Local Government
Infrastructure Design Association

How to Guide for Development Engineers

Version 1.5 **March 2020**

Adopted by the LGIDA (Section 17 is awaiting adoption at June 2020 meeting)

Release Date: 25 March 2020

The Infrastructure Design Manual

Is prepared and maintained by the

Local Government Infrastructure Design Association

PO Box 212, Golden Square, Victoria 3555

Version 1.5

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1 Introduction

The Infrastructure Design Manual (IDM) was developed by three Councils in 2006 and released in 2007 after an extensive public consultation process. Since that time other Councils in regional and rural Victoria have adopted the IDM so that at the time of writing this guide there are 46 Councils that have adopted the IDM with another two Councils considering membership.

This guide has been prepared to satisfy the demand by members of the Local Government Infrastructure Design Association (LGIDA) for training in IDM Basics and access to extensive documentation so that new staff have a resource to help them carry out their duties as a development engineer.

Given the increasing turnover of staff in Councils there is a need for a document like this to ensure that there is a consistency of approach and that the lessons of the past are not forgotten.

The IDM is a technical document which cannot due to its nature go into the issues behind some of the requirements contained within it and it certainly cannot document how to carry out the role of a development engineer. This guide seeks to fill these gaps and assist members in their everyday work. The guide relates to IDM version 5.20.

This guide is based on the experience of members and their discussions during Technical Committee meetings and posts that have been made on the forum in the member's section of the website.

It, like the IDM itself, is a guide only and is not be followed slavishly. It is written to assist members think about the tasks that they are required to undertake as a development engineer in a logical and consistent manner.

2 Role of Development Engineer

The role of the development engineer is a pivotal role within Council which involves working with or being part of the planning unit of Council to assess applications

- for planning permits, applications to rezone land,
- infrastructure requirements for new developments and for future expansion of urban areas,
- design plans and construction standards to ensure that developments approved by Council are compliant with the planning scheme and represent good outcomes for the community as a whole.

This will generally involve the development engineer in carrying out the following tasks:

- Assess planning applications, including those related to subdivisions, and recommend engineering conditions to ensure that Council's existing and planned infrastructure is not negatively impacted by the development and that infrastructure handed over to Council will be of a suitable standard and delivers the functionality and useful life that Council expects.
- Provide advice on the requirements for infrastructure, integrated water management, and traffic management for the development of Precinct Structures Plans and Development Plans
- Review and approve engineering plans submitted as part of planning permit requirements
- Inspect and test subdivision construction works to ensure compliance with approved design plans and engineering drawings, specifications, guidelines and conditions.
- Ensure that "as constructed" information relating to infrastructure handed over to Council is provided in the correct format and an accurate record of what has been handed over to Council.
- Ensure compliance with the Infrastructure Design Guidelines, Council Policies and Strategies relating to each development.

In order to carry out these tasks the development engineer will require a detailed knowledge of the Infrastructure Design Manual and a working knowledge of the following documents:

- Relevant Local Planning Scheme
- Planning and Environment Act 1987
- Subdivision Act 1988

The development engineer will require the following skills to assess the various plans and computations submitted as part of Precinct Structures Plans, Development Plans and planning applications:

- Drainage systems design
- Water Sensitive Urban Design (WSUD)
- Traffic Management Impact Assessment, including pedestrian and cycling
- Geotechnical Investigations
- Road design
- Sustainability
- Landscape plans
- Public lighting
- Utility servicing of subdivisions.

3 Infrastructure Design Manual

The IDM was written to provide greater consistency of design requirements across rural and regional Victoria by publishing these requirements and supporting their consistent application across all participating municipalities.

The IDM, Standard Drawings and Sustainable Infrastructure Guidelines can be downloaded from the LGIDA website at http://www.designmanual.com.au/download-idm

The IDM aims to reflect best practice in the industry and has provisions that allow Councils to vary specific IDM requirements providing they meet the objectives of the IDM.

Councils may consider factors such as neighbourhood and township character, heritage precincts, changes in technology, innovation and sustainability in determining the applicability of IDM clauses to a development.

Clause 1.7, 1.8 and 1.9 of the IDM clearly set out the circumstances where Councils may consider varying the requirements of the IDM.

3.1 Neighbourhood Character

There are many townships or parts of towns across Victoria where little development has taken place and they reflect the standards of the time e.g. no kerb and channel, unsealed shoulders, narrow seals. On occasions it has been the trees planted along the roadways that have determined the seal widths and the location of other infrastructure provided in these areas.

The Residents in these areas are often happy with the standard of infrastructure provided and do not wish to see current standards applied to developments in their area. For example, the instance below shows an instance in which development in accordance with the IDM may be considered in-appropriate by the local community.

In another Victorian Town the whole of the eastern section of a town has no kerb and channel or footpaths and minimal drainage. When the residents were asked whether they wanted to contribute to upgrading the streets to current standards they responded with a resounding no. They are happy to have the following streetscape.

Where development is occurring on the fringes of this area the Council is giving serious consideration to infrastructure standards that might apply. As a minimum they are considering underground drainage to address amenity issues that are likely to occur in flat areas. If the area to be developed must be accessed through an existing residential area, Council may consider applying the full IDM standards within the subdivisions, and matching the existing infrastructure provisions for lots fronting existing streets.

Each such application needs to be considered on its merits.

3.2 Heritage Precincts

Where development or infrastructure works are being carried out within a heritage precinct or an area with a heritage overlay it is important, in order to preserve that heritage, to ensure that the infrastructure to be provided is sympathetic to the heritage and in keeping with the infrastructure standards that applied at the time when the original buildings were constructed e.g. redgum kerb and channel as shown below.

Sometimes it is necessary to modify standard infrastructure so it is more keeping with the heritage of the area as can been seen from the side entry pit shown below.

When development is occurring in such areas, the development engineer should consult the Council's heritage adviser to determine what the appropriate infrastructure standards would be for development in these areas.

3.3 Latest version of the IDM

It is recommended that development engineers do not print of copies of the IDM, Standard Drawings or Sustainable Infrastructure Guidelines (SIG). These are updated regularly and must be considered living documents. Instead they should ensure that they are using the latest version of these documents by downloading them from the website.

3.4 Standard Drawings

The LGIDA have prepared a suite of Standard Drawings which accompany the IDM and are attached to it as Appendix F. Once again it is important that the development engineer is viewing the latest version of the standard drawings, downloaded from the website.
http://www.designmanual.com.au/download-idm

AutoCAD versions of the drawings can be downloaded from the resource area of the members section of the LGIDA website. The area can be accessed through the following link
http://www.designmanual.com.au/members

Clause 6.5 of the IDM states that Council will expect the design engineer to use the Standard Drawings so far as reasonably practicable. However they should only be used in more or less standard situations.

Where standard conditions do not apply, the design engineer must prepare a specific drawing for the situation in sufficient detail for the infrastructure to be constructed safely and efficiently.

3.5 Sustainable Infrastructure Guidelines

The Sustainable Infrastructure Guidelines were developed to assist Councils who wished to reduce the amount of energy and natural resources required to build, operate and maintain infrastructure whilst generating less pollution and preserving the natural environment to the greatest extent possible.

Clause 1.9 of the IDM provides a mechanism for Councils to require developers and their own design units to consider using alternative materials and new technologies to reduce the impacts of the infrastructure on the environment.

The SIG enables designers and Councils to evaluate the sustainability of their projects.

4 Understanding Planning

The development engineer must have a basic understanding of planning provisions and the role of the planning unit within a Council in order to carry out their role effectively.

The following link provides information on how the planning system works in Victoria.

The following is an extract from the State Government ""Using Victoria's Planning System" is a detailed guide for people who use the planning system on a regular basis…."

"This guide is designed to help professional planners, local council and referral authority officers, councillors, students, people applying for a planning permit, and people who may be affected by a planning proposal.

It is a technical guide about planning schemes, the Planning and Environment Act 1987, and the Planning and Environment Regulations 2015, and also explains the interaction with other related legislation."

https://www.planning.vic.gov.au/__data/assets/pdf_file/0017/95012/Using-Victorias-Planning-System-2015.pdf

The development engineer will often be asked to comment on proposals at various stages of the planning process from Planning Scheme amendments, including preparation of Precinct Structure Plans and Development Plans through to the issue of a planning permit.

In order to make an informed comment on these proposals it is important that the development engineer is provided with the necessary information to enable the application to be assessed in a timely and effective manner.

Clause 3 of the IDM specifies the information requirements for each phase of the planning process.

The specific information requirements for each stage of the planning process is discussed in detail in the sections that follow.

It is important to understand where the IDM fits within the planning framework. This will depend on whether the IDM is referenced in the planning scheme. The LGIDA has been working with Councils and the State Government to reference the IDM in all member planning schemes so that it will have legitimacy at Victorian Civil and Administrative Tribunal (VCAT) should an appeal to the issue of a planning permit be lodged.

VCAT have upheld conditions and requirements where the IDM requirements have been included in planning permit conditions. See *Evans v Greater Shepparton CC [2017] VCAT 1557.*

By contrast, see the Bass Coast case where the objector tried to use the IDM to defend their case. However, because the IDM was not referenced in the planning scheme at that time, even though it was planned to be referenced, the tribunal member dismissed it as not being relevant. The following is an extract from that decision, *"Although the IDM has been adopted for use by Council's Engineering Department, it does not form part of the Bass Coast Planning Scheme. I understand a Ministerial Advisory Committee has considered how best the IDM should be introduced into planning schemes across the State. However, this has not occurred in an integrated manner as yet. The IDM is not a reference document in the Bass Coast Planning Scheme and there is no policy referring to it. Accordingly, it carries little weight in my considerations."*

Even if the IDM is referenced in a local planning scheme it does not override the provisions of an approved Precinct Structure Plan (PSP) or Development Plan. These may implement different infrastructure standards, which take precedence over the IDM.

Therefore, it is important that when PSP or Development Plans are being prepared, the IDM requirements are used to determine the infrastructure design requirements for these plans.

The development engineer should also understand that the Planning Environment Act 1987 and Planning and Environment Regulations 2015 impose timeframes on Councils to process planning applications.

For normal applications, Councils have 28 days from receiving the application to ask for further information and have 60 days to issue the permit. In the case of VicSmart applications the time frames are much shorter i.e. 5 days to ask for further information and 10 days to issue a permit.

Development engineers must respond to referrals in a timely manner to ensure that these timeframes are met. It is also important to ensure that the planning unit forwards any referrals in a timely manner, so that the development engineer has a reasonable opportunity to assess the application and determine whether additional information is required.

5 Assessment of Planning Applications

5.1 Introduction

In assessing planning applications, the development engineer must consider the following matters:

- Access to and from the development
- Drainage into and from the development including stormwater quality treatment
- Traffic impacts including connectivity to footpaths and cycle paths
- Impact on Council owned infrastructure
- Impact on adjoining properties
- Standard of development
- Report and recommended conditions

The complexity of these assessments will vary with the size and type of development.

To provide a sound basis for these assessments, the applicant for a planning approval or amendment to the planning scheme will be expected to supply the necessary information in accordance with IDM Clause 3 Engineering Information Requirements.

This clause sets out the engineering information that Council would normally expect developers to provide when:

- Applying for a Planning Scheme Amendment
- Submitting a Precinct Structure Plan for review
- Submitting a Development Plan for review
- Applying for a Planning Permit
- Submitting Engineering Plans and Computations

These requirements have arisen from the experience of development engineers required to carry out such assessments. Developers may argue that the amount of information required is excessive and could be provided later in the planning process. However, experience has shown that the information requirements stated in Clause 3 are necessary to ensure good outcomes. There have been many examples where this information was not provided and resultant outcome of the development, from a Council perspective, was compromised. Nearly always the Council, not the developer, has to make the compromise. Unsatisfactory outcomes that have occurred in the past include reduced public open space, poor drainage basin design, poor drainage levels of service and inadequate road widths. The Council is left to deal with such outcomes, sometimes for many years after the development has been completed. The correct information must be provided at every stage of the planning process to ensure that the desired outcomes can be achieved.

The specific information requirements for each type of development will be discussed in the section of this guide dealing with that type of development.

5.2 Preparing a Report for the Planning Unit

Each Council planning unit will have its own referral and response requirements, ranging from the circumstances in which the development engineer is only expected to supply a list of recommended planning permit conditions to a detailed report discussing each of the issues with reference to the appropriate references in the planning scheme. This detailed report may include recommended planning permit conditions. Some planning units wish to prepare their own conditions based on the

information supplied – however, in such cases, misunderstandings can arise unless the development engineer has at least had the opportunity to review the conditions before the permit is issued.

When complex issues arise, development engineers should provide the planning unit with a written report detailing the key issues involved in the application. This will help the planners to understand the logic behind any recommended conditions and assist each party to understand each other's perspective.

Providing a written report on key engineering issues also means that, if the applicant decides to appeal the conditions on the application, all the background information is available and does not have to be reconstructed at the time of preparing for a hearing, which can be many months later.

An example of a planning referral is shown below:

MEMORANDUM

TO:	Development Engineer
FROM:	Planning unit
RE:	Planning Application
DATE:	xx/xx/2019

Application No.:	**PLNxxx/2019**
Proposal:	**Description of Proposal**
Location:	**Lot Number, LP No**
	Street Address and Postcode

I refer to the above planning permit application received by Council. Your comments etc., would be greatly appreciated within the next 14 days.

Should you have any further enquiries regarding the above matter, please do not hesitate to contact the undersigned.

Yours faithfully

Name of Planner

Planner

Comments:

(In this section discuss the issues that are to be considered e.g. access, drainage, impact on Council Infrastructure and any other factors that you believe the planners need to be aware of in assessing the application.)

Note: Please include any relevant reference or incorporated document (Local Planning Scheme).

Responsible officer: Name of Development Engineer Date of Response:

Meeting Required: Yes

Do you support the proposal: Yes

Conditions (IDM):

On the basis of the above comments it is suggested that the following conditions be included:

5.3 Typical Planning Permit Conditions

There are two sets of typical planning permit conditions that have been recommended for use as follows:

1. Model Planning Permit conditions developed by the MPA and available at https://vpa-web.s3.amazonaws.com/wp-content/uploads/2016/07/GAA-Model-Permit-Conditions-Manual-FINAL-November-2011.pdf

   Despite being primarily concerned with residential developments in growth areas around Melbourne, these conditions are useful for broad reference purposes.

2. Standard planning permit conditions prepared for LGIDA members. These have, to some extent, been superseded by the model planning permit conditions, but they can still be useful, particularly in areas not addressed by the Model Planning Permit Conditions.

5.4 Boundary Realignment

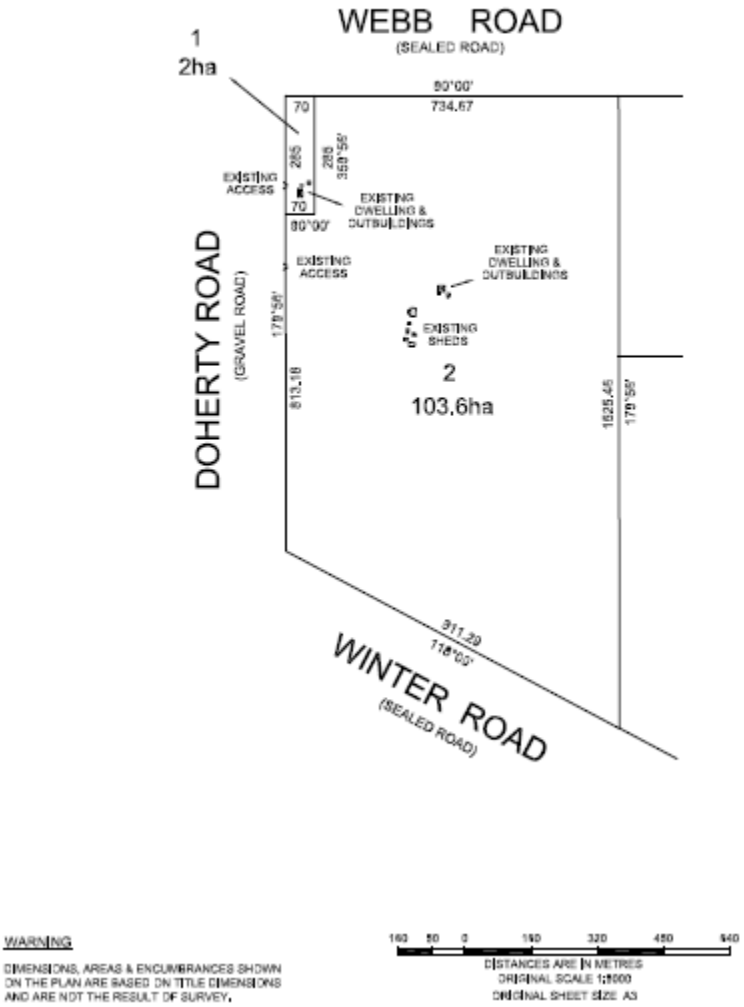
Boundary realignments are potentially one of the simpler planning applications that a development engineer has to assess.

A boundary realignment occurs when there is a subdivision to realign one or more boundaries of the properties without increasing or decreasing the number of allotments in the subdivision.

A typical example of a boundary alignment is shown below:

Existing lot arrangement

Proposed lot arrangement after boundary realignment



The boundary realignment allows for the existing house to be excised from the farm.

5.4.1 Information Requirements

Clause 3.3.4.1 specifies the information requirements for planning permits. Since there is no development associated with boundary realignment, there is no requirement for traffic impact assessments (Clause 3.3.4.2) or a stormwater impact assessment report (Clause 3.3.4.3) to be prepared.

Developers could save time later on in the planning process if, at the planning stage, they provided details of the location and size of existing vehicular crossings, including photographs. Offsets from the edge of the traffic lane would also be useful to determine whether driveable endwalls are required to bring existing crossings up to current standards.

5.4.2 Assessment Considerations

5.4.2.1 Access

Each new lot created will require an access to a road. If each lot has an existing access that meets the minimum IDM requirements for a vehicle crossing, no condition on the planning permit is required.

Clause 12.9 of the IDM provides details of the minimum crossing requirements and lists the relevant Standard Drawings for Urban crossings but not for rural crossings.

The relevant standard drawings for rural crossings are:

SD 255 Typical Swale Drain Vehicle Crossing (Rural Entrance)

SD 260 Typical Swale Drain Vehicle Crossing (Fringe Urban Residential Entrance)

SD 265 Typical B Double Vehicle Crossing (Rural Entrance)

If an additional crossing is required, or an existing crossing is to be upgraded to meet the IDM minimum requirements, then a planning permit condition will be required for this application.

If there is a redundant crossing created by the realignment then a condition will be required for the redundant crossing to be removed.

5.4.2.2 Drainage

The realignment of boundaries may impact the existing drainage on the site. The boundary realignment may cause concentrated water to flow from one property into another to gain access to a legal point of discharge or to a natural flow path.

In such cases drainage may need to be redirected or a drainage easement placed over one property in favour of the other lot.

In irrigation areas a boundary realignment can impact farm drains and access to the relevant irrigation authority's drainage channels. In such cases easements will be required to provide a right to drain through another person's property once the subdivision has been completed.

Alternatively, where there is a small lot excision as in the case above a condition can be placed on the permit for Lot 1 for all the drainage water to be retained on site. This is not unreasonable given that rainfall runoff from the house and sheds is normally collected in rainwater tanks for drinking and other needs.

5.4.2.3 Impact on Council infrastructure

A boundary alignment means that there is no development taking place and as such there is no increase in runoff or in traffic generation which may be triggers for the upgrade of Council infrastructure.

5.4.2.4 Typical Planning Permit Conditions

If each of the new allotments has an existing vehicular crossing that meets the current IDM standards, then no vehicular crossing condition is required.

If each allotment has access to a formal drain e.g. GMW or roadside drain – no drainage conditions required.

If the available information is not sufficient to enable the development engineer to decide whether either of the above exemptions can safely be granted, the following conditions can be inserted:

Rural Vehicle Crossing

Before the Statement of Compliance is issued under the Subdivision Act 1988 any new or otherwise vehicular entrances to the subject land from the road shall be constructed at a location and of a size and standard satisfactory to the Responsible Authority. The vehicle crossing(s) must be constructed at the applicant's expense to provide ingress and egress to the site to the satisfaction of the Responsible Authority.

The crossover must be no less than 4.9 metres in length and include a pipe (with a minimum diameter of 375 mm) able to accommodate the peak flow in the relevant open drain during a 10% AEP rainfall event. Culverts located in the clear zone shall be installed with trafficable end walls (refer VicRoads standard drawing SD 1991). The final location of the crossing is to be approved by the responsible authority.

All bridges and crossings shall be designed to carry a vehicle weighing at least 15 tonnes and be at least three metres in width.

Independent Drainage

Before the plan of subdivision is certified under the Subdivision Act 1988, plans to the satisfaction of the responsible authority must be submitted to and approved by the responsible authority. When approved, the plans will be endorsed and form part of the permit. The plans must be drawn to scale with dimensions, and must include:

a) direction of stormwater run off

b) a point of discharge for each lot;

c) independent drainage for each lot.

d) documentation must be provided demonstrating approval from the relevant authority for the point of discharge.

5.5 Construction of a rural house and or sheds, extension to a house

Planning schemes often require a planning permit for the construction of a house or shed or extension of one in a Farming Zone when the lot size is less than the minimum prescribed.

5.5.1 Information Requirements

Clause 3.3.4.1 specifies the information requirements for planning permits.

Due to the size of the development there is no requirement for traffic impact assessments (Clause 3.3.4.2) or a stormwater impact assessment report (Clause 3.3.4.3) to be prepared.

Since there is no subdivision associated with this application the provisions of Clause 3.3.4.4 do not apply.

Developers could save time in the planning process if at the planning stage they provided details of the location and size of existing vehicular crossings, including photographs. Offsets from the edge of the traffic lane would also be useful to determine whether driveable endwalls are required to bring existing crossings up to existing standards.

5.5.2 Assessment Considerations

5.5.2.1 Access

The lot containing the proposed house or shed will require an access to a road. If the lot has an existing access that meet the minimum requirements for a vehicle crossing in the IDM, no condition on the planning permit is required.

Clause 12.9 of the IDM provides details of the minimum crossing requirements and lists the relevant Standard Drawings for Urban crossings but not for rural crossings.

The relevant standard drawings for rural crossings are:

SD 255 Typical Swale Drain Vehicle Crossing (Rural Entrance)

SD 260 Typical Swale Drain Vehicle Crossing (Fringe Urban Residential Entrance)

SD 265 Typical B Double Vehicle Crossing (Rural Entrance)

If an additional crossing is required or an existing crossing is to be upgraded to meet the IDM minimum requirements, then a planning permit condition will be required for this application.

5.5.2.2 Drainage

Rainfall will normally be collected in water tanks for drinking and other uses. Only when the tanks are full and overflowing will the increased runoff cause a problem. Some Councils put a condition on the permit requiring that all stormwater runoff be contained within the site i.e. the nominated legal point of discharge is within the property.

5.5.2.3 Impact on Council infrastructure

This should have been considered at the time the subdivision was carried out to create the lot on which the buildings are to be erected.

The impact on Council infrastructure in rural areas is limited to the impact of a single vehicular crossing on the road network. This has been covered by detailing the construction requirements for vehicular crossings (see access requirements above).

5.5.2.4 Typical Planning Permit Conditions

If the allotment on which the house or shed is being built has an existing vehicular crossing that meets the current IDM standards, no vehicular crossing condition is required.

If the allotment on which the house or shed is being constructed has access to a formal drain e.g. GMW or roadside drain, no drainage conditions are required.

If the application is for a modest extension to an existing dwelling, there may be no conditions required as access to the property and the drainage point of discharge would not normally be changed as a result of the application. However, care should be taken when an extension would be large enough to have a major impact on the local runoff patterns.

If the available information is not sufficient to enable the development engineer to decide whether either of the above exemptions can safely be granted, the following conditions can be inserted:

> *Rural Vehicle Crossing*
>
> Before the use begins and/or the building(s) is/are occupied any new or existing vehicular entrances to the subject land from the road shall be constructed at a location and of a size and standard satisfactory to the Responsible Authority. The vehicle crossing(s) must be constructed at the applicant's expense to provide ingress and egress to the site to the satisfaction of the Responsible Authority.
>
> The crossover must be no less than 4.9 metres in length and include a pipe a pipe (with a minimum diameter of 375 mm) able to accommodate the peak flow in the relevant open drain during a 10% AEP rainfall event. Culverts located in the clear zone shall be installed with trafficable end walls (refer VicRoads standard drawing SD 1991). The final location of the crossing is to be approved by the responsible authority.
>
> All bridges and crossings shall be designed to carry a vehicle weighing at least 15 tonnes and be at least three metres in width.
>
> *Rural Drainage - Works*
>
> Before the use begins and/or the building(s) is/are occupied all stormwater and surface water discharging from the site, buildings and works must be conveyed to the legal point of discharge drains to the satisfaction of the Responsible Authority. No effluent or polluted water of any type will be allowed to enter any Council drainage system.

