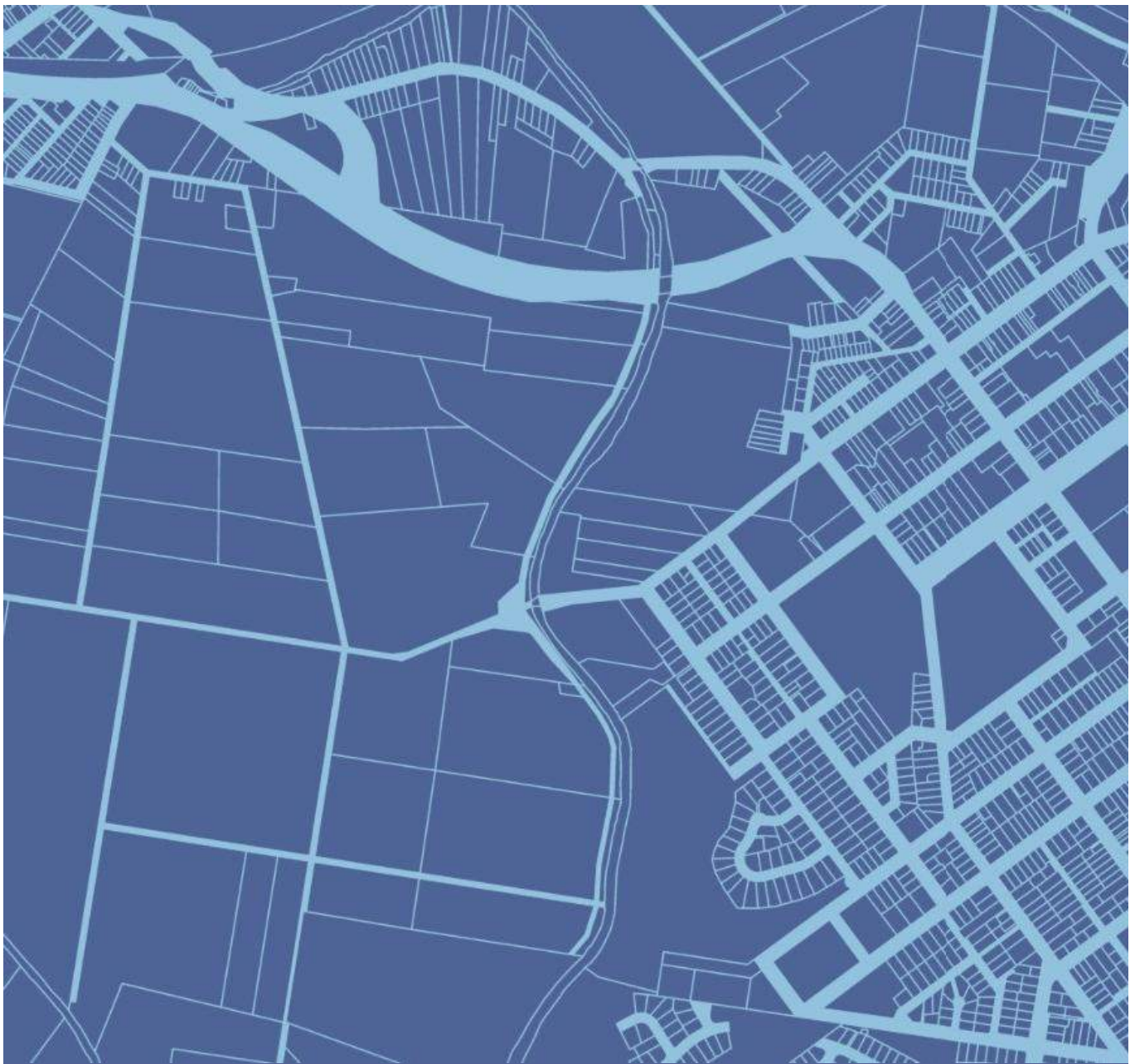




MoES – G 2026

General Requirements

Manual of Engineering Standards

maitland
CITY COUNCIL

Policy History

VERSION	CLAUSE NO.	DESCRIPTION OF CHANGES	AUTHORISED BY	DATE
1	-	2026 Comprehensive Update	Council Resolution	Date Adopted: 17/03/2026 Implementation: 14/04/2026

Table of Contents

G – General Requirements	1
1. Introduction.....	1
2. Preface	1
3. Aims and Outcomes	1
4. Structure of Manual of Engineering Standards.....	1
Figure G-1: Structure of Manual of Engineering Standards	2
5. Disclaimer	3
6. Design Considerations	3
6.1. Design Life	4
6.2. Built to Owners Scale	4
6.3. Ongoing Maintenance	4
6.4. Best Practice Design	5
6.5. Safety in Design	5
6.6. Crime Prevention Through Environmental Design	5
6.7. Designing for All Abilities	6
7. General Processes and Requirements	7
7.1. Introduction	7
8. Project Manager and Principal Certifier.....	7
9. Definitions	7
10. Design and Construction	8
10.1. Preliminary Engineering Plans (for Development Applications)	8
10.2. Endorsement by Accredited Professional	8
Table G-1: Design Submission Requirements	8
10.3. Construction	9
10.4. Safety of work	10
10.5. Removal of Defective Works	10
11. Insurance and Levy	10
11.1. Public Liability Insurance Policy	10
11.2. Workers Compensation	10
11.3. Professional Indemnity Insurance	10
11.4. Long Service Leave Levy	10
12. Works on Public Land	10
12.1. Council Approval	11
12.2. Approved Contractors	11
12.3. Commencement of (Minor) Works	11
12.4. Road Closure	11
12.5. Locks on Public Land	12

13. Utility Services.....	12
13.1. Utility Services General Requirements	12
13.2. The Electrical Power	13
13.3. Street Lighting	13
13.4. Other Authorities	13
14. Public Reserves.....	14
14.1. Drainage and Nature Reserves	14
14.2. Parks and Playing Reserves	14
14.3. Operation and Maintenance	15
15. Subdivision Certificate.....	15
15.1. Lot Classification	16
15.2. Road Widening	16
16. Bonds.....	16
16.1. Works Maintenance Bonds (WMB)	17
16.2. Performance Bonds	17
16.3. Outstanding Works Bonds	17
16.4. Bond Process	18
17. Works as Executed.....	19
18. Quality Assurance Submission.....	21
18.1. Compliance Certificates	21
19. CCTV Inspection of Drainage Conduits.....	22
19.1. Introduction	22
19.2. Technical Specifications	22
19.3. Inspection Procedure	22
20. Unapproved Works and Variations.....	24
21. Environment, Vegetation, Landscaping and Heritage.....	24
21.1. Introduction	24
22. Developer Responsibilities.....	24
22.1. Legislation	24
22.2. Heritage Conservation and Protection	24
23. Vegetation.....	25
24. Trees and Habitats.....	25
24.1. Tree Disturbance	26
24.2. Habitat Treatment	26
25. Environment.....	27
25.1. Fire Restrictions	27
25.2. Noise Control	27
25.3. Dust Control	27

25.4. Site Storage	27
25.5. Contaminants	27
25.6. Works on Waterfront Land	28
26. Soil Conditions	28
27. Erosion and Sediment Control	28
27.1. Controls - During Construction	28
27.2. Controls - Post Construction	28
27.3. Material Transportation	29
28. Landscape and Vegetation	29

G – General Requirements

1. Introduction

Council's Manual of Engineering Standards (MoES) is designed to support the delivery of quality civil engineering infrastructure for a range of projects benefiting the Maitland community. The purpose is to streamline the processing of engineering submissions, ensuring that infrastructure is designed and built to be safe, functional, cost-effective to maintain, and aligned with community expectations.

This Manual has been developed to enable designers, Councils, and consultants to prepare compliant concepts and designs for civil works. The manual is intended to provide all the necessary design requirements for preparing Development Applications (DA), Subdivision Works Certificates (SWC), Roads Act Applications (DW), and Construction Certificates (CC) for development works.

2. Preface

This Manual sets out the minimum standards and guidelines for engineering design and construction works in the Maitland City Council (MCC) Local Government Area. It is primarily intended for use by development professionals in the preparation of DAs and engineering design plans for the construction of approved works, including "SWC" under the Environmental Planning and Assessment Act (EP&A Act) and "DW" under Section 138 of the Roads Act.

3. Aims and Outcomes

The aims of the **Manual of Engineering Standards (MoES)** are:

- To manage development in a natural landscape with suitable infrastructure that supports pedestrians, cyclists, and vehicles, controls stormwater runoff, and maintains a good appearance.
- To identify Council's expectations and requirements relating to information required in engineering plans and standards of engineering design and construction for subdivision and development.
- To promote best engineering practice and quality environmental outcomes.

The desired outcomes in the application of the Manual are (**SPEL**):

- **Safety** – for public usage of the built infrastructure.
- **Politic** – manage interactions with affected residents tactfully and responsibly.
- **Environmental** – protect nearby residents and surrounding ecology.
- **Liability** – minimise Council's maintenance burden through appropriate infrastructure selection.

4. Structure of Manual of Engineering Standards

MoES is structured to provide a framework for engineering practices and guidelines for developments in the Maitland Local Government Area (MLGA). It is organised into four (4) key documents that outline standards and procedures relevant to various aspects of engineering projects, refer to Figure G-1. These include documents on general requirements, design criteria, construction, and lot-scale engineering. Each document is interconnected with references and cross-references, ensuring consistency and alignment across different aspects of engineering practice.

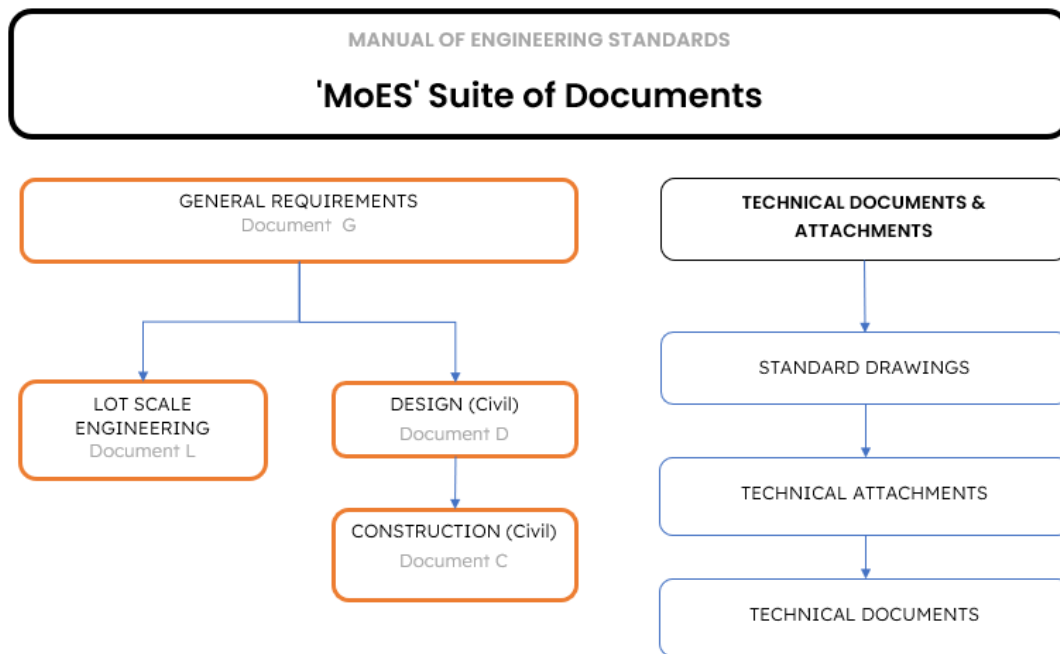


Figure G-1: Structure of Manual of Engineering Standards

G: General Requirements

Document G: General Requirements serves as the foundational document, including overarching principles and processes that apply to two or more documents within the suite. It establishes the fundamental expectations and procedures that shall be adhered to throughout the project lifecycle from design and construction to handover.

L: Lot Scale Engineering

Document L: Lot Scale Engineering provides guidance for small-scale developments, such as multi-dwelling housing, two-lot subdivisions, commercial, industrial, business developments, and other projects. These developments typically do not require the construction of public infrastructure including new roads and major public drainage, although some minor public works, such as footpaths or partial road upgrades, may be needed. The document aims to cover most topics relevant to small-scale developments (not already addressed in Document G: General Requirements), with some overlap with Design and Construction Documents where needed.

D: Design

Document D: Design focuses on the preparation of preliminary engineering plans and construction plans, addressing more detailed technical standards for larger civil engineering projects. It is primarily applicable to large-scale subdivisions and other developments that require the construction of public infrastructures, such as roads and drainage. This section does not cover private infrastructure. The requirements for civil earthworks including lot filling are also addressed in this document.

C: Construction

Document C: Construction outlines the construction requirements and critical engineering standards necessary to ensure safety, quality, and compliance. Its purpose is to support effective project management, enhance regulatory adherence, and promote best practices throughout all stages of construction.

Appendixes

The Appendixes at the end of the MoES suite provide additional information on submission requirements for engineering plans, erosion and sediment control and management, stormwater design parameters, pavement material specifications, and a list of best practice documents.

Technical Documents and Technical Guidelines

The manual also includes Technical Documents and Technical Guidelines, which provide supplementary information such as standard drawings, driveway design, street lighting design, etc. These attachments expand on and supplement the standards outlined in the main body of the manual. Typically located outside of the main documents. They are used in multiple processes by different users, such as developers, Council's programs, and/or resident-exempt development items. The goal is to provide easy access to this information without duplicating it across multiple documents.

Overall, MoES is designed to be a cohesive and integrated resource, ensuring that all development activities are conducted in accordance with established best practices and standard requirements. It serves as a vital tool for engineers, contractors, and stakeholders involved in development and Council's projects, fostering consistency, quality, and compliance.

5. Disclaimer

This manual does not confer any responsibility upon Council with respect to the accuracy of the design and calculations for which responsibility fully rests with the applicant's consultants and designers. The applicant is responsible for ensuring design compliance with the relevant Development Consent, current Council's MoES, Australian Standards, legislations, and current engineering industry standards.

The engineer and professional are fully accountable and liable for the design and work. They cannot rely solely on meeting the minimum requirements of Council's MoES, as newer or higher standards demand a more rigorous design, particularly in terms of structural integrity and safety considerations. They must demonstrate current best technical practices and standards in their assessments, consistent with what any reasonable engineer would apply.

If work has not commenced prior to the lapsing of the Development Consent or two (2) years after the issued date of the SWC, the SWC should be amended to comply with the current version of Council's MoES and the latest industry standards. Reassessment fees may apply.

MoES Documents are intended to be a technical manual and should not be used as a works specification. It does not remove the need for compliance with all relevant statutory requirements.

Whilst this manual is a policy document of Maitland City Council, the information contained herein at the date of publication, is subject to revision by Council due to changing standards over time. Therefore, no warranty can be given that this Document represents current standards and technical practices at the time of their application in design and construction. The responsibility is on the user of this manual to verify the currency of information contained and referenced herein, prior to implementation.

Prior to construction, any certified or approved designs for works located on existing public land, or on land proposed for dedication to the public, that are older than two years, must be reviewed and endorsed by Council.

6. Design Considerations

The design considerations complement technical standards to guide the design process. The following list, though not exhaustive, highlights some key considerations.

6.1. Design Life

All designs and construction shall provide a minimum design life of 25 years. MoES may specify a longer duration for certain items. Additionally, some industry requirements, such as those for concrete pipes and other prefabricated components, may specify a greater design life, which should be followed.

This design life requirement also applies to lot-scale items such as drainage and retaining structures. In some cases, rural residential lots may require the creation of small basins and level spreaders to manage stormwater. Earth basins and level spreaders, for example, may need to use concrete or other materials with a practical design life of 25 years or more.

6.2. Built to Owners Scale

For lot-scale infrastructure, designers must ensure that future maintenance and access to interallotment drainage lines and retaining walls can be effectively managed by lot owners and tenants in a practical and feasible manner.

While developers may use large excavators and machinery to construct major elements on a greenfield site, future owners will need to work around existing sheds, fences, and structures. In these cases, very small machines, hand tools, and wheelbarrows may be required. Designs, construction products, and techniques should be scaled to a level that is practical, economical, and safe for the intended owner to maintain and replace. Examples include:

- **Interallotment drainage** should not use concrete pipes or be placed at an unreasonable depth, which would require machinery and/or shoring boxes for future excavation.
- **Retaining walls** should not be excessively high to avoid the need for shoring during replacement. Tiering will create manageable scales for staged maintenance. The use of large concrete slabs and panels may be problematic.

6.3. Ongoing Maintenance

The ongoing maintenance of public and private infrastructure is critical throughout the design and construction phases. Given the large number of public assets, Council must optimise quality and minimise maintenance requirements to effectively manage and sustain new assets. Accordingly, designers and Council should carefully consider life cycle costs, including maintenance, demolition, and replacement, ensuring decisions are informed by research, engineering practices, and scientific principles.

- Minimise maintenance tasks that offer no environmental or public benefit.
- Minimise unnecessary mowing areas and, where possible, ensure adequate space for Council's 72-inch mowers to manoeuvre as a minimum, unless an alternative maintenance size is specified. This will help reduce the need for hand machinery and manual labour.
- Ensure public land and stormwater maintenance areas are easily accessible to maintenance traffic. The design should include provisions for turning and manoeuvring of Council's maintenance vehicles. Council can provide guidance on identifying suitable pathways and the required vehicle sizes.
- Consider health and safety impacts, prioritising a safe working environment for maintenance personnel by providing proper access for machinery and equipment, minimising manual labour, and avoiding temporary work pads or access tracks. For example, ensure open channels and swales have sufficient offsets and clearances from boundaries and obstructions to allow safe access from the road or top of the bank.

A Maintenance Plan must be prepared by the designer and submitted with the design. Public infrastructure and drainage systems should be low-maintenance and economically sustainable. A cost-effective maintenance strategy must be developed and included in the Maintenance Plan.

6.4. Best Practice Design

An Appendix E titled "Best Practice" is a crucial component of the manual, outlining industry standards, regulatory requirements, and current state and national engineering guidelines that align with MoES. Since it is impossible for the Manual to address every scenario, Council, engineers, and designers may reference these documents to supplement MoES as needed. They provide valuable resources for maintaining consistency and ensuring designs meet the necessary safety and quality standards within the industry.

Designers shall be flexible to accommodate evolving legislation, standards, technology, and emerging trends as appropriate.

Where MoES does not provide guidance on a specific item, the designer must consult with Council to confirm whether the topic has been intentionally omitted or simply not covered in the document. This list should not be used as an opportunity to reinterpret or contradict MoES requirements, as long as they remain relevant and up to date.

This list refers to industry documents, including the Australian Rainfall and Runoff (ARR) Guide, Australian Standards, Austroads, etc. Even if these documents are updated between MoES revisions, they remain mandatory and must be adhered to.

The design must be submitted with engineering details, including but not limited to methods, parameters, assumptions, calculations, and certifications from the designer confirming that it has been prepared in accordance with the latest versions of Austroads, Australian Standards, and/or the ARR Guide. Any standards or specifications used must be current at the time of the application.

6.5. Safety in Design

The *Work Health and Safety Act 2011* requires designers to prepare a written report for any structure that may pose health and safety hazards to people. This report, known as a Safety in Design (SiD) report. The report must meet specific requirements outlined in the Act and its Regulations. The SiD report shall be submitted to Council along with the design, with a particular focus on infrastructure components such as basins, stormwater drains, roads, and paths. The report must detail design measures aimed at mitigating the associated risks.

The designer is legally responsible and accountable for all designs submitted, regardless of whether they meet minimum standards, even after they have been accepted and approved by Council. This responsibility extends to the construction phase, including any products, techniques, and processes the contractor undertakes. Not all 'engineering solutions' are good designs, and accountability does not transfer from the consultant/contractor.

When designing civil infrastructure, the designer must consider construction alongside the location's functionality, intended uses, and key elements. This process should prioritise safety and ease of future maintenance while employing strategies that are sustainable and minimise environmental impact.

6.6. Crime Prevention Through Environmental Design

Crime Prevention through Environmental Design (CPTED) is a multi-disciplinary approach aimed at enhancing safety by integrating crime prevention principles into the planning, design, and layout of communities and neighbourhoods. The goal is to minimise opportunities for criminal activities and anti-social behaviour.

In designing public areas, including new streets, it is essential to prioritise community safety and consider how the design can deter potential crime. Elements such as plant selection, and the placement of lighting fixtures can significantly influence this. Vegetation or infrastructure that provides opportunities for concealment near pedestrian areas will not be permitted. The principles of CPTED include:

- **Natural Surveillance:** Designing spaces to maximise visibility, making it easier for people to see and be seen. For example, locate basins near roads so they can be seen from the front yard of four or more lots. Avoid narrow walkways between properties or dead ends/cul-de-sacs by designing connected streets.
- **Territorial Reinforcement:** Establishing a sense of ownership over a space through design elements such as clearly defined property lines, signage, and landscaping. This signals to potential offenders that the area is actively monitored and cared for. Example: Define public land and reserves from private land.
- **Access Control:** Regulating who can access a space and under what conditions. This can be achieved through measures like fencing, gates, and controlled entrances, which help manage movement and reduce opportunities for unauthorised activities.
- **Maintenance:** Ensuring that the physical environment is easy to maintain and care for. Neglected or poorly maintained areas can signal a lack of concern from residents or authorities, potentially attracting criminal activity.

For more detailed guidance on CPTED principles, the NSW Police Force website provides valuable information, as well as the outlined CPTED design principles in the MCC DCPs.

Council may also provide a list of how CPTED applies to civil infrastructure and spaces within its jurisdiction.

6.7. Designing for All Abilities

Designing for All Abilities refers to the principle and technical practice of creating streets and public spaces that are accessible and inclusive for people of all ages and abilities. This involves considering the needs of individuals with disabilities, elderly persons, parents with strollers, and others who may have mobility challenges or specific requirements. Key aspects of designing for all abilities typically include:

- **Accessibility:** Ensuring that streets and public spaces are accessible to wheelchair users and individuals with mobility impairments. This may involve providing ramps and accessible pathways that comply with accessibility standards.
- **Universal Design:** Incorporating features that benefit everyone, regardless of ability. Examples include tactile paving for visually impaired individuals, clear signage, seating areas, and adequate lighting.
- **Safety:** Designing streets with safety in mind, considering factors such as traffic flow, pedestrian crossings, and visibility to minimise risks for all users.
- **Inclusivity:** Designing spaces that are welcoming and accessible to diverse users, fostering a sense of community and social interaction, and ensuring that streets are safe, inclusive, and accommodating for all.

7. General Processes and Requirements

7.1. Introduction

This section focuses on processes that are involved as a developer moves through from concept, design, construction and signoff of civil works. This section assumes that Council or another authority has granted consent for the project, however it may also be applicable to other scenarios.

It is recommended that the Consultant/Project Manager consult with Council prior to commencement of design and construction to discuss the following requirements:

- conditions of consent,
- local conditions,
- intended design,
- construction methods; and
- materials.

Design and construction shall be carried out in accordance with this Manual and any amendments the subject of a “revision” of any part of the Manual and being the version current at the time of either the design or the construction. Should elements of a design, for the intended dedicated public works, at the time of construction, be considered by Council to be a variation to this Manual (the version current at the time of construction), the engineering plans under that certificate shall be reviewed and amended where necessary to ensure that the design and construction requirements meet current standards.

8. Project Manager and Principal Certifier

On all Subdivisions and Developments that require construction works, a specific person nominated to act as a Project Manager must be appointed. In addition, the project must have an appointed Principal Certifier (PC) for the entirety of works approved under the EP&A Act.

In the case of subdivision or where it is intended that works be dedicated to the public, Council must be appointed as the PC unless legislation allows otherwise.

In the case of works within an existing public road, approval for the works and an engineering design may only be obtained under the Roads Act from either Council or from TfNSW when relevant.

The Project Manager must be readily available and have sufficient authority and ability to discuss and resolve any operational problems that occur during the works.

9. Definitions

- Council’s Engineer refers to Council’s representative, who is the authorised responsible person for certification of subdivisions and development works. Generally, also the PC.
- Certifier refers to the definition within the EP&A Act.
- The Applicant (representing the Owner/Developer) refers to the person with authority to make decisions regarding the project and may be the Project Manager.
- The Contractor is the primary contractor/person engaged to carry out work.

- Approved, in the context of construction refers to any materials or treatments determined by Council's Engineer or Certifier to be suitable to meet relevant standards.
- Footpath, or shared path refers to the paved path which may be within a footway, pathway, or public reserve.
- Footway refers to the roadside verge between the road pavement and the road reserve boundary.
- Cycleway, a generic term used to describe a bicycle route, lane, or path or that part of a separate path used for riders. It is usually within a road pavement and dedicated by markings for cyclists.
- MoES, Manual of Engineering Standards.
- Planning Scheme refers to an adopted planning strategy/policy including Local Environment Plan (LEP), DCP, precinct plans.
- PC or Principal Certifier, as defined under the EP&A Act. Previously also called PCA (principle certifying authority prior to legislation changes
- TfNSW, Transport for New South Wales. Interchangeable with Roads and Traffic Authority (RTA), Roads and Maritime Services (RMS) and any future changes.
- Zoning, as applied by the Maitland Local Environment Plan (LEP).

All fees and contributions shall be paid in accordance with Council's fees and charges policy.

10. Design and Construction

10.1. Preliminary Engineering Plans (for Development Applications)

Engineering plans shall be prepared by suitably qualified and experienced consultants, satisfying the requirements of this Manual, as well as relevant Development Consent, Roads Act approval, or other processes that call for the use of MoES. Preliminary Engineering Plans outline a project's initial concepts and feasibility at the DA stage, providing primary details for approvals and costing.

Construction Plans provide detailed instructions, including drawings and specifications for the execution of the project. While Preliminary Engineering Plans focus on planning, Construction Plans are used for construction purposes.

10.2. Endorsement by Accredited Professional

All submissions shall be endorsed by an Accredited Professional as outlined below, refer to Table G-1. All professionals shall be suitably qualified, practicing, and able to provide current insurances and indemnities. For any additional requirements or uncertainties, contact for clarification.

Table G-1: Design Submission Requirements

TYPE OF DOCUMENTATION	ACCREDITED PROFESSIONAL	AREA OF PRACTICE
Plan of Subdivision Spatial & Boundary Definition	NSW registered surveyor	Spatial data and land surveying
Works-As-Executed Plan (WAE)	Qualified engineering surveyor	Engineering surveying
Civil Engineering Drawing	Professional engineer	Professional Engineer or approved equivalent

Structural Items (oversized pits, headwall, bridges, retaining walls, flood mound, etc.)	Professional engineer	Practicing structural engineering
Precast Items	Chartered professional engineer or manufacture compliance certificate, as directed by Council	Practicing structural engineering
Geotechnical Engineering (road construction, slope stability, basin structure, landslip, earthworks, and any geotechnical structural components)	Chartered professional engineer	Practicing geotechnical
Traffic Management Plan and Traffic Guidance Scheme	Traffic control work license: prepare a work zone traffic management plan	Suitably qualified and experienced in Road safety
Landscaping	Registered landscape architect or accredited landscape designer	Landscape architect/landscape designer
Bioretention Planting and Water Quality Planting	Suitably qualified engineer	Environmental engineering
Arboricultural	NSW registered arborist or holder of AQF Level 5	Arboriculture
Bushfire	Bushfire planning and design (BPAD) accredited	Bushfire consultant
Public Lighting and Electricity	NSW Level 3 Accredited Service Provider (ASP) for designing distribution works	Public lighting
Dilapidation Report (civil infrastructures)	Suitably qualified engineer or registered survey	engineering or surveyor

10.3. Construction

No work shall commence on the site until:

- The project has “Development Consent”,
- The engineering designs have been approved,
- The SWC, CC or another Certificate issued (eg S138, S68),
- Conditions of consent/approval that require action prior to commencement of works, have been satisfied; and
- The PCA has been appointed and notified of intention to commence, and payment of any necessary fees has been made.

Long Service Levy shall be paid prior to the issue of the SWC/CC. Two working days' notice in writing to the PCA is required prior to the commencement of site works. PCA fees shall be paid prior to the commencement of site works.

10.4. Safety of work

For works within the road reserve, the applicant or contractor, or landowner is responsible to erect and maintain approved standard safety devices such as fencing, barricades, signs and where necessary, lights in accordance with Council's standards and requirements. The worksite shall be kept in a tidy condition and maintained safe for pedestrian access for the duration of the work. Upon completion of works and removal of formwork, barricades, etc, the adjacent footway shall be filled or trimmed along the edges of the works to an even grade with a maximum slope of 1 in 8 (i.e. a 100 mm rise or fall over a distance of 800 mm).

10.5. Removal of Defective Works

Council retains the right to alter, repair or in some cases, remove and replace any work on public reserve/land for which approval has not been obtained, or that has not been carried out in accordance with this Manual, or is considered unsound or unsafe, or is of poor workmanship. The work would be undertaken by Council at the full cost of the responsible person, recoverable in accordance with the Roads Act.

11. Insurance and Levy

11.1. Public Liability Insurance Policy

Contractors engaged on Developments or Subdivision Works are to have current Public Liability Insurance to the minimum value of \$20 million before commencing construction. Minor works that are not on road pavements may be able to have \$10 million at Council's discretion. The policy is to indemnify MCC and/or the TfNSW where works occur in a public space. Council can require a higher minimum value on a site-by-site basis within public land.

11.2. Workers Compensation

Contractors engaged on Development or Subdivisional works are to have a current Workers Compensation insurance Policy for all employees, as required by legislation.

11.3. Professional Indemnity Insurance

Accredited Certifiers shall be insured in accordance with the requirements of the EP&A Act and the relevant Accreditation Body.

11.4. Long Service Leave Levy

In accordance with the EP&A Act, payment of the levy where applicable, must be paid prior to issue of the relevant SWC/CC.

12. Works on Public Land

Where works within public land such as a "road" or "open space" are necessary or are required through Development Consent under the EP&A Act, (such as road pavement, kerb and gutter, footpath, drainage, embellishments, etc) those works must be approved under Councils required application process, and completed to the written satisfaction of Council prior to issue of either the

relevant Subdivision Certificate (SC) or Occupation Certificate (OC) issued under the EP&A Act, or as stated in the consent.

12.1. Council Approval

Approval under S138 of the Roads Act or S68 of the Local Government Act shall be obtained from Council for any works on public land and/or for carrying out public stormwater drainage works. S138 or S68 approval may be combined with a SWC issued by Council, or it may need to be obtained separately from Council where a private certifier issues the SWC/CC for the private land component of the works.

12.2. Approved Contractors

Works within a road reserve or other public land may only be performed by an experienced contractor who is approved by Council. The developer/builder shall apply to Council for that approval of the contracting company. Council has the right to reject a contractor or sub-contractor if they are not demonstrated to be appropriate. Factors which Council may consider in determining the suitability of a contractor may include, but not be limited to, suitable experience, capability or past performance.

12.3. Commencement of (Minor) Works

Minor works in public roads involve small-scale activities such as stormwater connections, removal of redundant crossing and/or layback, service installations and adjustments, minor public infrastructure works etc. Prior to commencement of work, the contractor/builder shall have obtained written consent to commence works from Council and shall submit to Council:

- Evidence of currency of public liability insurance and relevant insurances,
- The method of works and proposed plant usage,
- The proposed duration of the works: and
- A traffic management plan (if required).

The contractor's representative must be present at the critical inspections required by this Manual.

Regarding works in a road reserve relating to property driveway access and installation of services, general term of conditions for "opening" a road, (such as trenching across a road pavement and/or within the road verge) should be referenced. These documents are available from Council as part of a Road Opening application. Minor works, such as a driveway or stormwater pipe connection to the street drainage system, may be applied for, and consented to, under Council's form "Work Application on Council's Land and Road".

For matters relating to the disruption of normal vehicle and pedestrian traffic movements and related to works (such as trenching) that may involve temporary or partial road closures, refer to Document C: Construction. These works may require the submission of a Traffic Guidance Scheme, which must be approved by Council before proceeding.

12.4. Road Closure

Permanent road closures may only be inaugurated by Council. An application to Council is necessary for consideration of such a proposal.

12.5. Locks on Public Land

Where locks are required on public land such as for maintenance gates, removable bollards, or switchboards, the contractor shall install them during construction. Upon completion of the works, the contractor must coordinate with Council via the subdivision inspectors to schedule the replacement of these locks.

13. Utility Services

Electricity, communications, water, sewer (and natural gas where applicable) shall be provided to subdivision developments in accordance with the relevant provider's requirements and in accordance with conditions of Development Consent.

Subdivision Works Approval: Utility plans shall be submitted along with typical sections showing utility allocations within the verge. If locations are not yet approved, pending locations must be clearly marked as draft.

Construction Phase: A copy of the stamped approved plans, along with approvals from the relevant utility providers, shall be submitted to Council within two (2) weeks of the issued SWC (or Roads Act Approval) and prior to the placement of road pavement materials and public stormwater pipes.

Practical Completion/SC: WAE plans for all utilities and services must be submitted to Council upon completion of all works.

The Developer is responsible for rectification of any damage to services resulting from construction activity.

All trenching and restoration shall be carried out to the provider's and Council's requirements. Adjustments to services, required by the development, shall be the responsibility of the Developer/Contractor.

Any restoration work shall match the existing surfaces, such as turf, concrete, asphalt, or pavers, or as otherwise directed by Council. Restoration within specific parts of Maitland CBD shall be undertaken at the developer's expense but constructed only by Council, in line with Council's fees and charges.

It is the applicant's responsibility to check whether the proposed works affect any Public Utility mains installation or any proposed new mains. Council cannot guarantee that future "openings" within the road reserve for the installation of mains, will not be required.

Where underground works within the road reserve are required or necessary for supply of services to the development site (such as water, sewer, communication, electricity, gas), further consent for a "*Road Opening*" must be obtained from Council.

13.1. Utility Services General Requirements

Council's typical sections cover local lot-scale servicing only. For trunk mains, all utility locations and details require Council approval. Developers must submit typical sections to Council outlining utility allocations within the proposed verges for both local and trunk main servicing. Additional verge width may be necessary for non-standard items that do not fit within the standard verge allocations. Typical cross sections shall have a layout and level of detail equivalent to the Standard Drawing SD001 and should include the following details:

- Shared service trench for standard electricity, gas, and telecommunication conduits,
- Trench for water mains conduit up to 300 mm in diameter for lot connection,

- Electrical pillar box,
- Special infrastructure for major electrical, gas, and telecom conduits, large water mains (over 300 mm in diameter), and telecom manholes,
- Deep soil zone reserved for street tree planting,
- Streetlight pole,
- Public stormwater drainage system,
- Footpath,
- Roadway including kerb and gutter; and
- Property boundary.

13.2. The Electrical Power

For new urban residential, business, and industrial subdivisions, all utility services shall be installed underground.

Council shall be notified in writing where a developer considers that above-ground services are unavoidable. In-principal support from Council's Infrastructure and Works Engineers shall be obtained prior to the submission of relevant plans and documentation. Modification of subdivision consent/plans will likely be required to incorporate wider verges capable of accommodating aboveground utilities.

In "large lot" residential R5 zoned areas, power shall be underground unless otherwise agreed with Council and the energy provider. In rural RU zoned areas, overhead services are acceptable, their use being in the form of Aerial Bundled Cable (ABC) as the preferred option.

13.3. Street Lighting

The major purpose of street lighting as defined by Australian Standards is required to "assist pedestrians to orientate themselves and detect potential hazards and to discourage fear of crime and crime against the person while protecting the integrity of the nighttime environment through control of light spill and glare".

Street lighting shall be provided for all new subdivisions for urban residential and business release areas as determined by Council. Design shall be generally in accordance with:

- Australian Standard AS1158 part 3 as a design guide,
- Council's Standard Drawing SD001 for pole standard location and footing; and
- Council's Technical Document: Street Lighting.

13.4. Other Authorities

All works shall be carried out in accordance with the requirements of relevant Government Authorities, for issues that relate to Planning, Environment, Fire, WORKCOVER, etc. The developer is responsible for obtaining all required approvals.

14. Public Reserves

Land to be used for any of the following purposes shall be dedicated to Council as a Public Reserve:

- Areas of land to be dedicated to Council as a nature reserve (generally in its natural condition perhaps with a path),
- Local parks (usually embellished for recreational activities for children),
- Drainage reserves (predominately for stormwater drainage devices but may include surrounding recreational amenity, seating etc); and
- Playing fields (for organised sports).

For assistance in planning for public reserves (including associated playgrounds) developers should refer to Council's adopted policies for the relevant open space and recreation areas and consult with Council personnel for each specific reserve type. The Development Contributions Team and the Community and Recreation Planning Team may also be contacted to determine applicable development contributions or to confirm any alternative contribution arrangements.

14.1. Drainage and Nature Reserves

Land to be dedicated to Council in its natural condition shall be left safe and tidy, free of hazards to public safety and made suitable for mowing (where appropriate) and being slashed prior to final inspection. All areas shall be managed in accordance with Environment, Vegetation, Landscaping and Heritage Section of this Document. Designated reserve areas shall not be used to stockpile deleterious materials or waste. Revegetation shall be required where damage is caused to reserve areas.

Where directed by Council, signposting, setting out the restrictions on the use of the reserve, shall be erected. Proposed reserves shall be examined for termite nests, by a qualified pest control person. Any identified nest shall be eliminated prior to issue of a SC.

Defined paths through natural reserves shall be made safe by the removal of trees/limbs and shrubs with potential to either fall onto the path. Adverse screening adjacent to the path caused by vegetation that may impede normal surveillance or create "entrapment" opportunities shall be removed.

Trees/limbs adjacent to and overhanging adjoining properties shall be removed. An assessment by an arborist or Council's officer shall be made prior to the work being performed.

Land to be dedicated to Council for drainage purposes shall be planned to ensure safety for areas that may attract public access, provide low-maintenance vegetation, and ease of access and manoeuvrability for mowing and maintenance plant. SWC and/or structural certification will be required for all structural elements.

In planning for drainage reserves, the area of land set aside should:

- be kept to a minimum for that purpose except as may be deemed necessary where coincidental with other non-drainage uses.
- Consider potential expansion of drainage infrastructure for future contributing catchments.

14.2. Parks and Playing Reserves

Land that is designated through planning strategies to be local parks and playing fields shall be subject to specific Development Consent. All proposed improvements shall be approved by Council.

Improvements shall be inspected by Council's officer and all approved equipment and facilities installed, shall be certified by either the manufacturer or a suitably qualified person, as satisfactory for public use and compliant with Australian Standards or some other appropriate standard.

Parks shall be serviced and enhanced with:

- Water supply (including irrigation sprinklers with appropriate safety control devices) for establishing vegetation,
- Landscaping in accordance with an approved plan conducive for efficient maintenance,
- Lighting only where specifically required by Council (preferably solar powered),
- Path paving at a minimum width of 1.8 metres and concrete edging around specified areas,
- Disability access,
- Maintenance vehicle access and lockable gates,
- Barriers such as steel bollards and fencing to deter unauthorised vehicle entry,
- Signposting nominating restricted activities within the park; and
- An assessment for suitability of any existing trees, as per Document G: General Requirements - Environment.

Where structures such as steps, handrails, ramps, balustrades, retaining walls, and other public use components are provided, they shall comply with the relevant provisions with design parameters for such items outlined in the Building Code of Australia and Australian Standards. For example, stairs must comply with the BCA regarding their design and construction.

14.3. Operation and Maintenance

Maintenance Manuals or Operation and Maintenance Plans for items such as public reserves, sports facilities, gross pollutant traps and like structures shall be prepared and submitted to Council prior to issue of a SC or OC for each type of reserve item indicating the location of infrastructure and services and including a maintenance and replacement regime for each applicable component.

15. Subdivision Certificate

An application for a Subdivision Certificate shall be made in accordance with the requirements of the EP&A Act and the EP&A (Development Certification and Fire Safety) Regulation.

Prior to issue of the SC, the following items (but not limited to those items) shall be satisfied:

- Compliance with the Development Consent,
- Submission of evidence that satisfactory arrangements have been made with the utility, authorities,
- Payment of all contributions and fees,
- Submission of bonds (cash or bank guarantee) where necessary,
- Submission of a copy of any instrument required under the Conveyancing Act. Regarding the creation of inter-allotment drainage easements under section 88B of the Conveyancing Act, the person or authority given the power to release vary or modify such easements shall be *"the lots burdened, and the lots benefited, only with the consent of MCC"*,

- Practical completion of construction works,
- Submission of geotechnical reports and test results including pavement layer details,
- Submission of WAE Plans,
- Lot classification as determined by AS 2870; and
- PDF copy of utility plans accompanying the WAE.

15.1. Lot Classification

Lot classification in accordance with AS 2870 is required for land within various planning zones, in accordance with the following guidelines:

- Residential (R1) – the classification shall apply to the whole of the lot.
- Rural – classification is not required.
- Large - lot Residential (R5) – the classification shall apply to the whole of the lot or that portion of the lot considered suitable for dwelling construction.
- Industrial and business zonings do not attract classification requirements by Council.

Regarding a ‘P’ classification, where subdivision work (such as filling) is performed on the land the subject of Development Consent, Council’s preference is that the works be performed such that no lot be classified as such. Similarly, land that in its natural state is determined to be “P” classification is considered by Council as not a desirable outcome for release, and the developer must consider performing works to improve the classification.

A “P” classification signifies that the land is considered to have limitations or constraints that affect its suitability for development. Improving land’s classification ensures future development aligns with the long-term planning goals and standards, ensuring sustainable and effective land use planning in MLGA.

15.2. Road Widening

Road widening involves an adjustment to a road reserve boundary such that a part of a property may be acquired by or dedicated to Council as “public road” in accordance with an adopted road widening scheme or as a requirement for planned works within Council’s construction programme. Where a SC is to be issued for a development, the widening shall be shown on the survey plan.

16. Bonds

Bonds are generally considered for the following:

- Repairing any damage caused to public infrastructure/property resulting from activities related to the consent.
- Completing public works (e.g., roadworks, kerbing and guttering, footway construction, stormwater drainage, environmental controls, landscaping, and other significant infrastructure) required in connection with the consent.
- Rectifying public work defects arising within twelve (12) months after completion, etc.

Bonds will generally be required by a condition of consent, by another agreement such as a Works in Kind Agreement, by a Council’s policy such as MoES, or other relevant legislation or policy.

In addition to the bond amount, there will be bond handling fees as set out in Council's current Fees and Charges. These fees include charges for receiving the bond, conducting inspections of the work, and processing the bond release.

Where the developer fails to complete, reinstate, or maintain the works during the bonding period, Council may draw on the bond to complete the necessary work and cover the costs from the bond amount.

16.1. Works Maintenance Bonds (WMB)

WMB is a bond required for developments creating public infrastructure and is set at 5% of the cost of works, held for twelve (12) months. The bond ensures the contractor repairs any defects that arise during the maintenance period.

The greater of the 5% calculation or a minimum fee of \$10,000 is required. Applicants must provide evidence of the construction works contract price to Council to determine the bond amount. The fees may be adjusted annually in accordance with Council's adopted fees and charges.

The maintenance or bonding period commences either on the date of registration of the SC or the date of the Practical Completion Certificate (for work not required or that will have an SC). Prior to the bond payment being received by Council:

- All services must be completed,
- WAE plans must be submitted to Council,
- Any works posing risks to public safety must be completed; and
- A lot-classification report must be undertaken, as applicable.
- All required contributions and fees stipulated in the consent must be paid in full.

If no application for a bond refund is submitted to Council within six (6) years from the payment date, or if the bond account has not been operated for at least six (6) years, the remaining bond amount may be transferred to the Chief Commissioner of State Revenue under the Unclaimed Money Act 1995.

16.2. Performance Bonds

Performance bonds may be required for several reasons, including:

- Landscape maintenance and/or establishment periods,
- Monitoring the performance of the constructed infrastructure or item, guaranteeing that it will function as intended for a certain period after the work is completed. If the infrastructure doesn't perform as expected (e.g., it fails to meet performance criteria or has defects), the bond may be used to cover the cost of repairs or replacement; and
- Situations where the construction quality of an item is questionable and requires a period of observation, which may include its removal and replacement.

The bond amount and terms will be set by Council. A formal bond agreement may also need to be entered into.

16.3. Outstanding Works Bonds

Consideration of a bond shall be given when works are substantially complete, and construction items are delayed due to circumstances beyond the reasonable control of the developer or contractor. Outstanding works bonds are strongly discouraged and is at the sole discretion of MCC. Council may

refuse to accept a bond if it determines that the bond presents an unacceptable risk or offers no public benefit. The purpose of the bond is to ensure that the infrastructure related to a development or subdivision is completed without imposing undue financial burden on Council or the community.

Consideration of the bond will be subject to the following conditions:

- The works do not adversely affect the operation of the development.
- The incomplete works do not present a safety issue that cannot be satisfactorily managed.
- The incomplete works and their subsequent completion will not inhibit the commencement of building development on the lots.
- Council considers the public benefit outweighs the risk.

All agreed works are on public land and may be undertaken by Council, or on its behalf, if the developer fails to complete them within a reasonable timeframe.

The bond amount is typically a minimum of 200% of the determined costs/quote or \$10,000, whichever is greater, and must be satisfactory to Council. Higher amounts may be required if Council identifies additional risks. If the works are not completed within the specified timeframe and Council has not used the bond money to execute the works, Council may require additional security to account for annual indexation in accordance with the Consumer Price Index (CPI). The minimum fee will be updated annually in Council's Fees and Charges.

The following works must be completed before a bond for outstanding works will be considered:

- Roads with a primer seal applied.
- Disturbed soil stabilised.
- Water and sewer connections completed and tested.
- Geotechnical reports regarding land suitability submitted and deemed satisfactory.
- All-weather access provided to each allotment.
- Drainage systems/structures in place.

Items that may be considered for bonding, where justified, typically include:

- Asphalt, due to large delays in industry supply.
- Sections of footpath paving affected by justified issues, such as utility considerations.
- Turf beyond that necessary for stabilisation.
- Signposting and line-marking not deemed essential for public safety.
- Landscaping with justifiable reasons.

16.4. Bond Process

Where the proposal meets the criteria for bonding set out in Sections 16.1, 16.2, or 16.3, the applicant shall satisfy the following:

- Provide a timeframe schedule for completing the bonded works. The outstanding works bond is generally three (3) to six (6) months maximum.
- Provide a quote from a suitable quantity surveyor, registered land surveyor, or qualified engineer/contractor for the cost of the works. The quote shall include site establishment and demolition, labour, traffic control, contingencies, and other relevant factors. The quote must be treated as a standalone project by a new contractor, as unit rates from the original and larger contract are not appropriate for the smaller scale of the bonded works.

- Provide suitable security to the satisfaction of Council in the form of cash, bank cheque, surety bond, or an irrevocable bank guarantee (from a reputable financial institution or equivalent) to cover the bonded amount.
- Enter into an agreement with Council outlining the terms of the bond. The agreement shall include a written program for the completion of bond works, including plans that identify the scope of works to accompany the quote estimate.
- Provide Council with authorisation for unrestricted access to the development site at any time to inspect and/or carry out works as necessary.
- Pay the relevant associated fees in accordance with Council's Fees and Charges, typically including bond inspection fees and bond administration fees.
- Pay any required contributions and acknowledge that contributions cannot be covered by a bond.
- Install temporary measures to ensure public safety regarding the incomplete works and their completion. These measures may include signposting, temporary fencing, and traffic control.

Note:

- 1) Any bank guarantee shall not have an expiry "sunset" date and must include a statement regarding Council's absolute right to draw on the security to carry out the works and, if necessary, recover any additional costs incurred in the execution of the works.
- 2) No interest will accrue on cash deposits.
- 3) Council will not release any part of the bond to a third party without written consent from the bond applicant.
- 4) The bond may be drawn down in stages according to the agreed schedule or as related works are completed, with Council approval. Administration fees will be charged for each change made to the bond. Where the bond applies to an entire stage, all works required under that stage must be completed before the bond can be released. Separate bonds may be required for different types of work, such as one for outstanding civil works and another bond for vegetation.
- 5) The bond will only be released once Council is satisfied that any identified damages have been properly addressed and/or the required works have been completed, following an inspection by Council.
- 6) Where no application for a bond refund is submitted to Council within six (6) years from the payment date, or if the bond account has not been operated for at least six (6) years, the remaining bond amount may be transferred to the Chief Commissioner of State Revenue under the Unclaimed Money Act 1995.

17. Works as Executed

WAE plans for the approved civil works, including utilities and services, shall be submitted to Council upon completion of the works. These plans must be accompanied by the Quality Assurance (QA) documentation. This submission is necessary for future reference, regulatory compliance, and to ensure that Council has up-to-date records of the completed works. The plans will be used to verify that the work was completed as per the approved specifications and will be required for any future maintenance or modifications.

WAE plans (or the equivalent electronic files) shall be submitted in the format required by Council. The WAE information, survey, and spatial data shall be endorsed by a suitably qualified surveyor who is independent of the contractor. The WAE information may also need to be certified by a professional practising engineer (or another appropriately qualified professional), as deemed necessary based on the scale of works and at Council's discretion (e.g., where WAE items are outside tolerances or field

changes have been made to the design). The developer must engage an external professional to complete the WAE information and cannot self-certify their own work.

The endorsement shall include:

- Name, contact information, and company name of the surveyor/engineer.
- Clear description of the relevant stage number and development.
- Signature of the responsible professional(s) and the date of certification.
- A copy of the professional indemnity insurance and public liability coverage.
- Include the professional registration number of the surveyor and/or engineer.
- A statement detailing the surveying methods employed, including the type of equipment used (e.g., GPS), and the horizontal and vertical accuracy of the methods. (Note: Certain GPS tolerances may not be suitable for all purposes).
- Certification from the engineer (or an equivalent qualified professional) confirming that the WAE information accurately reflects the constructed works, where required by Council.
- A statement acknowledging the responsibility of the surveyor and the applicant's engineer for the accuracy and completeness of the WAE plans/information, where required by Council.
- A statement acknowledging that Council and other stakeholders may rely on the information provided in the WAE drawings for further assessments or decisions, where required by Council.
- Engineer's certification that the onsite works including deviations meet design requirements, for components such as road geometry, safety drainage, hydraulic performance, flood mitigation, and drainage freeboards, where applicable or state the variations have negatively impacted design requirements and how it is deficient.
- Clearly highlight any deviations from specified tolerances or reasonable tolerances in the WAE drawings using clouding or other markers, where applicable.

Where construction varies from permitted tolerance, Council may require rectification. Additional testing may be necessary to determine the extent of the rectification works, as needed. The WAE plans shall provide sufficient details to accurately define the works and demonstrate compliance with the specified tolerances. The plans shall include:

- Plan views showing location.
- The entire construction plan set shall be provided as the works-as-executed drawings. The front sheet/index shall indicate which plans within the total set include WAE information, modifications, and field amendments.
- All WAE information shall be overlaid on the design for plan and section views.
- Sub-grade centreline and the outer edge of the box-out for both subgrade and "select/capping layer" where employed.
- Electronic conformance reports generated from field surveys during construction at subgrade, subbase, and base levels are accepted as an alternative to conventional survey methods, whether taken at random points or specific chainages. Plan views shall also be included.
- Location and level of kerb and guttering, road centreline, road crown, either lip of gutter or top of kerb, rear and front of footpath, at boundary, at changes of grade where no footpath exists, and overland flow paths (top, bottom, and changes of grade).
- Concrete works and structures, including vehicle access, paths, pads, shelters, retaining structures (top and toe).

- Location and level of piped and open drainage systems, including pipe sizes, subsoil drains/mats, inter-allotment systems, lintels, drainage aprons, ripraps, and other structures such as railings and signage.
- Finished surface levels of lots, including all cut/fill regraded areas. Provide contours at 0.2 metres or 0.25 metres intervals for flat land with spot levels at reasonable intervals. At a minimum, spot levels shall be provided for all corners, the middle of all boundaries, or at a maximum 20 metres grid, whichever is smaller. Changes of grade shall also be provided.
- Street furniture, including traffic control devices (line-marking and signage), utilities, particularly in the road reserve, street lighting, street trees, landscaping perimeters, and features.

Where construction parameters vary from, or are not specifically nominated and located on, the approved plans, additional information, as follows, shall be noted on the plans or detailed within a final geotechnical report:

- Sub-grade replacement/modification, specifications, thickness, levels, and extent.
- Sub-base and base-course specifications, thickness, levels, and extent.
- Location of tests carried out on the layers.

18. Quality Assurance Submission

Records of quality assurance (QA) must be created and maintained from the commencement of construction through to handover. These records must be kept in electronic format with appropriate backup strategies to prevent data loss, or in physical form. The contractor is responsible for ensuring that up-to-date copies of all documents are maintained.

The contractor must provide Council's subdivision engineers with documentation confirming that all work has been completed in accordance with the approval, approved plans, this manual, and certification lists. Submissions are to adhere to the following guidelines:

- Combined PDF format with no file access restrictions.
- Include a list of contents.
- Include all testing reports, surveys, and data sheets related to material and product qualities, as well as applications and specifications for civil works components such as stormwater systems, roads, landscaping, and earthworks.
- Include testing plans identifying the locations where testing has occurred.
- Include instruction manuals for infrastructure components such as gross pollution traps, etc.
- Include procedure documents and work instructions.
- Include forms and relevant external documents.
- Include any relevant certifications and certificates.

18.1. Compliance Certificates

The certifier (Council) may require a Compliance Certificate (Component Certificates) for a component of works from a suitably qualified professional for items including:

- **Geotechnical Certifications:** generally, by a NER geotechnical engineer or NATA registered laboratory, including Pavement Material, Density, Deflection, Basin Clay Core Density, Backfill Density.

- **Civil Engineering Certification:** including structural, design compliance, WAE conformance, etc., by a suitably qualified engineer.
- **Manufacture Certification:** for precast and pre-assembled structures.
- **Landscape Certification:** Certification by a qualified arborist (as relevant) or qualified landscape designer/architect.

The compliance certificate must include the following to be considered valid:

- The name and details of the person issuing the certificate.
- The certificate must be signed and dated by the issuer.
- Confirmation that the signatory is authorised and qualified to sign off on the works.
- The signatory's contact details.
- Indication of whether the certificate covers the entire project or only specific components of the works.
- A description of the relevant work/building component and its relationship to the development.
- Include references to the relevant clause in the Australian Standards, Austroads, or other applicable standards related to the sign-off work, specifying the year of adoption and the revision.

19. CCTV Inspection of Drainage Conduits

Closed-circuit television (CCTV) Inspection and reporting in conformance with Council's requirements are required for any construction and replacement of Council's stormwater drainage conduits. Council's engineer may waive the requirement for small scale projects.

19.1. Introduction

This section specifies the submission requirements for CCTV stormwater inspections to assess conduit conditions and identify issues such as blockages, leakages or damage. Submissions must include video footage, images, and detailed reports all formatted according to relevant standards and this guideline.

19.2. Technical Specifications

The inspection must be conducted by a qualified CCTV professional with appropriate public liability insurance. Inspectors entering confined spaces must have appropriate training and be provided with the necessary safety equipment. The work must adhere to WSA 05 guidelines, use a pan-and-tilt camera with an inclinometer and be coded on site with WinCan software. Equipment calibration records must be included in the report.

19.3. Inspection Procedure

The contractor shall conduct CCTV inspections of all stormwater drainage conduits within fourteen (14) days before the project's completion date to ensure compliance with industry standards, verify flow conditions, and detect any structural defects. Inspections shall cover all pipe and culvert joints including the invert and obvert in accordance with WSA 05 standards and be conducted during dry weather. Levels are to be recorded in Australian Height Datum (AHD).

A safety assessment must be completed prior to work, and all activities must adhere to Occupational Health and Safety regulations and Workcover requirements. Avoid using access structures under roads or heavy traffic areas and complete the CCTV inspection from adjacent structures where possible.

The contractor must notify the PCA of any CCTV inspections at least twenty-four (24) hours in advance. A preliminary CCTV inspection after subbase completion and before kerb construction is recommended to identify and address defects early and potentially reducing costs.

19.3.1. Reporting Requirements

The report must include a spreadsheet detailing all defects with the following information:

- Date and time of inspection.
- Asset Owner.
- Operator's name.
- Address/Location.
- Line details (reference, length, shape, type, class, invert levels, construction date, sizes).
- Starting and finishing pits.
- Defect chainage (m).
- Defect/Feature (WSA 05-2008 2.2).
- Characterisation 1 and 2 (WSA 05-2008 2.2).
- Quantification 1 (WSA 05-2008 2.2, including crack width in mm).
- Acceptance determination (WSA 05-2008 2.2).

19.3.2. Standard and Compliance

- WSA 05 Conduit Inspection Reporting Code of Australia.
- IPWEA PN 5 Condition Assessment and Asset Performance Guidelines – Stormwater Drainage.
- Council's Manual of Engineering Standards.
- AS 4058 Precast Concrete Pipes.

19.3.3. Quality Assurance (QA)

Works and reports for all characteristics must comply with WSA 05 and IPWEA PN5.

19.3.4. Submission Guideline

Inspection reports must comply with Council's specification and the Conduit Inspection Reporting Code of Australia WSA 05. Upon completion of the inspection, the contractor is required to submit the CCTV footage and the detailed report on a USB drive to Council within five (5) working days for the initial inspection and within ten (10) working days for any subsequent inspections.

19.3.5. Handover Requirements

Any defects identified during the CCTV inspection of the pipes must be thoroughly documented in the report, along with a detailed rectification proposal and assessment. Defects found post-installation must comply with WSA 05 standards, be classified by type according to AS/NZS 4058 and assessed for acceptability based on Table 3.6 of the standard, which outlines the criteria for pipe wall and joint surface defects. Council will review all measurements for accuracy and, at its discretion, determine the severity of the defects.

The proposed repair and/or reconstruction works must be submitted to Council for review and approval. Any repairs identified, agreed upon and approved by Council must be carried out. Once the

repairs are completed, Council will assess the completed work. If the repairs meet the required standards, Council will accept the pipes (or culvert conduits) for handover.

Council may propose an agreement that includes additional security measures, such as a bond, in exchange for issuing a Practical Completion Certificate or SC, at Council's discretion. The applicant will be responsible for all costs associated with inspections and any required rectification work. Council may also consult with an independent CCTV inspector or the conduit manufacturer.

Additionally, all stormwater conduits must be flushed clean from end to end and left in proper working order upon completion of the pipe works.

20. Unapproved Works and Variations

Where additional works or departures from the approved plans are made without approval, the Works as Executed plans must be accompanied by a report and/or calculations prepared by the Design Consultant providing sufficient justification for acceptance. Such reports shall also address the following:

- An explanation detailing that the departures comply with this Manual or adequately satisfy the intent of the Manual or some other standard.
- Where works do not comply and are not accepted by Council, the report shall recommend remedial works necessary to rectify non-compliance.
- Council will review the submissions and determine a way forward.

A modification to the DA application may be required for additional works or variations from the originally approved plans.

21. Environment, Vegetation, Landscaping and Heritage

21.1. Introduction

The protection of environment and heritage applies to all engineering works where disturbance of a construction site is inevitable. This may involve the existing surface or any vegetation, horticultural feature, water body or stream, objects, and places of Aboriginal or non-Aboriginal heritage, or natural vegetation and critical habitat.

22. Developer Responsibilities

22.1. Legislation

Items of the “built” or “natural” environment which have conservation significance are protected by the Heritage Act, National Parks and Wildlife Act, Biodiversity Conservation Act, Protection of the Environment Operations Act, Maitland Local Environmental Plan, State Environmental Planning Policy (Resilience and Hazards) or State Environmental Planning Policy (Biodiversity and Conservation), together with Council Policies and Plans including the “Maitland Greening Plan” and the Maitland DCP. The Biodiversity Conservation Act protects both plants and wildlife.

22.2. Heritage Conservation and Protection

Where a known item of heritage or heritage site is affected by or adjacent to a development, specific conditions of consent will require protection measures during construction. These must be strictly adhered to, or severe penalties (fines and imprisonment or both) may result from action under Section the Heritage Act, the EP&A Act, or the National Parks and Wildlife Act.

Where in the course of undertaking development works a person uncovers or discovers a relic (within the meaning of the Heritage Act) or Aboriginal object or place, they are to:

- Cease work on the site.
- Take appropriate measures to secure and protect the site or relic including fencing.
- Contact Council's Engineer.
- Notify either the Heritage Council or the Office of Environment and Heritage, as appropriate, of the discovery as required by the Heritage Act or the National Parks and Wildlife Act.

For the purposes of the Heritage Act a relic is any object or material evidence of settlement of the area, which is fifty or more years old, but specifically excluding Aboriginal objects.

For the purpose of the National Parks and Wildlife Act, an Aboriginal object means any deposit, object or material evidence relating to Aboriginal habitation of New South Wales. Similarly, an Aboriginal place means a place declared by the Minister (administering the National Parks and Wildlife Act) that is or was of special significance with respect to Aboriginal culture.

The purpose of these provisions is not to restrict development unnecessarily, but to ensure that valuable historical or cultural information or items are not lost or destroyed. In the majority of cases, work will be able to proceed once data on the item or place has been recorded or the relic excavated. It is advised that there is no advantage to be gained by ignoring the provisions and proceeding with works that result in destruction of items or places of heritage significance.

23. Vegetation

Environmental and vegetation protection measures shall apply to all works including the preparation of detailed plans of all necessary requirements for approval as part of the CC.

Any persons involved with such works and their design, shall as a minimum, abide by the requirements outlined within this Document, where applicable.

Measures must be taken to ensure that no contaminated material or noxious weeds are transported off site without due care, and with diligence and authorisation for removal and/or disposal.

24. Trees and Habitats

It is Council's policy to conserve native vegetation and minimise damage to trees in all new developments in accordance with the Maitland Environmental Sustainability Strategy 2030. The Maitland Greening Plan requires the preservation of trees with a height of 3 metres or more, or with a hanging branch spread of 3 metres or more in diameter. Additionally, a tree permit is required for most clearing within the Maitland LGA under the Maitland DCP. Australian Standard AS4970, *Protection of Trees on Development Sites*, applies to trees on both private and public land and contains the necessary information required to determine the tree protection zone and prepare a tree protection plan.¹⁵

Further:

- Areas of Council may be subject to a Tree Preservation Order (TPO). Consultation with Council will be necessary regarding tree disturbance.
- Removal of trees, endangered ecological community or mature vegetation is to occur in accordance with the planning pathways provided for vegetation management in the Maitland DCP.
- In cases where tree removal only requires notification to Council, Council must be notified of the intention to begin clearing at least 10 business days before commencing works. Trees to be

removed shall be clearly marked on site and correspond with those approved on the development and engineering plans for removal. Precision felling of some trees may be necessary to avoid damage to other trees or structures.

- Consent from Local Land Services may be required due to the nature of the work.
- Council's consent does not authorise access onto adjoining lands, such as for temporary storage or disposal of materials.

The applicant may have approval for large-scale clearing such as a major greenfield subdivision within the Urban Release Area (URA). It is important to consider that this approval could be based on offsetting and other avoidance measures.

24.1. Tree Disturbance

Regarding tree disturbance:

- Consent conditions regarding the protection of vegetation must be complied with, during construction.
- Works that are being carried out must be consistent with an approved Environmental Protection Plan, as part of a CC. That plan must show, where appropriate, protection of vegetation, soil stockpiles, site (and/or habitat, such as nest boxes or offsets) rehabilitation and replanting and soil erosion and sediment control and must show the size and spread of existing trees.
- Wherever possible all trees removed shall be recycled either by chipping, tub grinding or reuse as timber product.
- Replacement tree planting consistent with the *Greening Plan* will be required where shown on the engineering plans or as directed by Council's engineer following damage or unauthorised removal of trees.
- All trees and shrubs identified for protection on the engineering/environmental management plans shall be effectively protected by a fence enclosure to ensure:
 - Avoidance of soil compaction by stockpiling of fill material, sheds, or car parking.
 - Avoidance of spills or placement of oils, bitumen, distillate concrete or the like within 10 metres of tree(s).
 - Trenching is not carried out within the critical root zone of trees.
 - No topsoil removal within 4 metres of trees.
 - Avoidance of damage to trees by machinery.

24.2. Habitat Treatment

An ecologist shall be on site during the felling of identified trees and ensure that any displaced or injured wildlife is collected and released appropriately. All actions taken by an ecologist shall be reported to Council.

The following shall be satisfied prior to felling any tree or removing/pruning adjacent trees:

- Determine if the tree constitutes a habitat tree or supports any species listed under the Biodiversity Conservation Act and whether Environmental Impact Assessment (effect on threatened species, populations or ecological communities, or their habitats) under the EP&A Act has been carried out.
- Compliance with any Biodiversity Development Assessment Report (BDAR) shall be carried out as part of the DA.

- Measures should be taken to reduce the potential for injury and death to animals likely to inhabit the tree and may require inspection of hollows, sectional dismantling and/or supervision of works or removal/relocation of animals by a qualified ecologist. Habitat trees include any trees with hollows.
- Retention of hollows should be undertaken where possible on the site, where this is not possible and habitat is not significantly impacted, the tree hollows should be placed where possible in retained vegetation and/or nest boxes should be placed to retain habitat potential.
- Where approved construction work requires the removal of trees, the contractor is to engage the services of a suitably qualified ecologist to inspect the site and identify any tree which is likely to be a habitat tree. The ecologist is also to be on site during the felling of any identified tree and ensure that any displaced or injured wildlife is collected and forwarded to an appropriate Wildlife Rescue Service. All actions taken by an ecologist shall be reported to Council.

25. Environment

Protection of the environment (encompassing its human, natural and built aspects) is considered a priority of design and construction.

When working near a water body further information should be sought regarding adequate precautions.

25.1. Fire Restrictions

Burning of vegetation on-site is not permitted.

25.2. Noise Control

The contractor shall comply with all statutory requirements with respect to noise. All practical precautions shall be taken to minimise noise and to contain works within specified hours of operation. All construction equipment shall be fitted with recommended noise suppressors (see also Document C: Construction, Working Hours).

25.3. Dust Control

The developer shall comply with any statutory controls with respect to dust pollution. Soil-exposed areas shall be progressively mulched or vegetated and watered or treated with dust suppressants or other means.

When directed by Council, if in Council's opinion dust control is inadequate or that continued works creates a significant dust nuisance, works shall cease until it is considered by Council that works can recommence (see also Appendix B: Erosion and Sediment Control).

25.4. Site Storage

Equipment and materials stored on site shall be approved by Council's Engineer to prevent damage to the site, roadway, footpath and minimise hazards to person. Materials should be contained on-site to avoid impacting the surrounding properties and environment and stockpiled in a manner to avoid cross contamination of materials from the action of the weather or vehicle movement.

25.5. Contaminants

The developer is to dispose of all contaminants, oils, liquids, solids etc. in accordance with statutory regulations and produce receipts for appropriate disposal as required. Appropriate records should be available for all soil brought on site to show it complies with an appropriate resource recovery

exemption under the POEO Waste regulations. Where it is suspected that soil is contaminated, Council may direct that soil testing is required.

25.6. Works on Waterfront Land

A controlled activity approval must be obtained from the Department of Planning and Environment before commencing any controlled activity on waterfront land, unless an exemption applies. Waterfront land includes the bed and bank of any river, lake, or estuary, as well as all land within 40 metres of the highest bank of these bodies of water.

26. Soil Conditions

Soil issues such as salinity, acid sulphate soils and sodic soils can impact both the environment and infrastructure. Should any of these concerns occur management plans need to be established and provided to Council for approval with the relevant application (SWC/CC/other).

27. Erosion and Sediment Control

For works where there is a possibility of erosion of soil by wind, water or vehicles creating dust and sedimentation problems, an environmental protection proposal shall be prepared for approval as part of the engineering design for the CC. (Refer to Appendix B: Erosion and Sediment Control).

27.1. Controls – During Construction

Contractors must employ *effective* sediment control measures, to ensure that sediment and pollutants are not carried off the development site, nor eroded by wind and water, nor by “tracking” of vehicles.

It is an offence under the Protection of the Environment Operations Act to pollute the environment as a result of sediment leaving the site. A breach may result in the issue of an infringement notice and attract a monetary fine. (Refer also to Document C: Construction)

Designs should be prepared which minimises the extent of disturbed areas, which may involve staging of clearing/stripping such that small areas are exposed and stabilized (perhaps with established grass cover), prior to the next stage commencing.

27.2. Controls – Post Construction

Development and subdivision proposals shall include permanent devices and methods to treat pollutants in stormwater runoff, such as litter, coarse and fine particles, phosphorus, nitrogen, and hydrocarbons. (See also Document D: Design and Document L: Lot Scale Engineering).

Such devices and methods to be employed may be:

- Gross Pollutant Traps (pits, racks, basins etc),
- constructed wetlands,
- bio-retention (dry basins); and
- combinations of any such devices, as necessary.

Bio-retention facilities are particularly susceptible to uncontained erosion from future building activity within the subdivision and should therefore be postponed for construction until approximately 80% completed allotment development within the contributing stormwater catchment, or in the case of staged development, prior to issue of the SC for a later stage within the release area. For this purpose,

an unlimited-time cash bond or bank guarantee shall be submitted to Council for an approved value of the works, plus 50%.

27.3. Material Transportation

All transportation of construction materials, sands, gravels, soils etc to and from the site must be carried out in such a manner as to prevent depositing materials on surrounding streets. The developer shall ensure that adequate control measures are in place to prevent this occurrence or then to rectify the pollution if it occurs. All loads of loose materials shall be covered during transport to and/or from the site.

28. Landscape and Vegetation

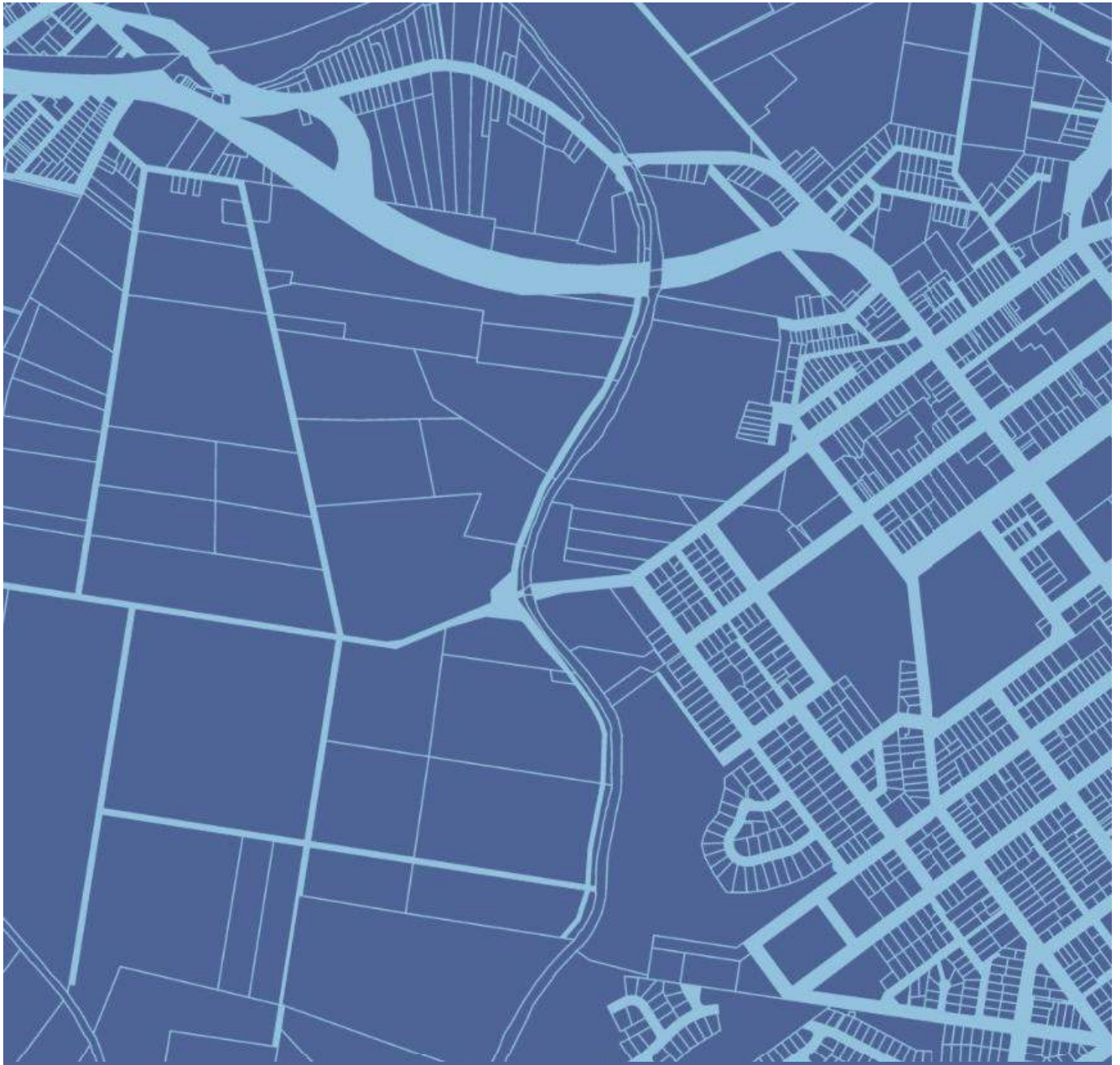
Before the lodgement of a DA, all Landscaping options should be investigated to best integrate the proposed development with existing landscaping and significant vegetation. Landscape and vegetation management should be based upon suitable initial site evaluation and analysis including any existing significant vegetation.

Aspects to be considered are:

- trees and vegetation for retention
- trees and vegetation for removal
- Areas to be undisturbed such as buffer areas and semi natural areas.

Earth mounds, retaining walls and grade changes should be designed so as not to impede normal surveillance, nor to create personal “entrapment” scenarios.

Refer to Technical Guideline: Street Tree, Tree Species List, and Canopy Cover for further information on street tree planting.



MoES – L 2026

Lot Scale Engineering

Manual of Engineering Standards

maitland
CITY COUNCIL

Policy History

VERSION	CLAUSE NO.	DESCRIPTION OF CHANGES	AUTHORISED BY	DATE
1	-	2026 Comprehensive Update	Council Resolution	Date Adopted: 17/03/2026 Implementation: 14/04/2026

Table of Contents

L – Lot Scale Engineering	1
1. Introduction	1
2. Driveway Crossings	1
3. Driveway Handles	1
4. Vehicle Access, Parking and Turning	1
4.1. Pavement	2
5. Ancillary Off-Site Works	3
5.1. Road, Footway and Drainage	3
5.2. Concrete Works	3
5.3. Inspection of Works	4
6. Stormwater Drainage	4
6.1. Aims and Objectives	4
6.2. Design Plans, Standards and Calculations	5
6.3. Discharge from Site.....	5
6.4. Inter-Allotment Drainage (IAD).....	6
Table L-1: Inter-Allotment Drainage Line Pipe Sizes.....	7
6.5. On Site Detention (OSD) of Stormwater	8
Table L-2: Determining Detention Method to Use.....	9
Table L-3: Residential Detention Parameters (less than or equal to 3000 m ²).....	10
6.6. Level 2 - Deemed to Comply Table - Industrial and Business (less than or equal to 3000 m ²).....	11
Table L-4: Industrial and Business Detention Parameters (less than or equal to 3000 m ²).....	11
6.7. Level 3 - Pre-Developed to Post-Developed Calculations – Residential, Industrial and Business (greater than 3000 m ²).....	11
6.8. General Detention Requirements (generally excluding Level 1 Systems)	12
6.9. Certifications and Works-As-Executed Drawings	13
7. Stormwater Quality and Maintenance	13
Table L-5: Post Construction Stormwater Management Targets.....	14
7.1. Maintenance of Devices	14
7.2. Water Sensitive Urban Design (WSUD)	15
7.3. Erosion and Sediment Control (ESC)	16
8. Drainage External to Site	16
8.1. Discharge from Upstream	16
8.2. Discharge to Downstream.....	16
8.3. Downstream Drainage Upgrade	17

L – Lot Scale Engineering

1. Introduction

This Document L: Lot Scale Engineering is part of the MoES Document suite. Document G: General Requirements serves as the main guide, explaining how this Document fits into the overall suite and providing other valuable information. This manual supports Maitland Development Control Plan (DCP) and should be read in conjunction with it.

This Document covers guidelines for vehicular access, drainage, and other topics for smaller-scale developments. This includes developments requiring vehicle access from a public road or an interallotment drainage system (private). This section also provides detailed guidance for industrial, business, medium-density residential developments, and small-scale subdivisions that do not create public roads or infrastructure. Small-scale subdivisions typically involve creating 2 to 9 lots, rather than a single dwelling, with direct access from existing road frontage and without the need for a new road and public drainage system.

