

Presentation to New WAter Ways

Subject: Stormwater Runoff calculations and
Disposal on Building Sites

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What Authority states what the stormwater requirements are on a building project?

Answer: Local Government in the majority of cases.

Requirements: Varies from Council to Council.

- Storm Events: can be long or short depending on geographical location, soil conditions, terrain etc .
- What determines the Local Council's requirements?
- In older areas the existing infrastructure plays a great part in Council's decision making!
- Currently there is no state wide standard.

What are the RULES?

- The Development Approval (DA) states the conditions of approval and the stormwater requirement.
- Who is the Certifier?
- Nearly all Building Permits are now issued by Private Certifiers who are members of the Western Australian Building Certifiers and Assessors (WABCA - <http://www.wabca.com.au/>)
- WABCA want all design disciplines to meet codes of compliance and certify that has occurred.

CODES and COMPLIANCE (Stormwater)

- National Construction Code (NCC) – old BCA.
- The NCC references the Plumbing Code of Australia (PCA) – happened last month – May 2015.
- PCA is a deemed to satisfy (DTS) type code which then references AS/NZS 3500.3 – Stormwater.
- AS/NZS 3500.3 calls up 3 event periods:
 - 1:100 years for all roof calculations – Perth is 214mm/hour
 - 1:20 years for the whole site – Perth 146mm/hour
 - Period is a 5 minute duration!
 - $1:100 = 214/12 = 17.8\text{mm}$ intensity.
 - $1:20 = 146/12 = 12.2\text{mm}$ intensity.
 - An overland flood path.
 - This will dictate Government Policy to come! There has to be a middle ground?
- Then the Local Council has their requirements
- Some have a 1:20 year event, others have 1 hour storm over 24 hours – HUGE REQUIREMENT.

The Event/Period:

- Today we will look at a 15mm intensity over building lots of varying sizes from residential to commercial/industrial sites.

The Calculation Formula:

- Area of the site (m²) x intensity (m) = Storage (m³). That simple!

The lot sizes:

- 175m² residential lot = $175 \times 0.015 = 2.625\text{m}^3$ of storage.
- 400m² residential lot = $400 \times 0.015 = 6\text{m}^3$ of storage.
- 2000m² industrial lot = $2000 \times 0.015 = 30\text{m}^3$ of storage.
- 10000m² commercial lot = $10000 \times 0.015 = 150\text{m}^3$ of storage.
- 105000m² commercial lot = $105000 \times 0.015 = 1575\text{m}^3$ of storage.

105000m² @ 1 year event (say 2.23mm) over 24 hours = 53.52mm =
 $105000\text{m}^2 \times 0.05352 = 5619\text{m}^3$ of storage

That additional storage cost to the developer was >\$800,000!

This is why we have to have a standard!

Kwinana Shopping Centre Redevelopment



The Event/Period:

- At a 12mm intensity over building lots of varying sizes from residential to commercial/industrial sites.

The lot sizes: The comparison.....

This is a significant difference to 15mm!

The costs/m³ storage installed is approx. \$350-\$450/m³

Lot size	15mm	12mm	Saving at \$450
175m ²	2.625m ³	2.1m ³	\$236.25
400m ²	6m ³	4.8m ³	\$540.00
2000m ²	30m ³	24m ³	\$2700.00
10000m ²	150m ³	120m ³	\$13500.00
105000m ²	1575m ³	1260m ³	\$141750.00

This is the cost of poor decision and bad policy.

How do we store the water???

- Now that we know how to calculate the storage, how do we physically store that water on a site and how do we protect against an event larger than we have calculated or Policy dictates?
- If we choose soakwells as the solution; how do we fit them on a small lot – 175m² to 400m²?
- Most small lots are now <10m to 14m wide and walls are built boundary to boundary. Set backs are minimal and the pool has taken over the back yard.
- Soakwells have to be 1.8m from boundaries, footings and should be placed at least 2m apart to allow sidewall soakage to occur.
- Blind or buried soakwells are an issue. The water entering the soakwell compresses the air inside and forces the lid up to allow air to escape and the water then pulls the sand/earth back into the soakwell after the event = subsidence around the well. Paving or grass sinks around that soakwell causing a long term problem.
- Therefore all blinds soakwells need air relief or venting.