5.6 Two lot rural subdivisions

Two lot rural subdivisions are typically carried out to excise an existing house or to create a lot for a new house.

These types of subdivisions are not considered good planning because they can create issues down the track. For example, the owners may complain about the adjacent farming activities and, if either house adjoins an unsealed road, the owner can complain about the level of dust generated from passing traffic.

Nevertheless, a significant number of such permits are still being issued.

5.6.1 Information Requirements

Clause 3.3.4.1 specifies the information requirements for planning permits.

Due to the size of the development there is no requirement for traffic impact assessments (Clause 3.3.4.2) or a stormwater impact assessment report (Clause 3.3.4.3) to be prepared.

If the subdivision is located within a Land Subject to Inundation Overlay or if portions of the land are known to be subject to flash flooding, or to have drainage issues, the provisions of Clause 3.3.4.4 should be considered, and building envelopes identified for lots affected.

Developers could save time later on in the planning process if at the planning stage they provided details of the location and size of existing vehicular crossings, including photographs. Offsets from the edge of the traffic lane would also be useful to determine whether driveable endwalls are required to bring existing crossings up to existing standards.

5.6.2 Assessment Considerations

5.6.2.1 Access

Each new lot created will require an access to a road. If each lot has an existing access that meets the minimum requirements for a vehicle crossing in the IDM, no condition on the planning permit is required.

Clause 12.9 of the IDM provides details of the minimum crossing requirements and lists the relevant Standard Drawings for Urban crossings but not for rural crossings.

The relevant standard drawings for rural crossings are:

SD 255 Typical Swale Drain Vehicle Crossing (Rural Entrance)

SD 260 Typical Swale Drain Vehicle Crossing (Fringe Urban Residential Entrance)

SD 265 Typical B Double Vehicle Crossing (Rural Entrance)

If an additional crossing is required or an existing crossing is to be upgraded to meet the IDM minimum requirements, then a planning permit condition will be required for this application.

5.6.2.2 Drainage

The proposed subdivision may impact the existing drainage on the site. The subdivision may cause concentrated water to flow from one property into another to gain access to a legal point of discharge or to a natural flow path.

In such cases, drainage may need to be redirected or a drainage easement placed over one lot in favour of the other lot.

In irrigation areas, a subdivision can impact farm drains and access to the relevant irrigation authority's drainage channels. In such cases easements are used to provide a right to drain through another person's property once the subdivision has been completed.

Alternatively, where there is a small lot excision, a condition may be placed on the permit for the small lot requiring that all drainage water to be retained on site. This is not unreasonable, given that stormwater runoff from the house and sheds is normally collected in rainwater tanks for drinking and other needs.

5.6.2.3 Impact on Council infrastructure

A two-lot rural subdivision would typically have no impact of Council infrastructure apart from vehicular crossings. These impacts have been reduced by specifying the construction standards for these crossings (see Access above).

Dust nuisance can be a real problem and if possible, should be addressed at the planning permit stage. Clause 12.10 of the IDM specifies the requirement for the provision of dust suppression works. Each Council needs to determine how they will deal with this issue.

When a two-lot subdivision is carried out on an earth road, Council may require that the developer upgrade the road with a gravel pavement to ensure that any dwellings constructed on the lots created have all weather access.

Where an allotment is created at the intersection of two roads, a splay will often be required to improve sight lines. See clause 12.5.5 which details the minimum dimensions of these splays.

5.6.2.4 Typical Planning Permit Conditions

If each of the new allotments has an existing vehicular crossing that meets the current IDM standards, no vehicular crossing condition is required.

If each allotment has access to a formal drain e.g. Irrigation authority drain or roadside drain – no drainage conditions required.

If the available information is not sufficient to enable the development engineer to decide whether either of the above exemptions can safely be granted, the following conditions can be inserted:

> *Rural Vehicle Crossing*
>
> Before the Statement of Compliance is issued under the Subdivision Act 1988 any new or otherwise vehicular entrances to the subject land from the road shall be constructed at a location and of a size and standard satisfactory to the Responsible Authority. The vehicle crossing(s) must be constructed at the applicant's expense to provide ingress and egress to the site to the satisfaction of the Responsible Authority.
>
> The crossover must be no less than 4.9 metres in length and include a pipe a pipe (with a minimum diameter of 375 mm) able to accommodate the peak flow in the relevant open drain during a 10% AEP rainfall event. Culverts located in the clear zone shall be installed with trafficable end walls (refer VicRoads standard drawing SD 1991). The final location of the crossing is to be approved by the responsible authority.
>
> All bridges and crossings shall be designed to carry a vehicle weighing at least 15 tonnes and be at least three metres in width.

Independent Drainage

Before the plan of subdivision is certified under the Subdivision Act 1988, plans to the satisfaction of the responsible authority must be submitted to and approved by the responsible authority. When approved, the plans will be endorsed and then will from part of the permit. The plans must be drawn to scale with dimensions. The plans must include

a) direction of stormwater runoff

b) a point of discharge for each lot;

c) independent drainage for each lot.

d) documentation must be provided demonstrating approval from the relevant authority for the point of discharge.

Splays

(Note: Where a plan of subdivision is submitted and there is an intersection of Council roads make sure that there is a splay at the intersection of at least 5m by 5m in rural areas and 3m by 3m in urban areas. If there is not put on the following condition.)

Before the plan of subdivision is certified under the Subdivision Act 1988 the plan of subdivision shall be modified to show 5m by 5m (for rural) or 3m by 3m (urban) splays at intersections unless otherwise agreed in writing.

Road Upgrading

Before the Statement of Compliance is issued under the Subdivision Act 1988, the developer must either pay an equivalent contribution of XX% of the upgrade cost or upgrade the (insert road name), in accordance with plans and specifications submitted to and approved by the responsible authority. Specific details are as follows:

(insert as appropriate)

(a) gravel pavement (specify location and length of upgrading required);

(b) approved dust suppression works (specify type, location and length);

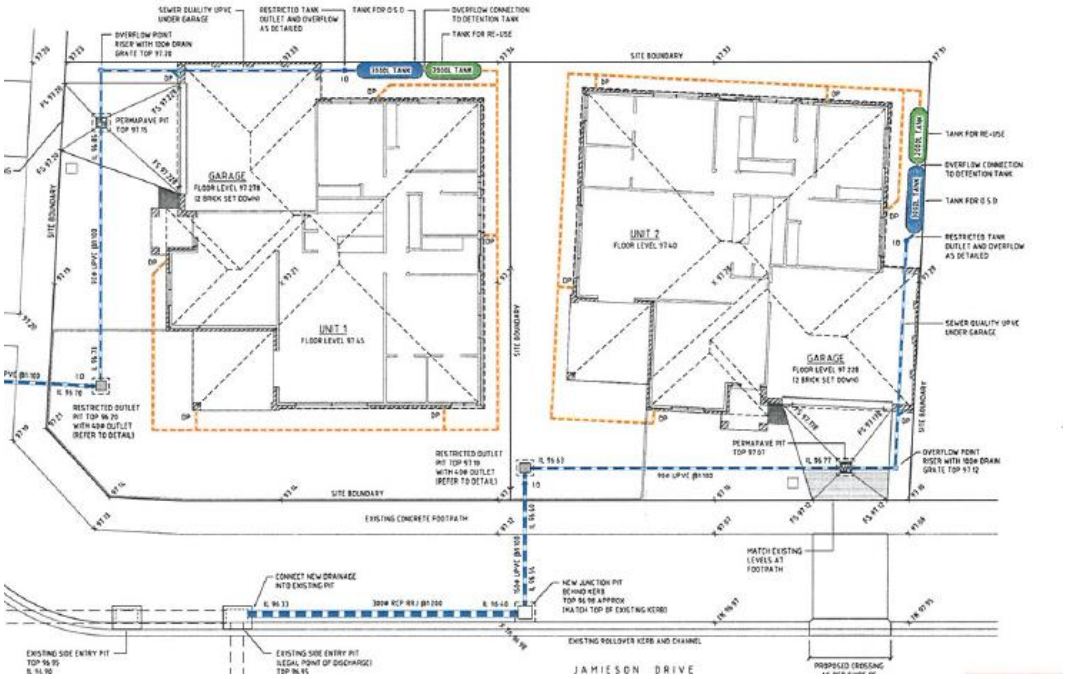
(c) drainage (specify any drainage works required as part of the upgrading of the road);

All works must be in accordance with the requirements of the Infrastructure Design Manual.

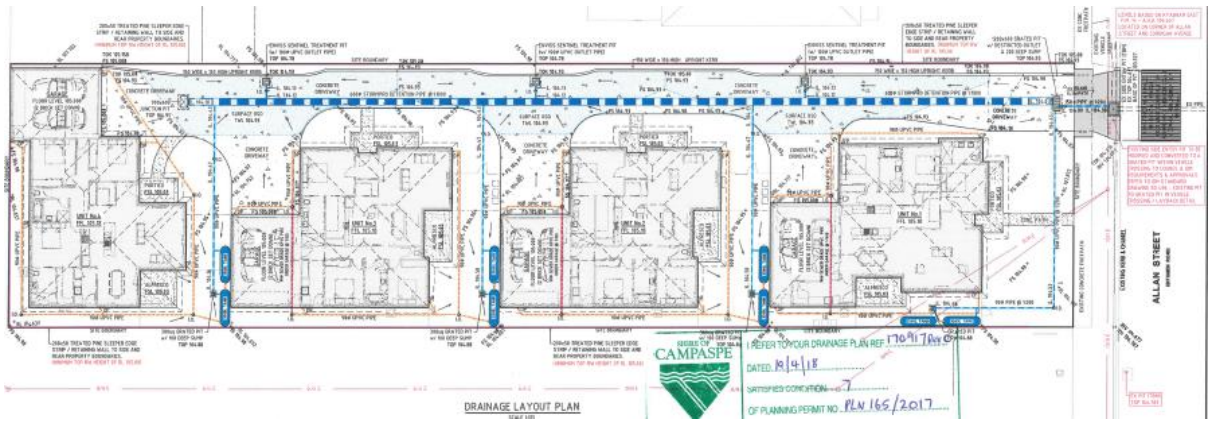
5.7 Multi-unit developments

Multi-unit developments are the most common type of developments in urban areas and need to be carefully assessed because of the impacts they have on existing drainage systems and Council infrastructure.

The following is an example of simple two-unit development showing independent access and independent drainage.



The next example is a 4-unit development with a single access and independent drainage located in common property.



Applications for multi-unit developments may or may not include a subdivision. Sometimes the units are built and occupied, and the subdivision is carried out sometime afterwards.

From a stormwater management perspective, such applications should be considered as if a subdivision was to be carried out immediately.

5.7.1 Information Requirements

Clause 3.3.4.1 specifies the information requirements for planning permits.

5.7.1.1 Traffic Requirements

Generally, this type of development does not require a Traffic Impact Assessment Report or Traffic Management Assessment Report to be carried out.

It is important however it is important to ensure that sufficient information has been supplied with the application to demonstrate that the relevant design vehicles can gain access to and from each allotment without detriment to the safe and convenient operation of the public road(s) serving the development.

5.7.1.2 Drainage Requirements

Clause 11.3 of the IDM states that an SIAR and/or SMAR will normally be required when "more than 5 lots will discharge to a common drainage system."

Normally, the specific drainage requirements are dealt with by planning permit condition/s.

Some applicants will provide details of onsite detention and stormwater treatment with the planning permit application. This assists in determining the impacts of the proposed development.

5.7.1.3 Access

Plans accompanying the application should clearly show all existing and proposed access points to the development. They should identify all those vehicle crossings that are no longer required and specify that they be removed and the area reinstated. The plans should show how any new vehicle crossings impact on street trees, existing drainage infrastructure, any existing traffic management mitigation measures, school crossings and other relevant infrastructure.

5.7.2 Assessment Considerations

5.7.2.1 Access

There is a need to check the practicality of vehicle movements within the development to ensure that wherever possible, when a driveway serves more than one unit, vehicles can enter and leave the property in a forward direction. This requires checking the turning circles of design vehicles for entry and exit to and from each unit when there are multiple units using a common driveway.

5.7.2.2 Drainage

The increased amount of impervious area resulting from multi-unit developments will generally require onsite detention to be provided to ensure that the Council drainage system is not adversely impacted. The exception may be when a two-lot subdivision is proposed in a development when a 10% additional runoff allowance has been made in the drainage network design of the overall development (in accordance with Note 2 to Clause 16.7).

If details of the onsite detention system or stormwater treatment have been provided with the application, it is important to check whether these meet the requirements of Clause 19 (onsite detention) and Clause 20 (Stormwater Treatment) of the IDM or to ensure that they are not endorsed as part of the planning permit when it is issued.

If details of the onsite detention proposed have been supplied it is important to consider whether the proposed legal point of discharge is suitable or whether Council's underground drainage system must be extended in order to service the development, if the plans are likely to be endorsed as part of the issue of a planning permit.

5.7.2.3 Impact on Council infrastructure

Connection to Council Drainage System

It is important to remember that the legal point of discharge is defined under the Building Code and is the point on the boundary of the property, or within the property, to which the drainage from the property is to be directed. It is not the connection point to the Council drainage system.

When Council is asked to nominate the legal point of discharge, it should also advise the applicant where the connection point to the Council drainage system is and what, if any, conditions apply to connecting to that system. This can also be done by planning permit condition.

The type of connection to the Council drainage system needs to be considered. Clause 16.16 of the IDM states that:

> *"In in-fill urban residential and commercial Developments where connection to underground drains is impractical, two (2) kerb adaptors per 20m of frontage should be provided at the time of development. Unless otherwise agreed by Council, kerb adaptors should be located clear of all driveway crossings and at least 1m from kerb crossings.*
>
> *Generally galvanised steel or UPVC adaptors are acceptable unless there is a specific Council requirement as detailed in Selection Table 16.16."*

Where there is no kerb and channel immediately fronting the property, but one exists within one or two allotments of the property, Council may require the developer to extend the kerb and channel and any associated roadworks to service the property due to the increased traffic and impacts on the Council drainage system.

In other situations, the Council may require the extension of the underground drain to service the property, providing that the existing drain is within one or two allotments of the proposed development and this is deemed to be the most effective way to drain the property.

When extensions or upgrades to Council infrastructure are required these will need to be specified in appropriately worded planning permit conditions.

If the property drains to the rear and there is no existing drainage pipe or drainage easement to connect into, consideration must be given to the location of the connection point to the Council drainage system to ensure that the provisions of the Water Act are not contravened by allowing concentrated water or increased flow rates to be discharged from the property. An appropriate drainage condition should be placed on the permit requiring the applicant to prepare and submit an appropriate drainage plan so that this matter can be sorted out as part of the engineering approval.

Stormwater Treatment

An assessment is required to determine whether the proposed development has access to an existing or proposed end of line stormwater treatment provided by Council, or the developer will be required to treat the stormwater prior to it being discharged from the development into the Council drainage system.

This decision will affect the type of stormwater treatment condition to be placed on the permit. Where end of line of treatment is available or proposed to be supplied by Council, a condition can be placed on the planning permit requiring the developer to contribute to the cost of that end of line treatment. This is usually a set cost/ha as determined by the Council.

Where the developer is to provide the treatment then a condition is placed on the permit requiring that computations and plans be supplied to Council to demonstrate how this is going to be achieved.

Other Council Infrastructure

Where a multi-unit development fronts a road without footpaths or sealed shoulders, and this standard is available within one or two lots of the proposed development, Council may require the developer to seal the shoulders, extend the footpath or both as the case requires.

Such extensions/upgrades need to be specifically covered by a planning permit condition.

Some Councils require the construction of the footpath in front of the proposed development regardless of the location within the street

5.7.3 Typical Planning Permit Conditions

Urban Vehicle Crossing Requirements

Before the use begins and/or the building(s) is/are occupied vehicular crossings shall be constructed in accordance with the endorsed plan(s) to the satisfaction of the Responsible Authority, and shall comply with the following:

a) standard vehicular crossings shall be constructed at right angles to the road to suit the proposed driveways, and any existing redundant crossing shall be removed and replaced with concrete (kerb and channel);

b) any proposed vehicular crossing shall have satisfactory clearance to any side-entry pit, power or Telecommunications pole, manhole cover or marker, or street tree. Any relocation, alteration or replacement required shall be in accordance with the requirements of the relevant Authority and shall be at the applicant's expense;

Redundant Crossing Removal

All disused or redundant vehicle crossings must be removed and reinstated (kerb and channel) to the satisfaction of the Responsible Authority.

Road Upgrading (modify to suit works being upgraded)

Before the use begins and/or the building(s) is/are occupied, or before the Statement of Compliance is issued under the Subdivision Act 1988, the developer must either pay an equivalent contribution or upgrade the ***Main Road/service road (insert road name)*** to incorporate ***earthworks, pavement, sealing, shoulder-sealing, drainage, line-marking, footpath, kerbing, and environmental treatments across the frontage of/to*** the development, and contribute ***XX%*** of the upgrade cost of ***(insert road name)*** in accordance with plans and specifications submitted to and approved by the responsible authority. Specific details (as appropriate) are as follows:

(a) fully sealed pavement with kerb and channel and vehicular crossings (specify location);

(b) footpaths and/or shared pedestrian/bicycle paths (specify location);

(c) underground drainage;

All works to be carried out in accordance with the Infrastructure Design Manual.

Where a subdivision is involved the following conditions can be applied.

Supervision Fees

Payment to the Responsible Authority of an amount up to 2.5% of the actual cost of work, being for the costs incurred by the Responsible Authority in supervising the works to the extent specified in the IDM, as determined by the Responsible Authority;

Plan Checking Fee

Payment to the Responsible Authority of an engineering design checking fee of an amount up to 0.75% of the value of documented works.

Drainage Headworks (if applicable)

Before the use begins and/or the building(s) is/are occupied or the plan of subdivision is certified in accordance with the Subdivision Act 1988***,*** the applicant must provide Council a payment of Drainage Headworks of ***($insert amount)*** as contribution towards the cost of existing or future works for the acceptance of surface and stormwater from the buildings, whether or not such works have been or will be situated within the boundaries of the land.

Drainage Discharge Plan

Before any of the development starts or before the plan of subdivision is certified in accordance with the Subdivision Act 1988, a properly prepared drainage discharge plan with computations to the satisfaction of the Responsible Authority must be submitted to and approved by the Responsible Authority. When approved, the plans will be endorsed and will then form part of the permit. The plans must be drawn to scale with dimensions and a minimum of ***three copies (or as specified)*** must be provided. ***The information submitted must show the details listed in the Council's Infrastructure Design Manual and be designed in accordance with the requirements of that manual.***

The information and plan must include:

a) details of how the works on the land are to be drained ***and/or*** retarded.

b) computations including total energy line and hydraulic grade line for the existing and proposed drainage as directed by Responsible Authority

c) independent drainage for each lot (for subdivisions only)

d) underground pipe drains conveying stormwater to the legal point of discharge for each allotment

e) measures to enhance stormwater discharge quality from the site and protect downstream waterways Including the expected discharge quality emanating from the development (output from MUSIC or similar) and design calculation summaries of the treatment elements;

f) a maximum discharge rate from the site is to be determined by computation to the satisfaction of Council **or** (insert) lit/sec/ha.

g) documentation demonstrating approval from the relevant authority for the legal point of discharge.

h) the provision of gross pollutant and/or litter traps installed at the drainage outfall of the development to ensure that no effluent or polluted water of any type will be allowed to enter the Council's stormwater drainage system.

i) the details of the incorporation of water sensitive urban design designed in accordance either "Urban Stormwater Best Practice Environmental Management Guidelines" 1999.

j) maintenance schedules for treatment elements.

Before the use begins and/or the building(s) is/are occupied or issue of a Statement of Compliance all works constructed or carried out must be in accordance with those plans to the satisfaction of the Responsible Authority

Units to be Independently Drained

Each unit including open space areas shall be independently drained to the satisfaction of the Responsible Authority.

As Constructed Plans

Prior to the issue of Statement of Compliance, the applicant or developer shall submit to the satisfaction of the relevant authority the following:

(a) an assets statement;

(b) 'as constructed' information providing the details listed in the Council's Infrastructure Design Manual;

(c) for Councils that have adopted A-Spec, the 'as constructed' information shall be provided in the relevant A-Spec format to Council's satisfaction.

5.8 Residential Subdivisions

Residential subdivisions vary from a simple two-lot subdivision to those used to create allotments for large estates. They also vary according to the zoning category applicable to the land being subdivided, for example, general residential, township, low-density residential or rural living.

While each category will have broadly similar issues that must be addressed by the development engineer, the infrastructure standards that apply will vary due to these factors.

In addition to these considerations the development engineer must take into account the provisions of the Subdivision Act 1988 that cover such matters as the construction of works, provision of public open space, checking fees, supervision fees, certification of plans of subdivision and statement of compliance to be considered when assessing subdivision applications.

The information and discussion that follows is based on the assumption that each subdivision will create at least one new road. Where this does not apply, the previous section, which covered multi-unit developments, can be used to assess the application.

5.8.1 Information Requirements

Clause 3.3.4.1 specifies the information requirements for planning permits. The level of information required to accompany the planning application will vary according to the number of residential allotments being created.

5.8.1.1 Traffic Requirements

There are two types of traffic reports that might be required to be provided with the application.

These are specified in Clause 9 of the IDM.

1. A Traffic Impact Assessment Report (TIAR) is required when there are impacts on the existing road network and identifies appropriate mitigating works
2. A Traffic Management Assessment Report (TMAR) is required to determine the internal road layout, road widths, functions and connectivity for all road users.

Clause 9.3.1 specifies that a TIAR where the proposed development is expected to increase the overall traffic by 10% or by 100 vehicles per day whichever is the lesser.

Clause 12.3.1 state that the traffic generation for residential lots can be assumed to be 10 vehicles per day. Using this rate, the development engineer can quickly determine whether a traffic impact assessment report is required.

Any subdivision with 10 lots or more will trigger the 100 vpd limit and, if an existing road has a traffic count of 100 vpd, even one additional lot would generate the requirement for a TIAR. If the existing road had a traffic count of 500vpd, a five-lot subdivision would be sufficient to generate the requirement for this report.

Clause 9.3.2 lists the triggers for the preparation of a TMAR as follows:

- Construction of a new road.
- Construction of a new intersection.
- Potential for further development (may need Development Plan to assess).
- Multiple Developers within a specific locality.
- Large industry or retail/commercial development.

As this section deals with residential subdivisions that create at least one road, a Traffic Management Strategy incorporating the requirements of both the TIAR and TMAR is required to be supplied with the application. Note that, if the subdivision proposes access to a VicRoads arterial road, VicRoads may also require a TIAR to be prepared.

The development engineer should check that the traffic reports submitted with the application provide all the information specified in Clause 9.4.

In particular, the development engineer should check that the road widths and their classifications comply with Table 2 of the IDM and the traffic generation figures match those specified in Clause 12.3.1. While some traffic engineers still believe that the figure should be around 9 vpd, the 10 vpd rate was arrived at by measuring the traffic volumes on court bowls where there are no other factors affecting the traffic volumes. The development engineer should ensure that the traffic growth figures are reasonable and that modelling covers a 20-year period. Note that, when the proposed development is part of a PSP or DP which is expected to provide a residential lot supply for a period of more than 20 years, a longer design growth period may be appropriate.

There is also a need to check the road classifications proposed by the developer. Classifications should not be based on traffic volumes, which are indicative only, but should reflect the primary function of the road.

The development engineer should ensure that the report addresses pedestrian and cycle movements and identifies the location and connection routes to existing footpaths, shared paths and bike paths in the area. The report should also address any proposed mitigation works required to address the impacts of the development.

Some judgment is required to determine how far away from the development the impacts should be considered. There must be a clear nexus between the proposed development and the proposed mitigation works. Otherwise there is a chance that a permit condition requiring these works may be overturned through an appeal to VCAT.

It is important to ensure that, where the TIAR and TMAR identifies required mitigating works, the trigger for these works is specified in the report, so that conditions can be drafted to indicate when these works are required to be carried out. Certain works may not be required at the start of the development but will be required once traffic volumes reach a certain level.

Care needs to be taken to ensure that the report refers to the number of lots, instead of stages, as stages can be varied to meet the wishes of developers during the life of the development.

5.8.1.2 Drainage Requirements

Two types of stormwater reports may be required to be provided with the application as part of an overall Stormwater Management Strategy. They are the Stormwater Impact Assessment Report (SIAR) and the Stormwater Management Assessment Report (SMAR)

These are specified but not defined in Clause 11 Stormwater Management Strategy of the IDM.

Although not formally included in the IDM, the following definitions will assist the development engineer to understand the requirements.