Larger subdivisions or major developments that require new or upgraded public infrastructure will need to refer to Document D: Design and Document C: Construction of the Manual.

2. Driveway Crossings

Also known as footway crossings or vehicle crossings, a driveway crossing is the section of the driveway that spans over the road reserve, between the edge of the formed road pavement and the front boundary.

A technical document is provided for driveway crossings, as there are multiple ways a driveway can be applied for and required. These include as part of a Development Application with building construction, Complying Development, or as a standalone driveway application outside these processes.

Additionally, the subdivision of vacant lots must demonstrate that a feasible location for a driveway can be achieved for each lot.

Developers are required to use the Technical Document: Driveways to show that a compliant driveway location is proposed or, in the case of a vacant lot, that a suitable location can be achieved.

3. Driveway Handles

Driveway handles, sometimes referred to as battle-axe handles or access handles, provide lot access. These driveway handles may require a reciprocal right of carriageway or right of access, depending on the nature of the development and the access arrangement.

Council's DCP is the governing document for Development Applications when access easements and handle widths are involved within the property boundaries.

4. Vehicle Access, Parking and Turning

Vehicle access to on-site parking areas shall, as a minimum, comply with Australian Standard AS 2890. The layout and geometry for manoeuvring and parking should be assessed under Council's DCP, ensuring it accommodates the design vehicle appropriate for the development. Vehicle movement to and from the site must follow best practice design for sight distance, approach angle, pedestrian and cyclist safety, and traffic flow, both for through-traffic and turning-traffic. All traffic must enter and exit the site in a forward direction.

Generally, only single-lot residential access allows traffic to reverse onto a public road. However, in special circumstances, such as high traffic volumes, limited sight distance, or adjacent traffic facilities, reversing onto a public road may decide otherwise at Council's discretion.

4.1. Pavement

4.1.1. Sealed

Off-street vehicle parking facilities shall comprise of a wearing surface of either a 2-coat bitumen seal, asphaltic concrete, rigid concrete, or segmental block pavement on a constructed foundation (pavement), designed by an engineer. Heavy vehicle loading and manoeuvring areas should be rigid pavements.

4.1.2. Unsealed

Where pavement "hardstand" is intended to be un-sealed for purposes of storage of materials or similar use, it is essential that silt controls are put in place. Controls should be implemented by means of surface flow with perimeter (or internal) grass swales (instead of an internal pipe system) and a depressed grassed silt trap retention area incorporating a pit-trap at/near the point of discharge from the site (usually within a landscaped area). The built-in detention features provided may be quantified for the hardstand catchment area only. The hardstand material shall be stabilised with lime or cement depending on the sourced material.

4.1.3. Turning Paths

Vehicle manoeuvring templates, in accordance with Austroads or Australian Standards shall be employed for each appropriate vehicle type for the nominated land-use.

Turning paths shall be applied for the appropriate vehicle to maintain unobstructed "free flow" conditions within the site for service vehicles such as small rigid vehicles (SRV), medium rigid vehicles (MRV) and heavy rigid vehicles (HRV) where required.

4.1.4. Intersections

Where determined by Council, and generally for developments that generate high/heavy-vehicle traffic movements an access intersection treatment may be required at the junction with the public road. An example of an absolute minimum intersection treatment (catering for basic right and left turns) is shown on Council's Standard Drawing SD031 and incorporates treatment for one or more of the following aspects:

- Access entry/exit
- Deceleration lane
- Passing lane

Council's preferred treatment for access to such developments is for intersections that comply with the "Warrants for Basic, Auxiliary, and Channelised Turn Treatment" types as set-out in Austroads Standards (Part 4A). Guidelines for intersection/driveway demand may be determined from Section 3 of AS2890.1 whereby the "Access Facility Category" for categories 3, 4 and 5, in the first instance be assessed as "intersections" rather than "driveways". Despite such warrants and demands, particular consideration shall be given to providing a protected right-turn and a separated left-turn capability. Left-turn treatments should allow generous turning paths to facilitate continuous free-flow manoeuvres. Such features as described above may include road reserve and road pavement widening.

Intersections for access shall cater for Articulated Vehicle (AV) turning paths, including "B-Double" where required (and approved) by the type of the development.

5. Ancillary Off-Site Works

All works within the road/public reserve shall be designed and constructed in accordance with this manual. Road works cannot commence without consent under the Roads Act 1993.

5.1. Road, Footway and Drainage

Works may be required through development consent to upgrade the existing road verge, footpath, pavement, and/or drainage system. This is generally limited to the frontage of the development site, although may be required to be extended beyond the property boundary to transition the works.

Warrants for such works may be:

- Continuation of existing adjoining, or nearby, infrastructure to cater for the additional usage needs created by the development and to enhance the streetscape.
- Where works coincide with *Council's Management Plan*.
- Where pedestrian, cycle and vehicle traffic movements/parking are significant or where "desire-lines" of travel result from the development activity.
- Where such works are required under the relevant DCP and other policies.
- Typically, works that may be required are:
 - Re-shaping and turfing of footway.
 - Concrete paths.
 - Concrete dish-drain or integral kerb and gutter.
 - Road shoulder pavement including a bitumen wearing surface.
 - Pipe and pit drainage.

Materials for new pavement works shall comply with the relevant road hierarchy outlined in this Manual of Engineering Standards and the specifications in *Appendix D: Pavement Material*, unless otherwise directed by Council. For pavement reconstruction, the design shall be consistent with, or match, the adjoining existing road pavement. Requirements for part-width road construction, where applicable, are set out in Document D: Design.

5.2. Concrete Works

Concrete works, such as footpaths, shared paths, pedestrian pram ramps and kerb gutter shall be designed and constructed in accordance with the Construction Document and Council's Standard Drawings, with particular attention given to:

- Concrete strength (MPa) and thickness
- Bedding specifications
- Formwork and Reinforcement
- Joints
- Curing
- Testing (where requested by Council)
- Weather Conditions

5.3. Inspection of Works

All works within the road/public reserve are subject to testing, and inspection by Council to ensure compliance with this Standard and/or manufacturer or material supplier specifications where not covered by Council's Manual of Engineering Standards. See also Document C: Construction regarding inspection regime.

6. Stormwater Drainage

6.1. Aims and Objectives

The following development standards should be used to provide:

- Best practice hydraulic engineering designs for development sites and,
- To provide a sensitive approach to the environment by the employment of Water Sensitive Urban Design (WSUD) principles.

The objectives of this section are to ensure that:

- The wider community is not disadvantaged by any one individual development.
- The development caters for any relevant upstream stormwater discharging onto the site.
- Stormwater discharging from the development site satisfies any Council's planning scheme and water quality objectives for overall public drainage systems within the wider area.
- The redirection and concentration of stormwater runoff onto adjoining properties is avoided.

The outcomes of these objectives are to ensure that:

- Collected stormwater is discharged in an appropriate manner to a private (interallotment) drainage system or public drainage system.
- Development which generates increased flow rates from stormwater runoff (greater than the site's "pre-developed" rate) from impervious areas such as driveways, paths, and roofs, adequately addresses potential adverse effects on downstream properties.
- Stormwater runoff entering the site from an adjoining upstream catchment, satisfactorily passes through the site without adversely affecting the development site by means of inter-allotment drainage benefitting the appropriate adjoining property(s).
- Development sustainably manages the water cycle with sensitively designed, constructed, and maintained systems, which may include:
 - Rainwater collection for use within dwellings and on landscaping.
 - Minimising impervious surfaces.
 - Water retention within landscaping.
 - Underground stormwater infiltration.
 - Treatment of stormwater leaving each site, to a satisfactory level of quality.
 - Construction sites that are adequately protected to prevent the movement of litter, sediment, nutrients, and hydrocarbons from the site during wet weather.

6.2. Design Plans, Standards and Calculations

Design plans should be prepared by a suitably qualified person and should reflect the following principles:

- All developments that generate stormwater runoff from impervious surfaces, and where landscaping, filling/cutting, or contouring reshapes or alters flow paths, must be detailed on a stormwater drainage plan. The plan should be consistent with the landscaping design but should be provided as a separate drawing.
- The design should address potential impacts, such as erosion and downstream discharge effects.
- The stormwater drainage plan shall be submitted with the development application and should include details of natural and design surface levels, building floor levels, driveway layout, down-pipes and underground pipes and their sizes, overland flow paths, easements (if any), on-site detention tank (if required), pits and any relevant objects that may affect drainage, such as gardens, kerbs, retaining walls etc.
- The plan, whilst not necessarily adequate for construction purposes, should be prepared by a person who is qualified and competent in drainage design principles, and upon approval will subsequently be the basis for a Construction Certificate prepared and certified by a qualified person, showing full construction details.

Drainage design shall adopt the principles of major/minor drainage system in accordance with the publication Australian Rainfall and Runoff (AR&R) and as detailed in Council's Manual of Engineering Standards Document D: Design. All calculations shall be carried out by persons competent, qualified, and experienced in hydrologic and hydraulic design, utilising drainage models that are accepted as current industry standards.

The major system shall provide safe overland flow conveyance for the 1% Annual Exceedance Probability (AEP) storm event, whilst the minor system shall be capable of conveying runoff from minor storm events within underground pipes.

Calculations (if required by Council) shall show all adopted coefficients to determine peak flows in accordance with Australian Rainfall and Runoff and this manual.

The adopted time of concentration shall be for the ultimate developed catchment. The general maximum time of concentration shall be 5 minutes for catchments up to 2000 m², although a range of 5 to 10 minutes may be justified in certain circumstances.

6.3. Discharge from Site

6.3.1. Gravity Pipe Flow

Final discharge of collected stormwater runoff from development sites shall be directed:

- By pipe to the roadside table drain or drainage channel with a concrete headwall/outlet protective structure, or
- By pipe to the street kerb and gutter with a kerb adapter in accordance with Council's Standard Drawing SD036 or, if Heritage Stone Kerb is in the road kerb, by coring (refer to Council's DCP and the Morpeth Management Plan), or
- By pipe to the existing kerb outlet provided in the kerb, or
- By pipe to the rear of the existing drainage pit in the street with a flush-mortared finish, or
- To an inter allotment drainage line provided for the property, or

- To another legal point of discharge i.e. defined water course. An easement will be required to be obtained where a legal point of discharge is on a neighbouring lot and does not touch the developments boundary, or other case law is not satisfactorily demonstrated.

Discharging concentrated stormwater at the adjoining private property is not permitted. This also applies to adjoining large residential or rural properties. Public land and legal points of discharge may be considered provided that the legal point of discharge, flow velocity, safety, scouring and maintenance impacts area considered acceptable.

6.3.2. Charged Pressure Head

Charged pressure head systems are permitted when gravity system options are not available, such as in cases where an existing lot does not slope toward the street and lacks an existing drainage easement. These systems will only be supported for single dwellings (i.e., no increase in density). Note: Proposals aimed at increasing the density of dwellings or land use will require appropriate easements.

The following criteria must be met for charged systems:

- A minimum of 1 metre of head, subject to design requirements.
- A completely sealed system to the property boundary.
- Metal or high-grade plastic downpipes (90 mm PVC pipe not permitted).
- 100 mm stormwater grade underground pipes (90 mm PVC pipe not permitted).
- A cleaning flush-point into a soakage pit/well.
- Gravity flow from the boundary to the drainage system.

6.3.3. Pumping

Collection of stormwater runoff for pumping to a high-level discharge point is not desirable and may only be permitted by Council in special circumstances, such as underground carparking areas and associated driveway ramps.

6.3.4. Footway Crossing

The minimum conduit treatment for the footway crossings shall be with 100 mm diameter sewer grade PVC pipe. In some situations where there is potential for pipe damage due to heavy loads, galvanised rectangular hollow section (RHS) steel may be desirable/required.

Where a pipe is to pass under a concrete path, and it is necessary to remove the path, a complete jointed section must be removed and replaced with a similar dowel-jointed slab section in accordance with Council's Standard Drawing.

Contractors should inquire regarding the possibility of the presence of an existing discharge point provided at the property boundary. Where a pipe exists, the contractor must check that the pipe is not damaged and is operating satisfactorily. Damages must be repaired.

6.4. Inter-Allotment Drainage (IAD)

Within a subdivision or development, where inter-allotment drainage is necessary the following applies:

6.4.1. Pipes

The pipe system shall be designed to accept runoff from all existing and future lands for 10% AEP storm event, without surcharge, and be based on impervious fractions nominated in Document D: Design. Careful design should ensure that surface flows are directed into the new drainage system.

For the conveyance of flows from a subdivision for single dwelling allotment to the public drainage system (typically through an easement on an adjoining property or along a battle-axe handle) the minimum requirements shall provide for a 100 mm stormwater grade PVC pipe at a minimum grade of 1%. Such a pipe may only be utilised for a single lot (with only one dwelling roof). Where other stormwater discharge is necessary for an adjoining development, the pipe must be upgraded to the appropriate size (typically 150 mm for two dwellings) or be an independently piped system. Pipes shall have minimum cover of 300 mm where concentrated surface loads are not present. The absolute minimum grade shall be 0.5% and is subject to design to ensure adequate capacity. Where more than one pipe occurs at the property boundary a grated surcharge pit shall be installed within the property and a single pipe in accordance with this manual, provided across the footway.

The interallotment drainage system shall be connected to the street stormwater pit. Subject to hydraulic design, the following pipe sizes may be used as a minimum guide, see Table L-1:

Table L-1: Inter-Allotment Drainage Line Pipe Sizes

NO. OF DWELLINGS SERVED	PIPE DIAMETER
Up to 2	150 mm
3 to 6	225 mm
7 to 10	300 mm

6.4.2. Pits

Pits shall be provided generally to the lowest point of the lot served, and shall be provided for maintenance access, change in pipe direction, grade, or size of pipe and at multiple pipeline junctions. As a guide, pit dimensions may be adopted similar to those shown in SD043, or in accordance with AS 3500.3. Pits within the easement shall be concrete, of minimum size of 450 mm x 450 mm, with a galvanised steel grate. The pit shall be depressed below the surrounding surface by 100 mm (min) to enhance entry flows.

The interallotment pit shall include a capped stub for the dwelling connection.

Interallotment drainage pits and pipes shall be a maximum of 1.2 metres deep to ensure reasonable access and maintenance by lot owners. At retaining wall crossings, the upstream pipes shall be kept up at 1.2 metres deep and the use of a drop pit to cross under the retaining wall/footing shall be kept to a minimum depth and offset to the wall.

A minimum 3 metres long subsoil drain 'lead-in' shall be installed in the inter-allotment drainage (IAD) line at every second pit upstream along the IAD pipeline, as well as at any location where the pipe changes direction. This helps prevent waterlogging, protects the pipe, and increases stability

6.4.3. Easements

When an agreement regarding the stormwater drainage easement is reached, a signed copy of the owner's agreement and an easement plan shall be submitted as evidence of the agreement at the DA stage. The easement shall either be registered prior to the determination of the development consent, otherwise, the affected lot(s) must be included in the application before the DA determination. Following the determination, the easement shall be submitted for registration and registered prior to the issue of any Construction Certificate or Subdivision Certificate in accordance with the development consent, as applicable.

Easements shall be provided over pipe systems and overland flow paths (where necessary). The minimum width of easements shall be the greater of 1.5 metres or $[(1.5 \text{ metres} \times \text{trench depth}) + \text{pipe diameter}]$. Interallotment drainage lines must be located centrally within the easement and are limited to a maximum depth of 1.2 metres. The width of overland flow paths may necessitate a wider easement. For subdivisions with single-dwelling allotments, an easement width of 0.9 metres may be accepted where the pipe can be installed at a shallow depth ($\leq 600 \text{ mm}$) and an existing structure along the proposed easement alignment prevents provision of a greater width.

Where new lots (or development) adjoin existing properties, minor and major flows from those properties shall be catered for with a pit and pipe system and a flowpath system, covered by benefiting easements.

Where an existing drainage line traversing a development site does not have a covering easement, that pipeline shall be covered by an easement registered onto the title of the property prior to issue of any Occupation Certificate or Subdivision Certificate.

6.4.4. Structures and Easement Relationship

Generally, building of a structure over a drainage easement is prohibited due to possible restriction to accessibility. Exceptions may be considered by Council where the structure is relatively light and readily removable, such as a carport or garden shed.

For any concrete slabs over an easement, the slab shall be dowel-jointed on the line of the easement. Segmental pavers are acceptable.

Where an overland flow path exists within an easement, obstructions (such as kerbs, gardens, sheds etc.) and structures are not permitted. Correctly shaped concrete slabs, such as for a driveway, are permitted.

Freeboard

Habitable floor levels adjacent to a flow path or surface detention area shall have a minimum freeboard of 300 mm. Non-habitable floor levels, such as garages, shall have a minimum of 150 mm freeboard.

6.5. On Site Detention (OSD) of Stormwater

On-site stormwater detention shall be provided for all developments. This requirement generally applies in cases where:

- The development exceeds the maximum impervious area requirements,
- The surrounding drainage network is outdated and undersized, or
- Provision has not been made for the development within the public drainage system.

Despite the provisions of this section, development consent may specify different requirements if the site-specific catchment or individual proposal warrants a higher or different standard.

Depending on the nature and scale of the development, on-site detention (OSD) systems can be categorized into (3) three levels for "small-scale" systems, refer to Table L-2:

- Onsite Detention (OSD) with "BASIX" Rainwater Harvesting
- Deemed-To-Comply tables
- Pre-Developed to Post-Developed Calculations

Table L-2: Determining Detention Method to Use

TYPE	DETENTION METHOD	DEVELOPMENT TYPES
Level 0	No OSD requirements	Single dwellings including minor building additions and ancillary structures (e.g. carports, sheds, patios) <u>below the maximum impervious area.</u> Note: Where the maximum impervious area exceeds apply Level 1 OSD.
Level 1	OSD in Basix rainwater Harvesting Tank <i>(Use Level 2 if not using Basix tanks)</i>	Residential buildings less than 1000 m ² in site area Secondary dwellings and dual occupancies
Level 2 Residential	Deemed to Comply Table - Residential (less than or equal to 3000 m ²)	Building construction and subdivision of vacant lots
Level 2 Industrial Business	Deemed to Comply Table - Industrial and Business (less than or equal to 3000 m ²)	Building construction and subdivision of vacant lots
Level 3	Pre-Developed to Post-Developed Calculations	Greater than 3000 m ² – all development types

In support of the implementation of Water Sensitive Urban Design (WSUD), the basic principles of water reuse (retention), "slow" release discharge (detention), and in-ground infiltration of runoff are required and considered part of the WSUD principles for Level 1 and Level 2. Therefore, despite alternative methods of calculation, a drainage design is deemed satisfactory for Level 1 and Level 2 if the guidelines (parameters) are adopted in the drainage system.

Note:

- 1) In-ground infiltration storage is not supported as a solution for detention in clay soils due to the extremely poor infiltration rates of the local soils.
- 2) A sediment sump with a minimum depth of 300 mm shall be installed within the property at the boundary prior to stormwater discharge.

6.5.1. Level 1 - OSD in Basix Rainwater Harvesting Tank (less than 1000 m²)

Level 1 applies to secondary dwelling and dual occupancy developments with a site area of less than 1,000 m² and may apply to single dwelling construction exceeding the maximum impervious area requirements, This does not include the creation of vacant lots.

OSD principles can be satisfied with a minimum detention volume of 2.5 m³ per dwelling. Note: This volume is in addition to the BASIX volume requirements and at least 90% of roof areas must be connected to the rainwater tanks.

The designer should reference the BASIX requirements for the development to ensure that the rainwater tank is adequately sized to provide both water re-use and detention storage.

All roof water runoff (with some exceptions for small patio covers) must be collected, and the tank must be plumbed into the household water supply. A slow-release outlet in the tank at the necessary height must be provided (see SD052).

SD052 provides an option where part of the volume is within a rubble infiltration trench. Sites with clay soils must provide 100% of the volume in the rainwater tank. Only two or three locations in the Maitland LGA, such as some parts of Lorn and Horseshoe Bend, contain sandy river soils suitable for infiltration.

Note: Offset requirements apply to trenches in relation to boundaries, slabs, and structures. For trenches longer than 3 metres, the infiltration trench must be designed based on a site test report from a geotechnical engineer confirming the soil type. The trench must be offset a minimum of 2 metres from boundaries and 3 metres from buildings and structures, unless otherwise specified by the geotechnical engineer. Additional offsets may be required to maintain the adequacy of nearby footings and foundations.

6.5.2. Level 2 - Deemed to Comply Table – Residential (less than or equal to 3000 m²)

Stormwater detention for residential development applies to new developments where an additional dwelling or an existing dwelling creates impervious surfaces beyond those of an average single dwelling and does not comply with Level 1 OSD standards, see Table L-3. This principle also includes the subsequent development of a subdivision from an original "parent" allotment within residential areas, where the density of the nominal parent allotment is increased as a result.

For vacant sites, the development must provide detention as specified in this section. Detention is however not required for existing roof areas that are unchanged. If the footprint is completely redeveloped, the existing footprint will not be credited, and the development must fully comply with the storage requirements.

Rainwater tanks can contribute a maximum of 20% of the total required detention volume. The remaining capacity (a minimum of 80%) must be provided within the centralised detention system. For the rainwater tank detention capacity, the designer should rationalise the detention, apportion the areas of the dwelling, and apply detention on a pro-rata basis. Each dwelling and/or unit must be provided with a rainwater detention tank.

Table L-3: Residential Detention Parameters (less than or equal to 3000 m²)

OSD MINIMUM (PER 1000 M² SITE AREA)	PSD^(A) MAXIMUM (PER 1000 M² SITE AREA)
7 m ³ ^(B)	15 litres/Second

(A) Permissible Site Discharge (PSD).

(B) Apportion volume to each dwelling on a pro rata basis.

For the creation of impervious ground surfaces, up to 50 m² of runoff from impervious areas may discharge from the site without detention. Detention is required where impervious areas exceeding 50 m², such as long driveways and large vehicle-turning areas. The detention must be provided at an

equivalent rate of 1.8 m³ per 100 m², with a peak discharge rate (PSD) of 1.5 Litres/Second per 100 m². This detention calculation must include the total impervious ground-surface area, including the first 50 m².

Also refer to Section 6.8 General Detention Requirements.

6.6. Level 2 – Deemed to Comply Table – Industrial and Business (less than or equal to 3000 m²)

For industrial and business development sites located in areas with major downstream detention facilities, detention is generally not required. However, it should be noted that water quality treatment may still be required.

In areas without public facility detention or where downstream facilities are undersized, Council may require the following parameters, refer to Table L-4:

Table L-4: Industrial and Business Detention Parameters (less than or equal to 3000 m²)

INDUSTRIAL AND BUSINESS DEVELOPMENTS	OSD MINIMUM (PER 1000 M² SITE AREA)	PSD MAXIMUM (PER 1000 M² SITE AREA)
Undersized public detention &/or WQ system Includes: Rutherford Industrial area (bounded by Racecourse Rd, Shipley Dr & Bradmill Ave)	12 m ³	12 Litres/Second
No public detention &/or Water Quality System	19 m ³	9 Litres/Second
Public System adequate but development exceeding the maximum impervious area requirements	Council will determine one of the above scenarios to apply dependant on the exceedance.	

Also refer to Section 6.8 General Detention Requirements.

6.7. Level 3 – Pre-Developed to Post-Developed Calculations – Residential, Industrial and Business (greater than 3000 m²)

For development sites greater than 3,000 m², the following requirements apply:

- Design plans and calculations shall be certified by a suitably experienced civil engineer or other persons with acceptable competency and experience in Hydraulic and Hydrological design.
- Storage volumes shall be calculated in accordance with the principle set out in the current Australian Rainfall and Runoff version. Onsite detention is determined by analysing pre-developed (natural site) and post-developed flows using computer modelling. The post-developed runoff shall be equal or less than the pre-developed flow for all events up to and including the 1% AEP event.

- Calculations shall be submitted to Council.

Also refer to Section 6.8 General Detention Requirements and Section 7 Water Quality

6.8. General Detention Requirements (generally excluding Level 1 Systems)

- Stormwater detention may be provided either as under-ground, surface depression or above-ground storage, or by a combination of any of those methods, providing the site PSD is maintained. In recognition of physical constraints, Council will consider alternative site-specific designs.
- OSD systems shall be calculated for the entire site area and apportioned between the OSD structures based on their contributing surface catchment areas. Development that includes residual sections of land, or staging or similar scenarios, shall consider a system appropriate for the combined area.
- Where development may be subject to future Torrens Title subdivision, each dwelling and/or unit shall be provided with an independent detention system. If shared systems are already provided, strata or community title will need to be utilised, or the system must be removed and replaced with individually systems.
- At locations deemed by Council to be subject to special circumstances due to downstream drainage problems or for other reasons, the above requirements may be altered by Council to suit those circumstances.
- When Council provides drainage plan certification and inspection for construction compliance, a fee, as per Council's Schedule of Fees and Charges will apply.
- Facilities for the retention of gross pollutants and sediment shall be provided in commercial, business, industrial, and residential developments (for residential sites greater than 1000 m²) prior to discharge into the receiving downstream system. Examples include a 300 mm deep sediment sump with a Lysaght RH3030 trash screen installed, a Maximesh screen placed across the outlet, or a proprietary gross pollution trap.
- Industrial developments and large driveway areas shall be provided with hydrocarbon filters or absorbent booms/socks (installed within the pit insert).
- Drainage detention and storage devices shall be designed in accordance with Australian Standard for Plumbing and Drainage AS3500.3 unless otherwise stated within this section.
- All metal components shall be hot dipped galvanised steel (after fabrication), aluminium or stainless steel, and fastened using 10 mm (min) stainless steel fasteners.
- Maximum depth of surface ponding shall be 200 mm in driveways, parking areas and 300 mm (desirable maximum) in accessible landscaped areas. In landscape areas, subsoil drains shall be provided around the outlets to prevent the ground from becoming saturated during prolonged wet weather.
- The volumes of hydraulically independent (with different surface ponding levels) detention areas shall be calculated separately and shall have separate outlet controls.
- The detention area shall be designed such that the major storm event (1% AEP storm) can safely overtop the area with no adverse impacts on the immediate surrounds, buildings, and adjoining properties. An overland flow path must be incorporated in the design.
- Detention outlet design shall assume maximum pressure head. A hydraulic grade line assessment must be based on outlet control operating at the major flood level. The analysis shall also consider potential for backwater pressure from the street drainage system to enter the detention system, in case of connection to Council's underground drainage.
- An orifice plate shall be machined to the required dimensions as calculated and may be made of 3 to 5 mm thick stainless steel with a circular hole of the required diameter, machined to 0.5 mm accuracy. The minimum orifice choke size shall be 25 mm. An orifice outlet with a diameter less than

90 mm shall be screened using a mesh screen. A stainless steel or galvanized mesh screen with a minimum area of 50 times the orifice area shall be latched over the orifice plate. A Maxi Mesh RH3030 or equivalent with the maximum aperture size, and a handle attached to the screen, is recommended. Alternatively, the designer may consider a “staged” pit-controlled discharge providing a tamper-proof orifice such as a buried pipe reducer (see SD052).

- o. Any cellular on-site detention system must include pits at both the entry and exit points to facilitate flushing and maintenance. It can only be used exclusively under grass or landscaped areas. The design must prevent stormwater from bypassing the system, ensuring that water flows in at one end and exits through the other end. A controlled discharge pit (orifice) located at the outlet of the storage system is to be provided. To minimise issues related to identification and ongoing upkeep, the system should be clearly marked on the surface and incorporate features for easy access and maintenance. This type of system is intended for individual lot developments only and is not suitable for subdivision-scale projects or shared systems. Additionally, it must not be located under areas designated for vehicle traffic.
- p. For below ground concrete detention systems:
 - An additional access grate diagonally opposite the outlet shall be provided for ventilation and cleaning purposes. The minimum size of the access grate shall be 600 mm by 900 mm.
 - Where the depth of the tank exceeds 1.2 metres, a ladder and/or step iron in accordance with the requirements of Australian Standards shall be installed.
 - The storage system shall be designed to fill without causing overflow in upstream conduits from backwater effects.
 - A spillway with an overland flow path shall be provided in the event of a storm exceeding the design storm or if the OSD device malfunctions. The path shall be capable of carrying the 1% AEP event, assuming the orifice (outlet) is fully blocked.

6.9. Certifications and Works-As-Executed Drawings

Works-As-Executed drawings (WAE) may be required by the Principal Certifying Authority and/or Council to verify works, particularly for the finished levels and storage volumes. The WAE drawings must be prepared by a suitable qualified surveyor. The following items along with any additional requirements specified by the conditions of consent shall be verified on the WAE plans:

- Finished surface levels.
- The pipe/pit system
- Storage volumes
- Discharge control device(s)
- Overland flowpaths

Where engineering certification is required for the constructed on-site detention system, it shall be prepared and signed by a suitably qualified engineer, typically holding a CPEng qualification.

7. Stormwater Quality and Maintenance

Developments that generate stormwater runoff from areas that may be a source of pollutants shall provide a means of “polishing” off the runoff prior to its discharge from the site. Of particular importance are sealed car-park areas servicing industrial and business complexes. Level 1 and 2 systems for residential developments are deemed to meet water quality requirements if they fully

comply with the specifications in Section 6. Business, Industrial, Commercial and large car park developments must include water quality treatment measures including management of hydrocarbon.

A Water Quality Modelling Assessment (MUSIC) demonstrating water quality reduction results shall be submitted to Council, consistent with Council's Manual of Engineering Standards. Water quality systems must incorporate multiple treatment devices, such as gross pollutant traps, bioretention rain gardens, bioretention swales, and sand filters, as appropriate, to ensure that water entering waterways meets quality standards. The following table shall be used as a target for pollutant retention goals:

Table L-5: Post Construction Stormwater Management Targets

POLLUTANT	RETENTION CRITERIA
Suspended Solids	80% of average annual load
Total Phosphorus	60% of average annual load
Total Nitrogen	45% of average annual load
Gross Pollutants > 5 mm	70% of average annual load
Litter > 50 mm	Retention up to the 4EY (3-month flow)
Oil and Grease	90% of average annual load

Noted that the above requirements are also included in Document D: Design. The retention criteria relate to the "reduction of average annual load" of stormwater pollutants that may be expected from a fully developed catchment or site.

7.1. Maintenance of Devices

The stormwater drainage systems incorporating runoff quality control treatments must be inspected on a regular basis and maintained in working order. A "Stormwater Maintenance Plan" for on-going execution by the owner and/or the operator of the site shall be included in the stormwater design for the site, nominating an inspection, cleaning schedule, and replacing regime for all drainage components. The following items (but not limited to) should be included:

- Pits, with filter materials, silt traps in the base, orifice plates and litter grates, ensuring satisfactory operation.
- Detention tanks, ensuring clean and satisfactory operation.
- Pipes, ensuring clean and free flowing.
- Surface swales and silt-trap basins, ensure mowed and removal of collected silt.
- Open discharge points, ensuring clear of debris and satisfactory scour protection.
- Non-return valves, ensuring satisfactory operation.
- Overland flow paths, ensuring free from obstruction.

7.2. Water Sensitive Urban Design (WSUD)

All developments covered by this manual are required to incorporate Water Sensitive Urban Design (WSUD) principles regarding the treatment and discharge of stormwater runoff. Developments will generally require a combination of treatments to be provided, known as a “treatment train”. Such treatments may include:

- Rainwater Tanks.
- Gross Pollutant Traps (GPT).
- Bio-Retention Beds – Surface vegetated depressed area underlaid by a bio-retention filter layer and subsoil pipe, which do not generally involve flow conveyance but have an overflow to the drainage system. Refer to SD047.
- Infiltration Systems – Note: The majority of the Maitland LGA consists of dense clay soils that are generally unsuitable for infiltration-based volume controls. Limited areas with river silts (e.g. Horseshoe Bend and Lorn) may provide suitable conditions. Where feasible, underground storage within void spaces, combined with a sandy soil media depression, can support infiltration into the surrounding soils. This method does not rely on surface-flow conveyance but must include an overflow connection to the drainage system. A socked subsoil pipe is also required to enable slow release of stored water when infiltration is ineffective due to soil saturation. Council must be consulted prior to design and implementation.
- Wet Basins.
- Dry Basins.
- Vegetated Filter Strips.
- Sand Filters.
- Contour banks/berms.
- Constructed Wetlands.

To achieve an effective WSUD “treatment train”, discharge controls may be selected from a combination of the following measures:

- Drainage system that collects and delivers stormwater from impervious areas to the treatment train, e.g., roof gutters, downpipes, paths, and driveways, etc.
- Pre-treatment system, e.g., leaf guards, first flush device, where leaves and dust may be prevalent.
- Rainwater tank for non-potable reuse including toilet flushing, washing machines and site irrigation.
- On site detention (OSD).
- Rainwater Garden.
- Vegetated Filter Strip.
- Mulching.
- Garden Bed or Contour Bank.
- Turf.
- Underground Infiltration.

Regarding underground infiltration (SD052) the system should:

- Not be trafficked unless specifically designed so.
- Be located such that structural foundations and adjoining properties are not adversely affected.
- Be provided with a subsoil drain relief pipe in clay soils.

7.3. Erosion and Sediment Control (ESC)

Pollutants carried in stormwater runoff from building activities, vehicle parking, manoeuvring, and hardstand areas should be assessed for their potential adverse effects, including sediment movement (due to wind, water, and wheel tracking) and hydrocarbon pollution from vehicles. Appropriate measures must be implemented to contain these pollutants both during construction and as part of long-term permanent treatments. Reference should be made to Landcom Department of Housing guidelines, “Managing Urban Stormwater.”

- Where the area of soil disturbance is less than 2,500 m², an Erosion and Sediment Control Plan (ESCP) must be prepared and submitted in accordance with Council’s requirements as part of the drainage design for the site.
- Where the area of soil disturbance exceeds 2,500 m², a Soil and Water Management Plan (SWMP) must be developed and certified by a suitably qualified and experienced professional in erosion and sediment control. This plan shall identify erosion prevention and detailed sediment control measures.

Appropriate erosion and sediment control measures must be installed and maintained to prevent pollutants from entering watercourses and/or downstream drainage until 70% ground cover is achieved. All development consents shall comply with the Council’s DCP requirements. These requirements do not override any conditions of consent imposed through development applications or other approvals granted under the EP&A Act.

8. Drainage External to Site

Stormwater runoff either entering or leaving the development site must be adequately addressed as part of a drainage design. Adjoining land shall be investigated regarding natural surface flows and any existing piped discharge points. Where discharge of stormwater involves works on a public road reserve (other than that permitted in this manual) such as adjustment of existing pits, new pits, extended pipelines beyond the immediate vicinity of the property, Council approval relevant to Section 138 Roads Act (S138) or S68 Local Government Act (S68) must be obtained prior to commencement of works. Development consent under the EP&A Act does not apply for this purpose when works are outside the development site.

8.1. Discharge from Upstream

Where stormwater discharges onto the development site from adjoining properties that discharge must be catered for. Allowance shall be made for discharge from a fully developed upstream catchment, (consistent with current and proposed zones and the maximum impervious area requirements), with provision made for major and minor storm events. Consider how catchment flows may change between current conditions and potential future development. This should include any extended detention flows, as well as other anticipated changes in flow patterns.

8.2. Discharge to Downstream

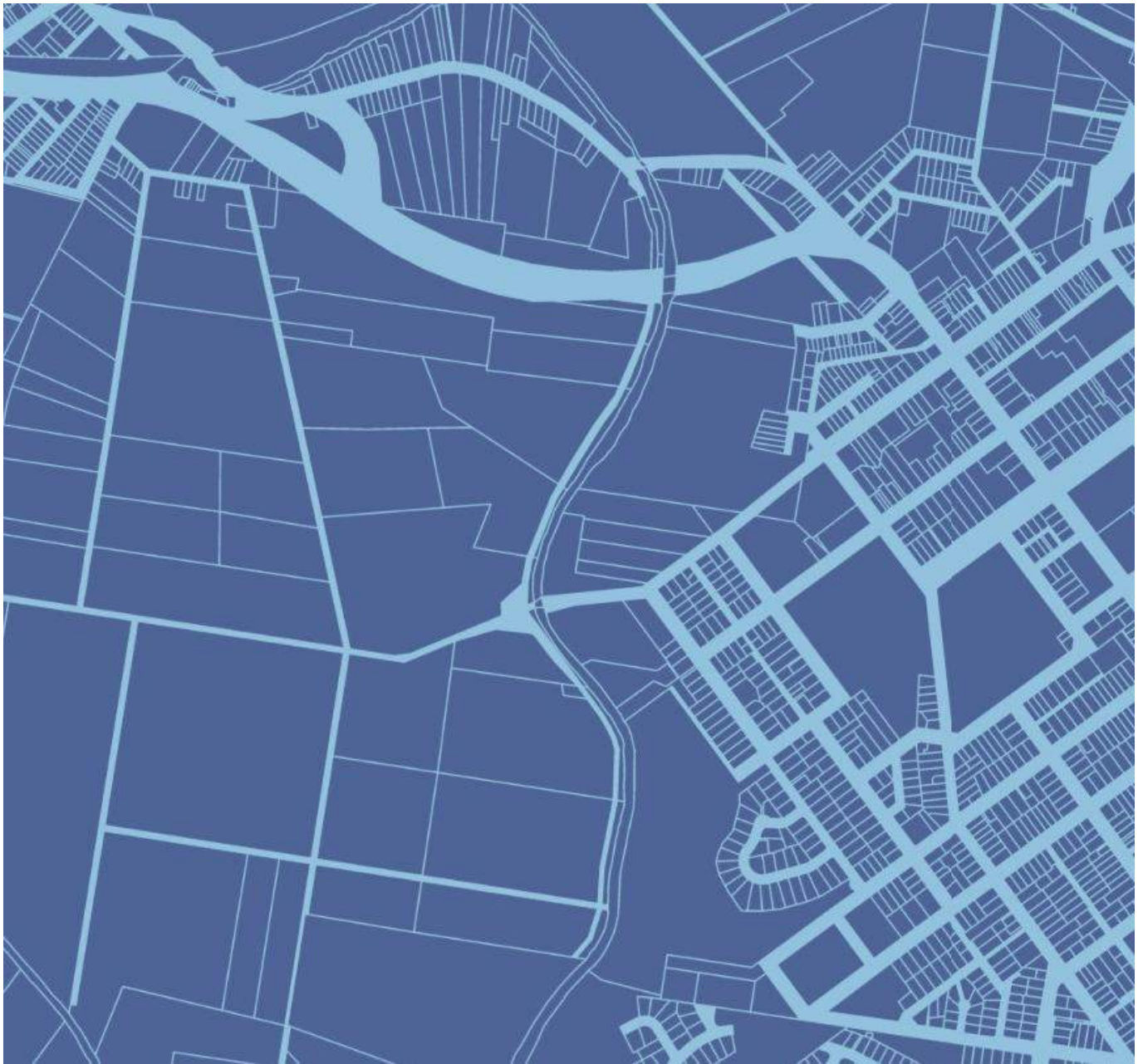
Where stormwater discharges from the development site is at a level that prohibits discharge at the surface, consideration shall be given to the provision of standard underground street drainage to the closest point of discharge, such as an existing pit, pipe, or channel. All pipes entering Council’s existing

pipeds drainage system from private property shall be connected at or with a concrete pit constructed in accordance with Council's Manual of Engineering Standards - Stormwater, or as a "saddle pit" over the existing pipe in accordance with an engineer's design.

Piped discharge shall be (for example, in large-lot and rural development) to a suitable watercourse and shall extend a minimum of 10 metres past a building or building envelope.

8.3. Downstream Drainage Upgrade

The existing downstream drainage system may require investigation for its adequacy to accept stormwater runoff from the development site. Works may be required to provide an up-graded pipe system, being either a new pipe system where none exists, or an open channel to an existing approved discharge point.



MoES - D 2026

Design (Civil)

Manual of Engineering Standards

maitland
CITY COUNCIL

Policy History

VERSION	CLAUSE NO.	DESCRIPTION OF CHANGES	AUTHORISED BY	DATE
1	-	2026 Comprehensive Update	Council Resolution	Date Adopted: 17/03/2026 Implementation: 14/04/2026

Table of Contents

D – Design	1
Introduction	1
1. Geometric Design	1
1.1. Road Hierarchy and Specifications	1
Figure D-1: Road Type and Function.....	4
Table D-1: Trunk Road Network Spacing	4
Figure D-2: Minor and Major Grids	5
Figure D-3: Minor Grid Width to Perimeter Road and Constraint Area (Flood, Bushfire, Riparian, Rural Landscape etc.)	6
Figure D-4: Designing for Emergency Routes.....	6
Figure D-5: Bushfire Cul-De-Sac Concept (See Standard Drawing for Details).....	8
Figure D-6: Off-Line Road Access to Activity Sites (Centres, Businesses and Schools).....	9
Table D-2: Urban Road Types Part A	10
Table D-3: Urban Road Types Part B	11
Table D-4: Large Lot Road Types (Large Lot and Rural)	12
Figure D-7: Road Cross Section (Yield Street, L8).....	14
Figure D-8: Road Cross Section (Local Street, L10).....	15
Figure D-9: Road Cross Section (Local Collector, LT11 & Local Distributor, T12).....	16
Figure D-10: Road Cross Section (Trunk Roads, T14 T15 T15.4)	17
Figure D-11: Road Cross Section (Urban Sub-Arterial, SA13)	18
Figure D-12: Road Cross Section (Council Arterial).....	19
Table D-5: Travel Lane Widths (T = Travel Lane)	20
Table D-6: Parking Lane Widths (P = Parking Lane).....	21
Figure D-13: Special Road Width Circumstances.....	22
Table D-7: Pavement Widths.....	22
Table D-8: Verge Additional Widths	23
Figure D-14: Configurations of Laneway.....	25
Figure D-15: Road Cross Section (Residential Laneway, LR).....	26
Figure D-16: Indicative Laneway Drainage	26
1.2. Footways, Footpaths and Steps	27
1.3. Cycleways and Shared Paths.....	27
Table D-9: Pedestrian and Cycle Paths	27
Figure D-17: Footpath and Share Path for Residential and Commercial Site.....	29
1.4. Horizontal Curves	30
1.5. Longitudinal Grades	31
Table D-10: Longitudinal Grades.....	31

1.6. Vertical Curves	31
1.7. Crossfall and Superelevation	31
1.8. Batters	32
Table D-11: Batter Slopes	32
1.9. Cul-De-Sac, Turning Heads and Kerb Returns	32
Figure D-18: Bushfire Cul-De-Sac and Aerial Sample	33
Table D-12: Nominal Kerb Face Radius (minimum metres)	33
2. Intersection Design	34
2.1. Traffic Signals	35
2.2. Channelised Intersections	35
2.3. Roundabouts	35
2.4. Minor Intersection	36
2.5. Kerb Returns	37
3. Public Transport (Bus)	37
4. Structures	38
4.1. Retaining Walls and Benching	38
5. Ancillary Design Requirements	39
5.1. Safety Audit	39
5.2. Traffic Control Devices (Traffic Committee)	39
5.3. Street Name Signs	40
5.4. Guard Fence and Guideposts	40
5.5. Pavement Edge Restraints	40
5.6. Subdivision Staging and Temporary Turning	40
Figure D-19: Turning Design for Subdivision Staging	41
Figure D-20: Temporary Tuning Heads (Loop, Offset T and Cul-De-Sac)	41
5.7. Driveways and Crossings	42
6. Roads For Large Lot Residential	43
7. Rural Roads	43
7.1. Rural Design Elements	43
8. Pavement Design	44
8.1. Pavement Types	44
8.2. Design Report	44
8.3. Minor Pavement Works	45
8.4. As-Built Records	45
9. Design Traffic Loadings	45
10. Subgrade Evaluation	45
Table D-13: Design CBR	46

11. Subsurface Drainage	47
12. Pavement Design.....	47
12.1. Flexible Pavement	47
Figure D-21: Design Chart for Granular Pavements with Thin Bituminous Surfacing (Austroads Pavement Design Guide)	48
Figure D-22: Design Chart for Granular Pavements with Thin Bituminous Surfacing (Based on a 90 percent confidence level for minor rural roads).	49
12.2. Rigid Pavement (Concrete)	49
12.3. Segmental Block Pavement	50
12.4. Accessways	50
12.5. Roundabouts Pavements.....	50
12.6. Intersection Thresholds	51
12.7. Pavement Joints	51
13. Wearing Course.....	51
14. Existing Pavement Reconstruction.....	51
15. Stormwater Drainage.....	53
16. Design Standards	53
17. Hydrology.....	53
17.1. Rainfall Data.....	53
17.2. Annual Exceedance Probability	54
Table D-14: Minor System	54
Table D-15: Major System	54
17.3. Catchments.....	55
17.4. Fraction Impervious	55
Table D-16: Fraction Impervious Rates for Land Uses	55
17.5. Coefficient of Runoff	56
17.6. Partial Area Effects.....	56
17.7. Rational Method.....	56
17.8. Hydrological Models.....	56
18. Hydraulics	56
18.1. Hydraulic Grade Line.....	56
18.2. Underground Drainage System	57
Table D-17: Piped Conduit Requirements	57
18.3. Trench Stops	58
18.4. Pits	58
Table D-18: Overland Flow Parameters (10% AEP).....	59
Table D-19: Maximum Pit Spacings	59
18.5. Hydraulic Losses.....	60
Table D-20: Pipe Friction Losses	61

19. Overland Flow Paths	61
19.1. Freeboard	61
20. Open Channels.....	62
21. Major Drainage Structures (Bridges and Culverts).....	62
22. Stormwater Volume and Quality Control	62
22.1. Detention Basins and Ponding Structures	63
Table D-21: Basin Embankment	64
22.2. Stormwater Quality	66
Table D-22: Post Construction Stormwater Management Targets	66
22.3. Constructed Wetlands	66
22.4. Swales.....	67
22.5. Bio-Retention Systems	67
22.6. References for WSUD Design	68
22.7. Fencing	69
23. Allotment Drainage	69
Table D-23: Inter-Allotment Drainage Line Pipe Sizes	69
23.2. Pits	70
Table D-24: Inter-Allotment Pit Depth: Size Relationship	70
24. Drainage Easements	70
Table D-25: Piped Drainage Easement Widths (Minimum)	70
25. Stormwater Outlet	71
26. Subsoil Drainage	71
27. Access Restriction to Drainage Structures	72
28. Earthwork and Regrading	72

D – Design

Introduction

The Document D: Design is part of the Manual of Engineering Standards (MoES) suite. It provides essential guidelines for the design of public roads and stormwater systems, ensuring that Council's infrastructure can effectively manage traffic and stormwater challenges while protecting the environment. The document aims to strengthen infrastructure resilience, optimise traffic flow, and uphold environmental standards. It serves as a key reference for engineers, designers, and stakeholders involved in planning, developing, and maintaining both urban and rural environments.

Road Design

This document deals with the requirements for the design of roads, vehicle access, paths and associated structures and embellishments. Details are not necessarily comprehensive for every possible scenario. The designer should refer to, and be competent with, the standards nominated as references. Generally, the primary documents for road design are the Austroads guidelines and Transport for NSW (TfNSW) publications and supplements. The designer should contact Council regarding the relevant scenario to determine whether an item has been intentionally omitted, or, if not, to discuss industry standards and the preferred way forward.

Engineering designs should include geometric details of, road and drainage layouts, their gradients, cross sections, and kerb returns. (See Appendix A for full details). All existing infrastructure, surface features and underground services must be shown on the plans.

All design proposals must be carried out by experienced and competent practitioners.

1. Geometric Design

1.1. Road Hierarchy and Specifications

Roadway infrastructure shall be determined and designed in accordance with, "Development Consent" issued by the consent authority, and the requirements of this Manual.

Widths of roads for residential subdivision are defined by their status within Council's Road hierarchy, which adopts a Trunk Road layout and maximum lot catchments for various road types. The Trunk Road layout incorporates a minor/major grid spacing system. The Trunk Road (grid) layout takes priority over the maximum lot catchment criteria. The following tables "ROAD TYPES" provides details of minimum road parameters. The table relates primarily to "greenfield" sites, generally applicable to large-subdivision release areas. For lot catchment calculations, a potential density shall be used. Unless a higher density is specified in the Local Environmental Plan (LEP) or Development Control Plan (DCP), a minimum of 15 dwellings per hectare shall apply for standard residential (release) areas, such as the R1 zone.

1.1.1. Road Width for Lot Catchment

For the purposes of determining the appropriate road-width for a local lot catchment area, the assessment should be based on an assumed and reasonable traffic distribution analysis of the ultimate development and the contributing lots, along desire-lines to points of destination such as for recreation, schools, shops, workplace, sports, open space, employment zones, etc. Site specific DCP's may already define some of the trunk road layout in terms of desire lines and destinations.

This approach may vary, potentially resulting in higher hierarchy levels when the Trunk Road layout requires it:

- Staged development may significantly increase traffic flow during the interim period, affecting the safety and amenity of the area.
- A new public roadway may serve a broader function than just the immediate local residential area. This can occur when development consent applies to only part of a larger integrated area, with roads connecting other population centres, public transport routes, commercial or school precincts, recreation facilities, or other major traffic-generating destinations.
- There may be potential to use a road as a “bypass” to relieve traffic constraints on another road, such as congestion or traffic signals. In these cases, careful planning is required to avoid unintended impacts.

1.1.2. Consistent Road Width

Where lot catchment numbers trigger more than one road type within a defined length of road/street, unless justified, the higher road type shall be adopted. Opportunities where road width may be varied may be at intersections, traffic management device, curving horizontal alignment, or similar.

1.1.3. Impacts on Existing Roads

Where a new subdivision impacts on the existing local road network and roadworks such as pavement widening or rehabilitation are required, the road alignment and pavement needs shall be determined by Council independently of the following Road Type table considering traffic volume and type, the needs and amenity of the existing road network, and an appropriate service to the community. Road widths greater than those shown in the ‘table’, may be required.

Where works are required as part of the development to augment an arterial or classified road, Council shall determine independently of this Manual the needs for that road.

[Refer also to Local Area Precinct plans for possible specific parameters for road needs.]

1.1.4. Part-width Road Construction

Council’s primary requirement is for full width road construction. Due to the risk posed by these variable road widths and construction, construction of part width streets as part of subdivisional developments is not encouraged. Subdivision design should avoid setting up this scenario against neighbouring properties. Trunk Roads should not be considered for part road construction.

Nominal “part-width construction” of roads may only be considered for subdivision servicing up to 10 lots or 150 metres in length unless justified otherwise, (with adequate traffic safety and convenience measures), to facilitate shared construction costs across property boundaries which share a common and existing road reserve, the subject in each case of separate development consents. Such part-width roads are considered an interim treatment to facilitate subdivision.

Part-width roads may be permitted along a property boundary, and generally parallel to that boundary, and adjoining undeveloped land not part of the subdivision which also has subdivision potential under a planning scheme.

Part-width roads are generally considered where the proposed road utilises an existing adjoining public road reserve (whether that road is unformed or formed in-part only) and where undeveloped land not part of the subdivision also adjoins the opposite side of that road, and which has subdivision potential under a planning scheme.

The proposed part-width road must provide adequate safety for two-way traffic movement [one-way traffic movement may also be considered as an interim treatment].

The width of these road pavements may extend beyond the road centreline and should be a minimum of 6.0 metres wide for two-way traffic on local yield street, plus any additional width requirements for parking lane or bike lane depending on the relevant road type. The overall construction width may be greater than the pavement width, subject to assessment of constraints such as kerb type (rolled type preferred), common boundary fencing type, pavement restraint or shoulder support, subsoil drainage, surface drainage, etc.

Where part-width construction is permitted within an existing road reserve (for roads with a catchment greater than 10 lots/150 metres maximum road length), the design must, at a minimum, provide a parking lane adjacent to the property and two-way traffic lanes, including a 0.5 metres wide sealed shoulder. A full-sized temporary turning area is generally required for brownfield road reserves. New greenfield roads shall avoid the need for temporary turning areas.

The applicant is responsible for covering all costs associated with the design of the full street width and the construction of the partial road width. The design transition shall extend at least 100 metres beyond the end of construction to ensure future continuity. Pavement design must also provide a 1:5 taper between the partial road width and the adjoining construction, including drainage design and any necessary utility adjustment or relocation.

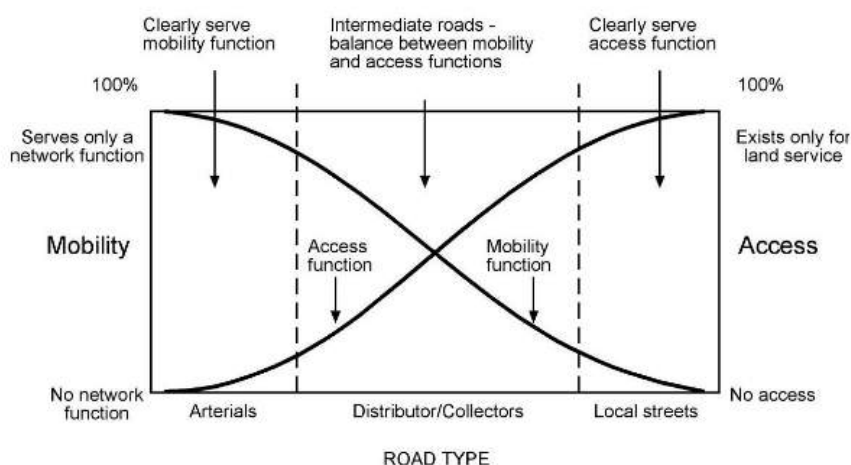
In all cases of part-width construction, “No Stopping” zones are necessary considerations and will need to be addressed in the Local Traffic committee process.

1.1.5. Crown Roads

Where Crown Roads are intended to be developed as part of a subdivision, such roads shall be constructed in accordance with this Manual and subsequently dedicated to Council (subject to relevant legislation and/or the Minister’s concurrence) as public road on the Subdivision Certificate.

1.1.6. Road Function

The objective of Council’s road hierarchy is to provide a network that balances the functions of different types of roads and streets. Austroads and NSW Movement and Place outline the concepts and principles for this. In general, streets are prioritised for quiet, local access, while roads focus on efficiently moving people to their destinations. All road and street designs should consider these frameworks when establishing the network and hierarchy (see Figure D-1).



(b) Road type and function – mobility vs. access

Source: Brindle (1987).

Figure D-1: Road Type and Function

1.1.7. Trunk Road Framework and Spacing

The road network shall use a grid and or radial Trunk Road framework with the Major/Minor grid spacing as per Table D-1, Figure D-2 and Figure D-3 below. Roads and Streets with two dedicated travel lanes shall be connected to other two-lane roads at the intervals specified in the minor/major grids.

Table D-1: Trunk Road Network Spacing

ROAD TYPE	SPACING TO SAME ROAD TYPE (M)	SPACING OF INTERSECTIONS FROM LOCAL NETWORK ONTO THIS NETWORK (TYPICALLY, RESIDENTIAL AREAS)
Arterial Road	1.0 km to 2.0 km apart (Typically parallel, not grid)	Between 300-500 m Centres consider tighter spacing
Sub-Arterial Road	0.8 km to 1.6 km apart (Parallel or grid)	Between 200-300 m
Major Grid - Trunk Roads	800 m x 800 m maximum spacing and grid Generally, 600 m x 500 m considering natural constraints (topography/drainage/habitat)	Street block spacing as per DCP Intersection staggers as per MoES Intersection criteria as per Austroads/TfNSW Also provide public bus network that is adaptable and offers alternatives

		in the event of disruptions or other unforeseen circumstances
Minor Grid - Local Trunk Roads	<u>Infill of major grid</u> 300 m min to 500 m max (400 m $\pm$ 100 m). <u>For perimeter edge</u> 400 m max walking depth to bus routes and for width keep 300 m min to 500 m max (See Figure below)	Street block spacing as per DCP Intersection staggers as per MoES Intersection criteria as per Austroads/TfNSW/Bushfire

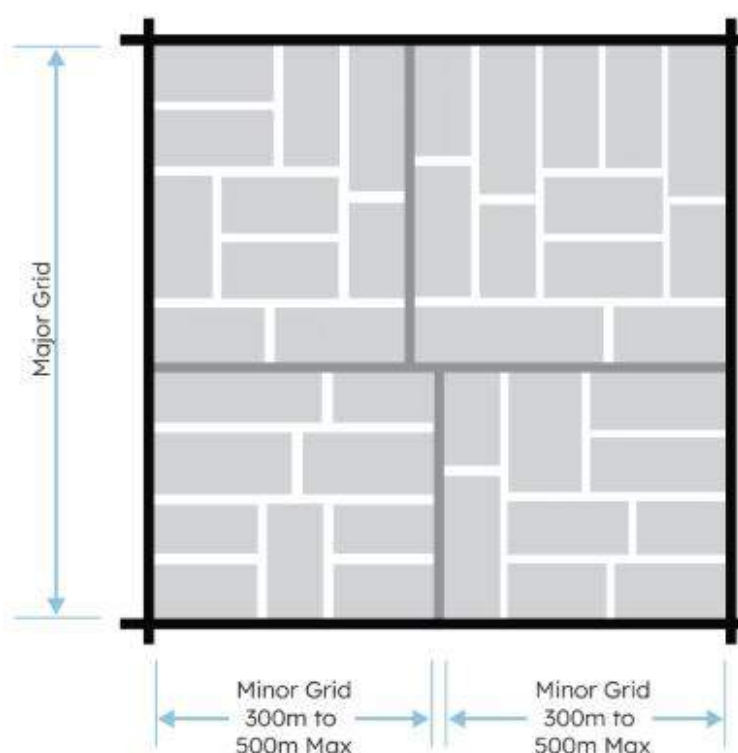


Figure D-2: Minor and Major Grids

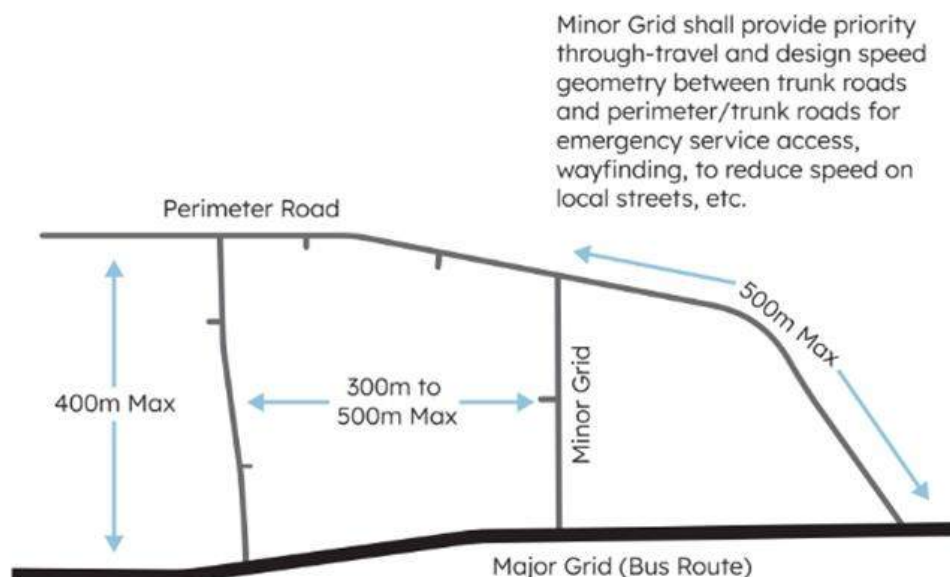


Figure D-3: Minor Grid Width to Perimeter Road and Constraint Area (Flood, Bushfire, Riparian, Rural Landscape etc.)

1.1.8. Designing for Emergency Routes and Bushfire

Designing for Emergency Routes

Both local streets and trunk roads must provide layouts that provide safe and efficient routes between the hazard and the escape routes. Hazards include bushfire and flooding. Current documents endorsed by the emergency services shall be adhered to. Escape from flood will consider flood event greater than the 1% AEP, as floods can vary in magnitude. The Figure below is example from DESIGNING SAFER SUBDIVISIONS - Guidance On Subdivision Design In Flood Prone Areas (SES website). These and other principles in the document are equally relevant to all hazard types.

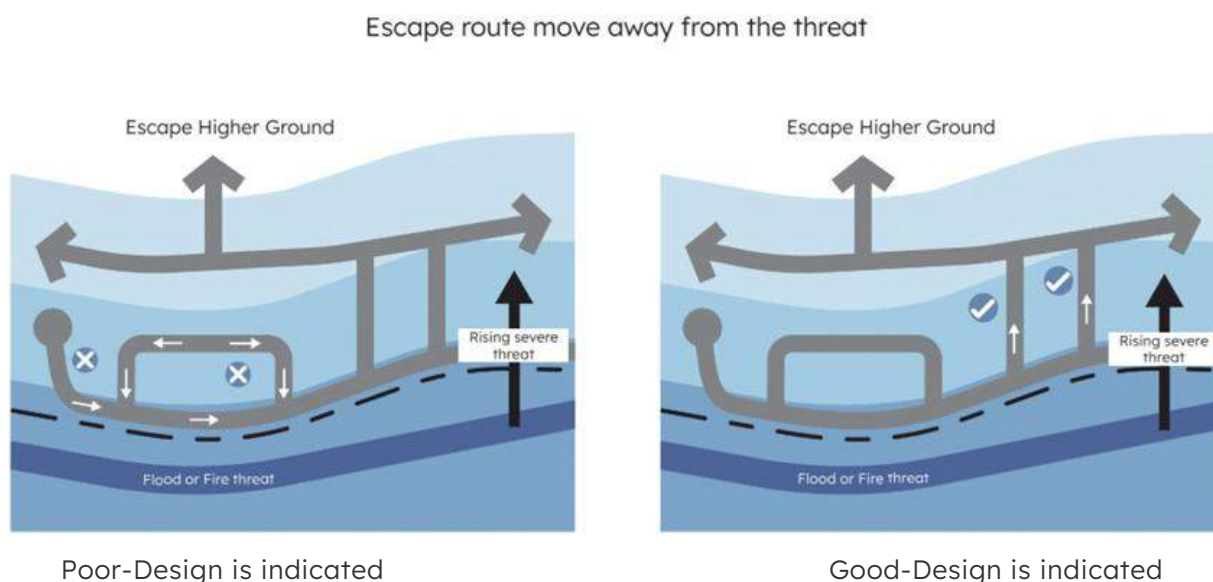


Figure D-4: Designing for Emergency Routes

Designing for Bushfire Hazards

Consideration in the design shall have regard to "Planning for Bushfire Protection (PBP)" requirements. When developing the bushfire report and preliminary engineering plans, the following information provides guidance on how Council interprets MoES and any General Terms of Approval (GTAs) when assessing proposed or existing public infrastructure (e.g., roads, drainage reserves, etc.). With the submission of a bushfire report and bushfire assessment, Council will require the following:

- **Road Type Identification:** To avoid ambiguity, the bushfire consultant's report must clearly identify each road type (e.g., perimeter, non-perimeter, property access roads, trunk roads, and any roads not fitting these categories). The road types must be labelled in both the report and accompanying diagrams. The report and diagrams shall also show the location of any parking restrictions, noting that Council's requirements for on-street parking adjacent to residential lots must be met.
- **Asset Protection Zones (APZs):** APZs and other bushfire restrictions are not permitted on drainage reserves, parks, or recreational lands dedicated to Council. These public areas shall be landscaped as part of the development and maintained in the future to meet urban heat canopy requirements and provide community amenity.
- **APZs on Roads:** APZs may be permitted on roads at Council's discretion, provided verge landscaping complies with APZ requirements. Additional verge width to achieve APZ will not be supported on the outside of perimeter roads. However, minimal increases in width along lot frontages may be considered. Concrete paths shall be located in the outer verge so that standard path maintenance also satisfies RFS GTA requirements, without creating additional maintenance obligations for Council.
- **Fire Source Considerations:** Drainage reserves and corridors (channels, basins, etc.) and riparian corridors are to be treated as fuel sources. Fuel loading is to align with the accepted RFS values for the vegetation type, unless a management regime is conditioned to maintain reduced fuel loads. These considerations are to be included in the bushfire assessment. Council will not support proposals that are impractical. For riparian corridors, Council may adopt a higher fuel loading than that specified by the Office of Water where supplementary planting is proposed, such as to achieve Urban Heat Canopy outcomes.
- **Parking Lane Requirement:** Council's road hierarchy provides for on-road parking on all roads, particularly adjacent to residential lot frontages. Although on-road parking is generally removed from the outside of perimeter roads, blistered parking may be provided where justified. The carriageway widths specified by PBP relate to the unrestricted travel corridor. As the Road Authority, Council sets the requirements for on-street parking, which are additional to the RFS minimum travel corridor width unless a performance solution has been agreed to in writing by both the RFS and Council. Utility services (water, gas, electricity) shall be located outside of the carriageway and parking areas, in accordance with PBP requirements.
- **Road ownership and Accountability:** Council is the ultimate asset owner of a road reserve and may reject a concept that NSW RFS finds acceptable if it is not also in the public interest. The design proposal must satisfy the requirements of both the RFS and Council.
- **Cul-de-Sac Parking Concept:** The RFS and Council prefer looped road connections and the elimination of dead ends, including cul-de-sacs. Where cul-de-sacs are unavoidable, the length should be minimised, and on-street parking must be provided adjacent to residential lots, on the outside of the clear turning radius/area required by PBP. Alternatively, and to be discussed with RFS early in the design process, on-street parking may be located in the centre of the cul-de-sac head, as illustrated in Figure D-5. Where this option is proposed, it must allow one-way circulation with the minimum width complying with the 'NSW Fire Safety Guidelines – Access for fire brigade vehicles and firefighters.' In such cases, parking may be excluded from the outer road pavement adjacent to properties.

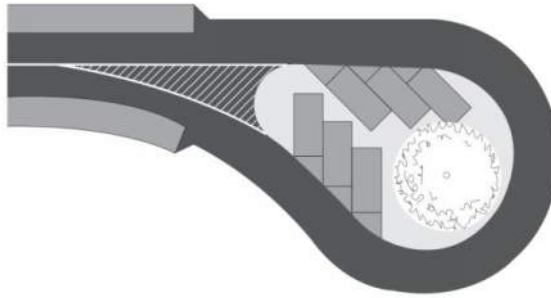


Figure D-5: Bushfire Cul-De-Sac Concept (See Standard Drawing for Details)

Subdivision Staging and Bushfire Report Considerations: The subdivision staging plan and bushfire report shall consider the following:

- How temporary APZs will be provided during staged development and who is responsible for maintenance.
- How turning heads, compliant with PBP requirements, will be achieved during staged development and be available throughout the construction phase of subsequent stages.

Note: Staging layouts with looping roads instead of dead-ends are strongly encouraged.

- When two points of access are required as part of the bushfire report and/or GTAs, the staged release should clearly outline when these access points will be constructed. Access and APZs should be in place before construction occurs unless otherwise conditioned.

Local Area traffic Management (LATM) Devices: Traffic calming devices are to be considered for perimeter roads to discourage speeding at intersections and as required by Council.

- Council will nominate the types of LATM device to be used. The modified intersection and mid-block island are pre-approved. At modified intersections, the main travel direction shall be clearly shown. A V-drain should be used to mark the give-way leg when the straight-through path does not have priority.
- All LATM devices shall meet Council's requirements and the NSW Access for Fire Brigade Vehicles and Firefighters document.
- Any traffic control devices that have integrated kerbs to slow traffic (e.g. speed hump, chicane slow point, small roundabout) are to have low profile mountable kerbing to allow easy negotiation by a fire appliance.

1.1.9. Positioning of Non-Residential Uses

Commercial activity, centres and other focal point land uses like schools, community and sports facilities need to be well-located to be prominent, highly accessible, and yet not obstructive to the adjoining trunk road networks. Placing these types of development adjacent to but off-line to the higher order trunk road network needs to be carefully considered. These developments should be located close to trunk roads with frequent public transport and a flexible road layout that can adapt as the site and surrounding area develop. They are best positioned next to, and visible from, higher-order trunk roads and major roads to attract passing trade.

These sites would generally be indicated the spatial positioned during strategic planning processes. It is required to locate the vehicle access points off a lower order road with lower traffic volumes consider safety conditions for pedestrians, bikes and public transport. The figure below shows indicative off-line scenarios. Larger activity centres that collocate commercial, community, recreation,

schools and the like may need to use an adjacent precinct that clusters off-line but against the sub-arterial and trunk road network. In all scenarios, the consideration to access via to other non-vehicle modes needs to be highly considered in order to deliver pedestrian priority, followed by cycling, public transport and finally motor vehicles.

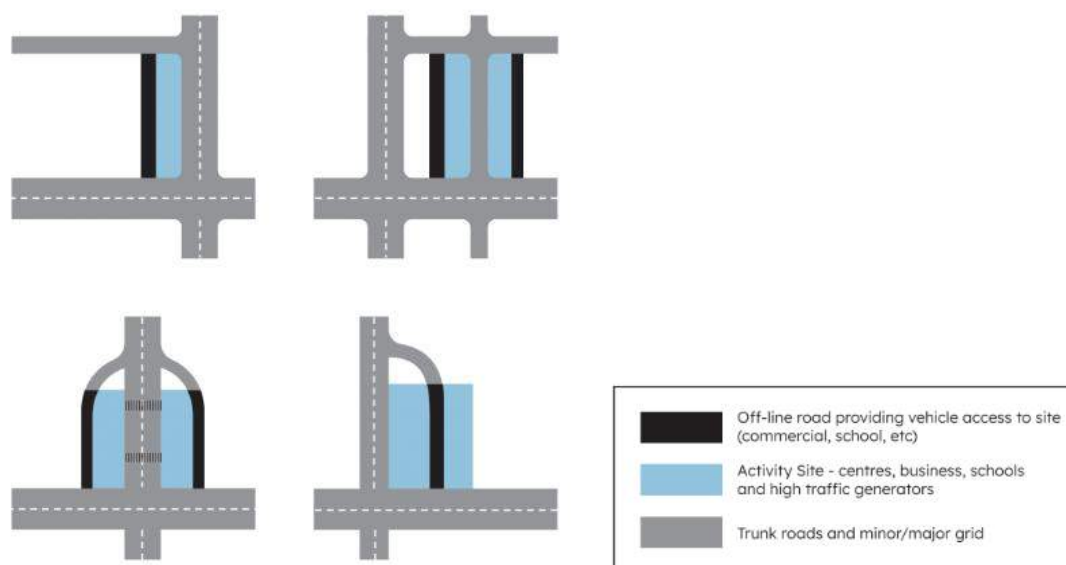


Figure D-6: Off-Line Road Access to Activity Sites (Centres, Businesses and Schools)

1.1.10. Road Types and Dimensions

Details of road types, including their dimensions, widths, contextual considerations, and cross-sections are outlined in Tables D-2 to D-4 and illustrated further in Figures D-7 to D-12.

Table D-2: Urban Road Types Part A

CATEGORY	LOCAL STREETS - RESIDENTIAL		TRUNK RD - MINOR	TRUNK ROADS – MAJOR, ALL ZONES			
Street Types	Yield Street ^(a)	Local Street ^(a)	Local Collector ^{(a)(b)}	Local Distributor	Secondary Distributor	Primary Distributor ^(c)	Minor Sub-Arterial
Abbreviation	L8	L10	LT11	T12	T14	T15	T15.4
APPLICATION							
Context	10-12 Dw/Ha	15+ Dw/Ha	Local Trunk Road	Trunk Rd	Major Trunk Rd	Major Trunk Rd	Major Trunk
Typical Lot No. [or VPD]	<200	<300	<300	<300	<400	<500	<6000 vpd
Network Layout	<700 m Travel Dist	<700 m Travel Dist	Minor Grid	Major Grid	Major Grid	Major Grid	See D1.1.7
Driveway Access	Front Loaded	Front or Rear	Front or Rear	Front or Rear	Front or Rear	Front or Rear	Front or Rear
ROAD WIDTHS MINIMUM (metres)							
Pavement ^(d)	8	10	11	12	14	15	15.4
Rd Reserve ^(e)	17	19	20	22	25	26	26.4
Travel Lane	4 Yield Passing	3	3	3.5	3.5	3.5	3.5
On-Road Cycle Lane	Mixed Travel	Mixed Travel	Mixed Parking	Mixed Parking	1 ^(f)	1.5 ^{(f)(g)}	1.7 ^{(f)(g)}
Parking Lane	2	2	2.5	2.5	2.5	2.5	2.5
Verge ^{(h)(i)(j)}	4.5	4.5	4.5 & 5.5	4.5 & 5.5	5.5	5.5	5.5
Verge Paths ^(k)	1x1.5 ^(l)	1x1.5 (2x1.5 for density)	1x1.5 or 1x2.5 ^(l)	1.5 or 2.5 ^(l) (add 1.5 for density)	1.5 & 2.5	1.5 & 2.5	1.5 & 2.5
Pedestrian Refuge & blisters ^(b)	No	No	No	Only Kerb Blisters	Yes max 400 m spacing	Yes max 400 m spacing	Yes 200-300 m spacing
ROAD FEATURES up to 15Dw/Ha							
Design ESA's ^(m)	*1x10 ⁶	*1x10 ⁶	1.5x10 ⁶	2x10 ⁶	4x10 ⁶	5x10 ⁶	1x10 ⁷
<i>(*) 5x10⁵ for lot clusters less than 100 lots</i>				<i>(Roundabout add 0.5 ESA)</i>			
kerb Type ⁽ⁿ⁾	Roll	Roll	Upright	Upright	Upright	Upright	Upright
Kerb Return	8	8	8	8	8	8	8
Intersection Blisters	N/A	Optional	Yes	Yes	Yes	Yes	Yes
Line Marking ^(o)	No	No	Intersection ^(c)	Yes, CL ^(p)	Yes	Yes	Yes
Bus Route ^(q)	No	No	Not Public Route ^(o)	Yes	Yes	Yes	Yes
Design Vehicle	B85 Car	B85 Car	B85 Car	12.5 m Bus	12.5 m Bus	12.5 m Bus	12.5 m Bus
Check Vehicle	8.8 m	8.8 m	8.8 m	12.5 m	12.5 m	19 m	19 m
Posted Speed	30-50	30-50	40-50	40-50	50	50	50

See Note section for additional information.

Table D-3: Urban Road Types Part B

CATEGORY						
Street Types	Sub-Arterial - Urban	Sub-Arterial Rural ^(r)	Arterial (Council)	Business/School Precinct	Industrial (min)	Laneway Residential
Road Abbreviation	SA13				I13	LR
APPLICATION	Urban	Rural	Rural	Business/Schl		
Context	Major Trunk Urban	Major Trunk	Major Trunk Network	Precinct Specific	Industrial	Not with L8
Typical Lot No. (or VPD)	<30,000 vpd	<30,000 vpd	>20,000 vpd	N/A	Also Use Trunk Roads	See D1.1.17
Network Layout/Spacing	See D1.1.7	Rural Context	See D1.1.7	N/A & Precinct Specific	Use Minor/ Major Grid	See D1.1.17
Driveway Access	Access Denied	Consider Context	Consider Context	Front or Rear Loaded	Front-Loaded	Rear Loaded
ROAD WIDTHS MINIMUM (metres)						
Carriageway ^(d)	13	TBD	TBD	15.4 - <i>or SA13 & Active Verge</i>	13	5.5 Concrete
Road Reserve ^(e)	27.6 min	TBD ≈ 27+	TBD ≈ 32+	16.4 - 32.4	23	8.5
Travel Lane Width	3.5 m 2-4 Lanes	3.5 m 2-4 Lanes	3.5 m 2-4 Lanes	3.5 m	3.5 m	5.5 m
On-Road Cycle Lane	in verge	Separated Cycle	Separated Cycle	1.7	Mixed Parking	N/A
Parking lane	3 incl Buffer	Rd Shoulders	Rd Shoulders	2.5	3	No
Verge ^{(h)(i)(j)}	8.3 & 6.3	TBD/Context	TBD/Context	5.5 School 5.5 - 8.5 Business	4.5 & 5.5 (min)	1.5
Verge Paths	4.5 & 2.5	TBD on Context	TBD on Context	Full Width or as directed ^(s)	2.5 min	N/A
Pedestrian refuge ^(b)	Yes	N/A	N/A	Yes	Yes for bus routes	N/A
ROAD FEATURES						
Design ESA's ^(m)	1x10 ⁷ (3500 lots)	TBD on ESA's	TBD on ESA's	1x10 ⁷	1x10 ⁷	1x10 ⁵
	<i>(Roundabout add 0.5 ESA)</i>					
kerb Type ⁽ⁿ⁾	upright	Usually N/A	usually N/A	upright	upright	No Kerb
Kerb return Radius	Design Vehicle Swept Path			TBD	12 (min)	N/A
Intersection Blisters	Yes	N/A	N/A	N/A	N/A	N/A
Linemarking ^(o)	Yes	Yes	Yes	Yes	Yes Partial	N/A
Bus route ^(q)	Yes	Yes	Yes	Yes	Yes	No
Design Vehicle	12.5 m	19 m	19 m	12.5 m	19 m semi	B85 Car
Check Vehicle	19 m	25 m B-Double	25 m B-double	19 m	25 m B-Double	12.5 m
Posted Speed (km/h)	50-60	70+	70+	40-50	40-50	10-50

See Note section for additional information.