STORAGE ON SITE - SCENARIOS

Lot size	15mm	12mm	Saving at \$450
175m ²	2.625m ³	2.1m ³	\$236.25
400m ²	6m ³	4.8m ³	\$540.00
2000m ²	30m ³	24m ³	\$2700.00
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Soakwell Sizes @ 15mm RFI	Volume (m3)	Storage (100%)	Storage (70%)	Base Area (m2)	Percolation Factor
					Fw Values - Cockburn figs.
900 x 900	0.572	0.00	0.00	0.638	3.75
1200 x 900	1.017	0.00	0.00	1.130	5.54
1050 x 900	0.779	0.00	0.00	0.868	4.53
1050 x 1200	1.038	0.00	0.00	0.868	NA
1200 x 1200	1.356	0.00	0.00	1.130	7.01
1200 x 1500	1.696	0.00	0.00	1.130	8.48
1500 x 1200	2.119	0.00	0.00	1.766	9.54
1 x well x 175m2 site - 1500 x 1500	2.649	0.00	0.00	1.766	11.49
1800 x 900	2.289	0.00	0.00	2.543	NA
2 wells x 400m 2 site; 10 x 2000m2 site - 1800 x 1200	3.052	0.00	0.00	2.543	12.39
1800 x 1500	3.815	0.00	0.00	2.543	14.85
33 wells x 10000m2 site - 1800 x 1800	4.578	0.00	0.00	2.543	17.31
258 wells x 105000m2 site - 1800 x 2400	6.104	0.00	0.00	2.543	22.23

400m² lots should be able to use soakwells.

