sizes (221–266 m²) where near-total site coverage is anticipated for single storey dwellings. The driveway common property is fully paved (C = 1.00).

All soakwells are 1200 mm diameter precast reinforced concrete units. Depths of 1500 mm and 1800 mm have been selected to maximise infiltration volume per unit footprint. Soakwell configurations have been optimised to minimise surplus storage capacity above the design requirement, with surpluses ranging from 0.3% to 7.6% across all lots.

All soakwells across the development are to be connected as a single integrated system via PVC stormwater pipework. This interconnected arrangement ensures equal distribution of stormwater load across all soakwells during a storm event, maximising the total infiltration area engaged throughout the event duration and optimising the use of the site's high hydraulic conductivity (k = 6.4 m/day).

Soakwells will be positioned in the following areas to avoid conflicts with structural footings, services, and lot boundaries:

- Within each lot's rear yard area;
- Beneath the garage slab (centre of slab, clear of perimeter footings and strip footings) — suitable given the proven dense sand profile and absence of groundwater; and
- Within the common property driveway, distributed to serve the combined CP drainage catchment.

Final impervious areas and soakwell configurations will be confirmed at Building Permit stage for each individual lot based on approved house plans.

NOTE — CONCEPT DESIGN: The soakwell volumes presented are concept-level calculations for DA/WAPC submission purposes. Detailed design will incorporate full DWER soakwell modelling including the Shallow Water Table Log Model, Clogged Base Model, and Deep Water Table Model. Notwithstanding, the estimated minimum depth to SHGWL of 18.4 m BGL (Gnangara/Jandakot max. 2019 level = 42.0 m AHD) indicates the Deep Water Table Model is the governing design scenario for this site, and the simplified volumetric approach adopted herein is considered appropriate and conservative for concept assessment.

Lot No.	Total Area (m ²)	Design Rainfall (mm)	V req (m ³)	Soakwell Size (Ø × D mm)	No. Required	Notes
1	221.5	16	3.190	2× 1200Ø×1500D	2	V _{prov} = 3.393 m ³ (+6.4%)
2	234.9	16	3.383	2× 1200Ø×1500D	2	V _{prov} = 3.393 m ³ (+0.3%)
3	265.6	16	3.825	2× 1200Ø×1800D	2	V _{prov} = 4.072 m ³ (+6.5%)

4	240.8	16	3.468	1× 1200Ø×1800D + 1× 1200Ø×1500D	2	V_prov = 3.732 m³ (+7.6%)
5	235.0	16	3.384	2× 1200Ø×1500D	2	V_prov = 3.393 m³ (+0.3%)
6	256.6	16	3.695	1× 1200Ø×1800D + 1× 1200Ø×1500D	2	V_prov = 3.732 m³ (+1.0%)
7	228.7	16	3.293	2× 1200Ø×1500D	2	V_prov = 3.393 m³ (+3.0%)
8	230.7	16	3.322	2× 1200Ø×1500D	2	V_prov = 3.393 m³ (+2.1%)
9	225.3	16	3.244	2× 1200Ø×1500D	2	V_prov = 3.393 m³ (+4.6%)
CP	307.6	16	4.922	1×1200Ø×1800D + 1×1200Ø×1500D + 1×1200Ø×1200D	3	Common Property driveway. V_prov = 5.089 m³ (+3.4%). C = 1.00.

Notes: All soakwells 1200mm diameter precast RC. Unit volumes: 1200Øx1200D = 1.357 m³, 1200Øx1500D = 1.696 m³, 1200Øx1800D = 2.036 m³. Design: $V = C \times I \times A / 1000$; $I = 16$ mm (1-yr 1-hr ARI, CoS/DWER); $C = 0.90$ (lots), $C = 1.00$ (CP driveway). $k = 6.4$ m/day (Perth Geotechnics GI913726PG). All soakwells on site connected as one integrated system via PVC pipework to achieve equal stormwater distribution and maximise infiltration area across storm event.

5.2.3 Soakwell Specification

Soakwells shall be installed in accordance with the following minimum requirements:

- Precast reinforced concrete soakwells, 1200 mm diameter, 1500 mm or 1800 mm effective depth as specified per lot (refer sizing table above), complying with AS/NZS 3500.3;
- All soakwells interconnected via PVC Class SN8 stormwater pipework (minimum DN100) to form one continuous site-wide system, ensuring equal load distribution and maximising infiltration area engagement;
- Minimum clearance from boundaries: 1.8 m from structures, as per manufacturer and AS/NZS 3500.3;
- Minimum clearance from services: per utility provider requirements and AS/NZS 3500.3;
- Minimum 500 mm clearance between soakwell base and SHGWL;
- Inlet grate/surround to be trafficable grade where located within vehicle access areas;
- Soakwells to be connected via PVC stormwater pipework, with overflow relief to street drainage system;
- All soakwells to be fitted with a sediment trap/silt pit at inlet to minimise maintenance requirements.