Table D-4: Large Lot Road Types (Large Lot and Rural)

CATEGORY						
Street Types	Local Large lot ^(†)	Collector Large Lot	Rural - local only	Rural	Rural	Rural
APPLICATION						
Context	Max Lot Area.		AADT (2 way)			
	<5000 m²		<500	<1000	<3000	>3000
Design speed	50 km/h – higher speeds consider Austroads and safety of lane/shoulder/etc					
ROAD WIDTHS MINIMUM (metres) - consider space for drainage, utilities and pedestrian and cycle paths						
carriageway width ^{(d)(u)}	8	9	9	10	11	12
Road Reserve ^{(e)(v)}	19	20	20	20	20	21
travel lane width	N/A	N/A	6	7	7	7
On-road cycle ^(k)	Mixed	Mixed	Shoulders do not include provision for cycle, or guardrail. Consult Austroads			
Total Shoulder Austroads AGRD3	NA	NA	1.5	1.5	2	2.5
Minimum Shoulder seal ^(d)	N/A	N/A	0.5	0.5	1	1.5
ROAD FEATURES						
Design ESA's ^(m)	Use ESA's based on Table A function and lots/AADT conversion					
Kerb ⁽ⁿ⁾	Roll	Roll <5000 Optional at 5000	Intersection returns as needed			
Linemarking	at intersection	Centreline	Yes	Yes	Yes	Yes
Bus Route/heavy vehicles	No	Yes	No	Yes	Yes	Yes

See Note section for additional information.

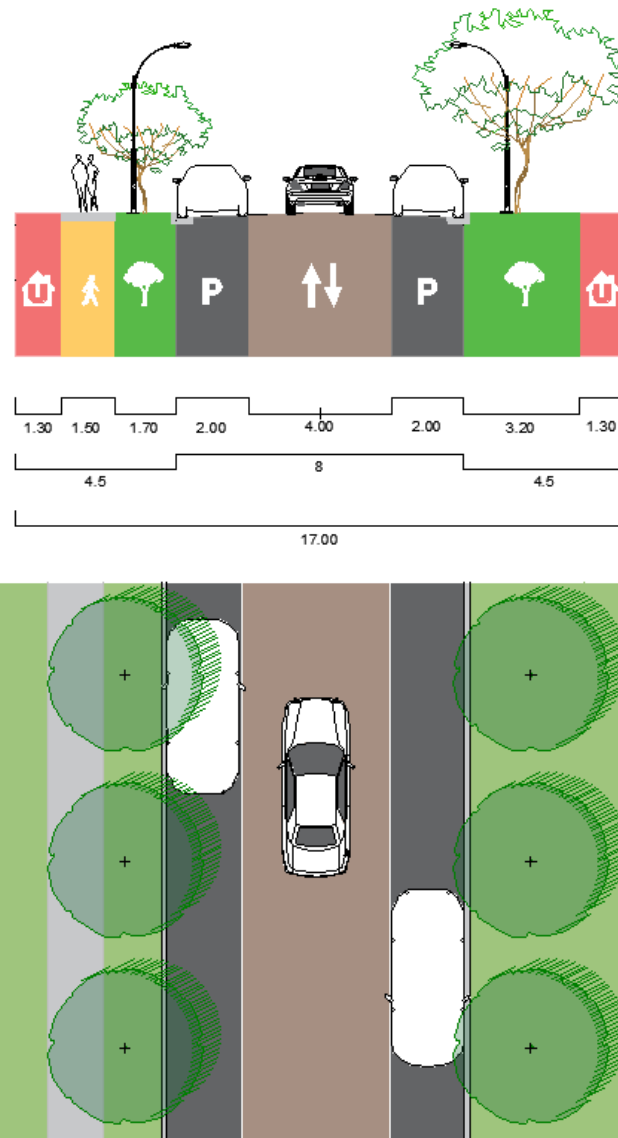
Notes: Road Types A to C

- a) Normally classified as “50 km/hr roads” servicing the local subdivision only; not through-roads connecting remote areas.
- b) For roads greater than 300 lots consideration should be given to safe street crossing points (pedestrian refuges etc) and aligned at 400 metres max spacing (i.e. at bus stop locations.).
- c) Line marking at Intersections for 10 metres – 15 metres.
- d) Additional width in accordance with this manual, Austroads or TfNSW standards may be necessary where on road cycle lanes, or greater component widths are required. For a rolled kerb profile, the nominal face of kerb shall be 150 mm from the back of kerb.
- e) Reserve width shall be increased where footway verges are greater than the minimum listed.
- f) Bike width is contingent on a 3.5 metres vehicle travel lane.
- g) Council may require a dedicated bicycle path fully separated from the road pavement.

- h) See Section 1.1.15 for verge additional widths. The verge may be reduced to 2.0 metres for roads up to and including Collector status where there is an adjacent public reserve and utilities are addressed. The verge shall be increased to 5.5+ metres where shared paths are required. Verge widths will be increased where necessary to accommodate public utility services.
- i) Formation width includes the whole road pavement as a full-width bitumen seal.
- j) Where the route is planned to carry large numbers of trucks, the bike travel lane shall be widened to Austroads Pt 3 Section 4.2 or change road type to Sub-Arterial -Major.
- k) To a maximum of 300 lots, otherwise bicycle lanes or paths must be considered.
- l) Where a path is upgraded to a wider path, an extra 1.5 metres path is not needed for local low-density streets.
- m) Minimum Equivalent Standard Axles up to nominated maximum number of lots using minimum 15 dwellings per hectare. Use Higher densities if planning schemes or the development proposal exceed 15Dw/ha. Parameters do not include bus access to Local Streets.
- n) Edge restraints are required for AC wearing surfaces. Concrete edge beams may be permitted.
- o) Additional line-marking to than listed may be required for delineation, safety. Consider other road users such as bicycles and pedestrians.
- p) Line marking at (CL) Centreline for full length, extra as needed for refuges & other.
- q) Bus routes refer to public bus route. For school bus route in residential areas should be confined to 11 metres or greater width roads (excludes the school/facility itself). 11 metres also for intermittent bus like sports ovals.
- r) Sub-Arterial - Road connecting Arterial Roads to urban districts and carrying traffic directly from one district or precinct to another. See Austroads Pt 2. Arterial Roads are defined separately to this Manual where location and design parameters are determined by Council. 'Classified' Highways, Regional and State Roads are typically Arterial Roads.
- s) Full verge concrete paving shall be provided where pedestrian traffic is concentrated, unless otherwise advised by Council.
- t) Not through-roads connecting areas remote from the subdivision.
- u) Formation width includes the whole road pavement as a full-width bitumen seal.
- v) Provide a 2.0 metres width of grassed footpath profile within footway verge.

ROAD CROSS SECTION – INDICATIVE TYPOLOGY

ROAD NAME: L8 – YIELD STREET



Overview

L8 is quiet, low-density residential street designed for slow traffic. Parking is kept to a low level, and drivers are expected to give way to each other by using the 10 metres parking gaps provided. Vehicle turning movements into individual driveways may be constrained, as swept paths can be compromised.

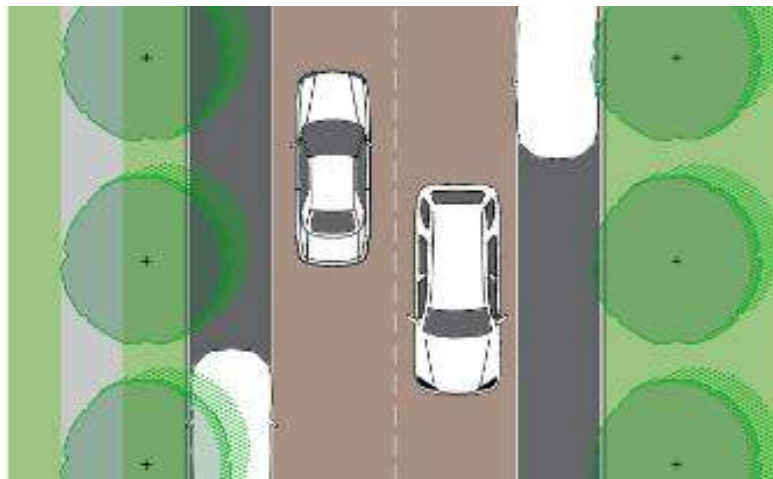
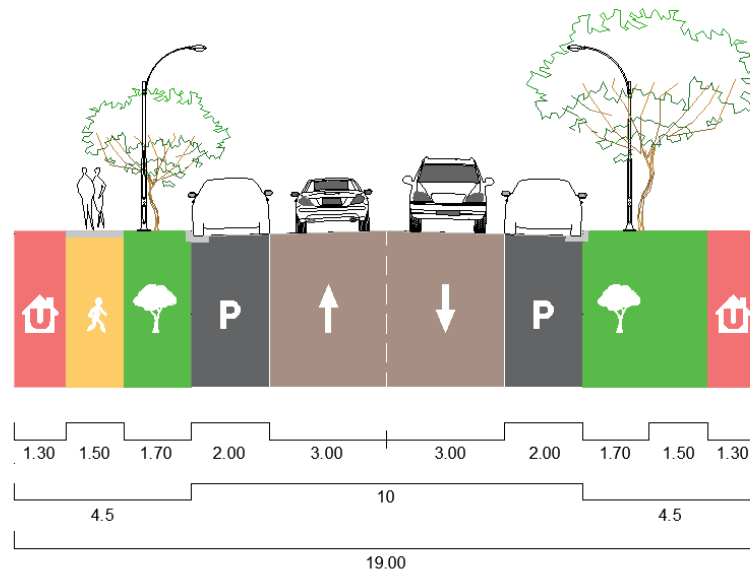
Features

- Footpath on one side in low-density areas
- Connects to minor and major trunk grids
- Single lane supports two-way travel
- High permeability modified grid with short block lengths

Figure D-7: Road Cross Section (Yield Street, L8)

ROAD CROSS SECTION – INDICATIVE TYPOLOGY

ROAD NAME: L10 – LOCAL STREET



Overview

L10 streets are local roads designed for low-speed environments where two travel lanes are required. They also serve as non-perimeter local roads for bushfire access across all densities and are commonly applied in medium and high-density residential areas.

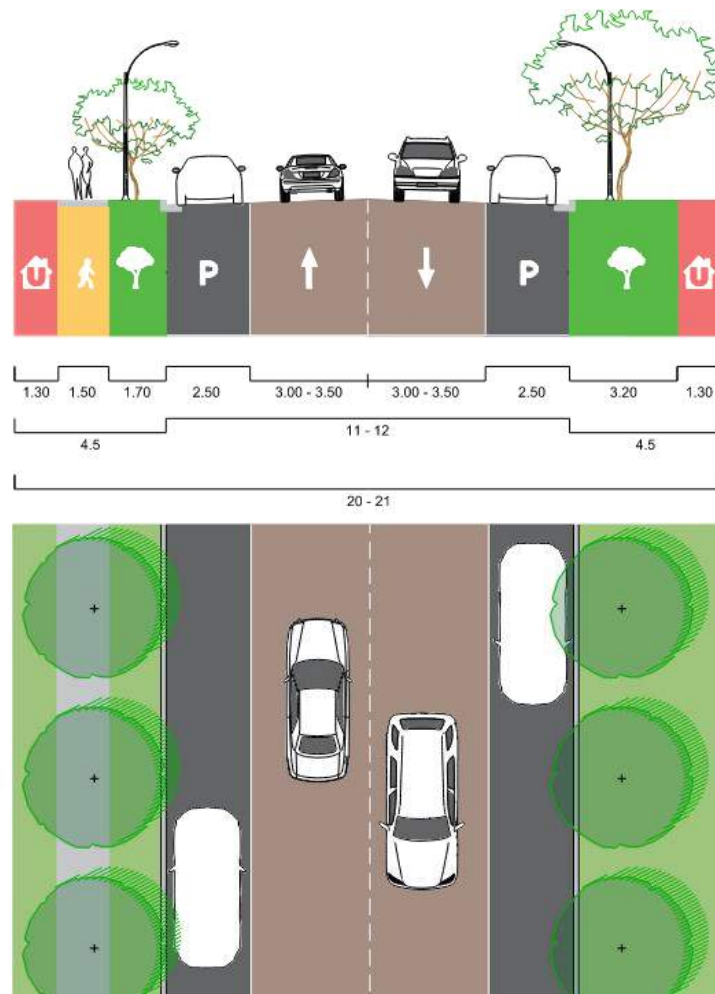
Features

- Footpath on one side in low density
- Footpaths on both sides considered in medium and high-density
- Connects to minor and major trunk grids
- Two travel lanes improve swept paths into individual driveways

Figure D-8: Road Cross Section (Local Street, L10)

ROAD CROSS SECTION – INDICATIVE TYPOLOGY

ROAD NAME: LT11 – LOCAL TRUNK COLLECTOR & T12 – LOCAL DISTRIBUTOR



Overview

LT11 and T12 are the smallest trunk roads. LT11 functions as a collector, linking local streets to bus and trunk routes. It also serves as a two-lane connector between perimeter roads, forming part of the minor grid. These roads support wayfinding and legibility, while direct routing helps reduce speeding and travel times on adjoining local streets.

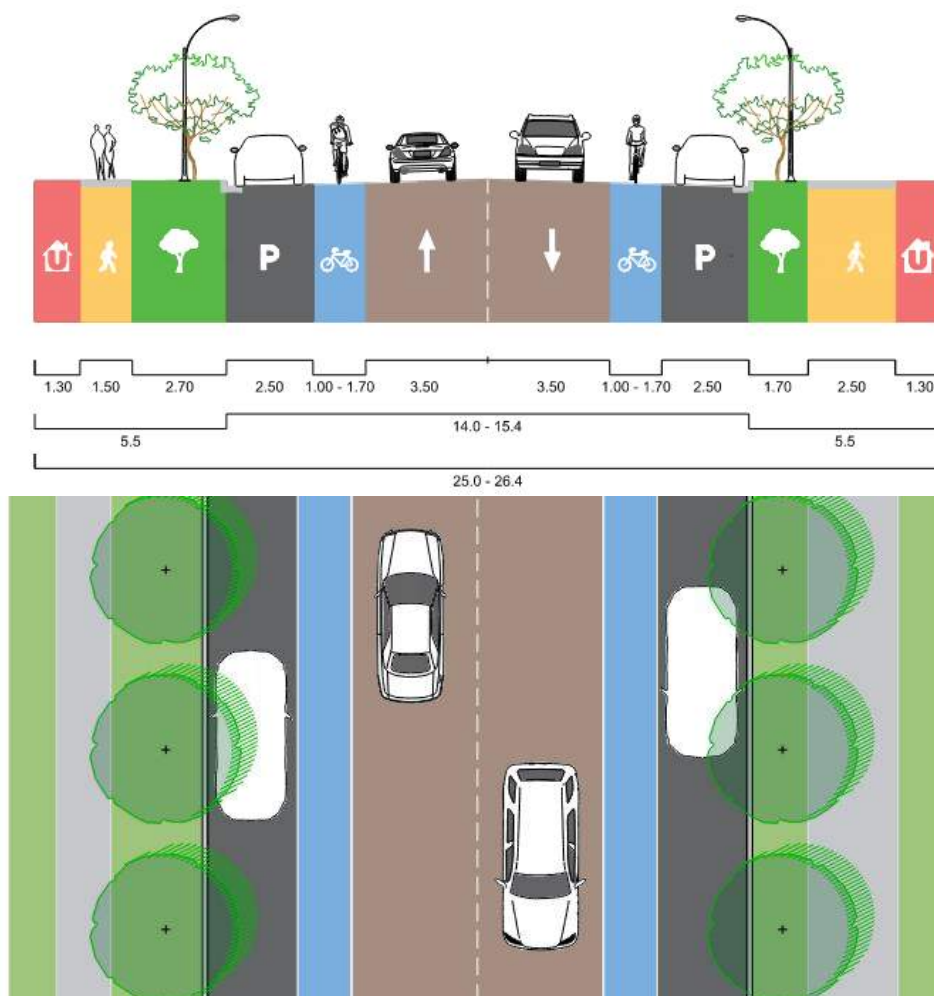
Features

- LT11 forms part of the minor trunk grid, while T12 may function as either a minor or major trunk road depending on bus routes and/or lot yields.
- Both typically provide two travel lanes and two parking lanes, with line marking and wider parking lane widths.
- Footpaths are generally provided on one side in low-density areas, with consideration for footpaths on both sides in medium- to high-density areas.

Figure D-9: Road Cross Section (Local Collector, LT11 & Local Distributor, T12)

ROAD CROSS SECTION – INDICATIVE TYPOLOGY

ROAD NAME: T14, T15, T15.4 – Trunk Roads



Overview

T14 to T15.4 form part of the Major Grid framework, providing connections between neighbourhoods within suburbs or release areas. These roads accommodate both on-road and off-road cycling facilities. The wider planting zone (on the side with a 1.5 metres path) allows for larger or additional street trees.

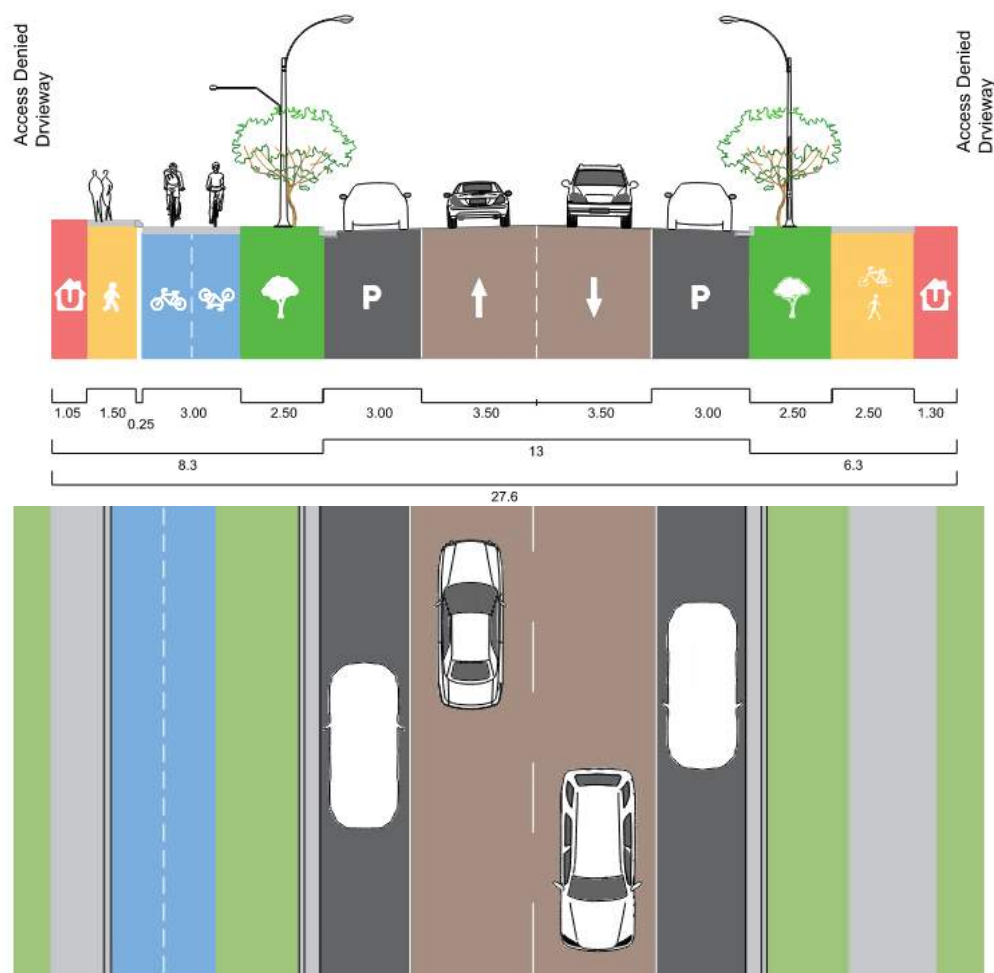
Features

- Dedicated on-road cycle lanes are provided, together with off-road shared paths (pedestrian and cycle) on one side and a separate pedestrian footpath on the other.
- These streets are designed to balance the movement of traffic with lot access.
- Pedestrian and cyclist safety shall be prioritised at street crossings.

Figure D-10: Road Cross Section (Trunk Roads, T14 T15 T15.4)

ROAD CROSS SECTION – INDICATIVE TYPOLOGY

ROAD NAME: SA13 – URBAN SUB-ARTERIAL



Overview

This feature road establishes the character of the suburb. The primary function of SA13 is traffic distribution. To enhance safety, on-road cycle lanes are relocated to the verge, while access-denied roads improve overall amenity and prioritise active transport within the verge. Adjacent lots maintain pedestrian and postal frontage to this road.

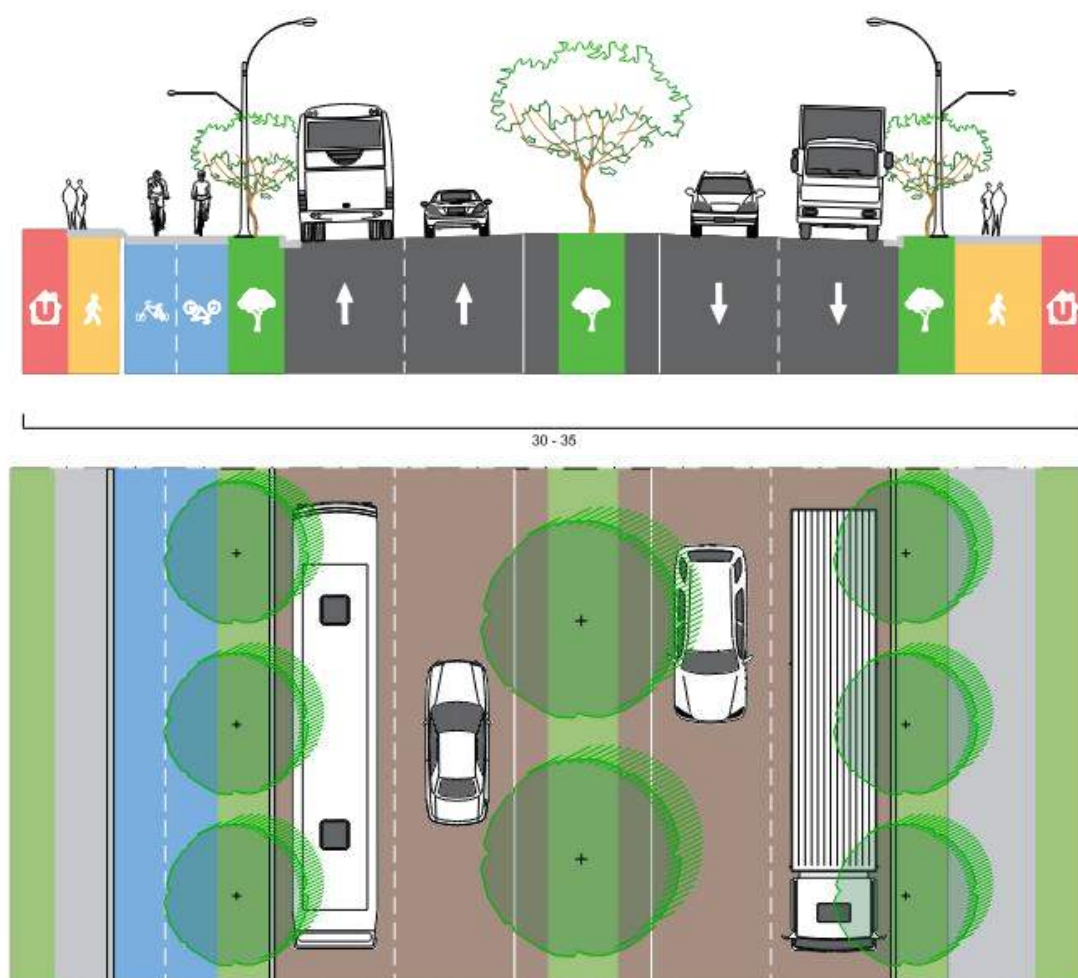
Features

- Dedicated off-road cycle paths are provided, while the opposite verge accommodates a shared path suitable for family cycling.
- Pedestrian and cyclist safety shall be considered at street crossings.
- The wider planting zone (with the 1.5 metres path) enables additional street-tree canopy.

Figure D-11: Road Cross Section (Urban Sub-Arterial, SA13)

ROAD CROSS SECTION – INDICATIVE TYPOLOGY

ROAD NAME: COUNCIL ARTERIAL



Overview

Council Arterials accommodate longer-distance travel, such as suburb-to-suburb movement, and generally connect to highways or state arterials. Their distribution and connectivity functions outweigh consideration of traffic volumes alone. Dimensions and typology should be negotiated in advance as part of urban release area planning.

Features

- Larger arterials may provide dual lanes in each direction, while smaller arterials may comprise single lanes with jointed pavements.
- In built-up areas, lots do not front directly onto arterials and access is instead provided via adjoining streets or parallel service roads.
- The inclusion of a central median, shoulders versus kerbs, and verge widths should be determined by local context and circumstances.

Figure D-12: Road Cross Section (Council Arterial)

1.1.11. Design Vehicles and Check Vehicles

These vehicles as listed in the road hierarchy table are used to determine street and road widths including lane widths and kerb radii. They also influence travel speeds through intersections and overall driver behaviour.

Design Vehicles: high-frequency, day-to-day users that are required to remain within the designated travel lanes.

Check Vehicles: lower-frequency users such as garbage services that may cross the centrelines of the leaving or entering road. Generally, this involves crossing up to halfway over the opposing traffic lanes in both directions. Note: Seldom frequency vehicles such as emergency vehicles and semi-trailers (during building construction) shall be able to enter any road without causing damage to infrastructure including mounting kerbs, stormwater lintels, signage and utilities. These vehicles may need to utilise the full width of travel lanes in both directions when making turns.

1.1.12. Components of Road Reserves and Travel Lane Widths

The following components of the road reserve are provided to clarify how the residential road types within the hierarchy table have been developed. The components are listed to provide guidance on the makeup of those road types and may assist Council's engineers in addressing site specific or exceptional circumstances where isolated changes are required. They are not intended to enable the creation of individualised 'design-your-own' roadway types. The Road Hierarchy Table shall remain Council's standardised reference for the road network.

The minimum travel lane width for each road type along with its corresponding function is provided in the table below.

Table D-5: Travel Lane Widths (T = Travel Lane)

ROAD TYPE	LANE WIDTH ⁽¹⁾	COMBINED TRAVEL WIDTH	NOTES
Local Street and Minor Trunk (non-public bus routes).	3.0 m	6.0 m	E.g. 10.0 m road (2P-3T-3T-2P). 11.0 m Local Collector Road (2.5P-3T-3T-2.5P)
Trunk Roads - Major	3.5 m	7.0 m	(includes Public Bus routes network)
Single Lane - Dual Direction (yield street) or One-Way	4.0 m	4.0 m	E.g. 8.0 m Yield Street (2P-4T-2P) and any single lane restriction for any road type
Laneway	5.5 m	5.5 m	Dual direction

Notes: (1) Excludes roundabouts and other traffic scenarios where wider lane requirements are necessary.

1.1.13. On-Road Parking Lane Widths

All roads within the road hierarchy table show how parking is provided within the carriageway. It is Council's requirement that all lots fronting a road will have on-road parking, see Table D-6. Larger lot rural and rural residential will be considered on merit. Short sections of parking such as at

roundabouts and traffic blisters can be omitted to comply with road design and legislative requirements. Lots with dual road frontage (front and rear) sometimes occur at entry roads to traffic signals and roundabouts, or an access denied road (denied driveways). Parking could be removed from one of the road frontages at Council's discretion unless commercial or other high-use activity abuts any of the road(s). Corner lots do not have the same concession except where intersection blisters occur.

Table D-6: Parking Lane Widths (P = Parking Lane)

ROAD TYPE	MINIMUM WIDTH	COMMENTS/EXAMPLE
Local Streets	2.0 m <i>* 2.25 m</i> # 2.3 m	E.g. on Yield Street (2P-4T-2P), and 6.0 m combined travel width (2P-3T-3T-2P) <i>*5.5 m is considered a driveway width however is provided to clarify Planning for bushfire requirements for non perimeter roads (2.25P-5.5T-2.25P)</i> #if delineation or line marked between parking lane & travel lane
Trunk Roads and Local Collector	2.5 m	Local trunk road. Major trunk roads with bike lanes between travel and parking lanes
Major Trunk Roads (with no on-road cycle lane)	3.0 m	Trunk Roads (generally over 6000vpd) with no separation on travel and parking lane.
Bus Indents/Other Heavy Vehicle	3.0 m	Bus indents minimum width (2.5 m wide parking lanes will require blistered bus stops. <i>Developers show stops on lot plans, so buyers are notified.</i>)
*Industrial Road (13 m wide)	3.0 m	

Note: The words bay and lane are interchangeable.

1.1.14. Minimum Combination and Pavement Widths

There are occasional reasons to vary a standard road type such as taking local area traffic management device necking points, see figure below for examples.



Figure D-13: Special Road Width Circumstances

The photos above illustrate an example of how the table below can be applied to a pinch point, as well as a potential solution for retaining a significant tree. The photos (sourced from Google Maps) are provided for reference and may be used at Council's discretion.

Table D-7 below presents the total pavement width required, determined by the number of lanes and the corresponding road classification.

Table D-7: Pavement Widths

LOCAL STREETS	MINIMUM WIDTH (M)	LANE TYPES <i>T = TRAVEL</i> <i>P = PARKING</i>	EXAMPLE
One Lane	4.0	1T	One-lane pinch point, one-lane turning circle
Two Lanes	6.0	TT or TP	Necking at intersection blisters. A short side road to save tree, or for slope
Three Lanes	8.0	PTP or TTP	Yield street or remove parking off one side of two-way street.
Four Lanes	10.0	PTTP	Local street and Bushfire non-perimeter road with lots and parking on both sides

Note: This Table overrides any other components where combined are of a lesser total width.

1.1.15. Verge Widths

Verge widths must adequately consider the infrastructure that needs to be accommodated and installed. Verge widths in the road hierarchy table are minimum and any verge may need to be widened to accommodate site specific infrastructure needs. The table below provides some requirements.

Table D-8: Verge Additional Widths

VERGE ADDITIONS	WIDTH (M)	RESIDENTIAL ZONES
Minimum Verge Width	4.5	Standard 4.5 m minimum verge already includes a 1.5 m footpath and a small tree
Street Tree	TBD	Add additional width as needed to accommodate the street tree size and minimum deep soil volume/widths (see Technical Guideline: Street Trees)
Shared Path 2.5 m wide	+1.0	Standard 4.5 m minimum verge includes a 1.5 m footpath. Replacing with 2.5 m shared path gives 5.5 m minimum verge
Other Path widths	+ (path width - 1.5)	Standard 4.5 m minimum verge includes a 1.5 m footpath
Overhead Power	+2.0 min	Where both overhead and underground services are provided, they are generally located behind the footpath and within the local utility combined trench, to avoid streetlights and tree
Stormwater Pipelines E.g. Dual pipes (major system drainage)	TBD (pipe width + buffers/influence)	Dual pipelines shall not be located under road pavements (except at crossings). Use open channels or provide extra width to avoid encroaching on allocations or trees
WSUD (biofilters, rain gardens, etc.)	+1.0 min	WSUD pits are located in the setback between kerb and footpath (biofilters in concrete box systems behind the kerb), positioned between trees
WSUD Swales	TBD	To be negotiated in a DCP only
Trunk Utilities (water, sewer, gas, electrical or communication)	TBD	Additional verge width may be necessary for non-standard items
Reduce Verge Adjacent Public Space	*	*See notes

*Additional widths are cumulative with no discounting, except where WSUD and street tree allocations are considered.

1.1.16. Local Area Traffic Management

Local Area Traffic Management (LATM) refers to traffic measures and strategies aimed at improving safety, particularly in residential neighbourhoods and local centres. It focuses on modifying traffic patterns to create safer, more efficient environments for pedestrians, cyclists, and drivers.

LATM measures are typically recommended for use on perimeter roads and local roads with 4-way intersections, especially where standard requirements are exceeded, such as long street block lengths, straight sections greater than 500 meters, or intersections with changes in priority. However, the use of LATM should not be interpreted as an endorsement of non-compliant or substandard design.

Below are a few examples of LATM measures:

- **Line marking and median islands in parking lanes on perimeter roads:** These measures slow down traffic in residential areas. Note: Islands are preferred over kerb blisters to ensure a minimum 1.5-meter distance between the edge and travel lanes, due to expansive clay soils.
- **Islands before blisters:** Traffic islands placed before blister islands (small raised areas at pedestrian crossings) help guide traffic, reduce speed, and provide safe areas for pedestrians to wait while crossing, improving safety and reducing crossing distances.
- **Mountable roundabouts:** Small roundabouts at intersections help maintain traffic flow and reduce the likelihood of accidents compared to traditional stop signs and intersections.
- **Raised intersection platforms:** Elevated sections at intersections are designed to slow down traffic, enhance pedestrian and cyclist safety, and improve visibility.

For the design requirements and further reference, see *Austroads Guide to Traffic Management Part 8: Local Street Management*.

1.1.17. Laneways (New Residential)

Residential Laneways are only to be used when all of the following criteria are met:

- They are parallel to roads with a minimum pavement width of 10.0 m (i.e., two dedicated travel lanes with a combined travel width of 6 m);
- They provide increased density by creating a mix of lots ranging from 8.0 m minimum to 12.5 m maximum width with a maximum depth of 25 m or provide access where high-order roads deny direct access.
- They are part of an integrated application with dwellings designed and forming part of the Development Application.
- They are not to be connected to trunk roads; and
- They are of a straight design (i.e., no bends, C, T, or H shapes). See figure below.

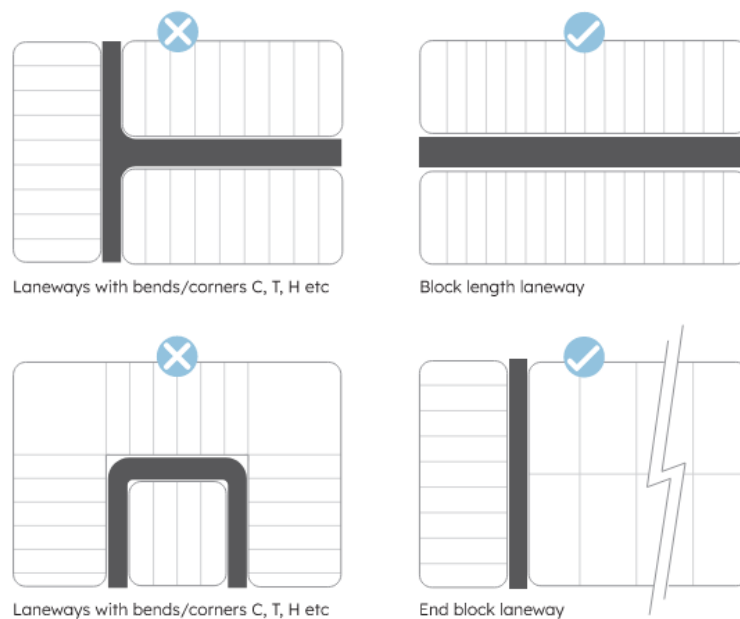


Figure D-14: Configurations of Laneway

Design and construction shall comply with the following:

- Laneways are to be constructed in concrete with a central “V” drain. The pavement width shall be 5.5 m with two verges of 1.5 m to support small street trees. The addition of kerbs is undesirable and, if provided, must allow 1.5 m of deep soil behind the back of the kerb, in addition to the 5.5 m pavement. Reserve may be increased in 0.5 m increments as required.
- A crossfall of 2.5–3.0% shall be provided to the centre of the pavement.
- Laybacks or V drains must be provided at road connections.
- Coloured concrete entry thresholds are allowed, provided they do not extend across pedestrian paths.
- Splay corners must measure 2 m × 2 m.
- The maximum length of a laneway is 100 m per block to control vehicle behaviour, speed, CPTED, and other safety measures. Variations, while not encouraged, require LATM measures and increased travel widths.
- All lots adjoining the laneway must use the laneway for vehicular and garage access.
- Streetlights must be installed at laneway entrances on the opposing side of the street to maximise light penetration and within the laneway in accordance with Council’s requirements (see Figure D-15).

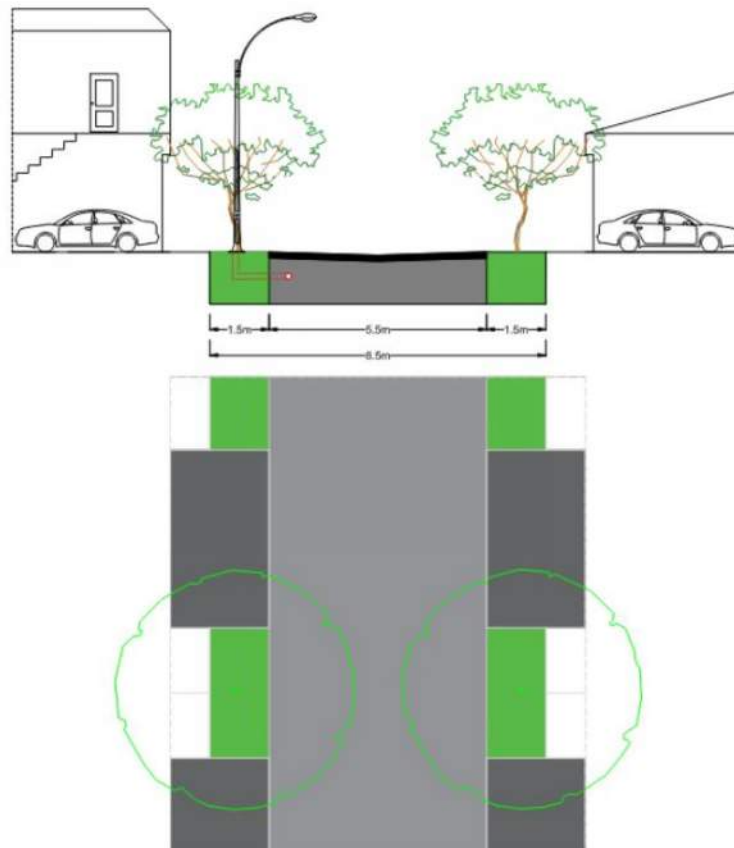


Figure D-15: Road Cross Section (Residential Laneway, LR)

- All utilities except street lighting must be provided from the primary road reserve.
- The maximum longitudinal grade of the laneway shall be 5% and lot grades must comply with any DCP requirements for lots with laneway vehicle access.
- No lot drainage shall connect directly to the laneway. All allotments on the laneway must drain stormwater to the street network or via an inter-allotment drainage line into the laneway pipeline (see Figure D-16).

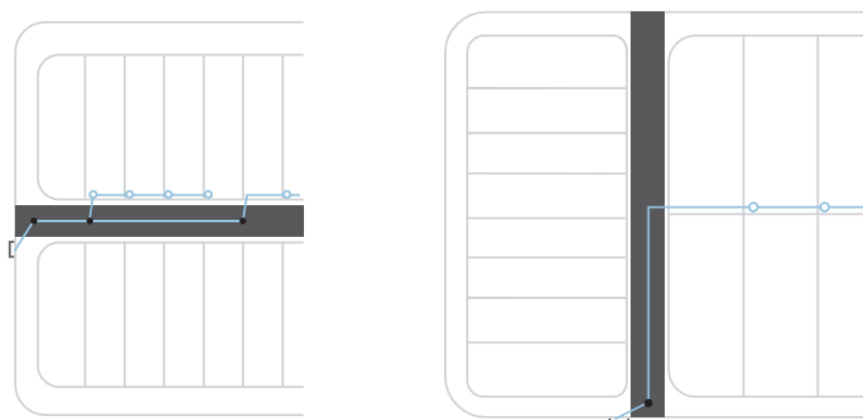


Figure D-16: Indicative Laneway Drainage

1.2. Footways, Footpaths and Steps

Footpath and footway parameters shall be designed in accordance with the Standard Drawings, Section 1.1.10 and the following:

- Footway (verge) minimum widths are provided in Section 1.1.15.
- Footway crossfall shall follow a standard profile of 4%.
- Footpath widths are provided in Section 1.1.10.
- Footpath crossfall shall be a minimum of 1% for drainage and a maximum of 2.5% for accessibility. Construction plans are recommended to use a design crossfall of 1.5% to ensure compliance with these limits.
- Longitudinal grades of footpaths shall match adjacent roadway or kerb grades with transitions to ramps or returns where appropriate.
- Where footpath grades exceed 12%, special consideration shall be given to pedestrian accessibility.
- Steps are considered undesirable in public space design and should be replaced with ramps wherever possible. Where steps are approved, they must conform to the Building Code of Australia, and handrails shall be provided.

Variations to these parameters will only be considered under exceptional and justifiable circumstances.

A concrete footpath within the footway shall be provided as a minimum standard in accordance with the relevant road types in Section 1.1.10. Footpath warrants, particularly near or within the desire-line of commercial and school precincts must be determined in conjunction with surrounding development (existing or planned) and key pedestrian destinations. Footpaths in rural zones (RU1, RU2, R5) are not generally required unless specified by a planning instrument. In industrial zones (E4), footpaths shall generally be provided along bus routes and other locations as specified by Council engineers.

1.3. Cycleways and Shared Paths

Cycleways shall be provided on routes as defined by the Maitland City Strategies or in accordance with any DCP or condition of development consent.

Off road cycleways (i.e., beyond the road pavement) are usually nominated “shared paths” being 2.5 metres minimum wide for both cyclist and pedestrian usage and shall be constructed in accordance with Standard Drawings SD012 & SD020. Such paths, usually located within footways that are 5.5 metres wide (See SD001) may also be located in open space corridors. Council may consider a shared path 2.0 metres wide were justified by special circumstances such as constraints of available corridor widths.

Shared path or cycleway connectivity between a road (i.e. a road reserve either existing or proposed, with or without a path) and the main path shall be constructed as a shared path, 2.5 metres wide.

Table D-9 below provides the minimum path widths based on their function and the nominated verge width.

Table D-9: Pedestrian and Cycle Paths

PATH TYPE	FUNCTION	MINIMUM WIDTH (M)	MINIMUM VERGE	MAXIMUM LONGITUDINAL GRADIENT	PROFILE CODE
-----------	----------	-------------------	---------------	-------------------------------	--------------

Minor Path - Footpath	Local access path with low traffic volumes; Pedestrian and low speed cyclist use.	1.5	4.5	Match road or in accordance with AUSTROADS AGRD Pt 6A.	A
Shared Path	Commuting pedestrian & cycle path (up to 20 km/h) where two-way movements are common.	2.5	5.5	Match road or in accordance with AUSTROADS AGRD Pt 6A.	B
Trunk Path (High Use) - Trunk Shared	Commuting path accommodate high level of pedestrians & cyclist (speeds up to 30 km/h) in both directions.	3.0	6.0	Match road type or in accordance with AUSTROADS AGRD Pt 6A.	C
Active Verge Combination	Access denied driveways 3 m Dedicated bike path and footpath	4.5 (3.0 & 1.5)	9.0+	Match road or in accordance with AUSTROADS AGRD Pt 6A.	D

Figure D-17 below shows Type D Active Verges (parallel and split paths). It is generally intended for use at the Strategic level (rezoning and DCP), but may also be applied at the Development Application stage where DCPs and precinct plans are not yet in place.

Driveways are denied on these paths and verge on opposing side of the road. *Roads under 10,000vpd could negotiate for driveways on the opposing verge (within the DCP or Precinct plan) subject to the surrounding context and street environments being created.*

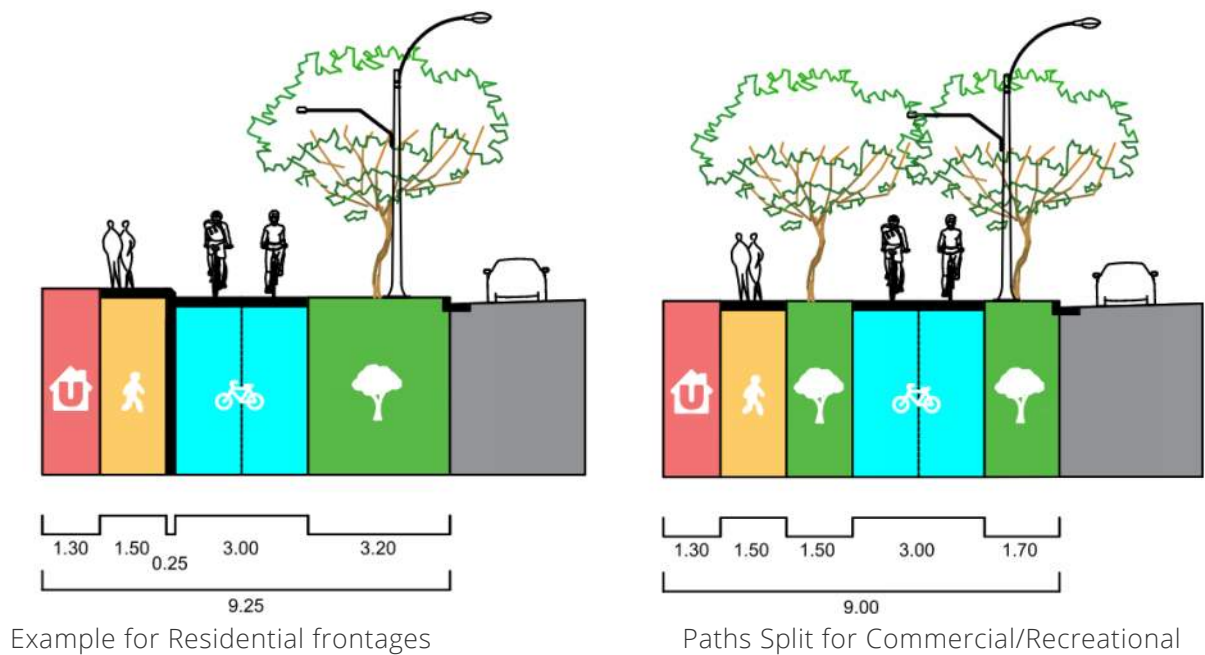


Figure D-17: Footpath and Share Path for Residential and Commercial Site

1.3.1. Kerb Ramps

Kerb ramps (pram ramps) shall be provided at locations to cater for road crossings but only when directing pedestrians to a continuing path, in accordance with Council's Standard Drawing SD019. The surface of the kerb ramps shall be coloured with a light terracotta colour oxide, with a stretcher bond brick stencilled finish. Ramps and their texture shall be perpendicular to the road and aligned to be directly opposing, to assist directional orientation of sight impaired persons.

1.3.2. Pathway (Corridors)

Pathway corridors between lots are not supported in low to medium density residential areas, and other locations with low use and low surveillance, due to poor Crime Prevention Through CPTED considerations. The necessity for pathways can be eliminated through effective design strategies such as adjusting street block lengths and orienting roads to align with natural desire lines and flowpaths.

In cases where a cul-de-sac is unavoidable and needs the bulb to connection for stormwater flowpaths or active connectivity, the bulb shall be extended to the adjacent road or park to negate the need for a pathway corridor.

In the case of mid-block pathways for stormwater and the like, align within a road or cul-de-sacs, or alongside for open channels. These configurations enhance CPTED surveillance and provide effective maintenance access.

Within this document 'pathway' refers to a laneway corridor bounded by private property (or the like) which links between public places to facilitate walking, cycling and can include stormwater overflows. Previously public pathways within dedicated land would have linked common destinations such as schools and commercial precincts and recreation areas. They may also have acted as stormwater overland flow paths.

Council will consider the construction of alternative pavement types, colours, textures, and widths on merits, however consideration will be restricted to areas of low lot catchment, and where, for example, residential lots are on one side of the street, or opposite to and adjoining a Public Reserve or "Open

Space". Such pavements shall only be provided at the terminal end of residential streets and shall cater for a maximum number of five properties, including the corner allotment. In addition, such pavements, if being considered as a connection between two streets, must not create an alternative route for "through traffic".

1.4. Horizontal Curves

The horizontal alignment should be carefully chosen to balance the topography, with the desired speed control and adequate safety, for all road users.

- In urban areas, a changing alignment is encouraged in order to maintain low traffic speeds. Curve radii are generally established by the approved subdivision plan.
- Long straights connected with short (isolated) radii curves are undesirable.
- The maximum deflection for which a curve is not necessary is 1.5 degrees.
- Horizontal curves on urban arterial, sub-arterial and distributor roads shall comply with Austroads standards. The desirable minimum curve length should be 70 metres and the minimum desirable radius, 400 metres (due principally to adverse crossfall), [Urban Road Design, A Guide to the Geometric Design of Major Urban Roads (AP-G69/02)]. Consideration of newer Austroads standards is allowable.
- Horizontal curves on rural roads shall comply with Austroads and TfNSW standards for rural roads.
- "Broken-back" curves (created by a short length of intervening straight between two uni-directional curves) should be avoided in an urban street environment regardless of road hierarchy due to an unsafe changing alignment. Such curves are not permitted on roads of Collector status or greater, or within Large-Lot subdivisions. Exceptions may be granted by Council where travel speed necessarily varies appreciably (as may occur at sharp curves/bends approaching 900 or approach to a traffic control facility, interrupting traffic flow) and, where the connecting straight is greater than 150 metres between tangent points. Regardless, good design practice should prevail with improvement by the substitution of a single curve or a compound curve.
- Compound (uni-directional) curves with common tangent points should provide comparable radii ratios, generally not less than 0.75 (smaller divided by larger), although a lesser value may be considered in constrained urban situations.
- Reverse curves without tangent point separation, are not desirable and should be avoided.
- Where vertical curves are combined with horizontal curves, the combined respective sight distance requirements should ensure compliance with relevant standards.
- All curves must be assessed to accommodate large-vehicle access to urban areas taking into account the road hierarchy and the potential for passing of moving vehicles, and of parked vehicles.
- Travel lane widening for vehicle-tracking must be considered on major roads (roads with a carriageway width greater than an 11 m) in relation to line marking and parking requirements. Generally, a 3.3 metres wide travel lane will accommodate large vehicles for a local street [Ref Guide to Road Design – Part 3: Geometric Design 4.2.4 and 4.2.5].

1.5. Longitudinal Grades

For urban areas centreline longitudinal grade limits are as follows:

Table D-10: Longitudinal Grades

	FLEXIBLE PAVEMENT	RIGID PAVEMENT
Minimum	0.5%	0.5%
Maximum	16%	16% 25% privately owned*
Public Bus route maximum	10% (12% for less than 150 m & not at a bus stops)	12%

Grading for an intersecting side-street shall attempt (where applicable) in the first instance to achieve a sag point in advance of the intersection. Where this occurs in deep cuttings, the deletion of the sag in favour of a dished concrete (being flat and wide – 40 mm deep invert x 0.9 metres wide) may be utilised, subject to acceptable drainage considerations and vehicle vertical clearances.

Note: *A maximum grade of 25% is generally allowed for private access road where commercial-sized vehicles as specified in AS2890.2 are not required to enter the site. However, if the private access road is to cater to commercial vehicles such as service, garbage, and/or delivery vehicles, the minimum requirements of AS2890.2 must be met.

1.6. Vertical Curves

Crest vertical curves shall be designed as a minimum for Stopping Sight Distance (SSD) for the nominated design speed. Sag vertical curves shall be designed for riding comfort. Where minor changes in grade (less than 1%) occur, vertical curve lengths shall satisfy appearance criteria.

Reaction times shall be 1.5 seconds for urban and 2.5 seconds for rural areas.

In order to improve gutter flows and pit inlet capacity where grades are less than 1%, sag vertical curves in kerb and gutter design should be eliminated. An increase in the road crossfall in the vicinity of the sag pit to achieve this requirement will ensue.

1.7. Crossfall and Superelevation

Generally, roads should be crowned in the centre with 3% crossfall. Offset crowns are acceptable where warranted, to achieve satisfactory cross section profiles for adequate gutter/road capacity for stormwater runoff. The crown shall not occur within wheel tracks. A minimum width between the kerb and the crown shall be provided to allow effective roller compaction and operation of the asphalt paving machine.

One-way crossfall may be applied in special circumstances subject to Council's concurrence (such as in difficult cross-sloping topography) with special attention given to control of the catchment

contributing stormwater runoff to the gutter, (such as providing IAD pipelines) that does not exceed gutter capacity.

Superelevation should not be applied to urban streets but may be permitted on major urban and rural roads with design speeds generally of 70 km/h or greater, unless otherwise advised by Council.

1.8. Batters

Batters of cut and fill should generally comply with the following requirements unless otherwise recommended by the suitably qualified geotechnical engineer, see Table D-11. This is to ensure that property access, pedestrian safety, and maintenance issues are satisfactorily achieved. Refer to Council's Standard Drawing SD002.

Table D-11: Batter Slopes

BATTER TYPE	MAXIMUM SLOPE (HOR : VERT)
Road Reserves	4 : 1 ⁽¹⁾
Lots between road and building envelopes <i>NOTE: Check Maitland DCP for other (lot) requirements</i>	4 : 1 ⁽²⁾
Public Open Space	5 : 1 ⁽³⁾

Notes:

- 1) This slope is nominated primarily for purposes of maintenance rather than batter stability.
- 2) Steeper slopes, up to 3:1 are permitted but should be avoided in front setbacks, building envelopes, mowing areas and vehicle access areas. Lots with steep batters shall be assessed for acceptable garage locations and driveway grades that conform to Council's Standard Drawings SD008.
- 3) Where regular maintenance is expected, 6:1 should be provided. Where maintenance is not required such as for natural bush or shrub/native grass plantings, 3:1 may be permitted.
 - Confirmation by a geotechnical engineer of suitable batter slopes for particular soil types may be necessary.
 - Cuttings in rock may be near vertical, as recommended by an engineer.
 - Batters for lot fill shall be contained within the lot.
 - Road batters which extend into lots, should intersect with the natural surface level within the building line setback as adopted by Council.
 - Variations outside of these parameters will only be approved where justified.

1.9. Cul-De-Sac, Turning Heads and Kerb Returns

Cul-de-sacs are discouraged due to various reasons including CPTED concerns and other factors (e.g. bushfire). Council prefers connected roads and streets. These reasons include lot frontage challenges for driveways, on-street parking, garbage collection, utility pit space in the verge, street trees for urban heat island effects and lot shape issues. Cul-de-sacs are only considered if no other option is feasible, and if so, they shall be straight enough for visibility from the intersection to the bulb end. If they exceed the length and visibility requirement, road width should be increased accordingly for two

dedicated travel lanes. Perimeter road cul-de-sacs shall be less than 200 metres long. Internalised cul-de-sacs (by lots) shall achieve a walkable perimeter in accordance with the DCP.

Other treatments such as 'T' and 'Y' heads are to be avoided in residential areas for reasons including pedestrian safety, reversing vehicles, unlawful parking/uses and others. T and Y heads are for generally appropriate for service area turning where the public is excluded. Turning head layouts shall cater for manoeuvres of a single unit Heavy Rigid Vehicle (HRV), typically a garbage truck. See Council's Standard Drawing SD027.

The minimum pavement crossfall in all turning heads and areas shall be 2% and a maximum of 5%. In turning heads where the depth of excavation is significant, in order to reduce the effect of the cutting and batter, the crossfall from the circle centre may be adverse (positive).

Where planning for bushfire requires larger cul-de-sac radii, consideration of on-street parking within the centre of a one-way turning head should be explored instead of providing parking on the outside of the turning radii, see figure below. The benefit includes less land-take, less pavement, urban heat canopy shade. Concrete construction may be required for shrink/swell soils.



Figure D-18: Bushfire Cul-De-Sac and Aerial Sample

The minimum kerb face radius requirements for Council's roads are provided in the table below.

Table D-12: Nominal Kerb Face Radius (minimum metres)

	RESIDENTIAL	INDUSTRIAL & ENTERPRISE
Cul-De-Sac	10 12* Bushfire swept path (*parking needs to be added)	16
Transition	30	50
Kerb Return (at intersections)	8	12

*Also see section 1.9		
Kerb Return (at sharp mid-block bends)	15 (inside radii) Local streets only <11 m wide Ensure lot width allows a driveway on the short frontage outside of prohibited locations (AS2890.1 6m from TP) OR provide a 1.0 m wide 88b restriction on the lot frontage restricting vehicle access and manoeuvring along the prohibited areas.	Not appropriate – use design speed curves. If unavoidable, B-Double and 19 m turning paths are the check vehicle for industrial and Enterprise respectively.

Note:

- Listed requirements are minimums and may need enlarging e.g. Bushfire.
- Enterprise includes but is not limited to commercial, business and large-lot retail areas.

2. Intersection Design

Intersections for the control of converging, merging, and diverging traffic streams may employ various design elements which are generally referred to as “traffic control facilities”, being, Major Facilities such as, Traffic Signals, channelised (with auxiliary lanes), Roundabouts in urban and rural environments, and Minor Facilities, such as Local Urban and Rural Intersections, as defined below.

Intersection requirements shall be implemented in accordance with Austroads guidelines and as supplemented by TfNSW standards, and in accordance with development consent. Road widening may be required along the existing road adjacent to the development lot to accommodate intersection treatments, compliance lanes, parking, and other related infrastructure. As generally encompassed by Austroads standards, warrants for typical intersection requirements shall be determined based on design objectives parameters such as: safety, traffic capacity and flow, sight distances, crash history, lighting, consistency, driver expectation, and including: speed, travel time, interruptions, queuing, freedom to manoeuvre, driving comfort and convenience, and operating costs; factors embodied in the Level of Service (LoS) of an intersection.

“General objectives for intersection design are to:

- Design the intersection to be as safe as possible.
- Cater appropriately for the movements of road users.
- Provide adequate facilities for all road users (including pedestrians, those with a physical impairment and cyclists)
- Maximise driver comfort.
- Minimise maintenance and replacement costs
- Minimise adverse environmental effects.

One option to improve capacity (and safety) is through channelisation and auxiliary lanes, to separate movements on an approach and provide storage space or remove conflicting flows, and to raise capacity by eliminating constraints on the priority flow” (Austroads Pt 6), and to achieve an outcome

“to maintain capacity of the through road...to operate with very minor interference to the through movement” (TfNSW).

Intersections shall be designed to accommodate the legal speed limit of the road existing at the time of construction approval.

Application of an Extended Design Domain (EDD) approach will not be considered unless adequately justified, whereby removal of constraints to achieve Normal Domain Design (NDD) is unreasonable or prohibitive.

For traffic-control design features, Council and TfNSW Traffic and Development Committee requirements may be inherent within the consent, or otherwise approved through or associated with, the Subdivision Works Certificate (SWC)/Section 138 of the Roads Act (S138) process for traffic device features such as signposting and linemarking.

2.1. Traffic Signals

All traffic signal facilities (including those for pedestrians) shall be approved in design and construction by the TfNSW through appropriate agreements with the WAD (e.g. Works Authorisation Deed).

2.2. Channelised Intersections

Channelised intersections (CH), together with auxiliary (AU) lanes to provide safety in diverging, storage and continuous flow of vehicles and cyclists, shall be provided in accordance with Austroads guidelines and as supplemented by TfNSW standards.

Intersections shall incorporate the following (but not limited to):

- Adequate capacity for the projected design life
- Adequate Stopping Sight Distance (SSD) where applicable, Approach Sight Distance (ASD), Safe Intersection Sight Distance (SISD) and, Minimum Gap Sight Distance (MGSD) where practically possible, as the circumstances require.

[Where an intersection is required in the vicinity of a crest vertical curve, it should be placed at the crest rather than immediately beyond the crest, where sight distance may be compromised.]

- Compliance with “turn treatments”.
- Provision of auxiliary lanes
- Provision of islands medians and kerbs where required.
- Provision for utility services, cyclists, pedestrians, disabled access, and lighting where required.
- Provision for 19-m (and “B-Double” where on an approved route) articulated vehicle turning paths.
- Provision of signposting, pavement markings and furnishings, including raised pavement markers in accordance with TfNSW standards.
- Intersection angles should be perpendicular wherever possible, otherwise within the limits according to road design standards.

2.3. Roundabouts

Roundabouts shall be designed in accordance with Austroads and TfNSW Guidelines.

General geometric layout principles should be confirmed with Council prior to preparation of a detailed design. Particular attention will be given by Council to future traffic needs as they relate to the number and configuration of approach and circulating lanes. Pavement markings shall be utilised for dedicated traffic-lane movements. Two lane circulating roundabouts when required must employ two travel lanes at departures.

The following principles should also be addressed: -

- Roundabout shall be designed as on-grade cross fall unless Council specifies otherwise.
- Circulating vehicle paths catering for a 19-m Articulated Vehicle (AV). See Austroads/TfNSW including requirements for single lane and two-lane circulating scenarios as appropriate.
- Council can determine a lower design standard for local streets and up to a local collector road. i.e. smaller island, mountable island, and larger annulus could be considered on merit.
- Consider roundabout pavement design as part of the geometric design process. See section 12.5 for pavement requirements.
- Adequate design capacity and strength, with a 40-year (min) design life.
- Appropriate sight distance and provision for future services, pedestrians, cyclists, drainage, lighting, signposting, and line marking.
- A maximum through-movement deflection radius in accordance with Austroads Requirements.
- An absolute maximum adverse radial crossfall of 4%
- Splitter islands, where pedestrian movement is expected, should be of sufficient width to accommodate “refuge” design parameters.
- Suitable landscaping in the central island (where approved) providing sight lines at the adopted design eye-height.
- Subsoil drainage for any landscaped (unsealed) areas.
- Subsoil drainage at the perimeter (upright) kerb returns.
- On-road cycleways are to be provided for arterial and sub-arterial roads and in accordance with the Bike plan.

2.4. Minor Intersection

2.4.1. Urban

In urban environments intersections configured within the standards of kerb radii and road-width within this Document shall generally be adequate for traffic access needs in local streets. Roads with higher levels of traffic usage such as Collectors or greater, should be assessed regarding traffic volumes and safe traffic usage in accordance with Austroads standards, addressing auxiliary lane potential for left and right turn manoeuvres. Use of regulatory signposting and linemarking in accordance with SD030 can usually accommodate most movements. Entry and exit movements for heavy vehicles that cross the road centreline within high volume roads are not permitted. (See “Kerb Returns” below)

Staggering of intersections, to achieve a desirable minimum separation distance of 40 metres between opposing road centrelines, is desirable on all road types. Four-way intersections on Trunk roads shall be roundabouts or traffic signals. Occasional four-ways on local to local streets is allowable but some treatments may be required such as central median, v-drain flush thresholds and/or other treatments to increase safety and visually distinguish priority of the intersection legs.

2.4.2. Rural

In rural, or transitional urban/rural environments (being generally where the legal speed limit is greater than 60 kms/h), and where single-lane two-way roads are impacted by a new road junction, intersections shall be assessed regarding traffic volumes and safe traffic usage in accordance with Austroads and TfNSW standards, addressing potential for auxiliary lanes for left and right turn manoeuvres, and flag lighting.

2.5. Kerb Returns

Kerb returns shall be provided at all road or street intersections. Any variations to this requirement are subject to Council's determination, such as within RU zoned areas where returns may, if justified, be deleted.

An adequate kerb radius/road-width relationship shall be adopted for the maximum sized expected design vehicle (usually a 19-m Articulated Vehicle - AV) to provide acceptable access to a subdivision and for manoeuvrability within intersections. In urban environments the usual minimum standard kerb radius is 8 m, although, depending on the type or the Level of Service (LoS) of the intersection, Council shall determine an acceptable sweep path (and hence kerb radii) that may or may not employ cross-lane vehicle manoeuvres.

To cater for single-lane approach and departure for AV requirements at square intersections, the nominal minimum radius is 15 m.

3. Public Transport (Bus)

A public transport route within this Manual refers to an approved road type or route traversed by a bus. A "bus route" (not being a school bus route) is determined by:

- TfNSW and Council, in consultation with the local bus providers or
- A planning instrument (i.e. DCP, Precinct Plan) or
- Development Consent

Public Bus routes should be confined to roads providing a carriageway width of 12 metres or greater in built up areas when determining either the route along an existing road or determining the alignment of a new/proposed road.

School bus route can utilise roads down to 11 metres with consultation with Council in conjunction with the local bus companies and Council.

Bus facilities such as bus stop and parking areas, signposting, set-down paving, and shelters shall be provided where required by Council, and designed in accordance with Council's requirements and Austroads Standards for individual items, as follows:

- Bus set-down verge paving and shelters where required shall conform to Council's standard
- Bus shelters, unless otherwise approved by Council, shall be the adopted style current at the time of installation.
- Road pavement for bus lay-by parking areas at major destinations such as business and school terminals, shall be provided in concrete.

Typically, shelters may be required as part of major release areas and may be located along a route within the release area or on a route nearby or adjoining the area.

For new subdivision release areas, the applicant for the development or the designer shall submit to Council verification of arrangements made (or otherwise) with TfNSW and local bus companies of public transport routes (existing and planned) and of any specific requirements for those routes, such

as bus stop/set-down locations, for consideration by Council for implementation within the road design.

4. Structures

Designs related to concrete, masonry, steel, and timber elements, such as for bridges, large culverts, retaining walls, headwalls, subdivision entry features, etc, shall be carried out in accordance with relevant Australian Standards and TfNSW Design Standards, and shall be certified by a practicing structural/civil engineer.

All precast and pre-assembled structures shall be similarly certified for structural adequacy. Where design elements are ancillary to a Construction Certificate for *Roads and Drainage*, documentation shall be submitted to Council for each component.

4.1. Retaining Walls and Benching

Retaining walls in this Manual relate to their location, design, and construction as part of a subdivision, and as part of a development whereby they are an integral part of a development approved with consent under the Environmental Planning and Assessment Act (EP&A Act). These guidelines may be applicable for other scenarios beyond the intent of this Manual.

Note: Within private lots, Council's DCP shall take priority over this section where discrepancies exist.

4.1.1. Location

These requirements are given for scenarios where a S138 approval, or a Section 68 of the Local Government Act (S68) stormwater approval may involve a retaining wall. Even in these scenarios Council may still require that the some DCP requirements should still be met. The location of retaining walls shall be determined by Council and the design engineer and should adopt the following guidelines:

- In public Land – retaining walls are unfavourable and not encouraged. The use of batters is the preferred method for grade changes.
- At public/road reserve boundaries – Fill retaining walls within the adjoining lots and on the boundary. Cut retaining walls shall be set back within the property to wholly contain the wall, footings, subsoil and any other features. Consideration of zone of influence into the road reserve shall also be considered. Zone of influence shall not extend to under the current or future road pavement and generally not under paths.
- At adjoining lots (common boundaries) – refer to Council's DCP.
- At stormwater overland flow paths – within the dedicated flow path or easement, being of concrete or masonry construction suitable for a flow path.
- Obstructions, such as walls or any other above-surface structures are not permitted within easements including those that act as overland flow paths.

Retaining walls within stormwater drainage easements (Inter-allotment Drainage) are not desirable due to the potential interference with the stormwater pipe and difficulty for access to the pipe for maintenance purposes.

If a retaining wall is permitted/required, then the following guidelines/actions should be considered:

- Avoidance of adverse impacts on the pipe from any structural elements of the wall

- Footings shall be finished below the zone of influence * of the drainage line and no loading shall be directly applied to the pipe without a detailed design demonstrating mitigation of the load. Note: * The zone of influence is defined as a line drawn at 1:1 slope from the invert of the pipe.
- Maintenance of a reasonable means for physical access for personnel and light machinery to “lay, place and maintain a line of pipes” (Conveyancing Act).
- Adequate measures to eliminate any potential loading on a pipe that passes through a wall or its footing.
- If a retaining wall is permitted/required and an adjustment to the pipeline is also required, a review of the hydraulic design of the pipeline, such as Hydraulic Grade Line, surcharge, pipe capacity, etc, must be made to ensure that there is no compromise to stormwater flows, that may create an adverse affectation on properties that either benefit, or surround the proposed adjustments.

4.1.2. Design

Retaining wall design shall be in accordance with Australian Standards, and be certified by a qualified engineer, taking into account loads from existing or future anticipated dwellings, pools, vehicles, etc.

Excessive cut and fill and subsequent retaining structures are not desirable. Retaining wall heights for public land if supported, such as for road embankments, shall be subject to Council approval through development consent. The consideration of tiering versus height would be considered by Council in each location and context of safety, fencing, maintenance and other.

Where approved by Council, retaining walls shall:

- Be designed in accordance with the Australian Standards AS4678 and AS5100 Bridge Design where traffic loads, safety barriers and/or stormwater/flooding flows are expected.
- Be of the materials in the specified locations, as nominated in the section of the Manual.
- Where supporting a public/road reserve, be constructed in masonry or reinforced concrete.
- Where supporting lots adjacent to public/road reserves may be other than concrete/masonry, being installed in accordance with the manufacturer’s recommendations.
- Where located within a public/road reserve, under justifiable circumstances, be constructed of reinforced concrete or an approved masonry specification (including crib wall).
- The subsoil drainage for the retaining wall must be connected to either the kerb and gutter, road pits, or an interallotment drainage system (which is sometimes located in front of the lot). Note: the retaining wall drainage cannot be directly connected to the road subsoil systems. The design must include detailed information on the subsoil drainage components of the retaining wall and its connection to the downstream system/discharge point.

5. Ancillary Design Requirements

5.1. Safety Audit

A Road Safety assessment, where required by Council, shall be conducted in accordance with the TfNSW Road Safety Audit process.

5.2. Traffic Control Devices (Traffic Committee)

Traffic control devices may include a sign, signal, marking, structure, or other device to direct or warn traffic (incl. pedestrians and cyclists) on a road or road related area that is prescribed by the regulations. Traffic control devices may also be of a type to reduce travel speeds to match urban design requirements where road geometry cannot provide that control. Such devices may also be used in conjunction with street landscaping and furniture.

The devices, including associated signposting and linemarking, shall be designed where applicable, in accordance with TfNSW, Australian Standards or Austroads guidelines, and Council's requirements. Any new and adjustment of regulatory signages and line markings will be presented to Council's Local Traffic Committee, upon receipt at Council of an acceptable engineering design.

Roads with an 11.0 metre (or greater) carriageway width, centreline and/or edgeline marking may be required. Raised pavement markers shall be provided where required by Council at intersections in accordance with TfNSW standards, in conjunction with line marking at locations that warrant particular traffic safety considerations.

The manoeuvrability of an articulated design vehicle shall be considered for traffic control devices.

5.3. Street Name Signs

Street signs shall be provided to Council's standard specifications and Standard Drawing SD029. An application for new street names shall be lodged with Council and be supported by adequate justification for the proposed names. Names shall conform to the guidelines of the Geographical Names Board.

5.4. Guard Fence and Guideposts

Guard fence refers to any approved type of safety barrier such as concrete barrier/kerb, steel W-Beam or wire rope. Where possible, effective road design should aim to negate the need for guard fence. Where there is a warrant, and where unavoidable, guard fence shall be provided in accordance with the current TfNSW Design standards or as directed by Council. Guard fence on the outer edge of a road carriageway shall be located within a constructed or extended road shoulder which shall be bitumen sealed.

Guideposts shall be provided in accordance with TfNSW.

5.5. Pavement Edge Restraints

Concrete restraints such as kerbs, flush edge-beam restraints or kerb and gutter shall be provided on both sides of all roads on urban residential subdivisions as determined by Council.

5.6. Subdivision Staging and Temporary Turning

Staging of subdivision should create staging boundaries that avoid the need for temporary turning heads. Temporary turning heads have been problematic as they have been inappropriately removed during construction of the next stages. This leads to safety issues and damage to public and private property as there is no suitable turning area during the next construction phase for garbage services, residential and construction traffic.

- Principal Control: The requirement is to have turning available including during the next stage of construction (without the need for management plans or temporary traffic control).
- Stage boundaries should finish with a closed loop or at a T-head of a permanent intersection.
- Trunk Roads shall be staged to create a loop due to the larger size vehicle and the road function (use of a local street is allowable to create the loop).
- Any lot should not be released unless every road that adjoins its boundary is completed in the stage.
- A chevron sight board shall be placed at the termination of the prolongation of the centreline of the road.

- Stage boundaries need to consider utilities and design including stormwater and streetlighting. Any proposal may need extra pits for the temporary situation or change the stage boundary/turning solution to avoid the infrastructure and issue.
- When staging at a permanent T intersection, the length of the legs shall be maximum 30 to 35 metres being the general depth of a lot.

The following examples in Figure D-19 are preferred for use internal to the site.

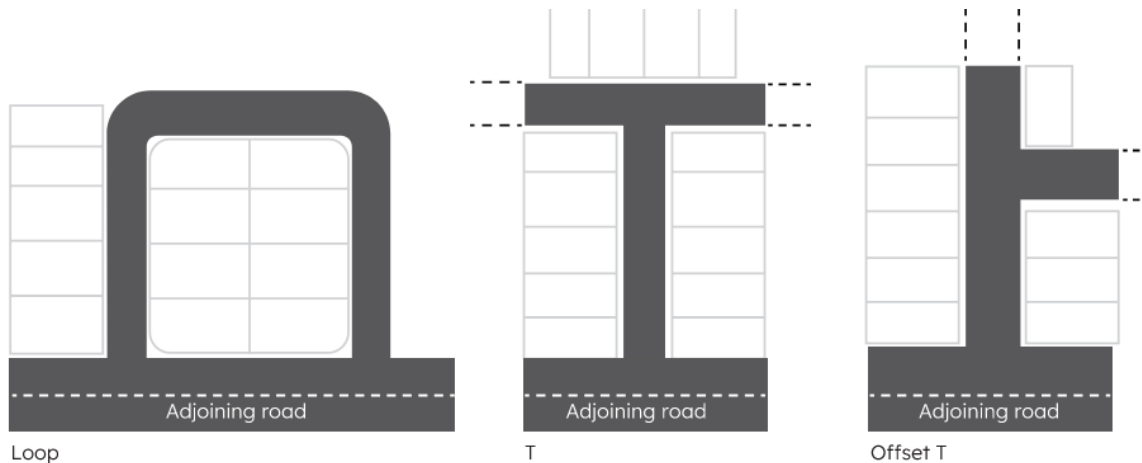


Figure D-19: Turning Design for Subdivision Staging

- At property boundaries it may not be feasible to create a loop or T. Justification shall be provided for any alternate solution that can address the Principal Control.
- Temporary Turning Treatments are to be used only at the property boundary.
- AC wearing course treatment shall be provided due to the heavy screwing and turning movements.
- Temporary turning 'heads' shall provide dimensions in accordance with SD027.

The following temporary turning examples in Figure D-20 are provided for use at site boundaries where other permanent options are not feasible. Refer to the Standard Drawings for further detail. *These are not encouraged internal to the site unless no reasonable option exists.*



Figure D-20: Temporary Tuning Heads (Loop, Offset T and Cul-De-Sac)

Note: This diagram is for illustrative purposes only, turning areas and lots are not drawn to scale.

- Lots will be withheld from the stage where easements for access are needed. Easements to extend 4.5 metres behind edge of turning area.
- Asphalt will be required in the gutter for vehicle comfort and stormwater pits (i.e. double V grate) need to be located at the upstream side
Note: DA approvals that pre-date this version of MoES can use the temporary cul-de-sac provided in MoES Document D: Design.
- Vehicle swept paths may be requested dependant on layout, or type of road. Major trunk roads and commercial/industrial will need to cater for the relevant design vehicle.

5.7. Driveways and Crossings

Also known as footway crossings or vehicle crossing is the section of driveway that crosses the road reserve between the front boundary and the edge of the formed road pavement.

A technical Document is provided for Driveway Crossings as there are multiple ways a driveway can be applied for and required. These include with building construction with a Development Application, Complying Development and simply as a driveway application outside of these processes. Additionally, subdivision of vacant lots also needs to demonstrate that a location for a driveway is feasible in the creation of each lot.

Development must use the Technical Document: Driveway Crossings to demonstrate that a compliant driveway location is being proposed, or for the scenario of a vacant lot that a location can be achieved. Where public infrastructure or safety constraints (e.g. roundabouts, pedestrian refuges, cycle path kerb ramps etc.) limit the driveway to a specific location, the driveway may be required to be constructed at the Subdivision Works Certificate stage.

5.7.1. Driveway Handles (dual)

Driveway handles, including battle-axe handles, can come in a couple of forms. Those are internal driveway corridors within subdivision or easement, and a battle-axe handle within lot access handle or an easement including a reciprocal right of carriageway/right of access.