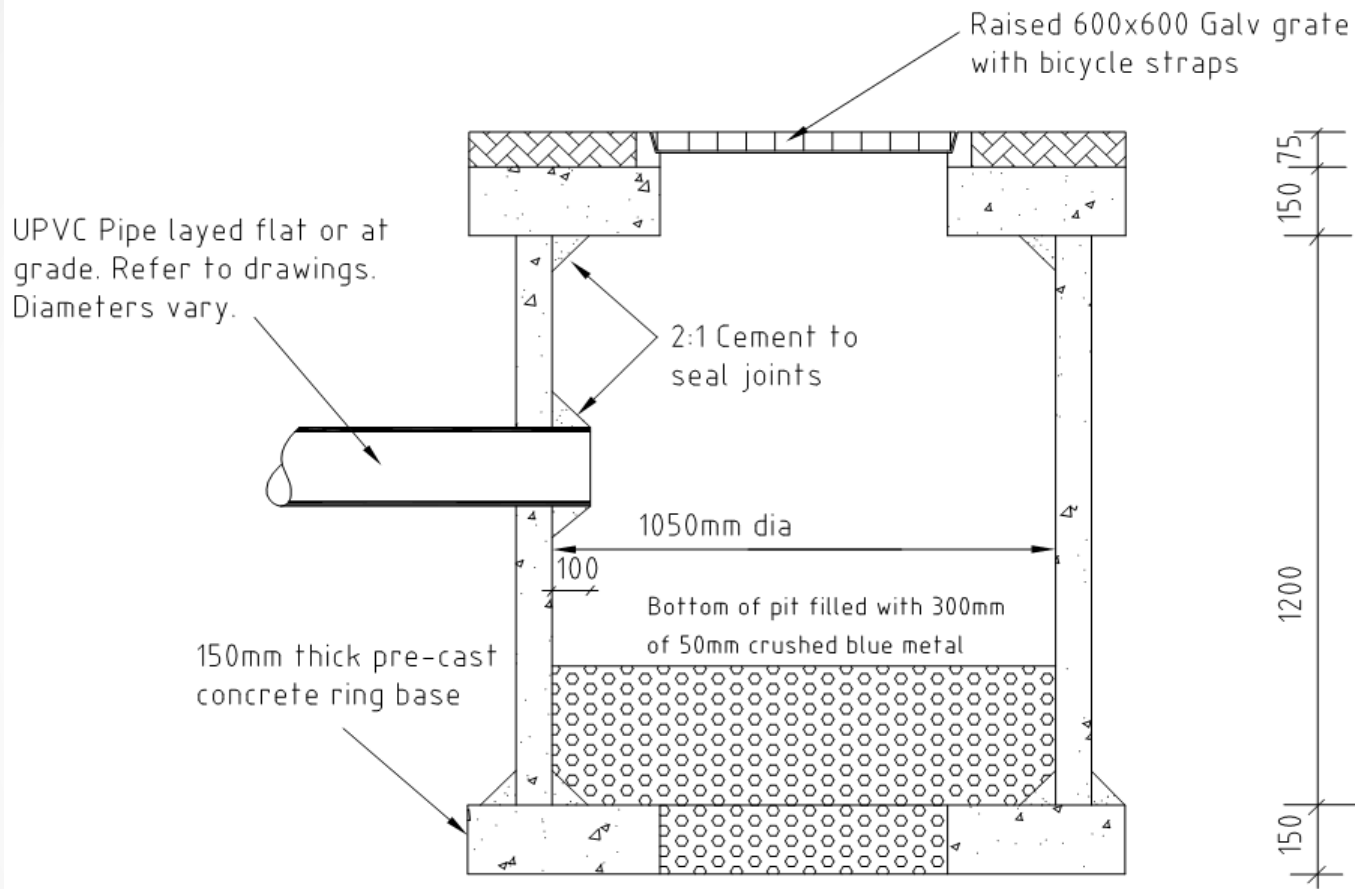


175m² lots will not accommodate soakwells

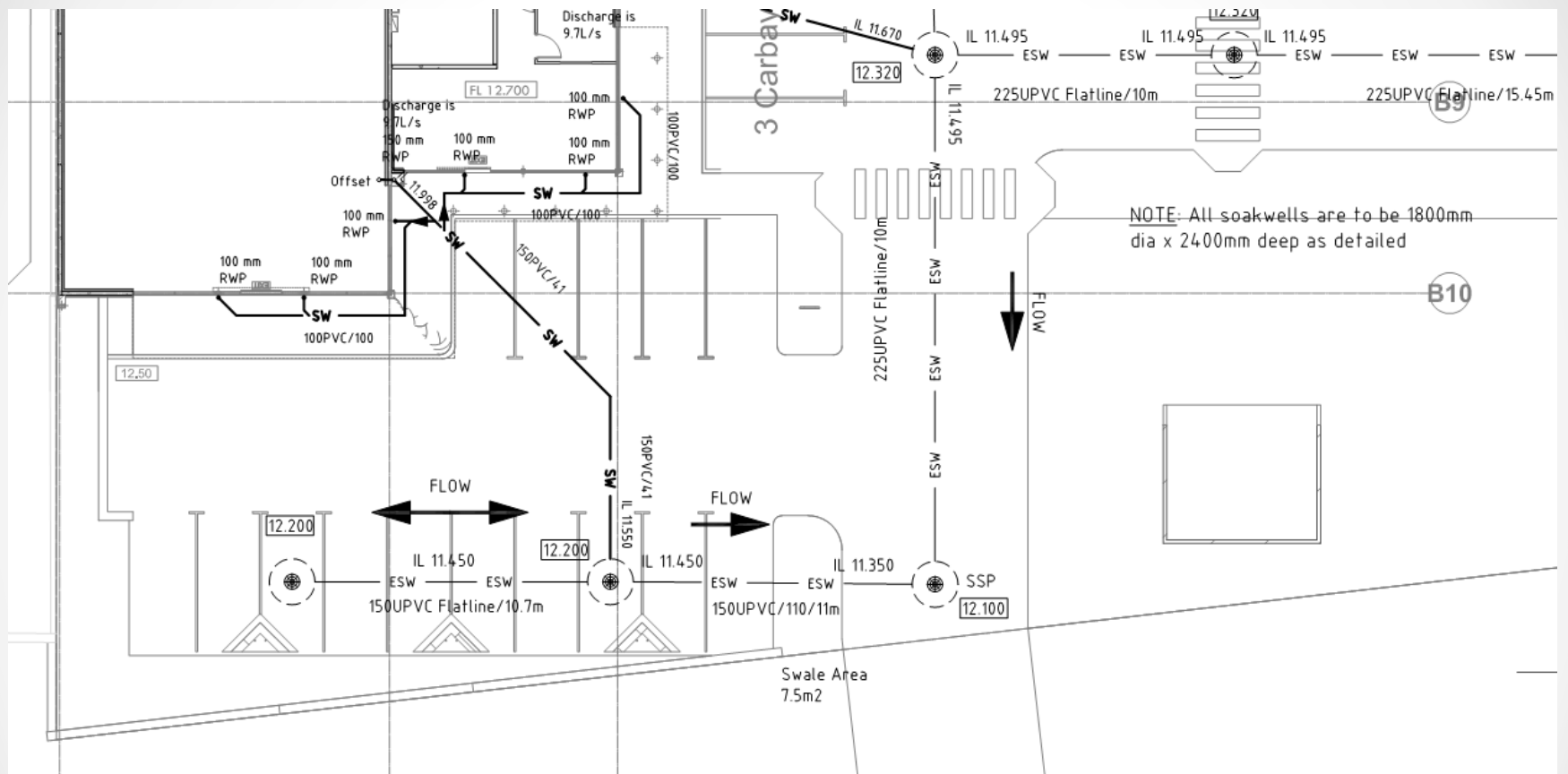