An SIAR is required when there are impacts on the existing drainage network and identifies appropriate mitigating works

An SMAR is required to determine the internal drainage, overland flow-paths, retardation and stormwater treatment and connectivity to the existing drainage network.

Clause 11.3 of the IDM states that an SIAR and/or SMAR will normally be required when

- a proposed d**evelopment** will include the construction of one or more new:
  - retardation basins; or
  - WSUD quality treatment facilities; or
  - drainage outfalls; or
- there is potential for significant further development within the catchment; or
- the catchment involves multiple **Developers** within a specific locality; or
- more than 5 lots will discharge to a common drainage system;

Based on the above requirements both a SIAR and SMAR are required.

Clause 11.4 details the specific information requirements and notes that the extent of the information required will vary with the relevant stage of the planning approval process.

For a residential subdivision all the requirements listed in 11.4 are relevant and should be provided.

The development engineer must ensure that the SIAR identifies and considers all flows entering the proposed development from adjacent properties and also considers where stormwater currently discharges from the site of the proposed development. This is essential to ensure that s16 of the Water Act, requiring that water not be concentrated or the rate of flow increased or the course of water altered to the detriment of others, is not contravened by the proposed development.

Where stormwater is being discharged into a watercourse, drainage channel or other outfall then the SIAR must include the requirements of the responsible authority in relation to receiving that flow. These requirements may include flow rate restrictions, water quality standards and standards for construction of outfall drains etc.

The report should include any staging of the works that are proposed to be carried out and show how interim works are going to fit in with the overall drainage design for the development.

5.8.1.3 Stormwater Treatment Requirements

Sufficient information should be provided with the planning permit application to determine whether any land set aside for stormwater treatment and or retardation is sufficient for that purpose especially as this may impact on lot yield and layout.

Rules of thumbs have proved to be unreliable for this purpose. Computations based on the lot layout, topography and stormwater quality parameters should be included with the application or at least submitted before the Plan of Subdivision is submitted for certification.

5.8.2 Assessment Considerations

5.8.2.1 General

If a Precinct Structure Plan (PSP) or Development Plan (DP) covers the area where the residential subdivision is taking place, the application must be assessed against the requirements of the PSP or DP, which take precedence over the requirements of the IDM.

If the application is for a later stage of a staged subdivision, the application must be assessed against the original permit conditions and any endorsed plans issued at the time.

5.8.2.2 Access and Traffic

The development engineer must consider any recommended traffic mitigation measures and determine whether they adequately address all the identified impacts, both within and beyond the subdivision. A nexus must be established between the development and the proposed mitigation works. The further away the proposed measures are from the development, the harder it will be to establish that a nexus exists.

Traffic modelling should indicate the percentage increase of traffic due to the development. This assists in determining the nexus for the works, but it is not the only factor to be considered.

Another factor will be the trigger for the works. Various intersection treatments are triggered by the through and turning traffic volumes. In some cases, those triggers may have already been reached, and it would be unreasonable to require the developer to upgrade an intersection which should already have been upgraded by the responsible road authority.

Where traffic mitigation measures are recommended, it is important to determine to what proportion of the total cost the developer should contribute to the relevant works. Some traffic engineers will recommend that cost sharing should be based on existing traffic volumes compared to the increase of traffic as a result of the development. For example, if there is a 50% increase in traffic resulting from the development, the developer should only have to pay 50% of the cost of the requisite mitigation measures.

This contention is unreasonable when the existing traffic does not warrant any mitigating works and only the development causes traffic to increase to such a level that the trigger is reached. When this is the case, the developer should be required fully to fund the mitigating works.

However, Councils should not require developers to meet or contribute to the costs of renewal works on existing Council roads.

Once the mitigating works have been determined, the development engineer must determine whether any special planning permit conditions are required for any of those works and when the works should be carried out. If the works have yet to be designed, a standard condition can be used requiring that the recommendations of the relevant TIAR be implemented to the satisfaction of the Responsible Authority.

In reviewing development plans, the development engineer must consider the location of all the proposed streets to determine whether the proposed road widths and profiles are acceptable. In cases where a street abuts Public Open Space (POS) or similar it may be possible to reduce the nature strip width on one side, if the footpath or shared path is to be located within the abutting POS, providing that there is adequate spacing for the services.

Where the proposed developed abuts an existing residential area that was developed when there were differing engineering standards, the development engineer must consider how to transition from one standard to another. For example, an existing street having a width of 11m between kerbs may be extended to serve a new area where the width between kerbs is to be reduced to 7.3m. Should the 11m carriageway be extended to the next intersection (after which it can be reduced to 7.3m) or should another type of transition be considered? Each case will have to be decided on its merits.

A similar situation can occur with footpaths having varying widths, or where footpaths were not previously required.

The development engineer must ensure that Council's practice in relation to vehicle crossings has been taken into consideration. In particular, Council may require vehicle crossings to be constructed prior to the Statement of Compliance being issued or, where rollover kerbs are used, may leave this to the purchasers of the allotments.

Both positions have advantages and disadvantages.

The advantages of requiring developers to fully construct vehicle crossings as part of the subdivision is that service connections to properties and street tree locations can be properly planned with regard to the location of the driveways. The disadvantage is that those purchasing an allotment rarely look at the location of an existing vehicle crossing when designing their house, resulting in many requests to Council to relocate their driveways, with some even expecting Council to pay for the relocation works. Any change to the location of vehicle crossings requires a Works Within Road Reserve Permit and removal of the unused crossing. In many cases, the workmanship evident in the processes of removal and reinstatement has been of a very poor quality.

For this reason, many Councils have adopted a SM2 modified kerb and channel profile and left it to landowners to place their vehicle crossings to suit the house they are building. Both the footpath and the kerb and channel have been designed for vehicular traffic, and the landowner only has to construct the infill between these elements. This has not entirely removed the disadvantages of the first option, as some landowners still want to construct vehicular crossings where there are drainage pits, street trees, service connections and other infrastructure. In addition, some landowners do not construct the infill, and just drive over the nature strip or place some gravel which is ineffective and unsightly.

Some Councils require developers to lodge a bond for the construction of vehicular crossings which is progressively released on the completion of crossings by landowners. This has the disadvantages of relatively high administrative costs, and the possibility of having insufficient bond funds available to construct any outstanding crossings.

5.8.2.3 Cul-de sac's

The plan of the proposed subdivision should be checked to see if there are any hammerhead or Y terminations to a cul-de-sac. These are not permitted by the IDM, because they involve vehicles reversing and several people have been killed by reversing cars. See Clause 12.3.4 of the IDM for further information on this matter. There is also a principle set within the IDM on this matter.

5.8.2.4 Access Lanes

The planning scheme allows for access lanes to be constructed but many Councils (see Selection Table 12.3.1 Access Lanes) believe they are undesirable. In particular, because they are normally located at the rear of the lots, they are not subject to direct surveillance from other properties.

This same reasoning has been used to ensure that pool fencing is used along pedestrian laneways (links) between streets and to avoid having houses back on to public open space.

5.8.2.5 Stormwater Drainage

The development engineer should carefully assess the stormwater drainage information supplied with the application, including any SIAR or SMAR, in order to determine whether:

- the impacts of the proposed development on the receiving waters or Council drainage system have been identified, and whether discharge rates from the development need to be specified or determined; and
- if discharge rates are to be restricted, a sufficiently detailed set of computations has been provided to determine the size of any retardation basin, and the area of land required to accommodate that basin (note that any area of land set aside for use as a retardation basin must include a 5m wide reserve around the edge for access by maintenance vehicles - see clause 18.4.8 of IDM); and
- the location of the development within the catchment has been considered in sufficient depth to establish whether upstream flows into the development have been adequately catered for in the drainage design; and
- the works are proposed to be developed in stages and, if so, how the drainage network will function until the development is completed; and
- adequate provision has been made for overland flow paths.

The development engineer must establish the planning permit conditions required to address all of the impacts identified. In some cases, it will be possible to deal with these impacts during the design of the drainage works. In other cases, for example, when there is a likelihood that the land set aside for retardation or stormwater treatment will have to be altered in area, this must be addressed prior to the certification of the plan of subdivision.

Issues that can arise

The connection point to the Council drainage system

If there is no formal drainage in the area other than an open earth drain, Council may require the developer to connect to the formal drainage system at some point downstream of the development, where this is in reasonable proximity to the development.

Where no formal drainage is available then the developer can be required to retard flows back to rural runoff rates. This is not ideal, particularly if there are already drainage issues in the area.

The connection point is another Authority's drainage system.

There are areas of the state near Melbourne where drainage discharges into outfall drains owned by Melbourne Water and their approval is required to do so.

A similar situation occurs in irrigated areas in rural Victoria, where drainage can discharge into drains belonging by the relevant irrigation authority.

When stormwater is discharged into streams and rivers the local Catchment Management Authority or Department of Environment, Land, Water and Planning may need to approve such discharges.

These other authorities may place restrictions on flow rates and water quality on any discharge into their systems. Normally this is picked up by these authorities when the planning permit application is referred to them. Development engineers should become familiar with their requirements so that the drainage impacts of a development can be assessed, and any mitigation measures required identified and conditioned, as necessary.

The number of retardation basins and pumps

For large subdivisions, the issue of the number of retardation basins and associated pumps can become contentious, with some developers proposing more units to enable ease of development staging, while Council would prefer that the number of basins and associated pumps be minimised to reduce renewal and maintenance costs. See Clause 18.1 of IDM. If the development is associated with a PSP or DP, the Council will need to set the maximum number of retardation basins and associated pumps at the planning permit stage or earlier.

Use of part of Retardation Basin as part of POS

Developers may argue that retardation basins should be used to offset the POS requirements.

Clause 18.2 of the IDM covers this matter in detail.

5.8.2.6 Stormwater Treatment

It is important to understand how the developer proposes to meet the stormwater quality requirements of Clause 20.3 of the IDM. Developers may argue that treatment basins should be used to offset the POS requirements. Each such case will need to be assessed on its merits (for example, a constructed wetland might be seen as a useful contribution to POS, but it is unlikely that a similar argument could be applied to a deep treatment basin protected by fencing.

Developers will often have preferred methods of stormwater treatment that are not preferred by Council due to ongoing maintenance issues with such treatment. In addition to this there have been issues with the public understanding the role of various types of treatment with the result that they are damaged by landowners doing work on their nature strip. In many cases, the infrastructure has not been (or can no longer be) maintained as required.

IDM Selection Table 20.3.4 *Bioretention Swales and Rain Gardens* and Selection Table 20.3.5 *Vegetated Swales/Grass Swales/ Buffer Strips* indicate the extent to which these types of treatments are acceptable in various municipalities.

From a Council perspective, end-of-line treatments are generally preferred. Fewer individual components need to be maintained and overall maintenance costs are generally much lower. For example, in one case, a developer handed Council 180 raingardens to maintain at the end of the development. Within 5 years, the filter material had become blocked by sediment and the units needed significant reconstruction work to enable them to function as designed. This was huge liability for Council that had not been considered when the original design plans were approved.

Swale drains should be avoided wherever possible due to their susceptibility to damage in an urban environment and the safety issues associated with them. If they are to be considered, the development engineer should make sure that they are constructed in accordance with the design requirements listed in Clause 20.3.3 and 20.3.5.

Where end-of-line treatment is available, or proposed to be supplied by Council, aa condition can be placed on the planning permit requiring the developer to contribute to the cost of that end-of-line treatment. This is usually a set cost/ha as determined by the Council.

Where a staged development is proposed, the development engineer should expect the design engineer clearly to demonstrate how retardation and stormwater treatment requirements can be met during each stage of the development as well as when the development has been completed

In the case of wetlands some Councils require the developer to maintain the wetlands throughout each stage of the development and will not accept these assets until the whole of the development is completed. Councils wishing to do will need to include appropriate conditions in the planning permit.

5.8.2.7 Impact on Council Infrastructure

Where a subdivision connects into the existing street network, the development engineer must determine what works will have to be carried out to enable this to take place. They will have to consider whether the following items need to be conditioned in the planning permit:

- Intersection works
- Widening of seal in proximity of the development
- Extension of the seal road, kerb and channel, footpath and drainage to connect to new road(s) being constructed even when they are located outside the development area. If an extension is necessary to provide access to the subdivision, the developer can be required to provide this connection
- Connection to the footpath network
- Connection to the shared path network
- Where part of the development fronts an existing government road, then what upgrading works are necessary to service the allotments in the development.
- Staging of works may require the construction of temporary turning areas at the end of roads. See clause 12.4.3 of the IDM.
- Provision for future roads
- Provision of street trees
- Provision of street lighting

Where the development engineer concludes that any of these works are required, special conditions must be included in the planning permit to require their design and construction.

5.8.2.8 Impact on the Environment

The construction of works within a subdivision can have an impact on the environment as a result of silt, dust, mud, and noise. These can impact neighbouring properties as well as Council roads and drains.

Suitable planning permit conditions gives Council the power to control such impacts.

Clause 24 of the IDM provides guidelines on how to manage the environment during construction. These requirements should be incorporated into a Construction Management Plan as per the requirements of Clause 7.2 of the IDM.

5.8.3 Typical Planning Permit Conditions

Construction Phase

Soil erosion control measures must be employed throughout the construction stage of the development to the satisfaction of the Responsible Authority.

Before the development starts, a construction management plan must be submitted to and approved by the Responsible Authority. The plan must outline how issues such as mud on roads, dust generation and erosion and sediment control will be managed, on site, during the construction phase. Details of a contact person/site manger must also be provided, so that this person can be easily contacted should any issues arise.

Management measures are to be in accordance with EPA guidelines for Environment Management, "Doing It Right On Subdivisions" Publication 960, September 2004.

No Mud on Roads

Appropriate measures must be implemented throughout the construction stage of the development to rectify and/or minimise mud, crushed rock or other debris being carried onto public roads or footpaths from the subject land, to the satisfaction of the Responsible Authority.

Generation of Dust.

The applicant must ensure that dust suppression is undertaken either by constant water spraying or by using acceptable proprietary dust suppressant systems to ensure that dust caused by vehicles moving along the access road and/or within the site does not cause a nuisance to surrounding properties. Any such suppression must be supplied to the satisfaction of the Responsible Authority.

The development must not have an adverse impact on existing or future air quality.

Deliveries to and from the site for all commercial vehicles, including waste collection, must only take place between **….. and …..(insert times).**

Access to and from the site for all commercial vehicles, including waste collection, must only use the following roads **(nominate roads).**

All roads/storage areas/external stockpiles/vacant or grazed areas must be covered and/or maintained to avoid dust and grit nuisance to any residential area to the satisfaction of the responsible authority.

Environmental Management Plan

Before the construction starts, an environmental management plan for the management and operation of the use which is to the satisfaction of the responsible authority and (specify authority) must be submitted to and approved by the responsible authority upon the advice of the (specify authority). When approved, the plan will be endorsed and will then form part of the permit. The environmental management plan must be reviewed and submitted to the authority/authorities annually. The use must be conducted in accordance with the endorsed plan at all times. The environmental management plan must include:

a) Overall environmental objectives for the operation of the use and techniques for their achievement;

b) Procedures to ensure that no significant adverse environmental impacts occur as a result of the use;

c) Proposed monitoring systems;

d) Identification of possible risks or operational failure and response measures to be implemented.

e) Day to day management requirements for the use

f) (specify other requirements)

Urban Vehicle Crossing Requirements

Before Statement of Compliance is issued, vehicular crossings shall be constructed in accordance with the endorsed plan(s) to the satisfaction of the Responsible Authority, and shall comply with the following:

a) standard vehicular crossings must be constructed at right angles to the road to suit the proposed driveways, and any existing redundant crossing must be removed and replaced with concrete (kerb and channel);

b) any proposed vehicular crossing must have satisfactory clearance to any side-entry pit, power or Telecommunications pole, manhole cover or marker, or street tree. Any relocation, alteration or replacement required must be in accordance with the requirements of the relevant Authority and must be at the applicant's expense;

Road Upgrading

Before the issue of a statement of compliance, the developer must either pay an equivalent contribution or upgrade the ***Main Road/service road (insert road name)*** to incorporate ***earthworks, pavement, sealing, shoulder-sealing, drainage, line-marking, footpath, kerbing, and environmental treatments across the frontage of/to*** the development, and contribute ***XX%*** of the upgrade cost of ***(insert road name)*** in accordance with plans and specifications submitted to and approved by the responsible authority. The specific requirements may include:

(a) fully sealed pavement with kerb and channel and vehicular crossings (specify location);

(b) footpaths and/or shared pedestrian/bicycle paths (specify location);

(c) underground drainage;

(d) street trees;

(e) indented car parking and/or bus parking bays (specify location);

(f) underground conduits for water, gas, electricity and telephone;

(g) appropriate intersection and traffic management measures;

(h) appropriate street lighting and signage;

(i) school crossing(s);

(j) high stability permanent survey marks.

(k) etc as specified).

Road reserve and road widths must be in accordance with the requirements of the Infrastructure Design Manual

Drainage Headworks

Before the Certification of the Plan of Subdivision, the applicant must provide Council a payment of Drainage Headworks of ($insert amount) as contribution towards the cost of existing or future works for the acceptance of surface and stormwater from the buildings, whether or not such works have been or will be situated within the boundaries of the land.

Drainage Discharge Plan

Before the plan of subdivision is certified under the Subdivision Act 1988, a properly prepared drainage discharge plan with computations to the satisfaction of the responsible authority must be submitted to and approved by the Responsible Authority. When approved, the plans will be endorsed and will then form part of the permit. The plans must be drawn to scale with dimensions and a minimum of three copies (or as specified) must be provided. The information submitted must show the details listed in the Infrastructure Design Manual and the works must be designed and constructed in accordance with the requirements of that manual.

The information and plan must include:

a. details of how the works on the land are to be drained and/or retarded.
b. computations including total energy line and hydraulic grade line for the existing and proposed drainage as directed by Responsible Authority
c. independent drainage for each lot
d. underground pipe drains conveying stormwater to the legal point of discharge for each allotment
e. measures to enhance stormwater discharge quality from the site and protect downstream waterways Including the expected discharge quality emanating from the development (output from MUSIC or similar) and design calculation summaries of the treatment elements;
f. a maximum discharge rate from the site determined by computation to the satisfaction of Council or specified in the planning permit.
g. documentation demonstrating approval from the relevant authority for the legal point of discharge.
h. the provision of gross pollutant and/or litter traps located at or close to the drainage outfall of the development to ensure that no effluent or polluted water of any type will be allowed to enter the Council's stormwater drainage system.
i. the details of the incorporation of water sensitive urban design designed in accordance either "Urban Stormwater Best Practice Environmental Management Guidelines" 1999.
j. maintenance schedules for treatment elements.

Before the issue of a Statement of Compliance all works must be constructed or carried out in accordance with those plans to the satisfaction of the Responsible Authority

Detailed Construction Plans

Before any road, drainage or landscaping works associated with the development or subdivision start, detailed construction plans to the satisfaction of the Responsible Authority must be submitted to and approved by the Authority. When approved, the plans will be endorsed and will form part of the permit. The plans must include:

a. Fully sealed pavement with (insert type) kerb and channel (insert number), metres invert to invert

b. Concrete footpaths
c. Underground drains
d. Other specified requirements

All works constructed or carried out must be in accordance with those plans.

As Constructed Plans

Prior to the issue of Statement of Compliance, the applicant or developer must submit the following documents to the satisfaction of the relevant authority:

a. an assets statement for each street
b. 'as constructed' information for the entire work in each development stage detailing information as listed in the Infrastructure Design Manual
c. a certified plan showing the extent and depth of fill in excess of 300 mm placed on any of the allotments
d. where Council so requires, 'as constructed' information provided in the relevant A spec format.

Construction of Works

Before the use begins and/or the building(s) is/are occupied or before the Statement of Compliance is issued under the Subdivision Act 1988, the applicant or owner must construct road works, drainage and other civil works, in accordance with plans and specifications approved by the Responsible Authority and in accordance with the Infrastructure Design Manual including, as appropriate:

a) fully sealed pavement with kerb and channel and vehicular crossings (specify location);
b) footpaths and/or shared pedestrian/bicycle paths (specify location);
c) access and parking
d) underground drainage;
e) rural drainage
f) irrigation
g) landscaping
h) lighting
i) street trees;
j) buffers
k) indented car parking and/or bus parking bays (specify locations)
l) underground conduits for water, gas, electricity and telephone;
m) traffic calming, appropriate intersection and traffic control/mitigation measures;
n) appropriate street lighting and signage;
o) school crossing(s);
p) high stability permanent survey marks;
q) stormwater retention and quality treatments;
r) bus stops;
s) services;
t) Others as specified.

Supervision Fees

Payment to the Responsible Authority of an amount up to 2.5% of the actual cost of work, being for costs of the Responsible Authority supervision of the works, as determined by the Responsible Authority;

Plan Checking Fee

Payment to the Responsible Authority of an engineering design checking fee of an amount up to 0.75% of the value of documented works.

Council's Assets

Before the development starts or subdivision works commences, the owner or developer must submit to the Responsible Authority a written report and photographs identifying any prior damage to public infrastructure. Listed in the report must be the condition of kerb and channel, footpath, seal, street lights, signs and other public infrastructure fronting the property and abutting at least two properties either side of the development. Unless identified with the written report, any infrastructure damage identified post construction will be attributed to the development. The owner or developer of the subject land must pay for any damage caused to the Councils assets or public infrastructure caused as a result of the development or use permitted by this permit.

Traffic Impact Assessment Report

Before the development starts or before the plan of subdivision is certified under the Subdivision Act 1988 the applicant must provide a Traffic Impact Assessment Report in accordance with the requirements of the Infrastructure Design Manual and to the satisfaction of Council.

Construction of Traffic Management Works

The cost of such works shall be fully met (or specify other cost sharing arrangement as required) by the applicant. Before the Statement of Compliance is issued under the Subdivision Act 1988, the applicant or owner must construct any traffic management works identified in the Traffic Impact Assessment Report dated xxxx (insert date) to the satisfaction of Council.

Tree Protection during Construction

Before the development (including demolition) starts, a tree protection fence must be erected around the (insert details of tree(s)) at a radius of (insert number) metres from the base of the trunk(s) /drip-line of the existing trees to define a 'Tree Protection zone'. The fence must be constructed of (specify star pickets and chain mesh or similar) to the satisfaction of the relevant authority. The tree protection fence must remain in place until construction is completed. The ground surface of the Tree Protection Zone must be covered by a 100mm deep layer of mulch before the development starts and be watered regularly to the satisfaction of the responsible authority.

Where lots shown on the endorsed plan(s) have a common boundary with any reserve for municipal purposes, tree reserve, floodway reserve, etc. such boundary must be fenced to the following minimum standard to the satisfaction of and at no cost to the council, prior to the issue of a Statement of Compliance under the Subdivision Act:

(*insert:-*

1.4m high "arcmesh".

or ***1.5m high colorbond type fence***

or 1.8m high colorbond type fence.

or half the cost of an equivalent colorbond fence to be held in reserve by council

or rural type wire mesh).

Street Trees for Residential Allotments

Prior to the issue of the Statement of Compliance for each stage of the subdivision, the owner or developer of the subject land must either provide or contribute to the cost of planting street trees within the subdivision to the satisfaction of the Responsible Authority. More specifically, the owner or developer must either provide or pay a sum equal to the cost of two (2) tree seedlings of one (1) metre high per 15 metres of road within the subdivision.

5.9 Commercial and Industrial Developments

Commercial and industrial developments can vary greatly from a small commercial development on an existing lot to a multi-lot industrial subdivision or a large commercial development involving extensive provision of parking and raising traffic management issues such as a Bunnings or large supermarket complex. The location of these developments can vary from one that is fully serviced to one where there is minimal drainage, no pedestrian or bicycle connectivity and where existing road infrastructure will have to be upgraded to cater for the development. The assessment of the development will also depend on whether the development has frontage to a VicRoads arterial road.

While each type of development will have similar issues to be addressed by the development engineer, the infrastructure standards that apply may vary due to the above factors.

Where the development involves the subdivision of land, the development engineer must consider the provisions of the Subdivision Act 1988 that deal with such matters as the construction of works, provision of public open space, checking fees, supervision fees, certification of plans of subdivision and statement of compliance when assessing the applications.

The discussion that follows assumes that the development engineer must assess a large industrial or retail/commercial development.

It is critical that, for such developments, a preapplication meeting is held prior to a planning application being submitted so that constraints of the proposed site can be discussed between planners, development engineers, planning and engineering consultants and the developer. One primary aim of such a meeting, as per IDM clause 3.1, will be to identify all the information likely to be required by Council prior to a formal submission or application.

