Yarra Ranges Council
Development Engineering Guidelines

Version:	1.2
Department:	Infrastructure Services

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2. Engineering Development Guidelines

2.1 Objectives

The Development Engineering Guidelines have been created to provide developers, engineers, and planners with consistent standards for the design and development of infrastructure within Yarra Ranges.

The primary objectives of these Guidelines are:

- Clearly document Council's standards for the design and development of infrastructure within the municipality.
- Ensure quality infrastructure is delivered to the benefit of the Yarra Ranges community.

These Development Engineering Guidelines have been separated into two sections:

- Section A – Development Stormwater
- Section B – Traffic, Transport and Road Design

Section A - Development Stormwater

3. Stormwater Engineering Process

The following steps are required as part of Councils engineering department for most developments that require a planning permit, with the exception of step 4 which is only required when the creation of new Council assets are required.

When applying for a permit it is recommended to provide the following information

- Point of discharge obtained from Council.
- Stormwater layout plan - concept design without calculations.
- Locations of easements and existing drainage infrastructure.

Providing this information along with a planning application will ensure an efficient permit approval process and avoid / minimise delays

This information and all online portals are available through Council's stormwater website.

3.1 Step 1 - Stormwater point of discharge

A stormwater point of discharge certificate is required to obtain information on where the stormwater will be discharged, it is recommended to obtain the point of discharge before applying for a planning permit.

- Submit via Council's website.
- Please allow 10 working days for processing of application.

3.2 Step 2 - Submit stormwater plans for approval

Prior to works associated with your planning permit commencing, stormwater plans and computations must be submitted.

3.2.1 Pay fee and submit plans and calculations via Council's website

- Refer to your planning permit for your stormwater drainage requirements.
- Designs and calculations must be in accordance with these guidelines and the planning permit.
- Please allow 20 working days for us to assess the submitted documents.

If stormwater plans and calculations have not met the requirements of the planning scheme, planning permit or Councils guidelines, amendments may be requested.

3.2.2 Submit amended stormwater plans and calculations to Council

- Amended plans should be submitted to mail@yarraranges.vic.gov.au to the attention of the stormwater team.
- To ensure plans are assessed/approved in a timely manner, it is the responsibility of the Permit Holder, Design Engineer or their representative to thoroughly review council comments and modify plans and calculations accordingly.
- Please allow 20 working days for the amendments to be assessed.

3.3 Step 3 - apply for a works within a road reserve or easement permit

This permit is required when connecting the stormwater to the point of discharge; this may be in the road reserve or within a council easement. View the permit online.

3.4 Step 4 – Construction of public assets

If the creation of council assets are required to be constructed as part of the permit the following is required.

3.4.1 Payment of bond and surveillance fee

- Inspection/surveillance fee, to the value of $500 or 2.5% of the estimated cost of all Council works.
- Maintenance bond, to the value $5000.00 or 5% of the estimated cost of all Council works.

Bond and surveillance fee can be paid by submitting a quote for the cost of the works to mail@yarraranges.vic.gov.au.

3.4.2 Inspections

48 hours' notice is required prior to the commencement of works. Construction is to be carried out to the satisfaction of council's Works Surveillance Officer. As well as regular site visits the following formal inspections will be required during the course of construction:

- Drainage prior to backfilling.
- Concrete pouring.
- Vehicle crossings prior to pouring of concrete.
- On Maintenance and Off Maintenance final inspections.

3.4.3 Hold Point Inspections

During construction of Council assets, the Permit Holder or their representative must schedule and facilitate inspections to the satisfaction of Council, to inspect the works at various hold points.

Drainage:

- Prepared drainage pipe bedding
- Prepared bedding for drainage pits
- Formwork and reinforcement for drainage pit walls
- Compacted drainage pipe haunching
- Compacted drainage

Backfill Roads

- The proof roll of the Subgrade layer
- The proof roll of the Sub-base layer
- The proof roll of the Base layer
- Base course
- Wearing course

The proof roll inspections must be completed in accordance with Australian Standards 3798 and Section 173 of the VicRoads specifications, to load test the layers to the satisfaction of the Responsible Authority, unless otherwise agreed in writing by the Responsible Authority.

These inspections require 24 hours' notice and should be arranged through Council's

Construction Team who may be contacted on 03 9294 6739.

3.4.4 On maintenance

There shall be a minimum maintenance period of twelve (12) months (between On and Off Maintenance inspections) on all construction work, in accordance with standard industry practice, to the satisfaction of Responsible Authority

3.4.5 Off maintenance

Prior to release of the maintenance bond. Council will require the following:

- 'As Constructed' plans. These plans shall be amended to accord with any alterations during construction and shall be certified by a qualified Civil Engineer that those plans are a true and correct record of the assets
- Where required 'As Constructed' must be submitted to 'A-spec' dataspecifications
- CCTV footage and report for all new Council drainage lines is to be provided to Council's satisfaction and in accordance with the Water Services Association of Australia (WSA) 05-2008 2.2 Code of practice.

4. Stormwater Design Submission

Designs must be submitted in accordance with these guidelines, including but not limited to the following:

- Plans and calculations must be designed by an appropriately qualified civil engineer.
- Copy of Point of Discharge obtained from Council.
- Point of discharge levels must be certified onsite and clearly shown on the plan.
- Permissible Site Discharge (PSD) is calculated using the Rational method.
- Drainage detention volume calculated using OSD4 software.
- Orifice size calculated.
- All pits and pipes are designed in accordance with Australian and Council Standards.
- Internal overland flow path for a 1% average recurrence interval (ARI) storm event must be catered for and shown on the plan.
- Retained trees shown on the plan, including the tree protection zone (TPZ) and structural root zone (SRZ) and tree sensitive construction methods
- Proposed and existing easements, cut and fill, retaining walls and relevant overlays.

The plans and computations must be submitted online with any other required engineering plans via Council's website.

5. Stormwater Calculations

Council has a responsibility under the Local Government Act 1989, Planning and Environment Act 1987 and Water Act 1989 to ensure that new developments within the municipal district do not adversely impact on the performance of the local stormwater drainage system or cause an unreasonable flow of water on to downstream properties in all storm events up to and including the 100-year ARI (1% AEP) storm event.

5.1 Minor Flows – Up to the 5 year ARI event

The minor drainage network system shall include the design of the gutter, pits and pipe network capable of carrying runoff from minor storms, without flooding of gutters, surface of property or access. The design of the minor system shall be to all relevant Australian Standards.

In the event that the contribution of a minor system flow from a development exceeds, pre-development peak flows or the capacity available at the downstream trunk drain the designer shall provide an on-site detention/storage system to Council's satisfaction.

5.1.1 Modelling approach

The scale or size of the development will determine the modelling requirements for onsite detention storage. Australian Rainfall and Runoff 2019 (ARR2019) provides advice is regards to the size of development and type of modelling that should be undertaken. The table below has been adapted from ARR2019 and should be used as a guide for the selection of a modelling approach for developers.

Table 5-1 OSD modelling approaches for various development scales

Development Scale/ Catchment Scale	Description	Size of development	Modelling Approach
Lot	A small parcel of land with 1 or 2 buildings.	Single detached dwelling or duplex up to 1,000 m^2 in area.	Permissible site discharge to be determined with the Rational Method. Site storage determined with OSD4 (Swinburne Method)
Site	A large parcel of land with multiple buildings. Sometimes a small number of 'lots' combined.	Large townhouse complex covering an area up to 1 ha.	Permissible site discharge to be determined with the Rational Method. Site storage determined with OSD4 (Swinburne Method).
Neighbourhood	Many parcels of land each with at least one building. Many 'lots' and potentially some multi-building complexes.	Development covering and area from 1 – 10 ha	Permissible site discharge to be determined with a hydrological model that uses runoff routing of the time area method (i.e. RORB or DRAINS). Site storage requirement determined with a 1D or 2D dynamic hydraulic model (i.e. DRAINS, TUFLOW).
Precinct	Hundreds of parcels of land	Site development	Permissible site discharge to be determined with a hydrological runoff

	each with at least one building. A large number of 'lots' and multi-building complexes combined. Several neighbourhoods	area > 10 ha	routing model (i.e. RORB). Site storage requirement determined with a 1D or 2D dynamic hydraulic model (i.e. DRAINS, TUFLOW).

5.1.2 Storage requirement

All developments that require onsite detention must detain a minimum of:

- 1 in 10 year ARI if the storm event if the property slopes to Council road reserve and meets the major flow design criteria
- 1 in 20 year ARI storm event if the property slopes to the rear or side or towards an easement and meets the major flows design criteria
- There may be cases where a property is required to store 1 in 100 ARI year storm event, this is discuss further in the major flow section of this document.

The majority of development sites (up to 1 ha) within Council will require onsite storage calculated using OSD4 software which utilises the Swinburne Method. OSD4 uses the following parameters to determine the site storage requirements for a property.

- A nominated 5 year ARI PSD calculated using the Rational Method
- The time of catchment (Tcat) = 10 min
- The time of site to outlet (Tso) = 5 min

Developments larger than 1 ha will require a more robust modelling method that will account for the dynamic nature of flow off a site (i.e. flood volume and flow timing). Dynamic hydraulic models such as DRAINS, EPA SWMM, TUFLOW or XP SWMM should be used to size storages. These models will require the consideration of all design storms and durations relevant to the development to create hydrograph inputs for the event being modelled from a runoff routing or time area hydrological model. Model outputs and parameters must be reported and supplied to Council.

5.1.3 Permissible site discharge

The permissible site discharge (PSD) is the peak flow rate allowed to be discharged from a property to the nominated legal point of discharge, and must be limited to a 5 year ARI pre-development peak flow rate.

In general the PSD for a development site will be limited to the either:

- The 5 yr ARI peak flow rate that corresponds to the equivalent of a 35% impervious site coverage.
- Pre-development sites deemed to have less than 35% impervious site coverage will result in a Council nominated PSD equivalent to the corresponding 5 year ARI peak flow for the predevelopment site imperviousness.
- Council may also nominated a PSD based on the interpretation of existing design capacities of the downstream pipe drainage network.