Council's DCP is the governing document for Development Applications when access easements and handle widths are involved.

5.7.2. Rights of Access and Carriageway (No Handle)

Where site constraints dictate, particularly within the existing built environment, a right of access/carriageway in lieu of an access handle may be considered.

5.7.3. Underground Services

Services, including stormwater conduits, shall be provided within and along the full length of individual access handles.

5.7.4. Driveway Pavement

Driveway pavements shall be provided along the full length of the access corridor handle prior to issue of a Subdivision Certificate in accordance with Standard Drawing SD012, including splays at each end and may be shared between adjoining properties. Pavements within Rights of Carriageway for all zone areas shall be provided as heavy-duty "commercial/industrial standard" slab type reinforced concrete, or to a greater design as determined by expected usage.

In single-lot residential areas concrete drive wheel-strips within the handle length are encouraged in order to reduce impervious surfaces and hard surface expanse. Pavement widths are subject to an assessment for the potential for vehicle-passing and turning movements.

6. Roads For Large Lot Residential

For road dimensions refer to the Road Types - Table C of this Document. Subject to Council approval the following design elements should be applied/considered:

- Road pavements shall be provided with an asphaltic concrete or bitumen wearing surface in accordance with the requirements of this Manual.
- The requirement for a table drains (swale) on the low side of the road is subject to specific design geometry such as downhill batter slope, road longitudinal grade and swale-drain relief. In situations where the batter slope is significant, the longitudinal grade is low, and the catchment area is small the swale may be deleted.
- In lieu of a swale, one-way crossfall on the road pavement against the natural topography is optional.
- Swale (or table drains) that may be crossed for vehicle access should be designed wherever possible to provide vehicle clearances for a dished invert crossing in accordance with AS2890, to avoid the necessity for a pipe crossing. Acceptable grades can often be achieved with reshaping of the natural surface within the property.
- In cut situations where a dished crossing is not practical, a 5 metres long, 375 mm (minimum diameter) Class 4 new concrete or equivalent pipe, with attached sloping headwalls, shall be provided for each lot, preferably in the centre of the lot but subject to adequate sight distance requirements. The pipe size should provide sufficient capacity for the 10% AEP storm event for the contributing catchment area or sized to take the majority of the table drain flow, ensuring that major overflows and driveway overtopping can be contained within the road reserve. Driveway details are shown on Council's Standard Drawing SD013.

7. Rural Roads

Rural roads in this Manual are assumed to be new roads within RU zones that either, service rural properties fronting the road, or roads (new or existing) that extend access to those roads from an existing public road. Such roads do not usually relate to existing rural roads under Council's control, such as a classified "main road", although Council may apply the design principles herein to those roads where works on those roads are necessarily the subject to development consent.

The parameters shown in Section 1.1 of this Document are specific to subdivisions with a minor vehicle catchment; otherwise, rural road and drainage design shall conform generally to the parameters required by Council based on Austroads and TfNSW design guidelines.

7.1. Rural Design Elements

Subject to Council approval the following design elements should be applied/considered:

- Rural roads shall be provided with a two-coat bitumen flush seal wearing surface across the full formation width.
- Table drain (swales) shall be grassed with a stable medium such as a jute-mesh type product or similar means.
- Driveways for vehicle access shall be provided, including a recessed access where appropriate where a vehicle with trailer can park clear of the road pavement.

- Clear zones shall be provided in accordance with the Austroads and TfNSW Design standards.

8. Pavement Design

In general, all infrastructure elements whether public or private including community title subdivisions and lot-specific features must be designed to last for the relevant design life of 25 to 40 years, unless higher durations are specified within MoES or by relevant standards including Austroads and Australian Standards.

The minimum design life for road pavement including public and private (such as community title subdivisions etc.) shall be:

- Flexible, 35years (Unbound Granular and containing one or more bound layers)
- Rigid (Concrete) - 40 years
- Private roads - 25 years including Segmental Block

Road Pavements

All road pavements shall be designed in consideration of design traffic loadings and evaluation of subgrade materials, environmental factors, and available materials.

8.1. Pavement Types

Typical pavement types are as follows:

- Unbound granular flexible pavement which may contain one or more modified layers.
- Bound granular flexible pavement.
- Rigid pavements (concrete)

8.2. Design Report

For purposes of determining an acceptable sub-grade and pavement design, designers should satisfy themselves that the pavement materials will perform to achieve the pavement design life, and that the design will satisfy characteristic deflection testing for construction purposes.

Refer to Document C: Construction and Appendix D for pavement material specifications and testing requirements.

A pavement design for all new road works shall be prepared for approval by Council, subject to a geotechnical engineer's report. The report shall utilise 10-day soaked "Californian Bearing Ratio" (CBR) testing undertaken on the relevant subgrade in accordance with AS1289 and shall recommend a design CBR and a pavement design thickness, determined using the methods outlined in Austroads standards for pavement design, based on Council's minimum standard Equivalent Standards Axle (ESA) requirements. Sub-grade and/or pavement material modification may form part of the design. The geotechnical report and pavement design report shall be submitted with the engineering plans. The engineering plans shall show pavement layer thicknesses (including the nominated ESA and design CBR parameters) based on the reports. Where alternative pavement designs are offered, the alternative design shall be presented by the supervising geotechnical engineer and be submitted to Council's Engineer for approval prior to construction of the pavement. Generally, pavements shall be consistent over long lengths of road, such that alternative designs for short sections of pavement are avoided.

In deep cuttings, fills or other instances where testing of subgrade is not possible until completion of bulk earthworks, pavement design or re-evaluation of a design shall occur upon assessment at subgrade level.

8.3. Minor Pavement Works

For minor works within a public road (isolated minor projects such as short lengths of shoulder, kerb and gutter in-fill, minor road widening or access works) full testing described above may not be necessary, subject to Council's assessment.

Minimum requirements may be as follows: -

- 30 mm AC10 over a 10 mm primer seal or a 2-coat bitumen seal.
- 300 mm minimum compacted thickness of a granular base course material for low-traffic roads (200 mm for very minor traffic loadings) and 300 mm minimum compacted thickness of a heavy bound granular base course for heavy-traffic roads and industrial areas.
- A compacted and stable subgrade.

Alternatively, the developer may submit a design report for alternative pavement treatments.

8.4. As-Built Records

Records of actual pavement construction, including where pavement amendments occurred, or where alternative pavements were approved, together with any subgrade replacement or modification, shall be collated as a final report to accompany the Works-As-Executed (WAE) plans and documentation.

9. Design Traffic Loadings

The design traffic loadings of Equivalent Standard Axels (ESA) are provided in the Road Types table in Section 1.1.10. The nominated values may be increased by Council, subject to an assessment of any special circumstances for subdivision or development, where a higher value is adopted, based on ultimate traffic generation for the catchment area, originating from:

- Strategic planning for future rezoning of land.
- Ultimate development of current zoned land.
- Staging of works and the resultant development and construction traffic.

Council or the TfNSW reserve the right to nominate specific ESAs for Arterial roads such as a State or Regional roads. A general minimum of 1×10^7 will apply.

10. Subgrade Evaluation

Investigation and testing of existing subgrade materials shall be conducted by a practicing geotechnical engineer (Level 1 responsibility AS3798) using a NATA-registered laboratory in accordance with AS 1289.0. A pavement design report including subgrade investigation and 10-day soaked CBR test results establishing the "design CBR" and "shrink and swell results" must accompany the Subdivision Work Certificate or equivalent design approval process and be submitted to Council for approval.

Design subgrade CBR shall be determined in accordance with current Austroads, TfNSW Supplements and Australian Standards. At the time of publication these were Austroads Guide to Pavement Technology - Part 2 Pavement Structural Design', A Supplement to Austroads Guide to Pavement

The testing authority shall confirm in writing that the location and depth of testing has been adequately defined, and what method and survey accuracy was used to positioning and height. The evaluation must assess natural material properties as follows:

- To a depth of one (1) meter below the design pavement subgrade levels (unless rock is encountered).
- With sample data recordings of borehole logs at intervals no greater than 50 metres and testing at intervals no greater than 100 metres.
- In variable conditions, the intervals shall be reduced to each homogenous sub-sections of subgrade.
- A minimum of two (2) samples must be taken for each lot (work lot) and/or road segment.
- Each soil layer with each log shall be tested and the lowest/poorest result used as the governing input for all relevant factors including CBR, shrink/swell/fit for purpose.
- Council must be satisfied that the location and depth of the test samples have been accurately surveyed to ensure they represent material that will remain in place when the subgrade is exposed.

Assessment of the supporting subgrade strength shall conform to Austroads Pavement Design guidelines. All pavement investigations and designs by the geotechnical engineer shall include comments on Austroads AGPT02 and supplements, and TfNSW Supplements, addressing the extent of testing, site investigation, assessment, and pavement design.

The report will include discussion and consideration on section 5.3 AGPT02. Factors to be considered in estimating subgrade support including but not limited to:

- Subgrade variability
- Target compaction moisture content and field density achieved
- Moisture changes during service life
- Pavement cross-section
- Presence of weak layers below the design subgrade level
- What allowances have been made for any changes in subgrade moisture content that may occur after construction while the pavement is in service.
- 5.3.5 Moisture Changes during Service Life including saturation or drying of the shoulders due to influences of street trees, utility crossing, water mains and stormwater
- Expansive soils and Volume changes
- Edge effects generally within the 1 to 2 metres of the sealed surfacing.

Subgrades need to be improved when subgrades are either soft and or expansive in accordance with TfNSW Supplement to AGPT. Table is provided below however further requirements are contained within the supplement.

Table D-13: Design CBR

DESIGN SUBGRADE CBR	CBR < 2.5%	SWELL ≥ 2.5%
< 2%	Working Platform Needed	Working platform and capping layer

≥2%	N/A	Capping layer
-----	-----	---------------

Working platform is minimum 200 mm thick for presumptive CBR 3.

Design provisions shall be provided for Expansive subgrades. 10-day soaks shall be used due to Maitland soil conditions (eg 5.6.2 AGPT02 and Table 6 TfNSW Supplement).

Determination of Moisture Conditions

A select layer shall be added – between at least 300 mm to 600 mm thick as recommended by the Geotech engineer to be fit for purpose and achieve the design life for the reasonable moisture range for the life of the pavement.

The select layer shall be ‘in addition’ to the minimum (Empirical) pavement design as per section 12 below. i.e. Do not use mechanistic design to reduce the buffer distance.

Design of select layer must include:

- permeability < 5×10^{-9} m/s
- CBR > 8%
- swell < 1.0%
- A select (capping layer) shall be between 300 and 600 mm thick as justified by the geotechnical engineer to achieve the design life and project reliability
- Out of specification homogeneous quarry gravel shall be reviewed and approved in writing by Maitland City Council (MCC).

11. Subsurface Drainage

Subsurface drainage must be provided to protect the subgrade and pavement in locations that necessitate its use such as boxed construction, cuttings, or areas with high water tables or in areas where subsurface moisture requires treatment.

Subsoil drainage pipes shall be provided on both sides of road pavements and where required by design, at new-to-existing pavement joints (see SD003, SD035 and SD032)

Where highly expansive soils and/or high moisture conditions are encountered special care should be taken for the placement of subsoil drains with respect to the any potential adverse effects upon the road pavement from significant moisture removal from the deeper levels of the subgrade.

12. Pavement Design

Public road pavements shall comprise of at least one subbase layer and one basecourse layer with a sealed wearing surface. Pavement layers may be combined into a single layer of base course material.

12.1. Flexible Pavement

Pavement thickness designs shall be based upon assessed subgrade strength and the following charts, with the nominate/approved traffic loadings.

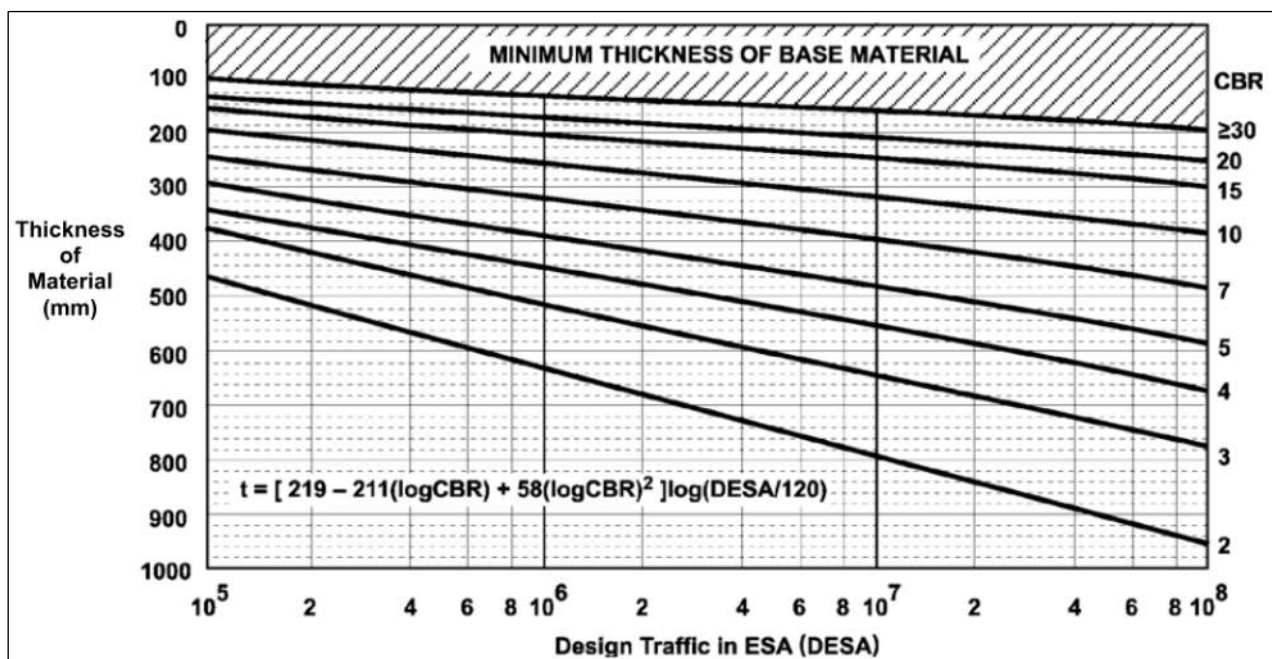


Figure D-21: Design Chart for Granular Pavements with Thin Bituminous Surfacing (Austroads Pavement Design Guide)

The minimum pavement thickness for flexible pavements will be derived as follows:

- Overall pavement thickness shall be a minimum of 300 mm (excluding any select layer).
- The asphalt thickness (AC) shall be excluded from the total granular pavement calculation.
- Base-course shall be determined from the Pavement Thickness Design Chart, where the minimum thickness is 100 mm. Ideally the depth is 150 mm to align with kerb depth.
- Sub-base thickness shall be determined from the Pavement Thickness Design Chart, using the relevant CBR curve by subtracting the base-course layer thickness from the required total pavement thickness. Irrespective of the foregoing, the minimum sub-base thickness shall not be less than 125 mm.
- Any Select or capping layers shall be additional to the minimum pavement thicknesses determined by the charts
- Asphaltic concrete (AC) thickness shall have a minimum thickness as follows
 - Local Streets up to 4×10^5 - 30 mm thick AC10 mix.
 - Design traffic over 4×10^5 - 45 mm thick AC14 dense graded mix.
- The pavement designer should be satisfied that the design will meet the requirements of this Manual in respect to permissible deflection and pavement life.
- Where a combined sub-base/base single-layer (with for example bound materials) pavement is proposed, a geotechnical engineer shall report on the proposal, nominating the materials (source) and relevant compaction and testing methods.
- Base-course for rural roads is shown in the Pavement Thickness Design Chart below. Overall pavement thickness shall be a minimum of 300 mm.

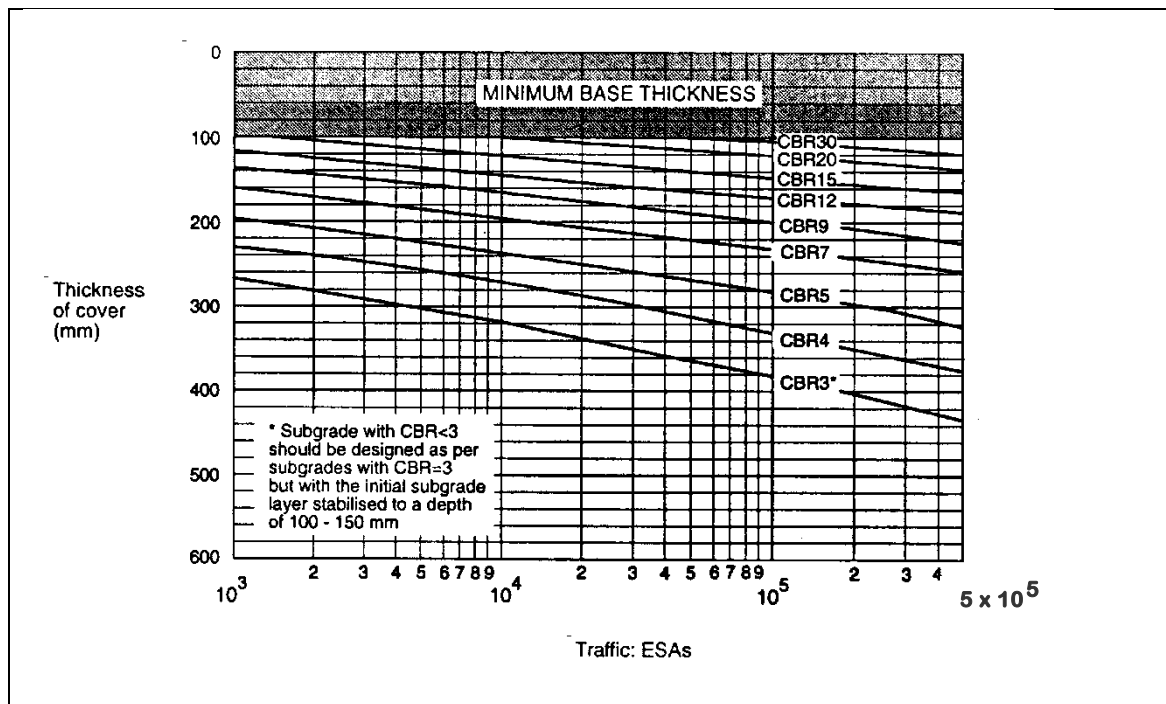


Figure D-22: Design Chart for Granular Pavements with Thin Bituminous Surfacing (Based on a 90 percent confidence level for minor rural roads).

12.2. Rigid Pavement (Concrete)

Rigid pavements on public roads shall be designed in accordance with the following documents:

- Concrete Pavement Design for Residential Streets - Cement and Concrete Assoc. of Aust.
- Pavement Design - Austroads Standards
- TfNSW supplements and directory notes to Austroads standards.
- TfNSW Concrete Pavement Manual.

Minimum thicknesses shall be:

- Sub-base - 150 mm minimum
- Base - 170 mm minimum

The base shall be jointed, reinforced concrete.

Details prepared by an engineer, are required for (but not limited to):

- Subgrade preparation to achieve a design CBR.
- Rigid Pavement thickness and design: Determine the pavement thicknesses/design as follows:
 - Design traffic up to 10^6 ESAs will use Austroads AGPT02 (including Figure 12.2 for Ver 2019).
 - Design traffic over 10^6 ESA will use Austroads AGPT02 (including Figure 8.4 for Ver 2019).
- A nominated maximum slump and testing procedure
- A proposed thickness for sub-base and base courses
- Steel reinforcement
- Joint types and locations

- Interface treatments between layers.
- Placement, compaction, surface texture and curing methods.
- Nominating the finished surface to be rake-textured in accordance with the TfNSW rake specifications.
- Nominating the application of a curing agent.

12.3. Segmental Block Pavement

Segmental block pavements, where permitted, shall be constructed of concrete or clay pavers. Such pavements shall be designed in accordance with the following: -

- Clay segmental block pavements: -
- Up to 10⁶ ESAs – Clay Segmental Pavements – Design manual, Clay Brick and Paver Association.
- Between 10⁶ ESAs and 10⁷ ESAs – The design will involve the above document and Austroads Pavement Design Manual with the method producing the thicker design to be adopted.
- Over 10⁷ ESAs – Austroads Pavement Design Manual.
- Concrete segmental block pavements.
- Up to 10⁶ ESAs – Cement and Concrete Association Technical Note 35.
- Over 10⁶ ESAs – Austroads Pavement Design Manual.

Concrete pavers shall be 80 mm thick Shape ‘A’; clay pavers being 65 mm thick Class ‘4’ being laid in a herring bone pattern. All areas of block paving shall be provided with a suitable concrete edge restraint. Large paved areas shall be bedded and laid in accordance with the supplier’s guidelines. Allowance must be made for an adequate number of expansion joints and restraining beams.

Shape “C” concrete pavers may be permitted in small infill areas such as residential street thresholds. (see below)

12.4. Accessways

Accessways to specialty-use areas or facilities such as public utility plant, parks, pollution control devices etc. where heavy vehicles are expected to gain access, shall be a minimum of 3.5 metres wide and constructed in concrete in accordance with the publication by the Cement and Concrete Association of Australia – “Concrete Pavement Design for Residential Streets”. Generally, the following parameters shall be maintained (see SD012):

- 150 mm thick.
- 32 MPa 28-day strength.
- Two layers of SL72 mesh fabric.
- Sub-base, 100 mm compacted thickness of “road-base” material.

12.5. Roundabouts Pavements

All roundabout road pavements servicing industrial subdivisions or commercial areas shall be constructed of fibre reinforced concrete in accordance with TfNSW TS 02764 Concrete Roundabout Pavements or greater.

All roundabout road pavements servicing residential subdivisions shall be constructed of 190 mm AC base and wearing course (A15E binder) with heavily bound sub-base or 5 MPa concrete sub-base.

Council may require a concrete roundabout for significant locations such as large sub-arterial roads, large numbers of heavy vehicles or other.

Adequate design capacity and strength, with a 40-year (min) design life for concrete. For other pavements add additional ESAs to the largest connecting road type (see section on pavement design). Increased heavy vehicles may need additional ESA considering Industrial or sub-arterial sized ESA's. See Rigid Pavements.

12.6. Intersection Thresholds

Where intersection thresholds are approved, they shall be provided in accordance with Standard Drawing SD025 – sheet 1, as a “heavy duty” plain concrete pavement as shown on SD012, with reference to SD026 where a dished drain is necessary.

Coloured concrete is not considered a satisfactory long-term treatment, but where approved, colour additive must include hardener (75-90 mPa), be applied as a minimum of two coats and be sealed with a polymer solvent-based sealer. Texture may be applied to a maximum depth of 5 mm.

12.7. Pavement Joints

All vertical pavement joints (new-to-existing), whether longitudinal or transverse, shall be benched a minimum of 300 mm. (with reference to SD032). Pavement joints and the wearing course shall be positioned away from under wheel paths to avoid accelerated wear and cracking.

Unless the adjoining pavements consist of the same material, and satisfactory compaction bonding of those materials can be achieved, subsoil drainage shall be provided in accordance with TfNSW QA Spec TS 03261 “Intra-pavement Drains” (Old number: IC-QA-R37) at the direction of Council or the geotechnical engineer.

13. Wearing Course

For the application of bituminous surfacing, refer to Document C: Construction.

For alternative decorative finishes, Council's approval is required to use such finishes in public roads. Smooth and/or irregular surfaces for roads and footway crossings, such as “deep-stamped” or “exposed river gravel” paving, is not permitted. Supporting documentation shall be submitted with any request to decorative finished products and shall include: -

Full specifications of the product.

- Durability and colour fastness
- Skid/abrasion resistance.

14. Existing Pavement Reconstruction

Where required by Council, existing road pavements shall be reconstructed, rehabilitated or re-surfaced. A pavement design shall be prepared for and approved by Council based on this Document adopting an ESA value as determined by Council.

Where new works abut an existing natural gravel pavement, it is preferred that the new pavement materials be an approved natural gravel in accordance with the specifications of this Manual. (Refer to “Pavement Joints” above).

Circumstances where construction works may be necessary are:

- Where either the existing pavement or surface quality are assessed by Council as incapable of sustaining the additional traffic loads from the development.
- Where vehicle turning movements occur, such that an asphalt wearing surface is appropriate to control premature surface deterioration.
- Where a longitudinal surface profile is significantly irregular.
- Where surface shape (e.g. crossfall) does not conform to standard design parameters.
- Where small local “patching” type pavement failures are required by Council.
- Where works coincide with Council’s Forward Works *Management Plan*.

The limits of such works shall be determined by Council, but will normally be applied to development that:

- Creates new intersections onto an existing road.
- Requires shoulder or parking lane works.
- Warrants new or replacement kerb and gutter.
- Has frontage to or requires vehicle access along an existing road that exhibits stress and/or has significant surface deterioration, and (subject to geotechnical testing) exhibits a failure to meet design requirements in this Manual.

Best design practice shall be employed such that a holistic approach is achieved, eliminating partial (“patchwork”), or part-lane, pavement sections.

15. Stormwater Drainage

General

This Document addresses stormwater design for the development of land (principally as greenfield subdivision sites) and does not assume coincidental influence from Hunter River flooding beyond normal flow levels, nor addresses drainage structures which may be affected by flooding of the Hunter River. Drainage structures inundated by such flooding are not prohibited by this Manual, although particular requirements may apply.

Stormwater drainage systems shall be designed to achieve the following goals:

- An underground “minor system” of conduits that eliminates inconvenience to traffic and pedestrians.
- An overland (open-style) “major system” that conveys stormwater flows within suitable velocity/depth limits, located within public land for residential zones, or where approved or unavoidable or undesirable, within private land (in rural zones), covered by an easement. Major drainage at road crossings will be constructed as drainage culverts.
- Detention of stormwater flows that mimics natural, pre-developed flows for all storm events up to and including the 1% AEP storm event.
- Retention of stormwater flows to achieve target water quality standards.
- Control of stormwater flows to minimise the impacts of erosion and sediment in the environment.
- Consideration of upstream and downstream catchments in their ultimate developed state to achieve a total system which does not adversely affect existing systems or properties within the flow path and catchment.
- Minimisation of the maintenance burden of Council
- Enhancement of the urban landscape.
- Employment of principles of Water Sensitive Urban Design and Stormwater Reuse.

16. Design Standards

Drainage design for roads, reserves, and inter-allotment systems the subject of this Document, shall adopt the principles of a major/minor drainage system in accordance with the current publication of Australian Rainfall and Runoff (ARR) and Australian Runoff Quality (ARQ) and as specified in this Manual. Other accepted reference material may be used, with acknowledgement.

All calculations must be carried out by competent persons, qualified, and experienced in hydrologic and hydraulic design, utilising drainage models that are accepted as current industry standards.

The requirements of Council’s Hunter River Floodplain Management DCP shall be observed for all developments.

17. Hydrology

17.1. Rainfall Data

Rainfall Data and other parameters shall be derived in accordance with ARR for the particular location and catchment. The ARR Hub and Bureau of meteorology websites provide details.

MUSIC Input Parameters for the Maitland area may be available from Council.

17.2. Annual Exceedance Probability

Minimum design Annual Exceedance Probability (AEP) for the major/minor systems are:

Table D-14: Minor System

MINOR SYSTEM	AEP (%)
Residential 'R1' & 'R5' (Streets and IAD)	10
Business 'B' & General Industrial 'IN' (Streets and IAD)	10
Public & Drainage Reserves (acting as flow paths)	10 ⁽¹⁾
Rural 'RU' - Longitudinal Drainage	20

Table D-15: Major System

MAJOR SYSTEM	AEP (%)
Urban Trunk Drainage Conduit at Road Crossing	1% plus freeboard ^(2,3)
Rural – Low-point Culvert Crossings	5 ⁽⁴⁾
Overland Flow Paths & Trunk Drainage	1 ⁽⁵⁾
Structural Adequacy of Major Drainage Items	PMF ⁽⁵⁾
Land Depressions with No Outlet	PMF
Safety: Pedestrians and Vehicles Safety: Vehicles only	0.4 m ² /s. Max velocity x depth product and 0.2 m max water depth 0.6 m ² /s. Maximum VxD

Notes:

- 1) May be reduced (minimum being 20% AEP) only in special circumstances, subject to specific design merits.
- 2) See Sections 20. Open Channels and 21. Major Drainage Structures of freeboard. Freeboard at the road reserve could be ignored for local streets (excluding trunk roads) if velocity x depth product is achieved, and alternative routes exist.
- 3) Depending on road hierarchy. Typically (subject to Council approval), Distributor Roads and higher should provide flood-free access up to the 1% AEP. Lower order roads may be inundated, with a design aim to maintain at least single-lane traffic movement in the 1% AEP.
- 4) Applies to minor roads. The 1% AEP event shall be catered for, typically including a causeway with signposting and water depth markers.

- 5) Probable Maximum Flood (PMF), to ensure that major drainage will not be washed away if overtopped or flooded.

As a first step approach, the designer should attempt to contain the whole of the major storm discharge within the road and footway cross section. (see ARR: Book 9 Runoff in Urban Area, Chapter 5: Stormwater Conveyance).

Trunk drainage system (major) shall be provided when the minor system exceeds 10% AEP, or under road pipe size is unreasonable, generally 15 hectares maximum catchment need to convert to major system open channels or similar. See D19.1 Overland Flowpaths

Council may require that the design AEP's for the subject drainage system be varied in certain circumstances.

17.3. Catchments

The catchment at an outlet is defined as the limits from where surface water will make its way by either natural or manmade features to this outlet.

Catchment area land-use shall be taken into consideration and be based upon current and possible future planning constraints and zonings. The ultimate developed state of each catchment shall be adopted. Notwithstanding the table below, in some areas Council may nominate design parameters regarding higher urban density uses.

Catchment plans showing the proposed pipeline layout shall be included in Engineering Design plans.

17.4. Fraction Impervious

Hydraulic calculations shall be based on the following fraction impervious figures:

Table D-16: Fraction Impervious Rates for Land Uses

LAND USE	FRACTION IMPERVIOUS (MAX)
Residential Low Density (Min lot size – m ²)	
<1500	0.75
1500 to <2500	0.5
2500 to <4000	1000 sq.m
Over 4000	1250 sq.m per lot
Medium Density Residential Zones and Small Lot Density	0.8
Road Reserve	0.8
Business Areas	1.0
Industrial Areas	0.9

Active open space - Public Recreation Areas (mowed and with improvements)	0.4
Passive open space - Parkland, Natural Public Reserve	0.1

17.5. Coefficient of Runoff

Coefficients of runoff shall be determined in accordance with ARR. Full details of coefficients used shall be provided in the calculation documents.

17.6. Partial Area Effects

17.7. Rational Method

Rational method has predominantly been superseded in ARR and may only be used for small scale developments at Council's discretion. Rational method calculations to determine peak flows shall be carried out in accordance with ARR, utilising the Kinematic Wave equation or an appropriate computer programme. Time of Concentration and modelling parameters shall be in accordance with ARR. The surface roughness coefficient, pipe capacity check, and pit inlet efficiency are provided in Appendix C.

17.8. Hydrological Models

Hydrologic and hydraulic models (such as RAFTS, DRAINS, MIKE 11, or HECS-RAS) shall be utilised for subdivisions and large-scale developments, providing the requirements of the latest ARR are met. Summary of calculations shall be provided within Engineering plans. Where computer analyses are used, details of all programme program input parameters and output data files shall be provided in the stormwater report.

18. Hydraulics

18.1. Hydraulic Grade Line

Hydraulic calculations shall substantiate the hydraulic grade line (HGL) adopted for the design of the system and shall be shown on the drawings.

Controls for a downstream hydraulic grade line design are as follows:

- Hydraulic grade line levels based on downstream calculations including pit losses at the starting pit in the design event.
- If the downstream start point is an existing pit and the HGL is unknown, a level of 0.15 metres below the pit inlet in this pit shall be adopted.
- If the downstream start point is an outlet into an open channel and;
 - the design storm is the minor event, the outlet pipe shall be the downstream control,
 - the design storm is the major event, and the design flood levels in the channel are unknown, the top of the outlet pipe shall be the control,
 - The flood levels are known, the control shall be 1% AEP flood level.
- Where appropriate the Hunter River Flood shall be considered as an outlet control.

- The HGL level in drainage pits shall be not higher than 150 mm below the top of the inlet grate, gutter, or lid in the minor storm event.

18.2. Underground Drainage System

Drainage systems shall be designed as gravity systems and as an overall pipe design having due regard to upstream and downstream systems.

Dual pipes are not supported longitudinally under pavement/kerb (including piping above 10% AEP).

18.2.1. Pipe Conduits

Minor drainage pipe/conduit systems shall conform to the following requirements:

Table D-17: Piped Conduit Requirements

PARAMETER	REQUIREMENT
Minimum Pipe Size	375 mm
Minimum Box Culvert Size	600 mm wide x 300 mm high
Minimum Flow Velocity	0.6 m/sec.
Maximum Flow Velocity	6.0 m/sec ⁽¹⁾
Minimum Pipe Grade	0.5% ⁽²⁾
Minimum Pipe Class	2 for drainage reserve, 4 under kerb line and road crossings .
Pipe Depth - Under road crossings and longitudinal ⁽³⁾ and to upstream subdivision/sites	1.1 m between top of collar and invert of kerb

Notes:

- 1) If exceeding, subject to greater scouring considerations and velocity/depth coefficient.
- 2) Unless otherwise approved in writing by Council Engineers.
- 3) Pipes should be provided with sufficient cover to avoid conflicts with service conduits (see pipe depth), ensuring adequate protection from damage during construction and to prevent pipe collars from protruding into the road pavement.

Pipe size reduction, from large upstream pipes to smaller downstream pipes is not permitted, unless approved in writing by Council.

The designer shall nominate on the plans all specific pipe details and their alignment and level. All drainage pipes within Council controlled drainage systems and to be dedicated to Council shall be

reinforced concrete rubber ringed jointed (RCP) spigot and socket type. Concrete pipes shall comply with AS 4058 "Precast Pressure and Non-Pressure Pipes". The class of pipe proposed will be determined to suit the design use and shall comply with the Concrete Pipe Association of Australia (CPAA) minimum cover or Australian Standard 3725 "Loads on Buried Pipes" requirements. Fibre reinforced (FRC), Blackmax and plastic pipes are not permitted for public system.

18.2.2. Box Conduits

Precast reinforced concrete box culverts (RCBC) shall comply with AS 1597. The minimum size shall be 300 mm high by 600 mm wide. Only cast in-situ slabs are permitted for box culverts in public ownership, precast base slabs are not supported.

18.2.3. Pipeline Radii

The minimum radius on which pipes may be laid shall not exceed the manufacturer's recommendation. Where smaller radii are required, the designer should consider short pipe lengths, extended collars, or alternative chord configuration.

18.3. Trench Stops

Thrust blocks/collars shall be provided generally where pipe grades exceed 12% and/or in embankments for storing water, to prevent seepage piping.

18.4. Pits

18.4.1. Pit Inlet Capacity

Blockage factors of 0.5 (50% blocked) for sag and 0.8 (20% blocked) for on-grade pits shall apply in the major storm calculations. Consideration of applying a factor to the minor storm should be considered where excessive debris is very likely to be a factor.

18.4.2. Pit Locations

Pit locations shall be provided to:

- Prevent ponding.
- Allow change of alignment, grade, or pipe size/number.
- Enable adequate vehicle entry points to lots. Preferably, pits should be located:
 - In the central section of lot frontage in residential areas, and
- At the high side of each lot in industrial areas, immediately downstream of the prolongation of the common side boundary, in order to provide direct discharge points for each individual lot, and/or IAD drainage systems.
- Prevent gutter flows crossing an intersection and/or a pram ramp.
- Limit flow widths to table below:

Table D-18: Overland Flow Parameters (10% AEP)

GUTTER FLOWS	WIDTH
Gutter Flow at Intersection	1 m
Gutter Flow at Bus Stop and Pram Ramps	0.5
Gutter Flows General	2*
Pits Upstream of Kerb Returns	<30 m radii
*During major storms, one lane in each direction of travel free of water must be achieved in a multi-lane road and a width of 3.5 m (one lane width) clear of water down the centre for residential streets. Water depth shall be limited to top of kerb to prevent flow from the roadway entering onto the property.	

Subject to the above table, the maximum recommended spacing of pits is: -

Table D-19: Maximum Pit Spacings

PIPE SIZE	SPACING
Less than 1200 mm	80 m
1200 or larger	100

18.4.3. Pit Construction

Pit Construction shall conform to Council's Standard Drawings. Non-standard pits include; pits greater than 2.5 metres high or 900 long, or 1450 wide and with oversized soffits, should try to be avoided. Where needed shall be designed by a structural engineer, and the details provided in Engineering design plans.

Pre-cast pits for public infrastructure

- have structural certification and list conformance to relevant Australian Standards.
- shall be a minimum 150 mm thick for pipes of 600 mm diameter or over.
- <600 diameter pipe shall be a minimum 150 mm thick wall for every component (pit, riser, etc).
- all protrusions including pipe and subsoil are to be provided. No cutting or modifications are allowed as structural certification will be voided.
- 100 mm cover of all block-outs to internal side walls, top edges and soffit, (subsoil on merit).
- shall only be 4 sided rectangular pits.

- minimum 200 mm clearance from top of soffit to bottom of precast lintel/grate units i.e. 350 mm from top of soffit to seal/lip of gutter
- rebates shall be provided at lift joints; flush joints are not generally acceptable.
- Not appropriate for multiple culvert or pipe protrusions within the same wall (excluding subsoil systems).

18.4.4. Extended Kerb Inlet (EKI)

Lintels shall have a desirable maximum nominal length of 3.6 metres and a minimum nominal length of 1.8 metres. In brownfield developments, a minimum nominal length of 1.2 meters may be considered under extreme circumstances and limitations.

The general maximum in industrial areas shall be 2.4 metres to avoid potential breakage due to heavy loads. Nominated kerb inlet length refers to clear opening length, (refer to SD039 for details). A 150 mm minimum race depth shall be provided at lintels.

18.4.5. Step Irons

Step Irons shall be provided in pits deeper than 1.2 metres from pit invert to top of kerb. Step irons are to comply with AS1657 and start no lower than 600 mm below invert of gutter with 300 mm spacings.

18.4.6. Benching

Provide benching in pits to reduce ponding and sediment, and improve hydraulic efficiency.

18.4.7. Grates

Grates shall be provided at all pits unless directed by Council or as specified on the plans. Grates in road/public lands shall be provided with lock-down 'J' bolts. Road gutter grates shall be a minimum of 900 mm long and shall include RHS steel reinforcement supports of the grate at both the lip line and the gutter line. Grates in pathways shall be "bicycle safe" to avoid tyres entering grate, to the manufacturer's recommendations.

Grate loadings shall conform to the intended use of the grate or adjacent area.

Class B type grates may be utilised in parks and reserves. Class D type grate shall be utilised in roads.

Grates within flowpaths such as table drains, catch drains and watercourses, shall be "raised" (see SD041).

Grates which may be subject to blockage by tree branches, twigs, leaf litter etc, shall, unless approved otherwise by Council, be typically an TfNSW "median pit" raised grate TfNSW Drawing No. R0220-52 (Old number:R11.B33.A.1) or similar, providing a grid opening of 150 mm x 200 mm.

18.5. Hydraulic Losses

The pressure change coefficient "K" shall generally be determined from the 'Missouri Charts' and the 'Hare Equations'. The Hare Equations shall only be used as a guide and the Missouri Charts shall have precedence where discrepancies between the two exist.

Computer program default pressure change coefficients (K) shall not be acceptable unless they are consistent with the above statement.

Pipe friction losses and pipe sizes in relation to discharge shall be determined using the Colbrook White Formula with the following coefficients for roughness (see Table D-20), unless circumstances exist that may give effect to “poor” pipe surface quality:

Table D-20: Pipe Friction Losses

PIPE TYPE	ROUGHNESS COEFFICIENT
Concrete Pipes	0.15
FRC, PVC, PE, PP	0.03

19. Overland Flow Paths

Flow paths shall be provided to convey runoff from rainfall events that exceed the minor pipe system capacity. Flow paths shall cater for the 1% AEP flows. These flow paths shall be in public roads and drainage reserves linked to provide a continuous flow at acceptable velocities and depths.

For reasons of public safety, the coefficient of velocity and depth, should not exceed 0.4 for the major storm event ($v.d < 0.4$). Higher velocity, depth products may be permitted by Council where a risk assessment shows limited adverse effect to public safety such as in rural areas.

Where flow paths other than the normal road reserve are necessary, the minimum corridor width shall be minimum 3.5 metres running parallel to a road reserve and shaped to contain the 100-year flows within an open channel (major system drainage). Overland flow paths as ‘pathway corridors’ between lots are not supported in low to medium density residential areas due to poor CPTED. See D 1.3.2 When running along open space, etc, where one side has full casual surveillance, should have as a minimum treatment a concrete invert, and the remaining area of the flow path fully turfed with couch grass (beyond any concrete paving). The flow path shape shall provide reasonable access for vehicles where necessary for maintenance purposes and on the low side of a road should incorporate a weir within the section of the footway crossing, ensuring that property boundary levels are flood-free (with 100 mm minimum freeboard), thence graded to direct the major storm flow downstream. A Typical flow path section is shown on Standard Drawing SD037.

Overland flowpaths (public stormwater) are not supported over private property and should be dedicated as drainage reserve. Large lot rural zones can be considered for easement over existing gullies. Any agreement for easements across private property will only be accepted if the piped system and pits are designed for the 1% AEP flows, with a 50% blockage factor applied for pit entry capacities. An emergency overland flow path, over the piped system, shall be provided. The easement surface/shape shall be protected against alteration or by obstruction by a “restriction” on the property title, and by the construction type (i.e. concrete invert to appropriate scale of the flows). Overland flowpath shall be a minimum 300 mm deep trapezoidal channel and maximise the width of the easement width, and convey at least 50% of the 1% AEP volume.

19.1. Freeboard

For the calculated 1% AEP flow level in the road gutter and for major flow paths in drainage reserves, a minimum of 100 mm freeboard (being measured from the top of water level) shall be provided to properties boundary surface levels. Particular care should be given to properties at levels lower than the footpath or reserve. Where design allows, greater freeboard heights should be achieved.

20. Open Channels

Open channels generally form part of the trunk drainage system that cater for the major events (1% AEP) and shall be designed with smooth transitions with adequate access for maintenance and cleaning.

Design of open channels (including safety and maintenance matters) shall be in accordance with ARR providing:

- A minimum of 300 mm of freeboard to the top of the channel (600 mm in mine subsidence areas).
- A minimum of 500 mm freeboard to adjacent dwelling floor levels.
- Maximum side slopes on conventional grass lined channels shall be 6H :1V for grassed batters for mowing, 4H:1V for landscaped.
- Friction losses in open channels shall be determined using Mannings “n” values, or as approved by Council.
- Provision for low flow structures within open grass lined channels shall be provided. In addition, subsurface drainage may be required to prevent water-bogging of the channel bed. The low-flow design parameters shall be nominated in the design and be approved by Council.
- Open channels need to provide all-weather maintenance access along drains and open channels starting from a public road. Provide a minimum of 200 mm thick 3 metres wide gravel track, or concrete access depending on the scope and nature of the drain. The access may be required on both sides where the arm reach of maintenance machinery is exceeded. Turning paths shall be provided to accommodate the excavator and dump truck.

The following design features should be avoided:

- Hydraulic jumps/supercritical flow
- Transitional changes in cross section
- Superelevated flows

Channels shall be signposted with a “WARNING” sign in accordance with Standard Drawing SD038.

21. Major Drainage Structures (Bridges and Culverts)

Major structures shall be designed to cater for the AEP event. Major structures in rural areas shall be designed to accommodate flood events as nominated by Council. Bridges shall generally be designed to provide a waterway area catering for the 1% AEP event for the contributing catchment, including afflux (300 mm minimum), any freeboards and blockage factors.

A certified structural engineer’s design shall be required for bridges and major structures and shall be in accordance with Australian Standard AS5100, and culverts designed in accordance with Austroads Waterway Design.

22. Stormwater Volume and Quality Control

The purpose for the control of flowrate and quality of stormwater runoff from new development is to minimise potential adverse effects generated from development on the downstream environment, and to maintain as close as practically possible the pre-developed flow regime, with the employment of storage structures for detention or retention such as earth basins, usually incorporating pollution control facilities (wetlands, concrete GPT’s etc).

22.1. Detention Basins and Ponding Structures

The basin access must meet the following design requirements:

- Freeboard above 1% AEP in any basin is 500 mm to floor levels.
- The gravelled access track around the perimeter of the basin shall be 3 metres wide on straight sections and 4 metres wide on bends, with a minimum design (inside) turning radius of 10 metres.
Note: A swept path plan for maintenance vehicle movements (MRV) around the track may be requested by Council when irregular geometry warrants.
- A concrete access must be provided from the road pavement to the GPT areas and to the boundary of the public drainage reserve, connecting to the 3 metres wide gravel maintenance track with a minimum thickness of 200 mm.
- A concrete turning head constructed in accordance with SD027 standards shall be provided where required to facilitate forward exit movements for maintenance vehicles. The turning head may form part of the access track perimeter.
- A concrete surround with adequate space adjacent to the concrete GPT opening must be included for maintenance crews to stand while operating the sucker hose for cleaning. Dimensions should be determined in consultation with Council.
- A 3 metres to 4 metres offset from the outside edge of the access track to the property boundary and/or fences must be provided for safety of loading trucks, as well as for excavator turning and other.
- For maintenance purposes of basin and other structures, vehicle access around the item shall be an all-weather access road.
- Access to and including the standing area to GPT's shall be provided as concrete. T head turning shall be included unless reversing is in a straight line and less than 20 metres in length.

22.1.1. Type and Location

Basins and structures come in different types including wet or dry. Wet basins may include an artificial wetland facility, that incorporates a deep-water zone.

Dry basins drain to empty but may include a bio-retention treatment and/or a localised silt trap at pipe inlets. The minimum slope of a dry basin floor should be 2%. Maintenance practices of the floor should be considered if floor widths exceed practical machinery reach from the banks.

Location and Positioning

Basins and structures must be located immediately against a public road where they are readily accessible by maintenance vehicles from a public road, must be contained within a public Drainage Reserve and have casual surveillance for public safety, and preventative anti-social behaviour. The long side of the basin should adjoin the road and achieve surveillance from the (centre of) dwelling frontage of two (2) lots to each area of the drainage reserve. Note: Lots can look across a road.

Location to Flood

Basins are discouraged from being within the 1% AEP flood waters. The LEP, DCP and adopted flood policy set the policy on flood matters and locating any basins or significant stormwater structures within the flood. Consult those documents for any assessment requirements if proposing to move into the flood area. Even when adjacent to the flood zone a design should achieve its maximum elevation

(RL) to limit inundation by flood waters. The lowest desirable level of the spillway shall be higher than the 5% AEP event even when basin walls are located outside of the 1% AEP contour.

22.1.2. Capacity and Discharge

Detention basins retaining stormwater runoff shall be designed so that peak discharges from new development are not increased beyond that of the pre-developed environment for the critical storm events up to and including the 1% AEP event. Basin design should result in a “flowrate which fills the basin to the greatest extent, or possibly the longest time. Where a drainage system is complex, it is likely that storms of different durations will be critical for various parts of the system” (ARR). To satisfy this requirement it is expected that a multi-staged outlet will be necessary to control the outflow, ensuring adequate flow-rate control for the more frequent storm events. A drainage report and calculations shall accompany the detailed design proposal.

Flood routing should be modelled by methods outlined in this Manual and shall include assessment for a basin catering for the total contributing catchment, inclusive of the catchment with its potential of being fully developed.

22.1.3. Overflow

The overflow weir, or high-level outlet for any basin shall be set at a level and have the capacity to maintain the 1% AEP flood event for the approved detained discharge rate.

The overflow weir (and spillway) should be designed in accordance with weir design principles. The weir crest shall be constructed in concrete, keyed into the embankment, and be designed to avoid possible failure in extreme storm events (greater than the 100yr event). The spillway down the embankment wall and at its toe should be protected from erosion with, as a minimum treatment, an approved robust stabilised (reinforced) earth/turf treatment including protection against turbulence/erosion at the embankment toe.

22.1.4. Outlet

Pipe systems shall contain the design outflow through the detention basin embankment with suitable bulkhead (trench-stop) protection to prevent water infiltration and “piping” between the conduit and the surrounding material. The pipe inlet structure shall be designed to avoid blockages, where a catchment may be the source of significant amounts of vegetation matter (see “Grates” above). Outlets shall include a device for energy dissipation.

22.1.5. Water Depth

Temporary water depth calculated for the 5% AEP event, in either a wet or a dry basin, shall be limited to a maximum of 1.2 metres (above either permanent water level, or dry floor). Where justified by reason of restrictive access, available area or other reasons, a greater depth may be considered.

22.1.6. Embankment

The following batter slope requirements apply:

Table D-21: Basin Embankment

STORMWATER BASIN SLOPES	MAXIMUM SLOPE
Internal Batter below Top of Embankment	1:6 grass or (basin) landscaped*

Internal batter slope above floor/Permanent Water Level PWL	1:6 grassed or landscaped*
External batter slope below basin embankment	1:6 grass or landscaped* 1:4 (basin) landscaped where topography or area is restrictive (needs 1:6 mowing between landscaped and private boundary)
Submerged batter for 500 mm below PWL	1V:8H
Max submerged batter after ledge	1V:3H
Above embankment and the maintenance track	1V:3H landscaped*

Note: (Basin) *Landscaped refers to native grasses, small shrubs (600mm max height) and groundcovers but excludes trees. See landscape requirements for stormwater.

The embankment shall be designed, and supervised in construction, by an engineer. The embankments shall be founded on and bonded to sound natural clay material incorporating a keyway and be compacted to (density and moisture) specifications prepared by a geotechnical engineer. Full details shall be shown on the plans. The embankment, batters and basin floor shall be fully turfed with couch grass.

22.1.7. Dams

Existing dams that are intended to remain or be adjusted for use as part of a detention system shall be reported by geotechnical investigation for adequacy for the purpose. The report shall be submitted as part of the engineering design.

22.1.8. Gross Pollutant Traps and Basin Inlets

All basins should incorporate permanent concrete Gross Pollutant Traps (GPT), to collect silt, trash, and litter from the road drainage system. Plastic and fibreglass GPT units are not accepted for public drainage systems.

As a temporary arrangement, road drainage discharge should be treated, within the basin floor with a sediment-pond/silt-trap. This area should generally be confined to the basin inlet pipe discharge point(s), being located and/or protected (e.g. off-line to accept minor flows only) to avoid scour and dislodgement of sediment. Such traps may eventually become redundant upon stabilisation of the subdivision catchment and may be removed by Council.

A note shall be included on the plans to ensure that the pollutant traps shall be cleaned out prior to issue of “practical completion”.

Where practical, basin inlet pipes for inter-allotment drainage may be separated from the road inlets and associated pollution controls due to the relatively “clean” nature of the stormwater discharge.

22.1.9. Safety

Detention basins shall be signposted with a “WARNING” sign in accordance with Standard Drawing SD038.

The designer shall take into account the requirements (in terms of potential risk/threat to downstream property/community) of the NSW Dams Safety Committee regarding a basin/dam proposal making reference to the NSW Dams Safety Act. Inlet and outlet pipes must be adequately screened with child-proof grates if they are large enough for children to enter or for flood safety reasons.

22.1.10. Access for Maintenance

The basin access track shall be of compacted gravelled 200 mm minimum thickness on a compacted and stable subgrade. For large basins, the track may need to be continued to the basin floor for maintenance of the biofilter. The crossfall of the access shall be maintained at the standard 3% (maximum 5%). Access grades and changes in grade are to comply with AS2890.2 for a medium rigid design vehicle. Suitable turnings shall be provided as necessary to facilitate service vehicle turning manoeuvres and enable the service vehicles to exit the basin area in a forward direction.

22.2. Stormwater Quality

Stormwater runoff from areas that may be a source of pollutants, such as roads and gardens, shall be treated to provide a means of “polishing” of the runoff prior to its discharge beyond the site. Constructed wetlands, bio-retention filters, silt traps, gross pollutant traps etc, shall be employed for this purpose. Exposed areas of soil/gravel shall be stabilised against erosion.

Design and construction parameters for constructed wetlands, silt traps, swales, bio-retention filters, etc, shall be determined with recognised computer software such as *MUSIC*, with supporting reference made to the publication “*The Constructed Wetlands Manual*” (1988); Water by Design publication “*Construction and Establishment Guidelines - Swales, Bioretention Systems and Wetlands*”; Landcom publication “*Managing Urban Stormwater - Soils and Construction*” or their equivalent.

The following table shall be used as a target for pollutant retention goals.

Table D-22: Post Construction Stormwater Management Targets

POLLUTANT	RETENTION CRITERIA
Suspended Solids	80% of average annual load
Total Phosphorus	60% of average annual load
Total Nitrogen	45% of average annual load
Gross Pollutants >5 mm	70% of average annual load
Litter > 50 mm	Retention up to the 4EY (3-month flow)
Oil and Grease	90% of average annual load

The above retention criteria relate to “reduction of average annual load” of stormwater pollutants that may be expected from a fully developed catchment or site.

22.3. Constructed Wetlands

For wetlands to operate efficiently they should be “off-line” accepting, typically, flows up to the 1-year ARI storm event. General objectives for wetland area design are as follows:

- The shape of the wetland should be designed to optimise the treatment of the flows with lengthy flowpaths through the wetland.
- Wherever possible, existing natural drainage gullies should form part of a stormwater and runoff drainage management system incorporating detention basins and/or wetlands to alleviate stormwater peaks and retain pollutants.
- Wetlands should be well-designed creating an attractive, safe amenity and be highly visible for both the adjoining residents and passers-by.
- Walking paths should have frequent contact adjacent to the wetland edge.
- Vegetation should be designed such that generous unobstructed view of the wetland is provided, but with dense planting where access should be restrictive, such as near deep water.
- The design should ensure that emergent macrophytes are minimal and manageable.
- Surrounding slopes to wetlands should be gentle and offer convenient tractor-mowing access – general maximum of 5H:1V.

The planting list for each section of the wetland shall be provided with the design, refer to Council's preferred species list available in Standard Drawing SD048.

A management plan, including lifecycle costing (MUSIC), shall be submitted with the design indicating a Program of On-Going Maintenance, appropriate for the particular wetland design. All wetlands shall be provided with a valve/pipe mechanism (other than mechanical pumping) to drain to the lowest possible level for periodic "clean-out" and harvesting of vegetation growth. A typical cross-section of a constructed wetland utilising the general objectives above is shown in Standard Drawing SD050.

Wetlands shall be signposted with a "WARNING" sign in accordance with Standard Drawing SD038.

22.4. Swales

Swales assist in the attenuation of flow and the removal of pollutants. Swales are most effective as source controls as opposed to end of pipe solutions.

Vegetated swales are suitable for catchments where they can convey flows longitudinally, with ultimate relief into a drainage conduit, device, or system, and are commonly used as an alternative to kerb and gutter within the road. Swales are intended to be non-trafficable and should only be employed where vehicle crossing is not required, such as within medians of dual carriageways and adjacent to reserves.

Where for a particular reason vehicle access is required, a concrete driveway may be provided across swales either within the swale invert or with a culvert/pipe.

Swale velocity depth coefficient should be kept below 0.4 and longitudinal slope of the swale should be kept between approximately 1% and 4%.

Swales must be fully vegetated on a sandy loam topsoil to ensure maximum filter effectiveness, and plantings, other than couch grass, will be considered on their low-maintenance merits, having regard to flow capacity and long-term maintenance. Woodchip is not permitted. Refer to SD046.

22.5. Bio-Retention Systems

Bio-retention systems are filtration devices sometimes located within smaller detention basins which comprise of porous subsurface soil layers and pipes and in some circumstances suitable vegetation (other than grass turf) to filter stormwater. Plant species shall be chosen from Table 15 of the CRC Water Sensitive Cities – Adoption Guidelines for Stormwater Biofiltration Systems (2015).

Like swales, these systems must be non-trafficable and designed for easy maintenance.

A concrete edging strip measuring 300 mm in width and 250 mm in depth installed on a gravel bed (or alternatively an SFM kerb profile on 100 mm compacted gravel) is essential between the basin's turf floor and the basin bio-retention stem. This measure defines and safeguards the bio-retention treatment area, preventing erosion, ensuring operational efficiency, offering structural stability, promoting longevity, and enhancing visual aesthetics. Other WSUD Treatments

Examples of other common WSUD treatments that may be provided include:

Primary Treatments:

- Pit inlet protectors
- Trash Racks
- Gross Pollutant Traps (e.g. Baramy Traps, CDS Units, ECOSOL Units, Humeceptor, Humeguard or other manufacturer's equivalent)

Secondary Treatments:

- Wet Basins
- Bio-retention swales
- Infiltration systems
- Vegetated Filter Strips
- Sand Filters
- Surface Retention
- Porous Paving

Tertiary Treatments:

- Constructed Wetlands
- Bio-retention

22.6. References for WSUD Design

- WSUD Technical guide for Western Sydney (Upper Parramatta Catchment Trust 2004)
- WSUD Basic Procedures for "Source Control" of Stormwater – a handbook for Australian Practice (Argue 2004)
- WSUD Engineering Procedures Stormwater (Melbourne Water 2005)
- Australian Runoff Quality – A guide to WSUD (Engineers Australia)
- SE Qld WSUD Engineering Design Guidelines (Healthy Waterways, June 2006)
- Water Smart Model Planning Provisions (HCCREMS 2007)
- Water Smart Practice Notes 1 to 11 (HCCREMS 2007)

22.7. Fencing

Warrants for fencing of permanent water wetlands, ponds, basins, and concrete GPT's shall be determined based on a risk assessment. Where pool-fencing style is approved, the fence shall be installed with tamper-proof screws (as approved by Council) or be welded to deter vandalism/theft.

Additional fencing as per SD057, or as specified by Council, may be necessary along overland flowpaths and drainage reserves at the discretion of Council to prevent unauthorised access and or where public safety is a concern. Fencing should not be proposed as a treatment to vary safe slope requirements. Access points and gates must be designed and installed to allow authorised entry for maintenance.

A concrete mowing strip 100 mm deep and 350 mm wide shall be constructed along the fence line. Additionally, mass concrete footings must be provided according to the specifications outlined in SD057 for public fences.

See Standard Drawing SD057 for Council's "wire rope" style fence option.

23. Allotment Drainage

This section addresses interallotment drainage requirements with the focus on major subdivision works. For small project developments such as two or three lot subdivisions refer to *Document L: Lot Scale Engineering*.

Inter-allotment drainage (IAD) shall be provided to every lot that cannot adequately drain to its street frontage. The drainage shall be designed to accept concentrated developed flows from each lot for the 10% AEP event. Where new lots adjoin existing properties minor/major flows from those existing uphill properties shall be catered for, with a pipe/pit/flowpath system. Depending on circumstances benefiting easements may be necessary.

Pipes shall be a minimum diameter of 150 mm UPVC, PE or PP and have minimum cover of 300 mm (greater where subject to vehicle loads), designed to flow full without surcharging at pits. Concrete pipes should not be used for IAD except for crossing a road verge. Minimum grade shall be 0.5%. Where IAD pipes are laid parallel to sewer mains, a clearance is to be the greater of 750 mm between pipe centrelines, and 450 mm clearance outside to outside of pipes (generally >300 mm diameter). If practical, the sewer shall be laid closest to the dwelling being served.

The maximum capacity for an interallotment drainage line shall be the 8 lots desirable, 10 lots maximum, and does not exceed 300 mm diameter. Other zones is maximum 8 to 10 lots but could negotiate on the maximum area if demonstrating lot numbers are fixed long-term.

Table D-23: Inter-Allotment Drainage Line Pipe Sizes

Subject to hydraulic design the following pipe sizes may be used as a minimum requirement.

NO. OF DWELLINGS SERVED (LOTS <600SQ.M)	PIPE DIAM MINIMUM (MM)
Up to 2	hydraulic design, 150 min
3 to 6	hydraulic design, 225 min
7 to 10	hydraulic design, 300 min

23.1.1. IAD Connecting to Kerb

For single-allotment drainage, each lot within a subdivision that drains to the road, shall be provided with a galvanised steel pipe or rectangular hollow section (RHS) with a minimum sectional area equivalent to a 100 mm diameter pipe (7850 mm²) across the footway. The conduit shall be located adjacent to the side boundary or at the lowest point of the lot frontage, connected to kerb outlet insert and extended into the lot being serviced with a pit just inside the property boundary.

23.2. Pits

Grated pits shall be provided to the low corner of each lot serviced, in accordance with Standard Drawing SD043, unless otherwise approved. Pits shall be concrete, to the following dimension:

Table D-24: Inter-Allotment Pit Depth: Size Relationship

DEPTH (MM)	SURF. DIM. (MM)
< 900	450 x 450
900 - 1200	600 x 600
1200 to 1500 (pipes discourage at these depths but may have to get under retaining wall footings)	600 x 900

Pits shall be depressed 100 mm below the surrounding ground level, to provide efficient surface water inflow. A 450 mm wide turf strip shall be laid around the perimeter of the pit. Segmental pit risers shall be adequately sealed at the joints.

Each pit shall have a capped stub for the dwelling connection, and all pit/pipe joints mortared. (Refer SD043). Where pit depth is designed to drain low areas of lots, the riser shall enter the pit at its base.

Interallotment drainage pits shall be 1.2 metres maximum deep to ensure reasonable access and maintenance by lot owners without requiring excessive excavation, machinery and/or shoring for pipe replacement. Pipes can be kept high in the pit and a drop pit used to get under retaining wall footings.

24. Drainage Easements

Within lots, easements shall be provided over pipe systems and overland flow paths. The minimum width of easements shall be as follows:

Table D-25: Piped Drainage Easement Widths (Minimum)

TYPE AND DIAMETER ⁽²⁾⁽⁶⁾	EASEMENT WIDTH (M) ⁽³⁾
IAD up to and including 300 mm dia. ⁽¹⁾⁽²⁾⁽³⁾	Greater of 1.5 m OR (1.5 x trench depth) + nominal pipe diameter ⁽⁴⁾
IAD greater than 300 mm dia. ⁽²⁾⁽³⁾	Greater of 2.5 m OR (1.5 x trench depth) + nominal pipe diameter ⁽⁴⁾

Public Drainage System up to & including 1200 mm dia. ⁽²⁾⁽³⁾⁽⁵⁾	Greater of 3 m OR (1.5 x trench depth) + nominal pipe diameter ⁽⁴⁾
Public Drainage System 1350 mm dia and greater ⁽²⁾⁽³⁾⁽⁵⁾	Greater of 5 m OR (1.5 x trench depth) + nominal pipe diameter ⁽⁴⁾

Notes:

- 1) Where site constraints exist, such as in-fill developments, 0.9 metres wide IAD easements may be considered for 2 lot maximum to pass down the side of an existing dwelling.
- 2) For pipe diameters larger than specified and for multiple pipe systems, the minimum clearance from the outer edge of the pipe to the easement limits shall be 1.0 metres.
- 3) The zone of influence (ZOI) should still consider existing and potential structures in the vicinity of the easement. There may be occasions to widen the easement to cover the whole ZOI.
- 4) Easement width shall be increased by 0.5-meter increments.
- 5) An additional easement width of 3 metres applies to stormwater channels and major swale drains where access for maintenance vehicles is necessary. Maintenance tracks are required on both sides when width exceeds maintenance machinery reach. See any requirements for open channels and maintenance.
- 6) Depths over 1.5 metres are not acceptable for IAD. Any public pipelines exceeding 1.5 metres in depth must be adequately benching or battered to Safework NSW requirements and the easement cover the extent of batter, etc.
- 7) All Drainage lines are to be centrally located within the easement.
- 8) The width of excavation shall be contained within the easement

25. Stormwater Outlet

Permanent, durable, and effective scour protection and/or energy dissipaters shall be provided at pipe outlets (and inlets where warranted).

In the absence of a defined natural watercourse or stream, points of discharge of concentrated stormwater onto an adjoining property, shall not be permitted without the agreement of the affected property owner. Where an agreement is reached with the adjoining owner, a letter and a drawing shall be signed and submitted to Council as evidence of the agreement, prior to issue of the DA. Drainage easements shall be created, as necessary, prior to or upon certification under part 4A of the EP&A Act.

Where permitted, piped discharge shall be in a suitable watercourse and shall extend a minimum of 10 metres past a building or future building envelope.

Similarly, discharge through parks or reserves, if permitted under the plan of management, should be directed to suitable watercourses. Easements are required on public land that is not drainage reserve.

26. Subsoil Drainage

Subsoil drainage shall be designed for installation in areas that are susceptible to groundwater seepage into the pavement and subgrade, and may be in the form of pipes, strips and/or mats.

Subsoil drains shall be placed on each side of all road pavements and in all stormwater pipe trenches within the road pavement in accordance with Standard Drawings SD035 and SD003 with flush points

placed behind the kerb (level with the kerb), as a screw-locked plastic fitting in a concrete surround and should be placed at approximately 60 metres intervals. Flush points within drainage pits are not permitted.

The design should indicate a subsoil drain “lead-in”, 3.0 metres long installed in Inter-Allotment Drainage lines where the line connects to the road pit, and at every second pit upstream within the IAD pipeline.

Subsoil drainage shall be shown at new pavement interfaces with existing pavements.

All subsoil pipes shall be, nominally, 100 mm diameter, and be “socked” with geotextile fabric.

27. Access Restriction to Drainage Structures

A risk assessment shall be undertaken on any open drainage structure that could be readily accessed by the public. If that assessment indicates a necessary treatment, and/or at Council’s discretion, a barrier grate shall be provided.

28. Earthwork and Regrading

Site regrading and bulk earthworks must be designed and constructed in accordance with the DCP and the development consent. Should minimise cut, fill, offsite haulage and environmental impacts. A cut-and-fill balance diagram within an Earthworks Management Plan must be submitted to Council. Pavement can be included in the net balance.

A certified geotechnical engineer shall have level 1 responsibility in accordance with AS3798 unless otherwise agreed in writing by Council in advance. A comprehensive Geotech report shall be provided in accordance with Australian Standards, and Council’s requirements.

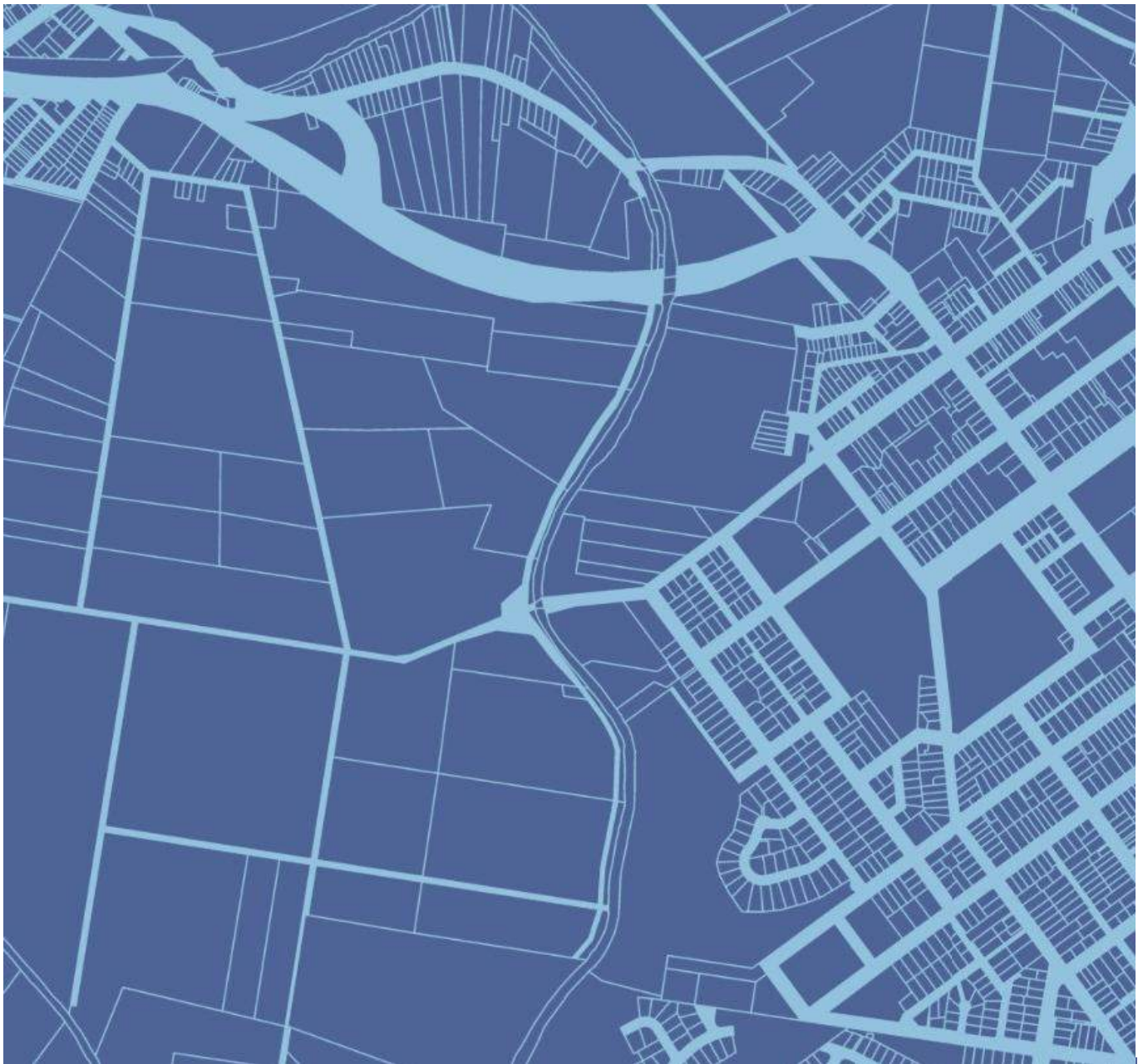
Filling on land adjacent to developments requires written consent from adjoining landowners.

Site fencing and barricades should avoid encroachment into public roads and lands. Where unavoidable and approved, works shall be prioritised to minimise disruption times, or made safe and re-opened until works can recommence.

If filling of existing dams or watercourses is authorised, the geotechnical report must outline necessary works. The certifying geotechnical engineer, as per AS 3798, holds Level 1 responsibility unless otherwise agreed upon by Council.

Batter slopes and requirements shall be in accordance with Maitland City Council Development Control Plan and MoES.

Surface grading shall ensure no surface ponding will occur, and flows are directed to the required discharge points without creating erosion problems.



MoES – C 2026

Construction (Civil)

Manual of Engineering Standards

maitland
CITY COUNCIL

Policy History

VERSION	CLAUSE NO.	DESCRIPTION OF CHANGES	AUTHORISED BY	DATE
1	-	2026 Comprehensive Update	Council Resolution	Date Adopted: 17/03/2026 Implementation: 14/04/2026

Table of Contents

C – Construction	1
1. Traffic	1
1.1. Traffic Control	1
1.2. Partial Road Closure	1
1.3. Full Road Closure	2
1.4. Road Opening Permit	2
1.5. Haulage Routes	2
1.6. Detour Routes	2
2. Contractors	3
2.1. Sub-Contractors	3
2.2. Working Hours	3
2.3. Safety	3
3. Site Management	4
3.1. Survey Marks	4
3.2. Material Storage	4
3.3. Adjoining Land	4
4. Inspections	4
4.1. Limitations on Approvals	4
4.2. Inspection Meetings	5
4.3. Inspections Outside Normal Hours	5
4.4. Approval of Works	5
4.5. Additional Works	5
4.6. Inspection Regime	5
5. Environment	7
5.1. Contamination	7
5.2. Erosion	7
5.3. Tree Clearing	8
5.4. Vegetation Disposal	8
6. Earth - Fill	8
6.1. Standards	9
6.2. Topsoil	9
6.3. Retaining Walls	9
6.4. Dams and Basins	9
7. Road Formation (Subgrade)	10
7.1. Materials and Testing	10

7.2. Fill.....	10
7.3. Cut.....	11
7.4. Sub-Grade (Natural).....	11
7.5. Sub-Grade (Select).....	12
8. Stormwater Drainage	12
8.1. Subsoil Drainage.....	12
Table C-1: TfNSW Type A Filter Material.....	13
Table C-2: TfNSW Type S Filter Material.....	13
Table C-3: Austroads Type A (Sand) Filter Material.....	13
Table C-4: Austroads Type B (Aggregate) Filter Material	14
8.2. Pipe Conduits.....	15
8.3. Pipe Installation (Concrete).....	15
8.4. Pipe Bed, Haunch and Sides	16
Table C-5: Bed and Haunch Zone	16
Table C-6: Side Zone	16
8.5. Pipe Overlay	17
8.6. Pipe Backfilling.....	17
8.7. Trench Compaction Testing	18
8.8. Precast Box Culverts	18
8.9. Base Slabs.....	18
8.10. Pits.....	18
8.11. Gross Pollutant Traps	20
8.12. Scour Protection	20
8.13. Open Drains.....	20
8.14. Inter-Allotment Drainage	20
8.15. Culverts	21
8.16. Pipe Tolerances	21
Table C-7: Pipe Construction Tolerances	21
8.17. CCTV Requirements	21
9. Pavement Construction	22
9.1. Flexible Pavement.....	22
Table C-8: Pavement Construction Tolerances.....	22
Table C-9: Acceptable Material Types	23
Table C-10: Pavement Compaction Requirements	24
Table C-11: Benkelman Beam Deflection Requirements	25
9.2. Rigid Pavement (Roads)	26
10. Kerb and Gutter	28

10.1. Concrete Supply and Placement.....	28
11. Wearing Surface	29
Table C-12: Acceptable Wearing Surfaces	29
11.1. Bitumen Flush Seal.....	29
11.2. Primer Seal	30
11.3. Asphalt.....	30
12. Concrete Items	30
12.1. Driveway Access Handles	30
12.2. Paths	30
12.3. Concrete Linings	31
12.4. Concreting Placement and Practise.....	31
Figure C-1: Evaporation from Concrete Placed on Site	33
13. Conduit and Road Crossings	33
14. Surface Restoration	34
14.1. General	34
14.2. Footways.....	34
14.3. Trenches.....	34
14.4. All- Weather Surfaces.....	34
14.5. Mulch and Turf.....	35
14.6. Street Trees	35
15. Locks and Keys	35
16. Linemarking and Signposting.....	35
17. Site Preservation	35

C – Construction

This Document C: Construction is part of the MoES suite of Documents. Document G: General Requirements serves as the primary source of information and guidance on how this document functions within the entire suite.

This document, found in the Council's Manual of Engineering Standards, provides a comprehensive guide to the principles and practices governing infrastructure construction in the Maitland Local Government Area. It outlines essential standards and procedures that are crucial for safe, efficient, and sustainable construction. Adhering to these guidelines ensures quality assurance, risk mitigation, and consistency in construction practices. Engineers, contractors, and stakeholders will find this document beneficial for executing projects that enhance infrastructure resilience and functionality.

All works shall be performed to the requirements of this Manual and as directed by Maitland City Council.

As the Principal Certifying Authority, Council must be notified two days prior to commencement of any works and may inspect the works, where necessary, at any stage of construction. Appropriately qualified and experienced Contractors shall carry out all work in a competent manner, in accordance with the Approved Construction Plans, this manual, relevant Occupational Health and Safety and WorkCover requirements.

1. Traffic

1.1. Traffic Control

Where impacts are expected within the existing road network, traffic control plans in accordance with Transport of NSW TfNSW "Traffic Control at Worksites" shall be prepared by a certified person and be submitted to Council for acceptance prior to the works commencing.

The control of works shall be undertaken to assist the passage of motorists and pedestrians through the worksite. Signposting shall ensure separation of motorist traffic and pedestrian traffic, and each from workers and machinery.

It is the developer/contractor's responsibility to maintain all temporary signposting for the duration of the construction works, which includes regular checking of the signposting to avoid accidental disturbance, displacement, interference, or vandalism. Signs and their placement shall be in accordance with Transport of NSW "Traffic Control at Worksites". Council reserves the right to request additional signposting where it is considered appropriate to enhance safety for road users.

All Traffic Controllers are subject to TfNSW regulations and WORKCOVER requirements. Controller certification and their traffic control methods are subject to inspection and if necessary, enforced compliance with the relevant standards.

1.2. Partial Road Closure

Minor closures such as footway and parking lanes or road shoulders constitute a temporary partial road closure to vehicular and/or pedestrian access for construction purposes. A more significant partial closure may include the closure of a vehicular traffic lane and the subsequent need for traffic control for single lane flow.