5.3 Common Property Drainage (Access and Driveway)

The common property accessway shall be drained via lineal drainage (trench drain or grated inlet) connected to a common soakwell or interconnected drainage system sized to retain the 1-year 1-hour ARI event for the accessway contributing area.

The accessway drainage system will be designed and detailed at the construction documentation stage. An appropriate easement or common property maintenance agreement will be registered on title to ensure long-term maintenance of the shared drainage infrastructure.

5.4 Major Storm Event / Overland Flow

For storm events exceeding the on-lot soakwell capacity (i.e., events greater than the 1-year 1-hour ARI), overflow is directed via surface overland flow to the street drainage network. The following measures will be implemented to manage major storm events:

- Lot grading will be designed to direct overflow away from buildings and towards the street;

- Finished floor levels (FFLs) for dwellings are to be set a minimum 150 mm above the Design Flood Level (DFL) or finished ground level, whichever is the greater, consistent with City of Swan requirements;
- The accessway will be graded to prevent stormwater from entering the lots during major events;
- No nuisance flooding or damage to downstream or adjoining properties will result from the proposed drainage configuration.

5.5 Water Quality

The proposed stormwater management system incorporates passive water quality treatment measures consistent with Water Sensitive Urban Design (WSUD) principles:

- Landscaped areas and permeable surfaces to be maximised where practicable to reduce runoff generation;
- Construction phase erosion and sediment control to be implemented in accordance with City of Swan Design Specification D7 to prevent sediment export during construction.

6. High-Level Stormwater Servicing Plan

6.1 Infrastructure Summary

The following high-level stormwater servicing infrastructure is proposed for the subdivision:

Item	Infrastructure	Description	Qty / Size	Ownership / Maint.
1	On-lot soakwells (×9 lots)	Precast RC soakwells — 1200mm dia, 1500D or 1800D per lot (refer sizing table). 2 units per lot, interconnected as one site-wide system.	2 per lot / 18 total	Lot owner (post-strata)
2	Common property driveway drainage	3× precast RC soakwells in CP driveway (1×1800D + 1×1500D + 1×1200D). $V_{req} = 4.922 \text{ m}^3$, $V_{prov} = 5.089 \text{ m}^3$. Connected to integrated site system.	3 soakwells	Body Corporate / Strata Co.
3	Sediment/silt pits	At each soakwell inlet — precast RC silt pit to CoS Std. STD 49s	21 (one per soakwell)	Body Corporate / Strata Co.
4	PVC stormwater pipework (interconnect)	DN100 PVC SN8 Class SWD connecting all soakwells site-wide as one integrated system; plus roof drainage connections DN90 UPVC	<i>[TBC — drainage concept plan]</i>	As above
5	Overflow relief to street	Surface overflow relief — kerb and gutter or kerb adaptor where required for major storm events	<i>[TBC — drainage concept plan]</i>	City of Swan

6.2 Maintenance Responsibilities

Long-term maintenance of stormwater infrastructure within the subdivision will be as follows:

- Individual lot soakwells: Maintained by each lot owner. Maintenance requirements (annual inspection, sediment clearance) to be noted on the Strata Plan documentation.
- Common property drainage: Maintained by the Body Corporate / Strata Company. Maintenance schedule to be incorporated into the Strata Management Statement.
- Street / Council infrastructure: Maintained by the City of Swan.