Other points of discussion depending on the type of development are:

- Indicative traffic generation figures, if available.
- Sizing and staging of the development and plans for future expansion.
- Drainage connection point(s) and likely general requirements in relation to treatment, retardation and collecting and conveying stormwater flowing through or onto the site from adjoining properties
- Likely requirements for upgrading Council road infrastructure including intersection, entry and exit treatments
- Connectivity to existing pedestrian, cycle paths and public open space
- Public transport requirements

5.9.1 Information Requirements

Clause 3.3.4.1 specifies the information requirements for planning permits. The level of information required to accompany the planning application will vary according to the number of residential allotments being created.

5.9.1.1 Traffic Requirements

There are two types of traffic reports that might be required to be provided with the application.

These are specified in Clause 9 of the IDM.

1. A Traffic Impact Assessment Report (TIAR) is required when there are impacts on the existing road network and identifies appropriate mitigating works
2. A Traffic Management Assessment Report (TMAR) is required to determine the internal road layout, road widths, functions and connectivity for all road users.

Clause 9.3.1 specifies that a TIAR must be prepared where the proposed development is expected to increase the overall traffic by 10% or by 100 vehicles per day whichever is the lesser.

Clause 9.3.2 lists the triggers for the preparation of a TMAR as follows:

- Construction of a new road.
- Construction of a new intersection.
- Potential for further development (may need Development Plan to assess).
- Multiple Developers within a specific locality.
- Large industry or retail/commercial development.

Given that this section deals with a large industrial or retail/commercial development, a TIAR will be required. If an industrial subdivision is involved, a TMAR will be required as well.

A traffic management strategy prepared in accordance with Clause 9 of the IDM is critical so that the development engineer can determine the likely impacts of the development on the existing road network and address the issues discussed above.

Traffic generation figures used in the Traffic Management Strategy (TMS) should be calculated in accordance with Clause 12.3.1 of the IDM. For commercial and industrial developments this clause requires traffic generation to be determined using the *RTA NSW Guide to Traffic Generating Developments 2002*. The TMS should detail any assumptions made in determining the traffic generation rates.

Council should provide the developer's consultants with any historical traffic counts that are relevant to the proposed development to assist with the preparation of the TMS. The report should address any proposed mitigation works to address the impacts of the development.

Judgment is required to determine how far away from the development the impacts should be considered. Unless there is a clear nexus between the proposed development and the proposed mitigation works, a condition requiring these works may be overturned on appeal to VCAT.

Where the TIAR and TMAR identifies required mitigating works, the trigger for the works must be identified in the report, so that conditions can be drafted to indicate by what stage of development the works must be carried out.

5.9.1.2 Drainage Requirements

Two types of stormwater reports may be required to be provided with the application as part of an overall Stormwater Management Strategy. They are Stormwater Impact Assessment Report (SIAR) and Stormwater Management Assessment Report (SMAR). In general terms:

> An SIAR is required when there are significant impacts on the existing drainage network and must recommend appropriate mitigating works.
>
> An SMAR is required to determine the internal drainage, overland flow-paths, retardation and stormwater treatment and connectivity to the existing drainage network.

Clause 11.3 of the IDM states that an SIAR and/or SMAR will normally be required when:

- a proposed d**evelopment** will include the construction of one or more new:
  - retardation basins; or
  - WSUD quality treatment facilities; or
  - drainage outfalls; or

- there is potential for significant further development within the catchment; or
- the catchment involves multiple **Developers** within a specific locality; or
- more than 5 lots will discharge to a common drainage system;

Based on the above requirements both an SIAR and SMAR will be required for large industrial and commercial developments. Clause 11.4 details the specific information requirements. The extent of the information required will vary with the relevant stage of the planning approval process. For large industrial and retail commercial developments all the requirements listed in 11.4 will be relevant and should be provided.

The development engineer must ensure that the SIAR identifies and considers all stormwater flows entering the proposed development from adjacent properties and those currently discharged, and proposed to be discharged, from the development site. This is essential to avoid contravening s16 of the Water Act, which requires that water not be concentrated, the peak rate or volume of flow increased, or the course of water altered to the detriment of others.

Where stormwater is discharged into a watercourse, drainage channel or other outfall, the SIAR must include the requirements of the responsible authority in relation to receiving that flow. These requirements may include flow rate restrictions, water quality standards, standards for construction of outfall drains etc.

The report should include any staging of the works that are proposed to be carried out and show how interim works are going to fit in with the overall drainage design for the development.

Where the development abuts an arterial road, VicRoads may require an assessment to be carried out to ensure that any overland flows discharging from the development will not cause inundation of the road in a 2% or rarer AEP event.

These types of development have large expanses of impermeable surfaces, resulting in the need for onsite detention to limit the peak drainage discharge from the site to the predevelopment rates or to the designed capacity of the outfall drain, whichever is the lesser.

For example, where a large retail development occurs on the outskirts of a town, and there is only a table drain servicing the property, care must be taken to determine the catchment area for the table drain and the capacity of the drain for the various AEP in accordance with Table 9 in Clause 16.6 of the IDM. Note that it will often not be sufficient to determine the permissible site discharge based on an assumption that an open channel will flow freely during any given rainfall event. Significant backwater effects are to be expected.

Furthermore, the development engineer must consider the impacts of overland flows when the AEPs in Table 9 are exceeded, for example by considering the impacts of a 1% AEP event. This may require that onsite detention be based on the 1% AEP event rather than a more frequent event.

5.9.1.3 Stormwater Treatment Requirements

Sufficient information should be provided with the planning permit application for the development engineer to determine whether the land area set aside for stormwater retardation and/or treatment facilities is likely to be sufficient for that purpose. This may well impact on the developable area.

Rules of thumb have proved to be unreliable for this purpose, and computations based on the lot layout, topography and stormwater quality parameters should be included with the application.

5.9.2 Assessment Considerations

5.9.2.1 General

When a Precinct Structure Plan (PSP) or Development Plan (DP) covers the area where the development is proposed to take place the application must be assessed against the requirements of the relevant plan, which take precedence over the requirements of the IDM.

5.9.2.2 Access and Traffic

Careful consideration of any recommended traffic mitigation measures needs to be undertaken to determine whether they adequately address all the impacts of the proposed development on the existing road network. The development engineer must ensure that a nexus has been established between the development and the proposed mitigation works. This may be tested at VCAT if the developer or others are not satisfied that the matter has been adequately addressed. The further away the proposed mitigation measures are from the development, the harder it will be to establish that a clear nexus exists.

Traffic modelling should indicate the percentage increase of traffic due to the development. This will assist in determining the nexus for the works but is not the only factor to be considered.

Another factor to be considered is the location of the proposed development relative to that of existing infrastructure. For example, suppose that a large supermarket is proposed to be constructed on the outskirts of a town. The nearest footpath is located 200m from the site. A decision will need to be taken as to whether the developer should extend the footpath so that residents in the area can access the supermarket safely without the need to drive a car.

The development engineer must ensure that the TIAR has covered all these matters, that its recommendations are reasonable, and that the report has addressed all forms of transport including whether there is a need for a bus stop to service the development (if public transport is available in the area) and whether special provision should be made for bicycle access.

Very large developments may generate a need for the construction of a new intersection, with or without traffic lights. Such intersections are usually located on arterial roads, not under the control of Council and covered by VicRoads conditions. However, local connections may also be involved, and the development engineer must assess the possible impacts on these connections.

For such developments, special attention must be given to how goods are to be delivered and waste materials removed. The development engineer must ensure that deliveries and removals take place within the development, not on the road reserve, that all traffic enters and leaves the development in a forward direction and that, wherever possible, there is a physical separation between delivery access and unloading routes and those open to the public.

Where shade sails are to be installed for customers of the development, the development engineer must ensure that the height and location of the structures do not impede delivery vehicles entering and leaving the development. There have been several cases in which delivery vehicles have collided with the overhead arms supporting the shade sails.

Councils should not require developers to contribute to, or meet the full cost of, renewal works on existing Council assets.

Once the mitigating works have been determined the development engineer can determine whether any special planning permit conditions are required and at which stage of development the relevant works should be carried out. Where the information is not yet adequate to identify all the works, the development engineer can use a standard traffic condition requiring the recommendations of a TIAR dated (****) to be implemented to the satisfaction of the Responsible Authority.

5.9.2.3 Stormwater Drainage

The development engineer must assess the stormwater drainage information supplied with the application, including any SIAR or SMAR, to determine whether:

- the impacts of the proposed development on the receiving waters or the Council drainage network have been identified; and
- discharge rates from the development need to be specified or determined; and
- if discharge rates are to be restricted, a sufficiently detailed set of computations is available to determine the size of any retardation basin and the total area of land required to enable the flows to be restricted, bearing in mind that land set aside for a retardation basin must include a 5m wide reserve around the edge for maintenance vehicles (see clause 18.4.8 of IDM); and
- the location of the development within the catchment has been established and flows into and through the development have been fully catered for in the drainage design; and
- that overland flow paths for rainfall events more intense than the design event have been identified and suitable land areas set aside to protect those flow paths.

The development engineer must determine the planning permit conditions required to address all the impacts that have been identified. In some cases, these impacts can be addressed during the detailed design of the drainage works. However, where there the land area notionally set aside for retardation, overland flows, or stormwater treatment may not be sufficient for the purpose, the potential shortfall must be addressed prior to certification of the plan of subdivision.

Issues that can arise

The connection point to the Council drainage system

If there is no formal drainage in the area, other than an open swale, Council may require the developer to connect to the formal drainage system at some point downstream, where the system is located in reasonable proximity to the development.

Where no formal drainage is available, the developer can be required to retard flows back to rural runoff rates. This is not ideal, particularly if there are already drainage issues in the area.

The connection point is another Authority's drainage system.

There are areas of the state near Melbourne where drainage discharges into outfall drains owned by Melbourne Water and their approval is required to do so. Similar situations arise in irrigated areas in rural Victoria where drainage can discharge into drains belonging by the relevant irrigation authority.

When stormwater is discharged into streams and rivers, the local Catchment Management Authority or Department of Environment, Land, Water and Planning may need to approve the proposal. They may place restrictions on the quantity and quality of any discharges into their systems. Normally this will be picked up by the authorities when the planning permit application is referred to them.

It is good practice for development engineers to become familiar with their requirements so that the overall drainage impacts of a development can be assessed, and any mitigation measures required identified and conditioned as necessary.

5.9.2.4 Stormwater Treatment

The development engineer must understand how the developer proposes to meet the stormwater quality requirements of the planning scheme and ensure that stormwater discharged to the Council drainage system meets the quality standards specified in Clause 20.3.1 of the IDM. Developers may seek the option of making a cash contribution to cover the costs incurred by the Council in providing end-of-line treatment. Council should not generally accept such a proposal unless there is already a costed and funded strategy in place for constructing the required infrastructure in a timely manner.

5.9.2.5 Impact on Council Infrastructure

The entry/exit point of the development and its impact on the road network must be considered. The development engineer must decide whether each of the following items should be conditioned in the planning permit:

- Intersection works
- Widening of seal in proximity of the development
- Connection to the footpath network
- Connection to the shared path network where appropriate
- Where part of the development fronts an existing government road, the upgrading works required to service the allotments in the development.

5.9.2.6 Impact on the Environment

The construction of works within a development can have an impact on the environment as a result of silt, dust, mud, and noise. These can impact neighbouring properties as well as Council roads and drains.

Suitable planning permit conditions give Councils the power to control such impacts.

Clause 24 of the IDM provides guidelines on how to manage the environment during construction. These requirements should be incorporated into a Construction Management Plan as per the requirements of Clause 7.2 of the IDM.

5.10 Renewable Energy Projects

5.10.1 Windfarms - Maintenance of Council Roads During Construction

Windfarms are to be considered in the same manner as commercial and industrial developments listed in clause 5.9 of this Guide.

There is one significant factor that needs to be considered and included in any planning permit condition granted for the development of a windfarm and that is the maintenance of Council roads during construction and the degradation of Council road network impacted by construction traffic.

A windfarm development in Moorabool Shire required the construction of 25km of gravel roads with the pavement being 8m wide and 300mm deep to service each wind turbine in the development. This required around 130,000 tonnes of crushed rock to be carted to the site over Council roads.

The resultant impacts on maintenance and renewal costs for the existing Council road network and on the amenity of those residents living adjacent to the roads over which the crushed rock is carted were clearly significant, reducing Council's ability to manage its responsibilities under the Road Management Act.

In order to deal with these issues, the Council transferred to the Developer its responsibilities for the care and maintenance of public roads affected by the works under its Road Management Plan, and required the developer to conclude a Dilapidation Deed with the Council. The Deed included requirements for:

- Measurement of the condition of the impacted roads prior to commencement of the works to determine the remaining life of the pavement and associated assets.
- Measurement of the condition of the impacted roads after completion of the works to determine the nett loss of the useful life of the pavement and associated assets.
- Maintenance standards for the impacted roads during construction, including inspection frequency, response times and specifying how the various maintenance works are to be undertaken. [These standards were generally similar to the those set out in the in the RMP, but with increased frequency of inspection and reduced response times to reflect the potential for rapid asset degradation during construction].
- Protocols and target response times for dealing with customer requests for these roads.
- An extensive public consultation process to ensure that impacted ratepayers were advised of the proposed works, what the likely impacts were expected to be, and how these would be mitigated.

The deed also included an agreed formula to assess the level of any payment to Council to compensate for the loss of useful life.

The development engineer will need to draft (in conjunction with planners) appropriate planning permit conditions to cover these matters.

5.10.2 Solar Energy Farms

The construction of large solar energy farms can have similar, although generally rather less severe, impacts on local road networks to those associated with wind farms. When unusually large projects are concerned, consideration should be given to whether a similar temporary transfer of inspection and maintenance responsibilities to the Developer may be justified.

In most respects, the stormwater management issues that arise in relation to solar energy farms will be similar to those of industrial developments with comparable scale. However, there will probably be only minimal potential for runoff to be collected and used for process and service purposes.

Furthermore, the fact that the individual solar collector units will generally move in a systematic manner to follow the sun around the sky throughout each day can result in unusual erosion patterns developing during intense rainfall events. Management of such erosion will, of course, be primarily a matter for the site operator, subject to the Water Act provisions that water not be concentrated, the rate of flow increased, or the course of flow altered to the detriment of others.

However, bearing in mind that such facilities will normally be constructed in rural areas with very limited drainage infrastructure it will often be good practice for the development engineer explicitly to require that all stormwater passing through, or generated within, the development be collected, conveyed and treated to specified quality standards, and that suitable detention and/or retention facilities be constructed to ensure that the peak outflow rates and volumes are restricted to the corresponding pre-development rates and volumes. Unless otherwise agreed by Council, all the relevant infrastructure should be constructed within the boundaries of the site.

One concern which can assume special importance for solar farms is the potential for glare from the solar collector units to reduce the safety and amenity of surrounding residents and businesses and those using the local road networks. Any such impacts should have been identified and addressed by then designers at an early stage in the planning process, with mitigation typically proposed to be achieved by a combination of screening and system management protocols.

However, the development engineer should carefully review the relevant evidence provided by the designers, having special regard to current and potential future traffic peak flows and volumes in the local network of public roads. For example, a significant potential for glare to occur in the vicinity of a primary school during the morning drop-off or afternoon collection times could represent a very serious hazard, although the overall traffic volumes on the relevant access roads may be modest.

6 PSP and Development Plans

6.1.1 Information Requirements and Assessment Considerations

Clause 3.3.2 and 3.3.3 of the IDM specifies the information requirements.

Checklist #C5 provides the development engineer with a tool to ensure that the proposed development concept:

- Provides the infrastructure required to achieve Clause 56 and IDM requirements
- Includes appropriate provision for community infrastructure, together with sufficient reserve areas to accommodate that infrastructure
- Ensures that access to and from the development can cope with the likely traffic
- Provides appropriate stormwater management for the development
- Fits within the existing physical constraints of the site
- Is in line with Council and community plans for the area
- Considers impacts on adjacent land use and minimises any negative impacts

This checklist provides a commentary on the various matters to be considered as well as providing a list of the points to be worked through.

In the case of a PSP, the IDM also refers the reader to the relevant PSP Guidelines which document this information. These can be downloaded from the VPA website. In addition, notes have been prepared to provide advice to key stakeholders and organisations responsible for preparing precinct structure plans. One of the PSP Notes prepared is titled “Contents of a Precinct Structure Plan”

The development engineer should ensure that the following information is available:

- Urban Structure Plan
- Integrated Water Management Plan
- Transport and Movement – including a transport plan, a transport table and street cross section drawings
- Utilities and Energy – A Utilities Plan
- Open Space Plan
- Precinct Infrastructure Plan
- Development Staging Plan
- Functional Layout Plans and Estimates of critical infrastructure to be funded by a Development Contributions Plan or similar.

It is critical to ensure that the standards and information contained within these plans is consistent, wherever possible, with the provisions of the IDM. The VPA will push for Councils to adopt their street cross sections which vary from the IDM requirements set out in Table 2 of the IDM. While these sections are applied in the Urban Growth Zones around Melbourne, they are not always applicable to rural and regional Victoria.

The VPA will also push for B2 kerbs to be adopted throughout while, under the IDM, Councils can use several different kerb and channel profiles according to the needs of their municipality in relation to vehicle crossings (see Section 5.9.2 of this guide).

The standards adopted for a PSP and Development Plans will guide development within the precinct for the period it takes to develop all the land. In some cases, this could be 30 to 40 years and so it is particularly important to ensure that the standards set out in the PSP or PD are suitable for this extended period, as they will, one adopted, take priority over the requirements of the IDM.

In assessing the information supplied as part of PSP or DP documentation, the development engineer should ensure that:

- The road layout, integration of drainage and public open space, provision of shared paths/cycling paths and the linkages to existing infrastructure are reasonable and logical. Public open space should have road frontages and schools should desirably have frontages to at least three roads. The key elements of an urban structure plan should avoid small isolated properties where landowners can prevent logical development from occurring where there is public acquisition overlay over the property.
- The integrated water management plan includes levels and computations which clearly demonstrate that the areas set aside for retardation and water treatment are realistic and are accompanied by functional layout designs of key elements, especially where works are to be funded by a Development Contributions Plan or similar arrangement. Several Councils have been caught out at the design stage when it emerges that there is insufficient land set aside for retardation and stormwater treatment and (commonly) an insufficient allowance to construct the works. In such cases, Council may end up having the pay the difference in cost or undertake a planning scheme amendment to vary the cost. Staging of the works is a critical factor to be considered. Council must be satisfied that the water treatment and retardation requirements can be satisfied at every stage of the development as well as at the end of the development. Some Councils require developers to maintain wetlands until the whole development is completed.
- The transport plan includes sufficient information and assessments to identify all traffic mitigation works, including types of intersection treatment, location of shared paths, and cycle paths, location of footpaths and connection to existing networks, and public transport routes. Functional layout designs are required for all transport infrastructure requirements that are to be funded by a Development Contributions Plan or similar. When these works are located on a VicRoads arterial road, the functional layout plan should be approved by VicRoads prior to the adoption of the PSP wherever possible. Many Councils have found that late decision-making by VicRoads has meant that the initial estimated costs of intersections has increased seven-fold by the time all VicRoads requirements have been accommodated. These requirements change with time and every effort should be made to document their current requirements and ensure that they have been signed off prior to the PSP being adopted. VicRoads also have strict policies and practices regarding access to their roads which will affect the spacing of intersections and types of movements at intersections. The development engineer should ensure that these constraints are identified in the PSP.
- The utility plan identifies where all services are to be located especially trunk services. The development engineer must ensure that trunk services are located on collector streets or in reserves wherever possible and that they comply with the requirements of VicRoads Code of Practice for the Management of Infrastructure within Road Reserves as per the requirements of Clause 5.6 of the IDM.
- The open space plan incorporates public space links with shared paths and drainage reserves to ensure that the maximum public benefits are obtained. Linear parks along watercourses may help to link different areas within the PSP or DP or connect to existing developments.
- The staging plan should be reasonable and logical and reflect the services available, such as trunk drainage. The development engineer must consider how to deal with potential future demands for out-of-sequence development and whether infrastructure development limits (for example, development beyond a certain point will require the construction of a section of the trunk drainage line and/or collector road) should be incorporated in the planning permit to discourage such demands.

- The infrastructure plan identifies all the infrastructure to be funded by a DCP or similar. The detailed plans must include realistic costings for each item based, wherever possible, on a functional layout plan and specific engineer's estimates. Unit rates adopted by metro-based consulting firms must be compared with local rates. Metropolitan construction costs can vary significantly from those in rural and regional Victoria. All estimates should include appropriate allowances for design, project management and contingencies. Council may have to justify each of these costs at VCAT panel hearings.

The development engineer should be part of the Council team involved in the planning and preparation of the PSP or DP. This includes attending meetings with VPA, consultants, reviewing briefs and determining what information needs to be provided as part of the PSP and what level of detail must be supplied to enable Council to have confidence that the infrastructure provisions have been adequately identified and costed so that they will not face significant unplanned financial expenditure to deal with any shortfall in provision.

7 Assessment of Design Plans

The assessment of design plans represents an integral part of the development engineer's responsibilities as it ensures that the infrastructure that is going to be handed over to Council has been designed to the standard specified in the IDM (or other standard, as approved by Council) so that it will perform the function that it was intended for and will reach its design life.

In accordance with Clause 5.2 of the IDM the Council requires engineering plans and associated documentation to be submitted in three stages during the design process as follows

Stage 1 Functional Layout Design

Stage 2 Detailed Design Stage

Stage 3 Final Design Plans

This three-stage process is aimed at improving outcomes and reducing timelines for approvals by ensuring that detailed design work is only carried out on functional layouts that have already been approved by Council.

7.1 Functional Layout Plans

Clause 5.8.1 of the IDM sets out the details to be provided at the functional layout stage for road design and drainage design.

The chief purpose of the functional layout is to ensure that the basics of the design are correct before proceeding to detailed design. This reduces the risk of spending valuable detailed design time on a design based on the wrong parameters e.g. fails to conform with the PSP, DP, planning permit, endorsed plans or the requirements of the IDM as appropriate.

Typical issues picked up at Functional Layout stage are street widths that do not conform to the relevant widths specified in the IDM, linkages to existing infrastructure have not been adequately addressed, failure adequately to address stormwater runoff from adjoining properties, lack of adequate provision for overland flows, inadequate land areas set aside for retardation basins and wetlands. The fundamentals of a development must be right before proceeding to detailed design.

When the designer submits a functional layout plan for approval it should be accompanied by a completed Design Engineer's Checklist #D1 Request for Functional Layout Approval.

The Development Engineer should undertake a review of the functional layout plan using Council Checklist #C1 Plans Submitted for Functional Layout Approval.

Both these checklists have been provided to assist the engineer to cover all relevant matters.

The development engineer must audit Checklist #D1 to ensure that it has been correctly filled out and that all the necessary matters have been properly addressed. When the development engineer is satisfied that a particular consultant has filled out the checklist correctly, he or she is more likely to proceed on the assumption that future information provided by that consultant will be accurate and can be relied upon.

Note that the functional layout stage is not required for all planning applications that require plans to be approved e.g. where a planning permit condition only requires the submission of a drainage plan for approval then a functional layout approval is not required.

7.2 Detailed Design Stage

Once the Functional Layout has been approved, design work should proceed to the near complete stage in accordance with the provisions of Clause 5.8.2 of the IDM.

When detailed design plans are submitted for approval by Council, they should be accompanied by a completed Design Engineer's Checklist #D2 Request for Detailed Design Approval.

The Development Engineer should undertake a review of the detailed design plans using Council Checklist #C2 Plans Submitted for Detailed Design Approval.

Both these checklists have been provided to assist the engineer to cover all relevant matters.

The development engineer must audit Checklist #D2 to ensure that it has been correctly filled out and that all the necessary matters have been adequately addressed. When they are satisfied that a particular consultant has filled out the checklist correctly, they are more likely to proceed on the assumption that future information provided by that consultant will be accurate and reliable.

One of the critical information requirements of this stage is the provision of a Master Services Plan because this plan determines the following matters:

- Whether the street width is adequate for all the services to be located within the road reserve
- The number and location of street trees in relation to driveways and property services. Note services to properties should not be located within the tree zone (SD630)

In addition to the items included in the checklists the development engineer must check that all kerb ramps are compliant with AS1428.1-2009 – Design for Access and Mobility and will, so far as reasonably practicable, not require lowering of the footpath to which they connect.

Where the infrastructure being designed requires a contribution from Council for its construction, the cost sharing arrangements should be finalised before this stage is completed.

There may be some situations where the design requires additional approvals from other authorities such as VicRoads. Clause 5.8.2 lists typical infrastructure items that require additional approvals e.g. Certificates of Compliance before Council can approve the design.

For some developments, assessing the detailed design process can be a protracted exercise with many iterations of the design being required before approval is given to proceed to the final design stage. Several factors may result in approvals being delayed. Some of these factors are:

- Designers not checking their designs and relying on the development engineer to identify and document the deficiencies in the designs.
- Development engineers not initially picking up all items that must be addressed and later seeking to rectify shortcomings that should have been identified earlier in the process. The development engineer should try to avoid this from occurring. Using the checklist should mean that all matters are considered, not just those that come to your mind when carrying out the approval of the design plans
- Functional layout step omitted.