Permission for the closure must be obtained from Council, and such a closure may only occur in normal daylight working hours, unless special circumstances exist where night-work is essential. Such

controls must be employed with the standard signposting, and manual or signalised traffic flow controls. Two-way flow for vehicle traffic must be reinstated for each night.

Acceptance of a Traffic Control Plan prepared by a certified traffic controller must be received from Council prior to implementing the plan.

1.3. Full Road Closure

Permission to temporarily close the whole of a public road to vehicular or pedestrian traffic for construction purposes must be obtained from Council - a fee applies. Application for road closure must be received at Council at least six weeks prior to the desired closure date.

1.4. Road Opening Permit

Permission to “open” public roads by excavation for purposes of installing underground structures, services and conduits must be obtained from Council – a fee applies. The area defined by a public road is any part within the road reserve. Council may require under-boring methods under road pavements and paving. General term of conditions is available as part of the application.

1.5. Haulage Routes

Haulage routes to, or from, the development or work site will be subject to approval by Council prior to the commencement of work. The Contractor shall ensure carriers comply with approved routes.

1.5.1. Damage to Roads

Damage to roads directly attributed to operations of construction plant serving the development shall be repaired to the satisfaction of Council, at no cost to Council.

It is advised that the Project Manager accompany Council’s representative on the assessment of the approved haulage route and document the condition of the approved route. Such documentation prepared by the Project Manager shall be agreed upon with Council.

Where required by Council, a bond shall be submitted to Council to cover possible pavement rectification due to damage of the haulage route roadway.

1.5.2. Overweight Vehicles

Where required by Council, a vehicle that is suspected of being overloaded, carrying a weight more than the legal limit for the vehicle, the vehicle shall be directed to a public weighbridge for confirmation with compliance, or otherwise, at no cost to Council. The vehicle shall not leave the weighbridge site until any necessary adjustment of weight is rectified.

1.6. Detour Routes

Where it is determined by Council that there is a need for a temporary road detour route to be established during development-related works, the proposed route(s) must be submitted to Council for approval, and the contractor shall be responsible for the on-going maintenance of the road pavement along the detour route.

When choosing a detour route, it must have where possible, a similar capacity for the expected traffic to that of the temporarily closed road.

An assessment of the risks associated with detouring vehicles onto other roads should be made regarding potential inclement weather. The existing condition of the chosen detour route must be

recorded prior to the commencement of development works, and any damage caused, rectified, as discussed under “Haulage Routes”.

2. Contractors

Contractors must be experienced and competent to perform all work in compliance with the approved Subdivision Works Certificate and the approved plans, this manual, relevant occupational health and safety standards, and WORKCOVER requirements. They also need to have the appropriate certifications for all aspects of the project.

Contractors need to know and follow their responsibilities according to relevant acts and regulations related to construction.

During the construction startup meeting, the contractor must provide Council with contact details for all relevant officers and parties involved in the project. This includes, but is not limited to, the Site Supervisor, Site Engineer, Project Manager, Environmental Manager, Geotechnical Engineer, Surveyor, and utility installation Subcontractors.

Any changes to the plan must be approved in writing by the Accredited Certifier or Council, depending on who issued the Subdivision Works Certificate. These changes might require submitting a new design for approval.

2.1. Sub-Contractors

Upon request the identity of sub-contractors and their proposed scope of works shall be supplied to the certifier or Council. The certifier or Council reserves the right to preclude any sub-contractor.

2.2. Working Hours

Construction workhours, particularly relating to noise generation, shall not be performed outside the hours that apply under legislative requirements or as determined through development consent conditions.

As a guide, time restrictions (as stated by State Government guidelines “*Construction Noise*”) are:

- *Monday to Friday: 7am to 6pm*
- *Saturday: 8am to 1pm if audible on residential premises,*
- *otherwise 7am to 1pm*
- *Sunday and Public Holidays: No construction work.*

Construction activity such as “emergency” or “night” work should be notified to Council. Construction works that may be considered to generate offensive noise may be subject to restrictions.

2.3. Safety

All adequate safety precautions in accordance with WORKCOVER and relevant legislation and codes of practice shall be the responsibility of the contractor. This will include matters related to public safety where interaction is expected (and may include fencing), traffic related matters discussed above and adequate induction and assistance for site visitors. Council or the TfNSW will not be liable for any consequence from the developer’s inaction or omission.

3. Site Management

3.1. Survey Marks

Adequate precaution shall be taken to protect and preserve all survey marks, such as SSM, PM, etc., relative to or affected by the work. New survey marks and replaced marks shall be installed by a Registered Surveyor. An appropriate plan of survey showing the relocated marks shall be prepared by the Surveyor and lodged for registration in accordance with the Survey Practice Regulation. Survey marks for the purpose of property boundary definition shall not be placed in any concrete path or kerb.

Survey set out for the purposes of construction of the works shall be performed by a surveyor. Recovery marks or stakes are not to be placed in locations that present a hazard to pedestrian or vehicular traffic unless suitably protected.

3.2. Material Storage

Storage of pipes, gravel and other materials on public roads or reserves is not permitted unless extenuating circumstances prevail, whereupon Council approval must be obtained. Any damage shall be made good to the satisfaction of Council or costs met where Council performs the restoration works.

Storage of material shall be in a non-hazardous manner and shall include the use of safety barriers, fencing and sediment controls as appropriate to the material. (See also Document G: General Requirements - Environment)

3.3. Adjoining Land

The Contractor shall liaise with adjoining property owners affected by the work and take precautions to prevent deterioration of or damage to private property, public roads, public utilities, and reserves during construction. Such property may include dwellings. It is recommended that the Contractor organise preconstruction inspections with adequately qualified independent inspectors to identify existing structural conditions that are within proximity of the proposed works and should keep written and photographic records for future reference.

4. Inspections

Inspections are required at certain hold points of construction as set out below. Principal Certifying Authorities and Accredited Certifiers shall be bound by this Manual's construction and inspection requirements.

4.1. Limitations on Approvals

During construction, approval of any critical stage of the work (as nominated below), will be given in regard to structural standard *only at the time of inspection*, and does not absolve the Contractor of responsibility for rectification of any damage or deterioration occurring before "final inspection" and/or "practical completion".

Where a third-party certifier is involved in the inspection regime (such as a geotechnical engineer) who gives approval for works, that approval will not be construed to be an approval of Council. Council reserves the right to take any course of action, or decide regarding the progress of works, deemed necessary to rectify a construction problem or dispute.

4.2. Inspection Meetings

The Contractor shall be present during each inspection to receive approval or otherwise of the works prior to proceeding to the next stage of works. Amended works may be subject to re-test or an additional inspection and therefore may attract a fee for that inspection.

4.3. Inspections Outside Normal Hours

Inspections of work outside of normal working hours may be possible with prior arrangements. For Council's attendance, the cost of the inspection, in accordance with Council's fees and charges, shall be borne by the Developer/Contractor. At Council's discretion, a suitable qualified person may be appointed for an inspection to which Council cannot attend.

4.4. Approval of Works

Approval to proceed through the critical stages of the various components of works must be obtained. "Critical Stage" approval does not absolve the developer from responsibility to correct defects or failure in the work that may become apparent prior to "practical completion" and/or dedication to Council. It is also the Contractor's responsibility to obtain any necessary approvals from the appropriate Certifier and Council prior to proceeding to subsequent stages.

4.5. Additional Works

Additional requirements beyond the Construction Certificate design plans, which become apparent during construction, shall be completed as directed. Where such works do not require in the opinion of the Principal Certifying Authority, a new design, additional works shall be shown on the Works-As-Executed (WAE) Drawings.

4.6. Inspection Regime

The minimum occasions as "hold points" for the following critical works, requires inspections to confirm that the nominated standards and approvals given under this Manual are met. Pavement reinspection is required after any rainfall event greater than 5mm and after any rainfall event that necessitates a proof roll, at Council's discretion.

A. Traffic

- Temporary signs and markings.

B. Environmental

- Erosion controls.
- Vegetation clearing (optional).

C. Stormwater

- Stormwater basins: inspection of the keyway floor prior to filling and monitoring of Level 1 clay core construction.
- Stormwater Pipes: prior to backfill above the haunch zone of type, class, bed, haunch, alignment, clearances, joints, plugs etc.
- Subsoil drainage pipe: prior to backfill of filter material.
- Stormwater pits: prior to concrete pour of forms and reinforcement.

D. Subgrade (Natural and Select)

- Proof-roll of full prepared width.
-

- String-line at centre, kerb-line, and intermediate points, alternatively, confirmation by electronic field survey.
- Density test (compaction and moisture including CBR shrink and swell).

E. Sub-Base

- Proof-roll under kerb and gutter.
- Proof-roll full pavement width.
- String-line at centre, kerb-line, and intermediate points, alternatively, confirmation by electronic field survey.
- Density test (compaction and moisture).
- Inspect road pits to ensure alignment of lintels is consistent and satisfactory.

F. Base

- Proof-roll full pavement width.
- String-line at centre and intermediate points, alternatively, confirmation by electronic field survey prior to application of primer seal.
- Density test (compaction and moisture).
- Benkelman Beam, prior to final wearing course.
- Primer seal prior to final wearing course.

G. Concrete

- Paths, driveways and pits and other structures prior to concrete pour.

H. Retaining Walls

- Foundations, backfill and drainage. Council will accept a geotechnical engineer's report for backfill and reinforced earth where required by design.

I. Final

- General workmanship of all works including pit/lintel/grate finish.

Notes:

- 1) Some items will require certification by a practising professional in the respective discipline.
- 2) Council/PCA reserves the right to request additional tests where considered necessary.
- 3) Council shall not be responsible for expenses arising from testing.
- 4) Inspections requested and either not ready at the appointed inspection time or work is obviously incomplete, may incur a re-inspection fee.
- 5) In the event that a Council officer is unavailable for a particular inspection, an inspection report from an independent professional may be permitted, with prior approval from the principal certifier (Council).
- 6) Inspections are only appropriate where the work is uncovered and capable of being inspected. IT IS NOT POSSIBLE to certify an inspection retrospectively where work has been completed and covered prior to being inspected.
- 7) Failure to call for an inspection or failure to carry out any rectification works found to be defective may result in certification being withheld.
- 8) Where an inspection reveals unsatisfactory or defective results, a re-inspection may be required, and fees may be applied for any subsequent or additional inspections. Continuation of further

works reliant on defected works is PROHIBITED until such times as a satisfactory inspection has been carried out and/or approval to continue is obtained.

- 9) All inspections must be booked with Council 24 hours in advance no later than 3.00 p.m. on the day before the inspection is required. Inspection bookings may be made by telephone to Council in normal office hours.
- 10) Inspections will generally be carried out between 8.30 am and 4.30 pm on the requested day (Mon-Fri).
- 11) A pavement re-proof roll is required after any rainfall event greater than 5mm, after any rainfall event that necessitates a proof roll at Council's discretion and following any extended period of inactivity.

5. Environment

This section relates to environmental controls and safeguards within a construction site and the requirement to maintain a "clean" environment in the surrounding area where works may impact that area.

5.1. Contamination

Measures must be taken to ensure that no contaminated material or noxious weeds are transported off site without due care, and with diligence and authorisation for removal and/or disposal. No contaminates, contaminated material or noxious weeds shall be transported onto the site. The contractor shall employ methods to discourage illegal dumping of waste materials on the construction site, and if occurring, remove the waste to an approved waste disposal depot.

Transported loose material must be covered to prevent loss.

5.2. Erosion

The Contractor shall take any necessary steps to prevent erosion occurring on the construction site. Effective sediment control measures must be employed. For works where there is a possibility of dust or water erosion problems, the Engineer's endorsement of treatment methods is required.

It is an offence under the Protection of the Environment Operations Act to pollute the environment as a result of sediment leaving the site, and that a breach may result in the issue of an infringement notice, attracting a monetary fine. Reference should be made to Council's Standard Drawings and the Landcom/Dept of Housing manual, "Managing Urban Stormwater - Soils and Construction" for examples of methods of control.

Regarding erosion control, Council may request certain preventative measures to be implemented, such as watering loose surface areas or constructing silt traps. Silt traps shall be employed in advance of existing downstream systems, basins, wetlands, natural gullies, etc.

For medium and large subdivisions, an earthwork plan with agreed allotment sizes and an indicative sequencing plan must be provided (if not already included in the SWC/construction plans). A cut sequence and a fill sequence may be necessary. The contractor shall not disturb more land than can be suitably worked to the design height and stabilised within 3 months, and in a size that can be managed 24/7, including non-workdays, to control dust, erosion, and sedimentation. It is not acceptable to rely only on water carts during working hours. Details of how the allotments will be stabilised, such as with hydro-spray applications, dust fences, and other techniques, must be provided with the plan.

The contractor must schedule the construction program to ensure that bulk earthworks are completed, and the area is brought to size within 3 months of commencing work. Once the area is properly shaped, or if it is not being worked for 20 days, it must be rehabilitated and/or stabilised.

Bulk earthworks for subdivisions must not expose more than three (3) hectares of unstabilised area (subject to wind and rain) at any one time, in accordance with the MCC DCP.

Progressive stabilisation can exclude, within reason, the road corridor. Lots and open space drainage areas must be stabilised progressively to minimise erosion, sedimentation, and dust. Small corridors, such as those for retaining walls, may be excluded, provided the adjacent area is fenced off or otherwise protected to prevent further disturbance. All disturbed ground due to the development must be progressively stabilised and rehabilitated so that it no longer acts as a source of sediment.

For building works, all landscaping must be installed in accordance with the approved landscape or rehabilitation plan before occupation or use of the premises. Such works must be maintained in a stable and effective condition.

5.2.1. Maintenance of Devices

Erosion control devices must be inspected on a regular basis, particularly following any rainfall event, and cleaned where necessary or as instructed, to ensure the devices are in working order.

5.3. Tree Clearing

For purposes of road infrastructure construction, the extent of clearing shall be limited to the road reserve and associated drainage facilities, and service corridors.

Unless inherent within the engineering design or explicit within Development Consent, approvals must be sought and obtained for site clearing beyond these limits prior to works commencing.

The Contractor should be made or make him/herself aware of the developer's responsibility regarding tree and habitat disturbance, and of the services of a suitably qualified ecologist engaged to supervise the site's clearing activities. (See also Document G: General Requirements - Environment).

Any trees associated with the development/subdivision works, considered by the engineer to be hazardous to traffic or pedestrian activity, shall be removed or pruned accordingly.

5.4. Vegetation Disposal

Disposal of vegetation that is chipped or tub-grinded may be either, spread over the site at specified locations, (particularly avoiding stormwater inundation or significant/major flow-path areas) as stabilising mulch (approximately 100mm thick), or stockpiled. Excess material not used as mulch shall be removed from site.

Approval for disposal by dumping to Council's "waste facility" may be considered.

6. Earth – Fill

This section relates to earth-fill material within subdivision construction projects, and within existing and/or proposed public land projects, its quality, importation, placement and retention with walls or batters.

The Protection of the Environment Operations (Waste) Regulations allows for certain materials to be used under the resource recovery exemptions. These materials are permitted to be used if they are

shown to Council to be fit for purpose. Usage of the materials must be in accordance with the approved development consent.

6.1. Standards

Filling of lots for residential development must be performed under specific controlled conditions. Lot-fill on residential land shall be consistent with the requirements of AS 2870 and reported by a geotechnical engineer verifying that compaction of fill-material on the lots is in accordance with AS 3798, providing 95% Minimum Relative Compaction (for cohesive soil) employing a “Level 1” inspection and testing regime adopting Type 1 Density Test frequency.

The geotechnical engineer’s report verifying satisfactory results shall be submitted to Council.

Further:

- Where isolated surface disturbance (such as tree removal) is filled, the filling shall be reported in accordance with the Australian Standard.
- Road fill batters that extend onto lots are considered lot-fill under this clause.

Filling of land for purposes other than residential development (such as open space, parks or playing fields) may be at a reduced standard than that for residential, subject to its type of use and the possibility of future building construction, as determined by Council for each specific site.

6.2. Topsoil

The contractor shall reclaim, and stockpile topsoil won from construction works where it is suitable for re-use on site. Where topsoil is imported it shall be in accordance with the resource recovery exemptions under the Protection of the Environment Operations (Waste Regulation) and shall be friable, of porous nature, relatively free of weeds contain no rocks, tree roots, clay lumps, chitter, ash or building waste. Topsoil shall have a maximum thickness of 150mm in road reserves and 300mm maximum in lots.

6.3. Retaining Walls

Retaining wall location and design is addressed in Council’s Manual of Engineering Document D: Design. The subsoil shall be connected to either the kerb and gutter, road pits, or interallotment drainage system by gravity and shall not be directly connected to the road subsoil.

The removal of any existing fence adjoining the works for purposes of constructing a retaining wall is the responsibility of the developer/contractor, together with the need for shoring and/or negotiations with adjoining owners regarding any adverse works affecting those properties.

6.4. Dams and Basins

Earth embankments constructed for the purpose of retaining stormwater runoff with or without permanent water storage shall be constructed in accordance with an engineer’s design as part of a Subdivision Works Certificate.

6.4.1. Redundant Dams

Where redundant dams are to be removed and filled, the contractor shall attend to the following matters:

- Flocculation of turbid water prior to release.
- Dewatering without causing erosion, such as by pumping.

- The removal of silt and organic matter prior to filling and its disposal in an approved manner.
- Backfilling under geotechnical supervision, and in accordance with this Manual.

7. Road Formation (Subgrade)

Material for road formation shall generally be won as a cut/fill operation within the site. Where material is imported to balance earthworks, it shall comply with Section 6 above.

7.1. Materials and Testing

All materials required for the project, whether won as natural earth or as a processed soil or granular or man-made, shall be in as new/original condition and of an approved standard, free of contamination or defects. If required, the contractor shall provide full testing information with respect to the materials. Test results of particular proposed imported materials shall be submitted to the Certifier and/or Council for approval prior to placement.

Materials (from established suppliers) that are subjected to a regularly testing programme and have been accepted by the Engineer as Quality Assured material, may be used without further testing. The Engineer/Council may instruct the amendment or removal of works or material not in accordance with the approved plan, specification, standards, or best practice.

In the event of dispute of material quality, the subject material will be submitted for testing/examination by an independent certified body or company registered with NATA qualification. The cost of testing shall be met by the developer/contractor.

7.1.1. Compaction Tests

Compaction of the natural and select subgrade to a minimum of '100% standard' shall be confirmed by a geotechnical engineer/NATA laboratory and tested at 50 metres intervals or part thereof for compliance under AS1289. The location of intermediate tests shall be at random locations. Additional test locations may be required if there are changes in the soil profiles.

Where subgrades are modified or stabilised, the application process shall be tested and reported for compliance with an approved geotechnical report.

Moisture content of the fill material shall be specified by the geotechnical engineer and shall be observed and/or tested.

7.1.2. Proof-Roll Test

Monitoring the results of natural and select subgrade compaction by "proof-roll" testing shall be observed by Council, or at Council's discretion, by an appropriate Certifier. The contractor should be confident that the prepared surface is ready for test, prior to the inspection. If re-inspection is required, an additional fee may apply.

Acceptable machinery for testing the subgrade includes a large grader. For proof rolling on gravel layers, the contractor may use a fully laden water cart or a three-point roller, with the preferred option listed first. The proof roll test shall be performed by an experienced road construction testing professional representing Council and/or the geotechnical engineer, as directed by Council. Any works that are considered by that person to be deficient, shall be rectified.

7.2. Fill

Fill material shall be tested and supported by a geotechnical engineer and shall be uniform, sound, and free from deleterious material. Approved fill shall be placed in compacted layer thickness of

200mm (max) and spread evenly for the width of formation, subject to the supervision of the geotechnical engineer. Placement of loose material over partially compacted filling to achieve road width is unacceptable.

On completion of filling to the bottom of road pavement (including bottom of any select) the inspection and testing regime shall conform to 7.4 Sub-Grade (natural) where the Geotech engineer provides results and recommendations to the engineer for approval of the road pavement design

Adequate support benching shall be provided in fill, on side grades in excess of 20%, or where considered necessary by the engineer to improve stability. Fill containing rocks or clay lumps will not be permitted in footways.

Batter faces shall be stabilised in accordance with erosion control procedures, typically, scarified, topsoiled and strip turfed and seeded between strips. The turf strips shall be run either along the contour or at a flat angle to the contour in order to intercept runoff.

7.3. Cut

7.3.1. Catch Drains

Are required at the top of cuttings intercepting large catchments or as directed. Catch drains shall be sized for the contributing catchment.

7.3.2. Batter Faces

All batters must be cut clean and free of loose or overhanging rocks. If the cut is more than 5.0 meters high, it must be benched with catch drains at the bottom of each step. For cuts higher than 2.0 meters, a geotechnical assessment is needed to determine the appropriate slope or treatments, see Document D: Design Document - Batters for more details. The cut faces should be stabilised using erosion control methods, such as scarifying, adding topsoil, and planting turf and seeds between strips. The turf strips should run along the contour or at a flat angle to intercept runoff.

7.4. Sub-Grade (Natural)

The road subgrade shall comprise of sound material compacted and trimmed evenly to design levels and cross-fall. The depth of cut/fill to subgrade level shall be governed by the approved pavement depth making allowance for cross-fall at any point of measurement, in particular at the centreline and the gutter lip ensuring a straight profile between each point.

Any unsuitable material shall be removed and replaced with approved material in layers and compacted to the required density in accordance with the process below.

The Geotech engineer shall undertake all necessary observations, additional testing, and any other matters in accordance with the approved (pre-construction) geotechnical report, MoES, and the Austroads and TfNSW documents as listed in Appendix E.

A (sub)report, including results, observations, and revised CBR, shrink and swell, pavement designs, and any need for select or working layers, shall be presented in writing to Council for approval. The report shall include any other matters such as construction techniques, concerns, and other issues as required or mentioned in the pre-construction (SWC) pavement design. The design shall be in accordance with Document D: Design - Pavement Design requirements.

The Geotechnical consultant will supply a 'component' compliance certificate for the natural subgrade prior to the placement of any layer (i.e., select, working platform, subbase), certifying the revised CBR, pavement design, and that the construction and site conditions, including moisture conditions, fall within the design ranges. The component certificate shall provide the minimum information in

accordance with the requirements in Document G: General and list the location specifically with road name, chainages, and offsets where part widths are being certified.

Where subgrade replacement with a granular pavement material (i.e. not using the natural soil or clay) is proposed, the excavation shall extend and grade to a subsoil drainage system, extending at least 500mm minimum behind the back of the kerb. Subgrade replacement shall be inspected and tested as per normal sub-grade inspection requirements.

Rock sub-grade shall be thoroughly ripped up to a depth of 300mm below sub-grade level and shall extend to the edge of the pavement. Ripped material shall be compacted to provide a sub-grade layer of homogenous density.

Construction works shall not proceed until the sub-grade, including floor of unworked excavation, has been certified by council as complying.

For subgrade bearing capacity under pavements, the use of geotextile materials is permissible, subject to recommendations by the Geotechnical Engineer, the suitability of the materials for the location, and only at the discretion and approval of Council.

7.5. Sub-Grade (Select)

A “select” subgrade where required, shall be of an approved material and be constructed similar to the requirements for natural sub-grade. The geotechnical engineer will confirm in writing to Council that the material specification is consistent with and fit for purpose according to the expected performance requirements of the geotechnical engineer’s approved (construction) pavement design. Council’s subdivision engineer shall approve the proposed material for use as “select”.

8. Stormwater Drainage

8.1. Subsoil Drainage

Subsoil drainage shall be provided on both sides of the road pavements and in all road stormwater pipe trenches in accordance with Council’s Standard Drawings SD035 and SD003, and additionally as required by Council, or the geotechnical engineer where for example, drains are considered necessary where sub-soil moisture problems are encountered. The type, location and extent of subsoil drainage may vary depending on pavement materials or in-situ conditions.

A subsoil drain “lead-in”, 3.0 metres long, shall be installed in Inter-Allotment Drainage lines where the line connects to the road pit, and at every second pit upstream within the IAD pipeline.

Subsoil drainage shall be installed at new pavement interfaces with existing pavements at Council’s discretion or under the direction of a geotechnical engineer, refer to Council’s Manual of Engineering Document D: Design and Standard Drawing SD032.

All subsoil pipes shall be, nominally, 100mm diameter, and be “socked”.

8.1.1. Trenches

Trench dimensions shall suit the size of the pipe/conduit used but generally trenches shall be a minimum of 200mm wide. The depth of trench shall be 600mm below subgrade level or deeper where it is necessary to drain intersecting service trenches. Depths less than 600mm may be considered by Council where sub-grade warrants exist, such as in rock.

The minimum grade on subsoil drainage shall be 0.5%.

8.1.2. Filter Material

Unless approved otherwise, the filter material shall conform to TfNSW TS 03357.1 (Old number: IC-QA-3580) or Austroads specification for subsoil drainage, reproduced as follows (See Table C-1 to Table C-4).

Other materials, not meeting the specifications in this Manual, may be considered subject to confirmation from a geotechnical engineer of compliance as free draining to achieve a sustained flow rate of 8 metres per day. (See Common Trench with Subsoil Drainage where stormwater pipe support should be considered)

Where “one-size” aggregate material is proposed as a medium surrounding the subsoil pipe, the material shall be wrapped in a geotextile fabric at its interface with adjoining natural or imported material and the pipe shall be un-socked.

Table C-1: TfNSW Type A Filter Material

GRADE	AGGREGATE SIZE (mm)
F20	20
F14	14
F10	10
F7	7
F5	5

Table C-2: TfNSW Type S Filter Material

SIEVE SIZE (mm)	WEIGHT PASSING (%)
4.75	100
2.36	95 - 100
0.425	20 - 80
0.300	0 - 30
0.150	0 - 10
0.075	0 - 1

Table C-3: Austroads Type A (Sand) Filter Material

TYPE A	PERCENTAGE PASSING SIEVE (%)
--------	------------------------------

	A1	A2	A3	A4	A5	A6
Description of Filter	Dune Sand	Course Washed Sand		5mm One Size	6 – 8mm One Size	Sandy Gravel
37.5mm						100
26.5mm						
18.0mm					100	85 - 100
13.2mm					90 - 100	
9.50mm		100	100	100	70 - 100	65 - 100
4.75mm		90 - 100	90 - 100	70 - 100	28 - 100	45 - 82
2.36mm	100	75 - 100	70 - 100	0 - 50	0 - 28	30 - 60
1.18mm	95 - 100	50 - 98	40 - 65	0 - 10	0 - 8	15 - 40
600µm	70 - 98	30 - 80	12 - 40			5 - 25
300µm	30 - 60	10 - 40	0 - 16	0 - 5	0 - 5	0 - 10
150µm	0 - 12	0 - 7	0 - 4			0 - 5
75µm	0	0 - 3	0 - 3	0 - 3	0 - 3	0 - 3

Table C-4: Austroads Type B (Aggregate) Filter Material

TYPE B	PERCENTAGE PASSING SIEVE (%)			
	B1	B2	B3	B4
Description of Filter	5mm One Size	6 – 8mm One Size	10mm One Size	19mm One Size
37.5mm				
26.5mm				100
18.0mm		100	100	70 - 100

13.2mm		90 - 100	90 - 100	0 - 30
9.50mm	100	70 - 100	40 - 70	0 - 10
4.75mm	70 - 100	28 - 100	0 - 15	
2.36mm	0 - 50	0 - 28	0 - 5	0 - 5
1.18mm	0 - 10	0 - 8		
600µm				
300µm	0 - 5	0 - 5		
150µm				
75µm	0 - 3	0 - 3		0 - 3

Glass sand requires pre-approval by Council, with considerations including respiratory and safety concerns.

8.1.3. Common Trench (with Water Main)

Where it is practical to provide common trenching with a water-main, the location and materials are specified on Council's Standard Drawing SD035.

8.1.4. Flush Points

Flush points shall be provided generally at the crest point of the road and adjacent to drainage pits or at intervals of approximately 60 metres. Flush points shall be plastic screwcaps with concrete surrounds, placed behind the kerb and gutter in urban areas, or in road shoulders in rural areas. Flush points shall not be placed within stormwater pits.

8.2. Pipe Conduits

Unless nominated on the construction plans, all drainage pipes within Council's controlled drainage systems shall be of steel reinforced concrete (SRC) or fibre reinforced concrete (FRC), rubber ringed jointed spigot and socket type and installed in accordance with the manufacturer's guidelines. Conduits that will not be under Council ownership/control (such as IAD systems) may be, concrete (as noted above), polyethylene, or UPVC complying with AS 1254 for un-plasticized PVC (UPVC), and PE and PP pipes.

8.3. Pipe Installation (Concrete)

Concrete Pipes shall be laid in the location as shown on the engineering plans, or as varied by the superintendent, with Council's approval. In general, the road formation should be completed to at least subgrade level, or top of select, prior to pipe installation. The appropriate excavation, bedding, backfill and cover shall be provided as specified by the manufacturer and/or in accordance with the Concrete Pipe Association of Australia (CPAA) or Australian Standard 3725 "Loads on Buried Pipes".

The minimum pipe support type under roads shall be "HS2".

The minimum pipe support type in other public areas shall be “H2”.

For pipes of 900mm diameter and less, the trench excavation shall provide a minimum of 150mm clearance to the pipe. Pipes greater than 900mm diameter, should provide a clearance of ‘D/6’.

Thrust blocks/collars shall be provided at every pipe joint, or as directed by Council, being generally where pipe grades exceed 12% and/or in embankments for storing water, to prevent seepage piping.

8.4. Pipe Bed, Haunch and Sides

The “bed zone” shall be a minimum of 100mm thick for pipes up to 1500mm drain. For pipes greater than 1500mm, the bed thickness shall be a minimum of 150mm.

The bed, haunch and side zone material shall be a graded material in accordance with AS3725, Table C-5 to Table C-6, or similar.

Table C-5: Bed and Haunch Zone

SIEVE SIZE (mm)	WEIGHT PASSING (%)
19.0	100
2.36	50 - 100
0.600	20 - 90
0.300	10 - 60
0.150	0 - 25
0.075	0 - 10

Table C-6: Side Zone

SIEVE SIZE (mm)	WEIGHT PASSING (%)
75	100
9.5	50 - 100
2.36	30 - 100
0.600	15 - 60
0.075	0 - 25

Compaction of the bedding material shall comply with AS3725 providing 60% Density Index for cohesionless material, and 90% Dry Density Ratio for cohesive materials. Where FRC pipes are

proposed bedding shall be a cohesive material (such as road-base) compacted to 95% Dry Density Ratio.

With all pipes the “haunch and side zones” shall be compacted to a minimum overall depth of 50% of the pipe diameter, with the haunch zone height being 0.3 x Diameter. For practical purposes the side zone material may be substituted with the haunch material.

In wet ground conditions pipes shall be laid on crushed rock and/or low strength concrete to the requirements of the engineer. Unsuitable material such as soft clays, irregular broken rock or saturated soils shall be removed and replaced with an approved support material.

The side zone shall not be considered to be effective in supporting pipes unless the trench walls or surrounding embankment have density and stiffness not less than those of the adjacent compacted fill. (AS3725)

The contractor shall produce, when requested, evidence that the specified or approved material is the material in use.

8.4.1. Common Trench (with Subsoil Drainage)

It should be noted that where subsoil drainage is installed with the stormwater pipeline the haunch, side and overlay/backfill zone materials must display, when compacted, both the desired characteristics of those zones for pipe support/cover, and the characteristics of a filter medium in terms of “filter material” for subsoil drainage, within the area of the trench effectively acting as “subsoil drainage”.

The material should exhibit zero or low occurrence of fine particles and may be a uniformly graded aggregate either compacted or otherwise to achieve the objectives for a cohesionless material nominated above. A geotechnical engineer’s concurrence, that the proposed material meets these objectives, shall be submitted to Council.

Pipe support material for each side of the pipe, must be the same material.

The contractor shall produce, when requested, evidence that the specified or approved material is the material in use.

8.5. Pipe Overlay

Other than in roadways the “overlay zone”, shall be an approved suitable/workable natural material, (not being large lumps of clay) compacted to a minimum depth of 150mm above the top of the pipe, not containing any stones larger than 150mm, nor more than 20% with a size between 75mm and 150mm.

The “overlay” zone in the roadway shall satisfy the parameters detailed under “pipe backfilling” below.

8.6. Pipe Backfilling

Other than in roadways, backfilling shall comprise of natural available earth material, suitable for adequate compaction to avoid surface slumping.

Where pipes are laid in roadways, backfill to the road sub-grade level shall be with approved crushed rock or sand filter materials. Compaction shall be by mechanical, and/or flooding or other approved means. Mechanical tampers shall be utilised for compaction in layers of not more than 300mm to “95% Modified” (for cohesive materials) and 65% density index (for sand) in accordance with AS 1289.

8.7. Trench Compaction Testing

Compaction of backfill materials in excavations for conduits and pits, usually within road and public reserves (or elsewhere as directed by Council), shall be certified by a geotechnical engineer as compliant with the standards within this Manual. Testing locations shall be chosen by the engineer at random locations that are considered to be representative of the works, generally being one test per 200 metres of stormwater pipe trenching and at two service crossings per project.

8.8. Precast Box Culverts

Precast concrete box section crown units and slabs shall comply with TfNSW Specifications for supply and delivery of precast RCBC sections and shall be installed to comply with AS 1597. Only cast in-situ slabs are permitted for box culverts. Refer to Document D: Design, D19.2, for further information.

Where rock is encountered it shall be neatly excavated to the underside of the bedding material. Unsound material shall be removed and replaced with compacted and approved select material.

Bedding shall be either mass concrete or lightly bound approved granular material unless otherwise approved by geotechnical and structural recommendations.

No bedding shall be placed until the foundations have been inspected and approved by the engineer or Council.

Mass concrete bedding shall be not less than 50mm thick. Granular bedding shall be a minimum of 100mm thick, compacted to 95% modified maximum dry density in accordance with AS 1289.

8.9. Base Slabs

In-situ base slabs shall be constructed as shown on the approved engineering plans. Slabs shall not be poured until the reinforcement, and formwork has been inspected and approved by the engineer or Council, and upon completion, the slab shall be cured in adverse weather conditions. Cells shall not be applied to the slab until the concrete has reached at least 70% of the design strength. Cells shall subsequently be placed on a bed of mortar in the recessed edge of the slab. Transverse cell joints shall be covered with a bituminous strip located centrally over the joint and adequately secured. Longitudinal joints in multi-cell components shall be mortar-filled.

8.10. Pits

Pits and associated drainage structures shall be constructed in concrete, in accordance with (firstly) Council's standards or the approved plans, thereafter TfNSW Standards, and in accordance with the requirements of AS 3600 - Concrete Structures. All drainage structures (pits, wingwalls, slabs etc) shall be constructed on a compacted granular foundation.

Pits shall be benched in the base, and subsoil drainage pipe outlets within pits shall be installed at the same level as the invert of the upstream pipe, regardless of pit-benching.

Grates at road kerb inlets shall be galvanised and of the type that provides an RHS support along both edges of the grate, (see SD039), and shall be hinged within a frame with a lock-down J-bolt.

Where pits are greater than 1.2 metres in depth step-irons shall be installed (see SD039).

8.10.1. Cast In-Situ Pits

All cast-in-situ pits shall be constructed with 25 MPa (minimum) concrete, including soffits and grate support, and shall be constructed using formwork. The base (reinforced concrete floor) shall be poured

first. Standard pits, up to 2.5 metres high, shall be reinforced as noted on the Standard Drawings in this Manual. Reference should be made to an engineer's design for non-standard pits. Minimum floor, wall and soffit thickness for in-situ pits shall be 150mm.

All "cold" joints shall have "starter" reinforcing steel consistent with drawing SD039 or the special pit design. Pit wall-to-base connections shall have "starter" reinforcing of N12 "L" bars (450 legs), at 400mm (max) centres.

8.10.1. Precast Pits

All precast pits require prior approval from Council before any work commences. Their shop drawings must be submitted to PCA and Council for review before installation to demonstrate compliance with requirements in Document D for precast pits, D.18.4.3.

Where precast units are utilised, the units shall be transported, stacked, stored, and installed in accordance with the manufacturer's specifications.

8.10.2. Pit Formwork and Backfill

All external formworks shall be removed (stripped) before backfilling. Reference should be made to the requirements of AS 3610, but also generally, as follows. Formwork shall not be removed from:

- Walls:
 - within an **18-hour** period from the time of the pour (i.e. when air shade temperature is between 5°C and 12°C); or
 - within a **12-hour** period from the time of the pour (i.e. when air shade temperature is between 12°C and 20°C).
- Soffits:
 - within a **5-day** period from the time of the pour.
 - No backfill shall be placed against a wall, within an **18-hour** period from the time of the pour, and then only loose material for purposes of a working platform.
 - No compaction of backfill by means of "flooding" shall occur within a **24-hour** period from the time of the pour.
 - No compaction of backfill by means of mechanical vibration shall be applied adjacent to a wall until the concrete has reached a compressive strength of at least **15MPa**, (generally achievable after 96 hrs - 4 days with 25MPa design strength) unless effectively supported by horizontal struts, and then not before a **48-hour** period has expired.
 - No backfill shall be placed on a soffit for a period of **5 days** from the time of the pour unless effectively supported by propping and then not within a **3-day** period, preferably with internal formwork in place.
 - No construction loads or compaction of backfill by means of mechanical vibration shall be applied over a soffit for a period of **7 days** from the time of the pour, and then not without effective propping supports, preferably with internal formwork in place.
 - Whilst under construction loads, propping shall remain in place until full design strength is reached (nominally 28 days).

The above criteria may be *extended or shortened* by the engineer subject to air shade temperature falls or rises beyond that specified. Backfill material shall be placed, and be of a type, similar to that required for pipes. All strutting and propping shall be to the satisfaction of the engineer.

8.11. Gross Pollutant Traps

Gross pollutant traps shall be constructed as shown on the approved plans, with all steel items being hot-dipped galvanised or stainless steel. Large top grates shall be lockable and removable, with lifting hooks, and shall include a hinged access grate component.

8.12. Scour Protection

Scour protection at headwall outlets, shall be caged rock or plain concrete, or large rocks that will remain stable under full flow conditions, to a distance of generally 4 times the pipe diameter (see Standard Drawing SD045), and be returned up the bank adjacent to the end of the wing-wall approximately 300mm. Rock mattresses shall have a geo-textile fabric underlay. Rocks within a wire cage shall be a size sufficient (100mm to 150mm) to be contained by the cage. Designers shall also consider energy dissipation and scour protection requirements consistent with industry guidelines, including Austroads standards.

Indicative Example (for pipe diameters up to 450 mm):

- Flow velocity below 2 m/s – Rock in concrete or gabion construction.
- Flow velocity greater than 2 m/s – Design and implement a suitable energy dissipator (with a proper rock size and length of apron).

8.13. Open Drains

Temporary catch drains shall be constructed in accordance with the plan or where considered necessary by the Engineer. Drains shall be sized to suit the catchment area. Drains may require erosion prevention measures. Temporary drains shall be backfilled and restored to the natural surface upon completion of works.

Permanent catch drains and batter drains shall be lined for protection against erosion, to the shape and location as shown on the approved plans. Prior to the placing of the lining material the foundation shall be shaped and compacted to form a firm base. Concrete lined inverts shall be a minimum of 600mm wide.

Concrete wing drains shall be constructed as cast-in-place or sprayed concrete. Weepholes shall be provided at regular intervals.

Stone pitching of open drains shall be of sound durable rock not less than 100mm thick and laid on approved geotextile fabric.

8.14. Inter-Allotment Drainage

Inter-allotment drainage details are also referenced in the above sections of this Document.

Pipes shall be constructed as shown on the approved plans, and laid centrally within easements, subject to sewer pipe location.

The following installation criteria shall be employed:

- Pipe “cover” shall be a minimum of 300mm (where vehicle loads are not expected).
- Trench “side” clearance to the pipe shall be a minimum of 100mm.
- The “bed” shall be a free-draining sand (or crushed rock aggregate – 14mm max.) and shall have a minimum compacted thickness of 75mm.

- The “side” support shall be a compacted, free-draining sand (or crushed rock aggregate) and shall extend to the top of the pipe.
- The “overlay” shall be an approved suitable/workable natural material, (not being large lumps of clay) compacted to a depth of 150mm above the top of the pipe, not containing any stones larger than 150mm, nor more than 20% with a size between 75mm and 150mm.
- The installed pipe shall be inspected prior to placement of the overlay zone.
- The “backfilling” shall comprise of natural available earth material, suitable for adequate compaction to avoid surface slumping.
- A 3 metres length of socked subsoil pipe shall be installed upstream at every second pit within IAD pipe system.
- All disturbed surfaces shall be fully restored.

Each IAD pit shall have a capped stub for the dwelling connection, and all pit/pipe joints shall be mortared flush with the pit. (see SD043).

8.15. Culverts

Culvert type road crossings shall be constructed such that granular bedding or subsoil drainage is well confined by a cut-off wall, wingwall and compacted clay embankment backfill. Where subsoil pipes are approved the inlet end shall be raised to the surface and capped.

8.16. Pipe Tolerances

Allowable construction tolerances for pipelines shall be as follows:

Table C-7: Pipe Construction Tolerances

ALLOWABLE CONSTRUCTION TOLERANCES FOR PERMANENT PIPES, CULVERTS AND DRAINS	
Grade Line (Vertical Alignment)	Tolerance per 2.4m Length or part thereof deviation from the design grade line level
Less than 1%	10mm
1% to 4%	15mm
4% to 7%	20mm
>7%	25mm
Horizontal Alignment	50mm

Notwithstanding the above each 2.4 metres length of pipe shall have fall in the direction of the design grade line.

8.17. CCTV Requirements

Requirements for CCTV are outlined in Document G: General Requirements

9. Pavement Construction

Subgrade preparation shall be carried out in accordance with Section 7: Road Formation of this Document.

9.1. Flexible Pavement

A flexible granular pavement, whether of modified material or otherwise, shall be constructed in accordance with the approved construction plans or as amended through geotechnical advice, with Council approval.

Nominated pavement depths refer to the compacted material depths of each layer.

9.1.1. Tolerances

The following table of construction tolerances, relative to the approved design for flexible unbound pavements, shall apply to subgrade, sub-base and base courses, and asphaltic concrete (AC10) wearing surface.

The approved design thicknesses/levels are to be achieved generally throughout the work. Variations of “Construction Tolerance” should not be assumed as a general variation and will only be accepted as an exception for minor areas.

Table C-8: Pavement Construction Tolerances

TOP OF LAYER	CONSTRUCTION TOLERANCE (FROM DESIGN LEVEL)	SHAPE (DEVIATION FROM 3 METRES STRAIGHT EDGE)
Sub-Grade	+ 0 to - 50mm	
Sub-Base	+ 10mm to - 20mm	Not greater than 20mm
Base	+ 15mm to - 0mm	Not greater than 10mm
Wearing Surface, AC Thickness (1)	-5mm to + 20mm	Not greater than 7mm

Notes:

1) The minimum AC Thickness is 40mm.

Sub-grade, sub-base and base course finished surface levels, at the gutter lip-line and the “crown”, shall be verified by Council. Where requested by Council such measurements may be subject to verification by survey prior to adding of any subsequent layers.

The finished wearing surface shall not be lower than the lip of the gutter or edge constraint.

9.1.2. Pavement Materials

All pavement materials shall comply with the requirements of:

- TfNSW Specification TS 03315.1 (Old number: IC-QA 3051 Ed.7) and TS 03315.2 (Old number: IC-QA 3051 Ed.2) for unbound base and unbound sub-base or,
- ARRB Special Report No 41 and APRG Report No 21 for granular materials; or
- The material properties detailed at Appendix D.

The use of materials not meeting these specifications, including recycled materials may be considered for Council's approval, subject to an evaluation by a geotechnical engineer. Materials subjected to treatment by a suitable modifying/stabilising agent must be through a mechanical mill and must meet the relevant specification for modified material. Each pavement layer at compaction shall have moisture content between 60% and 90% of Optimum Moisture Content (OMC).

Council's Environmental Sustainability Strategy 2030 supports the appropriate use of recycled products. A recycled gravel can be proposed to council demonstrating it is fit for purpose for the relevant or specific use. A register of pre-approved materials will be kept by council.

For subgrade bearing capacity under pavements, the use of geotextile materials is permissible subject to recommendations by the Geotechnical Engineer and suitability of use with location.

Where a combined sub-base/base single-layer constructed pavement is proposed, such a layer shall consist of base course material only. (See 'testing' below).

The following table provides details of acceptable material types:

Table C-9: Acceptable Material Types

DESIGN TRAFFIC	BASE	SUB-BASE
$= > 1 \times 10^7$	DGB20, GMB20	DGS20, DGS40, GMS40
$= > 4 \times 10^6 \text{ \& } < 1 \times 10^7$	DGB20, GMB20	DGS20, DGS40, GMS40
$= > 1 \times 10^6 \text{ \& } < 4 \times 10^6$	DGB20, GMB20	DGS20, DGS40, GMS40
$= > 1 \times 10^5 \text{ \& } < 1 \times 10^6$	DGB20, GMB20, NGB20-2c	DGS20, DGS40, GMS40, NGS20, NGS40
$< 1 \times 10^5$	DGB20, GMB20, NGB20-2c, NGB20-2d	DGS20, DGS40, GMS40, NGS20, NGS40

Generally, plasticity indices shall be restricted to 6 (max) for base material and 12(max) for sub-base material.

The pavement designer should be satisfied that the pavement material type and quality will, with suitable construction methods, meet the requirements of this Manual in respect to compaction and deflection standards for the nominated CBR and ESA requirements.

For select materials, the plasticity index must be limited to a maximum of 15. The material shall be well-graded, homogeneous, and generally meet subbase quality grading standards. It must have a swell of 1% or less and a minimum CBR of 8%.

9.1.3. Pavement Compaction

Unless the subject of special design, pavement layers (including “select material”) shall be placed in compacted layers not exceeding 200mm and not less than 100mm thick.

Minimum dry density compaction requirements are as follows:

Table C-10: Pavement Compaction Requirements

LAYER	COMPACTION REQUIREMENT (MIN)	STANDARD
Sub-Base	95% Modified	AS1289
Base	98% Modified	AS1289

Where a combined sub-base/base single-layer constructed pavement is proposed, testing shall be undertaken in accordance with TfNSW TS 03267.1 (Old number: IC-QA-RN73). Such a layer shall be base course material only.

9.1.4. Pavement Testing

Pavement testing for compaction density and deflection shall be undertaken by a NATA registered laboratory and a certificate of compliance shall be issued together with test results. All layers shall be tested.

Density testing by sand replacement, nuclear densometer or other NATA approved means is required at the start and finish limits of the work (within the first and last 5.0 metres) and thereafter as “Random Testing” in accordance with TfNSW or Australian Standards. A minimum of two tests shall be carried out for any road less than 50 metres in length.

Testing within cul-de-sac turning heads is also required.

The location of tests within the road cross section shall be randomly selected to ensure that the full width of the road pavement undergoes representative testing.

Proof-roll testing shall be observed at each layer using acceptable machinery to perform the test, such as a three-point roller, a fully laden watercart or a large grader, with preference in that order. The test shall be performed by a person experienced in road construction testing representing Council or geotechnical engineer.

Individual pavement layers shall not be covered by succeeding layers until test results have demonstrated that the layer has passed the nominated standard. Where a combined sub-base/base single-layer constructed pavement is proposed, testing shall be undertaken in accordance with TfNSW TS 03267.1 (Old number: IC-QA-RN73).

All test results shall be submitted to Council and accepted as compliant, prior to granting of “practical completion”.

Where test results fail to meet nominated standards, additional testing shall be carried out to isolate the failed area prior to reworking and retesting showing that nominated standards have been achieved.

Prior to application of the wearing surface, an assessment of the pavement shall be undertaken according to the elastic rebound deflection test, in accordance with Test Method T160, utilising the

Benkelman Beam or an equivalent method. The resultant Characteristic Deflection for a section of pavement, calculated as the "mean" plus "standard deviation", should not generally exceed the values (for unbound pavements) in the table below.

As part of the assessment, for roads greater than Distributor (secondary) status, a "reliability" product factor ($f=1.65$) should be applied to standard deviation. The coefficient of variation ("standard deviation" divided by "mean") should not exceed 0.3. Subject to assessment, upon failure of a test, further testing may be employed to "track" possible improvement and ultimate compliance of test results.

The frequency of testing shall be conducted on alternate wheel paths at intervals of up to 15 meters. For short road constructions, the testing frequency shall be reduced accordingly to ensure an accurate analysis on characteristic deflection.

Table C-11: Benkelman Beam Deflection Requirements

ROAD TYPE	ESA'S	CHARACTERISTIC DEFLECTION	MAXIMUM DEFLECTION
Laneway Residential (LR)	1×10^5	1.20	1.80
Yield Street (L8) < 100 lots	5×10^5	1.10	1.40
Yield Street (L8)	1×10^6	1.10	1.40
Local Street (L10)	1×10^6	1.10	1.40
Local Collector (LT11)	1.5×10^6	1.00	1.30
Local Distributor (T12)	2×10^6	0.90	1.10
Secondary Distributor (T14)	4×10^6	0.80	1.05
Primary Distributor (T15)	5×10^6	0.77	1.00
Minor Sub-Arterial (T15.4)	1×10^7	0.70	1.00
Sub-Arterial Urban (SA13)	1×10^7	0.70	1.00

Business/School Precinct	1 x10 ⁷	0.70	1.00
Industrial (I13)	1 x10 ⁷	0.70	1.00
Residential (R5-V), Residential (R5-X), Residential (R5-Y), Residential (R5-Z)	Apply deflections as per lot catchment and ESAs defined under road type and dimensions table (ESA 1 x10 ⁻⁵ minimum)		
Sub-Arterial Rural	Apply deflections as per ESAs defined under road type and dimensions table		
Arterial Rural	Apply deflections as per ESAs defined under road type and dimensions table		

9.1.5. Pavement Joints

Where new pavements abut existing pavements (whether longitudinal or transverse pavement joints), benching of the base course to a minimum width of 300mm shall be provided to achieve an effective key-in. Longitudinal joints located along wheel paths should be avoided. (See SD032)

Pavement joints and the wearing course shall be positioned away from under wheel paths to avoid accelerated wear and cracking. This approach enhances the pavement's durability, minimises maintenance requirements, and ensures a smoother and more aesthetically pleasing surface.

9.2. Rigid Pavement (Roads)

Rigid concrete pavements shall be constructed in accordance with TfNSW TS 03270 (Old number: IC-QA-R82) "Lean-Mix Concrete Sub-Base and TS 03271 (Old number: IC-QA-R83) "Plain Concrete Base" guidelines. Australian Standards shall apply with respect to concrete:

- supply - materials
- delivery - mixing, transport, time, consistency
- placement - compaction, evaporation rates, texture
- curing - method/product, protection
- texture - cove, broom, rake etc.
- jointing - cutting, filling

9.2.1. Materials

Material quality requirements for base and sub-base concrete, shall be as specified in the TfNSW Concrete Pavement Guidelines.

9.2.2. Components

~~The following limited details are summary guidelines for good practise concrete road construction.~~

Subbase

Concrete shall be compacted by means of “needle” immersion vibrators. Screeding may be by hand or vibrating screed. The surface shall be finished with a steel float and shall be covered with an approved curing agent. A bond-breaker shall be applied to the surface of the sub-base.

The sub-base shall not be subjected to traffic until the concrete has attained a compressive strength of 4MPa.

Base

Concrete shall be compacted by means of “needle” immersion vibrators and two passes of a vibrating screed. If required, the surface shall be finished with a steel float.

The surface shall be covered with an approved curing agent.

The base shall not be subjected to traffic until joints are sealed, and the concrete has attained a compressive strength of 20MPa (generally at 7 days for specified 32MPa). High early strength concrete may be used if earlier traffic use is necessary, where approved by the engineer.

Anchors and Terminal Slabs

Anchors shall extend over the full width of the base (not under the kerb and gutter) and the associated joints shall be no closer than 2 metres from other pavement joints. Terminal slabs shall be constructed adjoining bridges and at junctions with flexible pavements.

Characteristic concrete strength shall be a minimum of 32MPa.

Sub-grade Beams

Sub-grade beams shall be constructed flush with the sub-grade level. The beams shall be compacted by mechanical vibrator equipment, finished with a steel float, and cured and de-bonded as per the sub-base specification.

Characteristic concrete strength shall be a minimum of 25MPa.

Tie Bars

Tie bars shall be N12(min) galvanised bar of a minimum length of 25 times bar diameter and spaced at 900mm (in a 200mm thick slab).

Curing and Texture

Control of moisture for evaporation and curing shall comply with the requirements of TfNSW TS 03270 (Old number: IC-QA-R83). Methods for moisture-loss control shall be by the application of an evaporation retardant (such as an aliphatic alcohol) followed by curing with a water-based hydrocarbon resin or similar. Unless approved otherwise, road pavements shall be texture with an TfNSW type “rake” finish.

9.2.3. Concrete Testing

Concrete testing for hand-paved placement shall be sampled in accordance with AS1012 and AS1379, and tested at a minimum for each continuous pour, as follows:

Base and Sub-Base

Slump

- The first three truckloads of the project first day pour and,
- Each truck load during continuous pour-days at compression testing site visits.

Compression (One test being, 1 pair at 7day and 1 pair at 28 days).

- One test from the first load,

- Thereafter one test per 50m³ or part thereof.
- For small quantity "infill" pours, compression testing may be waived at Council's discretion (with 24 hrs notice to batching plant)

Base

Flexural (Steel Fibre Reinforced Concrete SFRC only)

- One test per 50m³ or part thereof.

10. Kerb and Gutter

Kerb and gutter and other concrete edged construction shall be graded and aligned in accordance with the approved engineering plans. Kerb, gutter and edge restraint profiles shall be provided as shown on Standard Drawing SD004.

Kerb and gutter shall be laid on an approved sub-base material of a minimum 150mm compacted thickness in accordance with the requirements for sub-base within this Document, with no loose material beneath the concrete, and may be placed on an approved and tested "kerb-run" of sub-base material of an adequate width or be the prepared road sub-base.

Minor construction variations of up to 20mm in line and 10mm in level over a distance of 5 metres may be accepted, providing the design layout (particularly for traffic control devices), appearance and drainage are not compromised. Construction works that exhibit ponding will not be accepted.

Kerb Outlets for roof stormwater discharge to the street for allotments shall be provided in the kerb usually on each side of each lot (or as directed by Council for unusual lot layouts or as appropriate for corner-lots), within 1.0 metre from the side boundary alignment, in accordance with Council's Standard Drawing SD036.

Pipe crossings (x2) to each lot within a subdivision that drains to the road shall be provided across the footway generally adjacent to each side boundaries of each allotment, connected to kerb outlet inserts and extended into the lot being serviced. The pipe shall be 100mm sewer grade PVC.

10.1. Concrete Supply and Placement

All concrete for kerb and gutter shall have a minimum compressive strength of 32 MPa at 28 days. Documentary evidence of concrete testing for compliance shall be submitted to Council as part of the final report. Concrete Slump shall be as follows:

- Machine extruded: 10-20mm.
- Manually formed and poured: 70-80mm.

Contraction joints shall be cut to within 50mm of the base of the kerb front and rear at 3 metres intervals. Gutter crossing laybacks, where required, shall be poured integral with the gutter. Kerb transitions are to be shaped into a lipless flattened section for a future (dowelled) pram ramp connection.

Concrete in kerb and guttering shall be placed in accordance with the general requirements for concrete within this Manual and Australian Standards. The surface shall have a smooth steel-trowel finish.

Excessive amounts of concrete expelled from the extruder onto the sub-base material shall be removed to leave a near vertical face.

11. Wearing Surface

The wearing surfaces shall generally be as follows: -

Table C-12: Acceptable Wearing Surfaces

ROAD TYPE	ACCEPTABLE STANDARD
Residential	Asphalt (AC10 “residential mix”) 40mm (min) depth
Business and Industrial	Asphalt (AC14) “Heavy Duty” 50mm depth.
Rural	Bitumen flush seal 1st coat 14mm, 2nd coat 10 or 7mm.
Classified Roads	Bitumen flush seal 1st coat 14mm, 2nd coat 10mm, OR Asphalt (AC14) “Heavy Duty” - 50mm depth.

Variations to the above table may be required where an existing road surface type may dictate the specification for any abutting works.

The application of a single coat reseal shall be nominally, a 10 or 7mm seal. Documentary evidence of wearing surface testing and/or application shall be submitted to Council as part of the final report.

11.1. Bitumen Flush Seal

All design material, quality and field procedures for sprayed sealing shall be in accordance with the TfNSW Sprayed Sealing Guide and Australian Road Research Board Sealed Local Roads Manual.

Works shall be carried out by contractors with established competence in hot bitumen sealing.

All new roads shall be surfaced for the full extent as shown on approved plans and shall merge with the existing to neatly match levels. Minimum overlap for top-coat spray seals onto existing bitumen surfaces shall be 300mm.

All flush seals shall comprise of two coats of bitumen and two coats of aggregate.

All aggregates shall be “pre-coated”.

Areas of high torsional loads may require polymer modified asphalt.

All binders for sprayed sealing shall have added an approved adhesion agent in accordance with manufacturer’s recommendations.

11.2. Primer Seal

A 7 or 10mm primer seal shall be placed under all asphaltic concrete wearing surfaces.

A minimum of fourteen days duration shall apply prior to application of subsequent asphalt layer(s). That period may be extended or shortened by Council subject to justifiable reason such as:

- providing an extended “test” period to monitor performance.
- reduction (minor) due to weather or contractual influences.

Primed areas subjected to damage shall be re-primed prior to placement of asphalt to the satisfaction of Council.

11.3. Asphalt

Asphalt wearing surfaces shall be provided in all new residential, commercial, and industrial roads, other than where concrete or segmented block paving is proposed. No asphalt shall be placed until the base course construction has been approved by Council.

The asphalt mix shall be designed in accordance with TfNSW Specification TS-03283 (Old number: IC-QA-R116) or similar for dense graded asphalt.

Works shall be carried out by contractors with established competence in asphalt application.

Construction practice for asphalt works shall be in accordance with TfNSW Specification TS-03276 (Old number: IC-QA-R106) and TS-03283 (Old number: IC-QA-R116) and Australian Road Research Board Sealed Local Roads Manual.

Hand placement of asphalt shall be kept to a minimum and only permitted for minor correction works or in areas where placement by paver is impracticable.

The contractor shall rectify any damage to the pavement surface adjoining the area of works. Minor depressions may be filled with asphalt and compacted as directed prior to placement of the final pavement wearing surface.

The finished asphalt surface adjacent to the concrete gutter lip or edge restraint shall not be lower than the concrete surface.

12. Concrete Items

Premixed concrete shall be from an approved supplier and must conform to Australian Standard 1379. Formwork shall conform to Australian Standard 3610 – Formwork for Concrete. All concrete components shall be designed in accordance with Australian Standard 3600 – Concrete Structures.

12.1. Driveway Access Handles

Construction shall be in accordance with the approved plans, or where additional detail is required, Council’s Standard Drawing SD012. Inspection is required of formwork and reinforcement prior to concrete placement.

12.2. Paths

Concrete footpaths shall be constructed and provided where detailed on the engineering plans, and in accordance with Council’s Standard Drawings SD002, SD007, SD012 & SD019. Variations on the location of the footpath may be required depending upon special site circumstances.

Joint layouts shall ensure that acute angles forming narrow triangular shapes are avoided.

Protrusions into paving such as service authority pits should be avoided, but where necessary shall have full depth compression joint fillers on all sides and at least two joints projecting from opposite corners of the pit to the edge of the paving.

Unplanned cracks in paving slabs may render such slabs unacceptable, resulting in their removal and replacement.

Adjacent surface levels shall be such that they do not intercept, pond, or concentrate stormwater flows onto footpaths.

12.3. Concrete Linings

Where concrete lining of small open drains inverts is required, the minimum thickness of concrete shall be 100mm. Sprayed concrete less than 1.0 metre wide, will not be permitted in drains, and the final surface being uniform and free of depressions.

Sprayed concrete shall conform to Australian Standard 3600 and all contractors shall be skilled and experienced in its application. Mix proportions, procedures etc. shall be submitted to Council or the Engineer for approval prior to placement.

Earth subgrade surfaces shall be graded, compacted, shaped, and dampened prior to applying concrete. Concrete can either be coloured to match surrounding conditions or natural (plain).

12.4. Concreting Placement and Practise

12.4.1. Sub-Base

Concrete shall be placed on an approved base material comprising either 50mm of sand, or 100mm compacted approved granular material or minimum 50mm thickness mass concrete, with this being placed on a firm subgrade. An approved plastic sheet underlay or sufficient wetting of the subgrade surface shall be provided.

12.4.2. Reinforcement

All reinforcement shall conform to Australian Standard 1302 – Steel Reinforcing Bars for Concrete, Australian Standard 1303 – Steel Reinforcing Wire for Concrete and Australian Standard 1304 – Welded Wire Reinforcing Fabric for Concrete and be free of excessive rust, oil, grease, or other deleterious matter.

All steel shall be overlapped as specified on the approved drawings (or if not stated, generally 30 x diameter) and securely tied at joints to provide a rigid matrix and correct load transfer.

Steel shall be supported by “bar chairs” or metal hangers of the necessary dimensions to provide the specified cover and adequate support at maximum 1.0 metre spacings ensuring that the steel is not dislodged during the concrete pour and compaction.

12.4.3. Placement

Concrete shall be compacted to expel air voids and where specified or directed, vibration by mechanical means. “Vibrators” shall not be left in one position for greater than 30 seconds and shall not vibrate reinforcement or formwork.

12.4.4. Joints

Joining of works shall provide the completed section with a clean cut off with residue concrete removed and an approved joint placed before recommencement of works. Expansion, contraction, tied, dowelled, longitudinal and construction joints, including joints between precast units, shall be provided where shown on the approved plans or where it has been nominated by the Engineer.

Generally, contraction joints, consisting of narrow transverse vertical grooves 30mm deep shall be formed or cut at intervals that provide individual slab side/length ratios of approximately 1:1.5. Expansion/construction joints with a filler material shall be full depth (see Standard Drawings). Joint filler material shall extend the full depth of the joint.

12.4.5. Surface

Pedestrian trafficked areas shall have an approved non-slip finish as a light broom finish. Trimming with steel edging tools shall be overworked with a textured finish (broom). Minor imperfections in stripped concrete shall be repaired.

12.4.6. Curing

Newly placed concrete shall be protected from rain by PVC sheeting. Curing of concrete shall be obtained with an approved curing compound or covering.

12.4.7. Damage

Concrete that is damaged or vandalised shall be repaired or replaced at the discretion of Council.

12.4.8. Testing

Council may require testing of concrete by slump or core samples (post-construction), if it is considered that the concrete mix may be sub-standard.

12.4.9. Weather

Concrete works shall not be carried out during adverse weather conditions such as when ambient temperatures are higher than 30°C or lower than 10°C without taking appropriate precautions. If temperatures exceed 35°C or fall below 5°C, placement should not take place. Council may direct that concrete placement be postponed. The following graph may be used as a guide to determine acceptable weather conditions to allow unprotected placement in order to achieve a rate of evaporation of 1.0 or less.

Precautions shall be taken to ensure that moisture content in the concrete is not reduced due to dry foundations.

A4.3.5 Prevention of Moisture Loss

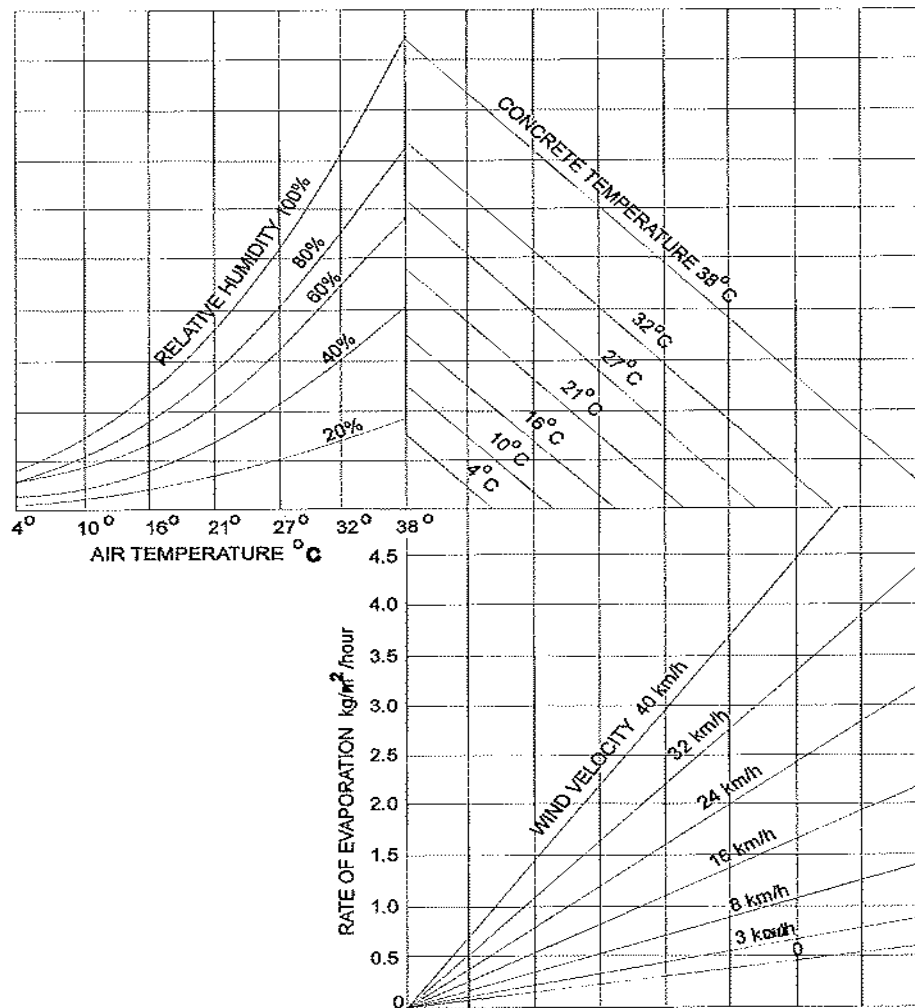


Figure A3.2 - Evaporation from Concrete Freshly Placed on Site

The graph shows the effects of air temperature, humidity, concrete temperature and wind velocity together on the rate of evaporation of water from freshly placed and unprotected concrete. An example follows:

With air temperature at 27°C, relative humidity at 40%, concrete temperature at 27°C, and a wind velocity of 26 km/h, the rate of evaporation would be 1.6 kg/m²/hour. To determine the evaporation rate from the graph, enter the graph at the air temperature (in this case 27°C), and move vertically to intersect the curve for relative humidity encountered (here 40%). From this point move horizontally to the respective line for concrete temperature (here 27°C). Move vertically down to the respective wind velocity curve (in this case interpolating for 26 km per hour) and then horizontally to the left to intersect the scale for the rate of evaporation.

Source: Gelber, S, 1984, "Predict evaporation rate and reduce plastic shrinkage crack", Concrete International (ACI) v5 n4, 19-22

Figure C-1: Evaporation from Concrete Placed on Site

13. Conduit and Road Crossings

All "Road Crossings" for primary services shall be laid in conduits and backfilled and thoroughly compacted no later than subgrade stage and shall be at a depth to ensure they are not damaged during the pavement construction process.

In urban areas the location of all crossings shall be marked (but not painted) on the top of the kerb as follows:

- Flushing points - “FP”
- Water - “W”
- Power - “E”
- Communications - “T”
- Gas - “G”

Water supply shall be provided to a point within each lot.

14. Surface Restoration

14.1. General

Any existing pavements, lawns etc, adjoining the works shall be protected from damage. If damage does occur, all remedial works shall be performed to restore the original item or surface, to the satisfaction of Council.

Restorations within Maitland CBD (the Levee and Mall restorations) are to be completed by Council in accordance with Council’s fees and charges, which must be paid by the applicant prior to the commencement of works.

14.2. Footways

Footway verges shall be constructed as shown on the plans and shall be fully topsoiled 150mm thick and stabilised with grass seed or be fully turfed. Where concrete paths are provided, the area between the kerb and the path shall be fully turfed.

A turf strip shall be placed along the edge of all concrete slabs. Additional turf strips may be required across the footpath on steeper longitudinal grades to prevent erosion.

Turf type is optional and may be Couch, Buffalo, or Kikuyu.

14.3. Trenches

Backfill of trenches shall be placed sufficiently high to allow for settlement. Further backfilling shall be carried out to restore ground conditions over trenches to match adjacent surface levels.

Backfilling of trenches through existing road pavements must be immediately restored to the existing surface. Where the trench crosses a bitumen or asphalt surface, pre-mixed asphalt shall be used for restoration. Any subsequent settlement of trenches not adequately filled or compacted shall be made good by the contractor.

14.4. All- Weather Surfaces

An all-weather surface is defined as a surface capable of being trafficable in all-weather condition and will generally consist of an approved gravel material. For minor access treatments, a pavement 4 metres wide and with 150mm compacted pavement thickness should be the minimum treatment. Cement modifying material may be utilised to bind the surface if bitumen seal is not proposed.

Where bitumen seal is proposed, the pavement thickness shall be increased to 200mm. Pavement crossfall, of 4% minimum shall be applied, and adequate longitudinal and transverse drainage installed. The engineer may consider the use and treatment of alternate materials where proposed.

14.5. Mulch and Turf

All disturbed earth areas shall be topsoiled (150mm maximum thickness in road reserves and 300mm maximum in lots) and seeded, together with turf strips on slopes likely to scour. Distinct flow-paths shall not be protected with mulch/woodchip. Holding-berms shall be installed as directed. All batters shall be similarly treated and must include turf strips. For areas that will be maintained by Council, turf and grass shall be “couch”. Other areas may employ species other than couch grass, such as Buffalo or Kikuyu.

All constructed earth drainage structures, such as basins, channels, overland flow-paths etc, shall be topsoiled (150mm maximum thickness) and fully turfed with couch grass to a point where scour is unlikely. Grassing of footways adjacent to lots may be Couch, Buffalo, or Kikuyu types.

14.6. Street Trees

Street trees in the footway shall be planted and located in accordance with Standard Drawings SD001, SD002 and SD049.

15. Locks and Keys

Where requested by Council, items such as gates, nominated grates, bollards etc, shall be locked with a padlock (and chain where necessary). The keys shall be delivered to Council.

16. Linemarking and Signposting

All linemarking, pavement markers and signposting shall be set out in accordance with the approved plan or as varied by Council. All linemarking set-out shall be inspected by Council prior to placement. Warning signs and temporary pavement marks must be employed in any interim period.

Application rates for beads and paint shall be in accordance with Austroads.

All new linemarking and signposting on public roads must be carried out after ensuring the surface is clean and free of loose aggregate, if applicable. A clean surface ensures better adhesion of the linemarking materials and leading to more durable and visible markings. The work shall be completed as soon as practicable after the wearing surface is finished and ideally within one week of completion. This helps to maintain the effectiveness and longevity of the linemarking and reducing the risk of it being compromised by contaminants or traffic wear.

- Pavement marking materials are essential for road safety and clarity, each offering unique benefits and applications. Applicants should consult with Council covering with a single coat bitumen spray seal with 10 mm (max) aggregate over an existing spray seal utilising a bitumen-spraying vehicle (or an alternative approved method for very minor needs) or,
- Removal by sandblasting or grinding on an existing asphalt surface.

17. Site Preservation

Upon completion of works, all buildings, construction plant, spoil, debris, and excess material used for the development shall be removed and the site left in a safe, clean, and restored condition. Where a significant time delay between “practical completion” and issue (or registration) of the Subdivision Certificate has occurred, Council will reinspect the works for any possible defects that may have arisen. Inspection fees may apply. The developer is responsible for the continued maintenance of all roads/drainage systems and reserves during the period, prior to “dedication”.

Date Adopted: 17 March 2026

Implementation Date: 14 April 2026

Version: 1.0

Appendix A: Preparation of Development & Engineering Design Plans

1. Plans

Plans shall be presented in a professional manner to normal industry standards and generally in accordance with AS1100. Any plan sets submitted to Council shall be marked with an issue/revision number, together with the associated date on each sheet.

DWG files shall be provided to Council. All hardcopy plans shall be presented in A1 drawing size.

2. Scales

PLAN TYPES	SCALE REQUIREMENTS
Roads and drainage	1:500 minimum or as required for clarity.
Site plans	1:1000 min.
Long sections	1:500 horizontal & 1:100 vertical
Cross sections	1:100 natural or 1:200
Catchment plans	1:1000 or sufficient to cover area and provide clarity.
Kerb profiles	1:200 H and 1:20 V

3. Details to be Shown on Plans

The plan set should have the following information:

- Property description.
- Owner/developer.
- Surveyor/engineer/designer and contact details.
- Scale, benchmark, and datum.

- Plan number and sheet number (sequential).
- Description of works on each sheet.
- Panel for signature of designated Council officer or Accredited Certifier.
- Plans shall show the location by survey or by service authority plans of all utility services.
- General, or Construction notes must include the following statement:

All works shall be carried out in accordance with the approved plans, subject to Maitland City Council's "Manual of Engineering Standards".

Other notes such as the following are recommended for inclusion.

3.1 Survey

All levels shall be obtained from established benchmarks to Australian Height Datum (AHD).

3.2 Traffic

Traffic control measures shall be in accordance with the RMS document "Traffic Control at Worksites"

3.3 Trees

All trees within the allotments and reserves (other than road reserves) shall be retained, unless otherwise nominated by an approved landscape plan and/or consent condition.

3.4 Utilities

Points of conflict between new construction and existing utility service mains shall be identified, exposed, and reported to the Project Manager prior to construction.

Service conduits shall be laid in positions as approved by the relevant authority.

3.5 Adjoining Access

Provision shall be made for suitable protection of the existing road pavement, kerb and gutter and footpath formation.

Vehicular access and all services to adjoining properties affected by construction works, shall be maintained at all times.

3.6 Soil/Grass

Topsoil, 150 mm thick shall be applied to all footpaths and filled areas. Where turf is not requested, all exposed topsoil shall be seeded immediately upon completion of the soil spreading operation.

A turf strip shall be placed along each side of concrete pathways, drainage structures, driveways, pedestrian/cycleways and at rear of all kerbs.

3.7 Erosion Control

All silt control measures shall be placed prior to the commencement of earthworks. Such measures shall be subject to further additions or alterations, where considered necessary, as directed by the Project Manager or Council, during the progression of works.

All final erosion prevention measures including establishment of grass shall be completed prior to the “final” inspection.

3.8 Subsoil Drainage

Subsoil drains shall be provided as shown on the plans. Additional drains shall be provided where considered necessary, by Council or a geotechnical engineer.

3.9 Materials & Testing

All materials and products for installation and construction shall comply with Australian Standards.

Monitoring testing (“stringline” and “roll”) where specified by Council’s Manual of Engineering Standards, to be performed by Council, shall be arranged 24 hours in advance. Where a Council officer is not available, a geotechnical engineer may perform such tests.

4.Plans

4.1 Layout Plans

Road plans as a minimum shall contain the following:

- Locality sketch.
- Site location.
- Centreline chainages as pegged.
- The chainage shall be aligned with the long section and run left to right across the plan for plans and long section.
- North point.
- Location and description of benchmarks (BM’s) to AHD or other appropriate datum.
- Subsoil drainage location and a typical section.
- Existing road names and proposed road names, (determined prior to release of engineering plans).
- Proposed lane widths and types of kerbs.
- Dimensions of all linemarking.
- All existing services to location and level.
- All drainage and structures with pipe and lintel sizes.
- Kerb radii.
- Existing drainage and road feature and their levels.
- Existing and proposed contours at 0.5 metres interval or 0.2 metres in flat terrain.
- The determined High Flood Level (HFL).
- Cut and fill batter limits and road reserve boundaries.

- Major trees or natural features affected by the design.
- Intersection and cul-de-sac details including lot boundaries, street sign location, pram ramps, pits, vehicular crossings, pipe crossing locations and contours (for abnormal complex shapes).

4.2 Longitudinal Sections

The chainage should run left to right across the page and shall include:

- Chainages.
- Natural surface levels on pegged centreline or design control line.
- Design surface levels.
- Vertical alignment details.
- Grade lines, vertical curves and lengths, high points (HP), low points (LP) and RL of intersection points (IP).
- Datum of long section.
- Chainage, conduit size and location of public utilities.

4.3 Cross Sections

Cross sections shall be shown generally at no more than 20 metres intervals and at all key points for design purposes, i.e. access, intersection or kerb service locations. Where appropriate for level control designs may require cross-sections down to 5 metres intervals.

Cross sections shall be laid out from left to right, bottom to top, on sheets sequentially numbered with the appropriate chainage shown in the title block.