Council's definition of "impervious site coverage" includes all hard surface areas where water is likely to run off rather than infiltrate into the ground. This includes, but is not necessarily limited to:

- All dwellings
- Garages
- Sheds
- Driveways
- Paved areas and paths, etc.

5.1.4 Treatment of uncontrolled runoff

The design of development shall consider the capture of runoff from the entirety of the site. If circumstances arise whereby a portion of the developments impervious area cannot be captured into the on-site detention system the drainage calculations must reflect this.

The simplest way is to calculate the uncontrolled runoff volume, using the detention storage storm event (10, 20 or 100 year ARI). The calculated PSD must be reduced by the calculated volume of uncontrolled runoff flow rate. The modified PSD must then become the nominated PSD.

5.1.5 Calculation method of PSD

The rational method is generally used to calculate design peak flow rates, and the PSD.

The peak flow rate resulting from a storm with an average recurrence interval (ARI) of Y (years) is calculated using the following formula:

$$Q = \frac{CIA}{360}$$

Where the parameters are:

Q = Peak flow rate resulting from ARI of y (years) in (m^3/s).

C = Runoff coefficient for design event having an ARI of y (years).

I = Rainfall intensity (mm/hr) corresponding to a storm duration and ARI.

A = Area of catchment in hectares.

5.1.6 Runoff Coefficient

The following run-off coefficients are to be used by the engineer/designer in the design of the OSD based on an ARI of 1 in 5 years.

- Impervious area (roof or paved areas) C = 0.9
- Pervious areas (Landscaped or grassed area) C = 0.30

Given the above values, a weighted runoff coefficient can be calculated for the pre-developed site. For example, when calculating the calculating the weighted ‘C’ value for a pre-developed site assuming 35% site coverage.

$$C = 0.51 = \frac{0.9\ X\ 35\%\ X\ Site\ Area + 0.3\ X\ 65\%\ X\ Site\ area}{Site\ Area}$$

If the pre-developed site impervious coverage is less than 35% then this should be adjusted in the equation above.

If the extent of works on a post-development site are not known then, weighted runoff coefficient 'C' values given in table below are to be used to calculate the post development flow rates. Alternately, Council may base the runoff coefficient on the maximum site coverage allowed for the development.

Table 5-2 Weighted runoff coefficients if extent of works is unknown

Land Use	C (5 Year ARI)	C (100 Year ARI)
Major open space	0.30	0.40
Residential (average lot size):		
>4000m²	0.40	0.50
>750m²	0.60	0.75
>500m²	0.70	0.85
>350m²	0.80	1.0
<350m²	0.90	1.0
High Density Unit Developments	0.90	1.0
Major Road Reserves	0.80	1.0
Commercial/Industrial	0.90	1.0

5.1.7 Rainfall Intensity

1. Use the time of concentration (TC) table below to choose an appropriate TC (mins) relative to the pre-developed lot size.
2. Select the IFD table that is closest location to the development site.
3. Select intensity value that represents the Tc value selected in step 1 for the ARI event that peak flow is being calculated for.

Table 5-3 Time of concentration for various lot sizes

Land Use (Average Lot Size)	TC (mins)
≥4000m²	12
≥750m²	9
≥500m²	8
≥350m²	7
<350m²	6

Table 5-4 IFD Parameters for Monbulk

Duration T_C (mins)	Intensity (mm/hr)			
	5 Year	**10 Year**	**20 Year**	**100 Year**
5 Mins	84.1	100.0	121.1	177.3
6 Mins	78.4	93.1	112.6	164.4
7 Mins	73.7	87.4	105.5	153.7
8 Mins	69.6	82.5	99.5	144.6
9 Mins	66.1	78.2	94.3	136.8
10 Mins	63.1	74.5	89.8	129.9
11 Mins	60.4	71.2	85.8	123.9
12 Mins	57.9	68.3	82.2	118.5
13 Mins	55.7	65.7	78.9	113.7

14 Mins	53.7	63.3	76.0	109.3
15 Mins	51.9	61.1	73.3	105.3

Table 5-5 IFD Parameters for Lilydale

Duration T_C (mins)	**Intensity (mm/hr)**			
	5 Year	**10 Year**	**20 Year**	**100 Year**
5 Mins	87.3	103.6	125.2	182.3
6 Mins	81.4	96.5	116.5	169.3
7 Mins	76.5	90.6	109.3	158.5
8 Mins	72.4	85.6	103.2	149.4
9 Mins	68.8	81.3	97.9	141.5
10 Mins	65.6	77.5	93.2	134.5
11 Mins	62.8	74.1	89.1	128.4
12 Mins	60.3	71.1	85.4	123.0
13 Mins	58.0	68.4	82.1	118.1
14 Mins	56.0	65.9	79.1	113.6
15 Mins	54.1	63.6	76.3	109.6

Table 5-6 IFD Parameters for Healesville

Duration T_C (mins)	Intensity (mm/hr)			
	5 Year	**10 Year**	**20 Year**	**100 Year**
5 Mins	94.9	110.0	130.3	182.0
6 Mins	88.6	102.6	121.4	169.3
7 Mins	83.4	96.4	114.0	158.6
8 Mins	78.9	91.2	107.7	149.6
9 Mins	75.0	86.6	102.2	141.8
10 Mins	71.6	82.6	97.4	134.9
11 Mins	68.6	79.1	93.2	128.9
12 Mins	65.9	75.9	89.4	123.5
13 Mins	63.4	73.0	85.9	118.6
14 Mins	61.2	70.4	82.8	114.2
15 Mins	59.2	68.0	80.0	110.2

Table 5-7 IFD Parameters for Warburton

Duration T_C (mins)	Intensity (mm/hr)			
	5 Year	**10 Year**	**20 Year**	**100 Year**
5 Mins	87.5	104.2	126.3	185.1
6 Mins	81.6	97.1	117.6	172.0
7 Mins	76.7	91.2	110.4	161.0
8 Mins	72.5	86.2	104.2	151.8
9 Mins	68.9	81.8	98.8	143.8
10 Mins	65.8	78.0	94.2	136.8
11 Mins	63.0	74.6	90.0	130.6
12 Mins	60.5	71.6	86.3	125.0
13 Mins	58.2	68.8	83.0	120.1
14 Mins	56.1	66.4	79.9	115.5
15 Mins	54.2	64.1	77.2	111.4

5.1.8 Orifice size computations method

For orifice sizing use the following formula to determine the area of the orifice. Orifice diameter must not be less than 40mm:

$$A = \frac{Q}{C_d\sqrt{2gh}}$$

Where the parameters are:

A = Area of orifice (m^2)

Q = Permissible Site Discharge (PSD) (m^3/s) (refer section 8)

C_d = 0.6 (coefficient for round shaped pipe)

g = 9.81 m/s^2 (gravity)

h = height (m) (level difference between invert level of orifice and top of weir)

To determine the diameter of the orifice from the area calculated above use

$$Diameter = 2 \times \sqrt{\frac{A}{\pi}}$$

Where π = 3.142

5.2 Major Flows up to the 100 year ARI event

The major system shall comprise both planned and unplanned drainage routes, in piped networks and overland, that will convey runoff from major storms (i.e. the 100 year ARI) to trunk drains or the Council road reserve.

In addition to the management of minor flows, all development must manage the post development overland flow up to the 100 year ARI event. An increase in imperviousness of a site will result in greater peak site runoff flows. Post-development overland flow paths left un-mitigated have the potential to flood private property downstream of a development or be hazardous to people and vehicles traveling along Council Roads.

The determination of overland flow paths for major flows up to the 100 year ARI event must consider the entire catchment flowing through a property (not just the site). In general the design of a development should demonstrate that:

- The development provides freeboard from the overland flow path to finish floor levels within and downstream of the development.
- The development does not cause the inundation of private property downstream.
- The development does not increase flood levels on private property.
- Overland flow paths must meet and maintain flood safety criteria.

The designer shall avoid trapped low points in road sags or downhill court bowls that could cause flooding of private property. Specific escape routes along roadways or public reserves shall be provided to eliminate such trapped low points.

The designer shall plan for roads, public open spaces or drainage reserves along overland flow paths. The pattern of drainage system flows shall be indicated on plans submitted with drainage design computations. The plans shall indicate specific routes designed to capture significant overland flows.

The designer shall ensure that proposed development within the drainage reserves, such as fences, facilities or bridges and culverts, shall not obstruct the path of flows from major storm events.

5.2.1 Flood Safety Requirements

Where a safe overland flow path can be provided along an easement or to an appropriate point of discharge the overland flow path must be clearly shown on the plans. The maximum depth and velocity of flow along an overland flow path for a 100 year ARI design storm shall be in accordance with relevant requirements including the *Melbourne Water LDM, Appendix A - Floodway Safety Criteria:*

- Maximum allowable water depth is 0.30m
- Maximum allowable water velocity is 1.5m/s
- Melbourne Water Flood Hazard Limit = Depth x Velocity = maximum of 0.35m²/s

5.2.2 Freeboard Requirements

Formal overland flow paths within and downstream of the development must provide the following minimum freeboards:

- Habitable buildings adjacent to overland flow paths for a 100 year ARI design storm should ensure gap flows provided 300 mm freeboard to finished floor levels.
- Allotments adjacent to overland flow paths for a 100 year ARI design storm should ensure gap flows provided 150 mm freeboard to the finished level of the lot.
- Allotments that cannot achieve freeboard may require a restriction placed on title (Plan of Subdivision) advising of the flood level and finished floor levels (300mm above flood level) applicable to the affected allotments.
- Council may require allotments to be identified as liable to flooding on the Plan of Subdivision. Hence, requiring the Report and Consent of Council before a Building Permit can be issued under Building Regulation 153.

Where freeboard in the road reserve downstream of the site cannot be provided to an existing structure or is unknown, peak flows and hence flood levels are to be maintained at existing levels for a 100 year ARI design storm.

5.2.3 Provision of overland flow paths within a development

All internal streets or overland flows paths within a development shall be designed for the conveyance of the 100 year ARI design storm, where no pipe is provided, or the applicable gap flow.

Where a low point occurs in a longitudinal road or driveway grading or at the end of a court bowl, the footpath or fixed level at the property line shall be designed to prevent inundation and to provide an overland flow path for the 100 year ARI design storm clear of private property and unencumbered open space.

