
Knox City Council



Stormwater Drainage Guidelines

*For Residential, Commercial, Industrial and
Broad Acre Subdivisional Developments*

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1.0 INTRODUCTION

Knox City Council, as the Responsible Drainage Engineering Authority, has adopted guidelines setting out drainage design engineering rules and conditions for residential, commercial and industrial developments within the municipality. They are to be used as guidelines by the applicant/developer for the above types of developments.

2.0 PRE-DEVELOPMENT DISCUSSIONS

Prior to submitting a Town Planning application, the applicant/developer should investigate the existing drainage conditions on and in the vicinity of the subject site. It is anticipated that this will reduce delays regarding stormwater drainage approvals.

It is important that prior to any development submission, the applicant/developer consult Council's Drainage Engineering Department (☎ 9298 8408), to determine the subject site's legal point of discharge, existing conditions and drainage requirements.

2.1 Design Options

In instances where there is no drainage available or the existing drains are inadequate, Council may allow the following options to be provided by the applicant/developer, with final approval to be given by Council:

- Construct a new outfall drain to the nearest suitable point of discharge at the applicant's cost.
- Upgrade a section of existing Council drainage system to accommodate the proposed development. (Any possible future development is also to be considered).
- Design and install an adequate On Site Detention (OSD) system that will limit the discharge rate from the proposed development to that determined by a weighted coefficient of runoff of 0.4 as applied to the site.
- In some circumstances there may be an opportunity to use Water Sensitive Urban Design (WSUD) practices as part of Council's stormwater management plan.
- A combination of the above options.
- Council will require the applicant/developer to provide computations by a suitably qualified engineering consultant who will determine the extent of any system upgrade and/or the size of OSD system required to cater for the proposed development.

2.2 Existing Site Conditions

- Where the existing dwelling is to be retained as part of the unit development, the applicant/developer shall determine and indicate on the plan the location of the existing house drain and discharge point of the existing internal stormwater drainage system.
- Where existing drainage & sewerage easements are shown on the title, the applicant/developer shall indicate on plan the exact location of any available assets within the easement. This information is to be accompanied by pit/inspection opening locations, size of pipe with depths and offset.
- All existing street features are to be accurately shown including driveways, pavements, drainage pits, electricity poles, Telstra pits, sewerage manholes, trees etc.
- No permanent or habitable buildings are allowed to be built over Council easements. However, in certain circumstances, removable structures may be allowed, subject to consent from Council's Building Department, prior to lodging an application with the Planning Department.

3.0 GENERAL DESIGN RULES

- All storm and surface water shall be collected and discharged in a complete and effective system of drains to be provided as directed by the responsible authority to an underground pipe drain at the owners cost.
- Minimum size of a stormwater drainage outlet for a single dwelling is to be no less than 100mm diameter pipe.
- Minimum size of a common stormwater drainage pipe from a two dwelling development is to be no less than 150mm in diameter. Upgrade of existing drainage and/or OSD may be a condition of permit.
- Minimum size of a common stormwater drainage pipe for multi unit developments is 150mm diameter or greater, depending on the size of development and provided that there is sufficient capacity downstream. Upgrade of existing drainage and/or OSD may be a condition of permit.
- Size of a stormwater drainage outlet for commercial and industrial developments shall be determined by computations provided by the developer's engineering consultant and will depend on the size of the development.
- Any on site drainage connecting into a Council or Melbourne Water drain must have consent from the relevant authority.
- A Road Opening Permit needs to be obtained by the applicant prior to any construction in a Council reserve or easement.

- For all developments, the applicant/developer shall make provision for overland flows through the subject site in the event of a blockage of the piped system or a storm exceeding the capacity of the piped system.
- Any floor levels within the property adjacent to an overland flow path are to be minimum 600mm above the lowest corner of property.
- Requirements such as use of litter traps may be imposed in some developments, where deemed appropriate.
- Pipes within a drainage easement are to be no less than 150mm diameter in size.
- Pipes running longitudinally within the road reserve, are to be no less than 225mm diameter in size.
- Pipes under road pavements are to be no less than 300mm diameter in size.
- Pipe materials, classifications and cover over pipe are to meet Council's engineering standards. Approved pipes shall be minimum Class 2 rubber ring jointed.
- Pipe types acceptable within road reserve are reinforced concrete, fibre reinforced cement or UPVC pipes.