When the development engineer is satisfied that the detailed design has reached the point where only minor matters remain to be approved then approval for this stage can be granted.

7.3 Final Design Stage

When the designer believes that the design has addressed all the outstanding issues a submission for final design approval can be made in accordance with clause 5.8.3 of the IDM.

When the designer submits detailed design plans for approval, they should be accompanied by a completed Design Engineer's Checklist #D3 Request for Final Design Approval.

The development engineer should undertake a review of the detailed design plans using Council Checklist #C3 Plans Submitted for Final Design Approval.

Both these checklists have been provided to assist engineers to cover all relevant matters.

7.4 Drainage Plans

This section is limited to the review of drainage plans that are not approved as part of the design approval in clauses 7.1 to 7.3 of this guide e.g. two-lot rural subdivision, multi-unit developments, commercial and industrial developments not involving infrastructure to be handed over to Council.

The primary Council interest in such developments is to ensure that the discharge rates from them do not have an adverse impact on the public drainage system whether from the perspective of flow rates or of water quality.

In the case of rural subdivisions, the Council interest is to ensure that drainage discharges do not have an adverse impact on roadside table drains or adjoining properties.

The development engineer needs to ensure that the provisions of IDM Clause 19 On-site Detention Systems and Clause 20 Stormwater Treatment are complied with.

Clause 19.2 of the IDM specifies the types of development that require on-site detention.

Clause 19.3.2 Basic Principles and Limitations states “Where the development site in question discharges to an established minor drainage network, Council will expect the permissible site discharge [PSD] to be based on the actual network design capacity rather than the peak discharge prior to development.”

Designers are required to supply computations in accordance with the provisions of Clause 19 using an approved method or using Table 13 Storage Volumes and Discharge Rates for Small Detention Systems.

Approved methods for small detention systems include:

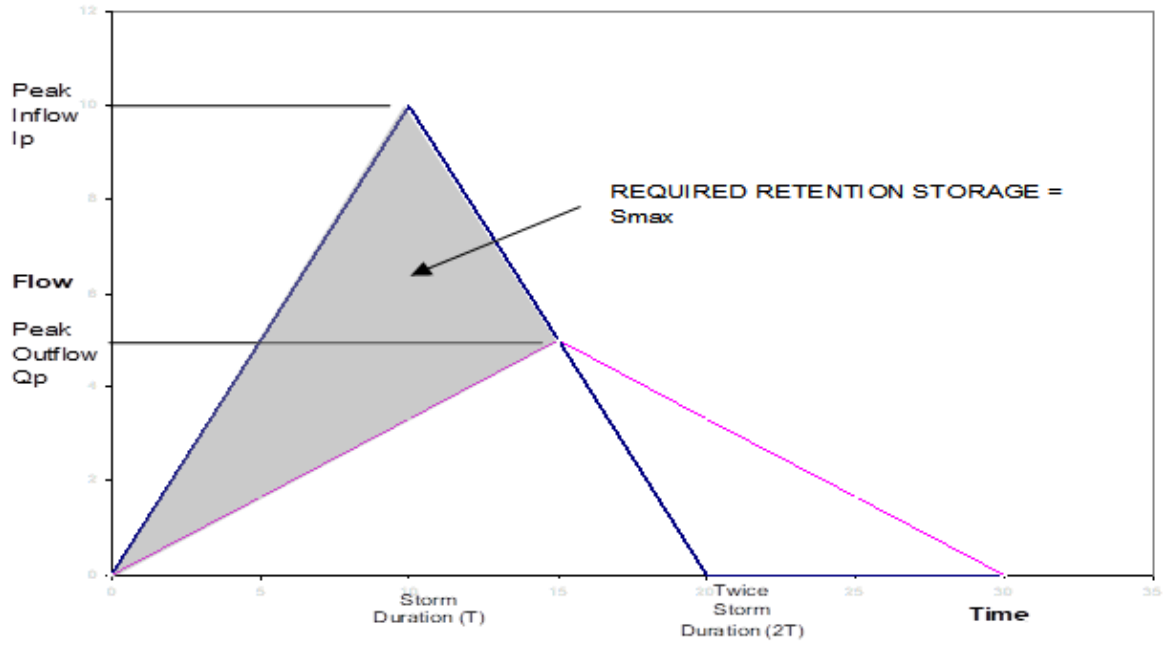
- Boyd Method (with reduced PSD)
- Swinburne Method (using OSDW4 or spreadsheet)

Some common errors that occur in using OSDW4 are:

- Not understanding the terms used in the program and limiting them to the development site only, without sufficient understanding of its place in the catchment e.g. Tso is the time from the site to the outlet, Tc is the time of concentration for the whole catchment (to which the site belongs to) to contribute and Tcs is the time from the top of the catchment to the site. In principle, Council should be able to provide these figures as it knows its drainage networks and where the site is located within the network.
- Not allocating the correct design rainfall event and runoff coefficients to the receiving Council pipe. Again, Council should be able to provide the requisite data. Typically pipe designs undertaken before the 1980’s used 1-year (1EY) rainfall events and 50% runoff coefficients.

The development engineer should have a range of tools that enable them to check the computations submitted to them. Various spreadsheets and software programs are available. Those who attended Stormy Waters “Drainage System Design” training received a spreadsheet for Boyd’s Method. Some Councils will also have a copy of OSWD4 available and the other simple, if sometimes conservative, check is Table 13 of the IDM.

The Boyd Method basics are as follows:



$S_{max} = V_1(1-Q_p/I_p)$

S_{max} = Maximum volume of temporary storage

V_1 = Volume of inflow flood (m^3)

Q_p = Peak discharge of inflow hydrograph (m^3/sec)

I_p = Peak discharge of outflow hydrograph (m^3/sec)

Council must fix the nominal peak outflow based on the design capacity of the receiving pipe. For example, if the pipe was originally designed for a 1EY event, and a 50% runoff coefficient, with an upstream concentration time of 20 minutes, the peak outflow should be equal to the contribution coming from the property in that event.

The peak inflow used for the Boyd Method is that discharged from the site in a rainfall event with the annual exceedance probability to which minor drainage systems are required to be designed in accordance with Clause 16.6 of the IDM (20% AEP for residential developments and 10% AEP for industrial developments) using the runoff coefficients defined in IDM Table 10.

As advised in IDM Clause 19.3.2, a better estimate of the required storage volume will be achieved when the nominal peak outflow is reduced by 25% for storage in tanks or basins whose plan shape is basically constant with increasing depth, or 40% for storage in pipes or horizontal cylindrical tanks.

The 1% AEP should also be checked to determine whether the overland flow path(s) available can safely convey the additional runoff created by the proposed development. If it cannot, the on-site detention must be designed for the 1% AEP event.

These tools provide a useful check to enable the development engineer to have confidence that the drainage plan being submitted does not reflect order-of-magnitude errors.

7.5 Landscaping Plans

Landscaping plans, where required, should be prepared to meet the requirements of clause 24 of the IDM.

Clause 24.2 specifies the types of development that require landscape plans to be prepared. These include any land to be vested in Council and any development where there is a condition on the planning permit that requires a landscaping plan to be prepared.

Some Councils have specific landscaping design manuals which must be complied with and these are listed in clause 24.2.1 of the IDM.

Landscape plans are normally submitted to Council's Parks and Gardens Units for their review and approval and therefore the development engineer is not usually required formally to review these plans. However, cases can arise in which the extent and nature of the development associated with landscaping will be sufficient to influence the minor drainage system design.

Another exception to this is when retardation basins are landscaped and form part of an integrated public open space corridor or similar facility. In such cases the development engineer must ensure that the proposed landscaping will not have an adverse impact on the operation of the basin(s).

Where landscaping is used to form a safety barrier from steeper embankments, care needs to be taken to ensure that the species selected will be suitable for the purpose. The development engineer should liaise with the Parks and Gardens Unit as necessary.

The landscaping plan should be submitted at the same time as the design plans for roads and drainage and not left as a separate set of plans to be reviewed. This is important so that the number of street trees can be maximised.

In order to avoid future damage to trees, no property services should be located within 2.5m of the trunk of a tree. Excavations for maintenance purposes (for example, access to a water tapping) within this zone can damage the root system and adversely affect the health of the tree.

7.6 Street Lighting Plans

Street lighting plans are required to be submitted when new street lights are to be provided in a development. Street lights should be meet the requirements of Clause 26 of the IDM.

The biggest issue for Council is whether to allow a developer to use decorative (non-standard) lighting. Many developers prefer to use a lighting style that sets their development apart from other developments.

However, in approving non-standard lighting, Council is taking the responsibility for the future maintenance and renewal of poles and lamps.

Clause 26.4.2 covers the fees payable to Council for the approval of non-standard lights. The reality is that, at some future point, special lamps and poles will no longer be able to be replaced or will become very expensive. They may have to be ordered from overseas and could take months for delivery. In the meantime, standard fittings must be used until the non-standard lamps arrive

Councils can be left in a difficult situation when it is no longer possible to replace like for like and a decision must be made as to whether to transition to standard lighting over time. Some ratepayers are not happy with such decisions.

Where Councils have taken spares at the time of the development, safe storage has often created problems. After many years they become difficult to locate. In some cases, when spare lamps have been located, they no longer work.

Finally, the widespread change to more energy-efficient lamps means that the special lamps will inevitably become obsolete.

Councils should not approve non-standard lights without being fully aware of the future issues they may face with the maintenance and renewal.

7.7 Approval of plans

Once the development engineer is satisfied that the plans submitted meets all of Council requirements then the plans can be stamped and approved and a copy of these provided to the planning unit and the designer as per the requirements of Clause 5.8.3 of the IDM. This clause states that the approval granted is only valid for two years from the date of that approval, after which time the Council may require revised drawings and specification to be submitted for review.

Where the plans are submitted as part of a subdivision, the development engineer must ensure that the plan of subdivision has been certified prior to approving the plans. It is very important to ensure that the design plans comply with the certified plan of subdivision. See Checklist #D2 Request for Detailed Design Approval and Council Checklist #C3 Plans Submitted for Final Design Approval.

Several Councils have expressed concern that in approving plans for designs other than for assets that are or will become the property of Council, they are exposing themselves to legal liability should they have overlooked an error in the design or specifications.

These Councils seek to limit the risk by acknowledging receipt of the plans and advising the designer as to whether the plans satisfy the requirements of specific planning permit conditions.

This becomes an issue for the approval of drainage plans for a multi-unit development where the Building Surveyor is responsible for approving drainage within the site. The primary interest of Council is to ensure that the discharge to its drainage system does not exceed the permissible site discharge set for the property and that the quality of the water being discharged meets the required standards. How that is achieved is up to the designer, but Council does have a legitimate right to seek evidence that the proposed design will function properly.

One Council endorses the drainage plans stating that these plans satisfy the relevant condition of the planning permit.

8 Assessment of Traffic Impact Assessment Reports and Traffic Management Assessment Reports

The development engineer will be required to assess Traffic Impact Assessment Report (TIAR) and Traffic Management Assessment Report (TMAR) when they are submitted as part of a planning application, development plan, PSP or required as a permit condition.

The first thing to check is whether the reports submitted have been prepared by a Qualified Engineer (see clause 9.2 of the IDM). The IDM defines a Qualified Engineer as "A person eligible to be registered as a civil engineer on the National Engineers Register and experienced in the relevant field of practice."

Once the development engineer is satisfied that the person who has prepared the traffic report has the requisite qualifications and experience to prepare such a report, they can commence the assessment of the report.

It is important to check that the traffic reports submitted approval provides all the information specified in Clause 9.4 of the IDM.

A typical report will include the following items:

- Location
- Zoning
- Whether the site it is within a PSP or Development Plan
- Existing traffic volumes
- Connections to existing footpaths, cycle paths, shared paths.
- Public Transport provisions
- Traffic model parameters and assumptions
- Design traffic volumes
- Where intersections are involved – capacity analysis
- Recommended mitigation measures or works
- Triggers for the mitigation measures and works

The development engineer must check that the road widths and their classification comply with Table 2 of the IDM and the traffic generation figures match those specified in Clause 12.3.1. Some traffic engineers still believe that the figure should be around 9 vpd for residential developments. However, the current 10 vpd rate was arrived at by measuring the traffic volumes on court bowls where there are no other factors affecting the volumes. The design engineer must ensure that the traffic growth figures are reasonable and that modelling covers a 20-year period. Note that, when the proposed development is part of a PSP or DP that is expected to provide a residential lot supply for a period greater than 20 years, a longer design growth period may be appropriate.

The development engineer must also check the classifications of roads. Classification should not be based on traffic volumes, which are indicative only, but rather on the function of the road.

The development engineer should ensure that the report addresses pedestrian and cycle movements and identifies the location and connection routes to existing footpaths, shared paths and bike paths in the area. The report should also address any proposed mitigation works required to address the impacts of the development.

Some judgment is required to determine how far away from the development the impacts should be considered. There must be a clear nexus between the proposed development and the proposed mitigation works. Otherwise there is a chance that a permit condition requiring these works may be overturned through an appeal to VCAT.

It is important to ensure that, where the TIAR and TMAR identifies required mitigating works, the trigger for these works is specified in the report, so that conditions can be drafted to indicate when these works are required to be carried out. Certain works may not be required at the start of the development but will be required once traffic volumes reach a certain level.

Care needs to be taken to ensure that the report refers to the number of lots, instead of stages, as stages can be varied to meet the wishes of developers during the life of the development.

The development engineer must consider any recommended traffic mitigation measures and determine whether they adequately address all the impacts both within and external to the subdivision. It is important to establish a nexus between the development and the proposed mitigation works as this may be tested at VCAT if the developer or others are not satisfied that this has been adequately determined.

The further away the proposed mitigation measures are from the development, the harder it is to establish that a nexus exists.

Traffic modelling should indicate the percentage increase of traffic due to the development. This assists in determining the nexus for the works, but it is not the only factor to be considered.

Another factor is the trigger for the works. Various intersection treatments are triggered by the through and turning traffic volumes. In some cases, those triggers may already have been reached and it would be unreasonable to require the developer to upgrade an intersection which should already have been upgraded by the responsible road authority.

Where traffic mitigation measures are recommended, it is important to determine how much the developer should contribute to these measures. Some traffic engineers may recommend that cost sharing should be based on existing traffic volumes compared to the increased volumes as a result of the development.

They argue that, where there is a 50% increase in traffic resulting from the development, the developer should only have to pay 50% of the cost of any traffic mitigation measures. However, this conclusion is unreasonable when existing traffic levels do not warrant any mitigating works and only the addition of the development causes the traffic to increase to a level requiring such works. When this is the case, the developer should be required to fully fund the mitigating works.

However, Councils should not require developers to contribute to or carry out renewal works on existing Council assets at their cost.

The development engineer must consider the location of all the proposed streets to determine whether the proposed road widths and profiles are acceptable. For example, where a street abuts Public Open Space (POS), and the footpath or shared path is proposed to be located within that POS, the nature strip width may be reduced on one side of the road, so long as adequate space remains for the services.

9 Assessment of Stormwater Management Strategies

9.1 Objectives

Clause 11.1 of the IDM defines the objectives of a stormwater management strategy as being to establish how the quantity and quality of stormwater arising from, or passing through, any proposed development during certain defined rainfall and/or flood events will be managed so as to avoid adverse impacts on people, property and the natural environment within and beyond the development.

To that end, Clause 11.3 of the IDM states that a stormwater management strategy, comprising a stormwater impact assessment report [SIAR] and/or a stormwater management assessment report [SMAR] may be required to be submitted at any stage during the planning process when:

- a proposed development will include the construction of one or more new:
  - retardation basins; or
  - WSUD quality treatment facilities; or
  - drainage outfalls; or
- there is potential for significant further development within the catchment; or
- the catchment involves multiple developers within a specific locality; or
- more than 5 lots will discharge to a common drainage system; or
- large-scale industrial or commercial use will be involved

The development engineer will be mainly concerned to establish from the documentation submitted that reasonable and practical systems have been identified which, once designed and implemented, will ensure that the safety and amenity of future landowners, residents, users and members of the public are secured, and the environment protected, during reasonably predictable local or regional rainfall events.

To that end, and in a manner commensurate with the purpose, location, scale and complexity of the proposed development, the development engineer will expect the design engineer to:

- identify the existing stormwater drainage network and the approximate surface storage available within and adjacent to the proposed development; and
- identify any portions of the proposed development located in or adjacent to areas subject to flooding and/or permanent or transient channels mobilised during major rainfall events; and
- undertake preliminary hydrological modelling to determine, with reasonable confidence, the peak flows and volumes of stormwater runoff, pre-development and post-development, to be collected and conveyed during such exercise; and
- develop contour plans showing the current profile and proposed future profiles of the development site, and identifying existing and proposed future pathways for surface flow; and
- develop an indicative plan showing the proposed minor drainage network, including the location, type and approximate scale of the required water quality treatment facilities; and
- identify the locations at which pump stations will be required and the approximate capacity proposed for each relevant installation and provide a realistic assessment of the land area required for detention, retention and quality treatment facilities.

9.2 General Assessment Principles

A stormwater management strategy is intended to provide the development engineer and the design engineer with a high measure of confidence that a proposed development can be constructed, commissioned and maintained without detriment to the safety and amenity of upstream or downstream properties or to the quality of stormwater released to the environment.

These objectives are most likely to be achieved when the plan deals primarily with issues that may have a significant impact on the ultimate layout of the proposed development and deals only in broader terms with other significant matters that can safely be addressed and resolved later in the development process. For example, an undue focus on the details of the minor drainage network at this stage may divert attention from the need to assess the scale and alignment of the proposed major drainage network and any associated storage requirements.

One significant issue that can be overlooked, particularly when dealing with the major drainage network in a relatively flat area, is the need to take into account the extent to which backwater effects can lead to sharply increased upstream water levels, and potentially to unexpected flow diversion. The calculations are not complex, with suitable spreadsheets being readily available.

In residential, and major industrial and commercial subdivisions the road network will normally, conventionally and economically, be expected to operate as an integral part of the major drainage network. The need for a road network to collect, control and convey peak discharges while ensuring that water depths and flow velocities remain within safe limits can have a very significant impact on their layout, and therefore on the layout of the individual lots within the development.

Council and the developer have a shared interest in ensuring that, when a permit has been granted and a development plan endorsed, the proposed road and lot layout is achievable, with adequate provision having been made for drainage reserves, particularly those needed to provide for surface flows and/or for stormwater detention, retention and treatment facilities.

9.3 Council Information

The development engineer should make every possible effort to ensure that the design engineer is given full access to all relevant information held by Council, including recent surveys, GIS data, flood modelling outcomes, and drainage network plans and condition assessments.

Local knowledge can often be critical when establishing the potential for flooding, whether fluvial or pluvial in origin, to occur in or adjacent to the proposed development site. Photographic evidence can be particularly important when estimating the water levels and peak velocities experienced, and the alignment and extent of the flow pathways and natural storage mobilised, during major events.

When the minor drainage network within the development site is planned to discharge to an existing trunk drainage network, the development engineer should, so far as reasonably practicable, provide the design engineer with a realistic estimate of the peak flow capacity of that network at the point of connection. Where the external network was designed more than, say, twenty years ago, this may well require some forensic engineering to establish the design criteria that were applied at the time, and to estimate the extent to which the original design capacity may already have been consumed by infill development completed prior to the introduction of on-site detention requirements.

9.4 Hydrology

The nature and extent of the hydrological modelling required to provide base data for a stormwater management strategy will mainly depend on the scale, location and environment of the proposed development and the relevant upstream catchments.

For major developments involving many hundreds of lots established on essentially green-field sites, particularly in areas which may be affected by riverine or stream flooding, or where there are large upstream areas of rural land with minimally defined flow channels, the development engineer may be justified in calling for comprehensive two-dimensional flood modelling to be undertaken.

This can be a very expensive exercise, the results of which are critically dependent on the availability of reliable flow and depth data from previous rainfall events that can be used to calibrate the model outcomes. For typical medium-to-large developments undertaken on the outskirts of regional cities and towns, where the existing flow channels are often well defined, one-dimensional energy-based modelling may provide more reliable results and will certainly be much less expensive to complete.

For more modest developments in and immediately around urban areas, particularly where other evidence is available to support an assessment, the rational method remains available and, despite its known shortcomings and debatable theoretical justification, actually has a longer track record of producing workable designs in such circumstances than any other approach.

In any case, interpreting the results from all these models essentially relies on sound engineering judgment to reflect the many uncertainties involved in designing infrastructure to accommodate extreme and chaotic natural events. Early provision of background information by the development engineer, and subsequent discussions with the design engineer, will facilitate a better mutual understanding of the key parameters applicable to the development site in question.

9.5 Major Drainage System

The most important consideration when a stormwater management plan is prepared and submitted is to ensure that the major drainage system is well-conceived, with low maintenance requirements, and is likely to operate reliably, and with a significant margin of safety, over the full life-cycle of the development. It is becoming increasingly common for catchment authorities to require that the peak discharge from a completed development in a 1% AEP rainfall event does not exceed the equivalent pre-development flow. Compliance with this criterion will normally govern the overall stormwater storage requirements within the development.

In assessing a stormwater management plan, the development engineer should therefore place more emphasis on ensuring that the major drainage system is reliable and achievable within the proposed constraints on the development layout than on the proposed minor system (which can usually be relatively more easily adjusted at the detailed design stage).

Ideally, the floodways associated with the major system (mainly, but not exclusively, represented by the road reserves) should conform as closely as possible to the pre-existing drainage lines within the development, and be free from abrupt changes in direction. Where tee-junctions are unavoidable, the safest solution will usually be to drop the opposing kerb and establish a channel within a linear drainage reserve which allows the 1% AEP flows to continue in a more-or-less constant direction across the intersection.

Once the basic hydrology has been established correctly, the road reserve capacities can be initially checked against typical cross-section and long-section profiles, leaving detailed computation of the peak flow depths and velocities until a later stage in the development process.

However, as previously noted, careful attention should be given to estimating the storage volumes required to restrict outflows to pre-development levels, and ensuring that the land allocated to any necessary retention, detention and treatment facilities will be adequate for the purpose, and incorporate sufficient provisions for construction and maintenance access.

Clause 19.3.2 of the IDM explains the basic principles and limitations applicable to the simplified methods available for computing storage volumes. Essentially, those methods are not suitable for larger developments. Volumetric rainfall-runoff methods, such as RORB, should be used. RORB is an interactive runoff and streamflow routing program that calculates catchment losses and streamflow hydrographs resulting from rainfall events and/or other forms of inflow to channel networks. The software is free (thanks to continuing support from Melbourne Water) and readily available.

The development engineer will need to be satisfied that appropriate methods have been used to establish the storage volumes, and consequently the dimensions of any storage facility. The simplest Boyd Method computations will not generate conservative results and should not be accepted in the context of a stormwater management plan. The values given in Table 13 of the IDM should be used by the design engineer only in the circumstances set out in Clause 19.3.4. However, they may also provide the development engineer with a very quick “order-of-magnitude” check.

9.6 Minor Drainage System

The primary purpose of the minor drainage system is to preserve the amenity of a development. This will usually be achieved by collecting and conveying the stormwater runoff generated in a “design event” by kerb-and-channel and underground pipes and/or culverts. The selected “design event” will usually have an annual recurrence probability of 20% (residential), 10% (industrial) or 5% (major commercial).

The development engineer will need to be satisfied that the overall geometry of a proposed development will be such as to facilitate drainage under gravity to a defined outfall point or points. In certain cases, there may be no practical way to achieve this goal other than adding a storage facility to the network and drawing the facility down by a pump and rising main.

The development engineer should be very cautious indeed about accepting proposals for multiple “pump-and-sump” systems. They can add considerably to the future operational and maintenance costs faced by Councils, and every effort should be made to consolidate storage and pump station at a single location where possible.

9.7 Water Quality Treatment Options

Within the context of a stormwater management plan, the development engineer will need to be satisfied that the design engineer has identified a sensible and workable system for water quality treatment. The key objectives are set out in Clause 20 of the IDM, which also covers the range of common treatment options available and the overall water quality improvement targets to be achieved.

The development engineer will need to be satisfied that adequate provision has been made for the improvement of water quality leaving the development site, preferably by works located close to the nominated point of discharge for the development. This criterion is not intended entirely to exclude local treatment within the development, which can be taken into account when a MUSIC model is prepared, usually at the detailed design stage.

The most common arrangement proposed by the design engineer is likely to be for water detention tanks to be installed within properties (pursuant to a Section 173 agreement and/or required by development covenants). These are usually intended to serve the dual purpose of reducing the overall demand for potable water and contributing to improved discharge quality.