Cross sections shall extend for the full width of the road reserve or sufficient to detail batters and shall show enough detail to transition to existing works such as grades, distances, etc. and crossfalls to such new works shall be generally within the range of 2% to 7%.

Details on cross sections shall include:

- Road centreline.
- Offset chainage.
- Existing surface RL and design surface RL.
- Design crossfall in % batter slope ratio and access grades.
- Design centreline shift, offset crown or transitions if applicable.
- Public utility location for offset distance and RL.
- Existing and proposed road reserve boundaries and levels.

A Typical Cross Section shall be included and shall show (in addition to the points above):

- Crossfalls & batter slopes.

- Subsoil drainage.
- Footpath and/or cycle path.
- Turfing (strip & full).
- Road pavement details including a table of pavement parameters, with design CBR and ESA details.
- Dimensioned widths.

5. Kerb Return Profiles and Plans

Each profile should have a kerb return number (e.g. KR1) corresponding with a KR1 number shown on the plan view. The profile chainages should follow the flow of traffic direction.

- The details to be shown include:
- The horizontal and vertical scale.
- Chainage. The running face of kerb chainage related to the profile, together with the chainage related to the road centrelines, generally tangent points (TPs).
- Design level, specifying either top of kerb or lip of gutter.
- Existing kerb levels where appropriate.
- The applicable road/street names/numbers leading into the profile.
- An extension of a minimum of 15 metres beyond the tangent points to ensure a smooth profile is achieved.
- Show location and number of proposed drainage structures.
- Datum RL of kerb return.

Kerb or pavement profiles should be provided for traffic islands etc. at large, complex intersections and roundabouts to provide additional level control.

6. Stormwater

The stormwater detail sheets shall show catchment plans including areas outside of the development, calculations, pit sub-catchments numbered or referenced, and overland flow paths for the 100-year ARI storm event including flow path capacity calculations.

Stormwater plans shall include the following:

- North point.
- Numbering of drainage lines.
- The pit/structure nomenclature.
- The location of any pit utility mains/services crossing influenced by the pipeline or pit.
- The location and centreline chainage of any applicable drainage structure.

- Note referring to type of bedding.
- Location and width of existing or proposed drainage easements.
- Overland flow paths, typical sections, and capacities.
- The 100-year flood contour/line, whether from the Hunter River or the local catchment.

Drainage longitudinal section sheet shall show the chainages running left to right across the sheet starting at the upstream end of the system.

Details on the longitudinal section shall include:

- Consecutive centreline chainages and finished surface levels.
- Pipe design invert level, grade, and existing surface level.
- Inverts of existing drainage open channels where necessary.
- Pipe size, class and type and hydraulic grade line.
- Public utilities affected.
- Pit structure, type, and reference number.
- Datum RL to AHD.
- Capacity and design flow.
- Bulkheads, trench stops and any bedding requirements.

7. Engineering Survey

Engineering survey of the proposed development/subdivision shall accurately show landform and features. Prior to any layout design all physical features that may affect design and construction shall be located, levelled, and plotted on the plan including: -

- Rock outcrops.
- Trees, their diameter and canopy spread.
- Watercourses, dams, springs, etc.
- Any manmade structures, drainage, kerb and gutter, buildings, fences, property access etc.
- Existing utilities and services.
- Top and bottom of banks, gullies, etc.
- Contours to 0.5 metres intervals (or 0.2 metres in flat terrain).

7.1 Datum / Benchmarks

Benchmarks related to Australian Height Datum (AHD), shall be located clear of any proposed works with a maximum spacing of 150 metres. Benchmarks shall be clearly shown on the plans with origin of levels and datum. Road pegging shall commence at zero at the centreline of any intersecting road. The centreline shall be approximately indicated and labelled at each chainage.

Unless adequately justified, all survey shall be related to Australian Height Datum (AHD) and the appropriate grid, in accordance with Survey Practise Regulations.

7.2 Cross Sections

Cross sections shall be located at 20 metres (max.) intervals on straights and 15 metres (max.) on curves. Cross sections shall also be located at tangent points (TP) of curves and to superelevation widening transitions. The above spacings are a maximum and additional cross section may be necessary in difficult terrain or unusual features.

Cross sections shall be provided at least 60 metres along any existing intersecting roads to assist a satisfactory design match.

7.3 Longitudinal Sections

Longitudinal sections shall extend a minimum of 60 metres along any intersecting roads to assist a satisfactory design match. The long section for cul-de-sacs shall be carried 20 metres beyond the kerb or to the recovery peg on the centreline prolongation.

Long sections on offset cul-de-sac heads shall be along a curve between the TP and centreline and shall also extend beyond the kerb a minimum of 20 metres. Hammerhead turning areas shall be treated similarly.

8.Erosion & Sediment Control Plans

These plans shall be clear and legible and show the location and type of each structure or device.

Details on sediment control plans shall show:

- Capacity of structures.
- Batter slopes and lengths.
- Maintenance access – fences, spillways.
- Proposed staging of restoration/vegetation works.
- Stockpile sites and treatment.
- Construction entry/exits.
- Details of the type of control (sketch).

9.Traffic Management Plans (& Traffic Control Plans)

Traffic/Pedestrian Management Plans shall be provided where the works impact on public roads and footpaths, in accordance with AS 3742.3 or RMS Traffic Control at Worksites.

The plan shall be certified by an approved designer and shall include (but not be limited to) the following:

- Total area of works and management features.
- Constructional stages resulting in changed provisions.
- Pedestrian movements and safe barriers.

- Detailed signposting, barricading, linemarking, lighting or any temporary works of such nature.
- Construction Zone speed restrictions including traffic control signals and signposting will necessitate liaison with the RMS for approval.
- Partial or full road closures (if permitted) will require liaison with Council and/or the RMS through Traffic Committee. Any advertising or public notification of such requirements will require adequate lead-time.

The Traffic Management Plan may be amended by Council's engineer, (or the RMS or Police where necessary), at any time during construction, as the need arises. No works shall commence prior to Council or RMS concurrence to the plan.

10. Miscellaneous

Sufficient survey, design and drawing detail to define all works on the plan of the proposed development or subdivision shall be shown. These details shall include:

- Site regrading (cut and fill).
- Batters.
- Retaining walls and structures, heights, structural design details.
- Drainage transitions/connections.
- Limits of works.
- Terraced areas including long sections and typical cross sections.
- Treatment of trees to be retained.
- Restoration or transition of new works to existing infrastructure.
- Pathways and overland flow routes.
- Detention basins/gross pollutant traps.
- Battleaxe handle, access grades and transitions/connections.

Date Adopted: 17 March 2026

Implementation Date: 14 April 2026

Version: 1.0

Appendix B: Erosion and Sedimentation Control

1. Introduction

Works shall be carried out in accordance with this document relating to the design, construction and maintenance of erosion and sediment control structures. Such structures may be either temporary or permanent.

The contractor shall carry out all works with an approach that is well planned, and which minimises the likelihood of erosion and sediment affecting downstream lands, watercourses, wetlands, or water bodies.

Developers are reminded of their obligations under the Environmental Planning & Assessment Act, the Protection of the Environment Operations Act and regulations and ordinances under those Acts, and the Local Government Act.

It is the responsibility of the developer, and/or representative, to be fully informed of their obligations with respect to legislative requirements. Neglect of these requirements may result in the issue of infringement notices, attracting appropriate fines.

The following guidelines should be understood in their context with the overriding parent publication “Managing Urban Stormwater – Soils & Construction,” the “*Blue Book*”.

2. Soil Erosion & Sediment Loss

Soil erosion and sediment loss can either result from disturbance to land by the subdivision construction processes or development.

Soil disturbance is an integral part of development however it is essential that construction activities limit exposure to erosion. This may be achieved by:

- Limiting the area of site disturbance.
- Isolating catchment areas of the site so that clean (upstream) water is not directed through the works area.
- Retain and stockpile topsoil for reuse and revegetation.
- Control runoff and sediment movement at point source by the implementation of protection measures.
- Progressively vegetate disturbed areas as the work proceeds to minimise area of exposure.

- Provide large sediment capture systems where appropriate sized to the contributing catchment.
- Filtering/polishing of the trapped water prior to release to receiving watercourses/drainage system.

3. Erosion & Sediment Control Plan

Designers and consultants must be familiar with the principles and objectives of soil erosion and sediment control prior to the preparation of such plans.

No works shall commence on the site until the erosion and sediment control plan has been approved by the Engineer or Accredited Certifier. The design plan shall in all cases be site specific and not a generalisation of soil erosion and sediment control philosophies.

The erosion and sediment control plan shall include, but not be limited to, the following:

- Existing site catchment topographic details and contours of natural surface and regrade areas.
- Lot layout, sewer, water, roads, and areas of disturbance.
- Nominated and fenced “NO-GO” areas to retain existing vegetative cover.
- Site works staging where appropriate and location of critical vegetation areas & watercourses.
- Location of soil stockpiles, sediment control fences and other sediment control works.
- All hydrological information and calculations relative to sediment traps and basin designs.
- Type and location of ‘clean water’ diversion works.

Council must be provided with at least two days’ notice, prior to the commencement of construction.

The contractor shall strictly follow the works and recommendations contained within the soil erosion and sediment control plan and must discuss and gain approval for any possible changes for improvement.

4. Maintenance

Transportation of materials to and from the site shall not cause deposition of material onto surrounding roads. Any inadvertent deposition shall be immediately removed from the road.

The contractor shall maintain all erosion control devices such that runoff from all disturbed areas shall be free from sediments and pollutants.

5. Temporary Minor Erosion & Sediment Controls

5.1 General

Such barriers, traps and point source control measures shall generally cater for catchments of less than 0.5 hectares. They shall be used on the downstream side of disturbed areas or around drainage pits below water outlet sites, and around culvert inlets and outlets.

5.2 Hay Bale Barriers

Straw bales should be installed on a similar basis to Silt Fences.

5.3 Silt Fences

Silt fences shall be employed to filter runoff leaving the site, to trap sediment. They are normally placed on the contour with slight convex to the contour to form a pond for water collection. Each fence should be no longer than 20 metres, should be overlapping, and they should not capture large or concentrated flows.

Areas below silt fences should be undisturbed or revegetated. They should also have a stable outlet condition. Silt fences shall receive regular maintenance. The base of silt fences should be buried to prevent stormwater flows passing beneath the fence.

5.4 Stormwater Pit & Inlet Traps

Such sediment traps shall be used to protect constructed inlet pits, stormwater piping, culvert inlets and outlets etc. They can either be built from hay bales, silt fence or silt fence 'sausages', gravel filled, or rock filled wire baskets. The choice of material depends upon the catchment area, type of material and the structure type shall be protected. These traps must be regularly maintained.

5.5 Buffer Zones

Buffer zones are corridors of existing vegetation intervening between the area of works and necessary areas of stormwater, gullies, creeks, Hunter River, and the like. The vegetation filters impede solids and reduce nutrient levels in runoff. Wetlands, streams, rivers and remnant bushland on Council's reserves and public land shall be protected by buffers. Buffer zone performance increases as catchment area and slope gradient decreases. 35 metres wide buffer zones generally provide adequate protection.

Batter Slopes

SLOPE (%)	BUFFER LENGTH (M)
2	15
4	20
6	30
8	40
10	50
12	60
14	70

Such areas are required to be fenced where shown on the approved engineering plans as directed by the Engineer. Such fencing must be plainly visible to all machine operators.

Buffer zones and "no access" vegetation areas may sometimes be utilised as minor filter systems for small catchments. Council may also require binding upstream of buffer zones to divert surface waters

and/or stilling ponds to slow water and stop weed invasion into bushland areas, particularly adjoining sensitive environmental sites, or wetlands.

5.6 Diversion Banks & Drains

Runoff from natural areas and disturbed areas shall be controlled by the construction where appropriate of diversion drains. These may be in the form of earth or lined drains/banks, hay bales, sandbags, or pipelines. They may require progressive implementation and frequent alteration as works proceed. Diversion drains shall be provided along haul roads and access tracks where such roads are considered to constitute an erosion hazard.

5.7 Level Spreaders

These are generally used at the outlet to diversion drains and have a level cross section to convert concentrated flows into non-erosive sheet flows. They may only be used to dissipate flows from small catchments.

5.8 Shake Down Areas/Access to Sites

Shake down areas shall be provided to vibrate loose material adhering to the wheels and bodies of vehicles and plant. They shall be provided at the entry/exit to construction sites and are to reduce the tracking of sediments onto roadways from sites. They can be provided by a bed of large aggregate or cattle grid or similar.

6. Permanent or Semi-Permanent Controls

These are control devices that intercept sediment from catchments generally greater than 0.5 ha and mainly at the outlet or discharge point of the site. They should not be considered for use in isolation of the temporary or point source measures. There are generally two types:

- The dry basin.
- The wet basin (wetland).

Basin designs must meet the following:

- Volume/capacity of the trap shall be at least 250 m³/ha of the site for the undisturbed area of the contributing catchment, dependent on soil types.

The capacity shall be measured below the invert of the lowest incoming flow into the trap. A secondary or emerging stabilised spillway shall be provided to prevent overtopping the structure. The basin shall have a 0.3 metres freeboard at the spillway.

The basin internal batter slopes shall be no steeper than 6h:1v in accordance with safety requirements of Australian Rainfall and Runoff. External batter slopes shall be no steeper than 2h:1v.

An all-weather access shall be provided to the basin to allow access for maintenance in all conditions.

The basin shall have an arbitrary length to width ratio of 3:1 to encourage sediment settlement and longer distance travel.

Depending on the type of basin, discharge from the basin shall usually be via a perforated riser outlet encapsulated within a filter medium adequately joined to a pipe extending through the embankment to outlet to an approved area.

7. Channel Stabilisation

Channels should be stabilised where high flows or velocities may cause erosion and scouring of the channel. Techniques employed depend upon the velocity of the flow and materials. Materials for stabilisation should be chosen accordingly. Such materials comprise:

- Jute mesh.
- Reinforced turfing.
- Revetment mattress.
- Geotextile or plastic lining.
- Stone pitching concrete or rip rap.

8. Installation of Services

It is the responsibility of the contractor and developer to install the necessary structures to services, which require protection. Such protection shall include the following:

- Minimise the time any trench is open.
- Protect all road drainage pits and inlets.
- Progressively backfill all other service authority trenches.
- Revegetate specific areas, i.e. turf strip, or grass seed and mulch.
- Place backfill on side of trench away from road.
- Surplus material removed immediately to stockpile.
- Protect stockpiles with silt control.
- Divert runoff away from trenches.

8.1 Wind Erosion

The developer shall comply with statutory controls.

An exposed site that is susceptible to wind generated dust particles, shall be progressively vegetated and watered. Where vegetation is not yet possible, dust suppression by constant watering shall be provided.

Mulching should be provided to minimise wind erosion. In some cases, the provision of windbreaks may be necessary in highly exposed or sensitive areas. These requirements will be considered on merits.

8.2 Soil Stockpiles

Soil stockpiles shall be located as shown on the approved plans and shall:

- Be located outside of watercourses or flow paths.
- Be no higher than 3.0 metres, (however 1.0 metre is preferable).

- Slopes shall not exceed 2:1.
- Revegetated with a seed mix of oats, ryecorn or Japanese millet or similar.
- Provision of soil erosion protective measures shall be placed around the stockpile.

9. Progressive Revegetation

- All disturbed areas should be revegetated immediately after construction with the provision of topsoil, grass seeding or turf, or a combination of each.
- Footpaths shall be topsoiled following provision of all services and a turf strip placed behind the kerb.
- Staging of works shall allow for the progressive revegetation of disturbed areas to minimise potential for erosion.
- All large disturbed areas (such as within lots) must be scarified to a depth of 75 mm and topsoiled to a minimum depth of 50 mm. Should the Engineer or Accredited Certifier deem that the topsoil stockpiled is unsuitable for use, then he/she will direct that the contractor imports suitable topsoil for the works.
- Hydromulching of all disturbed areas is recognised as an effective and speedy method of achieving revegetation and will be considered by the Engineer or Accredited Certifier as an acceptable practice where appropriate. Hydromulching shall be provided in accordance with the experienced and accredited supplier's specifications.

10. Hay/Straw Mulching

10.1 Surface Preparation

Surface preparation shall comprise topsoil over the area scarified to achieve a 50 mm depth massed into a scarified 75 mm subgrade. Seed and fertiliser to be sown at specified rates. Hay/straw shall be applied must be free from thistle or other woody species of acceptable quality and not rain affected.

Hay/straw shall be applied at the rate of 5 tonne/ha evenly spread over the soil surface. The hay/straw shall be tacked with nontoxic biodegradable binder at the rate of 2,500 litres/ha.

The following is a recommended seed mix:

- Spring/Summer
 - 12 kilograms per hectare of Japanese millet.
 - 8 kilograms per hectare of Perennial rye grass.
 - 3 kilograms per hectare of Red Clover.
 - 3 kilograms per hectare of White Clover.
 - 5 kilograms per hectare of Hulled Couch.
- Autumn/Winter
 - 15 kilograms per hectare of Oats or Black Winder rye corn.
 - 10 kilograms per hectare of Wimmera rye grass.

- 5 kilograms per hectare of Red Clover.
- 5 kilograms per hectare of White Clover.
- 5 kilograms per hectare of Couch.

The above seed mixtures are appropriate for urban areas only. Where any “bush” areas or reserves shall be seeded with native species these will be determined by Council.

“Rhodes Grass” sown at 3 kg/ha may be included in harsh environments, e.g. quarry sites or similar.

10.2 Fertiliser

Fertiliser at the rate of 250 kg/ha should be provided where approved.

10.3 Watering

The developer is responsible for the adequate watering of all revegetated areas and turf to ensure its natural regrowth from the time of planting through to issue of the subdivision certificate, although, if within a reasonable time beyond that date it is determined by Council that the works have failed to provide the intended result, the developer shall make good the defect.

Upon completion of construction works and full revegetation temporary sediment control structures shall be removed and those areas once containing the structures shall be revegetated and made good.

Mowing of revegetated areas and turf strips adjacent to kerb and gutter and pathways etc. shall be carried out to maintain the subdivision/development works in a tidy and presentable state.

Date Adopted: 17 March 2026

Implementation Date: 14 April 2026

Version: 1.0

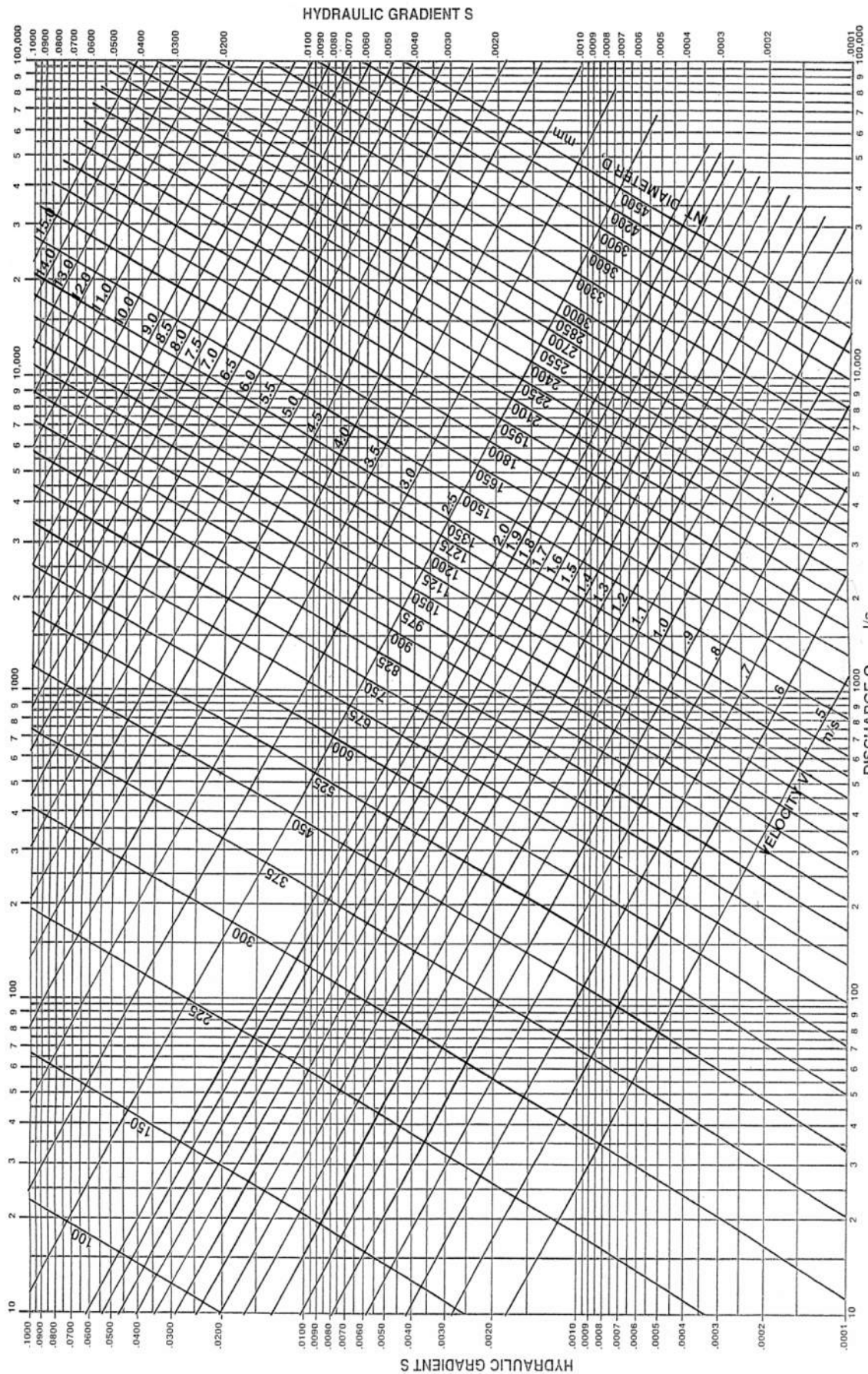
Appendix C: Stormwater Drainage

Surface Roughness or Retardance Factors

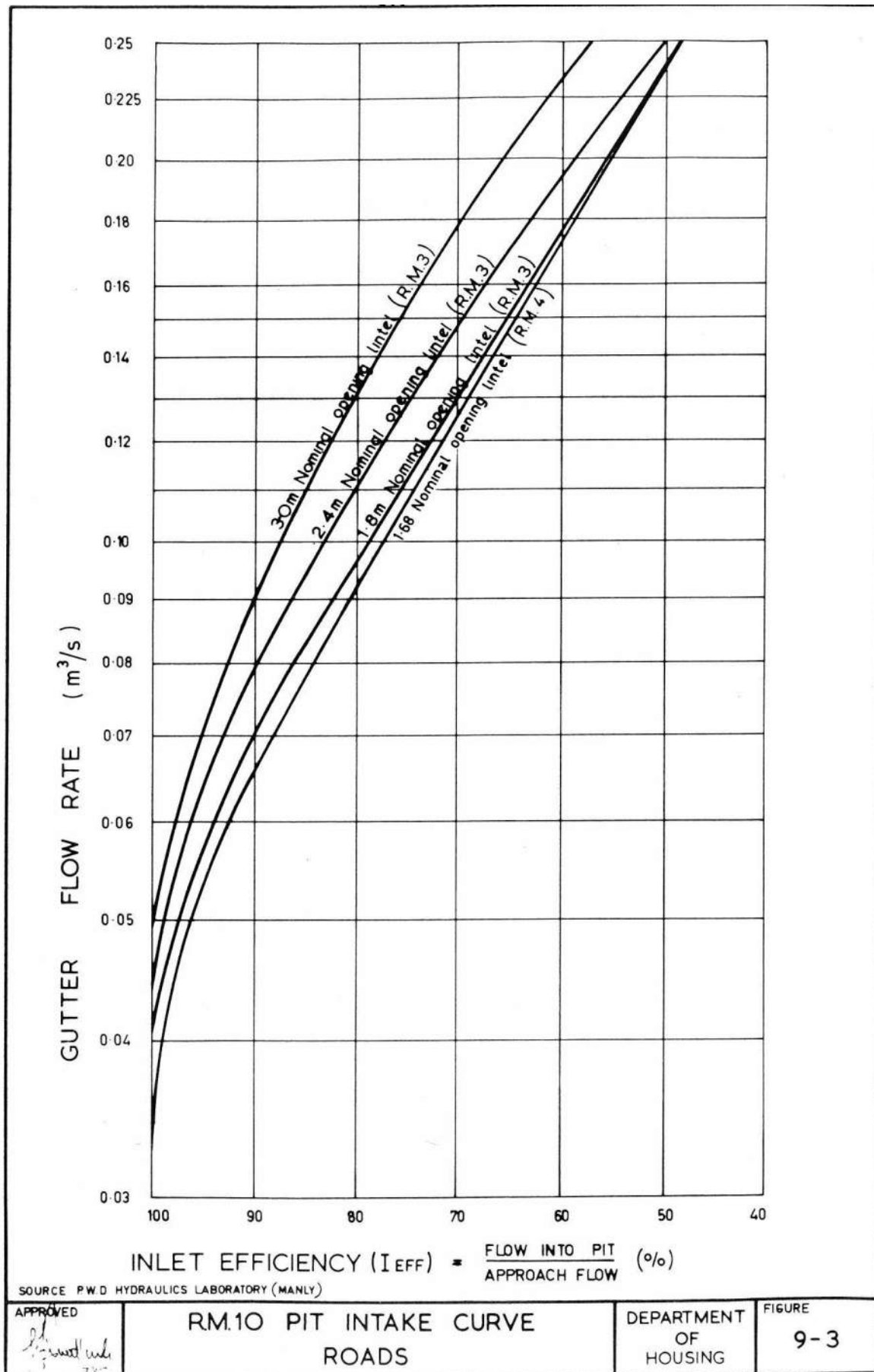
SURFACE TYPE	ROUGHNESS COEFFICIENT
Concrete or Asphalt	0.010 – 0.013
Bare Sand	0.010 – 0.016
Gravelled Surface	0.012 – 0.030
Bare Clay-Loam Soil (eroded)	0.012 – 0.033
Sparse Vegetation	0.053 – 0.130
Shod Grass Prairie	0.100 – 0.200
Lawns	0.170 – 0.480

Eg: For a sub-catchment length of 60 metres, a slope of 2 percent and a roughness of 0.05.

$K = 43.38$ For a 10-year ARI and the Overland Land Travel Time is 6 minutes.



CIRCULAR PIPES FLOWING FULL
COLEBROOK-WHITE FORMULA $k = 0.15\text{mm}$



Appendix D: Pavement Material

MoES 2026

Date Adopted: 17 March 2026

Implementation Date: 14 April 2026

Version: 1.0

Appendix D: Pavement Material

Unbound Base Material Properties – AUS-SPECS

TEST METHOD	DESCRIPTION	BASE MATERIAL REQUIREMENTS			
		DGB20	GMB20	NGB20-2C	NGB20-2D
AS1289.3.6.1	Coarse Particle Size Distribution				
	% pass 75.0 mm sieve	-	-	-	-
	% pass 53.0 mm sieve	-	-	-	-
	% pass 37.5 mm sieve	-	-	-	-
	% pass 26.5 mm sieve	100	100	100	100
	% pass 19.0 mm sieve	95-100	95-100	93-100	93-100
	% pass 13.2 mm sieve	-	-	-	-
	% pass 9.5 mm sieve	-	-	71-87	71-87
	% pass 6.7 mm sieve	50-70	30-55	-	-
	% pass 4.75 mm sieve	-	-	47-70	47-70
	% pass 2.36 mm sieve	35-55	20-30	35-56	35-56
	% pass 0.425 mm sieve	-	-	14-32	14-32
	% pass 0.075 mm sieve	-	-	6-20	6-20
AS1289.3.6.3	Fine Particle Size Distribution Ratios expressed as % (for that portion of the material passing 2.36 mm sieve)				
	A. Pass 425 µm sieve %	35-55	30-50	-	-

	B. Pass 75 µm sieve %	35-55	30-50	-	-
	C. Pass 13.5 µm sieve %	35-60	-	-	-
AS1289.3.1.1	Liquid Limit (if non plastic) ▼	max 20	max 20	max 20	max 20
AS 1289.3.3.1	Plastic Limit (if plastic)	max 20	max 20	max 20	max 20
AS 1289.3.3.1	Plasticity Index ■	max 6	max 6	max 6	max 8
T114	Maximum Dry Compressive Strength on fraction passing 19 mm sieve. (only applies if Plasticity Index is less than 1)	min 1.7 MPa	min 1.7 MPa	min 1.7 MPa	min 1.7 MPa
AS 1141.14	Particle Shape by Proportional Calliper. % misshapen (2: 1)	max 35	max 35	-	-
AS 1141.22	Aggregate Wet Strength (kN) ◇				
	For category 1 or 2a	min 80	min 150	-	-
	For category 2b or 2c	min 70	min 130	-	-
	For category 2d	min 60	min 100	-	-
AS 1141.22	Wet/Dry Strength Variation ◇				
	<u>Dry - Wet %</u>				
	Dry				
	For category 1 or 2a	max 35	max 30	-	-
	For category 2b or 2c	max 40	max 30	-	-
	For category 2d	max 45	max 30	-	-
AS 1289.F1.1	4 days Soaked CBR (98% Modified Compaction)	-	-	80	60

Notes:

Material consisting of rounded river stone shall have a minimum of two fractured faces on at least 75 per cent of the particles larger than 6.70 mm.

- ▼ The maximum value of the Liquid Limit may be increased to 23 for non-plastic material, provided that the value determined is not influenced by the presence of adverse constituents.

■ For category 2d base materials the maximum Plasticity Index shall be 8.

◇ All fractions of the sample specified by AS 1141.22 must be within specification. The fraction with the highest wet/dry strength variation is the value for determining conformance with the specification. The fractions 19.0 mm to 13.2 mm and 6.7 mm to 4.75 mm must be tested. The other fractions do not need to be tested unless there is a risk in the opinion of the Superintendent that such fraction may fail the specification. Any fraction at risk of failing must be tested.

Unbound Sub-Base Material Properties – AUS-SPECS

TEST METHOD	DESCRIPTION	BASE MATERIAL REQUIREMENTS				
		DGS20	DGS40	GMS40	NGS20	NGS40
AS1289.3.6.1	Coarse Particle Size Distribution					
	% pass 75.0 mm sieve	-	-	-	-	-
	% pass 53.0 mm sieve	-	100	100	-	100
	% pass 37.5 mm sieve	-	-	-	-	95-100
	% pass 26.5 mm sieve	100	-	-	100	80-97
	% pass 19.0 mm sieve	95-100	50-85	50-75	96-100	-
	% pass 13.2 mm sieve	-	-	-	-	-
	% pass 9.5 mm sieve	-	-	-	65-89	48-85
	% pass 6.7 mm sieve	50-70	30-55	15-35	-	-
	% pass 4.75 mm sieve	-	-	-	47-80	35-73
	% pass 2.36 mm sieve	35-55	25-50	5-15	32-67	25-58
	% pass 0.425 mm sieve	-	-	-	14-42	10-33
	% pass 0.075 mm sieve	-	-	-	6-26	3-21
AS1289.3.6.3	Fine Particle Size Distribution Ratios expressed as % (for that portion of the material passing 2.36 mm sieve)					
	A. Pass 425 µm sieve %	35-55	35-60	25-50	-	-
	B. Pass 75 µm sieve %	35-55	35-60	25-50	-	-
	C. Pass 13.5 µm sieve %	35-60	35-65	-	-	-
AS1289.3.1.1	Liquid Limit (if non plastic)	max 23	max 23	-	max 23	max 23
AS 1289.3.3.1	Plastic Limit (if plastic)	max 20	max 20	-	max 23	max 23
AS 1289.3.3.1	Plasticity Index	max 12	max 12	max 12	max 12	max 12

T114	Maximum Dry Compressive Strength on fraction passing 19 mm sieve. (only applies if Plasticity Index is less than 1)	min 1.0 MPa	min 1.0 MPa	-	1.0 MPa	1.0 MPa
AS 1141.14	Particle Shape by Proportional Calliper. % misshapen (2: 1)	max 35	max 35	max 35	-	-
AS 1141.22	Aggregate Wet Strength ♦ For category 1 or 2a For category 2b or 2c For category 2d	min 50kN	min 50kN	min 130kN	-	-
AS 1141.22	Wet/Dry Strength Variation ♦ <u>Dry - Wet %</u> Dry	max 60	max 60	max 30	-	-
AS 1289.F1.1	4 days Soaked CBR (98% Modified Compaction)	-	-	-	30	30

Notes:

Material consisting of rounded river stone shall have a minimum of two fractured faces on at least 75 per cent of the particles larger than 6.70 mm.

♦ All fractions of the sample specified by AS 1141.22 must be within specification. The fraction with the highest wet/dry strength variation is the value for determining conformance with the specification. The fractions 19.0 mm to 13.2 mm and 6.7 mm to 4.75 mm must be tested. The other fractions do not need to be tested unless there is a risk in the opinion of the Superintendent that such fraction may fail the specification. Any fraction at risk of failing must be tested.

Where the proposed unbound base material complies with all of the requirements of the Unbound Base except gradings (AS1289.3.6.1 and AS1289.3.6.3), the Contractor may propose the use of the material, subject to approval of the Superintendent, if the material complies with the RMS Modified Texas Triaxial Classification Number (T171) requirements specified in table below, (T171 tested at not less than 85 per cent of Optimum Moisture Content and 98 per cent of Maximum Dry Density as determined by AS1289.5.2.1).

RMS Modified Texas Triaxial Classification Number Requirements

TRAFFIC CATEGORY	MODIFIED TEXAS TRIAXIAL CLASSIFICATION NUMBER (TEST METHOD T171)
1	max 2.0
2a	max 2.2
2b	max 2.5
2c	max 3.0
2d	max 3.0

Date Adopted: 17 March 2026

Implementation Date: 14 April 2026

Version: 1.0

Appendix E: Best Practice

Engineering submissions shall be prepared by a suitably qualified and accredited professional in accordance with Council's Manual of Engineering Standards (MoES), Maitland Development Control Plans (MDCP), and the following supplements. These documents expand on and provide further guidance to MoES, as well as professional and reasonable design and construction standards.

Some publications may overlap into other Topics but have not been listed again for brevity. For example, Road Design, Traffic and Transport, and Movement and Place share many linkages.

TOPIC	PUBLICATIONS AND REFERENCE MATERIAL
Road Design	• Transport for NSW (TfNSW) publications - supplements, technical directions, specifications, etc. • Austroads Guide to Road Design • Australian Road Research Board (ARRB) • Australian Standards • Fire and Rescue NSW: Fire Safety Guideline – Access for Fire Brigade Vehicles and Firefighters • TfNSW Delineation Guidelines
Traffic and Transport	• TfNSW publications • TfNSW Guide to Transport Impact Assessment • Australian Standards AS 1742: Traffic Control Devices • SOCC Guide to Codes and Practices for Streets Opening (7th edition) • Austroads Guide to Traffic Management • MCC Integrated Land Use and Transport Study

Movement and Place (Urban Design within road reserves)	• TfNSW Movement and Place: Design of Roads and Streets • NSW SES Design Safer Subdivisions • NSW Architect (Greener Places, Urban Design Guide for Regional NSW, etc)
Geotech Road Pavement and sealing	• TfNSW Supplements • Austroads Design Guides • ARRB • TfNSW Supplement to Austroads Guide to Pavement Technology Part 2: Pavement Structural Design
Earthwork	• Australian Standards AS 3798: Guidelines on Earthwork
Geotech	• Australian Standards AS 1726: Site Investigations
Parking	• Australian Standards AS 2890
Bridges and Structures	• Austroads • Australian Standards • Australian Standards AS 1170: Structural Design Actions • Australian Standards AS 5100: Bridge Design • Australian Standards AS 3600: Concrete Structures • Australian Standards AS 4100: Steel Structures • Australian Standards AS/NZS 3845: Road Safety Barrier Systems
Bus	• TfNSW State Transit Bus Infrastructure Guide • TfNSW Guidelines for Public Transport Capable Infrastructure in Greenfield Sites
Stormwater	• Australian Rainfall and Runoff • EA Australian Runoff Quality: A Guide to Water Sensitive Urban Design • Australian Standards AS 3500.3: Plumbing and Drainage • Australian Standards AS/NZS 3798: Precast Concrete Pipes

	• CRC Adoption Guidelines for Stormwater Biofiltration Systems • Water by Design WSUD Publications • FAWB Guidelines for Filter Media in Biofiltration Systems
Cycling	• Austroads Guide to Road Design • TfNSW Planning Guidelines for Walking and Cycling
Street Lighting	• Australian Standards AS 1158
Erosion and Sediment Control	• Landcom Managing Urban Stormwater: Soils and Construction (Volume 1) • Department of Planning Guidelines for Erosion and Sediment Control on Building Sites
Bushfire	• NSW Rural Fire Service (RFS) Planning for Bushfire Protection

Date Adopted: 17 March 2026

Implementation Date: 14 April 2026

Version: 1.0

Technical Document: Driveway Crossings

The objective of this section is to ensure that development provides safe, practical, and durable vehicular access between the property boundary and the public roadway. The driveway within the property shall also adequately accommodate vehicle loads and manoeuvring with acceptable gradients. To achieve these goals and ensure safety for all road users, driveways and crossings are to be designed in accordance with this document and relevant standards, specifically Australian Standard 2890 and Austroads Standards Part 3 (particularly relevant to rural environments).

Works within the road reserve cannot commence until approval is obtained from Council. For a list of relevant application forms, including the "Application for Vehicle Access Crossing (Driveway)" and "Application for a Road Opening Permit," please refer to Council's website under the section "Work Applications on Council Land and Roads."

1. Specifications

1.1 Crossing Width

For residential developments, driveway crossovers for single-garage dwellings shall be 3 metres wide. The crossing may be reduced to 2.7 metres in width where site constraints exist for existing dwellings. Where a crossover services a double-garage dwelling, a maximum crossover width of 4.5 metres may be adopted. For multi-dwelling housing, the driveway crossover shall be a minimum of 5.5 metres wide (a maximum of 6 metres) and shall extend 6 metres minimum inside the property boundary to accommodate vehicle passing. Where drive strips are installed inside the boundary, their width should accommodate vehicle turning wheel paths (refer to SD015). Crossings should be perpendicular (i.e., straight) to the kerb and maintain the same width from the kerb line to the property boundary.

For business, commercial, and industrial developments, the crossing width shall accommodate the expected design vehicle turning paths as determined by the AS2890 series.

For rural accesses, the width shall be sufficient to cater to expected usage and shall be a minimum of 3.6 metres (a maximum of 7.1 metres), with additional width for splays at the junction with the edge of the road (see SD013).

For high-use access or high-traffic-generating developments, such as markets, events, and centres, the crossing shall be designed to accommodate the expected design vehicle turning paths, with minimum intersection treatment in accordance with Council's Standard Drawing (see SD031) and Austroads as applicable.

1.2 Construction Requirements

The Standard Drawings that must be followed are set by Council typically through the 'Application for Vehicle Access Crossing (Driveway)' process, and sometimes through the Development Application (DA) process. The standards listed below can be used as a guide to prepare plans for DA and CDC approval however Council may assess that a different drawing shall be used.

For urban residential developments, the crossing shall be provided in accordance with Council's Standard Drawings SD007, SD008, SD009, SD010, SD011, and SD012. Grated trench drains shall be installed at the low points of the driveways either in front of a garage or at the property boundary (inside the lot) and connected to the onsite or street drainage system.

For heritage areas, the vehicular crossing shall comply with Standard Drawings SD014 and SD015. The concrete colour should be selected in accordance with Council's requirements for heritage areas. Any site-specific requirements in Council's Development Control Plan will also be considered during the driveway approval process.

For business and industrial developments, the crossing shall be provided in accordance with Council's Standard Drawings SD007, SD008, SD010, and SD012, using "Commercial/Industrial Driveway Crossing" concrete construction, or as designed by a qualified engineer to accommodate expected (heavy) vehicle loads.

For rural developments, the crossing shall be provided in accordance with Council's Standard Drawing SD013. Driveway crossing roadside table drains should be installed as a dished crossing with a regrade to avoid scraping. Where the depth of the drain makes a dish impractical, 5 metres long, 375 mm diameter (minimum) concrete Class 4 pipe (or equivalent Fibre Reinforced Concrete pipe if appropriate) with headwalls shall be provided. The table drain shall be diverted so that the pipe is located at least 2 metres from the edge of the road bitumen. The pipe size must provide sufficient capacity for the 10% Annual Exceedance Probability (AEP) storm event for the contributing catchment area, with larger overflows being contained by the road pavement/reserve. The crossing shall consist of compacted gravel (minimum 200 mm thickness), with a 2-coat or asphaltic bitumen seal from the edge of the existing road seal to the property boundary, or as shown on Council's Standard Drawing SD013.

2. Profiles

Driveway crossing profiles shall be designed and drawn to show levels for both the design surface and the existing surface in compliance with the specifications for high/low level driveway crossing construction as indicated on Council's Standard Drawing SD008.

The designer/builder should aim to match the existing surface levels as closely as possible while complying with the standard profile. Minor cuts and fills of up to 120 mm may be acceptable in the footway provided a 14:1 slope is achievable as it transitions to the adjoining sides/existing surface levels.

Where there is no footpath, the profile should have a maximum grade of +4% (parallel to the longitudinal fall of the footway) over the road footway.

Where the footpath exists in the footway verge, the profiles shall be +4% from the back of layback to the front of footpath, +2.5% maximum grade over the concrete footpath and may vary from the back of the footpath to suit property or garage levels, as per SD008.

Where requested by Council, a 1.5 metres wide section within the crossing with a maximum grade of +2.5% for a future footpath construction shall be provided or another width may be specified for wider paths at +2.5%.

Where an existing concrete path crosses the driveway crossing, the path shall be retained to maintain the appearance of continuity.

Development on the low side of a road must consider the potential for stormwater runoff from the roadway or gutter to enter the site via the driveway layback. The design profile should be designed and constructed to effectively manage and contain stormwater flows within the roadway.

The design shall have a maximum internal driveway grade of 25% at any point and shall include suitable grade change transitions to facilitate driveway and garage entry in accordance with AS2890.

3. Clearances to Utilities and Street Furniture

Crossings shall provide a minimum clearance of 600 mm from the edge of the crossing to service poles, edge of lintel kerb transitions, and pillars (a minimum of 300 mm may be considered where constraints exist), and a minimum of 2 metres clearance from the edge of the crossing to any street tree, as per SD009.

The minimum clearance to any obstructions higher than 150 mm shall be 300 mm or as required by the relevant authority and standards, whichever is greater.

Note: Variations may be considered in older areas where constraints exist. This does not apply to new areas.

4. Table Drain Crossings

Where crossings run through a shallow roadside table drain, a concrete dish crossing may be the preferred option for crossing within the table drain in accordance with Council's Standard Drawing SD004. To achieve this, regarding the surface by cutting into the verge and extending into the property may be necessary to prevent vehicle scraping.

5. Public Laneways (Existing)

Where permitted by consent, access to property development via an existing public laneway (or unformed or informal 'paper road') is subject to an assessment of the existing road pavement (if any). This may require construction or rehabilitation of the laneway to meet Council's standards, either as a bitumen-sealed gravel, flexible or reinforced concrete pavements, unless otherwise justified. All works shall be carried out in accordance with Council's Manual of Engineering Standards with the pavement generally being a minimum of 4 metres wide. Additional pavement width may be required depending on factors such as the type and volume of traffic, passing opportunities, length of works, sight distances, and other relevant considerations.

6. Removal of Paths

Where path removal is necessary due to damage, required strengthening, level adjustment, or for drainage pipes, the path shall be removed to the nearest existing joint and reinstated to match the appearance of the existing path (plain concrete). The reinstated path shall be dowelled to the existing concrete and constructed in accordance with Council's Manual of Engineering Standards.

7. Verge Damage

Any damage to existing verges or paths caused by building construction activity should be prevented. Access to the building site should be restricted to limit potential damage to a single point. Any necessary reinstatement of the verge (with full turf cover) or path (with new reinforced concrete) must

be completed prior to the occupation of the development and in accordance with Council's requirements.

8.Redundant Laybacks

Redundant laybacks shall be removed and reinstated with integral kerb and gutter, and the footways and road surfaces shall be restored to match the existing surfaces.

9. Service Conduits

Service connections must be provided along the full length of the corridor to all rear lots.

10. Sight Distances

Fencing and landscaping on both sides of driveways, at least 2 metres wide and within a distance of 2.5 metres from the property boundary, shall be limited to a height of 1 metre to maintain sight distances in accordance with AS2890.1 and as shown in Figure 1 below.

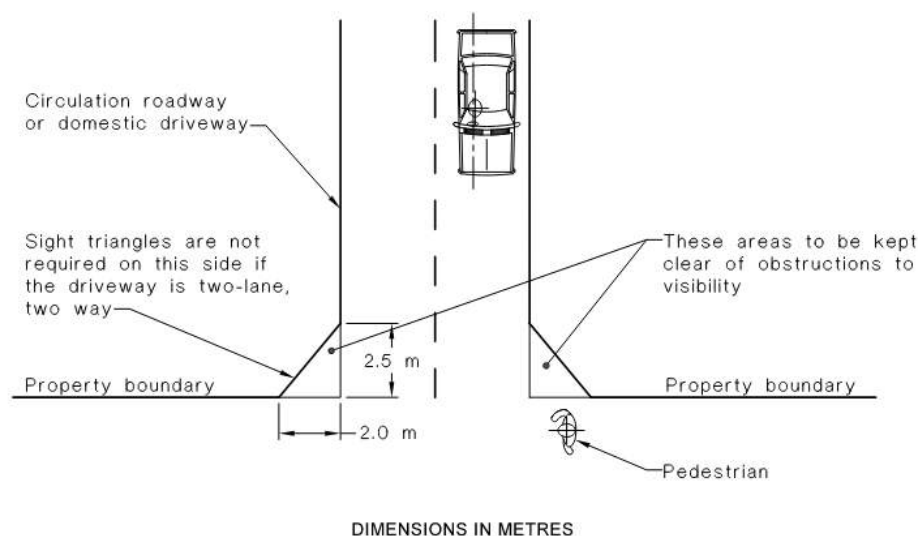


Figure 1: Minimum Sight Lines for Pedestrian Safety (AS2890.1)

11. Lintel & Grate Adjustments

Driveway crossings shall not be located on stormwater pits, utilities, and other street furniture. Council will not approve the removal or relocation of pits/lintels in relatively new subdivisions due to the potential for excessive damage to new infrastructure.

If a crossing is located over a pit in older roads, it is a standard requirement to provide a new pit adjacent to the crossing, and to replace the existing pit with a heavy-duty "V" grate to ensure adequate inlet capacity. Council may consider the removal of the additional pit/lintel only if an engineer can demonstrate that the stormwater inlet capacity, including gutter flow widths, will not be compromised, and subject to Council's discretion.

The surplus lintel and grate shall be delivered to Council's depot in good condition.

12. Locations of Crossing

Crossing locations shall comply with the following guidelines set by Council:

- Crossings shall be aligned with the garage, not angled to the road. This alignment enhances safety and sightlines, improving visibility when entering or exiting. Angled crossings can create blind spots, limit the driver's field of sight (especially when reversing), and increase the risk of accidents with pedestrians, cyclists, and other vehicles. Straight crossings provide safer, more predictable navigation, making it easier for drivers to reverse or pull forward without dealing with sharp turns or restricted visibility. Generally, crossings shall be between 70 and 110 degrees (ideally 90 degrees) to the kerb line or road pavement to ensure safe and efficient vehicle access.
- Crossings shall be spaced less than 1.5 metres apart or greater than 6 metres apart to maximise retention of on-street parking, especially for the secondary driveway crossing.
- Crossings shall be positioned 0.9 metres minimum from any side boundary, providing a landscape area as per Council's DCP.
- Crossings are not to be located at pedestrian pram ramps or bus stop concrete pads.
- In residential areas, crossings may be located within bus zones, which is acceptable for small residential developments. However, for larger developments or bus stops with rapid turnover, crossings should be positioned so that laybacks do not align with the front or back door, and they should be placed outside the bus drawn out length.
- Crossings are not permitted at bicycle lane on/off ramps (consideration may be given to relocating the bicycle ramps to the next lot frontage, at Council's discretion).
- Crossings must not align with existing aboveground utilities, including street lighting.
- Crossings cannot be placed over public stormwater pits or lintels.
- Crossings are prohibited within the main radius kerb return at intersections and roundabouts.
- Crossings are not allowed opposite isolated central median islands/refuges.
- Crossings must be located at least 10 metres from the hold line of the intersections/roundabouts where a continuous central median exists.

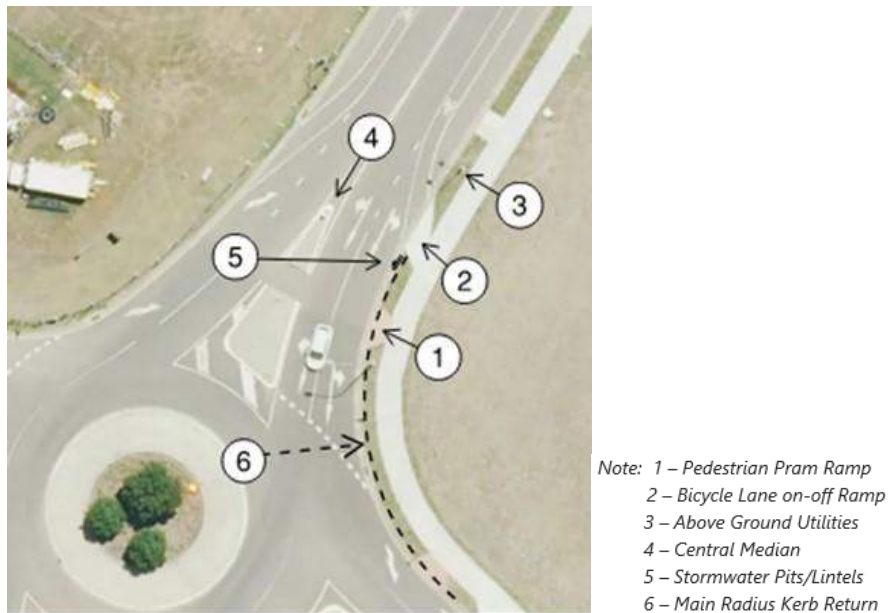


Figure 2: Locations to Avoid for Crossing Placement

- Crossings are not permitted in the sections of the kerb marked with heavy lines in Figure 3 (AS2890.1). Access to domestic crossings is excluded from this prohibition with respect to the kerb section marked Y-Y, as per AS2890.1.

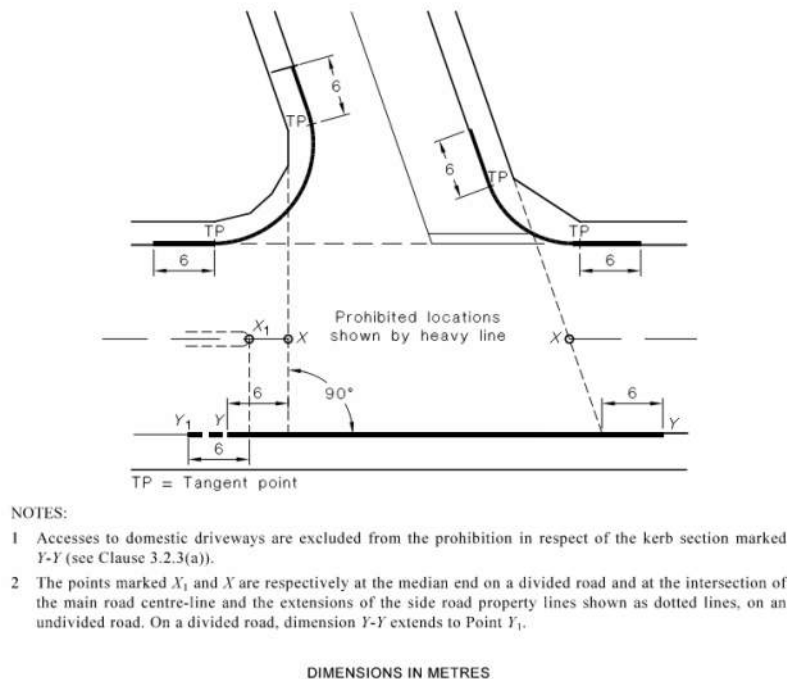


Figure 3: Prohibited Locations of Access Crossings

- Figure 3 above is based on a standard kerb return with an 8 metres radius. Where the kerb return exceeds an 8 metres radius, the prohibited crossing location is the first 15 metres from the intersection, measured from the prolongation of the side kerblines.

13. Driveway Handles

Driveway handles, sometimes referred to as battle-axe handles, can be categorised into two types: internal driveway corridors within developments such as strata or enterprise properties and battle-axe handles used for lot access or easements. Council's Development Control Plan is the governing document when easements and handle widths are involved.

Access handles and carriageways must comply with Council's DCP Design Guidelines.

The DCP extract below is provided for convenience. The most current version of the DCP shall take precedence.

ZONING ¹	SINGLE HANDLE ²	DUAL HANDLES ³	PAVEMENT WIDTH ⁴
Residential (R1)	4.0	(2x) 3.0 or (2x) 3.5 ^{5,6}	3.0 ⁷
Residential (R5-V & X)	4.0	(2x) 3.0	3.0
Residential (R5-Y)	4.5	(2x) 3.0	3.0
Residential (R5-Z)	6.0	(2x) 3.0	3.0
Business (B) & Industrial (IN1)	6.0 or 8.0 ⁸	(2x) 4.0	3.3 min or 6.0 ⁹
Rural (RU)	6.0	(2x) 4.0	3.5

Notes:

- (1) For minimum lot size: V=2,000, X=5,000, Y=10,000, Z=20,000 and above
- (2) For a single allotment. Long or bent handles may require greater widths for passing
- (3) Each handle width for two adjoining lot handles, with a single driveway covered by a full-width reciprocal ROC.
- (4) For single lane. Note: concrete wheel strips can be provided for residential
- (5) Three metres (x2) permits vehicle passing within o/a 6m width for each residential zone. It is assumed regular conflict is unlikely and "give-way" will apply in residential zones.
- (6) Where lots are >600m² (excluding handle), OR having potential for further subdivision or additional dwellings, adopt 3.5m each.
- (7) Where lots have potential for high density development with regular traffic movements, adopt 5.5m, preferably as two carriageways with a 400mm grassed separation.
- (8) Increase to 8m where regular two-way conflict is likely.
- (9) Generally for one-way or minor two-way movements with "give-way". For two-way movements with regular traffic conflict 6.0m min should be provided.

Figure 4: Handle Width Requirements

Note: It is recommended that the applicant refer to the DCP for the latest requirements, as the specifications in the DCP will take precedence in this instance.

13.1 Pavement Handle Width

For internal driveway corridor widths, the designer shall consider Council's Development Control Plan (DCP), the relevant planning legislation or scheme, and Australian Standard AS2890.

13.2 Pavement Handle Construction Specifications

Driveways for residential land use shall be constructed using reinforced concrete, segmental pavers, bitumen, or asphalt, with an appropriate depth of compacted road-base material. "Shared" driveways shall be covered by a reciprocal right of access (or carriageway) and/or designated as common or community property. Driveways for business and industrial land use shall consist of reinforced concrete across the verge, with either reinforced concrete or asphaltic concrete (AC) used internally. All driveways must meet the minimum construction thickness requirements outlined in Council's Standard Drawings SD007 to SD015. The designer or engineer is responsible for ensuring that the pavement thickness is appropriate for its intended use and for specifying a thicker pavement where necessary.

13.3 Pavement Handle Grades

The recommended maximum driveway grade for standard residential scenarios is 4 horizontal to 1 vertical (25%), as shown in Standard Drawing SD008. Where possible, driveways within the property should be graded to evenly shed water runoff toward adjacent landscaped or grassed areas, ensuring that runoff is not directed as concentrated flow onto adjoining properties. Stone or sand-filled trenches adjacent to driveways are encouraged to promote infiltration, provided a subsoil outlet is available at the low point of the trench. Otherwise, stormwater collected from the driveway should be conveyed via pipes and/or concrete kerbing to the on-site or street drainage system.

MAITLAND CITY COUNCIL STANDARD DRAWINGS

THIS DOCUMENT

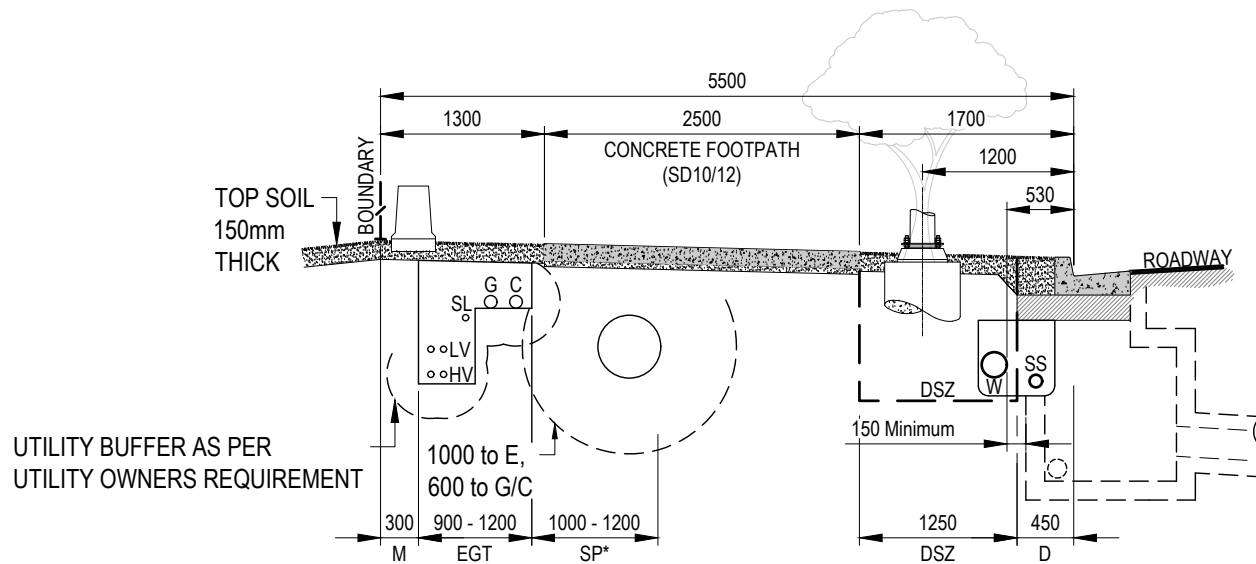
To be read in conjunction with:

- Maitland City Council's 'Manual of Engineering Standards'
- Relevant Australian Standards
- Austroads guidelines
- Roads & Maritime Services supplements
- Any copy of these documents is uncontrolled. Check the revision date of each sheet against the document held on Maitland City Council's website for currency
- Copyright in this document belongs to Maitland City Council.



SD001	FOOTPATH ALLOCATIONS FOR SERVICES & ACCESS	SD032	PAVEMENT WIDENING TO NEW KERB & GUTTER
SD002	FOOTWAY PROFILE - NEW SUBDIVISIONS	SD034	SILT TRAP & SWALE FOR UNSEALED HARDSTANDS
SD003	TYPICAL CROSS SECTION - RURAL RESIDENTIAL ROADS - NEW SUBDIVISIONS	SD035	SUB-SOIL DRAINAGE
SD004	STANDARD KERB PROFILES	SD036	KERB STORMWATER OUTLETS & KERB ADAPTOR
SD007	FOOTWAY DRIVEWAY CROSSING - GENERAL ARRANGEMENT	SD037	FOOTWAY FLOWPATH
SD008	DRIVEWAY PROFILES - RECOMMENDED MAXIMUM GRADES	SD038	FLOOD WARNING SIGNAGE
SD009	DRIVEWAY LOCATIONS - OBSTACLES & OFFSETS	SD039/1	GRATED GULLY PITS WITH EXTENDED KERB INLETS
SD010	DRIVEWAYS & KERB LAYBACKS - CONSTRUCTION DETAILS	SD039/2	GRATED GULLY PITS WITH EXTENDED KERB INLETS
SD012	DRIVEWAY, FOOTPATH & CYCLEWAY CONSTRUCTION DETAILS	SD040	SURFACE INLET PIT
SD013	RURAL DRIVEWAYS - PIPED CROSSING	SD043	INTER ALLOTMENT DRAINAGE PIT
SD014-15	KERB CROSSINGS	SD045	HEADWALL SCOUR PROTECTION - TYPICAL TREATMENT
SD019/1	FOOTPATH & KERB RAMP LOCATIONS AT INTERSECTION	SD046	DRAINAGE SWALE
SD019/2	KERB RAMPS	SD047	BIORETENTION SYSTEM (PLANTING BED)
SD020	SHARED FOOTPATH / CYCLEWAY SIGNAGE	SD048	WETLAND SPECIES LIST
SD023	BUS STOP FACILITIES - RURAL & URBAN SITES WITH & WITHOUT SHELTERS	SD049	STREET TREE PLANTING - TYPICAL TREATMENT
SD025/1	CONCRETE ACCESSES & THRESHOLDS	SD050	CONSTRUCTED WETLAND (WITH DETENTION)
SD025/2	CONCRETE ACCESSES & THRESHOLDS - JOINTS & LAYOUTS	SD052/1	ON-SITE STORMWATER DETENTION PIT
SD025/3	CONCRETE ACCESSES & THRESHOLDS - JOINT DETAILS	SD052/2	ON-SITE STORMWATER DETENTION TANK & DISPOSAL TRENCH
SD025/4	CONCRETE ACCESSES & THRESHOLDS - JOINT DETAILS	SD052/3	ON-SITE STORMWATER DISPOSAL TRENCH
SD026	CONCRETE DISH CROSSINGS AT INTERSECTIONS	SD057	FENCING
SD027	CUL-DE-SAC OPTIONS	SD058/1	STANDARD ACCESS GATE - GENERAL ARRANGEMENT
SD029	STREET NAME SIGN POSTING	SD058/2	STANDARD ACCESS GATE - COMPONENTS
SD031	MINIMUM INTERSECTION TREATMENT FOR HIGH/HEAVY TRAFFIC GENERATING DEVELOPMENTS		





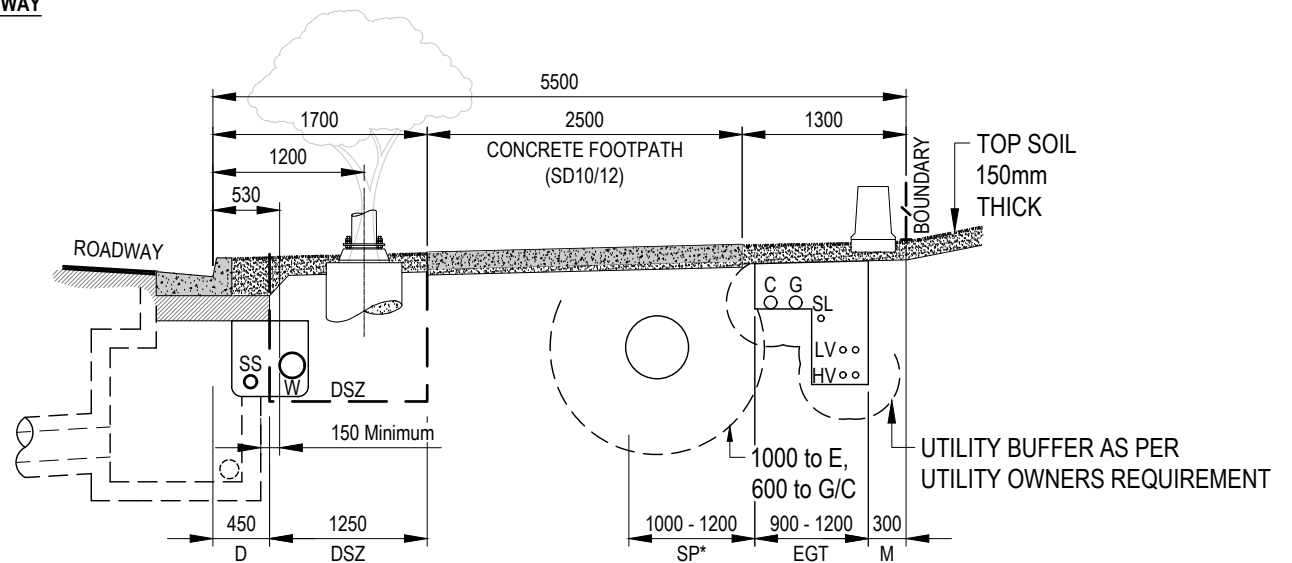
5.5m FOOTWAY

NOTE:

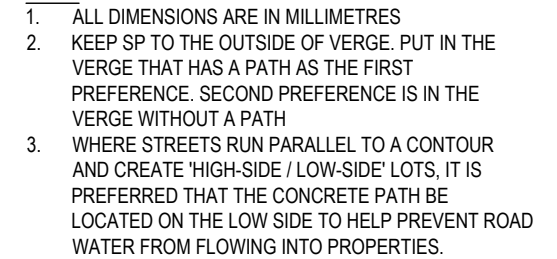
1. ALL DIMENSIONS ARE IN MILLIMETRES
2. KEEP SP TO THE OUTSIDE OF VERGE. PUT IN THE VERGE THAT HAS A PATH AS THE FIRST PREFERENCE. SECOND PREFERENCE IS IN THE VERGE WITHOUT A PATH
3. WHERE STREETS RUN PARALLEL TO A CONTOUR AND CREATE 'HIGH-SIDE / LOW-SIDE' LOTS, IT IS PREFERRED THAT THE CONCRETE PATH BE LOCATED ON THE LOW SIDE TO HELP PREVENT ROAD WATER FROM FLOWING INTO PROPERTIES.

LEGEND

- E - ELECTRICITY
- M - MISCELLANEOUS - TEMPORARY WATER SERVICE, PRIVATE PUMPING MAINS, TRAFFIC LIGHT CONTROLS, PRIVATE COMMS
- DSZ - DEEP SOIL ZONE, STREET LIGHT POLE AND TREE. NO UTILITIES EXCEPT WATER MAIN (W)
- W - RETICULATED WATER $\leq \text{Ø}200$
- LV - LOW VOLTAGE
- HV - HIGH VOLTAGE
- SL - STREET LIGHT CABLE
- C - TELECOM
- G - GAS
- SS - SUBSOIL DRAINAGE
- D - STORMWATER DRAINAGE
- SP - SPECIAL SERVICES - SPECIAL SERVICES EGT, TRUNK MAINS W>Ø300mm, MANHOLE (eg. COMMS) BOXES

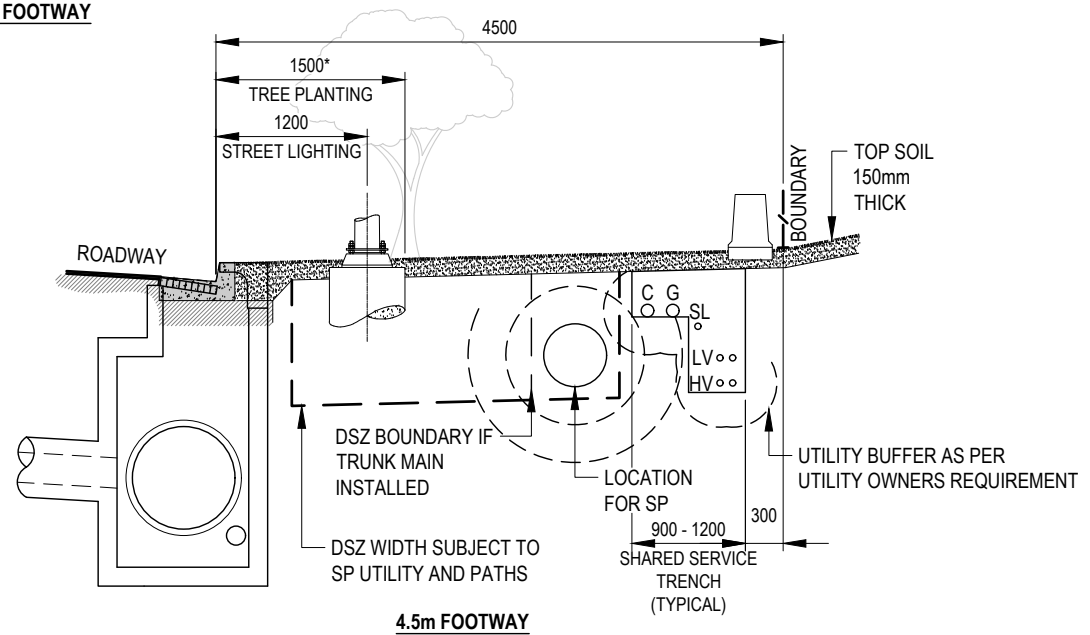


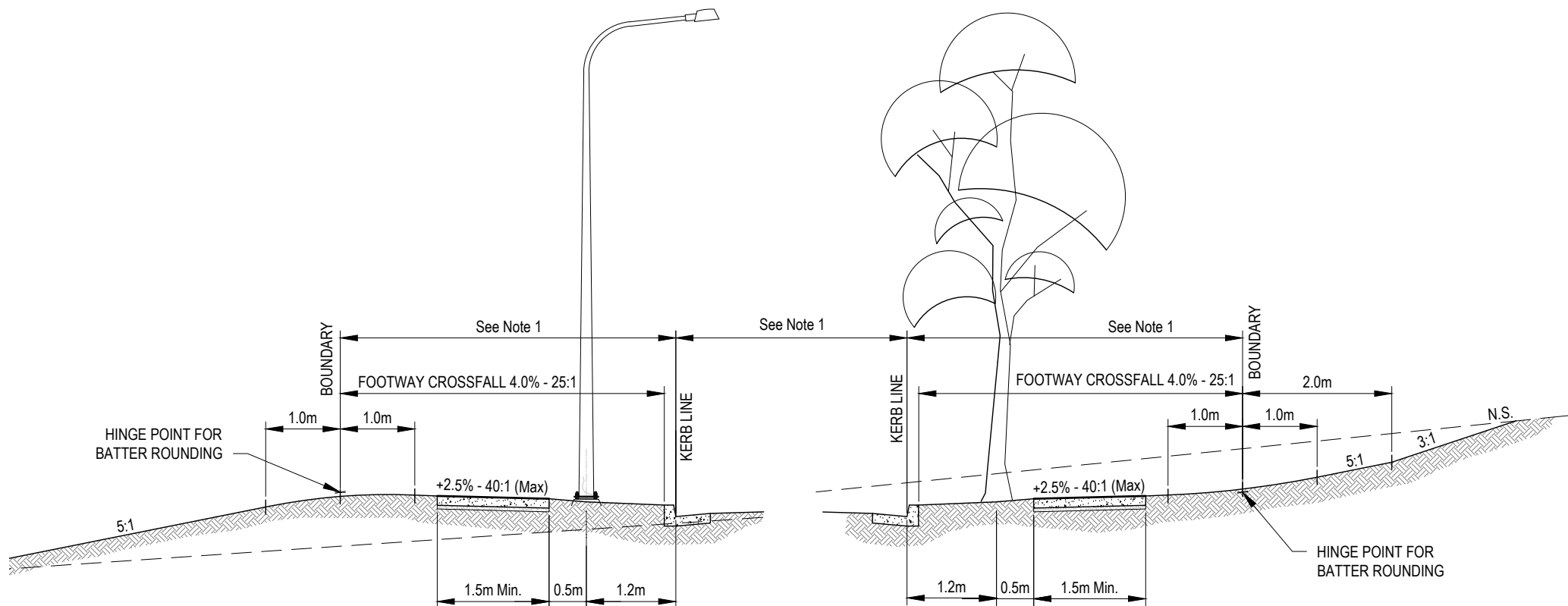
5.5m FOOTWAY



4.5m FOOTWAY

E	- ELECTRICITY
M	- MISCELLANEOUS - TEMPORARY WATER SERVICE, PRIVATE PUMPING MAINS, TRAFFIC LIGHT CONTROLS, PRIVATE COMMS
DSZ	- DEEP SOIL ZONE, STREET LIGHT POLE AND TREE. NO UTILITIES EXCEPT WATER MAIN (W)
W	- RETICULATED WATER $\leq \varnothing 200$
LV	- LOW VOLTAGE
HV	- HIGH VOLTAGE
SL	- STREET LIGHT CABLE
C	- TELECOM
G	- GAS
SS	- SUBSOIL DRAINAGE
D	- STORMWATER DRAINAGE
SP	- SPECIAL SERVICES - SPECIAL SERVICES EGT, TRUNK MAINS W> $\varnothing 300\text{mm}$, MANHOLE (eg. COMMS) BOXES



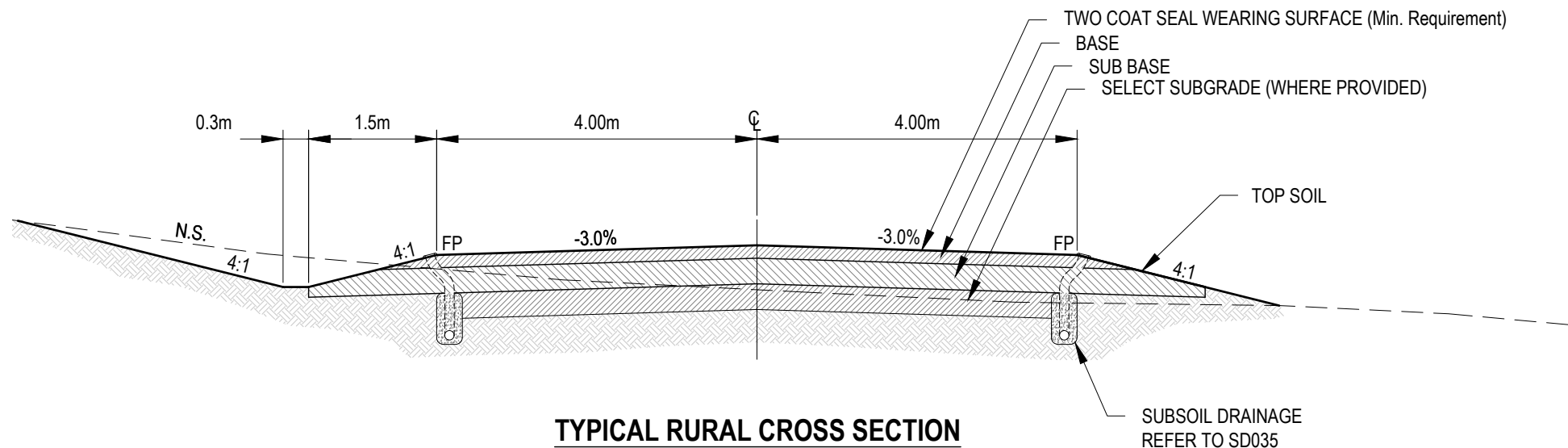


FOOTWAY ON FILL

FOOTWAY IN CUT

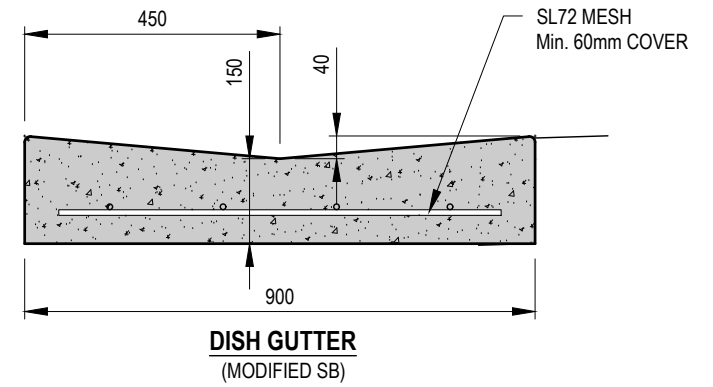
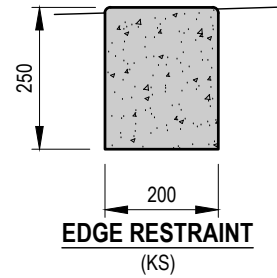
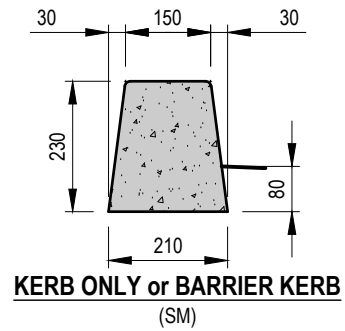
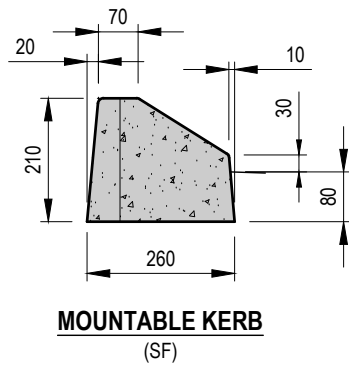
NOTE:

1. FOR CARRIAGEWAY, FOOTWAY & FOOTPATH WIDTHS SEE ROAD DESIGN SECTION OF "MANUAL OF ENGINEERING STANDARDS"
2. TYPICAL CROSSFALL ON CARRIAGEWAY TO BE -3% FROM CENTRELINE
3. TYPICAL CROSSFALL ON FOOTWAY TO BE +4.0% (25:1) FROM TOP OF KERB TO BOUNDARY
4. FOR PUBLIC UTILITY ALLOCATIONS IN FOOTWAYS SEE SD001
5. FOOTPATH WARRANT - SEE ROAD DESIGN SECTION OF "MANUAL OF ENGINEERING STANDARDS"
MINIMUM FOOTPATH WIDTH 1.5m, CROSSFALL TO BE +2.5% MAXIMUM WITH DESIGN TO SD012 & SD019
6. TREES TO COUNCIL'S "STREET TREE SELECTION GUIDE" OR AS APPROVED - PLANTING IN ACCORDANCE WITH SD049



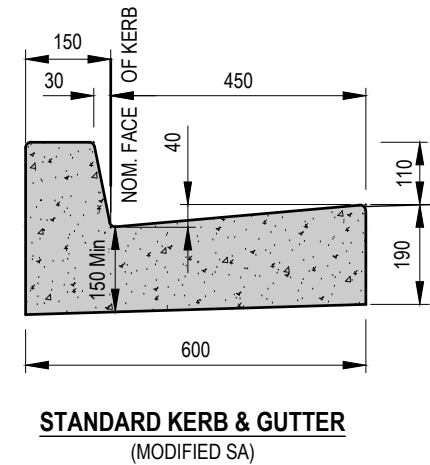
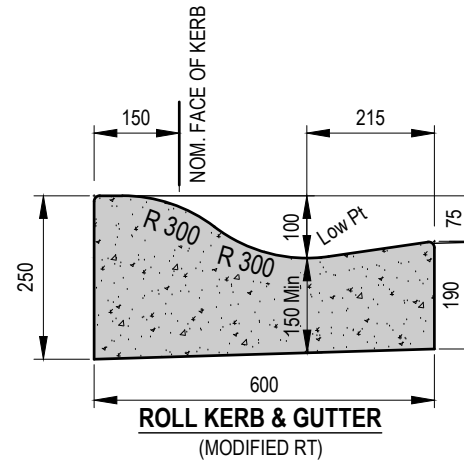
NOTE:

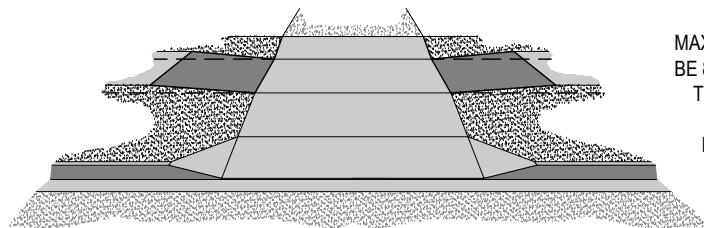
1. EROSION & SEDIMENTATION CONTROL MEASURES ARE TO BE IMPLEMENTED ON TABLE DRAINS, BATTER SLOPES & ANY AREAS DISTURBED DURING CONSTRUCTION IN ACCORDANCE WITH THE "BLUE BOOK" & COUNCIL'S "MANUAL OF ENGINEERING STANDARDS". APPROPRIATE MEASURES SHALL BE IMPLEMENTED FOR BOTH CONSTRUCTION & POST CONSTRUCTION PERIODS.
TYPICALLY, TABLE DRAINS ARE TO BE PROTECTED WITH TURF, SEED IMPREGNATED JUTE MESH OR OTHER MEASURES APPROVED BY COUNCIL. ALL DISTURBED AREAS ARE TO BE TOPSOIL & SEEDDED.
2. DRIVEWAYS SHALL CONFORM TO SD013.
3. FOR ALTERNATIVE WEARING SURFACE TREATMENTS REFER TO COUNCIL'S "MANUAL OF ENGINEERING STANDARDS".
4. FOR SUBSOIL DRAINAGE REFER TO ARRB "UNSEALED ROAD MANUAL".