4.0 DESIGN CRITERIA

4.1 Hydrological Design

The Rational Method shall be used in calculating design peak flow rates through the system.

$$Q = C I A / 360 \text{ (m}^3\text{/s)} \text{ or } Q = C I A / 0.36 \text{ (l/s)}$$

Q = peak flow rate (in litres per second or metres cubed per second)

C = runoff coefficient (based on fraction impervious)

A = area of catchment (Hectares)

I = rainfall intensity (mm/hr) (VicRoads road design manual, relevant intensity frequency duration (IFD) charts – Melbourne area)

For large catchments, the times of concentration, overland flow determination and coefficient of runoff shall be determined in accordance with the drainage chapter of VicRoads Design Guidelines.

4.2 Recurrence Interval

- In residential areas the drainage system shall be designed for a 5 year Average Recurrence Interval (ARI) or greater.

- In commercial and industrial areas the drainage system shall be designed for a 10 year ARI at least.
- For a main drain where the surcharge would seriously affect private property, the drainage system shall be designed for a 10 year ARI.
- For major commercial areas e.g. Boronia or Bayswater, the drainage system and its outfall shall be designed for a 25 year ARI.

4.3 Coefficient of Runoff and Time of Concentration

TYPE OF USE	WEIGHTED Cr
Residential < 300m ²	0.80
Residential > 300m ²	0.60
Commercial	0.90
Industrial	0.90
Reserves < 1 Ha	0.35
Reserves > 1 Ha	0.45

For the purpose of calculating a weighted co-efficient of runoff for the design or analysis of a drainage system the C pervious = 0.35 and C impervious = 0.90.

Minimum times of concentration:

- Residential - 7 minutes
- Low density - 9 minutes

Special consideration may be necessary for other buildings such as factories.

4.4 Hydraulic Analysis

Hydraulic grade line analysis to be undertaken to evaluate existing stormwater drainage controlled or maintained by Council within the road reserve of property to determine design levels of new pipes and pits.

4.5 Design Velocity

Minimum:

- Pipe running half full or greater - 0.75 m/s
- Pipe running less than half full - 1.00 m/s

Maximum:

- Pipe running full ≤ 5.5 m/s

4.6 Ownership of Drainage

Subject to agreement by Council:

- Drainage constructed within easements or road reserves, will be handed over to Council for the future maintenance and control after the completion of the contractor's 3 months maintenance period to Council's satisfaction.
- Drainage constructed outside an easement or within private / common property shall remain the responsibility of the owner or body corporate for the future care and maintenance of the drain.

5.0 ON-SITE DETENTION

Not to be sited on land to be maintained by Council e.g. road reserves, parks etc.

5.1 Background

Knox City Council has developed significantly in recent years. Some areas have been densely developed and runoff flows exceed the capacity of existing Council stormwater drainage pipes. Therefore, Council requires applicants/developers, to consider on-site detention as one of the options for controlling the stormwater discharge increase that results from most developments.

These guidelines require:

**NO NET INCREASE IN STORMWATER RUNOFF.
PRE DEVELOPMENT DISCHARGE RATE = POST DEVELOPMENT DISCHARGE
RATE.**

Applicants/developers are to provide on-site detention systems in order to restrict the rates of flow from new developments to pre-development levels based on a weighted coefficient of runoff of 0.4, or to a figure acceptable to Council that will not exceed the capacity of existing drainage infrastructure.

5.2 Design Criteria (OS D4 Modified Swinburne Method)

Average Recurrence Interval:

- Detention System – to be designed for a 5 year ARI.
- Pre-development discharge – to be based on a 5 year ARI.
- Post-development discharge – to be designed for a 5 year ARI.

Coefficients of Runoff:

- Minimum for Permissible Site Discharge – 0.40.
- Development runoff coefficient – based on total anticipated impervious area.

Time of Concentration:

- Development site, (Ts) – 5 minutes.
- Catchment, (Tc) – applicant to obtain from Council.
- Location within catchment, (Tso) – applicant to obtain from Council.

Rainfall Intensity (mm/hr):

- Relevant charts for Knox City Council – Adopt VicRoads standard (Melbourne chart).

Permissible Site Discharge:

- The discharge that would be generated by the development site assuming an average coefficient of runoff of 0.40.

Orifice Size:

- The orifice diameter is to be determined by the Permissible Site Discharge applied to the formula below. The restricting device must be placed so that the entire runoff from all impervious areas within the development site passes through it. The orifice invert must be set at the same level as the floor of the pit in which it is placed.
- Storage Volume shall be calculated by considering the anticipated inflow and allowable outflow hydrographs applicable to the development site, to be sufficient for a 5 year ARI. (Use of OSD4 software is preferable.)
- For the analysis of an orifice the following formula is acceptable:

$$Q = A_o C_d \sqrt{2gH}$$

Q - discharge (m³/s)

A_o - area of orifice (m²)

g - acceleration due to gravity (m/s²)

H - head acting on orifice (m) i.e. above orifice centreline

C_d - coefficient of discharge is 0.6 for a square or rectangular outlet and 1.0 for a circular outlet.