The overland flow path must meet freeboard and safety requirements.

5.2.4 Storage requirements for up to the 100 year ARI event

In situations where detention basins or tanks for flood storage are proposed for major flow events, modelling methods such as runoff routing and dynamic hydraulic modelling are preferred. It is the designer's responsibility to use the most appropriate method for the particular situation under investigation. The table below provides guidance on the volume of onsite storage required to manage post development 100 year overland flows.

Table 5-8 Criteria for determining required storage volumes

Slope of property & **LPD location**	**Treatment of overland flow path (Q100 from site)**	**Detention requirements** **(1 in x storm event)**
Forward or side sloping with LPD in road reserve	A safe post development 100 year ARI overland flow path can be provided to the road reserve and along Council Roads downstream of the site. The overland flow path must not affect proposed and existing private property and meet Council safety and freeboard requirements. Supporting calculations (modelling if required) must be submitted to Council proving the above.	Provide storage up the 10 year ARI event in accordance with the Minor Flow requirement: retard flow to an acceptable PSD as determined by Council.
Forward or side sloping with LPD in road reserve	No safe 100 year ARI overland flow path can be provided to and along The Council road reserve without affecting proposed and existing property. The flow path does not meet Council safety and freeboard requirements. If the contributing catchment is less than 1 ha then the storage can be designed with software such as OSD4 If the contributing catchment is greater than 1 ha then storage must be designed using a runoff routing hydrological model and/or dynamic hydraulic model (i.e. RORB, XPRAFTS, DRAINS or TUFLOW). Model outputs and parameters must be reported and supplied to Council. Supporting modelling must prove that the addition of onsite detention storage results in an overland 100 year ARI flow path that does not impact private property, meets Council safety and freeboard requirements.	Provide storage up to the 100 year ARI event to retard flow back to pre-development peak flow levels or retard stormwater back to the sufficient capacity of the downstream drainage system whichever is appropriate.

Rear or side sloping with LPD in rear or side easement	The developer can prove that a safe post development 100 year ARI overland flow path can be provided to and along an easement to the road reserve. The overland flow path must not affect proposed and existing private property and meet Council safety and freeboard requirements. If the contributing catchment is less than 1 ha then the storage can be designed with software such as OSD4 If the contributing catchment is greater than 1 ha then storage must be designed using a runoff routing hydrological model and/or dynamic hydraulic model (i.e. RORB, XPRAFTS, DRAINS or TUFLOW). Model outputs and parameters must be reported and supplied to Council. Supporting modelling must prove that the addition of onsite detention storage results in an overland 100 year ARI flow path that does not impact private property, meets Council safety and freeboard requirements	Provide storage up the 20 year ARI event in accordance with the Minor Flow requirement: retard flow to an acceptable PSD as determined by Council.
Rear or side sloping with LPD in rear or side easement	No safe 100 year ARI overland flow path can be provided to and along the easement to the road reserve without affecting proposed and existing property. If the contributing catchment is less than 1 ha then the storage can be designed with software such as OSD4 If the contributing catchment is greater than 1 ha then storage must be designed using a runoff routing hydrological model and/or dynamic hydraulic model (i.e. RORB, XPRAFTS, DRAINS or TUFLOW). Model outputs and parameters must be reported and supplied to Council. Supporting modelling must prove that the addition of onsite detention storage results in an overland 100 year ARI flow path that does not impact private property, meets Council safety and freeboard requirements	Provide storage up to the 100 year ARI event to retard flow back to pre-development peak flow levels or retard stormwater back to the sufficient capacity of the downstream drainage system whichever is appropriate.

5.2.5 Development in Flood Prone Land

In accordance with Building Regulation 153 the report and consent of Council must be obtained for building in areas liable to flooding. If a development is deemed to be in land liable to flooding Council may ask for hydrological and hydraulic modelling to prove that the development provides:

- Finished floor levels of habitable buildings set a minimum 300 mm above the applicable flood level for the property.
- The development does not reduce flood plain storage and displace flood waters.
- The development allows for and does not restrict the free passage of floodwaters so that it does not cause an increase in flood levels, velocity or flows relative to existing conditions.
- Maintains site access to and from the site in line with Council flood safety requirements listed above.

6. Stormwater Design

6.1 Onsite Detention System

When designing a detention system the required detention volume must be below ground (above ground rainwater tanks with a slow release orifice will not be accepted)

The detention system must discharge via gravity to the point of discharge; pumping systems will generally not be supported as part of the detention system.

The following design criteria should be considered when designing the detention system:

- Each chamber of the baffle pit must meet minimum internal dimensions required by Australian Standard AS3500.3:2003 8.6.2.1 (refer to Section 12.1).
- Minimum orifice size is 40mm.
- The construction plan must show the length of detention pipe being used.
- Orifice must be fixed and not removable
- Angled trash grate must be installed using rh3030 Maximesh Expanded Metal Mesh or equivalent
- Minimum 300 cover on storage pipes
- Minimum pipe grade to be 1:200 on storage pipes
- Multiple outlets at different levels may be required if the development requires storage for the 100 yr ARI event.
- Underground detention storage other than storage pipes must be easily maintainable and have sufficient self-cleaning functionality, with silt and build-up protection
- The detention systems must be within the development (preference to be in common property) and must not be on public land or within an easement.
- Ensure the detention system pits are not constructed under buildings or decks.
- Must not be constructed within a tree protection zone, unless the project arborist is able to demonstrate that it will not impact protected trees
- A piped detention system cannot be constructed within a trees structural root zone.
- Is easily accessible for maintenance and in a well-ventilated area.

6.2 Pumping systems

Where Council determines there is no point of discharge, a pumping system may be used with the following requirements:

- Two pumps are required for suitable operation of the pumping system.
- It is suggested that both pumps have equal capacity and that the pumps cycle alternatively during all operations. This will ensure the pumping efforts are shared between both pumps for their lifespan.
- The combined pump capacity must be equal to or exceed the calculated discharge from the site during the 1 in 100 year ARI. This combined pump capacity is to kick in once a preset water level is reached.

- A control panel is to be provided with warning lights to alert of pump or electrical supply failure. The control panel must be placed in a prominent location where property owner/s has easy access and exposure to warning systems.
- Pump systems must have battery back-up power for 3hrs continuous operation in the event of mains power failure. Warning lights to be illuminated when battery back-up is in use.
- An appropriate pump well is to be constructed to house the pumping gear. The pump well shall be easily accessed and maintained and have a grated lid to enable visual inspection of the well.
- Minimum pump sump well dimensions are 900wx900wx800mm deep.
- Pump systems shall pump to a discharge pit which then allows the flows to gravity feed to the Council nominated Legal Point of Discharge.

- Pumps systems must be located as to not adversely affect neighbouring properties with noise during operation

6.3 Outfall drainage

Outfall drainage or drains that will be owned by Council shall be designed based on hydraulic grade line (HGL) analysis, using appropriate pipe friction and drainage structure head loss coefficients. Friction losses in pipe drains shall be calculated using Manning's formula or Colebrook-White formula. Council will also accept dynamic hydraulic modelling outputs from DRAINS, EPA SWMM, 12D or TUFLOW and may in some case request this if storage volume is of concern for the design.

Council will require the designer to submit HGL calculations. HGL analysis shall be carried out by starting at the outfall structure at the lower end of the pipe network and proceeding upwards through each consecutive pipe run to the most remote structure of the pipe network. The designer should consider the following in the design of outfall drains:

- The pipe system shall be designed such that the HGL shall be shown on drainage plans is to be at least 300mm below the surface or kerb or channel invert and not more than 2 metres above the pipe obvert.
- The tailwater level (downstream boundary condition) shall be taken as 300mm below either:
    - Invert of kerb and channel for drains in roads; or
    - Existing surface in easements and open space.
- The design must be submitted on separate plans for archiving with longitudinal section
- Design flow and capacity, velocities are to be shown on the longitudinal section

The table below outlines maximum outfall lengths as required by Council for various types of development.

Table 6-1 Typical maximum outfall lengths for various types of development

Development type	Maximum outfall
Extension to dwelling (if impervious are is greater the 65%)	30m
New single dwelling	30m
1 new, 1 existing	30m
2 new	60m
3 new	80m
4 new or more	100+
Commercial / Mixed	100+

If site drains to the rear, additional outfall may be required.

6.3.1 Pipe Friction factors

The table below outlines pipe friction factors to be applied

Table 6-2 Pipe Friction Factors

Material	Manning's N	Colebrook White (mm)
Concrete	0.013	0.6
Other Materials	To manufacturers specification	To manufacturers specification

6.3.2 Loss coefficients for pits and junctions (adopted from Melbourne Water)

Loss coefficients for pits and junctions are presented in the table below and have been adopted from guidance provided on the Melbourne Water website.

- Qu = flow from upstream pipe;
- Qo = flow out of pit;
- QL = flow from lateral pipes;
- Qg - flow from above the water level; k = pit head loss coefficient
- The pipes are assumed to operate below the water level in the pit. Flows entering from above the water surface should be added to Qg
- Where part full flow occurs in the outlet pipe, tests have shown the water surface is significantly higher. Assume the HGL to be at the pipe obvert and add
- Where the design flows are between the tabulated values, interpolate between the k values

- If Du/Do is less than 0.9 or a better estimate of k is required, refer to design charts in Sangster et al
- Where flow is deflected through a horizontal angle at a pit, add the coefficient from the Figure 6-2 below to the k value from the table, except at drop pits. For drop pits, use the values from the table.