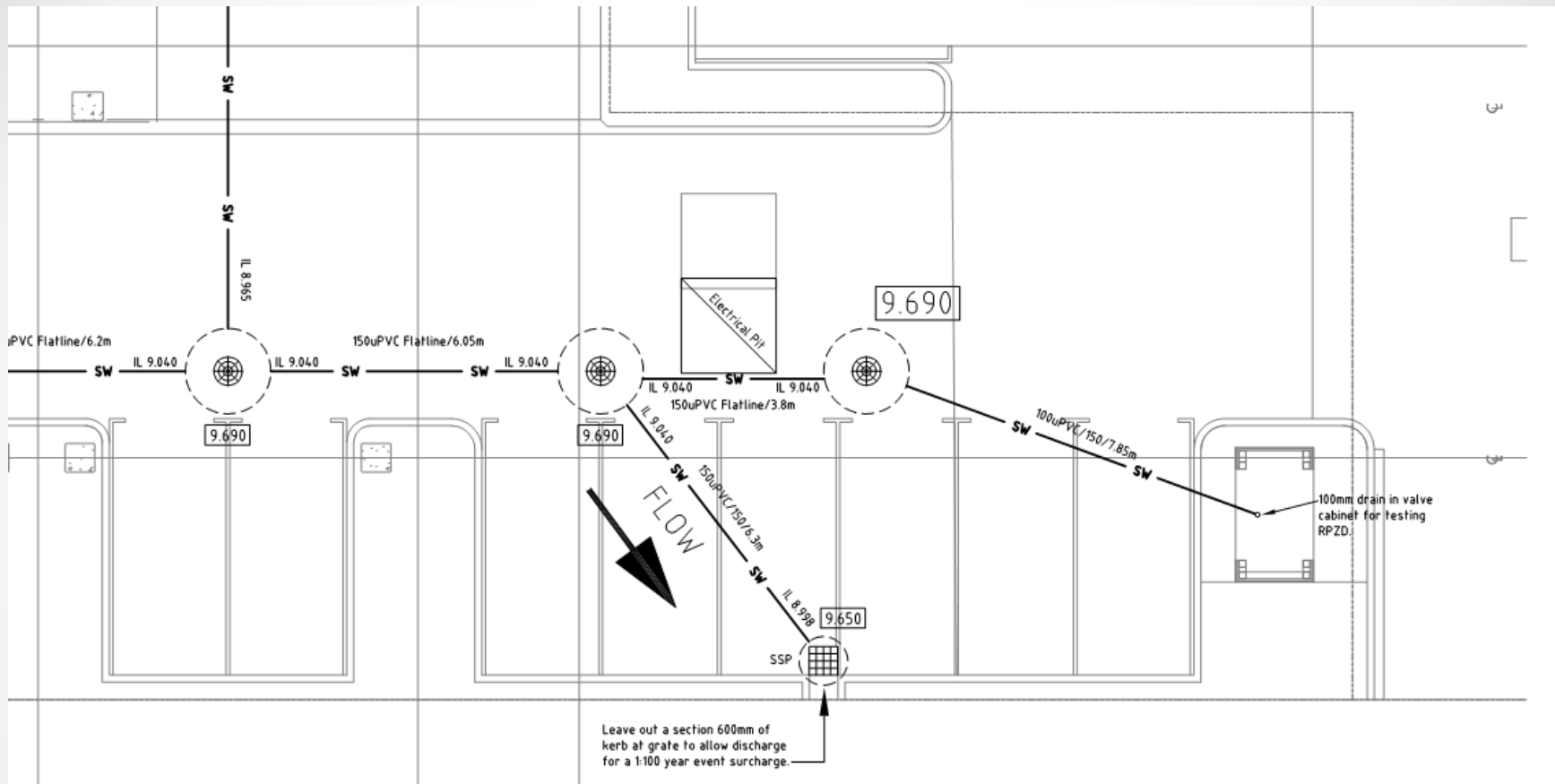
Storage is done, but what about the larger event than approvals have provided for?