- Orifice pits are preferable for discharge control instead of Phillips multi cell units.

5.3 Floor Levels

- Any floor levels of all buildings both existing and proposed are to be set at least 300mm above the water surface level of any above ground storage area or flood area.
- For any stormwater detention system a suitable overflow arrangement must be provided to cater for higher intensity storms or in the event of an orifice blockage. The overflow facility should be designed to pass the runoff generated by a 20-year average recurrence interval storm for the particular development.
- Where it is intended to use a paved area for above ground storage, and also for access or the parking of vehicles, the overflow should be positioned in such a way so that the depth of water stored, does not exceed 200mm. It needs to be positioned so that it does not obstruct pedestrian access to dwellings. Consideration should be

made to ensure that all surcharge waters are directed away from dwellings and garages.

5.4 Information Required on Construction Plans

Plans for detention systems shall include the following information as a minimum:

- Invert levels – all drains within the development site and outfall drainage external to the site.
- Design surface levels adjacent to the device.
- Floor levels of all buildings both existing and proposed.
- Cross section details of the detention device.
- Existing surface levels of the development site.

Construction drawings, together with a set of drainage computations in accordance with the above design criteria, are to be submitted to Council for approval prior to commencement of any construction works.

- Ensure that the on site detention system is located within the area that is easily accessible (i.e. common property within unit developments) and that the system is always amenable to regular maintenance by the owner or the relevant body corporate.
- The location of overland flow paths is to be depicted on the layout drawing.

6.0 ENGINEERING DRAINAGE CONSTRUCTION DRAWING GUIDELINES

For further information on drainage design please contact the Drainage Engineer on ☎ 9298 8408.

6.1 Engineering Drainage construction plans must be in accordance with:

- (a) Approved development plan to Australian Height Datum (AHD);
- (b) Town Planning Permit conditions;
- (c) Council issued drainage direction;
- (d) Melbourne Water approval is required, where any construction is proposed to be adjoining or adjacent to any Melbourne Water declared drains or land subject to inundation, e.g. overland flow paths, natural valleys, etc.
- (e) VicRoads approval, where any construction is proposed involving access on to a Main Road or Highway.

6.2 The following items are to be shown on the Engineering Drainage construction drawings:

Three sets of drawings are required for Town Planning assessment. Non compliance of the required detail will delay the approval process.

General:

1. Lot No., boundary dimensions, easements – showing location of any assets e.g. stormwater or sewerage.
2. Street names, north point. [North must be shown up the page].
3. Temporary or permanent bench marks. Location and level. [Level Datum to A.H.D.]
4. Natural surface levels shown as contours.
5. Existing vehicle crossing (including size) and footpath.
6. Existing side entry pits in road reserve adjacent to property.
7. Existing drainage within property boundaries.
8. Existing service authority fixtures – poles, pits, hydrants, mains, etc.

Pavements:

1. Carriageway access widths, and car park set out details.
2. Design pavement contours to be shown, including design levels at all control points.
3. Pavement grades (maximum 1 in 8, minimum 1 in 200).
4. Pavement crossfalls (maximum 1 in 20, minimum 1 in 40).
5. All proposed floor levels.
6. Kerb details (if not standard).
7. Cross-section showing pavement makeup.
8. Expansion/contraction joints, type detailed and location specified.
9. For any alternative pavements, full details to be specified.
10. Soil analysis and pavement recommendation to be shown if alternative pavement type intended (where applicable).
11. For pavement widening within road reserve, (e.g. deceleration lane, passing lane, etc.) check requirements for pavement composition.
12. **Access for disability** – consideration shall be made for disability access in accordance with the DDA (Disability Discrimination Act), i.e. maximum grade 1 in 14.

6.3 Drainage of all paved and roofed areas to be contained and controlled on site:

1. Existing drainage levels.
2. Design drainage levels (to A.H.D.).
3. Downpipe locations and their connections to drainage system.
4. Pipe sizes, types and gradients to be specified.
5. Pit sizes and types to be specified.
6. For industrial, or commercial developments, the pavement drainage is to be via kerb and channel and side entry pits.
7. Trench gratings in accordance with design loads.

8. The drainage collection system for each unit on the site shall be independent of the others with a single connection point to the central or common system.
9. Maximum distance between pits – 30 metres.
10. Where construction is proposed over an existing Council drain or easement, application must be made as soon as possible to the Building Surveyor, where structural building works are concerned.
11. Storm Recurrence Interval – 10 year return period to be used for industrial and commercial developments, and 5 years for residential.
12. Method of providing water proofing to the buildings (where appropriate) to be detailed. For example, where a wall is to act as a retaining wall, consideration should be given to providing adequate subsoil drainage and a suitable tanking membrane.