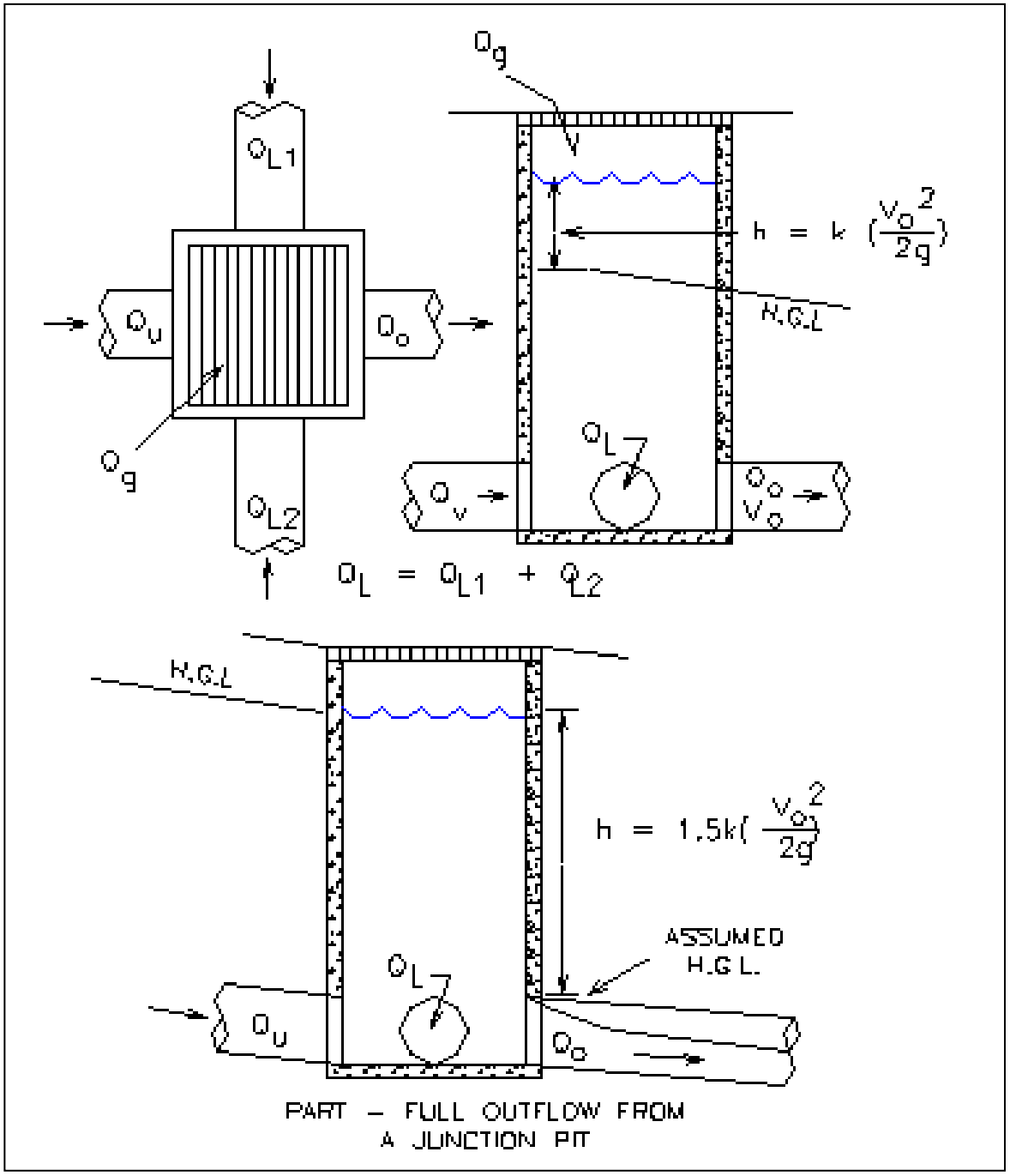

Figure 6-1 Flow regimes through pit (based on Melbourne Water Guidelines)

Table 6-3 Head loss factors for pits (based on Melbourne Water Guidelines)

Description	Qu	Ql	Qg	k
Inlet pit with one outlet pipe:				
(a) side entry	-	-	=Qo	10
(b) grated pit	-	-	=Qo	5
Inlet pit on through pipe	~0.9Qo	-	some	0.5
	~0.7Qo	-	~0.3Qo	1.3
	~0.5Qo	-	~0.5Qo	2.1
Junction pit on through pipe	= Qo	-	-	-
Inlet pit on through pipe with laterals	~0.9Qo	some	some	0.5
	~0.7Qo	some	some	1.1
	~0.5Qo	some	some	1.5
	~0.3Qo	0.7Qo	some	2.0
Junction pit on through pipe with laterals	~0.9Qo	some	-	0.5
	~0.5Qo	~0.5Qo	-	1.5
	~0.2Qo	~0.8Qo	-	2.0
Inlet pit on L bend	-	~Qo	some	1.5
Junction pit on L bend	-	=Qo		1.3
Inlet bend on T junction with laterals	-	~Qo	some	1.8
Junction pit on T junction with laterals	-	=Qo		1.6
Drop pit				

(a) direction change less than 45 degrees	~Qo	-	some	2.0
(b) direction change more than 45 degrees	~Qo	-	some	2.5

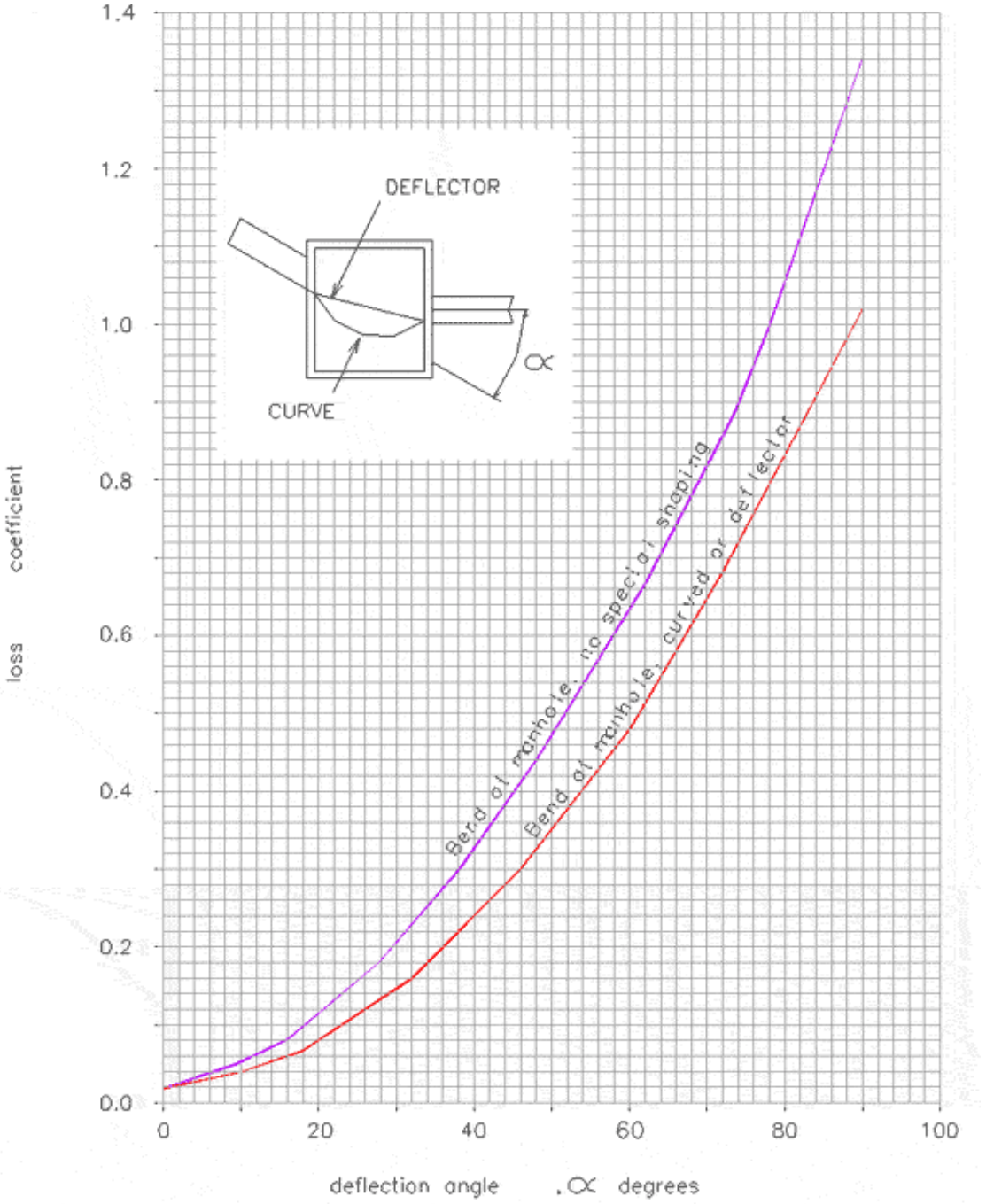

Figure 6-2 Head loss factors for angles in pits (based on Melbourne Water Guidelines)

6.3.3 Minimum acceptable pipe design criteria

Council has some minimum acceptable pipe design criteria including capacity, minimum cover requirements, and minimum slopes (grades) for pipes to be laid to maintain self-cleansing velocities to help prevent blockages and maximum velocities to help prevent scouring. These are detailed below:

- Outfall pipes must be at least 1:100 slope or achieve velocity requirements
- Pits must be used at all changes in direction and grade to allow ease of access for maintenance.

Table 6-4 Minimum pipe capacities for new Council drains:

Property type	Treatment of overland flow path	Minimum pipe design capacity
Residential areas	An adequate safe overland flow path can be provided without detrimentally affecting proposed and existing lots	1 in 5 year ARI
Commercial **Industrial** **High density residential areas**	An adequate safe overland flow path can be provided without detrimentally affecting proposed and existing lots	1 in 10 year ARI
High density industrial & commercial areas of central Lilydale and Kilsyth	An adequate safe overland flow path can be provided without detrimentally affecting proposed and existing lots	1 in 20 year ARI
All Areas	An adequate safe overland flow path CANNOT be provided without detrimentally affecting proposed and existing lots	1 in 100 year ARI

Table 6-5 Pipe cover and backfill and preferred material for Council drains

Location	Minimum Cover	Backfill	Acceptable Material	Minimum Diameter
Easement drain	450mm	Refer to Council standard drawings	RCP UPVC Polypropylene	300mm
Behind kerb	600mm		RCP UPVC* HDPE*	300mm
Under road pavement	700mm		Min Class 2 RCP	375mm
Municipal reserve	450mm		RCP	300mm

Note: Council does not accept Fibre Reinforced Concrete (FRC) or vitrified clay pipes.