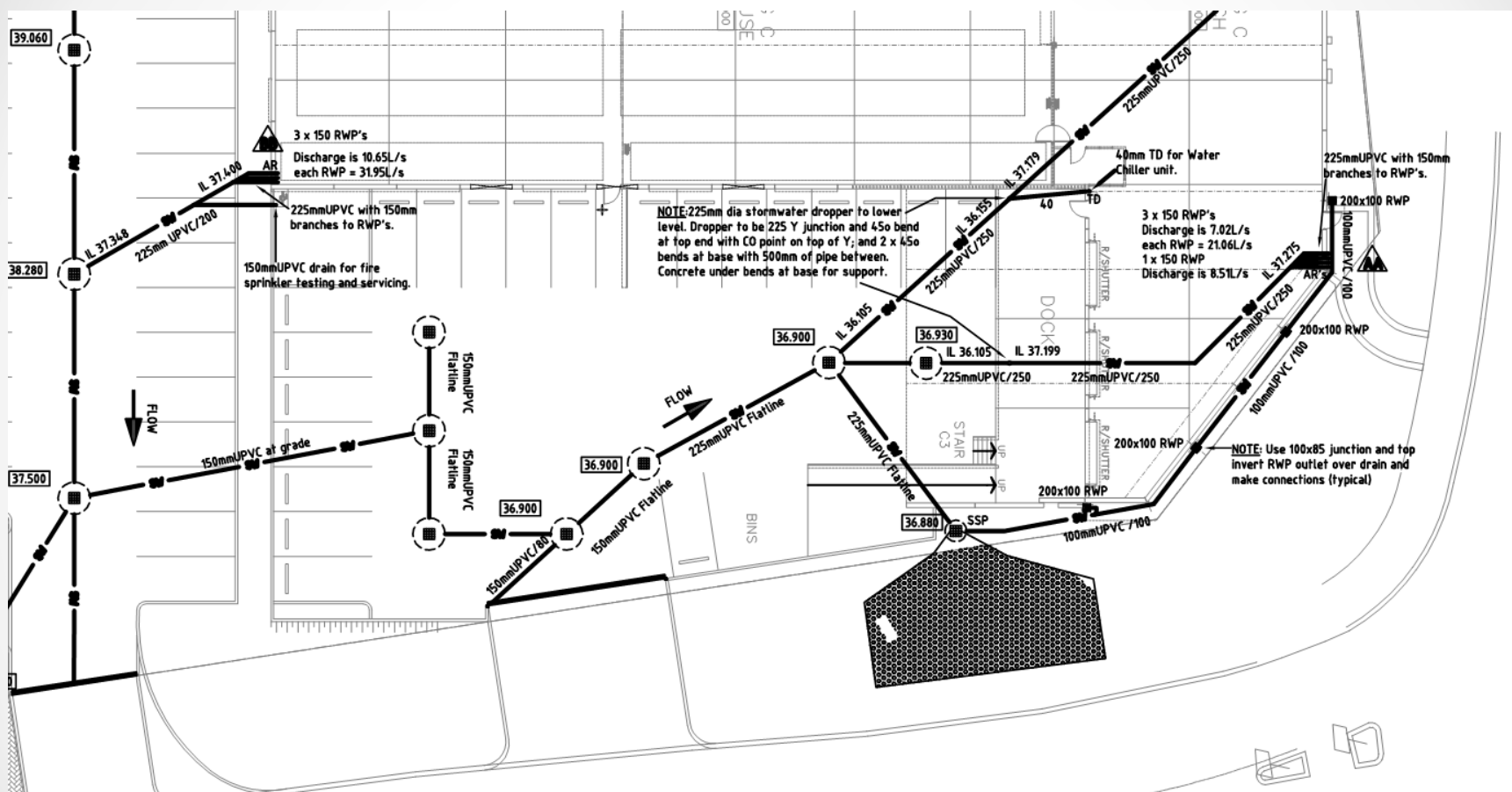
- AS/NZS 3500.3 references a 1:100 year overland flood path from a 1:20 year storm event to be provided for.
- How is the overland flood path provided for? It must be the lowest point of the site and on commercial/industrial sites, a bubble up pit is installed but not as you know it, I coined the phrase of an SSP – Stormwater Surcharge Pit. The grate has to be lower than any other soakwell on site and the grate should be set around a limestone swale using 100mm-200mm spalls sloping away for the grate and discharging towards the road verge but located within the property boundary.
- On a residential site this is very difficult to achieve and needs addressing in the future. It may be by an overflow relief through the kerb in the road.