6.4 Industrial, Commercial and Multi-Unit Development – Drainage Construction Requirements

1. Class of pipes allowed:

(a) Concrete Pipes

Shall conform to AS 1342-1973 “Precast Concrete Drainage Pipes” and its amendments. All pipes designated as R.C. pipe on the drawings shall be Class 2 pipe with spigot and socket rubber ring joints.

(b) Fibre Reinforced Cement Pipes (F.R.C.).

All Fibre Reinforced Cement Pipes shall conform to AS 1342-1973 “Precast Concrete Drainage Pipes”. All pipes designated as F.R.C. pipe on the drawings shall be Class 2 pipe with Adcol “V” ring joints.

(c) PVC

- **Within property** Installation of P.V.C. pipes shall be specified as U.P.V.C. sewer quality or U.P.V.C. heavy duty stormwater, depending on application. Jointing of pipes shall be either:
 - i) solvent welded; or
 - ii) rubber ring joints.

All jointing procedures to conform with AS 2032 Part 3.

The installation of U.P.V.C. pipes to be in accordance with Part 7 of AS 2032.

- **Within road reserve** All U.P.V.C. pipe shall conform to AS 1260-1974 Parts 1-5 “Unplasticised P.V.C. (U.P.V.C.) pipes and fittings for sewerage applications.”

All pipes designated as U.P.V.C. pipe on the drawings shall be Class S.H. Sewer Grade.

- **On-site detention storage** polyethelene pipe as supplied by Caliber Pipelines (formerly RibLoc Australia) or Blackmax supplied by Iplex Pipelines Australia Pty Ltd.

2. Cover Details

Application	Cover Requirement		Class Pipe Required		
	RCP/FRC	UPVC	Minimum Pipe Diameter	RCP/FR C	UPVC
Not subject to vehicular loading	150mm	300mm	90mm	2	Heavy Duty Storm Water
Traffic Areas: Not in Road Reserve Refer Notes	1	2			
(i) within road reserve (not in road formation)	500mm	500mm	225mm	2	Sewer Quality – SH
(ii) in sealed roadway	600mm	600mm	150mm	2	Sewer Quality – SH
Under building slabs	1	600mm	150mm	2	Sewer Quality - SH

Notes:

- (1) Cover to be minimum of 150mm below underside of slab or 500mm below finished level of sealed pavements.
- (2) If cover is not obtainable, then pipe in areas not subject to construction vehicle loading may be encased in 100mm of concrete.
- (3) Whole drain to be encased in 100mm of concrete.

3. Bedding

All drains to be laid in fine crushed rock – minimum of 50mm depth.

4. Backfill

All drains to be backfilled with suitable material properly compacted, for sealed pavements trenches are to be backfilled with 20mm Class 2 crushed rock. Under slabs, it is preferred that where drains are laid close to the surface, the backfill be crushed rock.

5. Pit construction within developments

Refer to Council Standard Drawings for pit construction within the road reserve.

Pits to be constructed in concrete.

Sizes: Junction pits up to 0.5 m deep	minimum 500 mm x 500 mm
Junction pits 0.5 to 0.8 m deep	minimum 600 mm x 600 mm
Junction pits greater than 0.8 m deep	minimum 900 mm x 600 mm
Side entry pits up to 1.5 m deep	minimum 1000 mm x 600 mm
Side entry pits greater than 1.5 m deep	minimum 1000 mm x 900 mm

Note: Polycrrete pits or approved equivalent may be acceptable at the discretion of Council's Representative.

Trench Grates – minimum width of 225mm.

7.0 DRAINAGE DESIGN GUIDELINES FOR BROAD ACRE SUBDIVISIONS

7.1 Major Networks

- Return period is 100 years.
- Flow paths need to be demonstrated.
- Flow volumes need to be estimated.
- Flood levels need to be estimated in order to prevent any blocks from inundation.

7.2 Minor Networks

7.2.1 Return Period:

Industrial Subdivisions	-	10 years
Residential Subdivisions	-	5 years

7.2.2 Runoff Coefficients:

Industrial	-	0.90
Shop sites	-	0.90
Residential < 300m ²	-	0.80
Residential > 300m ²	-	0.60
Low Density	-	0.45
Reserves < 1 Ha	-	0.35
Reserves > 1 Ha	-	0.45

7.2.3 Rainfall Intensities:

Knox City Council rainfall intensities are to be used – Melbourne Area acceptable.