6.3.4 Pipe Flow Velocity and Grade

To enable the pipe to be capable of self-cleaning during dry weather flows, the velocities shall be at least:

- 1 m/s for the pipe running full
- 0.8 m/s for the pipe running 1/3 full
- The maximum pipe running full velocity shall be no more than 5.0 m/s

For drains on flat grades, where self-cleaning velocities may be difficult to achieve, additional pits shall be provided to facilitate desilting and removal of debris.

Please note that maximum discharge velocity at water way must comply with water way authority requirements.

6.3.5 Anchor Blocks

Anchor blocks to be used for steep gradients 1:10 designers shall be in accordance with Council's standard Drawing SD/03. The designer may use the table below as a guide for spacing

Table 6-6 Anchor block spacing for various grades

Grade	Max Spacing (m)
Grade steeper than 1 in 5	5
Grade between 1 in 5 and 1 in 10	10
Grade flatter than 1 in 10	Not required

6.4 Pit design criteria

All pits to have:

- Minimum 50mm fall between inlet/outlet inverts
- All grated pit lids in trafficable areas are to be medium or heavy duty bike safe grates

Table 6-7 Design criteria for privately owned pits

Depth to invert of outlet pipe		Minimum Internal Dimensions (mm)		Step Irons Required SD/P8
		Width	Length	
	<600	450	450	No
>600	<900	600	600	No
>900	<1200	600	900	Yes
>1200		900	900	Yes

Table 6-8 Design criteria for Council Owned Pits

Depth to invert of outlet pipe	Minimum Internal Dimensions (mm)		Step Irons Required SD/P8
	Width	Length	
<1000	600	900	No
>1000	900	900	Yes

6.5 Trench grates

- Trench grates must have a minimum internal width and depth of 150mm.
- Where driveway grades exceed 1 in 20, trench grates must have a minimum internal width and depth of 300mm.
- Outlet pipes from trench grates must be a minimum 150mmdiameter.
- Trench grates must be medium or heavy duty bike safe grates.

6.6 Easements

Where no owners' cooperation exists, a Council outfall drain is to be constructed to provide stormwater amenity to each individual lot. An easement in favour of council must be created for the outfall drain on the Plan of Subdivision for the Development

Drainage easements in favour of council must be:

- Shall be a minimum 3 m wide to allow for access and maintenance
- Shall provide a minimum 1 m clearance from the edge of pipe or pit to building footing or structures such as a fence (as shown in the figure below)
- Shall achieve the angle of repose from structures such as footings (as shown in the figure below)
- Shall allow a minimum 2 .7 m clearance to any adjacent roofs or overhead structures (as shown in the figure below)
- Must not contain any private assets
- Must only contain public assets with the approval from the relevant authorities
- Easement shall be wide enough to accommodate overland flows where required.

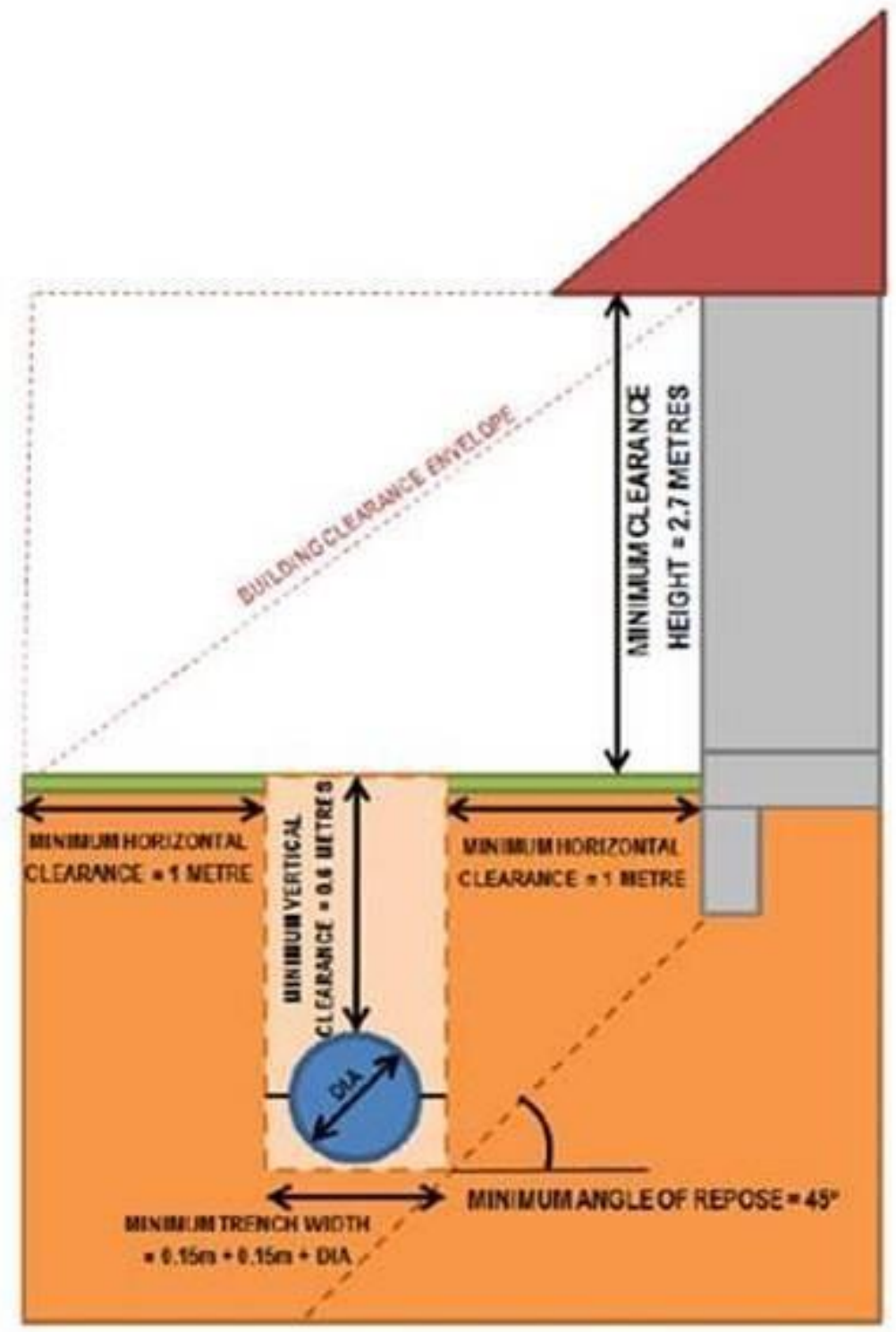

Figure 6-3 Clearances for easements

6.7 Water Sensitive Urban Design (WSUD)

Clause 56 of the Victorian Planning Provisions requires that stormwater run-off from residential subdivisions in an urban area comply with the Urban Stormwater – Best Practice Environmental Management Guideline (BPEMG).

In particular, the urban run-off management objectives outlined in Clause 56.07–4 and Standard C25 address urban stormwater, and will contribute to improved stormwater water quality and assist in achieving the objectives of the State Environment Protection Policy (Waters of Victoria). The standards to be met include performance objectives BPEMG these standards can be met by incorporating water sensitive urban design (WSUD) elements as part of the drainage system.

Council supports the principles of Water Sensitive Urban Design (WSUD) and requires the drainage design to incorporate these principles.

WSUD shall be designed and in accordance with the requirements of Melbourne Water's publication "WSUD Engineering Procedures". Designs should meet Urban Stormwater: Best Practice Environmental Management Guidelines, CSIRO 1999 and WSUD Engineering procedures Stormwater CSIRO 2005 to achieve the following water quality standards:

Best practise must be met on the increase in impervious surface area of the site, existing impervious area does is not required to be treated. The targets are as follows:

- 80% retention of the typical urban annual load for Total Suspended Solids(TSS)
- 45% retention of the typical urban annual load for Total Phosphorus (TP)
- 45% retention of the typical urban annual load for Total Nitrogen(TN)
- 70% retention of the typical urban annual load for Gross Pollutants(litter)

A maintenance plan must be included when designing and determining the location of the WSUD feature

- Plans must clearly show which portion impervious area are connected to WSUD elements
- Rainwater tanks are rain gardens are considered part of WSUD, and are not considered part of the detention storage volume

6.7.1 MUSIC software

For developments greater than 10,000m^2 a water quality model from MUSIC must be submitted to Council to verify the best practices have been met.

Melbourne Water's MUSIC guidelines shall be used for the water quality model and the rainfall zones for Narre Warren North and Mt St Leonard selected as appropriate. Developments in high priority WSUD catchments must achieve 100% best practice. Developments outside these catchments are required to achieve a minimum of 70% best practice.

Please see Melbourne Water's MUSIC Guidelines for further details

6.7.2 Storm calculator

For developments less than 10,000m^2 the Melbourne Water online tool 'STORM' can be used to assess whether best practice water quality objectives have been achieved for your

site.

Developments in high priority WSUD catchments must achieve 100% STORM rating Please see Melbourne Water's STORM Calculator for further information.

6.7.3 Payment of levies to Melbourne Water

If a residential subdivision is less than 10,000m² in area, and offset payment to Melbourne Water in lieu of achieving best practice may be granted. Developments in high priority WSUD catchments are not eligible for the offset payment regardless of the development size.

Further information can be found on Melbourne Water's website.

6.7.4 Little Stringybark Creek

All internal stormwater drainage is to be managed in accordance with the Little Stringybark Creek Catchment project letter from the Department of Resource Management and Geography, the University of Melbourne.

More information can be found at:

https://www.yarraranges.vic.gov.au/Lists/Current-amendments/Amendment-C122-Little-Stringybark-Creek-Planning-Scheme-Amendments

https://www.melbournewater.com.au/planning-and-building/apply-to-build-or-develop/little-stringybark-creek-eso-pre-development-advice

Section B – Traffic, Transport and Road Design

7. Road Design

The design and construction of all relevant roads, streets and allotment accesses should meet or exceed the requirements of Planning Scheme Clause 56.06, these Guidelines and any relevant Acts, Regulations, Australian Standards and VicRoads requirements.

Should additional traffic be generated by a proposed developed, Council may require the upgrade and/or construction of a road from an unsealed road to a sealed road to be funded by the Developer. Where this is required, design should be in accordance with Standard Drawing A2 for Pavement Composition. This drawing can be made available by contacting Council's Infrastructure Services Department.