Other arrangements may be proposed, such as small bioretention basins and/or rain gardens located within the road reserve, responsibility for which will pass to Council in due course. These devices can be effective when regularly maintained but tend to suffer significant damage during the construction period after completion of the works, and to call for continuing frequent, expensive maintenance. In some cases, the devices have effectively been bypassed by landowners or by Councils to avoid local nuisance flooding.

The development engineer should always check whether particular proposals for distributed quality improvement treatments are consistent with Council policy and seek advice from counterparts in other Councils as to the demonstrated longer-term performance of the proposed devices.

The stormwater management plan may also include proposals for the staged construction and commissioning of treatment works as development progresses.

For example, when a major access road and truck drainage line has to be completed prior to the beginning of individual developments within an area, provision may be made for the road runoff to be treated by a gross pollutant trap, with the subsequent construction of full treatment facilities occurring progressively. Any such proposals will need to be discussed with the relevant catchment management authority, which will probably wish to secure the construction of treatment facilities at the earliest possible time, but will be aware of the potential for works to be damaged during to the civil construction period due to sedimentation in high-intensity rainfall events.

Clause 20.2 of the IDM provides that the developer will be responsible for the maintenance of all completed water sensitive urban design works for a period of two years unless otherwise agreed in writing or specified in the planning permit. When the permit envisages staged construction of wetlands, the developer will be expected to maintain each stage until all the stages have been completed, and the two-year period will commence from that point.

These provisions are is consistent with the general provisions applicable to landscaping works, and extended maintenance should be implemented as a matter of routine.

10 Bonds and Fees

10.1 Bonds

Clause 8.5 of the IDM specifies the requirements that apply should a Council agree to bonding outstanding civil works to allow a Statement of Compliance to be issued. This clause makes it clear that bonding should only be considered as a last resort. It is much better from a Council perspective to require the developer to complete the works.

In the past, bonding of works was common practice. However, experience has shown that there are many negatives associated with bonding of works. Some of these are described below:

- Bonding involves a significant administrative overhead. The funds must be kept in a separate bank account and, if unclaimed, cannot simply be returned to general revenue.
- Some Councils still hold bonds for developments that occurred 10 to 20 years ago. Given the inevitable staffing changes over such periods, it can be difficult to determine what the bonds were for, and whether the work has been partially or fully completed. Sometimes it can be difficult or impossible to locate those who lodged the bonds. The company may no longer exist, or the individual may have died or relocated.
- When the Councils decide to carry out the outstanding works using the funds, particularly when some time has elapsed, the cost may exceed the funds available, and Council has no option but to meet the shortfall from general revenue.
- Developers may complete only part of the required works, then seek a partial refund of the bond.

Nevertheless, Councils can come under considerable pressure to accept bonding in lieu of timely completion of works, and there can occasionally be legitimate reasons for so doing.

Clause 8.5 specifies that the amount of the bond is to be for $5,000 excluding GST, or 1.5 times the estimated cost of completing the works, whichever is the greater, and to take the form of cash or a bank guarantee with no expiry date.

Normally a 12-month time limit should be imposed for the works to be completed. If they are not completed within that time frame, Council can, and generally should, arrange for the works to be done and meet all costs, including those of supervising and administering the works, from the bond.

The exception to bonding being a last resort is bonding for uncompleted landscaping works when plantings would be carried out at the wrong time. Clause 8.5 specifies under what circumstances Council would consider bonding such works.

Other Councils avoid this issue by taking a cash payment for landscaping works and carrying out the works themselves once all or most of the homes or industrial units have been constructed. This can help to ensure that street trees are not damaged during the construction process.

Bonding for landscaping maintenance is also used by some Councils.

The following are extracts from the LGIDA forum in 2016 concerning this issue

> *"The following methodology is used at Baw Baw in relation to street tree bonding: Urban Operations team advise that the cost of installing and maintaining a street tree for 24 months is $450. Council will accept an outstanding works bond of $450 x 150% = $675 per tree. After planting has occurred satisfactorily, council will return $525 and retain $150 until 24 months has been completed. The $150 which is held to cover maintenance reflects the fact that street trees generally experience some level of attrition. It is also in line with practice across growth area councils which hold a bond of 35% for landscaping maintenance. Please note, only the balance of the 24-month period would apply to interim plantings – for*

example if a dead tree is replaced after 12 months, it would only be subject to 12 months more."

The City of Greater Geelong posted the following comments

"Following details provided by our parks planning officer; 'I'll run with the most common scenario we deal with for outstanding works being street trees. On average the approximate cost of installing and maintaining a street tree for 24 months is $470 using a containerised 45 litre tree broken down into $220 for the supply and planting then $250 for the two-year maintenance period. Council will accept an outstanding works bond of $220 x 125% = $275 per tree plus a maintenance bond of $250 x 100% = $250 per tree for the two-year period, these are bonds lodged separately. This is due to the inability to do partial returns of Bank Guarantees which are often used.

After planting has occurred satisfactorily, council will return $220 and retain $250 until 24 months has been completed. A few years ago, the 'green space team' elevated outstanding works to 125% in order to be consistent with the Engineering Team and the 100% maintenance bond requirement is standard across all permits. I have concerns regarding the figure of 35% because internally our breakdown of costs for tree planting and two years maintenance does exceed this sum. The preference is to remain with a 100% lodgement of the maintenance estimate because here it's not so much the large sites we have issues with, unfortunately it always is the smaller sites, i.e. up to 20 lots where the issues arise and we need to ensure we are covered."

The provision of vehicle crossings is another area where some Councils allow bonding to take place. They do this to reduce the number of applications that are made to relocate vehicle crossings that were provided at the time of the subdivision.

The use of SM2 modified kerb and channel and 125mm thick concrete footpaths has been adopted by many Councils, with landowners being allowed to choose where they place their driveways. The disadvantage is that some landowners do not construct the section between the footpath and the kerb and channel and just drive over the nature strip. Some place gravel in this area, which looks unsightly and allows loose stones to move to the road and footpath, causing slip hazards.

10.2 Fees

Clause 4.1 of the IDM specifies the fees that a Council may impose under the Subdivision Act for the checking of plans and for supervision.

The specified fees are 0.75% of the value of works for plan checking and 2.5% for supervision. Over the years the application of these fees has created many differences in opinion particularly in relation to the supervision fee.

Most Councils charge the full 3.25% for plan checking and for supervision. A few Councils only charge the plan checking fee and do not charge for supervision of the works.

Some developers believe that Council should not charge the full 2.5% for supervision because they are not fully supervising the works.

The IDM specifies witness points and hold points at which the Council will inspect infrastructure that will be handed over to Council. See Appendix E *Council Inspections* for a list of witness and hold points.

Wherever Councils have reviewed the engineering fees for supervision of subdivisions, the actual inspection and administrative costs incurred have been found to be commensurate with the fees received.

Some Councils have also sought to levy plan checking and supervision fees on developments other than those involving the subdivision of land. This cannot be done under the Subdivision Act. When the issue was raised on the forum in 2016 one Council responded as follows:

> *"We are considering using conditions on the consent permit under the RMA for Works Within Road Reserves to require a 12-month maintenance period, 5% maintenance bond and 2.5% supervision fee (and as constructed plans) for all council assets constructed as part of a development. I believe that as the coordinating road authority under the RMA we can legally place these conditions on the consent."*

Over the years there have been numerous enquiries on what constitutes the value of works on which the fees are to be paid. The value of works is to be based on the value of the infrastructure to be handed over to Council. This includes site setup, earthworks (not including lot filling), all footpath, kerb and channel, roadworks, drainage costs, traffic mitigation measures, road signs, linemarking, landscaping works etc. It does not include water and sewerage costs or the value of the land on which the works are located.

10.3 Additional Inspection Fees

Clause 4.1 of the IDM allows the Council to charge the developer for the cost of attending an inspection when the works are, in fact, not ready for any inspection.

The specified additional fees are $50.00 for the first additional inspection, $100.00 for the second additional inspection, and $150 for the third additional inspection. This has been included in the IDM to ensure that developers check that the works are complete before requesting an inspection.

This can be a significant issue for small subdivisions, where the consultant may request a state of compliance inspection without checking whether all the required works have been completed, especially where these works are to be carried out by a landowner (for example, installation of a vehicle crossing).

11 Inspection of Works

11.1 General

The IDM provides an extensive list of checklists for inspections and these are found in Appendix E Council Checklists.

It is recommended that these checklists be used when carrying out inspections to ensure that every matter is considered.

The following is a list of checklists provided in the IDM.

LIST OF CHECKLISTS INCLUDED
LANDSCAPING
Pre-start meeting
Prior to landscaping inspection
Preliminary acceptance inspection
Final acceptance inspection
CIVIL WORKS
Pre-start meeting
Drainage inspection
Subgrade inspection
Subbase inspection
Kerb and channel pre-pour inspection
Footpath pre-pour inspection
Base inspection prior to priming
Prior to wearing course being laid inspection
WSUD inspections
Acceptance of works inspection
Final acceptance of works inspection
WSUD asset handover inspection
QUALITY
Non-conformance report

Whenever the term development engineer is used in this clause it also includes inspectors appointed by Council to carry out these duties.

In carrying out inspections, the development engineer must understand that the role of an inspector is to develop a good working relationship with the developer's construction engineer to deliver infrastructure that meets the requirements of Council as specified in the IDM.

As part of this the development engineer must ensure that:

- their decisions and processes are consistent; and
- inspections are carried out in a timely manner; and
- instructions, when required, are clear and concise.

The development engineer must appreciate that, when carrying out inspections, they will be entering a works site, and so will need to:

- be wearing appropriate personal protection equipment such as high-viz jacket, helmet and protective footwear
- be inducted onto the worksite
- complete the site logbook and other documentation as required.

The detail of each civil inspection will be discussed in the following sub-clauses in the order of construction as follows:

- Pre-start
- Drainage
- Sub-grade
- Sub-base
- Kerb and channel
- Footpath and driveways
- Base
- Prior to wearing case being laid
- Acceptance of works
- Final inspection

The development engineer should ensure that the construction engineer understands that the Council's role in carrying out inspections is that of an auditor. This means that the construction engineer in requesting an inspection has already satisfied themselves that the particular test is going to pass.

The advantages of this understanding are as follows:

- There are no time delays created as a result of the Council failing a test i.e. paperwork, additional inspection required
- The instances of disagreements are significantly reduced
- The development engineer's time is not wasted.

11.2 Inspection Notice

Clause 7.4 of IDM specifies that *"**Council** will expect the **Construction Engineer** to give at least 48 hours' notice when requesting the **Council Engineer** or an officer nominated by the **Council Engineer** to attend a construction inspection at a hold point or witness point, unless otherwise provided within this **Manual**."*

Development engineers will be often asked to carry out inspections with less than 24 hours' notice. In each case, the development engineer must determine whether there is a real justification for the shorter notice or the request reflects a lack of planning.

Generally, 24– 48 hours' notice should be acceptable.

Development engineers are entitled to expect that the works are actually ready for inspection, that there are no obvious defects or deficiencies, and that approval can be given to proceed to the next stage of the works.

11.3 Hold Points and Witness Points

Appendix E of the IDM specifies the hold points and witness points that Council requires. There are some variations between Councils and the development engineer must be familiar with the specific requirements of their Council.

A hold point is a mandatory hold on works until the development engineer is satisfied that the works meet the requirements of the IDM and therefore can proceed past this point.

A witness point is a point where the works are witnessed or reviewed by the development engineer, who may provide comments where appropriate to the construction engineer. However, works may proceed beyond this point.

11.4 Prerequisites for inspections

Prior to undertaking an inspection, the development engineer should check that all the prerequisites have been met. For example, compaction test results should be available prior to subgrade, sub-base and base inspections.

11.5 Pre-start Meeting

Use Pre-Start Meeting – Civil Works checklist found in in Appendix E of the IDM when carrying out this meeting.

All information required to be submitted as part of the Pre-start meeting should be made available to the development engineer at least 48 hours before the meeting to enable the documentation to be assessed. This documentation includes:

- Environmental Management Plan
- Traffic Management Plan
- Construction Management Plan

Ideally, submission of these plans should have been included as a planning permit condition and be endorsed by the planning unit. This will enable inspectors to require compliance with these plans. Continued failure to comply with these requirements will enable the issue to be referred to the planning unit for enforcement.

The City of Greater Geelong uses this process and has seen a significant improvement in compliance with these requirements. Where a failure to comply is identified, a notice is issued by the senior subdivisions officer requiring the matter to be attended to. If the matter remains outstanding, the issue is forwarded to the planning unit for enforcement action.

Throughout this process, the development engineer should document all steps and the details of any non-compliance. The documentation should include copies of warnings given, as there is a possibility that the matter may end up in VCAT should the non-compliance continue.

The purpose of a pre-start meeting for Civil Works is clearly to identify and document all the people involved in the management and supervision of the construction of the infrastructure that is to be handed over to Council. It is important that each person involved understands what their roles and responsibility are so that that a quality product can be delivered to the Council.

The Pre-start Checklist for Civil Works has been prepared for this purpose, and documents the roles and responsibilities of the various people involved in the construction as well as setting out such information as:

- Date works are to commence
- Time for works to be completed
- Defects liability period
- Maintenance period
- Hold points
- Witness points
- Any other inspections required
- A checklist of information requirements before works commence

The biggest issue may be the question of supervision of the works. Clause 7.4 of the IDM makes it clear that Council is NOT responsible for the day-to-day supervision of the construction works and that the developer is required to appoint a construction engineer for this purpose.

The supervision fee charged by Council under the Subdivision Act is intended only to cover the cost of carrying out the hold point and witness point inspections. Council officers will carry out all hold point inspections and as many of the witness points as they feel necessary.

However, they cannot and must not be expected to manage the day-to-day supervision of works. This task is normally governed by a contract between the developer and the contractor performing the works. Council is not a party to this contract and cannot be responsible for ensuring the works meet the requirements of the specification.

Developers must be made aware, at the earliest possible stage in the planning process, that they will be responsible for engaging a Construction Engineer to supervise the works, and to ensure that the infrastructure to be handed over to Council complies with the requirements of the IDM and any relevant provisions of the VicRoads Specifications and Austroads Specifications.

During the pre-start meeting the parties should consider and agree upon the circumstances under which more than one inspection visit may be allowed for any particular purpose (for example, base course profile and consolidation) during any stage. The work should be completed in a single visit by Council officers, but adverse circumstances (such as wet weather) may make this impracticable.

11.6 Drainage

Use Drainage Inspection – Civil Works found in Appendix E of the IDM when carrying out this inspection.

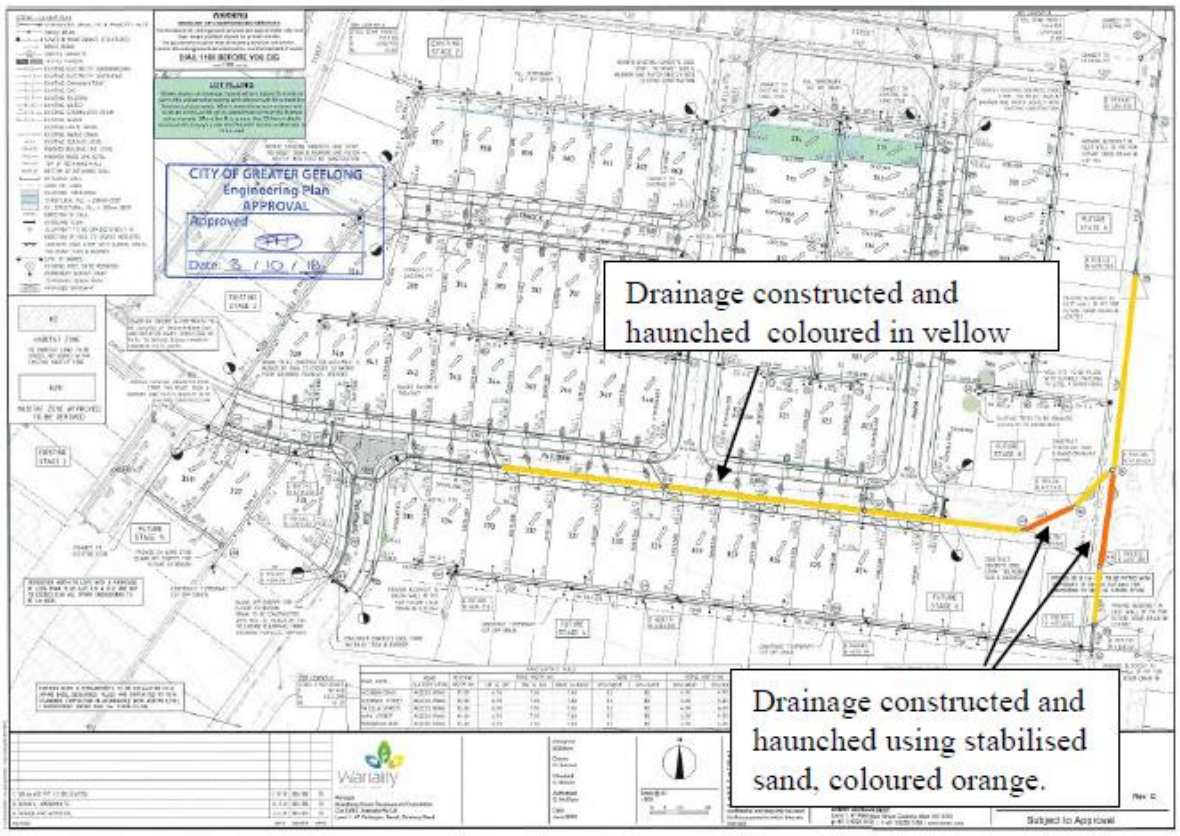
Underground drainage works are conducted prior to pavement works to ensure that trenches are compacted prior to commencement of the pavement works.

Drainage inspections prior to backfilling are considered a witness point. It is considered good practice by the construction engineer to arrange for a block of inspections prior to drainage works

commencing to allow each day's works to be inspected prior to backfilling. The inspections would typically take place around 2pm each day to allow time for backfilling to be carried out.

It is good practice to have an alignment plan of the proposed works available so that, as each pipe is inspected, it can be marked of as being completed. This will help to ensure that each pipe has been inspected.

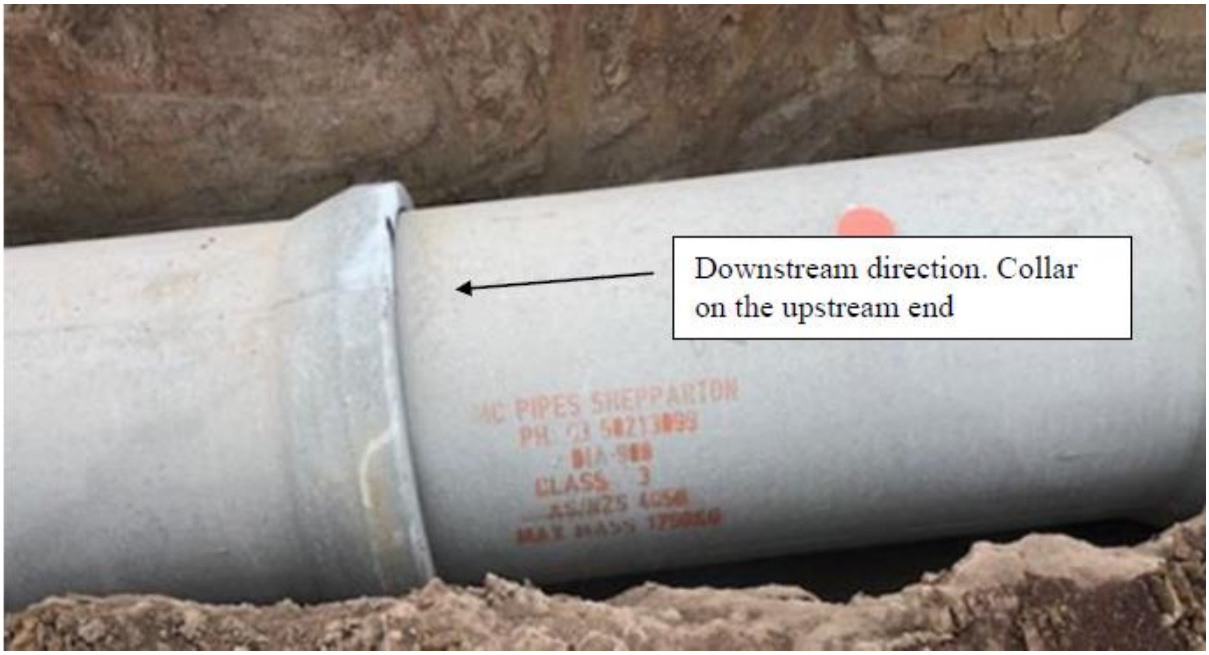
The City of Greater Geelong have automated the process, so that the inspection checklist and the plan of the works showing the drainage works alignment are loaded on a tablet, with pipes being marked up as completed and details of the inspection being recorded against each subdivision.



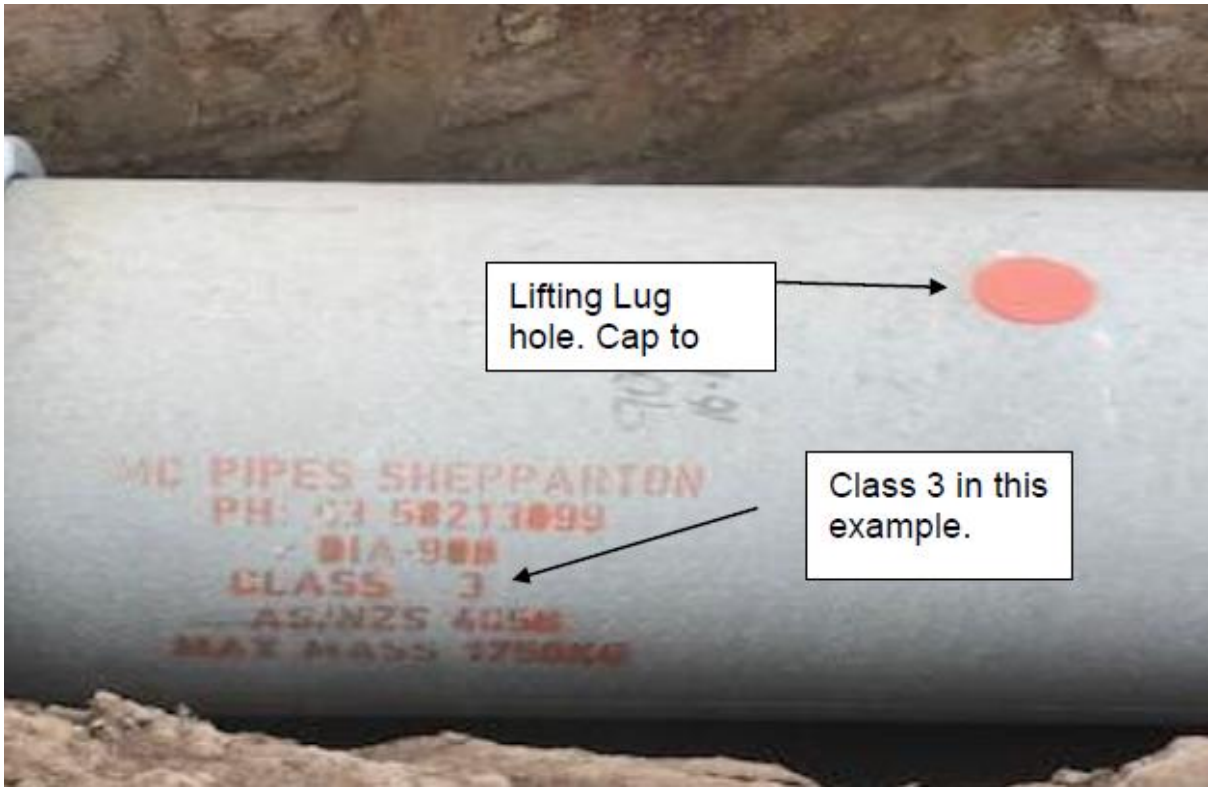
It is important to ensure that the bedding is installed in accordance with manufacturer's recommendations and compacted.

Things to look for:

- Collars are pointing the right way i.e. collar facing upstream



- Rubber rings are properly located and none are protruding.
- The correct class of pipe has been used



- Lifting holes for the pipes are plugged and located at the top of the pipe (see above)
- All house drains have been connected in accordance with the manufacturer's recommendations and the relevant standard drawing.
- Check for any pipe damage incurred during delivery or installation e.g. cracking or chips.
- Ensure that approved flexible (polyethylene or polypropylene) pipes are adequately restrained during backfilling to prevent vertical and lateral movements.

- Ensure that road crossings have cement stabilised backfill to the haunch of the pipe.

11.7 Sub-Grade Inspection (Proof Roll)

Use Subgrade Inspection – Civil Works checklist found in in Appendix E of the IDM when carrying out this inspection.