NOTE:

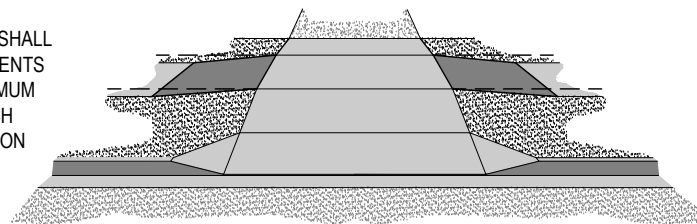
1. ALL DIMENSIONS IN MILLIMETRES
2. CONCRETE TO BE 32 MPa UNLESS OTHERWISE SPECIFIED
3. ALL EXPOSED CORNERS RADII 10mm UNLESS SPECIFIED OTHERWISE
4. MINIMUM THICKNESS OF CONCRETE TO BE 150mm





LOW LEVEL FOOTPATH CROSSING

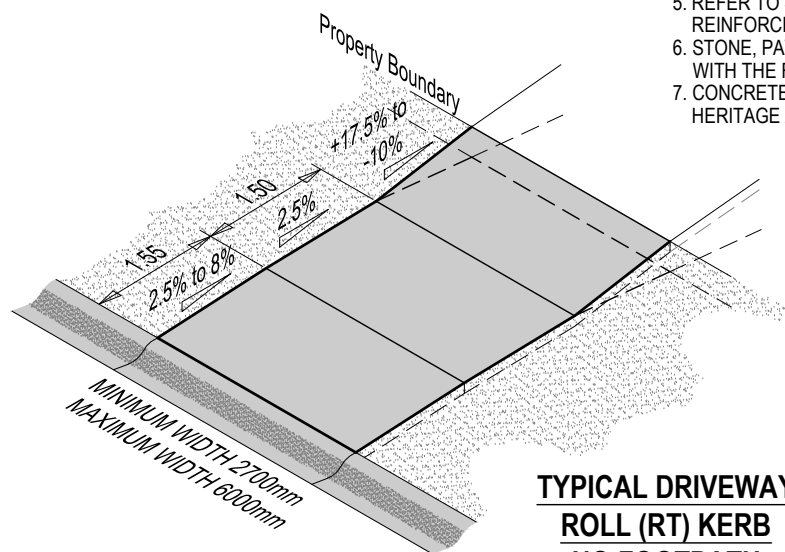
FOOTPATH GRADES MAY BE ADJUSTED TO ACHIEVE COMPLIANT DRIVEWAY GRADES.
MAXIMUM GRADE FOR CONNECTING RAMPS SHALL BE 8:1 FOR 1.5m OR 14:1 FOR LONGER ADJUSTMENTS
THE FOOTPATH IS TO BE REPLACED WITH A MINIMUM WIDTH OF 1.5m. COLOUR & FINISH TO MATCH EXISTING FOOTPATH. MAXIMUM CROSSFALL ON FOOTPATH SECTION IS 2.5%



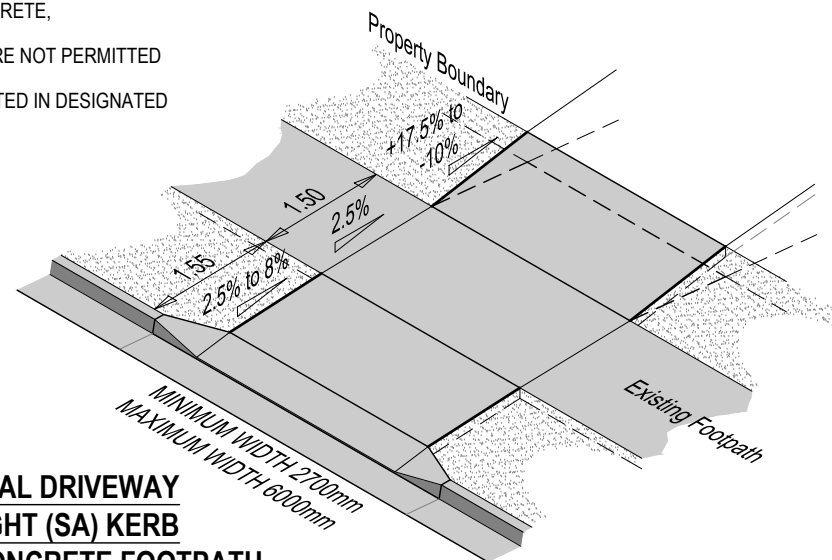
HIGH LEVEL FOOTPATH CROSSING

NOTE:

1. MINIMUM WIDTH OF THE FOOTPATH SHALL BE 1.50m IRRESPECTIVE OF EXISTING FOOTPATH WIDTHS.
2. ALL FINISHED SURFACE LEVELS OF THE FOOTWAY CROSSING SHALL PROVIDE SATISFACTORY VEHICULAR ACCESS TO AS2890.1 OR BETTER. THIS SHALL BE AT ALL POINTS OF THE FOOTWAY CROSSING PROFILE FROM THE KERB SIDE LANE TO BEYOND THE PROPERTY BOUNDARY.
3. FINISHED SURFACE LEVELS SHALL COMPLY TO SD008.
4. VARIATIONS TO THESE STANDARDS WILL REQUIRE INSPECTION & ACCEPTANCE BY COUNCIL'S APPROVING OFFICER.
5. REFER TO SD010 AND SD012 FOR LAYBACK, CONCRETE, REINFORCEMENT & SUB-BASE DETAILS.
6. STONE, PAVER OR FLAG DRIVEWAY SURFACES ARE NOT PERMITTED WITH THE FOOTWAY AREA.
7. CONCRETE STRIP DRIVEWAYS ARE ONLY PERMITTED IN DESIGNATED HERITAGE AREAS

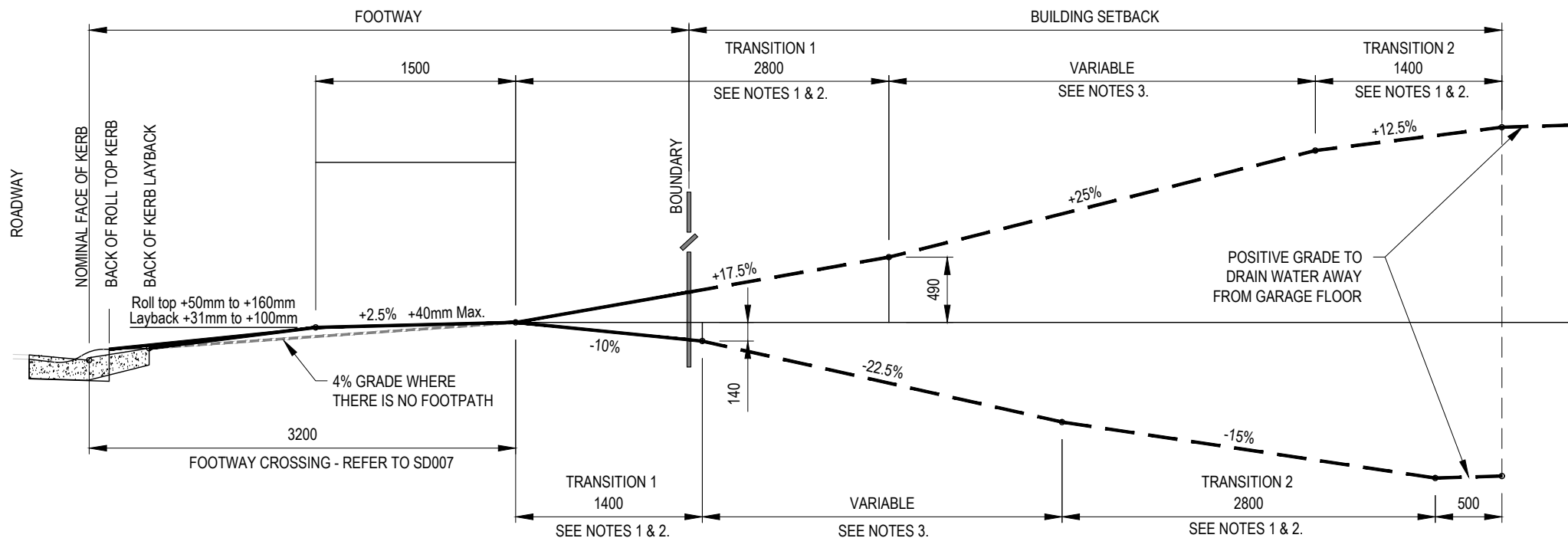


**TYPICAL DRIVEWAY
ROLL (RT) KERB
NO FOOTPATH**



**TYPICAL DRIVEWAY
UPRIGHT (SA) KERB
EXISTING CONCRETE FOOTPATH**





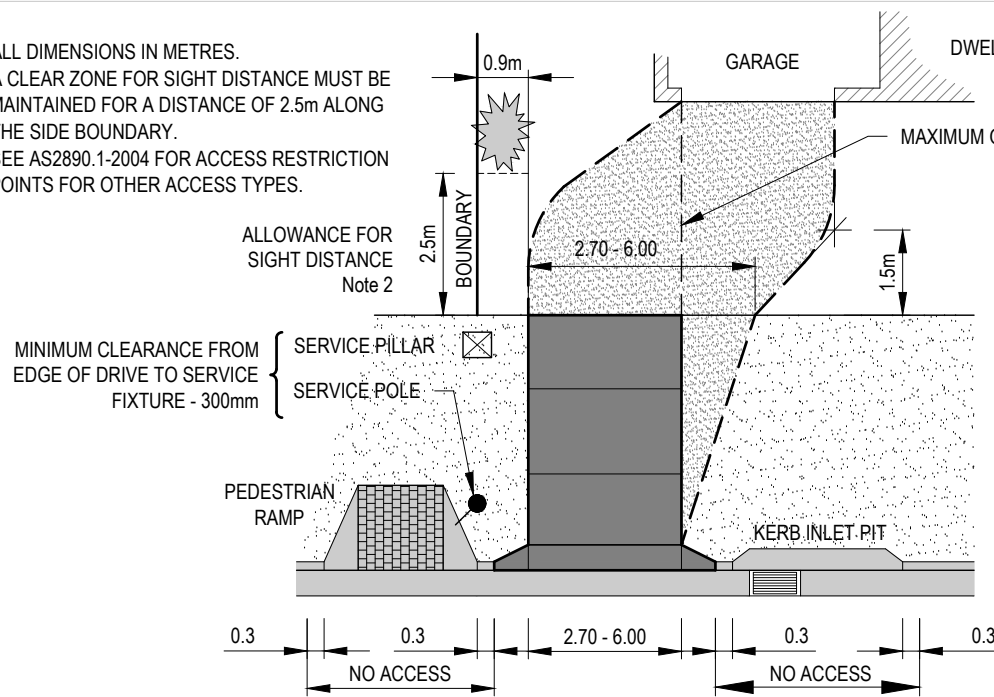
LONGITUDINAL SECTION

NOTE:

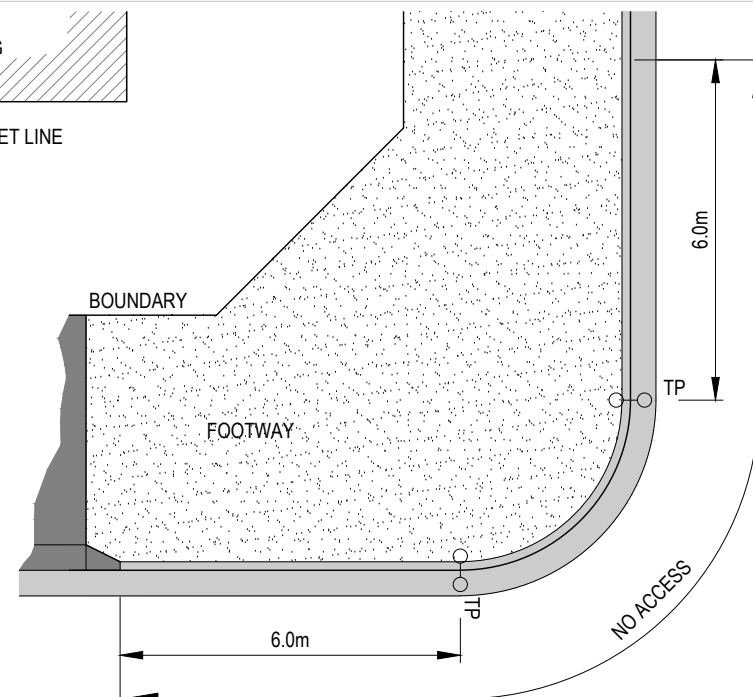
1. CONFORMS TO AS2890.1-2004 GROUND CLEARANCE TEMPLATE FIGURE C1 B85 VEHICLE - MAXIMUM 2.8m WHEELBASE, MINIMUM 120mm GROUND CLEARANCE.
2. PROFILES WITH GRADES LESS THAN THE MAXIMUM MAY NOT REQUIRE TRANSITIONS OR MAY HAVE ALTERNATE TRANSITION TREATMENTS.
3. CHANGES OF GRADE BETWEEN SECTIONS SHALL NOT EXCEED 15% IN SAGS OR 12.5% OVER CRESTS.
4. MINIMUM LENGTH OF TRANSITION SHALL BE 2.8m FOR A POSITIVE CHANGE IN GRADE AND 1.4m FOR A NEGATIVE CHANGE IN GRADE.
5. MAXIMUM GRADE SHALL BE 25% (1 in 4) WITHIN THE PROPERTY.
6. FOR APPROVAL, DESIGN PROFILES SHALL SHOW EXISTING & FINISHED SURFACE LEVELS AT KERB, AT CHANGES OF GRADE & AT GARAGE FLOOR OR PARKING AREA.
7. PROFILE TO BE APPLIED TO "WORST CASE" SIDE OF DRIVEWAY BEING SIDE WITH SHORTEST LENGTH, AND/OR GREATEST HEIGHT DIFFERENCE BETWEEN KERB AND GARAGE FLOOR LEVEL

NOTE:

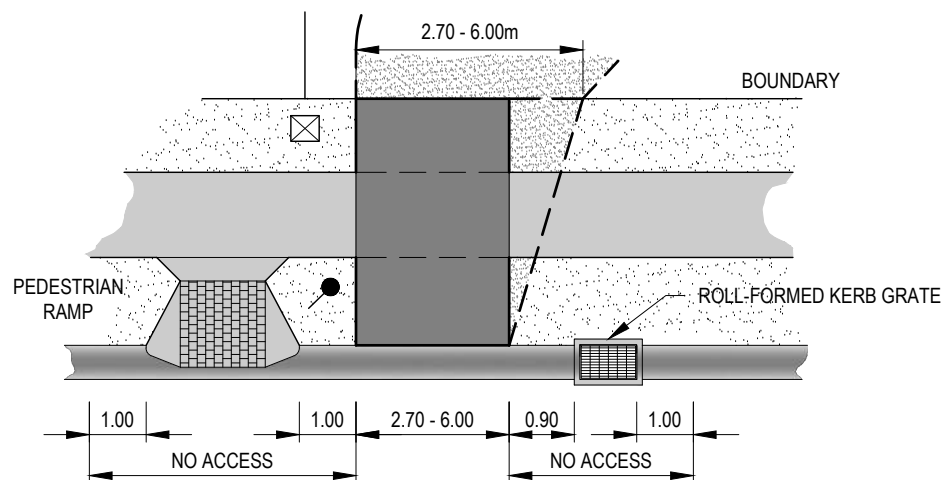
1. ALL DIMENSIONS IN METRES.
2. A CLEAR ZONE FOR SIGHT DISTANCE MUST BE MAINTAINED FOR A DISTANCE OF 2.5m ALONG THE SIDE BOUNDARY.
3. SEE AS2890.1-2004 FOR ACCESS RESTRICTION POINTS FOR OTHER ACCESS TYPES.



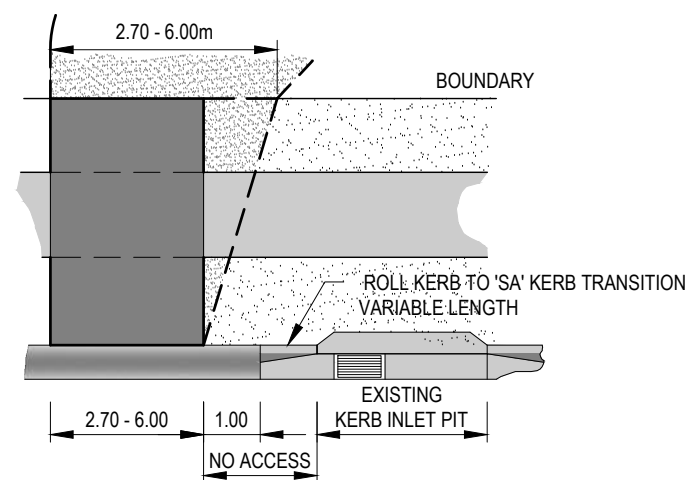
UPRIGHT 'SA' KERB



ACCESS RESTRICTION - INTERSECTIONS



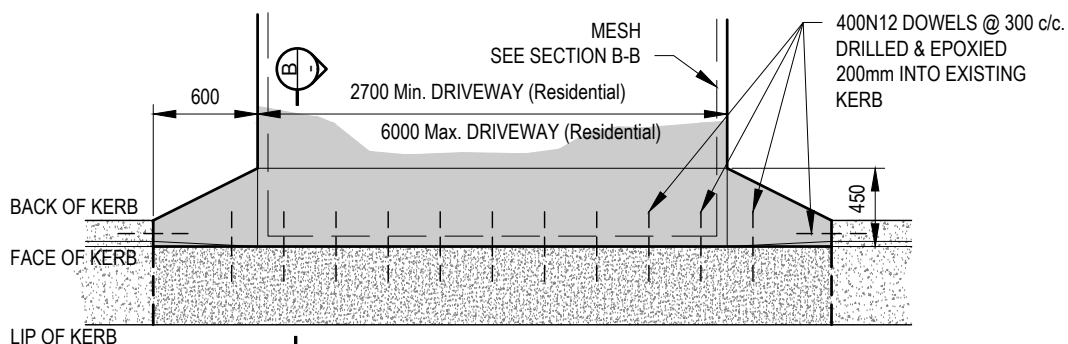
ROLL 'RT' KERB WITH KERB GRATE



ROLL 'RT' KERB WITH 'SA' KERB INLET



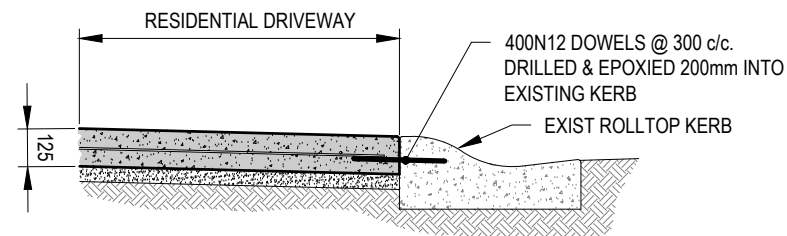
**PLAN - ROLL ('RT') KERB
RESIDENTIAL ONLY**



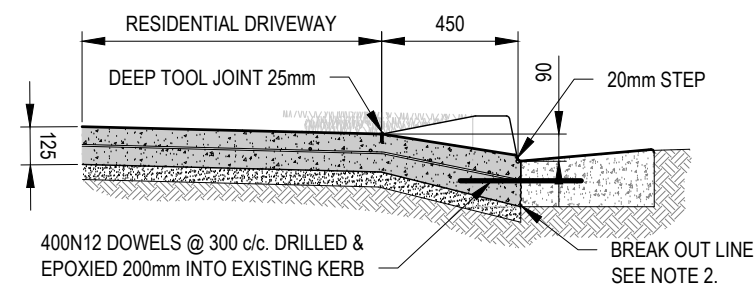
**PLAN - UPRIGHT ('SA') KERB
FOR RESIDENTIAL AND COMMERCIAL**

NOTE:

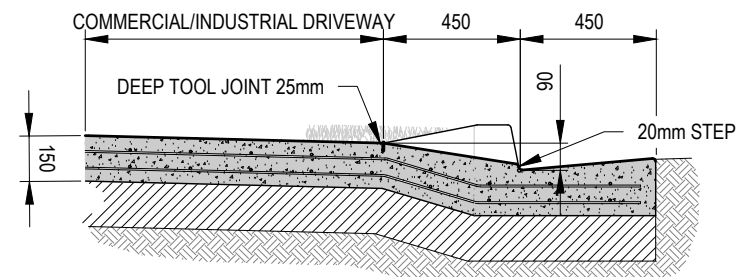
1. ALL DIMENSIONS IN MILLIMETRES
2. ALL CONCRETE TO BE 32MPa
3. SAWCUT BREAKOUT LINE TO MINIMUM DEPTH OF 75mm (NO MASTIC JOINTS PERMITTED).
4. PROVIDE FULL DEPTH EXPANSION JOINT AT BOUNDARY LINE.
5. FOR COMMERCIAL AND INDUSTRIAL ACCESSSES - WIDTH AND LAYOUT ARE SIZED TO SUIT TURNING MOVEMENTS OF DESIGN VEHICLES.



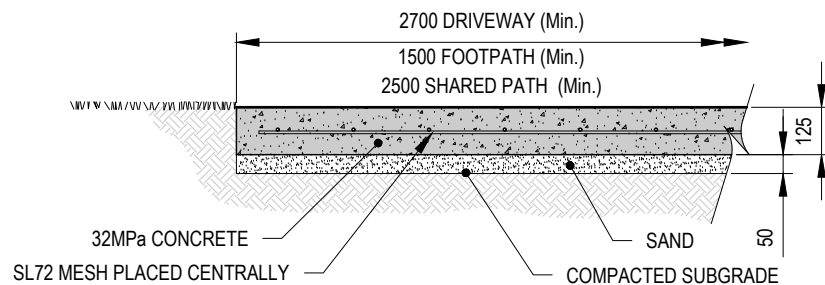
**SECTION C-C - ROLL ('RT') KERB
RESIDENTIAL**



**SECTION B-B - UPRIGHT ('SA') KERB
RESIDENTIAL**



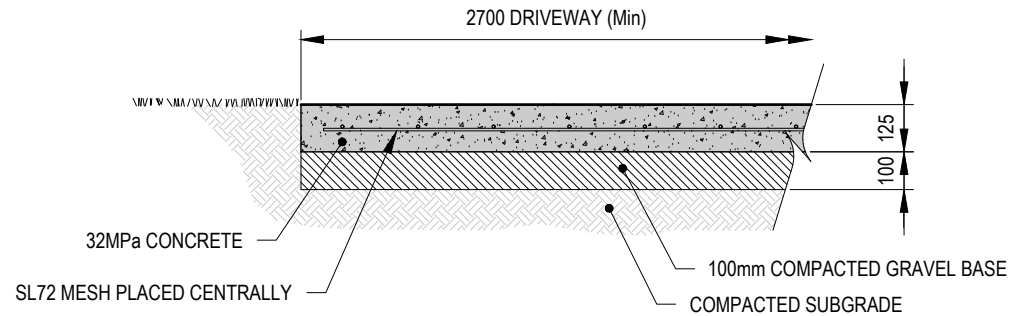
**SECTION B-B - UPRIGHT ('SA') KERB
COMMERCIAL/INDUSTRIAL**



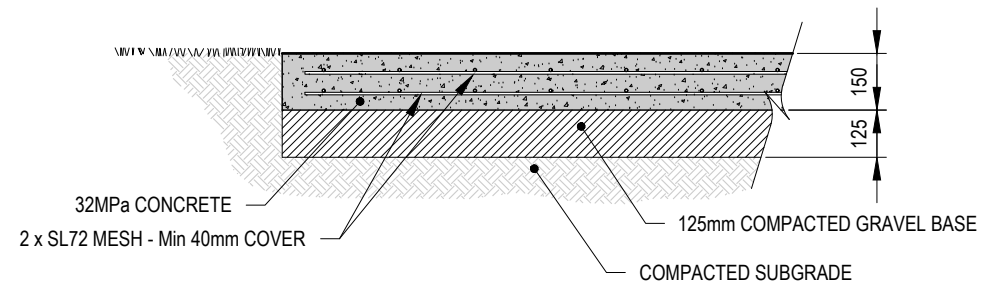
RESIDENTIAL DRIVEWAYS, CYCLEWAYS & FOOTPATHS

NOTE:

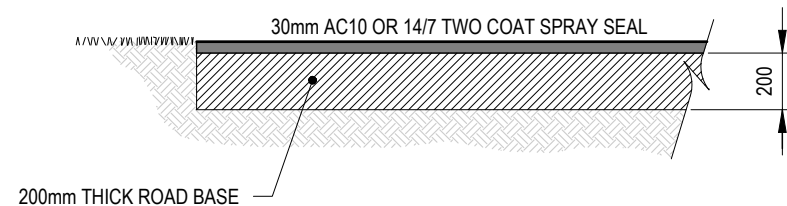
1. ALL DIMENSIONS ARE IN MILLIMETRES.
2. PROVIDE TRANSVERSE EXPANSION JOINTS AT 8.0m INTERVALS WITH R12 DOWELS, 300mm LONG AT 300mm CENTRES. REFER TO SD025 SHEET3 - JOINT FILLER SHALL BE FULL DEPTH
3. PROVIDE TOOLED DUMMY JOINTS AT 2.0m INTERVALS FOR PAVEMENTS LESS THAN 2.0m WIDE AND AT 4.0m INTERVALS FOR PAVEMENTS UP TO 3.0m WIDE. CUT EVERY 2nd BAR AT JOINT
4. JOINTS WITH EXISTING CONCRETE FOOTPATHS TO BE DOWELLED WITH R12 DOWELS, 300mm LONG AT 300mm CENTRES.
5. ALL DISTURBED EARTH OR GRASSED AREAS TO BE TURFED.
6. FOOTPATH WIDTHS TO SD001.
7. LAYBACKS AND CONNECTIONS TO SD010.
8. RURAL DRIVEWAY TO SD013.
9. KERB RAMP CONNECTIONS TO SD019.
10. CYCLEWAY AND FOOTPATH FINISH TO BE "LIGHT BROOM".



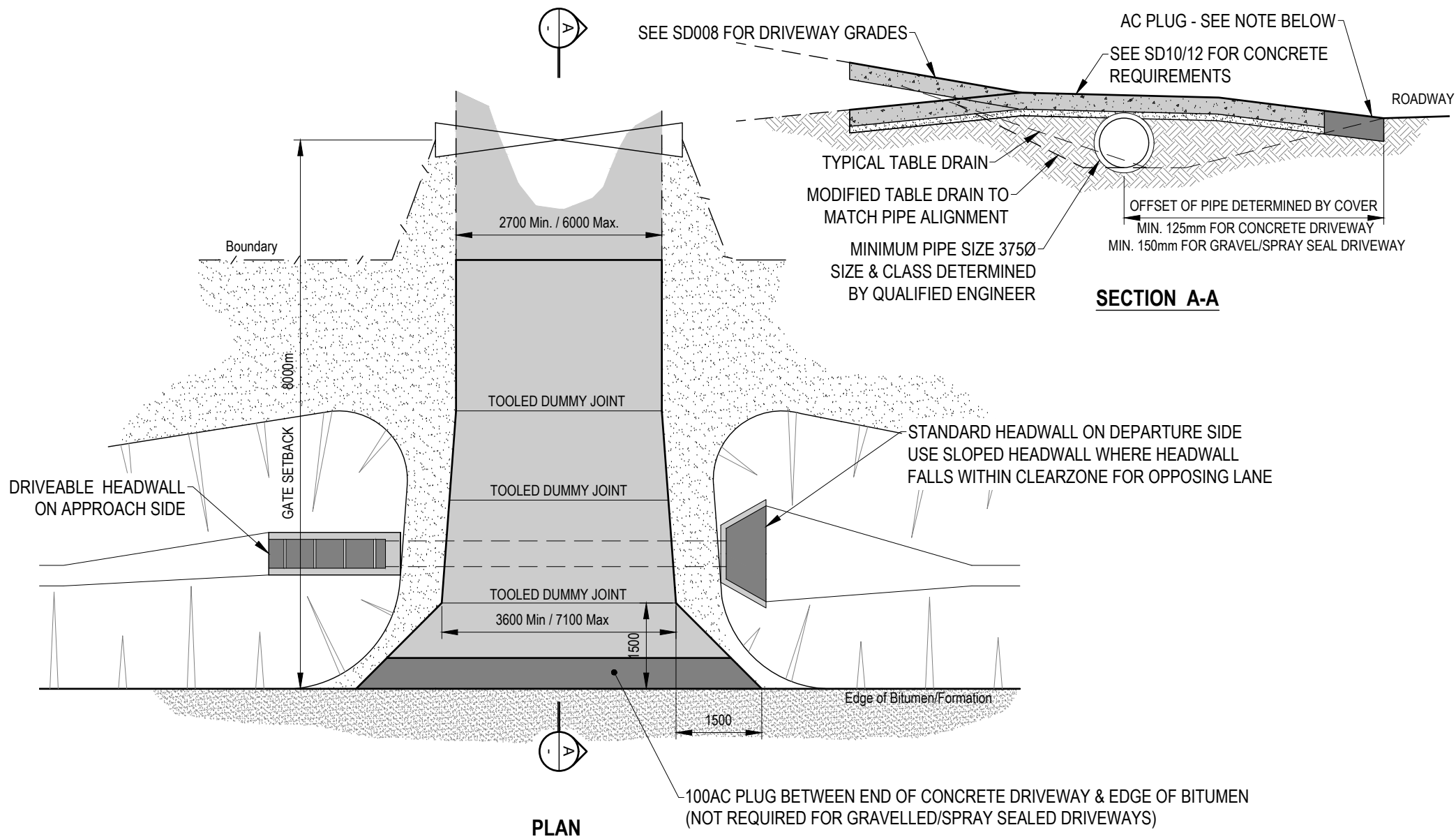
SHARED DRIVEWAYS & ACCESSWAYS INCLUDING MAINTENANCE VEHICLE ACCESS

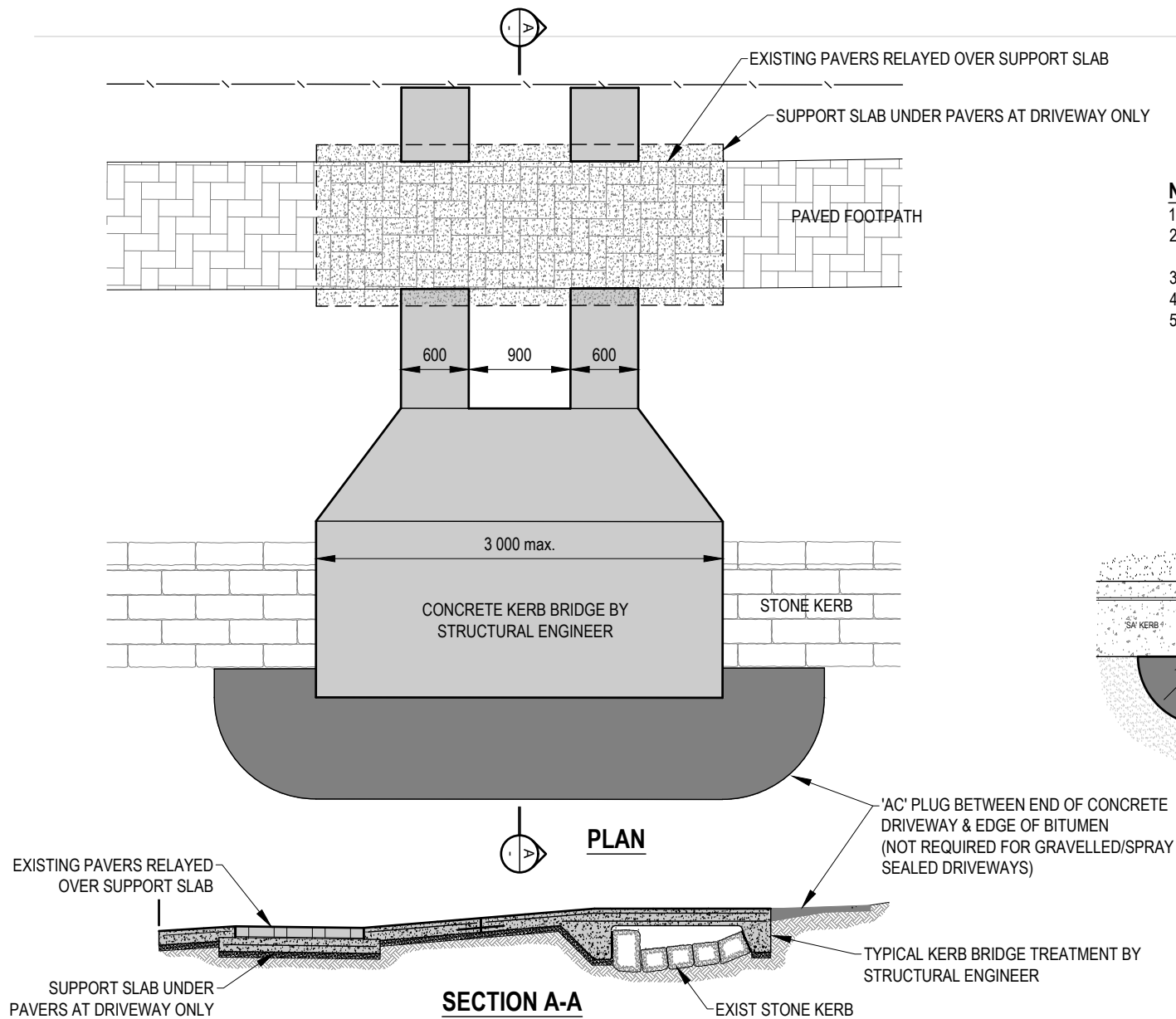


COMMERCIAL / INDUSTRIAL DRIVEWAY



RURAL DRIVEWAY

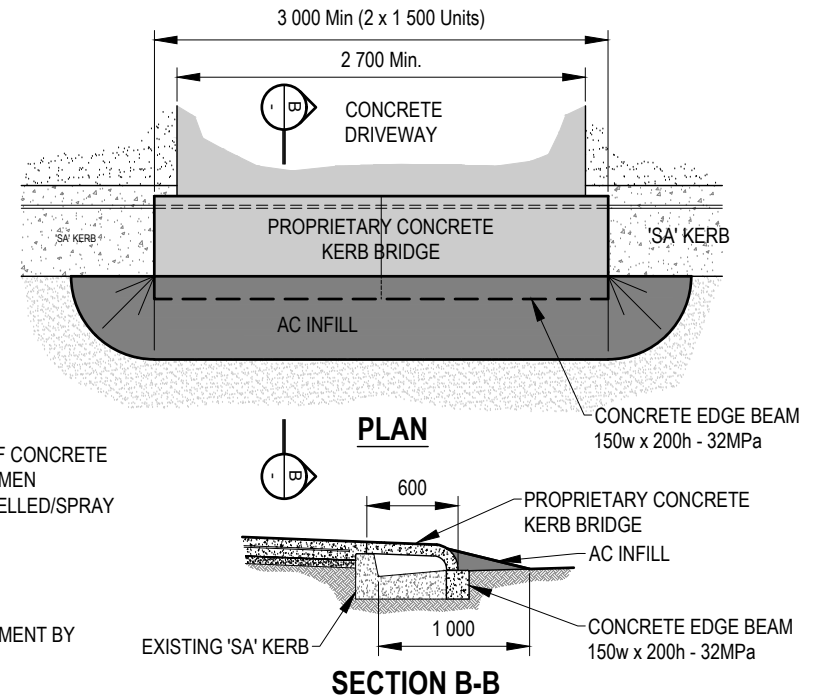




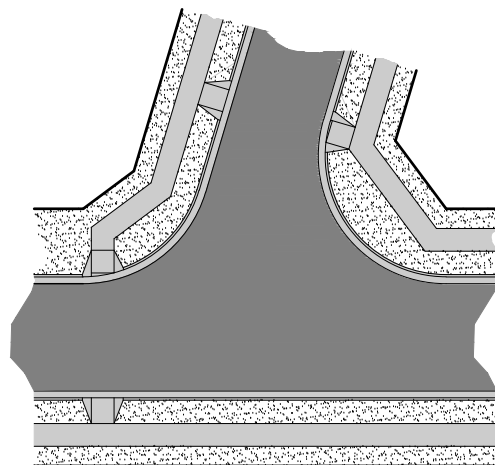
TYPICAL KERB CROSSING FOR STONE KERBS IN HERITAGE AREAS

NOTE

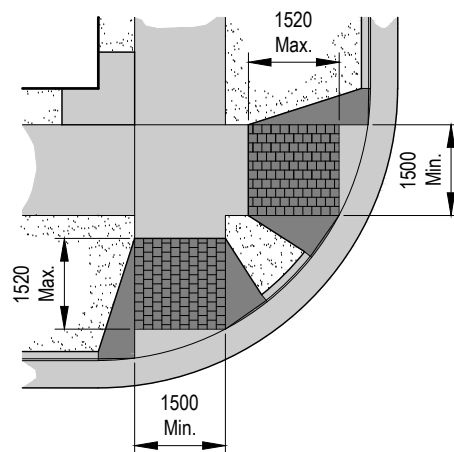
1. EXISTING KERB STONES ARE NOT TO BE DISTURBED
2. FOR HERITAGE AREAS, ALL EXPOSED CONCRETE TO BE "MORPETH MIX"
3. ALL CONCRETE TO BE 32MPa
4. CONCRETE STRIPS & FOOTPATHS TO COMPLY TO SD010/12
5. ALL FORMWORK & DEBRIS TO BE CLEARED FROM WATERWAY AFTER COMPLETION



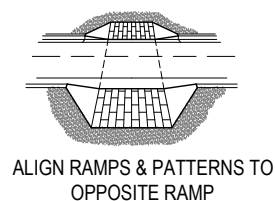
KERB CROSSING FOR UPRIGHT 'SA' KERBS



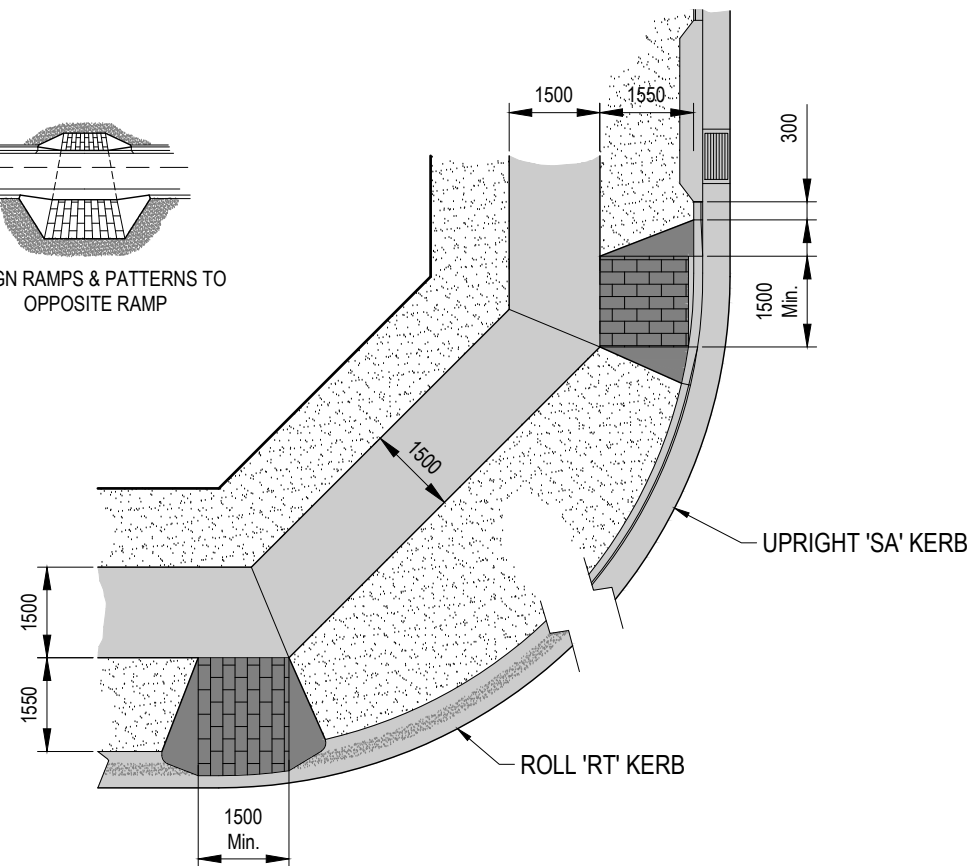
TYPICAL FOOTPATH TREATMENT AT INTERSECTIONS



**RAMP & FOOTPATH LAYOUT
EXISTING KERB RETURNS**



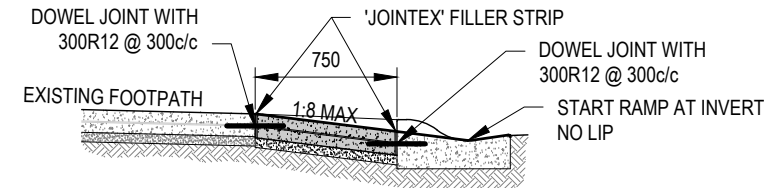
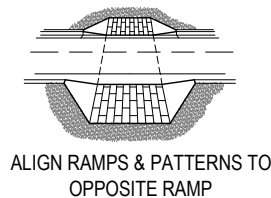
ALIGN RAMP & PATTERNS TO
OPPOSITE RAMP



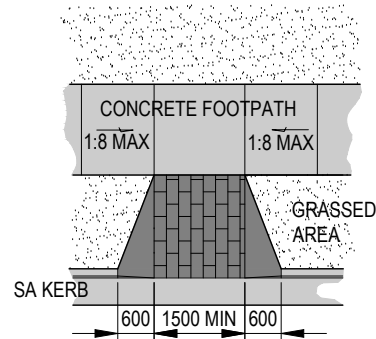
**RAMP & FOOTPATH LAYOUT
NEW WORKS**

NOTE:

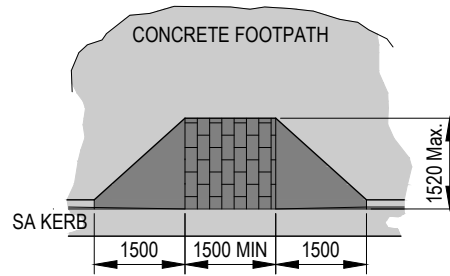
1. JOINTS TO EXISTING PAVEMENTS TO BE DOWELLED WITH 300R12 DOWELS @ 300c/c
2. ALL DISTURBED EARTH OR GRASSED AREAS TO BE TURFED
3. NEW SECTIONS OF FOOTPATH TO BE CONSTRUCTED IN ACCORDANCE WITH SD10/12



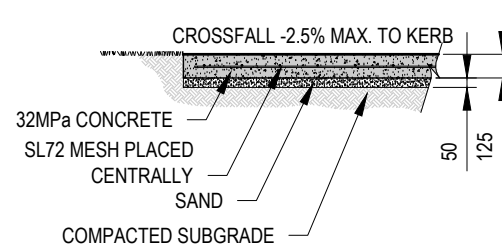
TYPICAL SECTION - ROLL 'RT' KERB



RAMP IN GRASSED FOOTWAY



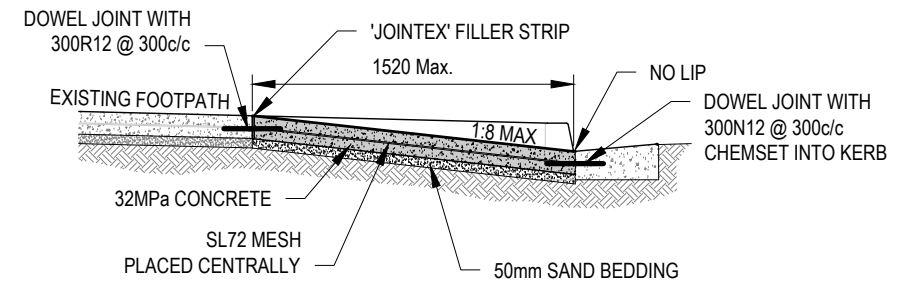
RAMP IN FULL CONCRETE FOOTWAY



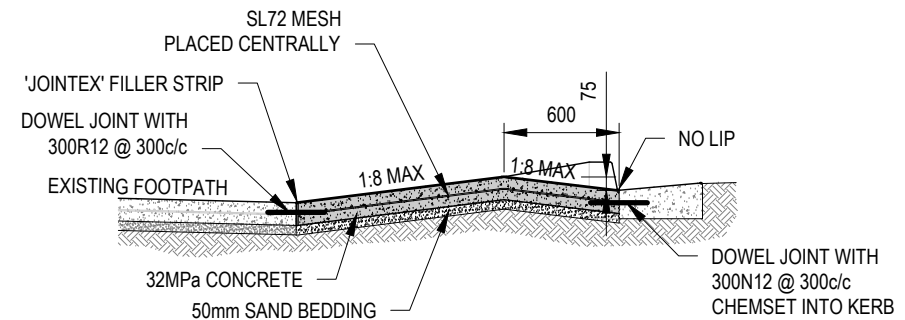
TYPICAL SECTION CYCLEWAYS & FOOTPATHS

FOR CONCRETE FOOTPATHS:

1. PROVIDE TRANSVERSE EXPANSION JOINTS EVERY 8.0m WITH 300R12 DOWELS @ 300 c/c
2. PROVIDE TOOLED DUMMY JOINTS EVERY 2.0m FOR PAVEMENT LESS THAN 2.0m WIDE & 4.0 m FOR PAVEMENTS OVER 2.0m WIDE
3. FINISH TO BE 'LIGHT BROOM'. BROOM OVER JOINTS



TYPICAL SECTION - UPRIGHT 'SA' KERB

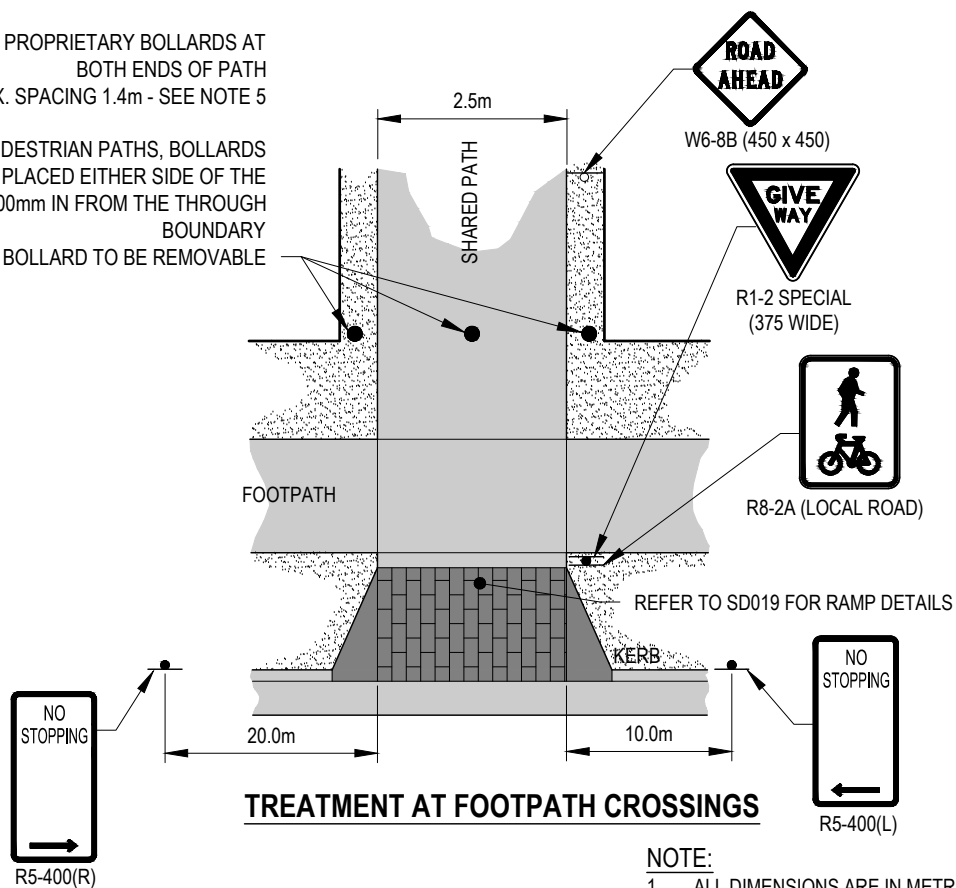


TYPICAL SECTION - LOW LEVEL FOOTPATH

RAMP - ROLL 'RT' KERB

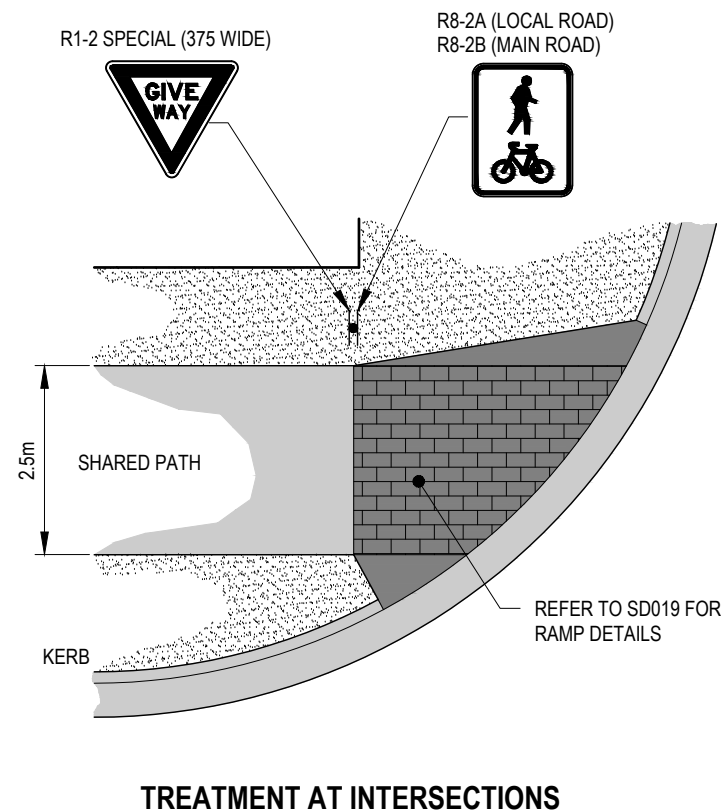
INSTALL PROPRIETARY BOLLARDS AT
BOTH ENDS OF PATH
MAX. SPACING 1.4m - SEE NOTE 5

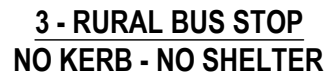
FOR PEDESTRIAN PATHS, BOLLARDS
ARE TO BE PLACED EITHER SIDE OF THE
END & 100mm IN FROM THE THROUGH
BOUNDARY
CENTRE BOLLARD TO BE REMOVABLE



NOTE:

1. ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE SHOWN.
2. PAVEMENT MARKINGS MAY BE SUBSTITUTED FOR SIGNS.
3. REFER TO SD012 FOR CYCLEWAY PAVEMENT DETAILS.
4. ALL REGULATORY SIGNAGE SHALL BE APPROVED BY COUNCIL'S LOCAL AREA TRAFFIC COMMITTEE
5. WHERE PATHWAYS ARE USED FOR MAINTENANCE OR EMERGENCY VEHICLE ACCESS THE BOLLARDS ARE TO BE REMOVABLE & LOCKABLE

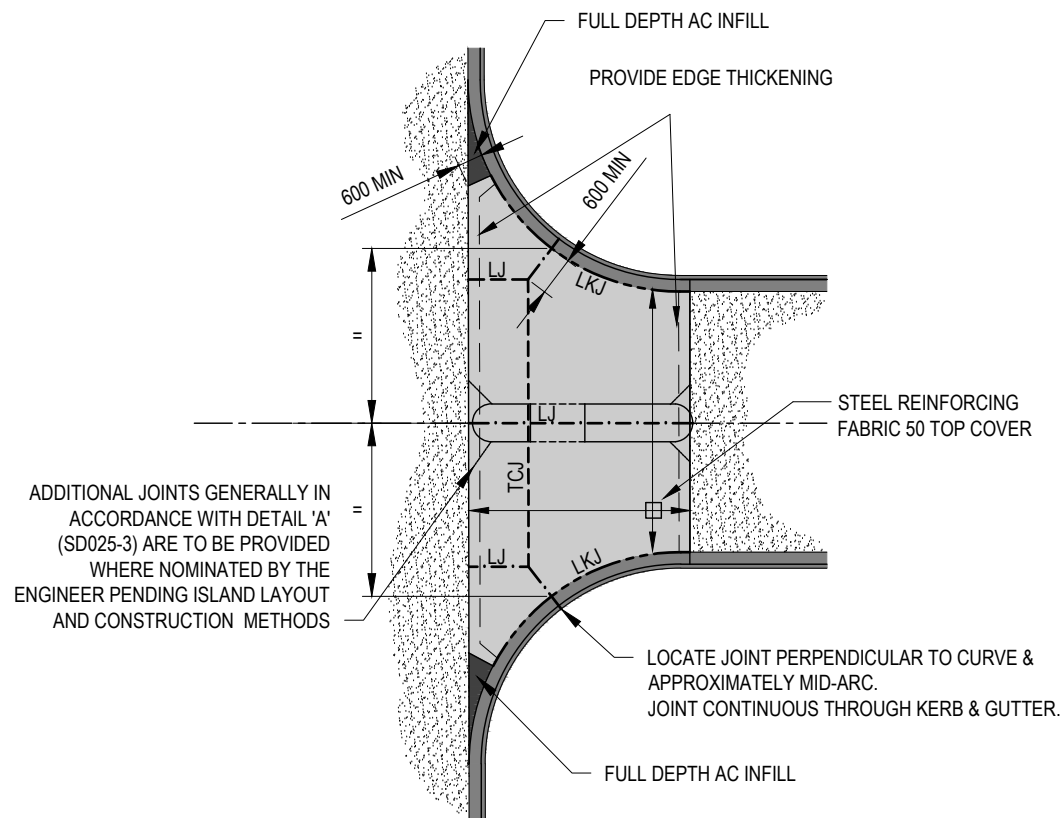




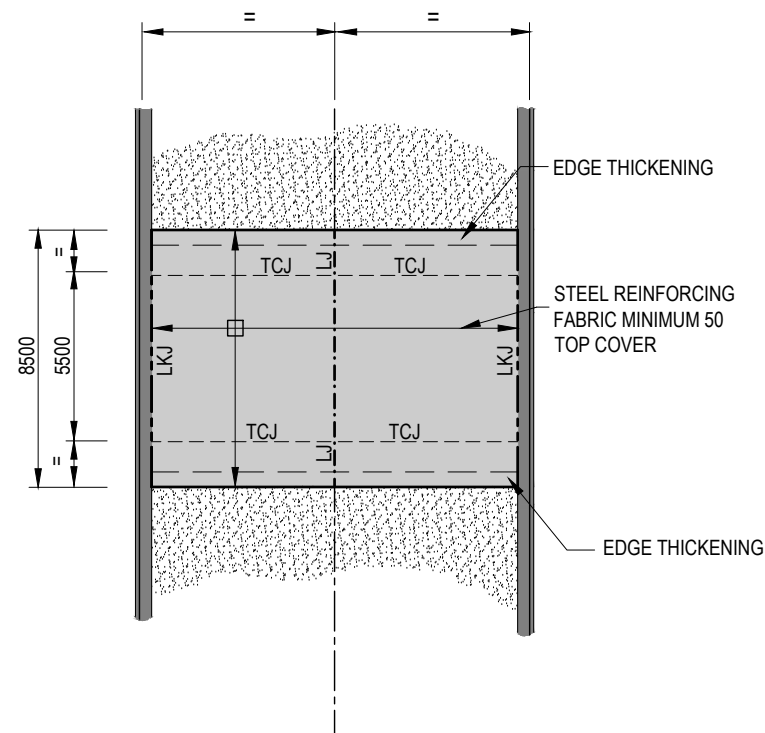
2 - URBAN BUS STOP - SHELTER

1. DIMENSIONS ARE BASED ON BUS STOP SIGN POLE & BACK OF KERB
2. BUS STOP SIGN TO BE NOMINATED BY COUNCIL'S TRAFFIC SECTION
3. ALL SIGN POLES TO BE FIXED IN V-LOCK MOUNTING SOCKETS
4. APPROACH & DEPARTURE ZONE LENGTHS MAY BE AFFECTED BY ADJACENT TRAFFIC FACILITIES
5. DIMENSIONS WILL VARY DEPENDING ON SIZE OF SHELTER
6. ALL CONCRETE TO BE 32MPa & 150mm THICK WITH SL72 MESH PLACED CENTRALLY & DOUBLED UNDER SHELTER AREA
7. WHERE THROUGH ACCESS 1.50m WIDE IS NOT AVAILABLE BEHIND THE SHELTER, THE SHELTER MAY BE MOVED BACK TO THE BOUNDARY.





'T' INTERSECTION THRESHOLD PLAN



MID-BLOCK RAISED THRESHOLD PLAN

LEGEND

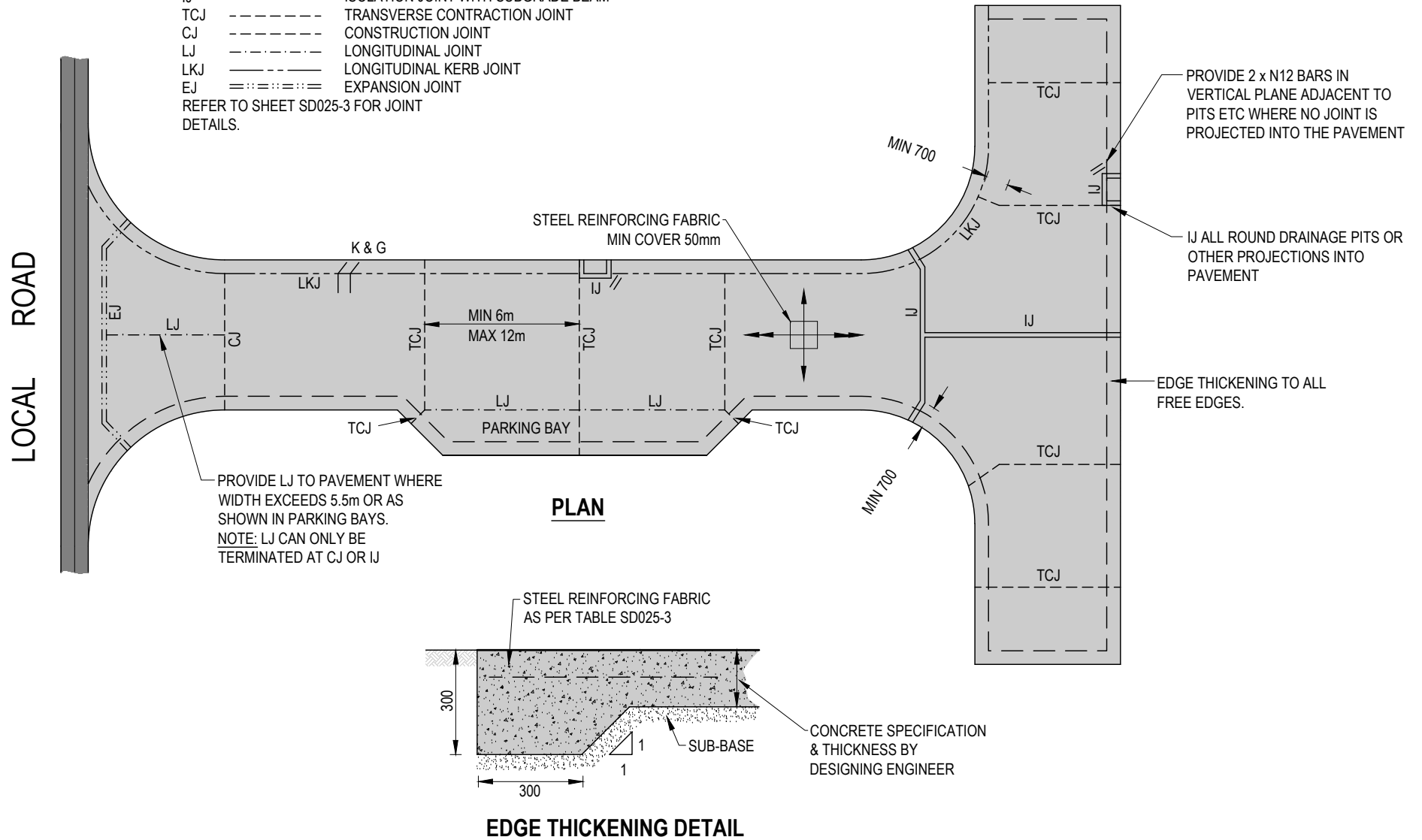
IJ	=====	ISOLATION JOINT WITH SUBGRADE BEAM
TCJ	-----	TRANSVERSE CONTRACTION JOINT
CJ	-----	CONSTRUCTION JOINT
LJ	-.-.-.-.-	LONGITUDINAL JOINT
LKJ	-----	LONGITUDINAL KERB JOINT
EJ	==::==::==	EXPANSION JOINT

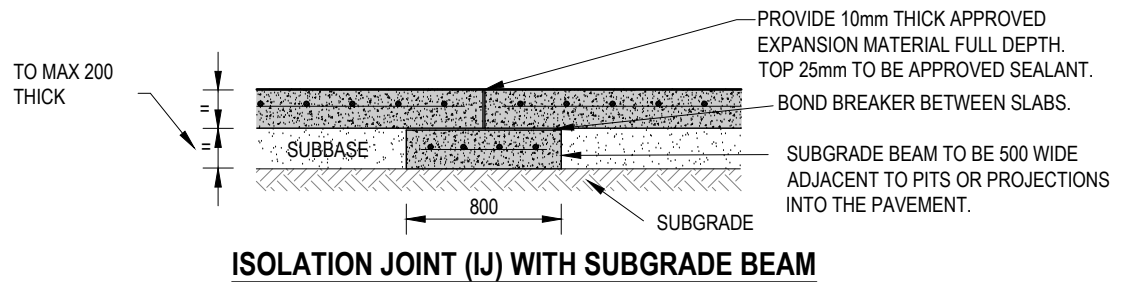
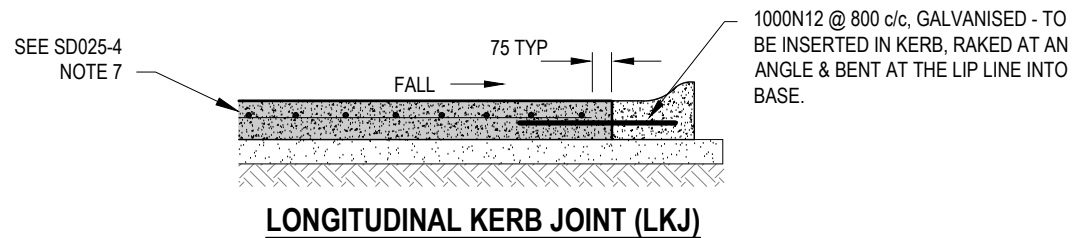
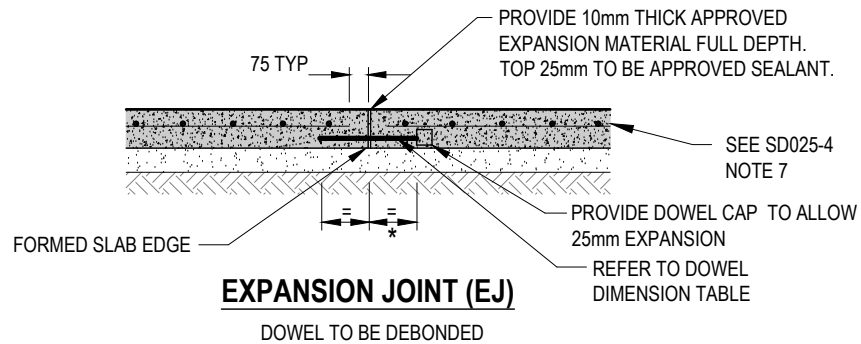
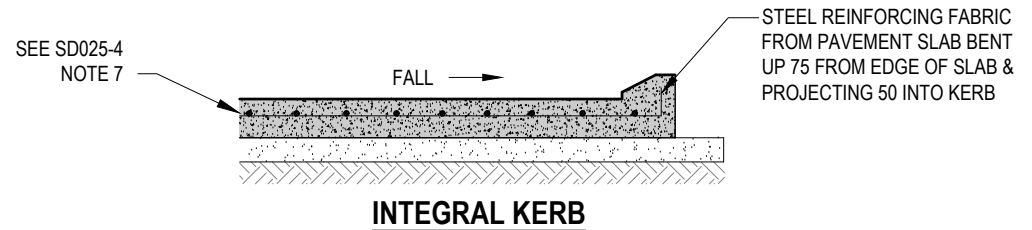
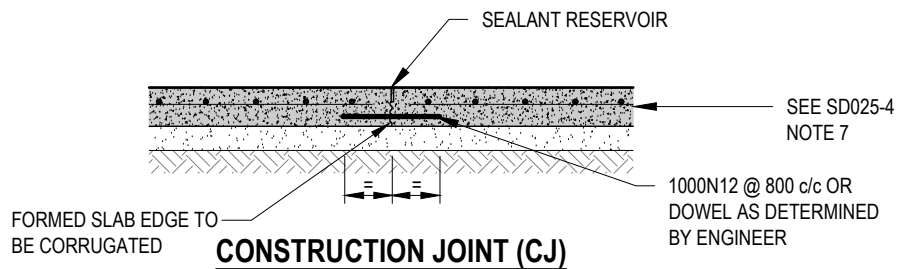
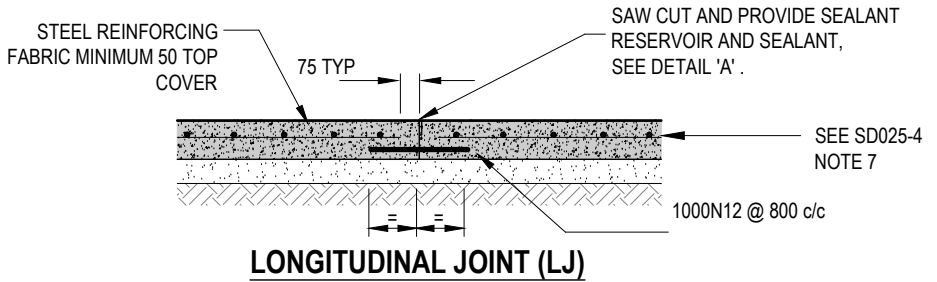
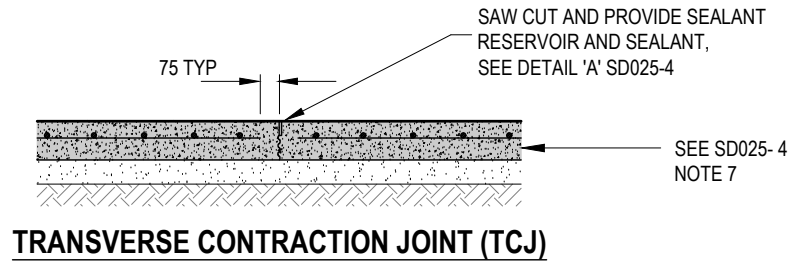
REFER TO SD025-3 FOR JOINT DETAILS.

* PEDESTRIAN RAMPS
OMITTED FOR CLARITY

LEGEND

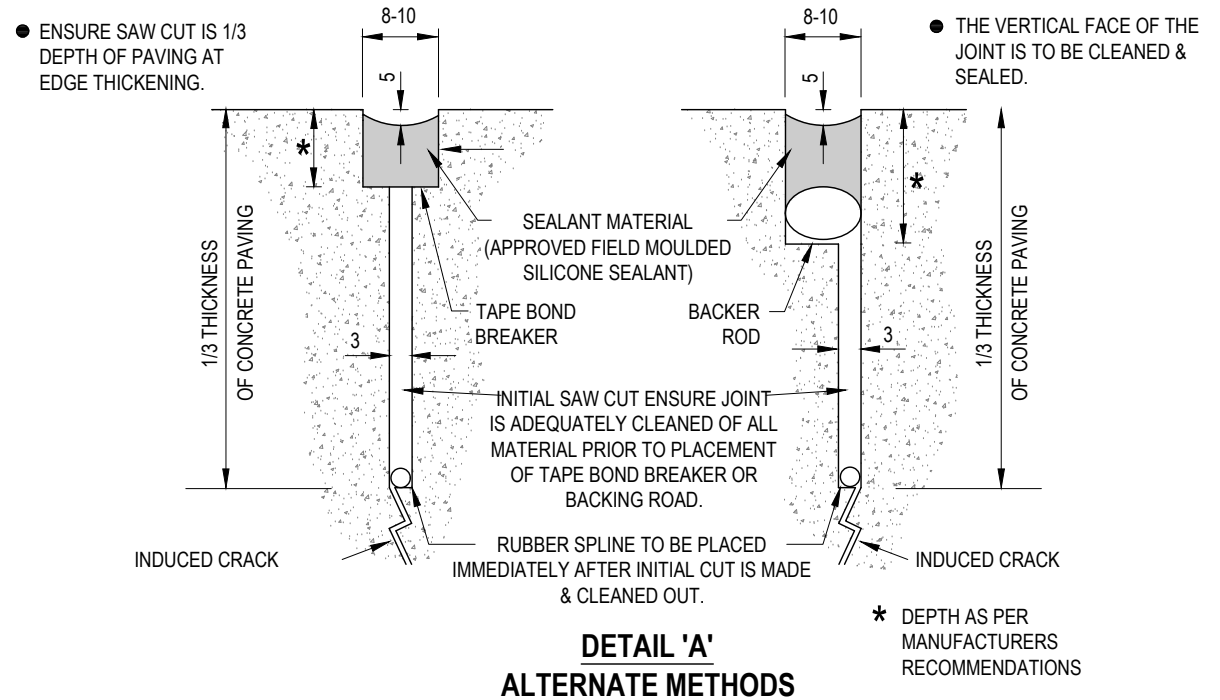
IJ	=====	ISOLATION JOINT WITH SUBGRADE BEAM
TCJ	-----	TRANSVERSE CONTRACTION JOINT
CJ	-----	CONSTRUCTION JOINT
LJ	-----	LONGITUDINAL JOINT
LKJ	-----	LONGITUDINAL KERB JOINT
EJ	=====	EXPANSION JOINT
REFER TO SHEET SD025-3 FOR JOINT DETAILS.		





NOTE:

1. ALL DIMENSIONS IN MILLIMETRES
2. ALL WORK TO BE CARRIED OUT IN ACCORDANCE WITH MAITLAND CITY COUNCIL ENGINEERING REQUIREMENTS.
3. ALL EXPOSED CONCRETE EDGES TO BE ROUNDED TO A 5mm RADIUS.
4. ALL DOWELS TO BE EFFECTIVELY DEBONDED WHERE SPECIFIED.
5. SAW CUTS TO BE CARRIED OUT AT A TIME TO ENSURE CRACKS ARE INDUCED AT THE JOINT LOCATIONS AND TO MINIMISE SPALLING.
UNPLANNED CRACKS IN SLABS MAY RENDER THEM UNACCEPTABLE.
6. PROVIDE APPROVED CURING COMPOUND TO FINISHED CONCRETE SURFACE IN ACCORDANCE WITH THE MANUFACTURERS RECOMMENDATIONS.
7. REFER TO STEEL REINFORCING FABRIC TABLE.
8. ALL DOWELS & DEFORMED BARS TO BE PLACED CENTRALLY.
9. PAVEMENT THICKNESS, JOINT LAYOUT & TYPE SUBJECT TO GEOTECHNICAL INVESTIGATION, DESIGN & APPROVAL BY COUNCIL'S REPRESENTATIVE.
10. THESE STANDARDS ARE TO BE READ IN CONJUNCTION WITH THE "CEMENT & CONCRETE ASSOCIATION OF AUSTRALIA". CONCRETE PAVEMENT DESIGN FOR RESIDENTIAL STREETS (T51).
11. MINIMUM COMPRESSIVE STRENGTH (FC) TO BE MIN. 32MPa AT 28 DAYS (INCL. ADJACENT KERB & GUTTER & SUBGRADE BEAM).
12. PAVEMENT EDGE THICKENING WILL BE REQUIRED WHERE NO KERBING IS PROPOSED UNLESS OTHERWISE APPROVED.
13. LATERAL SUBSOIL LINES WILL BE REQUIRED AT THE INTERFACE OF FLEXIBLE AND RIGID PAVEMENTS IN ADDITION TO COUNCIL'S STANDARD REQUIREMENTS.
14. WHERE LONGITUDINAL GRADES EXCEED 15% OR PROTECTION OF ADJACENT PAVEMENTS OR STRUCTURES IS NECESSARY, SLAB ANCHORS (ANCHOR BLOCKS) SHALL BE PROVIDED.
15. JOINTS IN KERBS SHALL BE OF ADEQUATE DEPTH TO ENSURE POSITIVE CRACK INDUCTION (NOT TOOLED DUMMY JOINTS) & ARE TO BE LOCATED TO ALIGN WITH JOINTS IN ADJACENT PAVING OR K&G.
16. ALL DEFORMED BARS TO BE GRADE 500Y.