7.1 Residential Areas

The road reserve of proposed roads, streets and allotment accesses in residential areas should meet or exceed the requirements of Planning Scheme Clause 56.06, based on the projected traffic speed and volume determined in the traffic management strategy, and complies with the aforementioned emergency and waste vehicle requirements.

Where Council holds traffic count data on relevant roads, this information may be made available to the Design Engineer on request. In some instances, the Design Engineer may be asked to undertake additional traffic count data collection on affected roads to ascertain predevelopment traffic volumes and types. Where traffic volumes and type vary seasonally, Council will expect the Design Engineer to use the available data conservatively and to identify any assumptions.

Council will expect all road reserve widths to be sufficient to accommodate the Carriageway, the required services with all necessary clearances, pedestrian and bicycle access, parking, landscaping, drainage and bus routes. Should the development design incorporate certain WSUD devices, increased road reserve widths may be required.

Council will not accept the use of minimum road reserve widths where that would compromise the standard of provision for pedestrian, bus and bicycle users.

7.2 Rural Areas

The design and construction of roads and allotment accesses should meet or exceed the requirements of the Austroads Guide to Road Design, and any relevant Acts, Regulations and Australian Standards.

Council will expect the minimum road reserve width in rural and simular low density developments to be 20 metres. However, additional reserve width is encouraged to facilitate landscaping and pedestrian/bicycle facilities.

7.3 Road Geometry

Council will expect the geometric design of roads to be in accordance with the Austroads Guide to Road Design Part 3: Geometrical Design and any VicRoads supplement to that

publication.

Where horizontal curves are superelevated, Council will expect the Design Engineer to demonstrate that any low points in the kerb and channel resulting from the application of superelevation are adequately drained.

Council will expect all roads for which they are responsible to provide sufficient space for emergency service vehicles (including Country Fire Authority), waste collection vehicles and street-cleaning vehicles to carry out their functions while travelling in a forward-only direction throughout the Development. Information on specific and current Country Fire Authority requirements for subdivisions is available through the CFA website.

7.4 Vertical Curves

Council will expect vertical curve design to comply with the Austroads Guide to Road Design Part 3: Geometric Design and any VicRoads supplement to those guidelines.

7.5 Longitudinal Grade

7.5.1 Roads

Unless otherwise agreed by Council, the minimum longitudinal grade of a sealed road shall be 0.4%., and the maximum longitudinal grade should be 18.0%

Roads without kerb and channel should have a minimum longitudinal grade of 0.2%, subject to the table drains being independently graded at a minimum of 0.5%. The maximum longitudinal grade for rural roads should be 15%, with that grade being maintained over a distance of no more than 150m, while the maximum longitudinal grade adjacent to intersections should be 10%.

7.5.2 Accessways

In accordance with Yarra Ranges Planning Scheme Clause 52.06-9, accessway grades should not exceed 1:10 (10 per cent) within 5 metres of the frontage unless they are safe for pedestrians and vehicles having regard to pedestrian and vehicular traffic volumes, the nature of the car park, the slope of the land and transition treatments at the frontage. This does not apply to accessways serving three dwellings or less.

In accordance with AS2890.1 Clause 3.3, the gradient between the edge of the road and the property boundary shall be a maximum of 1:20 (5%), and for at least the first 6m into the car park.

The grade of the first 6m into the car park may be increased to 1:8 (12.5%) provided all three of the following conditions are met:

- The grade is a downgrade for traffic leaving the property and entering the road; and
- The user class is Class 1, 1A or 2 only; and
- The maximum car park size is:
    - for entry onto an arterial road – 25 car spaces; or
    - For entry onto a local road – 100 car spaces.

In accordance with Yarra Ranges Planning Scheme Clause 52.06-9, Ramps (except within 5 metres of the frontage) should have the maximum grades as outlined in the table below.

Table 7-1 Minimum grades for accessways

Type of Car Park	Length of Ramp	Maximum Grade
Public Car parks	20 metres or less	1:5 (20%)
	Longer than 20 metres	1:6 (16.7%)
Private or residential car parks	20 metres or less	1:4 (25%)
	Longer than 20 metres	1:5 (20%)

7.6 Crossfall

The normal cross-fall on sealed pavements should be 3%. When design speeds require super- elevation of horizontal curves, the cross-fall design should be based on the Austroads Guide to Road Design Part 3: Geometric Design and any VicRoads supplement to that document.

Shoulder cross-falls should be 5%. Where shoulder cross-falls greater than 6% are proposed to be used at intersections or horizontal curves, prior agreement should be sought from Council's Infrastructure Services Department.

The relative change in grade of the kerb line and centreline should not exceed 0.5%.

7.7 Turning Movements

Unless otherwise agreed by Council, cul-de-sacs should be of bowl geometry, and 'T' or 'Y' cul- de-sac heads are not permitted. This is consistent with the requirements of other Victorian Councils.

Council may request for sufficient detail to demonstrate that appropriate, safe and effective passing and turning movements can be accommodated within the proposed road reserve.

7.8 Sight Distance

Council will expect the Design Engineer to demonstrate that adequate sight distances, have been provided, particularly at street intersections and on crest vertical curves. These following sections of the Austroads Guide to Road Design and any applicable VicRoads supplements provide authoritative guidance on these:

- General road design – Austroads Guide to Road Design Part 3: Geometric Design
- Intersections – Austroads Guide to Road Design Part 4A: Signalised and Unsignalised Intersections
- Roundabouts – Austroads Guide to Road Design Part 4B: Roundabouts

Council will expect the Design Engineer to ensure that landscaping plans, and any plans for estate entrance structures, are prepared with due consideration for sightline requirements, and that plans submitted for approval show all existing and proposed features in sufficient detail to demonstrate that appropriate sight distances have been achieved.

7.9 Accessways

In accordance with Yarra Ranges Planning Scheme Clause 52.06-9, the access way should be designed so that vehicles can exit the site in a forward direction if the accessway serves four or more car parking spaces or connects to a road in a Road Zone.

Accessways should:

- Be a minimum of 3m wide, and have an internal radius of at least 4 metres at changes of direction or intersections or be wider than 4.2 metres.
- Be designed to allow vehicles parked in the last space of a dead-end carriageway in public car parks to exit in a forward direction in one manoeuvre.
- Provide at least 2.1 metres headroom should be provided beneath overhead obstructions, calculated for a vehicle with a wheel base of 2.8 metres.

Note: If disabled parking spaces are provided within a basement car park, AS2890.6-2009 requires a minimum clearance of 2.5m above the disabled parking space, and a clearance of 2.2m within the car park accessway.

The planning scheme only requires vehicles to exit in a forward direction if the site has four or more parking spaces, or connects to a road in a road zone. However, Clause 52.06 also recommends that the overall ease and safety of vehicle access to and from the road network is considered.

Reversing for large distances is considered unsafe, particularly where sight distance may be restricted (i.e. along long narrow accessways). As the total distance between the parking space and the road is greater than 30m, it is requested that vehicles accessing this car space are able to turn in no more than three movements, and exit in a forward direction.

In accordance with Yarra Ranges Planning Scheme Clause 52.06-9, if the accessway serves ten or more car parking spaces and is either more than 50 metres long or connects to a road in a Road Zone; a passing area should be provided at the entrance at least 6.1 metres wide and 7 metres long

Accessways serving more than 16 dwellings (Residential driveway as defined in AS2890.1) and longer than 60 metres from the edge of the existing street carriageway are required to

- Incorporate road features from relevant standards of Clause 56.06 based on the Decision Guidelines in Clause 52.06-9.
- Have maximum access way grades of 1:10 (10 percent) within 5m of the existing street frontage to ensure safety for pedestrians and vehicles and/or be designed as an intersection
- Have approved street name(s) on the development plan (along with location of the street sign(s) and subdivision plan (Sign(s) to be supplied and installed at applicant cost and be without Council Logo).
- Facilitate implementation of Waste Management Plan (where collection on the existing front street is unacceptable) that includes a Section 173 Agreement indicating internal Council collection with Indemnity (preferred) OR private collection along with reasonable cost estimates - to ensure future owner or occupier awareness

7.10 Corner splay

Accessways should have a corner splay or area at least 50 per cent clear of visual obstructions extending at least 2m along the frontage road from the edge of the exit lane and 2.5m along the exit lane from the frontage, to provide a clear view of pedestrians on the footpath of the frontage road. The area clear of visual obstructions may include an adjacent entry or exit lane where more than one lane is provided.

Council may consider allowing solid structures (including letterboxes, meter boxes, fences and retaining walls) to be located within the 2m x 2.5m splayed area adjacent to the driveway entrance provided they are constructed to a maximum height of 900mm, to ensure adequate sight distance to pedestrians.

7.11 Roads for Subdivisions

Council roads for subdivision of vacant land serving four or more lots require:

- Full compliance with Clause 56.06 including Table C1- other than use of Shared Zones for 5 lots or less.
- Use of loop roads in accordance with Clause 56.06-4
- 7.5 metre (7.0 metre absolute minimum) carriageway to enable on street parking in front of lots on both sides of the road
- Approved street name(s) on the proposed subdivision plan (Sign(s) to be supplied and installed at applicant cost and is with Council Logo).
- Appropriate footpath facilities in accordance with these Guidelines

7.12 Common Property

A developer may propose for access to be provided to properties by a common area as noted on the Subdivision Plan. Council would expect facilities for all road users in these areas to meet the requirements of these guidelines, and the Planning Scheme or to relevant Australian Standards.

7.13 Kerb and Channel

Council will expect all urban streets to be constructed with a sealed pavement and provided with kerb and channel unless Council has agreed that a different form of treatment is required to comply with WSUD requirements.

Council will expect the Design Engineer to demonstrate that the kerb and channel design secures adequate and safe access to each allotment for vehicles, bicycles and pedestrians, and meets drainage needs. Unless otherwise required to maintain township character, kerb and channel variants should be constructed in accordance with Council's Standard Drawings.

Further advice and more specific detail on this can be provided once a Planning Application has been submitted, or may form part of Planning Permit Conditions.