Prior to carrying out a subgrade inspection, the development engineer must confirm that the appropriate compaction tests for any fill have been provided and checked. There is no point in carrying out a subgrade inspection if the compaction tests have failed.

Proof rolling of the subgrade is required by the IDM and is considered a hold point, with no pavement materials being placed until this inspection has been signed off by Council.

Clause 12.7.14 specifies the standard to be met as being: "The subgrade should not deflect more than 2 mm vertically within 300 mm of the test roller in isolated locations during the proof rolling of the subgrade."

The development engineer must consider what constitutes acceptable plant to carry out the proof roll. The IDM refers to s173 of the VicRoads specifications which states as follows:

> *Plant which is nominated for use in test rolling procedures shall comply with the following requirements:*
>
> *(i) Static smooth steel wheeled rollers shall have a mass of not less than 12 tonnes and a load intensity under either the front or rear wheels of not less than 6 tonnes per metre width of wheel.*
>
> *(ii) Pneumatic tyred plant shall have a mass of not less than 20 tonne and shall have a ground contact pressure under either the front or rear wheels of not less than 450 kPa per tyre. The area over which this ground contact pressure shall be applied shall not be less than 0.035m^2 per tyre.*

Each layer should be test rolled immediately following completion of compaction but if test rolling is carried out at a later time the surface of the layer shall be watered and given a minimum of three passes with the test roller prior to commencement of test rolling.

Some Councils have allowed loaded trucks or fully loaded water carts to be used for this purpose. In Tasmania they allow the following:

"A truck with rear double-axle fully loaded weight 24,000kg (12,000kg unloaded) or water cart with rear double-axle fully loaded weight 24,000kg."

Clause 12.7.14 states that, where the standard of deflection is not met for areas greater than 20% of the project area, the whole subgrade will need to be reworked. Where the area is less than 20% of the project area these "soft spots" can be dug out and replaced with other suitable material and compacted.

On occasions if the subgrade does not have adequate drainage, and there is heavy rainfall, the subgrades can become affected by moisture. The options available to the contractor when this occurs as follows:

- Allow the subgrade to dry out
- Scarify the subgrade to a minimum depth of 150mm and work as necessary to accelerate drying and recompact when moisture levels are suitable. Some contractors have been known to add lime and mix in to speed up the drying process and increase subgrade strength.
- Excavate the affected material and replace with suitable material.

In addition to checking that subgrade is adequately compacted the development engineer must ensure that:

- The road has been correctly set out
- The levels and shape of the subgrade are correct using string lines or other approved means. If the contractor uses a total station to set out the project, request the contractor to install pegs (1m behind kerb) showing lip of kerb at each chainage on the plan so that levels can be checked at every stage of the works.
- The subgrade is free of floaters, oversize rock and organic material such as tree roots which can break down over time and cause soft spots leading to pavement failures
- Ensure that all trenches have been backfilled and compacted satisfactorily.

11.8 Sub-base inspections

Use Sub-base Inspection – Civil Works checklist found in in Appendix E of the IDM when carrying out this inspection.

The development engineer must ensure that, following the subgrade inspection, approval was granted to proceed to sub-base stage, and that the compaction tests for the sub-base material have been received and checked before agreeing to the inspection. There is no point in doing the inspection unless both these actions have been completed.

The design engineer should check the levels, using a string line, to ensure that the correct depth of sub-base has been placed and that the shape is correct.

Approval can then be granted for pavement construction to proceed to base stage.

11.9 Pre-pour inspections

The development engineer will be required to carry out several pre-pour inspections, as follows:

- Kerb and channel pre-pour inspection (see checklist)
- Footpath pre-pour inspection (see checklist)
- Pit pre-pour inspection (where precast pits are not used; no checklist available).

The aim of the pre-pour inspection is to ensure that, prior to pouring concrete, the location, level and bedding type, depth and compaction are all correct.

Some LGIDA members have reported the following issues that have resulted in concrete having to be removed and replaced:

- Kerb and channel poured to the incorrect level resulting in pooling of water requiring the removal and replacement of concrete. See photo below:

- Footpath being poured over the boundary line and therefore needing to be removed. This was only discovered when the title pegs were re-established.
- Kerb and channel bedding not being properly compacted resulting in the kerb and channel rolling over during the defects liability period.
- Footpaths cracking at edges due to poor compaction of bedding.

Common issues to be on the lookout for are:

- Contractors not aware of change in bedding depths for footpaths. Note the bedding depth has been increased so that it is capable of taking the loads and the concrete is considered a

wearing surface. Note also that the bedding has to extend 100mm from the edge of the footpath or 150mm behind the back of kerb and channel.

- Reinforcement for footpaths is not on chairs, so that there is no guarantee that the reinforcement will end up in the right place.
- Expansions joints not properly constructed e.g. dowel bars not at correct spacing size or set up in accordance with SD210. It should be noted that the diameter and length of the dowel bars was increased in version 5.2 of the Standard Drawings. Some examples of poor workmanship that does not comply with the requirements of the IDM.

- Footpath bedding not being properly compacted along the edge resulting in cracking when a vehicle crosses the path.
- The depth of bedding under the kerb and channel is to a minimum of 75mm or the extension of the bottom of the road pavement whichever gives the greatest depth of bedding.

11.10 Base Inspections

Use Base Inspection – Civil Works checklist found in in Appendix E of the IDM when carrying out this inspection.

The development engineer must ensure that approval has been granted for pavement construction to proceed to the base stage, and that compaction tests for the base layer have been received and checked before agreeing to the inspection. There is no point in doing the inspection unless both these actions have been completed.

The design engineer should check the levels, using a string line, to ensure that the correct depth of base has been placed and that the shape is correct. The surface should be even and smooth, should not contain coarse sections and should be free from irregularities (which will be magnified, rather than reduced, when a seal is placed over them).

Approval can then be granted to proceed to the wearing course application stage.

11.11 Prior to Wearing Course Being Applied Inspection

Use Prior to Wearing Course Being Applied Inspection – Civil Works checklist found in in Appendix E of the IDM when carrying out this inspection.

The checklist is quite extensive in the items to be checked. The items are clear and straightforward and no further commentary is required.

11.12 Acceptance of Works (Practical Completion) Inspection

Use Acceptance of Works (Preliminary) Inspection – Civil Works checklist found in in Appendix E of the IDM when carrying out this inspection.

Before agreeing to carry out this inspection, the development engineer should ask the Construction Engineer to provide Council with a formal statement that all required works have been completed. There is no point in doing this inspection unless these works have been completed.

City of Greater Geelong send out one of their inspectors 2 days before the inspection to check that all the works have been completed. This unofficial inspection does not look at the standard of the workmanship, only that the works appear to have been completed.

There is no point in carrying out an acceptance of works, inspection if all required works have not been completed. It is not good practice to accept works with a list of outstanding matters that need to be completed during the defect liability period. These works should all have been completed prior to the Acceptance of Works inspection being carried out.

The checklist is quite extensive in the items to be checked and handed over. The items are clear and straightforward, and no further commentary is required.

The City of Greater Geelong also require their traffic engineers to be present during this inspection to sign off that all traffic management requirements have been complied with. This is the last opportunity to ensure that everything is OK.

This inspection is also used as one of the items that need to be completed prior to the Issue of a Statement of Compliance. Therefore, check that all matters that need to be addressed prior to the issue of a statement of compliance have been addressed, including the provision of As Constructed Information

See Checklist C4 for the items to be checked prior to the issue of a Statement of Compliance.

11.13 Final Acceptance Inspection (End of Defects Period)

Use Final Acceptance Inspection (End of Defects Period) – Civil Works

Typical matters to be on the lookout for are:

- Cracking in footpaths and asphalt
- Street light poles not being vertical
- Any infrastructure that has failed
- Subsidence of trenches and similar

12 CCTV Inspections

Clause 7.9 Verification of Underground Drainage Assets of the IDM specifies the requirements for undertaking CCTV inspections of newly constructed stormwater drains.

The development engineer must check Selection Table 7.9.1 to determine when CCTV verification is required i.e. prior to asphalting pavement or prior to the issue of a Statement of Compliance.

Those Councils who require verification prior to asphalting are doing so to allow any repair works that are necessary to be carried out prior to the asphalt being laid, so that a new asphalt surface does not have to disturbed and reinstated.

CCTV verification of underground assets must be completed by a qualified person as specified in Clause 7.9.2 of the IDM.

The assessment criteria are specified in Appendix H of the IDM. Two types of failure modes are considered - structural defects and service defects.

In relation to structural defects there are two types of defects in rigid pipes that will require the development engineer to decide how to proceed:

- Cracking
- Surface damage

For flexible pipes, in the absence of any major deformation of the cross-section, the only structural damage calling for a decision by the development engineer will be surface damage (for example, wall puncture) or joint deformation.

No service defects are permissible and any identified by the CCTV verification must be repaired.

Where the development engineer is required to assess whether the cracking or surface damage requires remedial works the following factors should be considered:

- The extent of the damage or cracking
- The severity of the damage or cracking i.e. depth compared to overall wall thickness
- The consequences of any failure.

Some examples of defects are shown below:

Poor property connection

Wall of pipe punctured.

13 Certification of Plans of Subdivision

Certification of Plans of Subdivision only applies to subdivisions carried out in accordance with the Subdivision Act 1998.

The following is an extract from the Subdivision Act User Guide:

> *Certification is the key administrative step in enabling a subdivision proposal to proceed. Certification is undertaken by councils and ensures that any proposed plan of subdivision complies with the Subdivision Act, the regulations and any requirements of the planning scheme or planning permit and any matter required under section 6(1) of the Subdivision Act.*

Generally, this means that the development engineer is limited to checking compliance with planning permit conditions that include the words “prior to the certification of the plan of subdivision”

Clause 3.8 of the IDM states that:

> *Certification of a Plan of Subdivision can only occur if the plan of subdivision is in accordance with the requirements of the planning permit and any accepted Functional Layout Plan.*

It is important to check that road reserve widths comply with the relevant IDM provisions and that court bowls are of an adequate size.

Many Councils require drainage plans to be approved prior to certification of the plan of subdivision so that the size of drainage reserves and easements can be finalised.

14 Statement of Compliance

A Statement of Compliance only applies to subdivisions carried out in accordance with the Subdivision Act 1998.

The following is an extract from the Subdivision Act User Guide:

> *Under section 21(1) of the Subdivision Act, an applicant receives a statement of compliance from a council once all public works and open space requirements placed on a proposal under the planning system or under the Subdivision Act have been satisfied or adequate arrangements have been made to secure compliance with those requirements.*
>
> *A statement of compliance cannot be issued before a plan is certified and it must be obtained before a plan can be registered with Land Victoria.*
>
> *A statement of compliance enables a council to ensure compliance with any agreements and conditions placed on any planning permit relating to public works and open space provision.*

Clause 7.7 of the IDM specifies all the matters that must be attended to prior to the issue of a Statement of Compliance and includes the following provisions:

- All engineering and landscape works have reached Practical Completion, or **Council** has accepted a bond for the uncompleted works.
- Construction supervision fees in accordance with Clause 5 of the *Subdivision (Permit and Certification Fees) Regulations 2000* (currently to the value of 2.5% of the total estimated cost of constructing the works which are subject to supervision) have been paid.
- Any non-standard public lighting fees required in accordance with the provisions of this **Manual** or the Planning Permit have been paid (where such fees apply, a public lighting plan approved by the current Service Provider should also be submitted).
- "As constructed" survey data and asset information required by the provisions of this **Manual** have been submitted in electronic format, together with other documentation required by the Planning Permit.
- Completed Inspection and Test Plans have been submitted.
- Certificates of Compliance have been provided for any structural works.
- Reports, maintenance plans and other documentation required by the Planning Permit have been submitted.
- Any required maintenance bonds for the infrastructure have been paid.
- Any item specified in a planning permit condition which states "Prior to the Issue of a Statement of Compliance"

15 Urban Vehicle Crossings

15.1 When to construct

In relation to residential subdivisions the development engineer must ensure that Council's practice in relation to vehicle crossings has been taken into consideration. In particular, Council may require vehicle crossings to be constructed prior to the Statement of Compliance being issued or, where rollover kerbs are used, may leave this to the purchasers of the allotments.

Both positions have advantages and disadvantages.

The advantage of requiring developers to fully construct vehicle crossings as part of the subdivision is that service connections to properties and street tree locations can be properly planned having regard to the location of the driveways. The disadvantage is that those purchasing an allotment rarely look at the location of an existing vehicle crossing when designing their house. This can result in many requests to Council to relocate their driveways. Some purchasers may even expect Council to pay for the relocation works. Any change to the location of vehicle crossings requires a Works Within Road Reserve Permit and removal of the unused crossing. In many cases, the workmanship evident in the processes of removal and reinstatement has been of a very poor quality.

For this reason, many Councils have adopted a SM2 modified kerb and channel profile and left it to landowners to place their vehicle crossings to suit the house they are building. Both the footpath and the kerb and channel have been designed for vehicular traffic, and the landowner need only construct the infill between these elements. This has not entirely removed the disadvantage of the first option, as some landowners still want to construct vehicular crossings where there are drainage pits, street trees, service connections and other infrastructure. In addition, some landowners do not construct the infill section properly, and just drive over the nature strip or place some gravel which is ineffective and unsightly.

Some Councils require developers to lodge a bond for the construction of vehicular crossings which is progressively released on the completion of crossings by landowners. This has the disadvantages of relatively high administrative costs, and the possibility of having insufficient bond funds available to construct any outstanding crossings.

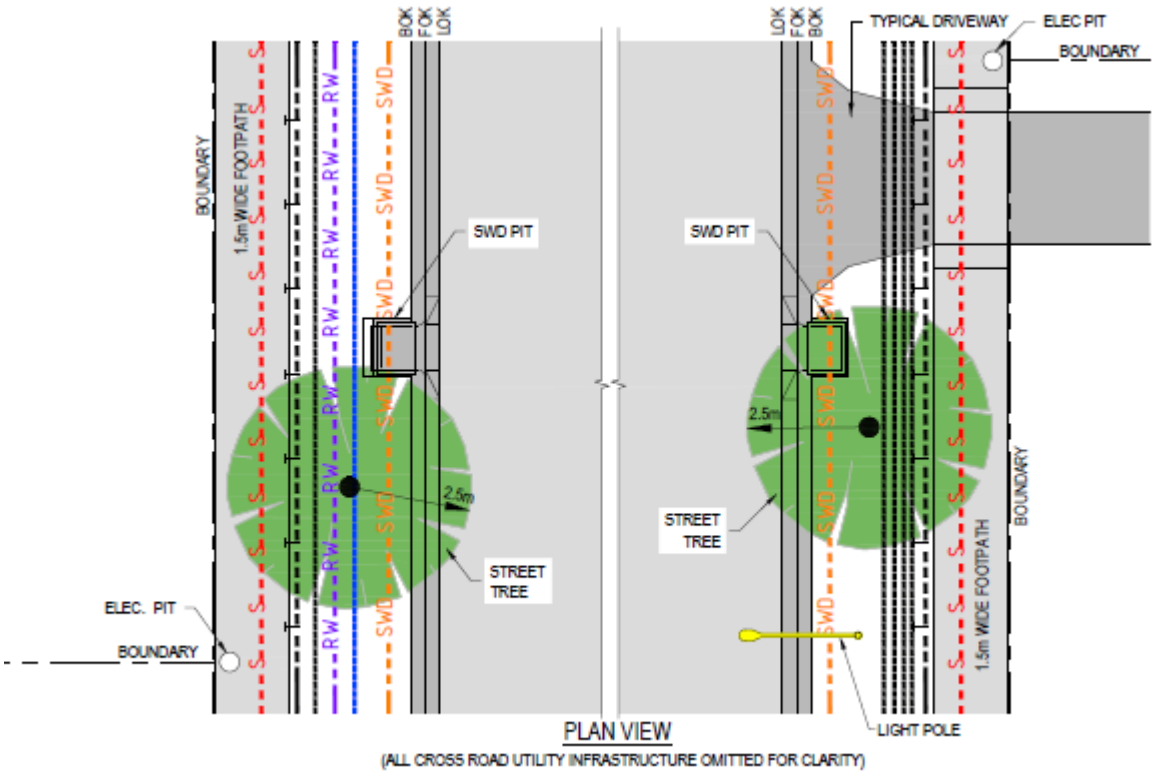
15.2 Location of Crossings

Clause 12.9.1.2 provides details on where crossings should be located to avoid negatively impacting traffic safety and to ensure that street trees can be planted along the street at regular intervals.

As the frontage of allotments becomes narrower (10 to 12m frontages are already common) it will be necessary for developers to determine in advance where crossings are to be located in order to ensure that utility services to the property are not located within the tree zone or under crossings. This exercise becomes even more complex when service connections to properties on the opposite side of the road are taken into account, particularly where boundary lines are staggered from one side of the street to the other.

VicRoads *Code of Practice for the Management of Infrastructure within Road Reserves* provides good advice in relation to clearances between utility services, trees and vehicle crossings.

See SD 630 (see extract below) for typical locations of street trees and vehicle crossings in a residential street. The space that is left between the boundary and crossing and the space between crossings and trees and trees and boundary are suitable locations for service connections.



16 TGSI and Kerb Ramps

The development engineer must assess the requirements for the placement of Tactile Ground Surface Indicators (TGSI) at kerb ramps and other locations.

Clause 13.3 states "Tactile Ground Surface Indicators should be provided in accordance with *AS/NZS 1428.4*, with the VicRoads *Traffic Engineering Manual Volume 3 – Part 2.19 Accessibility DDA Guidelines* and with **Error! Reference source not found.**"

It then goes on to say that "**Councils** listed in Selection Table **Error! Reference source not found.** o nly require these indicators to be installed in the central commercial area of urban centres."

There has been a lot of confusion over the requirements for TGSI. Some of the most common misconceptions are that:

- they are required at every pram crossing (kerb ramp); or
- it is only practical to require them in CBD areas (hence Selection Table 13.3).

It is important to understand how visually impaired persons use these and other aids.

There is a useful PowerPoint presentation titled "Kerb Ramps 2017" that can be downloaded from the resources section of the website. This presentation emphases that good kerb ramp design can eliminate the need for TGSI in many situations.

Good kerb ramps:

- provide a suitable grade for all users to get both down and up; and
- direct users straight across the roadway to a continuous path of travel on the other side;
- have smooth transitions between surfaces and grades; and
- do not trap users on the roadway by bull nose, trough or steep exit; and
- provide sufficient clear warning of the hazards ahead; and
- are easily "readable" by users.

Such kerb ramps can eliminate the need for TGSI in many situations

TGSI should be installed to alert vision impaired people to hazards that could not otherwise be reasonably be expected or anticipated, including:

- obstacles, hazards or sharp changes of direction in the path of travel; or
- locations where users will have to turn off in order to access a crossing point; or
- other circumstances requiring guidance as to the path of travel.

However, TGSI are not generally required when the grade of a ramp is 1 in 8, as this fact alone should inform visually impaired persons that they have come to an intersection. Similarly, TGSI are not usually required at kerb ramps when the demarcation between the footway and the surrounding surfaces can be easily seen and sensed (for example, where there is a clear edge between concrete and grass). By contrast, in a CBD location, where the area between the building line and the back of the kerb is covered by smooth, uniform materials such as concrete and asphalt, TGSI will typically be required to direct visually impaired persons to the kerb ramp.

See the PowerPoint presentation for examples of good and bad kerb ramps.

17 Pumpstation Design

When the development engineer receives design plans for a stormwater pumpstation the first thing to check is whether the type of pump is appropriate for the application.

There are two main types of stormwater pumps:

1. Low head, high volume pumps
2. Moderate to high head and lower volume pumps

Each of these pump types is discussed in detail below.

Low head, high volume pumps

Low head, high volume pumps are typically used in levee bank situations when a river or stream is running at or above minor flood level and there is a need to prevent water flowing back into the town drainage system. This is normally achieved by closing a sluice or gate valve located at or near the outfall to the river and setting up one or more pumps to pump drainage water over the levee bank in the event of local rainfall. Depending upon the required discharge rate, the pumps may be mounted on trailers to facilitate rapid deployment. After the flood has passed, the pumps can be removed and put back in storage. An example of such a portable pump is shown below.

When the required discharge rates are beyond the capacity of portable pumps, pumpstations will have to be permanently established, for activation as required.

An example of a permanently installed low-head high-flow pump to convey stormwater over a levee bank is shown below.

Note that locating pumps on trailers or on permanent above-ground installations saves the cost of a traditional pumpstation. Centrifugal or axial flow pumps are often used in such cases and are much cheaper than submersible pumps capable of delivering the same flow rate. The key restriction to such installation will usually be the suction lift required. Because a perfect vacuum can never be achieved in the suction pipe the typical maximum lift will be around 5-6m

Consideration needs to be given as to whether above-ground pumps have electric motors or diesel motors. The decision will usually be based on the following factors:

- Availability of power
- Likelihood of a power failure when the pump is in use
- Consequences of pump not working

Further design considerations will include

- The amount of retardation, if any, that is available
- The flow rate to be designed for when the sluice valve is closed. This will depend on the extent of flooding that can be tolerated. Installations are typically designed for 1% AEP.
- The amount of lift required.
- The volume and depth of sump required to prevent cavitation and, so far as practicable, to reduce the number of starts and stops required during normal pump operation.

Moderate to high head lower volume pumps

Moderate to high head and lower volume pumps are usually submersible units that collect and transfer stormwater from a retardation basin or wetland to a receiving watercourse. By their nature, these are usually permanent installations which operate whenever a local rainfall event occurs.

In most such installations, good practice dictates that there should be two pumps with one on duty and the other available as a standby should the duty pump malfunction or become blocked. The pumps should be rotated from duty to standby after every rainfall event.

Examples of submersible pumpstations are shown below.

Photo of a typical arrangement of a small pumpstation

Photo of the inside of a typical small pumpstation

Photo of a typical switchboard

An example of a large pumpstation consisting of three submersible pumps and one diesel backup is shown below:

Once you are satisfied that the correct type of pump has been chosen, the following matters should be considered:

- Pump design
- Pumpwell design
- Gantry design, if applicable
- Switchboard details
- Flow controllers
- Alarm and telemetry requirements

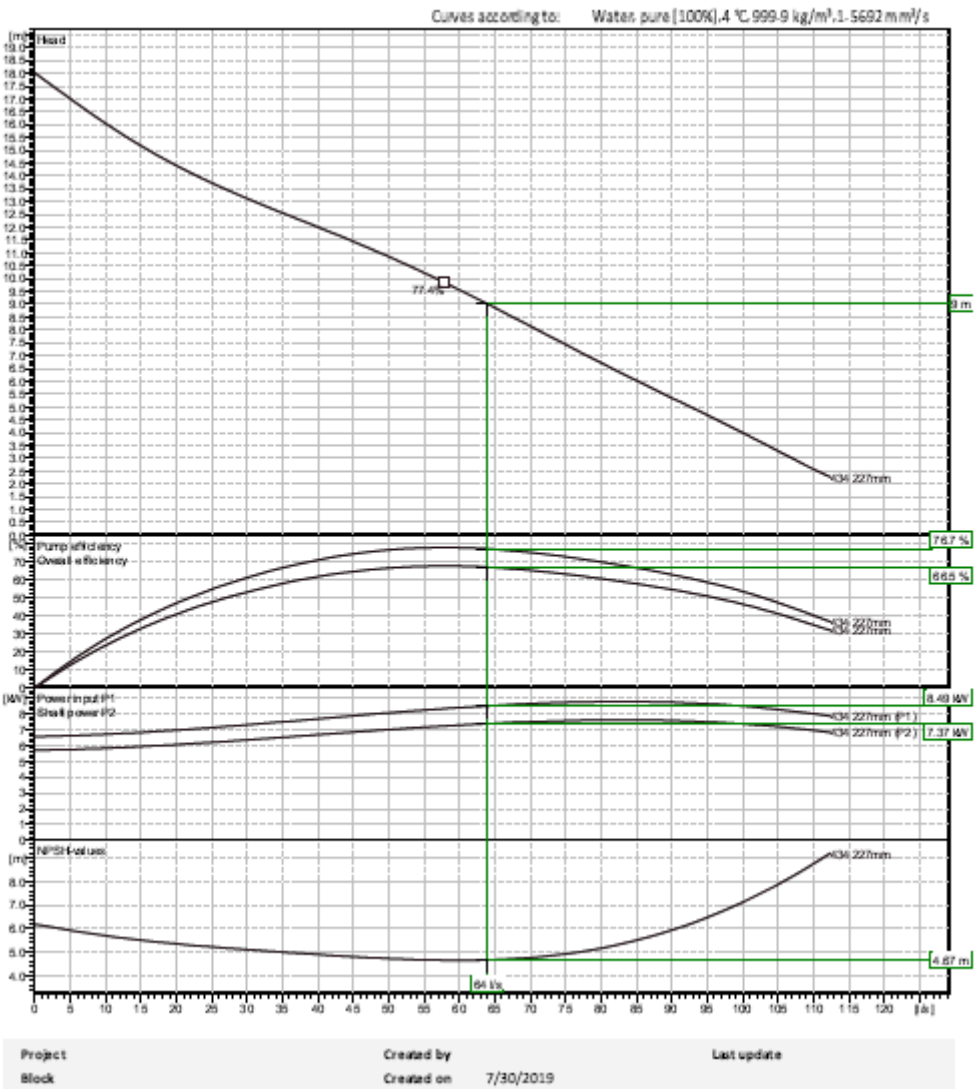
Note that all pumpstation components that have not been specifically designed to operate safely when fully immersed must be installed above the 1% AEP flood level.