7.2.4 Minimum Times of Concentration:

Residential	-	7 minutes
Low Density	-	9 minutes

7.2.5 Manning's n, sewered & unsewered - 0.013

- 7.2.6 Design needs to cater for all external catchments. Tree reserves should be included in the catchment area.
- 7.2.7 Provide drainage computations that show pipes to be of sufficient capacity.
- 7.2.8 Check if existing properties upstream have existing drains.
- 7.2.9 Check if there is any outfall drainage available. If so check if the consent is required from:
- Affected landowners.
 - Melbourne Water.
- 7.2.10 If any drainage outfall discharges into another property you need to:
- Ensure that an easement exists.
 - Require permission from adjoining owner to enter, and carry out works.
- 7.2.11 Depth of open outlet drains is to be no more than 1.5m maximum, and side slopes to be no steeper than 1 in 3.
- 7.2.12 Check whether catch or cut off drains are required to protect houses from sheet flow from undeveloped neighbouring properties.
- 7.2.13 Velocity in all pipes needs to be greater or equal to 1 m/s, in order to enable self-cleansing.
- 7.2.14 Minimum drop through pits is 50mm. Larger drops may be required if head losses are high.
- 7.2.15 Check if any pipe outlets to lakes or dams are submerged. If so check if backing up in pipelines will occur.
- 7.2.16 No bends in drainage lines larger than 90° are allowed. Also avoid opposing pipes.
- Pipes that are 525mm in diameter and larger, can have bends less than 45° as per manufacturers' recommendations.
- 7.2.17 Provide correct drainage computations. Make sure that the sub-areas are draining as per detail and that they are correct in size & time.
- 7.2.18 Aim for a layout that provides for the drainage of each property at the lowest corner.
- 7.2.19 All house drain connections in the street are to be located 6 metres from the side boundary to allow for vehicle crossing alterations.
- 7.2.20 Consider Water Sensitive Urban Drainage Design methods and options.

- 7.2.21 All pits are to be a minimum of 7m from the side boundaries, except where required to cater for easement drains.
- 7.2.22 Drainage pipes that are parallel to the road should be laid on the high side for practical purposes.
- 7.2.23 Ensure that there are no Grating Pits or SEP's between T.P.'s in kerb returns (only permitted in exceptional cases).
- 7.2.24 Minimum pipe sizes:
- General 225mm
 - Outlet from SEP 225mm
 - Under road pavement 300mm
- 7.2.25 Pipes should not decrease in size downstream.
- 7.2.26 Minimum cover is:
- 500mm in easements
 - 500mm in nature strips
 - 225mm under base course
- 7.2.27 Pipes up to and including 600mm diameter are to be RRJ, Class 2 RCP. (Pipes in easements, of 150 and 225mm Dia, may be Class 12 PVC, UPVC SHGrade).
- 7.2.28 Rubber ring joints need to be provided for large diameter pipes on curves or where there will be heading in pipe.
- 7.2.29 Easement drains should be located to provide 500mm clearance from either side of easement.
- 7.2.30 Anchor blocks are required on all pipes with a slope greater than 1 in 10, at 10 metre intervals.
- 7.2.31 For pipes greater than 1000mm, a separate drain is required for individual house drains.
- 7.2.32 Maximum spacing of side entry pits along kerb and channel is 80m (provided grade is above 1 % when properties drain to kerb and channel).
- 7.2.33 Maximum spacing of pits for easement drains is 60m (for maintenance reasons).
- 7.2.34 Invert level of property inlets to be minimum of 500mm below finished natural surface.
- 7.2.35 Side entry or Grating pits are required on all returns to prevent water flowing around the return.

- 7.2.36 Grating pits, type S-120 series to be shown on all type S-301 series kerb & channel.
- 7.2.37 Pits deeper than 2.5m required gatic covers or as specified.
- 7.2.38 Maximum depth of 600 x 600 easement pits to be 800mm.
- 7.2.39 Minimum depth of side entry pits to be $900 + D/2$ to facilitate connection of A.G. drains.
- 7.2.40 Pit schedule is required with the appropriate pit types and correct sizes shown.
- 7.2.41 Pipes laid around road curves are to be laid straight between pits. Curved pipeline are allowed using RRJ pipes within the radius and deflection limits specified by the manufacturer.
- 7.2.42 Pipes under pavements, parking bays, etc and where side of trench comes within 150mm of back of kerb, must be backfilled with crushed rock. Such backfilling must be shown on long sections.
- 7.2.43 Pit covers to be "Terra Firma" or similar in road reserves and drainage easements unless otherwise specified.