8. Footpaths/Shared Paths

Where there is no footpath along the existing public road frontage of the site, construction of a sealed footpath, in accordance with Council requirements, should be provided to the nearest existing public footpath or bus stop. Footpaths within the development must be linked to the nearest existing public footpath.

Existing path widths within Yarra Ranges vary from 1.4m footpaths to 3.0m shared paths, however new footpaths must be a minimum 1.5m, as per the Disability Discrimination Act requirements.

Footpaths and shared paths must comply with the Yarra Ranges Planning Scheme Clause 56.06- 5 and Table C1. All footpaths and shared paths must be constructed to Council standards, and appropriate Austroads and VicRoads requirements.

Where a development is expected to cater to a broad range of users, a wider path width may be accepted.

If a footpath along the public road frontage is classified as a shared path under the Principal Bicycle Network or the Hike and Bike Plan, a 3.0m wide path must be constructed to Council standards.

Further advice and more specific detail on this can be provided once a Planning Application has been submitted, or may form part of Planning Permit Conditions.

9. Batter Slopes

Batter slopes should be appropriate for the predominant use of the locality and be designed with consideration to Clear Zones as defined in the Austroads Guide to Road Safety Part 6: Roadside Design, Safety Barriers and any VicRoads supplement to those guidelines.

In areas within the Clear Zone batter slopes should preferably be no more than 1:6, and the absolute maximum should be 1:4. Residential driveway slopes should not exceed 1:10.

10. Bicycle Facilities

On-road bicycle facilities should be provided in accordance with the 'Cycling Aspects of the Austroads Guides' document – available online, and with reference to Council's Hike and Bike Plan, and VicRoads Principal Bicycle Network

Bicycle end-of-trip facilities are required for all developments as outlined in the Yarra Ranges Planning Scheme Clause 52.34 which includes:

- The appropriate number of bicycle parking spaces (refer to table 1 of Clause 52.34-5) for employees/ residents and visitors/ customers.
- Provision of change room and shower facilities.
- Details of the dimensions, signage and facilities required for the different user groups.

11. Vehicle Crossings

Vehicle Crossings are to be constructed in accordance with Council's Vehicle Crossing Guidelines.

Design of Vehicle Crossings must give consideration to:

- Tree Protection Zones
- Clearance to in ground and above ground infrastructure
- Number of vehicle crossings per individual property
- Provision for properties with multiple frontages
- Other considerations as per the Vehicle Crossing Guidelines

Where the choice and/or design of vehicle crossing type are unclear, advice should be sought from Council prior to approval of construction plans.

Where a redundant vehicle crossing is proposed to be removed, kerb, channel and nature strip must be reinstated to Council standards.

Adequate clearances, determined by the relevant Service Authorities, must be maintained from in ground infrastructure some of the nominal horizontal clearances to be observed from assets belonging to Service Authorities include:

- Telstra assets 0.60m
- Yarra Valley Water assets 1.0m
- Power company assets 1.0m
- Council drainage 1.0m

If the above clearances cannot be achieved, the Developer must seek approval from the relevant Authority in writing. Applications will not be considered without the relevant documentation.

If the proposed vehicle crossing requires the removal of a tree or vegetation on private land, or in the road reserve, a Planning Permit will be required.

Note that a Road Reserve/Easement Works Permit is required for vehicle crossing works from Council, and must be obtained prior to works commencing.

All costs related to the alteration, relocation, modification and/or reinstatement of any of the assets or services belonging to Council and/or a Service Authority that may be affected by the proposed vehicle crossing works must be borne by the applicant.

12. Signage and Linemarking

Any proposed signage and linemarking must in accordance with the requirements of:

- AS1742.2:2009 Manual of Uniform Traffic Control Devices - Part 2
- AS2890.5:1993 - Parking Facilities - On-street Car Parking
- AS2890.1:2004 Parking Facilities - Off-street Car Parking

Street, directional and wayfinding signage should be in accordance with Council guidelines for specific roads, trails and townships. These are available on request.

All signage must be designed and located so that sight distance is not obstructed, there is overhead clearance, and the supports are frangible or outside the clear zone.

13. Car Parking

Car parking requirements must be ascertained from the Yarra Ranges Planning Scheme Clause
52.06 - Table 1, to establish the number of car parking spaces required for a development. For residential developments parking must be provided not only for residents but also specifically for Visitors. Industrial/Commercial developments cater for employees, customers and visitors combined.

Further advice, and more specific detail on this can be provided once a Planning Application has been submitted, or may form part of Planning Permit Conditions.

13.1 Reduction

A Planning Permit is required for a reduction in on site car parking requirements or provides additional or improved parking on another site.

Where a reduction in car parking requirements is sought a Car Parking Demand Assessment (undertaken by a qualified traffic engineering consultant) must be submitted with an application, strongly justifying the reduced parking requirement and comparing the car parking supply and occupancy rates observed at other similar developments in Yarra Ranges or comparable locations, to be assessed and to the satisfaction of Council

The Car Parking Demand Assessment must provide all information required in Scheme Clause 52.06-6, any applicable Parking Overlay and or as required by Council.

13.2 Car Parking Layout

The following information should be included in the Planning Application submission documents:

- A statement in the Planning Application submission addressing parking requirements assessed against the Planning Scheme.
- A Car Parking Plan showing:
    - Existing and proposed surface levels.
    - Existing features and services within the abutting road reserve
    - Functional layout in accordance with Scheme and current Australian Standards
    - Dimensions and numbering of car parking spaces and accessways.
    - Location of Visitor car spaces if required, not in tandem with other spaces.
    - Vegetation to be removed and retained.
    - Line marking
    - Signage
    - Traffic controlling/calming infrastructure
    - Details of the composition of the pavement
    - Lighting

13.3 Design

Car park and accessway dimensions shall be in accordance with Clause 52.06 of the Yarra Ranges Planning Scheme.

Car park space dimensions for 90° parking, car spaces are to have the minimum dimensions of 4.9m length x 2.6m width, with a minimum accessway width of 6.4m.

Table 13-1 Car park spacing

Yarra Ranges Planning Scheme Requirements			
Angle	**Accessway width**	Car park width	Car park length
Parallel	3.6m	2.3m	6.7m
45°	3.5m	2.6m	4.9m
60°	4.9m	2.6m	4.9m
90°	6.4m 5.8m 5.2m 4.8m	2.6m 2.8m 3.0m 3.2m	4.9m 4.9m 4.9m 4.9m

Note: The dimensions shown in the table above allocate more space to aisle widths and less to parked spaces to provide improved operation and access. The dimensions in the table above are to be used in preference to the Australian Standards.

Where parking is provided in tandem (one parking space behind another) an additional 500mm in length must be provided between each parking space. Each set of tandem car spaces, or pair of vehicle stacker spaces must be allocated to one residential unit, or commercial tenancy respectively.

Car spaces located within garages, carports or otherwise constrained by walls shall be at least 6m long x 3.5m wide for a single space, and 6m long x 5.5m wide for a double space.

13.4 Gradients

In accordance with AS2890.1 (2004) clause 2.4.6, the maximum gradient within a parking space shall be as follows:

- 1 in 20 (5%) along the length of the parking space; and
- 1 in 16 (6.25%) in any other direction within the parking space

13.5 Column locations

Columns adjacent to 90° parking spaces are to be located between 3.65m and 4.65m as measured from the rear of the car space.

A wall, fence, column, tree, tree guard or any other structure that abuts a car space should not encroach into the area marked ‘clearance required’ as shown in the diagram below. A structure may project into the space if it is as least 2.1 metres above the space.

13.6 Wheel stops

Wheel stops may be provided where it is considered necessary to limit the travel of a vehicle into a parking space. Wheel stops are required to meet AS2890.1:2004 – shown below:

13.7 Accessible Car Parking

All accessible (disabled) parking must comply with the requirements of AS2890.6:2009 - Parking Facilities - Off-street Parking for People with Disabilities.

Accordingly, the parking space must be 5.4m long, with a shared area 2.4m x 5.4m to be provided alongside the parking space. To accommodate their additional length, disabled car parking spaces may encroach into an accessway width specified in Table 2 of Clause 52.06-9 by 500mm.

Refer to the Building Code of Australia 2010 (Section D3 pg. 217) for provision requirement and numbers.

13.8 Car Stackers

A Car Stacker Management Plan will be required by Council whenever mechanical parking or use of car stackers is proposed. Mechanical parking:

- Must not be used for visitor car parking unless used in a valet parking manner.
- Space must be 5.4m long to accommodate vehicles and have a 1.8m height clearance or designed to the satisfaction of Council.
- Operational and Maintenance information must be included in the Car Stacker Management Plan.

13.9 Parking Area Construction and Maintenance

In accordance with Yarra Ranges Planning Scheme Clause 52.06-10, all car parking spaces and vehicular accessways will be required by permit conditions to be constructed, delineated and drained with an appropriate surface. These areas must be maintained in reasonable condition by the owner and must not be obstructed or made inaccessible. Recommendations as to the application of parking surfaces are shown in the table below:

Table 13-2 Applications of parking surfaces

Permeability	Information
Permeable paving	Typically used where pavement is required to have a load bearing capacity such as: car parks, vehicle crossings, and streets with low traffic volumes
Porous concrete or brick pavers	Typically used where a pavement is required to have a load bearing capacity in car parks, vehicle crossings, and streets with low traffic volumes. Note: The pavers are to be spaced in a way to allow for drainage otherwise slope paving to drain to garden beds, swales etc.
Non-porous concrete, asphalt, etc.	Typically used where pavement is required to have a moderate to high load bearing capacity. Note: Where porous/permeable paving cannot be applied, slope hardstand drainage towards swales and grassed buffer zones to reduce stormwater run-off. Load bearing capacity which supports vehicular access.

14. VicRoads Requirements

For property with access to a State Highway or to an arterial road, the proposed access and vehicle crossing will be in accordance with the parameters set out for residential, commercial and industrial development, and is subject to VicRoads referral and approval

15. Construction Management Plan

Council may request the preparation of a Construction Management Plan (CMP) that takes into account all relevant aspects of demolition and building work. The requirement of a CMP is contingent on the type of work proposed, and the likelihood of disruptions to the adjacent road network, local amenity, traffic management, and any other identified risk or issue which requires mitigation at the Planning Permit stage.