7. Compliance Summary

The proposed stormwater management strategy demonstrates compliance with applicable regulatory requirements as follows:

Requirement	Reference	Status	Notes
On-site retention of 1-yr 1-hr ARI event	DWER / CoS D5 Handbook	✓ Compliant	Soakwells sized per Section 5.2
No increase in post-development runoff	SPP 2.9 / DWER	✓ Compliant	Full retention on-lot; no net discharge to public drain
Soakwell clearance from SHGWL (≥ 0.5 m)	DWER SWMM / AS 3500.3	✓ Compliant	Est. SHGWL depth ~18.4 m BGL (Gnangara/Jandakot max. 2019 = 42.0 m AHD; site ~60.4 m AHD). Min. clearance ~16.6 m at max. soakwell depth.
Major storm overflow management	CoS D5 / ARR 2019	✓ Compliant	Lot grading and overflow to street
Water quality / WSUD	SPP 2.9 / CoS D7	✓ Compliant	Sediment traps, landscaping, pervious surfaces
FFL above design flood level	CoS requirements	✓ Compliant	The development is outside of any flood zone and situated on the highest area of Ellenbrook Plateau.
Services clearance	AS/NZS 3500.3	[TBC]	To be confirmed at detailed design stage

8. Limitations & Assumptions

CONCEPT DESIGN ONLY — The soakwell sizing and stormwater servicing strategy presented in this Technical Note are prepared at concept level for the purposes of a Development Application (DA) and WAPC Subdivision submission only. The calculations are based on simplified volumetric methods and conservative assumptions. Detailed design phase will require a comprehensive soakwell drainage analysis incorporating the following models in accordance with DWER guidelines: (1) Shallow Water Table Log Model; (2) Clogged Base Model; and (3) Deep Water Table Model. Detailed design calculations will be prepared and submitted at Construction Documentation stage prior to the issue of Building Permits.

This Technical Note has been prepared based on the following information and assumptions, which are subject to confirmation:

- Site area and lot layout are based on the concept strata plan provided by the applicant / surveyor. Final lot areas will be confirmed on the deposited plan.
- Impervious areas for each lot are estimated based on standard residential development ratios; final areas will be confirmed at Building Permit stage.
- Geotechnical and soakage investigation results are relied upon as provided; any material change to soil conditions or groundwater levels would require reassessment.
- The site is assumed to be outside any flood-prone area, drainage Development Contribution Area (DCA), and Development Control Area (DCA). This should be confirmed via City of Swan's interactive drainage map and WAPC's DCA mapping.
- No external stormwater is assumed to drain onto the site.
- This Technical Note represents a high-level assessment for DA and WAPC submission purposes. A detailed stormwater design will be prepared at construction documentation stage.

9. Conclusions

CENTRELINE Group has prepared this Stormwater Technical Note and High-Level Servicing Plan in support of the DA and WAPC Subdivision application for the proposed nine (9)-lot survey strata development at:

Lot 9399 (#5) Caldervale Avenue, Ellenbrook WA 6069 (DP 427059 9399)

The proposed stormwater management strategy is based on full on-site retention of minor storm events via individual soakwell systems on each lot, consistent with City of Swan requirements and the demonstrated geotechnical suitability of the site. Key conclusions are:

- The site soils are suitable for stormwater disposal via infiltration (soakwells), subject to the clearances and specifications described herein.
- Soakwells are to be designed to retain the 1-year 1-hour ARI event on-lot, in accordance with DWER and City of Swan requirements.
- No connection to the City of Swan reticulated stormwater network is proposed.
- Major storm events are managed via controlled overland flow to the street, with lot grading and finished floor levels to be confirmed at Building Permit stage.
- The proposed stormwater management strategy is considered to comply with all applicable policies, standards, and local government requirements.

10. References

Ref.	Author / Authority	Document
[1]	Department of Water and Environmental Regulation (DWER)	Stormwater Management Manual for Western Australia (2019 updated)
[2]	Western Australian Planning Commission (WAPC)	State Planning Policy 2.9 – Planning for Water (Draft 2021)
[3]	DWER	Decision Process for Stormwater Management in Western Australia (2017)
[4]	City of Swan	Handbook of Stormwater Drainage Design (AUS-SPEC D5, April 2022)
[5]	City of Swan	Design Specification D5 – Stormwater Drainage Design
[6]	City of Swan	Design Specification D7 – Erosion Control and Stormwater Management
[7]	Geoscience Australia / BoM	Australian Rainfall & Runoff (ARR) 2019
[8]	Standards Australia	AS/NZS 3500.3 – Stormwater Drainage
[9]	Perth Geotechnics (M.A. Hossain)	Geotechnical Investigation — Lot 9399 (#5) Caldervale Avenue, Ellenbrook WA. Ref: GI913726PG, 15 April 2026 (refer Appendix C)

Appendices

The following appendices form part of this Technical Note:

Appendix	Description
Appendix A	Stormwater Concept Plan / Site Servicing Plan
Appendix B	Proposed Strata Plan / Concept Subdivision Plan
Appendix C	Geotechnical and Soakage Investigation Report