Detail of Stormwater Surcharge Pit (NTS)







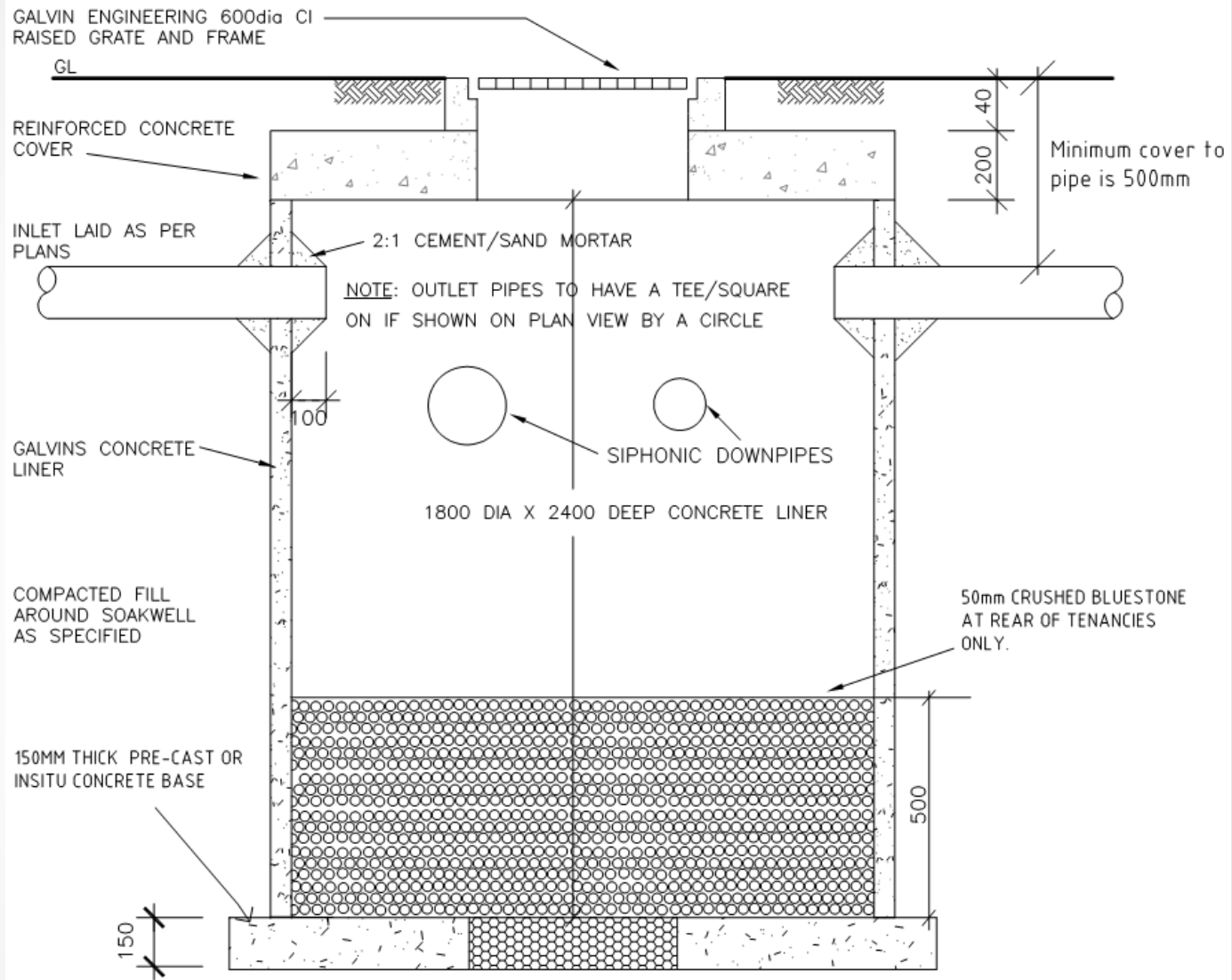
Taking the runoff from the roof to the storage wells/chambers.