A CMP is generally required for multi-unit developments and other developments abutting an arterial road or roads where vehicles are likely to obstruct through traffic and impact on the local amenity. To ensure that building work is undertaken in a safe and effective manner on site, a builder may be required to identify in the CMP some or all of the following elements:

- Public Safety and Amenity
- Operating Hours, Noise, and Vibration Controls
- Air and Dust Management
- Stormwater and Sediment Control
- Waste and Material Re-use
- Traffic Management

16. Waste Management

Waste Management should be considered with regard to Council's Waste Management Policy.

Waste collection, storage and management must be considered as part of the application process. Developers are to take into consideration, Best Practice Guidelines for Kerbside Recycling (By Sustainability Victoria) at Multi-Occupancy Residential Developments. This document recommends that residents walk no more than 50 metres to place the bins for collection or walk more than 70 metres to place waste within the bins.

Generally the collection of all waste bins occurs from the street frontage. However it is also a requirement that when bins are placed in the road reserve, the length of road that the bins occupy cannot encroach onto the frontage of the neighbouring properties. Each week it should generally be allowed for the placement of 2 bins per unit/dwelling, allowing 1 x metre total width for each bin.

Collection can occur on roads within a body corporate development if the road is constructed to enable 10 metre trucks to service. This would need to be undertaken with an Indemnity provided to Council which indemnifies Council and its contractor.

A Waste Management Plan will need to be provided for the site if it is:

- over 4 unit subdivision
- over 3 units within a court bowl
- within a street that has over 60% developments of units
- only a narrow frontage or no frontage other than a driveway I.e. it is not feasible for placement of bins on the frontage
- a roadway within the development to which collection is expected
- on a road with a frontage that is vegetated/impeded (i.e. table drain/bus stops/parking areas/power poles) which will restrict collection
- a Commercial development
- where a developer is proposing a private waste collection service

17. Bicycle Parking

Bicycle parking is required to be provided as part of a development in accordance with Planning Scheme Clause 52.34.

In accordance with Clause 52.34-4 of the Yarra Ranges Planning Scheme, bicycle spaces should:

- Provide a space for a bicycle of minimum dimensions of 1.7 metres in length, 1.2 metres in height and 0.7 metres in width at the handlebars.
- Be located to allow a bicycle to be ridden to within 30 metres of the bicycle parking space.
- Be located to provide convenient access from surrounding bicycle routesand main building entrances.
- Not interfere with reasonable access to doorways, loading areas, access covers, furniture, services and infrastructure.
- Not cause a hazard.
- Be adequately lit during periods of use.

17.1 Long term bicycle parking

A bicycle space for an employee or resident must be provided either in a bicycle locker or at a bicycle rail in a lockable compound. A bicycle compound or a bicycle locker must:

- Be located to provide convenient access to other bicycle facilities including showers and change rooms;
- Be fully enclosed;
- Be able to be locked
- If outside, provide weather protection for the bicycle

A bicycle locker must provide a bicycle parking space for at least one bicycle.

A bicycle compound must:

- Include wall or floor rails for bicycle parking
- Provide an internal access path of at least 1.5 metres wide

17.2 Short term bicycle parking

A bicycle space for a visitor, shopper or student must be provided at a bicycle rail. A bicycle rail must:

- Be securely fixed to a wall, floor or ground.
- Be in a highly visible location for bicycle security (when not in a compound).
- Be of a shape that allows a cyclist to easily lock the bicycle frame and wheels.
- Be located to allow easy access to park, lock and remove the bicycle.

18. Loading and Unloading of Vehicles

Unless there is an existing Loading Zone operating on-street within the vicinity of the site (within 250m), Council will generally not support the unloading or loading of vehicles on-street.

19. Planning Permit Application

19.1 Submission Requirements

Council recognises that requiring a high level of detailed engineering information at an early stage in the planning approval process may serve both to discourage appropriate development and to limit the potential for innovative solutions to engineering problems to emerge. The following sections give an indication of the nature and extent of the engineering information that Developers should normally provide at each stage in the planning approval process.

19.2 Roads, Traffic and Parking

The Developer should, where relevant, engage a Qualified Engineer to prepare a roads and traffic assessment which addresses, at a level of detail appropriate to the objectives of a Development Plan, the impact and management of traffic on the internal and external road networks associated with the planned development. The assessment should consider:

- Proposed internal road hierarchy and functions based on current and predicted traffic volume
- Nominated carriageway widths (measured between kerb inverts) and road reserve widths.
- Conceptual plans of major road layout and major intersection treatments internal and external to the development
- Requirements for upgrading external roads and intersections
- Potential and identified impacts on public transport networks; and
- Potential and identified impacts of staged development;
- Consideration of existing and predicted pedestrian and cyclist movements;
- Any proposed road closures.
- Car-parking layout plan in accordance with the requirements of the Planning Scheme
- Details of any staging of the development and impact on the road network
- Proposed location and design of vehicle crossings and accessways, with reference to Council's Vehicle Crossing Guidelines
- Removal of any existing vehicle crossing/s and proposed reinstatement of kerb and channel

Where new roads are to be provided, and/or existing roads are to be upgraded, in the course of a Development, Council may require that a Traffic Impact Assessment Report [TIAR] and/or Traffic Management Assessment Report [TMAR] be prepared to identify and address the impact of the development on the existing road network, and to establish the key features of the internal road network.

Council will expect the Developer to engage a Qualified Engineer to prepare a TIAR and/or TMAR and may request additional information concerning the experience of the proposed appointee prior to approving the relevant document. While some commercial and industrial Developments may not create new roads or intersections, they may generate sufficient changes in traffic volumes and movements to cause Council to require the preparation of a

TIAR, as defined above.

Where a TMAR is required to be prepared as a condition of the Planning Permit, the submitted plans will not be approved until the traffic control requirements have been accepted in principle by Council's Infrastructure Services Department.

19.3 Traffic Impact Assessment Report

The need for the TIAR should be determined at or before the time of issue of the planning permit, and will normally be triggered where Developments are expected to increase overall traffic volumes by 10%, or by 100 vehicles per day, whichever is the lesser number.

Where both VicRoads and the Council require a TIAR, one report may be prepared meeting the requirements of both organisations.

Issues to be addressed in the TIAR include, but need not be limited to, the following:

- Estimated traffic volumes
- Proposed road closures
- Impact of staged development
- Pedestrian and cyclist movements
- Entry to and egress from thedevelopment
- Recommendations for appropriate mitigating works

19.4 Traffic Management Assessment Report

The need for a TMAR should be determined at the time of issue of the planning permit, or before, and may be triggered by the following:

- Construction of a new road.
- Construction of a new intersection
- Potential for further development
- Multiple Developers within a specific locality
- Large industry or retail/commercial development
- Issues to be addressed in the TMAR include, but need not be limited to, the following:
- Estimated traffic volumes
- Major traffic control items
- Proposed road closures
- Determination of road function and connectivity
- Impact of staged development
- Off street and on street parking
- Pedestrian and cyclists movements within and outside the development
- Entry to and egress from thedevelopment
- For large retail commercial and industrial Developments loading and unloading of deliveries.
- Traffic calming devices, which may include:
    - Roundabouts
    - Traffic islands

- Parallel slow points
- Road humps
- Bus routes
- bus stops/bays

For larger industrial, commercial and retail Developments, Council will expect the traffic management strategy to consider traffic and pedestrian conflict points, location of loading zones and movement of forklifts and other vehicles for loading and unloading, ingress and egress from the site, provision of disabled parking, and parking requirements overall.

The Design Engineer will be responsible for ensuring that, where major Traffic Control Items are proposed to be used, those items are submitted to and approved by Council or VicRoads in a timely manner so that they do not impact on the works program.

19.5 Reduction

A Planning Permit is required for a reduction in on site car parking requirements or provides additional or improved parking on another site.

Where a reduction in car parking requirements is sought a Car Parking Demand Assessment (undertaken by a qualified traffic engineering consultant) must be submitted with an application, strongly justifying the reduced parking requirement and comparing the car parking supply and occupancy rates observed at other similar developments in Yarra Ranges or comparable locations.

The Car Parking Demand Assessment must provide all information required in Scheme Clause 52.06, any applicable Parking Overlay and or as required by Council.

19.6 Road Safety Audits

Where road safety is considered to be an issue in a development, Council's Infrastructure Services Department may request that a road safety audit be conducted prior to the approval of the development.

The purpose of a road safety audit is to achieve the safest outcome for the project or Development concerned.

Council will expect Road Safety Audits to be conducted in accordance with the Austroads Guide to Road Safety Part 6: Road Safety Audit and any VicRoads supplement.

Audits should be carried out at the detailed design stage and after construction has been completed.

The Design Engineer will be responsible for selecting an audit team including two or more experienced or qualified people, at least one of whom should be a Senior Road Safety Auditor accredited by VicRoads. The person responsible for designing the roads in question should not be a member of the team.

The Design Engineer will be responsible for proposing actions to be taken in response to the recommendations of the audit report, but consultation with Council is encouraged if the recommendations are complicated or require community involvement.

Council's Infrastructure Services Department will expect to receive a copy of the road safety audit report, with documented responses to the recommendations, when the detailed design documentation is submitted for approval.

The report of the audit conducted after construction has been completed should be submitted to and accepted by Council prior to the issue of a Statement of Compliance, where relevant, or to the commencement of use.

19.7 Asset Protection Report

Prior to the commencement of any works covered by this permit an asset protection report, including documentation, video and photos, of the existing condition of the asset must be submitted to, and approved by, the Responsible Authority. The condition of the asset must be monitored for the duration of the works and any repairs required must be completed to the satisfaction of Council

At the completion of works a final condition report for of the asset must be submitted and any repairs/re-construction works identified shall be carried out at the cost of the permit holder to the satisfaction of Council

19.8 Works within Road Reserve

Council consent is required to conduct work within a road reserve or easement where Yarra Ranges Council is the responsible authority. This includes:

- constructing, altering or removing a vehicle crossing
- service connections
- drainage and stormwater connections

Prior to commencement of works, a permit must be issued, with Council having received payment and a receipt issued.

The permit will include any standard, or site specific conditions, that must be adhered to.