Each of the above matters is discussed below.

Pump design

Consideration should be given to:

- The volume of retardation available.
- The annual exceedance probability adopted in designing the retardation basin.
- The peak discharge rate adopted in designing the retardation basin.
- The amount of lift required.
- The volume and depth of sump required to prevent cavitation and, so far as practicable, reduce the number of starts and stops required during normal pump operation. A common goal would be to have less than 6 starts per hour, with an absolute upper limit of 15 starts per hour. This should not be a major issue where there is large retardation basin feeding the pumpstation, given the volume of water required to be pumped to change the level of the water in the basin by 100mm. The sump must also be large enough to house two pumps, and deep enough to ensure that the submersible pump units remain fully immersed at all times, to avoid over-heating the motor, pump and bearings.
- The type, capacities and manufacturers of pumps. Where Council already has a number of pumpstations, with staff trained in maintaining, and having access to a range of spares for, a specific brand of pumps, Council may be justified in nominating that brand, should such action be permitted under their purchasing policies and procedures.
- Whether to nominate a variable speed drive on the pump to reduce the power demand when pumping commences and handle low flows without excessive stopping and starting.
- The impeller for the pump should be selected so that the duty point (the point at which head and flow rate intersect) for pump operation achieves the maximum efficiency for the pump. An example is shown below for a duty point of 64lit/sec at a head of 9m.



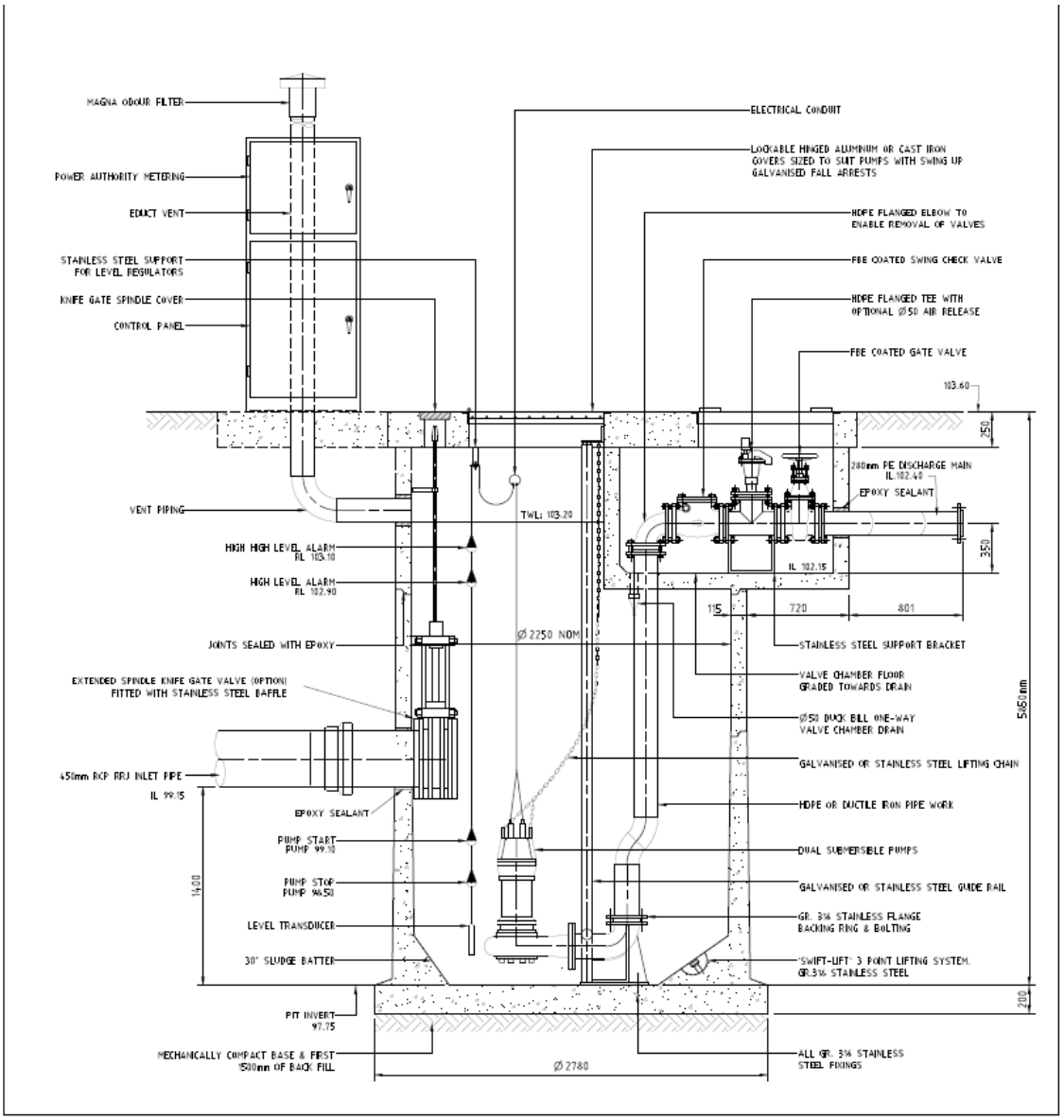
Pumpwell Design

Consideration should be given to:

- The type of material used (concrete is often preferable because it has a longer life than, and is not as easily disturbed or damaged as, lightweight products).
- Whether the valve pit should be incorporated with, or be separate from, the pumpwell.
- The attention given to eliminating trip or fall hazards for staff and members of the public.
- The well diameter (having due regard to the size of the sump as determined above).
- Provision of sufficient access to carry out maintenance at ground level and within the pumpwell (there should always be sufficient room for a ladder to be deployed – step irons are **not** desirable, due to potential failure and facilitation of unauthorised access).
- The arrangements made to ensure that the pumpwell can be isolated when there is a need to carry out maintenance work within the well. In many cases, a sluice valve or similar device will be required for this purpose.

- GPT or litter traps should be installed upstream of the pumpwell to prevent the pumps from being blocked by litter and debris.

An example of a typical pumpstation design is shown below (note the valve pit location is not typical)



Gantries

Gantries are normally not required as cranes mounted on the back of utes or maintenance vehicles can raise and lower most submersible pumps. However, when access is limited or very large pumps are involved, a gantry may be required. All components must be protected from corrosion (galvanised steel is preferable).

Consideration should be given to ensuring that:

- maintenance vehicles and personnel have ready access to the pumpstation and gantry;
- sufficient lateral and vertical clearance is available for pumps to be lifted clear of the pumpwell and loaded onto a truck; and

- the structural design of the gantry has been certified by a qualified engineer.

Switchboard (electrical cabinet)

Consideration should be given to:

- Housing for main switch and distribution circuit breakers and supply authority meters.
- Locating the facility at a point visible from the nearest roadway during daylight hours to reduce the likelihood of vandalism.
- Installing a vandal-shielded warning light displaying:
  - green constant – normal;
  - red constant – fault; and
  - red flashing – high water level.
- Providing a stainless-steel cabinet with a vandal proof lockable handle in the door.
- Providing a door-operated light within the cabinet.
- Orientating the cabinet so that pump operation can be monitored from the control panel.
- Installing an external 3-phase outlet to allow a generator to be connected in the event of a power failure (and including a phase reversal switch).
- Installing a general power outlet with auto-off provision within the cabinet.
- Providing sufficient space to accommodate the required telemetry systems.
- Installing an automatic duty/standby controller for multiple pumps.
- Providing a selector switch for automatic or manual operation.
- Installing thermistor motor over-temperature protection relays

Flow controller

Consideration should be given to the type of controller to be nominated (for example, float switch, ultrasonic, or electronic rods). The selection should be have due regard to operational issues such as the frequency and cost of maintenance, and whether the controller and sensors can be accessed without requiring access to the pumpwell.

Alarm and Telemetry

Where a single telemetry network is already used for other pumpstations in the municipality, the proposed system must be shown to be fully compatible with that network. Where any doubt exists, Council may be justified in nominating a particular type and/or brand of system, should such action be permitted under their purchasing policies and procedures.

The typical alarms required include:

- High water level within a retardation basin.
- High water level within the pumpwell.
- Low water level within the sump (to avoid pump running dry).
- No flow with pump running (possible blockage in outlet pipe).
- No power.
- Low fuel level for diesel pumps.

Asset Handover Requirements

Once the pump has been installed and tested, and in the case of a subdivision, before a Statement of Compliance is issued, there should be a formal handover of the pump from the contractor to the Council.

The following people should be invited to the meeting as appropriate:

- Contractor
- Consultant / Designer
- Council engineer
- Council maintenance personnel that will be responsible for maintaining the pump.

The meeting should cover:

- The operation and maintenance of the pump
- The handover of operation manuals for the pumps and associated equipment

18 Frequently Asked Questions

18.1 Information required at functional layout stage – Drainage Master Plan

Submissions have been received over from time to time claiming that the information required at functional layout stage is excessive and generally not available at that time.

The requirement for a drainage master plan to be prepared at this stage ensures that, at the detailed design stage, retardation and bio-retention basins can be fitted into the area allocated to them, with due allowance for access, construction and maintenance. In several instances, this information has not been provided until detailed design phase, by which time the lot layout has been fixed, and the area set aside for drainage infrastructure has turned out to be insufficient.

18.2 Footpaths on both sides

The requirement for footpaths on both sides is specified in Clause 56 of the planning scheme, with the exception of streets that have less than five dwellings. However, this is a minimum requirement and Clause 56 does not preclude additional footpaths. In fact, to comply with the objectives of access and mobility there is good argument that footpaths at all frontages are appropriate. While Clause 56 refers to shared zones, the consensus view of several universal access workshops has been that people with disabilities are placed at an unreasonable risk in these environments. That could well be deemed to be discriminatory under the Disability and Discrimination Act.

18.3 Does the IDM conflict with Clause 56 of the Planning Scheme?

One of the objectives of the Infrastructure Design Manual is to provide a system by which Councils can determine and implement infrastructure standards that reflect and address local needs or desires. This is permitted under Clause 56 and is referred to as an “Alternative Design Solution”

The IDM is generally considered to be consistent with the objectives of Clause 56 of the Planning Scheme. Disputes about discrepancies between Clause 56 and the Infrastructure Design Manual arise mainly when people compare the minimum standards for certain items but neglect to consider the overall objectives of the relevant Clauses. The Planning Scheme does not require that minimum standards be provided, but does require that the objectives of the Planning Scheme are met. Clause 56, Residential Subdivision states as follows:

Purpose

To implement the State Planning Policy Framework and the Local Planning Policy Framework, including the Municipal Strategic Statement and local planning policies.

In other words, local policies recognised in the planning scheme can require higher standards than the minima specified in the planning scheme. Too often Councils feel pressured into accepting the minimum standards of Clause 56 without consideration being given to the objectives of the Clause.

Many people live in regional areas because of the neighbourhood character of the streets that are historically found in the those areas. Country residents generally do not want to live in minimum width streets and often provide this feedback to Councils.

18.4 Size of car parking spaces

One issue of difference between the IDM and the Planning Scheme is that parking in regional areas is not adequately addressed by the minimum requirements of Clause 56. Residents in country towns do not have the same parking requirements as those in metropolitan areas, which have vastly more extensive public transport services. They often work in areas over 50 km away from home with no public transport systems, and therefore use their own cars. The cars themselves tend to be larger, requiring more space than the smaller vehicles used to commute within large cities.

Councils often receive complaints about the size of parking bays constructed in accordance with the provisions of the Planning Scheme being too small, with cars suffering damage as a result. Parking bays designed in accordance with the requirements of the Australian Standards and AustRoads do not receive the same number of complaints.

18.5 Supervision Fees should be reduced

Several submissions have been received over time claiming that Councils should not collect the full 2.5% supervision fee specified in the Subdivision Act as they are not fully supervising the works.

Councils are in effect undertaking the same level of inspection that they have undertaken for years and are asking the same fee for such. Councils are carrying out inspections at hold points or witness points to ensure that the assets to be handed over to Council comply to Council's standards.

What the manual highlights is that Councils are not administering the contract or giving direction to contractors. The only contractual arrangements exist between the Developer and the Contractor, and Council is not one of the parties to these arrangements. The supervision by Councils referred to in the Subdivision Act relates to the very wide range of activities undertaken outside the contractual between the Developer and the Contractor, including the independent technical review of proposed developments throughout the many stages of design and construction. That review helps to protect the interests of all parties, including communities and the future purchasers of subdivided land, as well as Designers, Developers and Contractors.

Where Councils have reviewed the engineering fees for subdivisions the actual costs incurred have been found commensurate with the fees received. It is not deemed to be necessary further to justify these costs.

18.6 T and Y intersections should be permitted

The Planning Scheme allows three-point turning of service vehicles in developments. Council have adopted an engineering principle that no waste vehicle, emergency service vehicle or street-sweeper

shall need to reverse in developments. This is in response to recommendations made by the Coroner in relation to fatalities resulting from these types of vehicle movements. In addition to the Coroner's recommendation, Councils believe that cul-de-sacs are beneficial to the amenity of the residents living there because of footpath connectivity and safer environments for children.

Councils often receive criticism and complaint from their residents about cul-de-sacs which incorporate T and Y intersections. They have expressed a strong preference for court bowls.

Councils have also been contacted by waste collection contractors with concerns about this issue. The lack of appropriate turning facilities at the end of dead-end streets may, in the future, prevent Councils from providing waste collection services in these areas at great inconvenience to residents.

18.7 The IDM is not flexible enough and doesn't promote innovation

This comment has often been levelled at the IDM. The following two clauses in the IDM have adequately addressed this issue in that they provide for the situations where compliance to the IDM is not possible in the circumstances and where innovation or new technology can be used. The whole structure of the IDM with clear objectives for each clause give designers the opportunities to use new technologies provided the objectives of the IDM are met. Clause 1.6 states that:

> *The **Councils** using this **Manual** will make every endeavour to follow the requirements of this **Manual** unless there are circumstances that exist that make it impractical or unreasonable to follow the requirements of this **Manual** e.g.*
>
> - *Renewing an existing asset which does not comply with the standards specified in this **Manual**.*
> - *Where the protection of native vegetation or the existing streetscape make it impractical to adopt the IDM standards*
> - *Where the adoption of the IDM standards would result in detriment to the neighbourhood character of an area.*
> - ***Infrastructure** in a heritage precinct or heritage significant area.*
> - *Infill **Development** where the surrounding or abutting standards are those which the Council wants to maintain.*

Clause 1.7 states that:

> ***Councils** may give consideration to adopting and approving innovative solutions and using new technologies where it can be demonstrated to the satisfaction of the Council that the objectives of the relevant clauses of the IDM have been satisfied even though the specific technical provisions have not been met.*

18.8 What can I do if my Council is not following the requirements of the IDM?

Occasionally submissions are received from developers and consultants which claim that a Council which has adopted the IDM does not apply those requirements consistently to developers and consultants and sometime asks for arrangements that are actually contrary to the IDM.

The Technical Committee of the LGIDA does have provision for stakeholder representatives to have full rights of audience and debate at their meetings, and matters of general interest have been, and will continue to be, raised by those representatives. This has provided a good basis for the IDM to be developed in a way which reflects a fair balance of interests.

However, the LGIDA does not operate an internal appeal process to deal with disputes about how individual Councils interpret the Manual, nor is it likely that it will develop such a mechanism in the future. Where developers and/or consultants have concerns about how a Council implements the IDM, they should contact the Chief Executive Officer (or Council) to explain their concerns. Should such contacts fail to resolve the situation, they may wish to consider appealing to VCAT.

18.9 Can drainage reserves be counted towards the provision of Public Open Space?

Reserves provided for drainage purposes are not normally included in the calculation for public open space. In some instances, for example, where large retardation basins have been designed to serve a dual function as active or passive recreation areas, Council may consider part of the drainage reserve as contributing to public open space as per the requirements of clause 18.2 of the IDM.

19 Appendix 1 Comparison between IDM and Clause 56 of the Planning Scheme

Clause 56 states that:

> *A standard should normally be met. However, if the responsible authority is satisfied that an application for an alternative design solution meets the objective, the alternative design solution may be considered.*

Where IDM standards relating to residential development vary from those in Clause 56, the IDM is to be considered as providing alternative design solution.

56.01-1 Subdivision site and context description

In addition to the information required by this clause of the planning scheme, the IDM Clause 3.2 (Plans of existing site conditions) requires the following information:

- The interval of contour information as per Table 1
- Details of onsite wastewater management systems
- Levels on the adjacent lot where lot filling or construction of structures may impact overland flow of drainage waters
- Details of impervious surfaces.

56.06-5 Walking and cycling network detail objectives

Standard C18 requires that:

> *Footpaths, shared paths, cycle paths and cycle lanes should be designed to be of a quality and durability to ensure a minimum 20-year life span*

IDM Clause 6.4 Specifications states that:

> *Unless otherwise agreed by **Council**, the specifications for assets should ensure that the design life as listed below can be achieved with industry standard maintenance:*
>
> - *Concrete structures generally 80 years*

Concrete footpaths are a standard within the development industry. For these paths to be durable and not crack under traffic during dwelling construction, 125mm thick reinforced concrete is normally used, with a typical useful life of 80 years.

56.06-7 Neighbourhood street network detail objective

Standard C20

The design of streets and roads should (only those dot points where there is a possible variation are mentioned):

- Meet the requirements of Table C1. Where the widths of access lanes, access places, and access streets do not comply with the requirements of Table C1**, the requirements of the relevant fire authority and roads authority must be met.**
- Provide a minimum 5m x 5m corner splay at junctions with arterial roads and a minimum of 3m x 3m corner splay at other junctions unless site conditions justify a variation to achieve safe sight lines across corners.

Table C1 Differences

Access Lane

In relation to Access Lanes, Clause 12.3.1 of the IDM states that:

> *Access Lanes as defined in The Planning Scheme are not considered desirable by the **Councils** listed in Selection Table 12.3.1, and should not be provided within **Developments** unless specific approval is obtained from the **Council's Engineering Department**.*
>
> *Roads of width and function equivalent to Access Lanes may be approved as private roads or common property. However, **Council** may require specific treatment such as fencing, paving and drainage. It is recommended that this issue be addressed as early as possible in the planning process.*

The underlying principle underlying this is clause is that Access Lanes:

> *…are considered to be socially undesirable as they provide out-of-sight places where undesirable behaviour often takes place. Where they are approved, specific conditions may be imposed by Council such as open fencing to adjacent properties, planting restrictions etc to create more open and visible environment.*

This is consistent with the objectives of Clause 56 which require that each development:

> *… provides a safe neighbourhood street system for all users.*

Access Place

Provision	Clause 56	IDM	Comment
Traffic volume	300-1000 vpd	0-300 vpd	*Unlikely to reach greater than this volume given that the maximum length of an access street is 100m e.g. 12 houses @10vpd = 120vpd.*
Carriageway width	5.5m with one hardstanding verge parking space per 2 lots or 5.5m wide with parking on one side of carriageway	6.0m. Note CFA require 7.3m minimum unless parking is restricted to one side	
Verge width	7.5m minimum. States a minimum width on one side of 2.5m	3.5m both sides providing services fit in	*Issues with fitting services in due to footpaths both sides mean that 3.5m is required*
Road reserve width	Not stated	14m	
Footpath provision	Not required if less than 5 dwellings	Required both sides	*Disability Discrimination Act requires provision otherwise it could be deemed that discrimination is taking place.*

Access Street Level 1

Note that the IDM has only one classification of Access Street due to CFA requirements.

Provision	Clause 56	IDM	Comment
Traffic volume	Level 1 1000 -2000 vpd Level 2 2000 – 3000 vpd	1000-2500 vpd	*More realistic traffic volume for rural and regional areas*
Carriageway width	Level 1 5.5m with one hardstanding verge parking space per 2 lots or 5.5m wide with parking on one side of carriageway Level 2 7 -7.5m parking both sides	7.3m minimum	*CFA minimum is 7.3m*
Verge width	Level 1 - 4m Level 2 – 4.5m	3.5m both sides providing services fit in	*A 7.3m carriageway in 16m road reserve provides 4.2m verge widths*
Road reserve width	Not stated	16m	
Footpath provision	Required both sides	Required both sides	
Cycle path provision	Carriageway designed as shared zone and appropriately zoned	No mandatory cycle path provision. Access Streets are designed to offer a low speed environment suitable for use by cyclists.	

Connector Street Level 1

Provision	Clause 56	IDM	Comment
Traffic volume	3000 vpd	2500 - 6000 vpd	
Carriageway width	3.5m lane width in each direction 2.3m parking lane where parking is required Total 11.6m Additional width where bicycle lane is required	11.6m minimum	*Adopted PTV minimum requirements*
Verge width	4.5 minimum	6.0m	*Additional verge width is required because of shared paths and services Note 4 of Table C1 states that additional width may be required for shared path.*
Kerb Profile	Semi mountable	B2	*Parking is provided on street so there is no requirement for semi mountable kerb.*
Road reserve width	Not stated	24m	
Footpath provision	1.5m path required both sides	2.5m shared path required both sides	*If one or more on-road cycle lanes are provided one of the shared paths can be deleted.*
Cycle path provision	On road and additional carriageway width required	See footpath provision	

Connector Street Level 2

Provision	Clause 56	IDM	Comment
Traffic volume	3000 - 7000 vpd	6000 - 12000 vpd	*The provision of two traffic lanes in each direction means that these roads can accommodate the higher traffic volumes*
Carriageway width	3.5m minimum lane width in each direction of travel. 7m minimum carriageway width in each direction of travel where separated by a central median	2 x 7.0m with 6m median.	*Similar provision for dual lane carriageway but single lane option in each direction is classified as Connector Street Level 1.*
Verge width	6.0 minimum	6.0m	
Kerb Profile	Semi mountable	B2	*Parking is provided on street so there is no requirement for semi mountable kerb.*
Road reserve width	Not stated	34m	
Footpath provision	1.5m path required both sides and 1.7m bicycle lanes on the carriageway or 2.5m wide shared path on both sides	2.5m shared path required both sides	*If one or more on-road cycle lanes are provided one of the shared paths can be deleted.*

Splays

Clause 12.5.5 of the IDM states that:

> *Splays of suitable dimensions should be provided at all corners of all intersections.*
>
> *At intersections involving at least one collector road the minimum splay on the intersecting roads is 5m x 5m. At intersecting roads of lesser classification, the minimum splay is 3m x 3m. Larger splays may be required to secure traffic safety and/or to accommodate the provision of services.*

There is a minor difference to the planning scheme in that the 5m x 5m splay comes into effect at Collector Street level not arterial road level.

Apart from mentioning safety reasons for the splay, the IDM also recognises that services at intersection may benefit from the larger splay.

Conclusion

While the IDM provides much more detail as to how the alternative solution should be implemented, and covers many areas on which Clause 56 is silent, when dealing with residential subdivisions there are only very minor differences between IDM and Clause 56 of the Planning Scheme.

Comparison of IDM and other clauses within planning schemes.

Clause 52.06 Car Parking

Clause 52.06-8 states that:

> *Plans prepared in accordance with Clause 52.06-7 must meet the design standards of Clause 52.06-8, unless the responsible authority agrees otherwise.*

This clause includes Table 2 which gives the minimum dimensions of car spaces and accessways.

The note to Table 2 states that:

> *Some dimensions in Table 2 vary from those shown in the Australian Standard AS2890.1-2004 (off street). The dimensions shown in Table 2 allocate more space to aisle widths and less to marked spaces to provide improved operation and access. The dimensions in Table 2 are to be used in preference to the Australian Standard AS2890.1-2004 (off street) except for disabled spaces which must achieve Australian Standard AS2890.6-2009 (disabled).*

Clause 14.3 of the IDM states that :

> *The layout and access arrangements for all parking areas should comply with the Austroads Guide to Traffic Management: Part 11 Parking or Australian Standard AS2890.1 – 2004 Off Street Parking, AS2890.2 – 2002 Off Street Commercial Vehicle Parking, AS2890.3 Bicycle Parking Facilities, Australian Standard AS2890.5 -1993 On Street Parking and AS2890.6 Off Street Parking for People with Disabilities.*

LGIDA members have found from experience that car parks designed to the provisions of the IDM receive fewer customer complaints than do those designed according the planning scheme.