➤ The issues:

- ❖ Small sites will be via eaves gutters and downpipes direct to soakwells or via grates at ground level disconnecting the gutter from the underground storage systems – best method. Overcomes backpressure issues at the eaves gutters.
- ❖ Larger sites it can be gravity systems from box gutters/eaves gutters via rainwater pipes (RWP) to the underground storage systems via a disconnected grated system or air relief grate at the base of the RWP.
- ❖ 100mm RWP's can take 8LS^{-1}
- ❖ 150mm RWP's can take 16LS^{-1}
- ❖ 225mm RWP's – no data available. AHSCA National is undertaking a test study with the University of Sunshine Coast to obtain credible data on the flows and sizes box gutters should be and also what flows can be discharged under gravity from RWP's connected to box gutters.

➤ Siphonic Discharges:

- ❖ Siphonic RWP's use HDPE pipe to stop the pipes from imploding due to the suction rates of the discharges. Siphonic discharges range from $<10\text{LS}^{-1}$ up to $>150\text{LS}^{-1}$.
- ❖ Siphonic discharges need to be decelerated prior to being discharged into the underground storage systems. A siphonic discharge should never be taken direct to a soakwell. They cause erosion of the wells and subsidence at the base due to washaway.
- ❖ They need to be discharged to specifically designed liners or chambers.



LINERS RECEIVING SIPHONIC DISCHARGES (NTS)

Factors affecting storage system selection:

➤ Geotechnical Report:

❖ Soil type:

- ✓ Sand – no issues.
- ✓ Sandy clay – not a big issue.
- ✓ Clay but stable – needs to be discharged off site but can be stored in liners with weepholes.
- ✓ Clay but unstable – needs liners, blue metal and geogrid under bottom of liners and discharged off site to Council infrastructure.

❖ Water table height:

- ✓ Low water table allows a wide selection of storage options – soakwells, arches, box crates etc.
- ✓ High water table – limits soakwells as a solution – need geotech cloths, arches cannot be deep, box crates can be into water table as long as they balance for floatation. Best suited to liners/gullies and discharged off site.

❖ Available area to install systems :

- ✓ Traffic areas.
- ✓ Non traffic areas.
- ✓ Location on the site.
- ✓ Proximity to water courses.

For information on

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