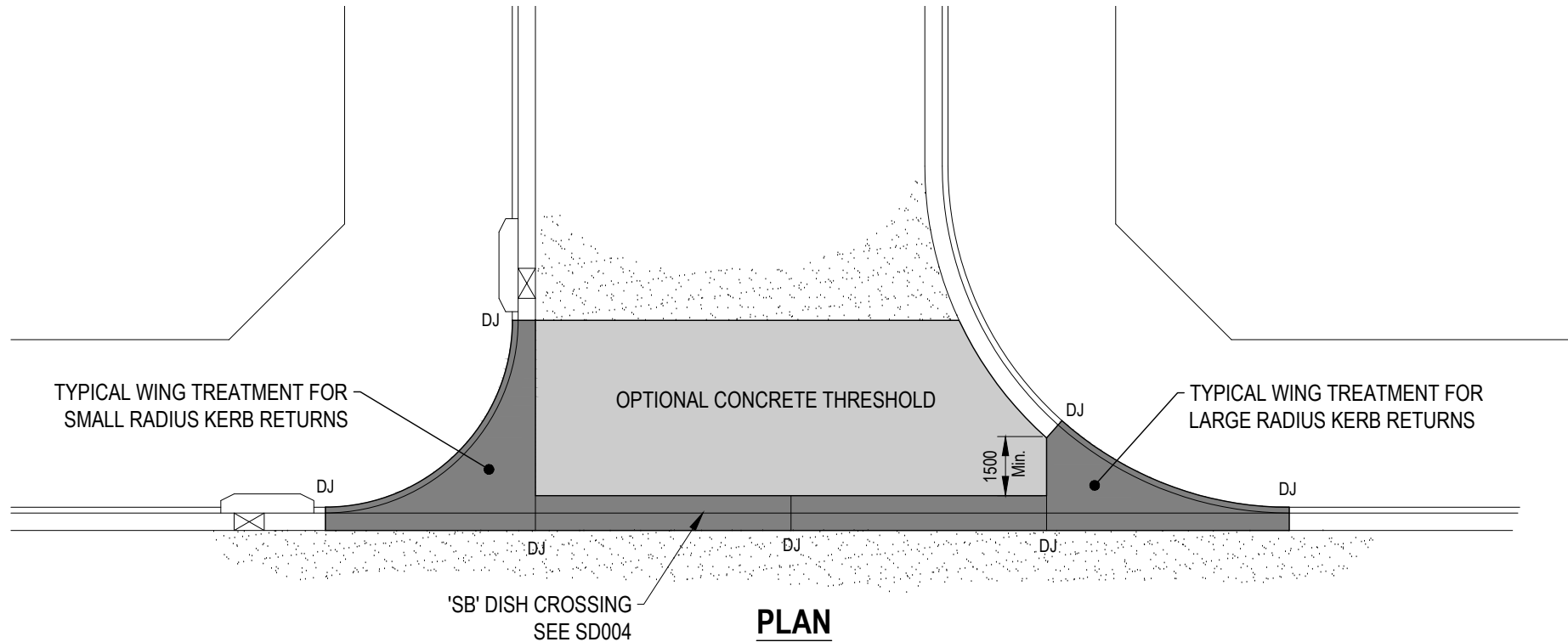
MESH

CONCRETE THICKNESS (mm)	STEEL REINFORCING FABRIC (AS 1204)
165 min	F82 or F828
175	F82 or F828
200	F82 or F828

DOWELS

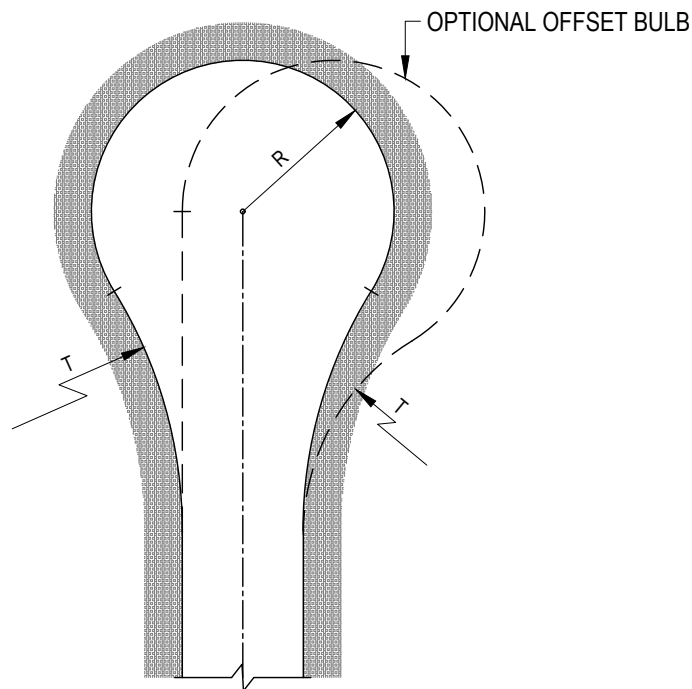
CONCRETE THICKNESS (mm)	DOWEL DIAMETER (mm)	DOWEL LENGTH (mm)
165 min	28	450
175	28	450
200	33	450
ALL DOWELS PLACED AT 300mm CENTRES TO BE GRADE 250R STEEL BARS		

NOTE: ALL DOWELS WITHIN A JOINT ARE TO BE ALIGNED PARALLEL WITH THE LINE JOINING THE CENTROIDS OF ADJOINING SLABS.



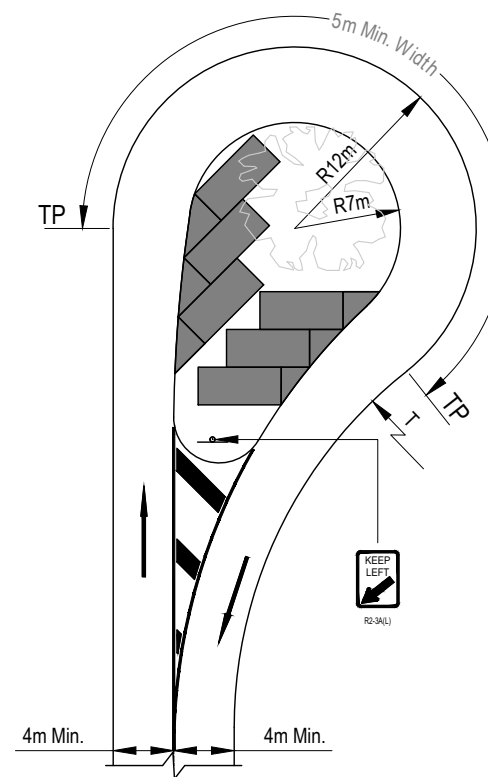
NOTE:

1. ALL DIMENSIONS IN MILLIMETRES
2. DISH DRAIN TO BE MINIMUM 150mm THICK, REINFORCED WITH SL72 MESH PLACED CENTRALLY
3. WINGS TO BE FORMED & POURED INTEGRAL WITH KERB
4. ALL CONCRETE 32MPa
5. 'DJ' ALL JOINTS TO BE DOWELLED (400 N12 @ 300c/c)
6. KERB RAMPS DELETED FOR CLARITY. SEE SD019/1 & SD019/2 FOR LOCATIONS



CUL-DE-SAC

	LOCAL STREET	RESIDENTIAL BUS/TRUNK	BUSHFIRE	INDUSTRIAL
CUL-DE-SAC RADIUS (R)	10	16*	14.5*(12m + 2.5m PARKING ON ARC)	16
TRANSITION CENTRED (T)	30	30	30	50
TRANSITION OFFSET (T)	15	15	15	30

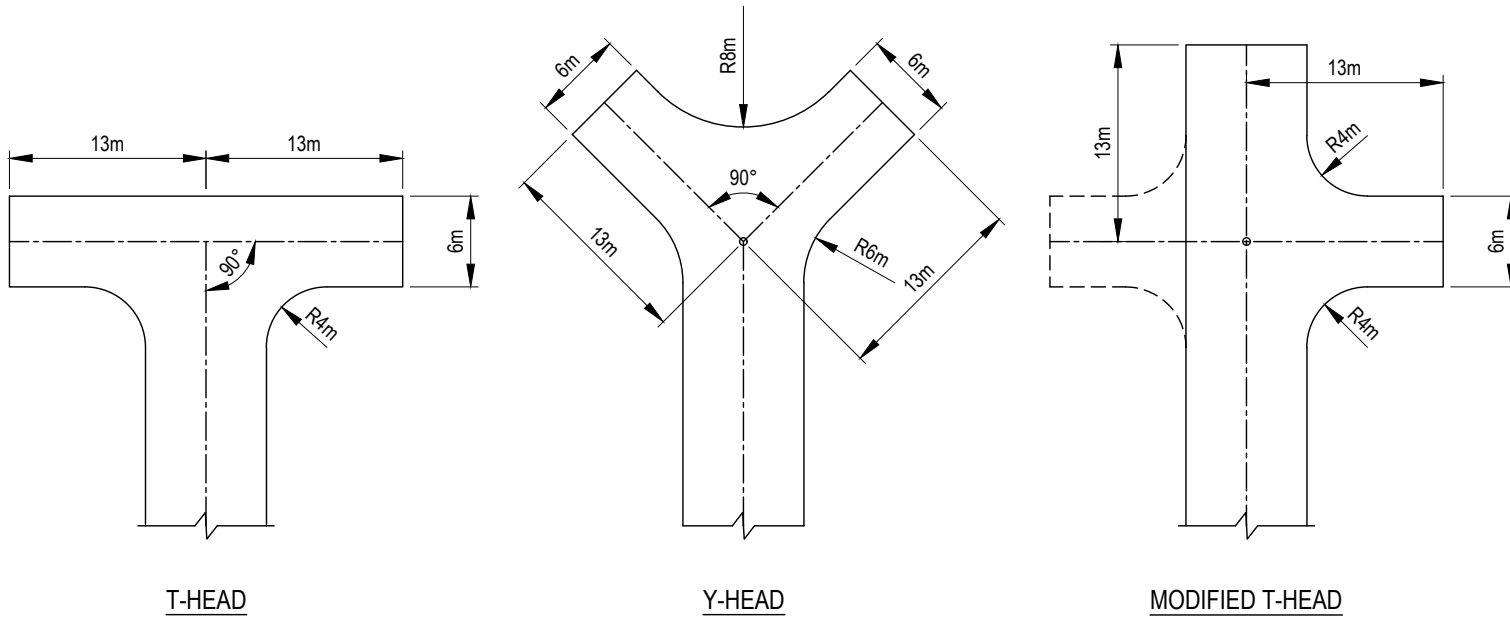


CUL-DE-SAC (BUSHFIRE)

NOTE:

1. NO PARKING RESTRICTION ALONG THE WHOLE ONE WAY SECTION.
2. WIDTH OF THE BEND (5m MINIMUM) IS PROVIDED TO SUIT TURNING MOVEMENT OF DESIGN VEHICLE.
3. DESIGN VEHICLE - MEDIUM RIGID VEHICLE.
4. PROVIDE CONCRETE PAVEMENT AROUND ONE WAY SECTION.
5. ROLL KERB INSIDE AND OUTSIDE.
6. PARKING - 1 SPACE PER LOT.
7. PROVIDE PARKING SPACE (2.5m WIDE AND 5.5m LENGTH) AS PER AS2890.1.
8. PARKING AREA TO BE FULLY CONCRETED WITH RUNOFF SLOPING TOWARDS THE TREE.
9. PROVIDE SUBSOIL AND INTERNAL DRAINAGE TO INNER LANDSCAPED AREA.

FOR SERVICE TURNING SUCH AS GPT, BASIN, ETC. NOT FOR PUBLIC ROAD.



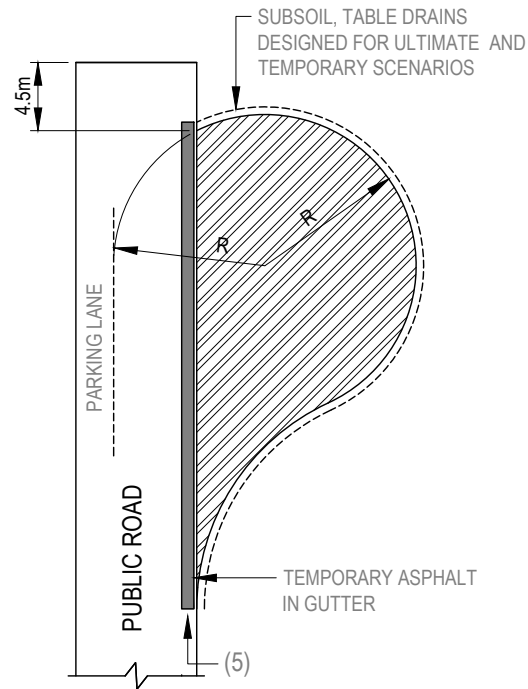
NOTE:

1. INCOMING WIDTHS DETERMINED BY ROAD CATEGORIES SETOUT IN THE ROAD DESIGN SECTION OF COUNCIL'S "MANUAL OF ENGINEERING STANDARDS".
2. NOTWITHSTANDING THE ABOVE DIMENSIONING, AUSTRALIAN STANDARD AS 2890.2 - *PARKING FACILITIES PART 2: OFF-STREET COMMERCIAL VEHICLE FACILITIES* SHALL BE USED TO VERIFY ADEQUATE MANOEUVRING AREA.
3. ALTERNATIVE LAYOUTS WILL BE CONSIDERED BY COUNCIL.

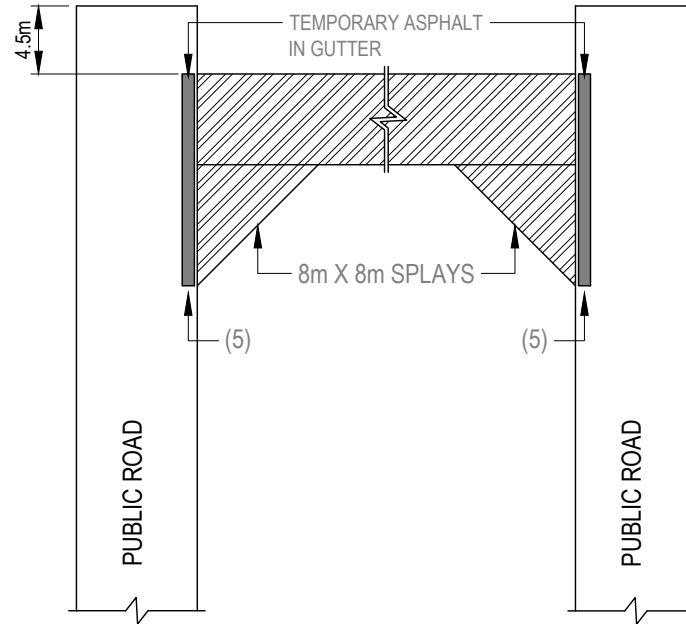
NOTE:

R AND T - SEE TABLE ON SHEET 1

* CLEAR OF PARKING LANE

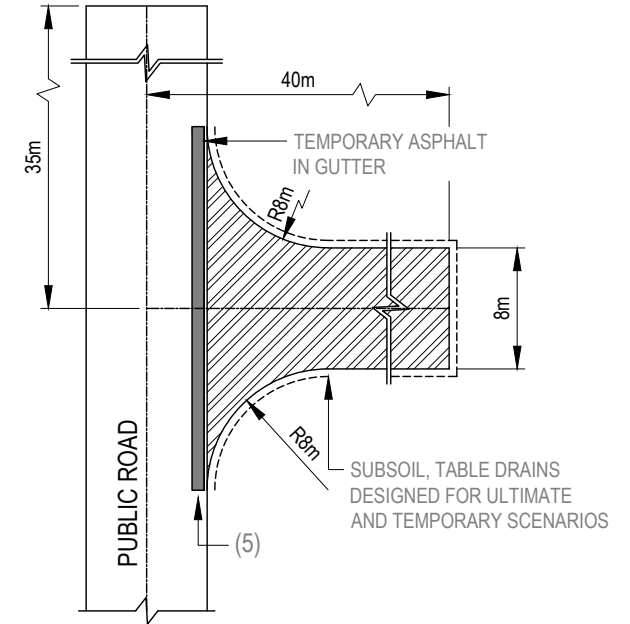


OFFSET BULB



TEMPORARY LOOP CONNECTION

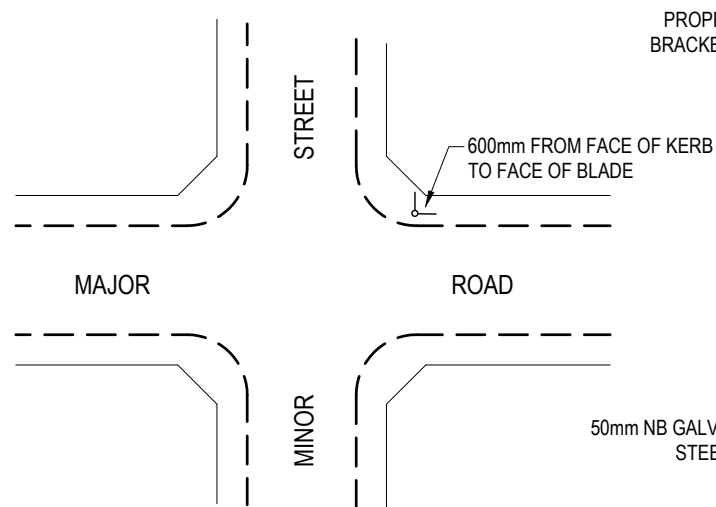
OFFSET T ONLY SUITABLE FOR MAXIMUM 120m FROM CROSS STREET AND ON 8m TO 10m WIDE ROADS



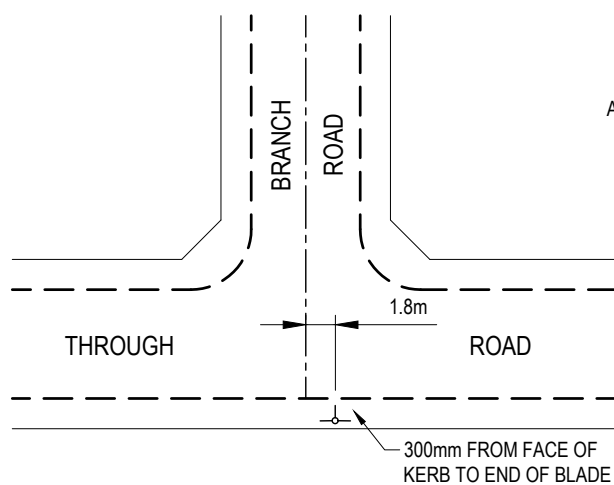
OFFSET T

NOTE:

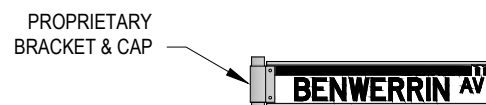
1. INCOMING WIDTHS DETERMINED BY ROAD CATEGORIES SETOUT IN THE ROAD DESIGN SECTION OF COUNCIL'S "MANUAL OF ENGINEERING STANDARDS".
2. NOTWITHSTANDING THE ABOVE DIMENSIONING, AUSTRALIAN STANDARD AS 2890.2 - PARKING FACILITIES PART 2: OFF-STREET COMMERCIAL VEHICLE FACILITIES SHALL BE USED TO VERIFY ADEQUATE MANOEUVRING AREA.
3. PROVIDE BUSHFIRE AND REGULATORY TRAFFIC CONTROL INCLUDING GUIDEPOSTS, PARKING RESTRICTIONS, SIGNAGE AND LINEMARKING.
4. PROVIDE G9-18 - NO THROUGH ROAD SIGNAGE.
5. PROVIDE STORMWATER PIT UPSTREAM OF EACH TURNING HEAD AS NEEDED TO CATER FOR TEMPORARY DRAINAGE REQUIREMENT.



CROSS STREET INTERSECTION



"T" INTERSECTION



50mm NB GALVANISED STEEL POST

V-LOCK BASE SOCKET IN CONCRETE PAVING

ANTI-TURNING PIN

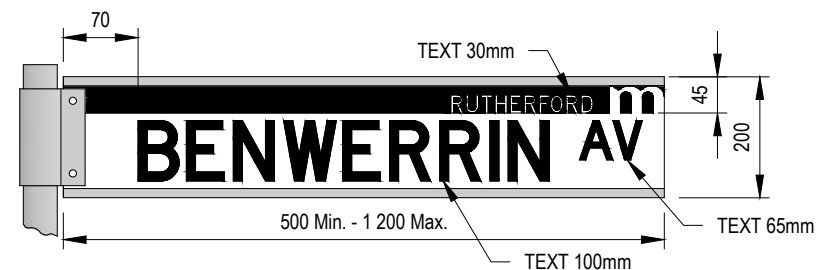
MASS CONCRETE

POLE

SIGN LOCATION

1. STREET NAME SIGNS TO BE PROVIDED AT ROUNDABOUTS AND MAJOR INTERSECTIONS WHERE SHOWN ON THE APPROVED ENGINEERING PLANS OR AS DIRECTED BY THE ENGINEER.
2. SIGN POST LOCATIONS MAY BE VARIED BY THE ENGINEER WHERE POWER POLES OR SIMILAR OBSTRUCT VIEW.

1. ALL DIMENSIONS ARE IN MILLIMETRES.
2. SIGNS ARE TO BE ERECTED BY THE DEVELOPER UNDER COUNCIL'S SUPERVISION.
3. NON-STANDARD SIGNS MAY BE USED SUBJECT TO PRIOR APPROVAL BY COUNCIL.



FINGER BOARD

SIGN SPECIFICATION

SIGN COLOUR

STREET NAME BLADE :BLACK LETTERS ON WHITE REFLECTORISED BACKGROUND
DIRECTIONAL SIGN BLADE : BLACK LETTERS ON WHITE REFLECTORISED BACKGROUND

SIZE & SHAPE

SIGNS SHALL BE RECTANGULAR, HAVE A BLADE WIDTH OF 200mm, A MINIMUM LENGTH OF 500mm & MAXIMUM LENGTH OF 1200mm.

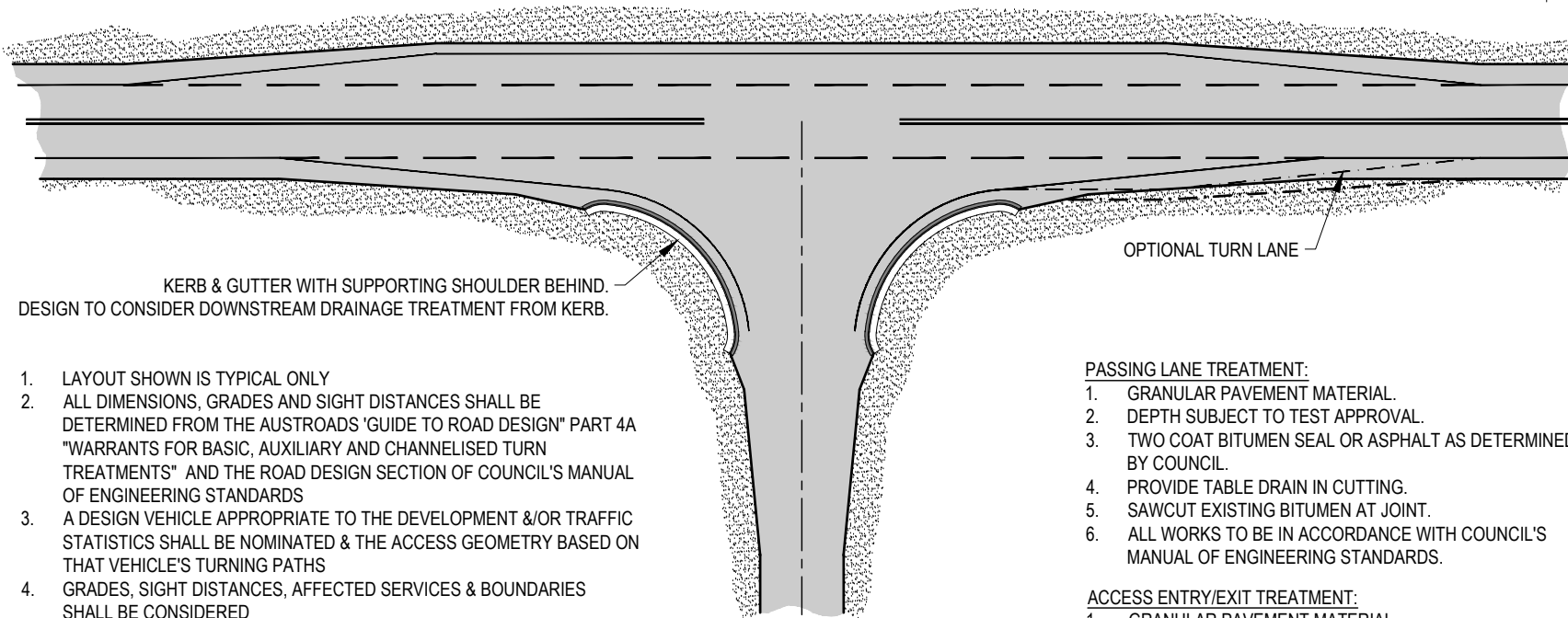
REFLECTIVE MATERIAL

THE BACKGROUND SHALL CONSIST OF CLASS 1 MATERIAL, LAMINATED TO THE EDGE OF BLADE.

LETTERING

LETTERS & NUMERALS FOR STREET NAMES SHALL BE SERIES 'D', AS SPECIFIED IN AS1744, WHERE THE TEXT PRODUCES A SIGN GREATER THAN 1200mm IN LENGTH, THE LETTERING MAY BE MADE PROPORTIONALLY NARROWER BUT NOT NARROWER THAN SERIES 'C'.





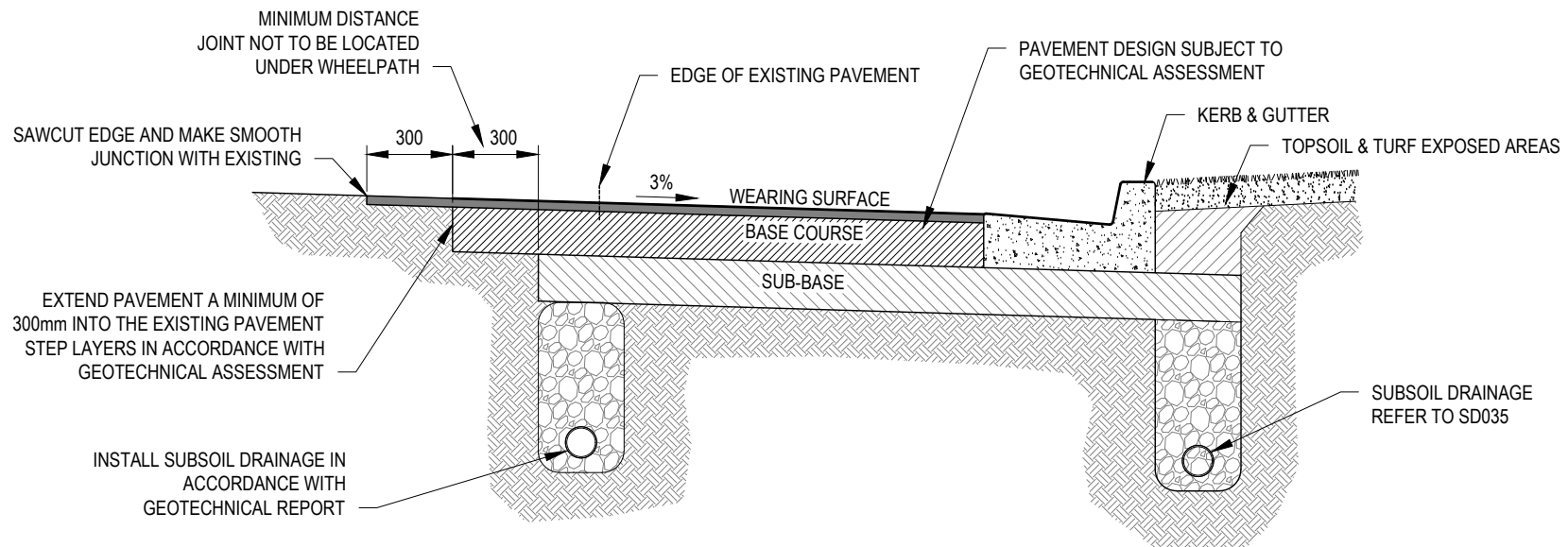
1. LAYOUT SHOWN IS TYPICAL ONLY
2. ALL DIMENSIONS, GRADES AND SIGHT DISTANCES SHALL BE DETERMINED FROM THE AUSTRROADS 'GUIDE TO ROAD DESIGN' PART 4A "WARRANTS FOR BASIC, AUXILIARY AND CHANNELISED TURN TREATMENTS" AND THE ROAD DESIGN SECTION OF COUNCIL'S MANUAL OF ENGINEERING STANDARDS
3. A DESIGN VEHICLE APPROPRIATE TO THE DEVELOPMENT &/OR TRAFFIC STATISTICS SHALL BE NOMINATED & THE ACCESS GEOMETRY BASED ON THAT VEHICLE'S TURNING PATHS
4. GRADES, SIGHT DISTANCES, AFFECTED SERVICES & BOUNDARIES SHALL BE CONSIDERED
5. LINEMARKING & SIGNAGE SUBJECT TO LOCAL TRAFFIC COMMITTEE ASSESSMENT

PASSING LANE TREATMENT:

1. GRANULAR PAVEMENT MATERIAL.
2. DEPTH SUBJECT TO TEST APPROVAL.
3. TWO COAT BITUMEN SEAL OR ASPHALT AS DETERMINED BY COUNCIL.
4. PROVIDE TABLE DRAIN IN CUTTING.
5. SAWCUT EXISTING BITUMEN AT JOINT.
6. ALL WORKS TO BE IN ACCORDANCE WITH COUNCIL'S MANUAL OF ENGINEERING STANDARDS.

ACCESS ENTRY/EXIT TREATMENT:

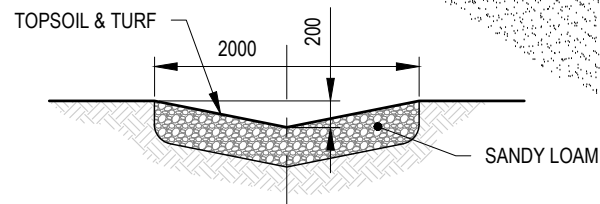
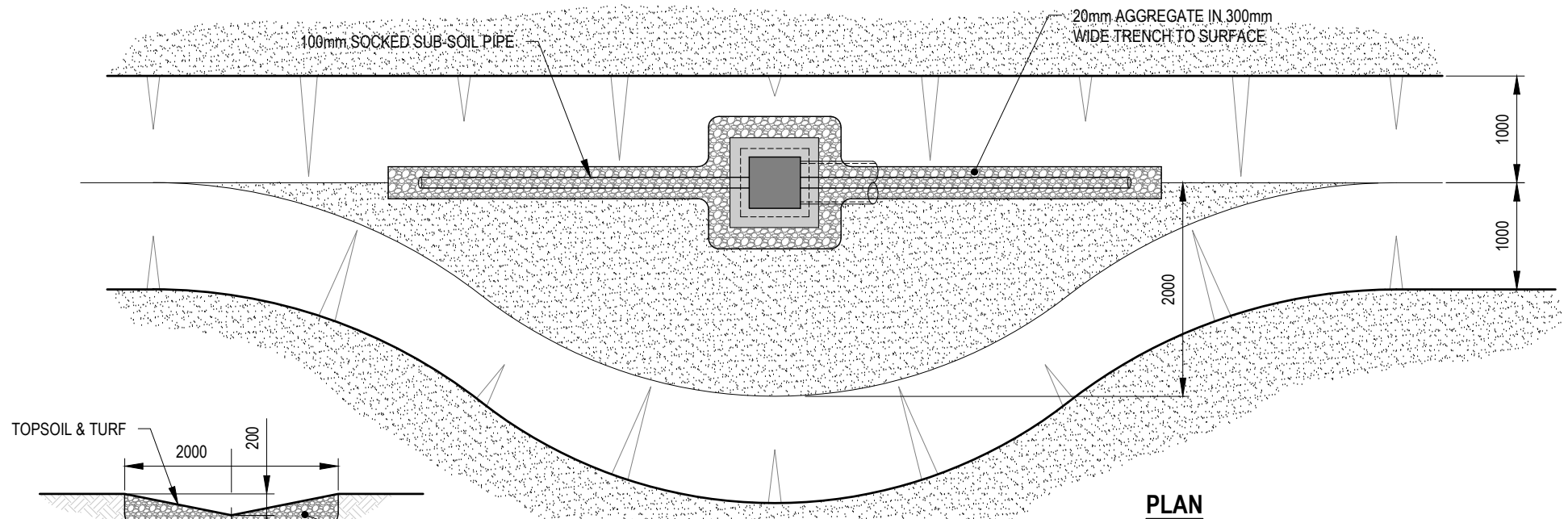
1. GRANULAR PAVEMENT MATERIAL
2. COMPACTED DEPTH MINIMUM 200mm
3. TWO COAT BITUMEN FLUSH SEAL
4. WHERE PIPE CROSSING IS REQUIRED SEE SD013-1 FOR HEADWALL DETAILS



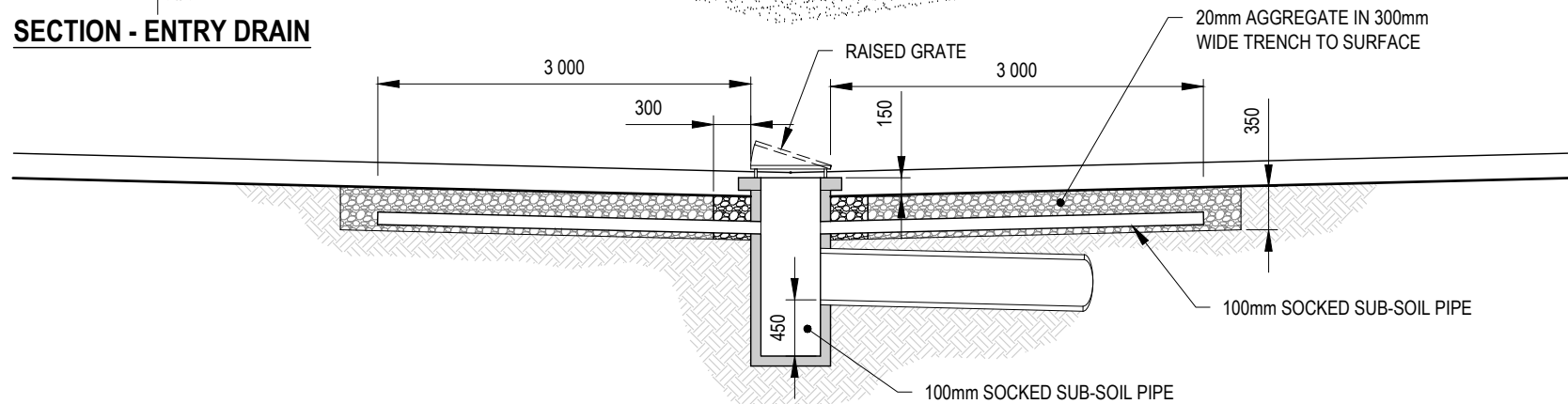
TYPICAL SECTION

NOTE:

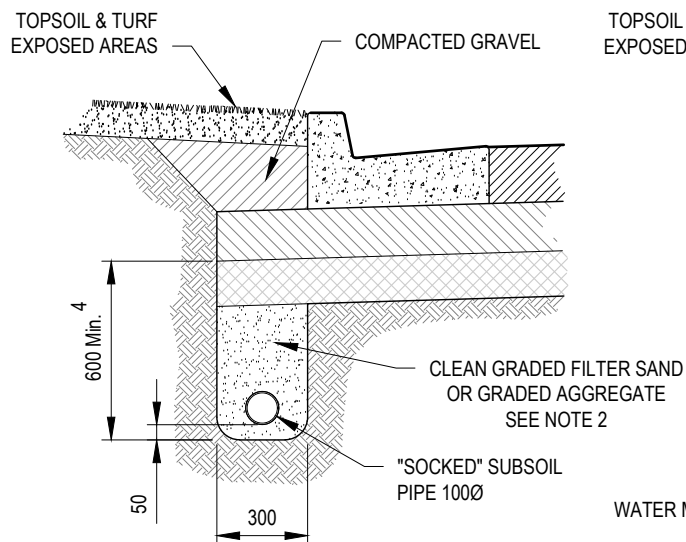
1. ALL DIMENSIONS IN MILLIMETRES
2. PAVEMENT JOINS NOT TO BE PLACED UNDER WHEELPATHS.



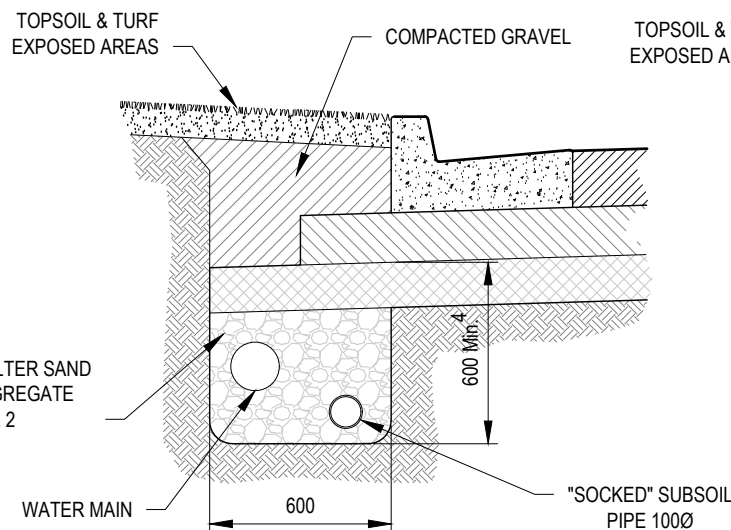
SECTION - ENTRY DRAIN



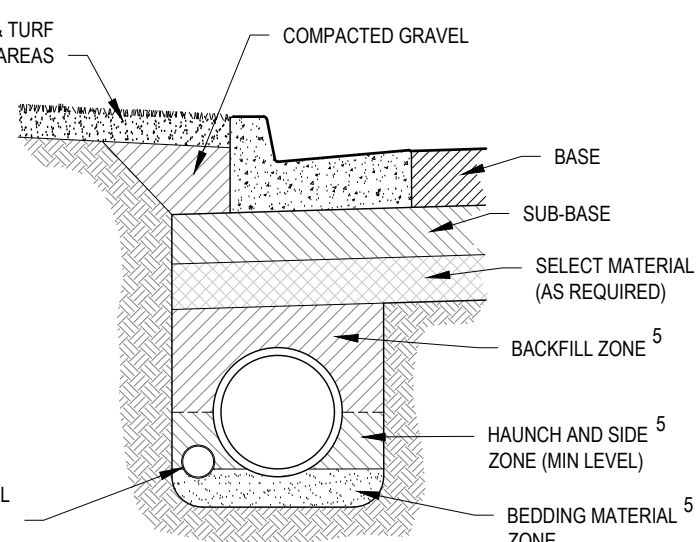
LONGITUDINAL SECTION



TYPICAL INSTALLATION



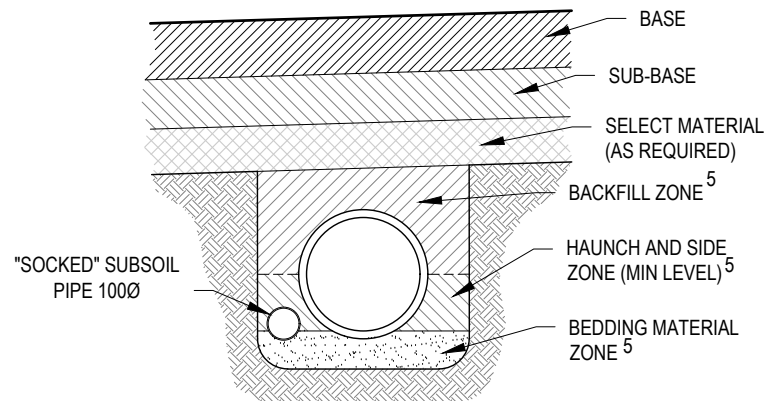
**SHARED TRENCH
(WITH WATER MAIN)**



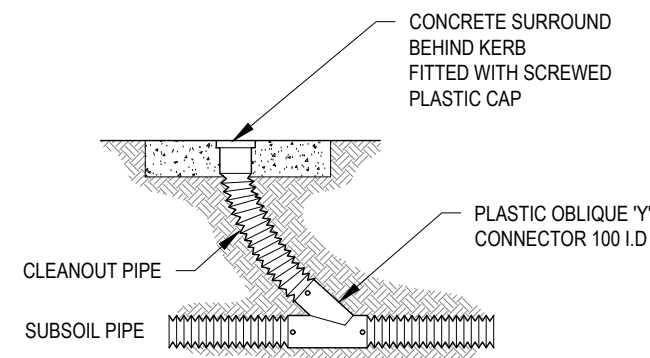
**STORMWATER TRENCH
(ALL STORMWATER PIPES)**

NOTE:

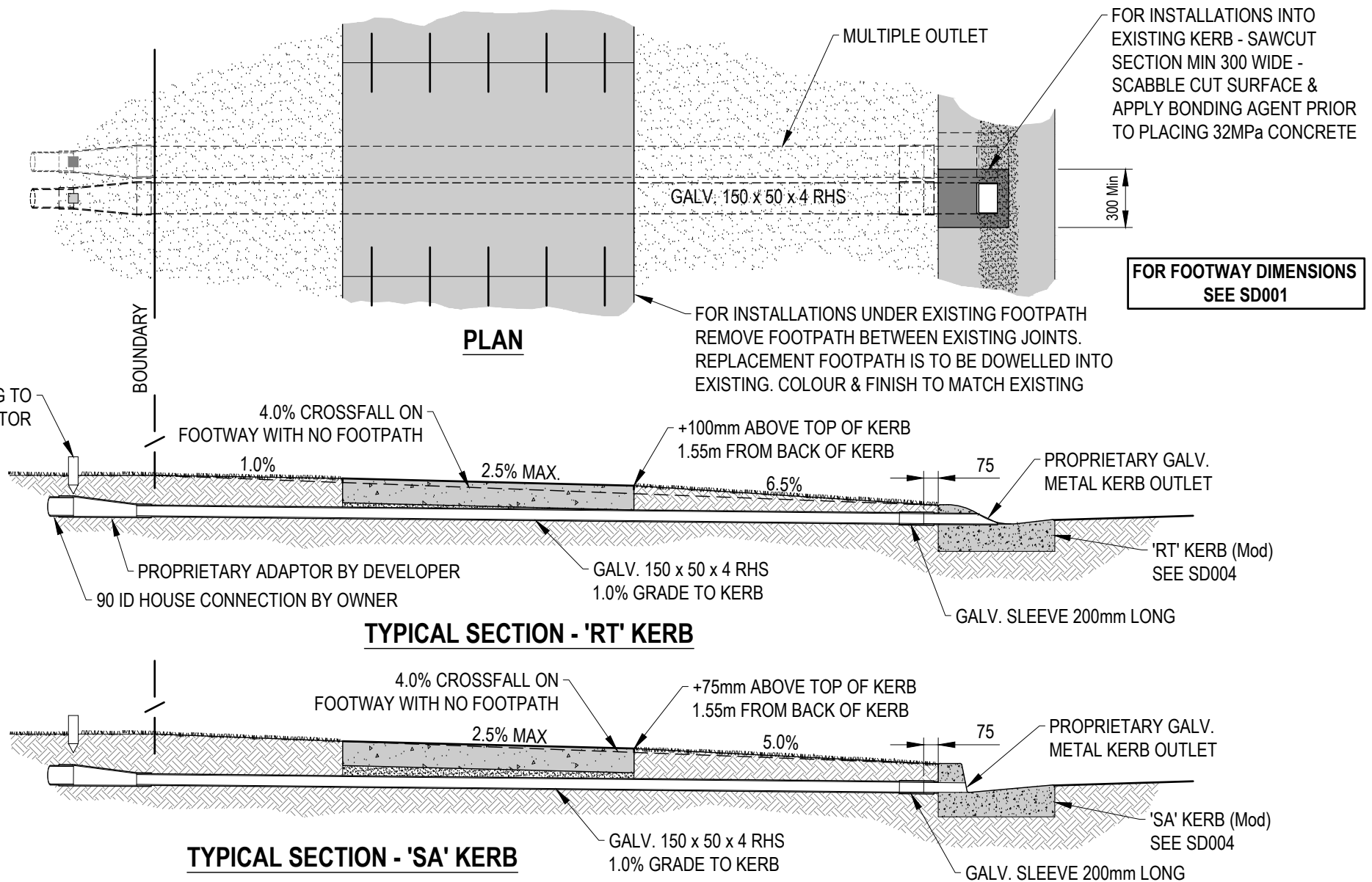
1. TYPE, LOCATION AND EXTENT OF ADDITIONAL SUBSOIL DRAINAGE SHALL BE IN ACCORDANCE WITH A GEOTECHNICAL CONSULTANT'S ASSESSMENT.
2. A NOMINAL SIZE AGGREGATE (10mm MAXIMUM) MAY BE SUBSTITUTED FOR THE FILTER SAND
3. FLUSH POINTS SHALL BE PROVIDED AT UPSTREAM DEAD ENDS & CRESTS & AT MAXIMUM OF 60m CTRS.
4. DEPTH MAY BE VARIED IN A ROCK SUBGRADE.
5. SEE THE CONSTRUCTION SECTION OF THE MANUAL OF ENGINEERING STANDARDS FOR TRENCH MATERIAL SPECIFICATION. EACH ZONE MAY BE ONE HOMOGENEOUS APPROVED MATERIAL.

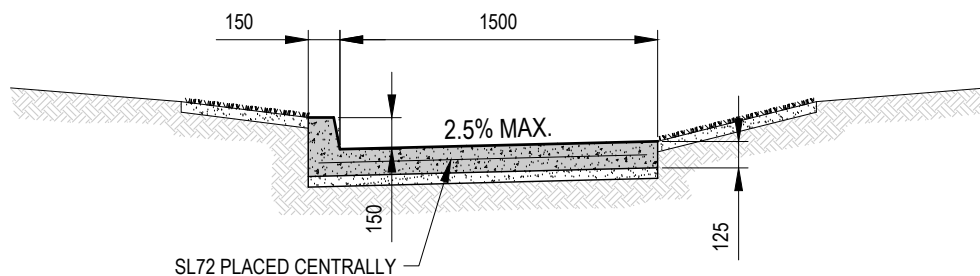


**STORMWATER TRENCH UNDER ROAD
(ALL STORMWATER PIPES)**

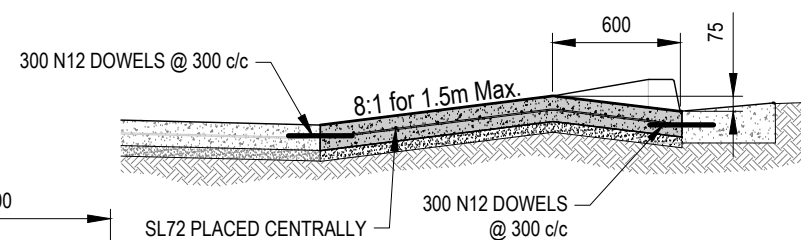


FLUSH POINT

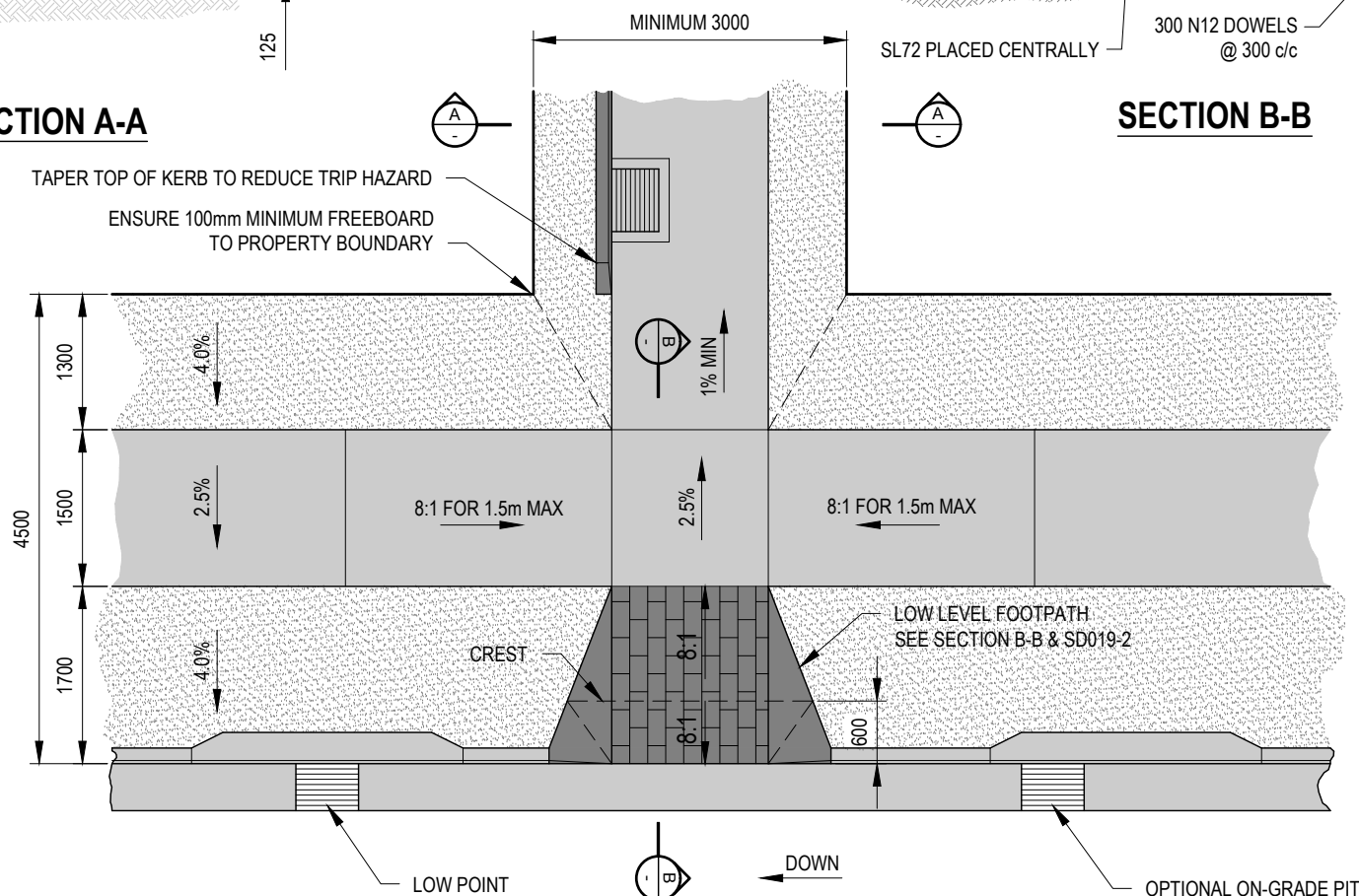




SECTION A-A



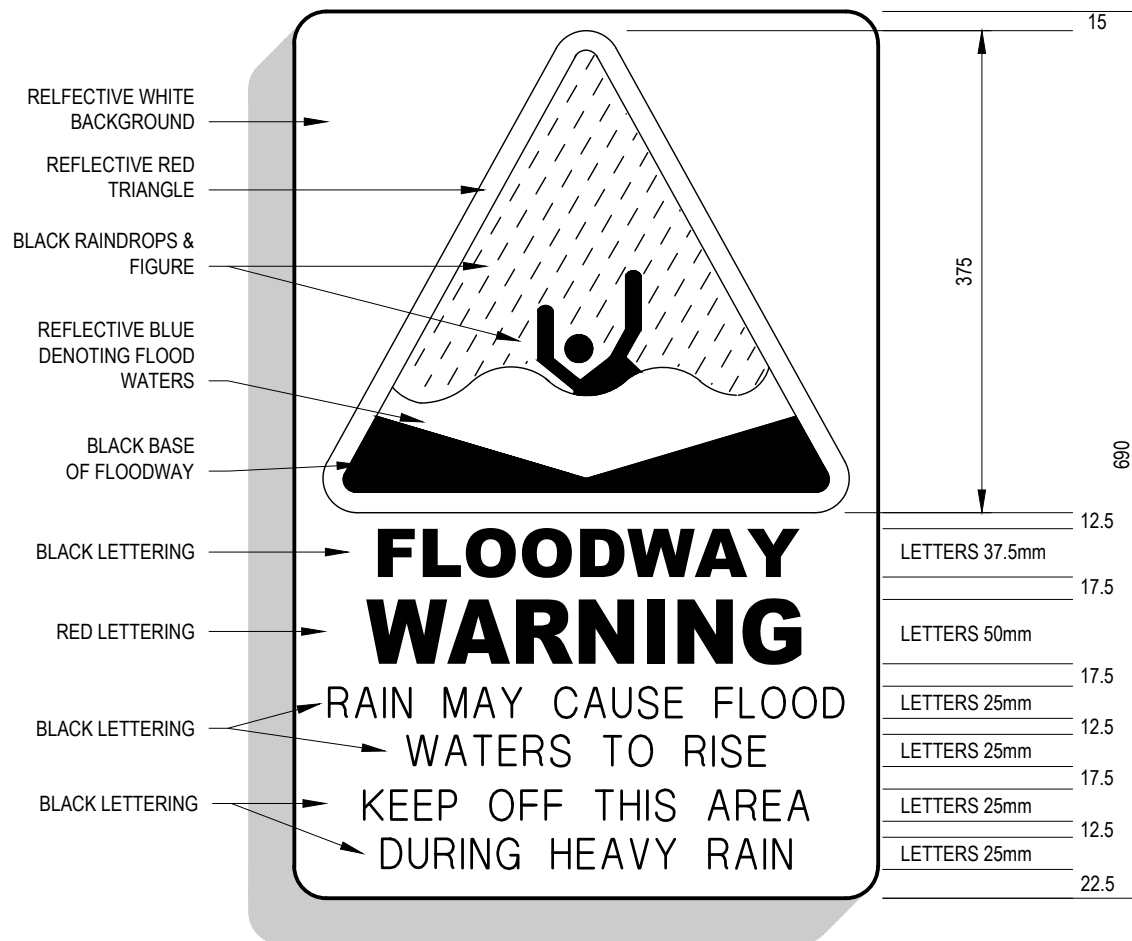
SECTION B-B



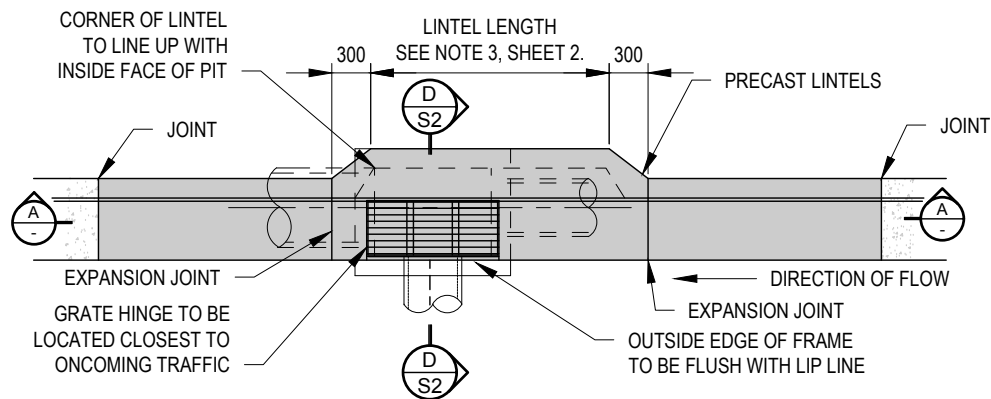
PLAN

NOTE:

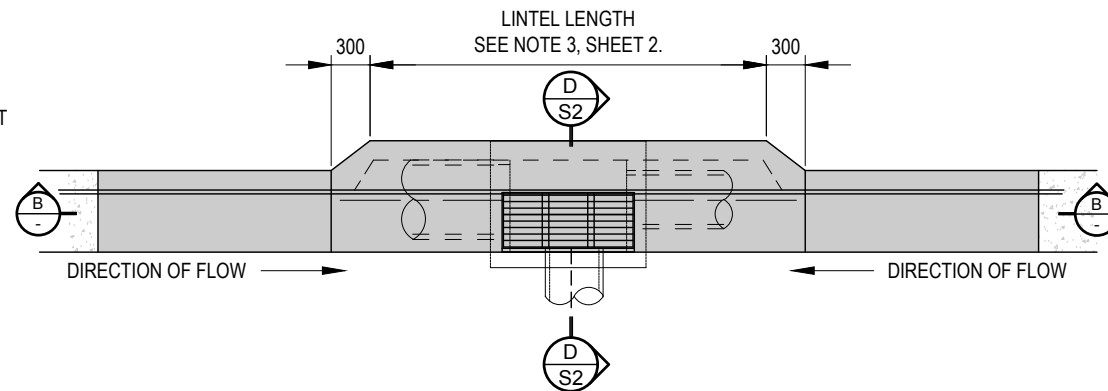
1. DETAILS SHOWN ARE APPLICABLE AT UPSTREAM ENTRIES TO FLOW PATHS ONLY.
2. SHAPE AND GRADES OF FOOTPATH AND PRAM RAMP TO BE IN ACCORDANCE WITH SD019-2.
3. REFER TO SD10 FOR JOINT REQUIREMENTS IN CONCRETE PAVING.
4. FLOW PATH AND RAMP AREAS TO BE FULLY CONCRETED.



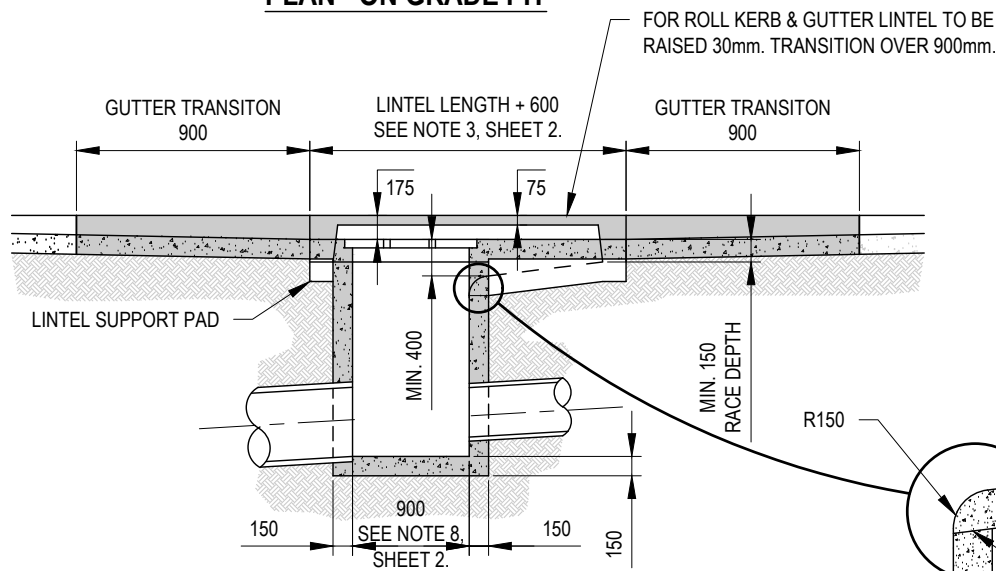
NOTE: ALL LETTERING TO BE "E" SERIES



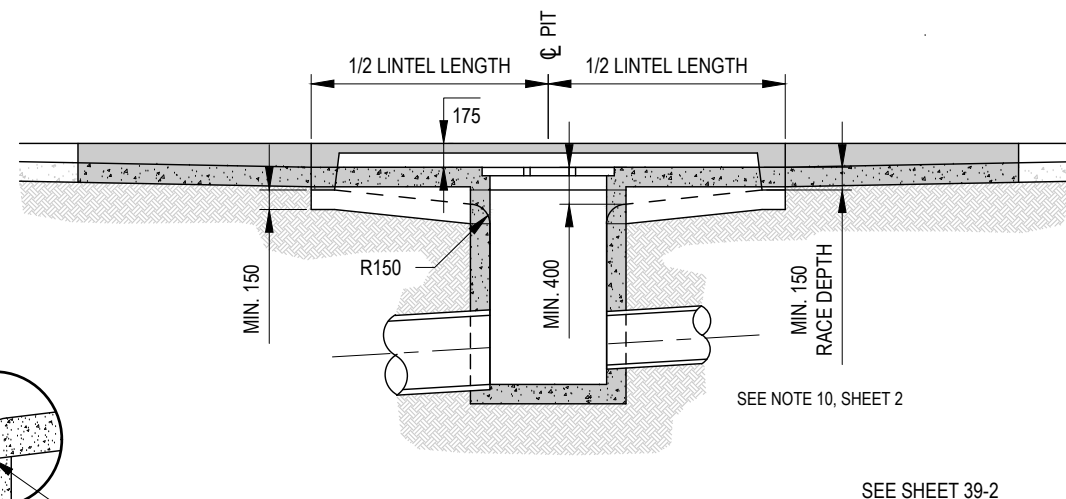
PLAN - ON GRADE PIT



PLAN - SAG PIT

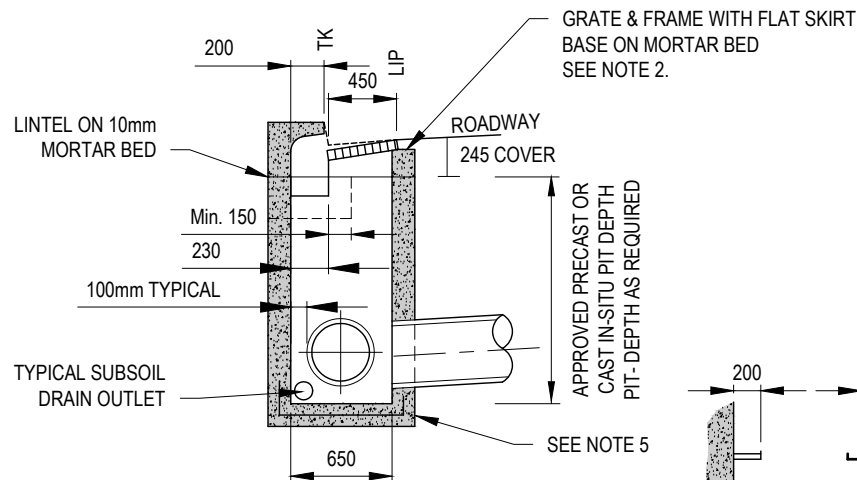


SECTION A-A



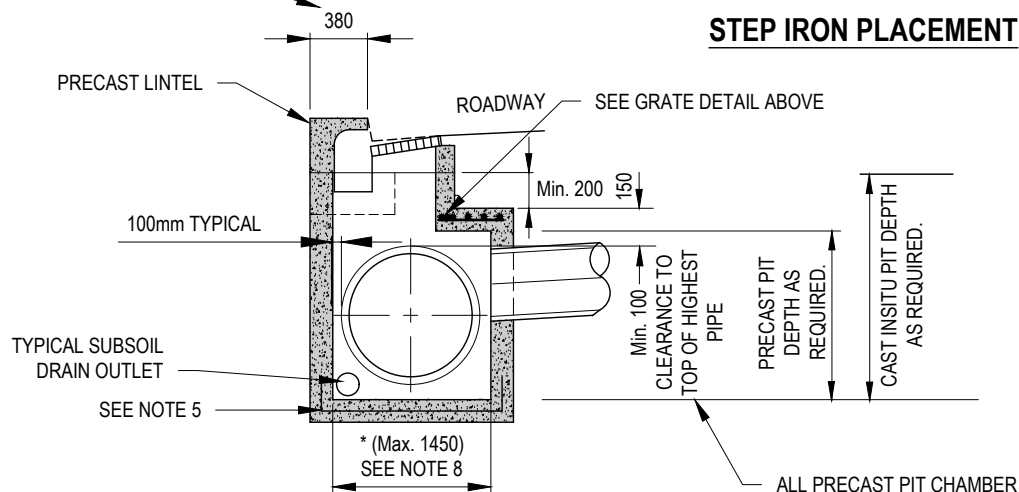
SECTION B-B

SEE SHEET 39-2
FOR SECTION D-D



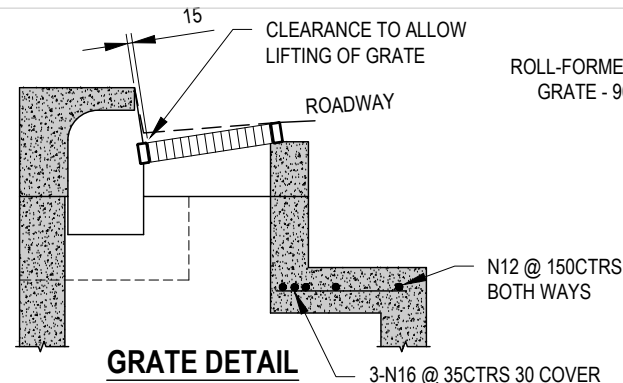
SECTION D-D (Min 650mm WIDTH)

MAY VARY SLIGHTLY
BETWEEN MANUFACTURERS

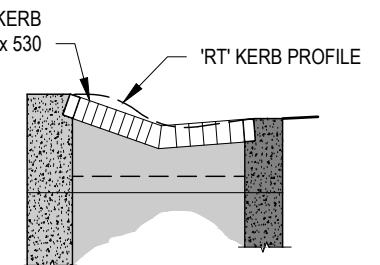


SECTION D-D (Max 1450mm WIDTH)

STEP IRON PLACEMENT



**GRATE DETAIL
'SA' KERB**



**GRATE DETAIL
'RT' KERB**

NOTE:

1. ALL DIMENSIONS ARE IN MILLIMETRES.
2. GRATES TO BE;
- CLASS 'B' FOR OFF ROAD AREAS
- CLASS 'C' - MEDIUM DUTY FOR LIGHT TRAFFIC AREAS
- CLASS 'D' FOR ROADS & COMMERCIAL AREAS
3. GRATES ARE TO BE HOT DIP GALVANISED 80-85 MICRONS THICK. ALL GRATES TO BE PROVIDED WITH HINGE PINS.
4. ALL LINTELS TO BE APPROVED PRECAST TYPE. DIMENSIONS SHOWN ON PLAN TO DENOTE CLEAR OPENINGS, MIN SIZE 1.2m. DIMENSIONS MAY VARY BETWEEN MANUFACTURERS.
5. PROVIDE STEP IRONS FOR PITS DEEPER THAN 1.2m.
6. MINIMUM THICKNESS OF WALLS AND BASE TO BE 150mm.
7. ALL PITS TO HAVE A MINIMUM OF SL82 MESH IN BASE AND N12 "L" STARTER BARS (450 LEGS) @ 400 CTRS.
8. PITS BETWEEN 1.5m & 2.5m DEEP TO HAVE SL82 MESH CENTRALLY PLACED IN WALLS FOR FULL DEPTH WITH N12 "L" CORNER BARS (450 LEGS) @ 400 CTRS.
9. PITS DEEPER THAN 2.5m OR LONGER THAN 900 OR 1450 WIDE SHALL BE DESIGNED BY A QUALIFIED ENGINEER.
10. PITS POURED IN MULTIPLE HEIGHT SECTIONS SHALL INCLUDE SL82 MESH OR 400N12 STARTER BARS @ 300 c/c.
11. COMPRESSIVE STRENGTH (FC) FOR CAST INSITU CONCRETE SHALL BE A MINIMUM 32 MPa @ 28 DAYS.
12. NO RENDERING PERMITTED IN STRUCTURAL COMPONENTS.
13. THIS STANDARD REFERS TO PITS CONSTRUCTED ADJACENT TO FLEXIBLE PAVEMENTS. TOTAL ISOLATION OF PITS IS REQUIRED ADJACENT TO RIGID PAVEMENTS.
14. ALL PITS TO BE ADEQUATELY STREAMLINED AND BENCHED.
15. FOR PITS LOCATED AT KERB RETURNS REFER TO SD009

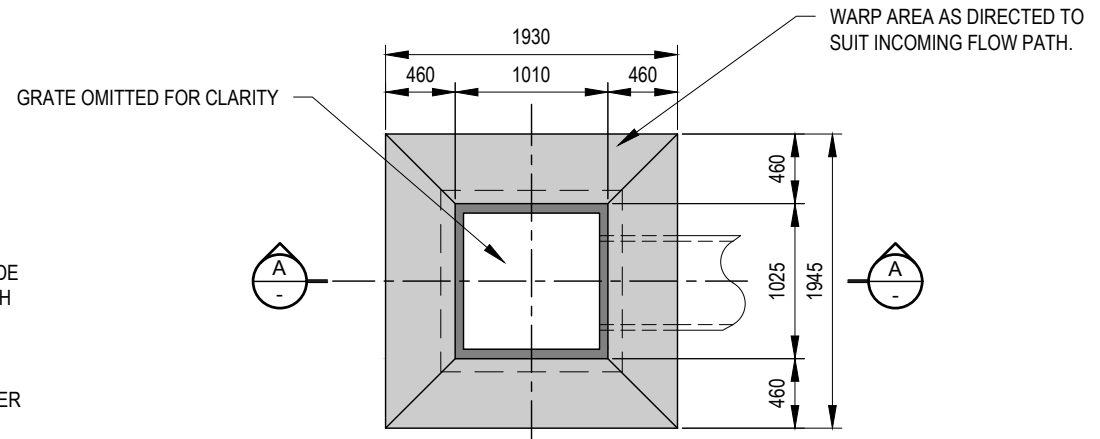
STEP IRON NOTE:

1. STEP IRONS TO COMPLY TO AS1657.
2. STEP IRONS TO BE HOT DIPPED GALVANISED OR PLASTIC.
3. STEPS TO BE FIXED INTO THE PIT WALL WITH AN EPOXY RESIN COMPOUND.

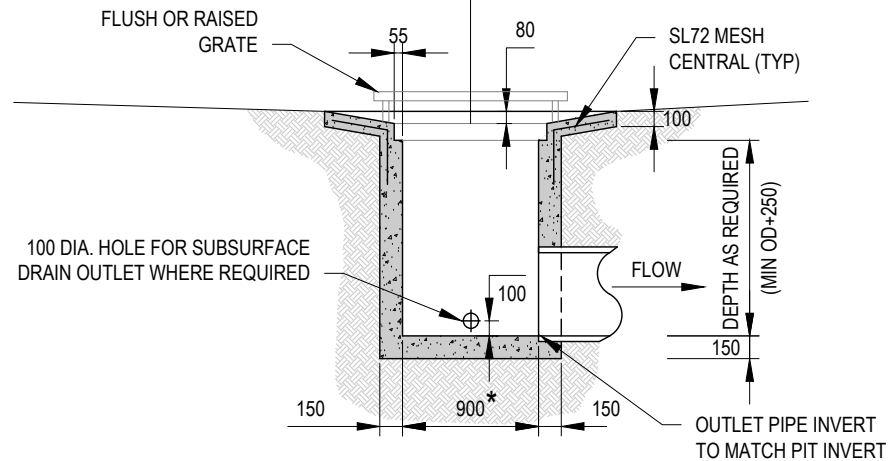
NOTE:

1. ALL DIMENSIONS ARE IN MILLIMETRES.
2. FOR DETAILS OF GULLY GRATING AND FRAME SEE WEDLOCK GRATE CODE PC9090B OR APPROVED EQUIVALENT. ALL GRATES TO BE PROVIDED WITH LOCKING BOLTS. HINGES TO BE LOCATED ON UPSTREAM SIDE.
3. PROVIDE STEP IRONS FOR PITS DEEPER THAN 1.2m REFER TO SD039.
4. MINIMUM THICKNESS OF WALLS AND BASE TO BE 150mm.
5. ALL PITS TO HAVE A MINIMUM OF SL82 MESH IN BASE AND N12 "L" STARTER BARS (450 LEGS) @ 400 c/c.
6. PITS BETWEEN 1.5m & 2.5m DEEP TO HAVE SL82 MESH CENTRALLY PLACED IN WALLS FOR FULL DEPTH WITH N12 "L" CORNER BARS (450 LEGS) @ 400 c/c.
7. PITS DEEPER THAN 2.5m OR LONGER THAN 900 OR 1450 WIDE SHALL BE DESIGNED BY A QUALIFIED ENGINEER.
8. PITS POURED IN MULTIPLE HEIGHT SECTIONS SHALL INCLUDE SL82 MESH OR 400N12 STARTER BARS @ 300 c/c.
9. COMPRESSIVE STRENGTH (FC) FOR CAST INSITU CONCRETE SHALL BE A MINIMUM 25 MPa @ 28 DAYS.
10. NO RENDERING PERMITTED IN STRUCTURAL COMPONENTS.
11. ALL PITS TO BE ADEQUATELY STREAMLINED AND BENCHED.
12. PROVIDE MIN 450mm PINNED TURF SURROUND.
13. SHAPE ADJACENT AREAS TO ASSIST WATER COLLECTION.

*	PIPE DIAM RANGE
900	600mm TO 750mm INCL
1200	825mm TO 900mm INCL



PLAN



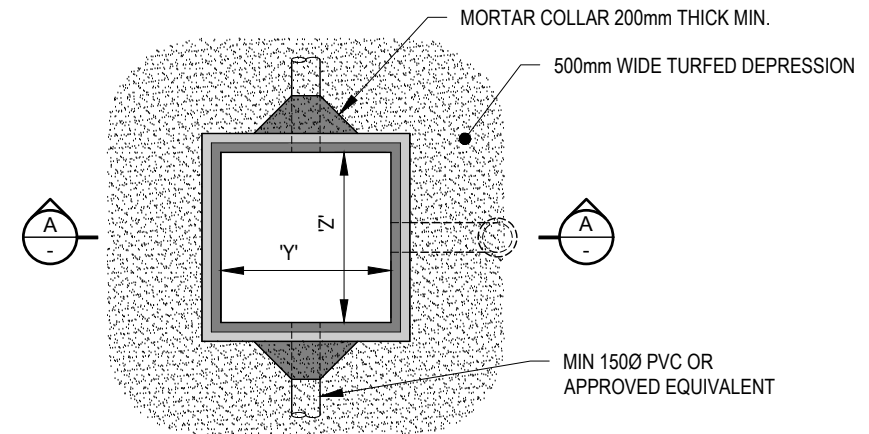
SECTION A-A

MINIMUM PIT DIMENSIONS

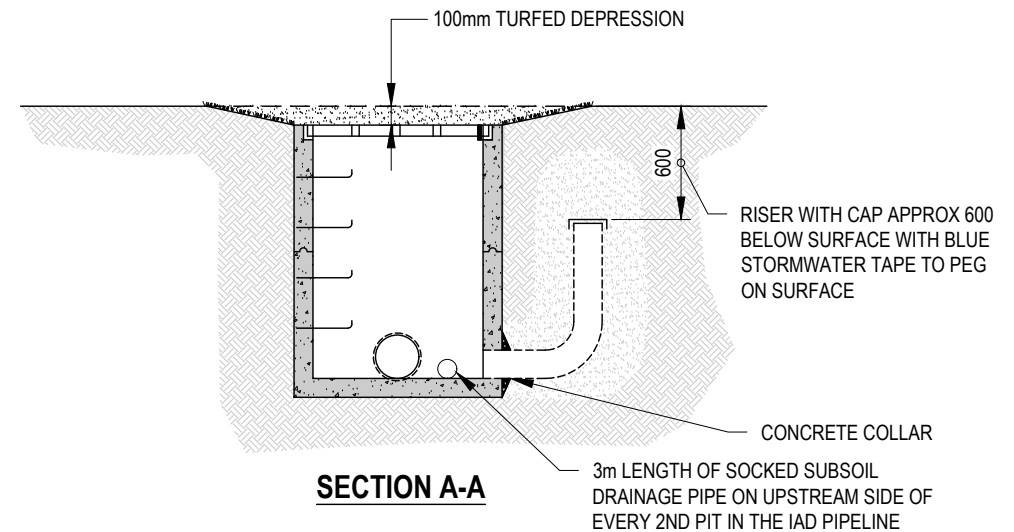
PIT DEPTH	<900	900 - 1200	>1200
'Y'	450	600	600
'Z'	450	600	900

NOTE:

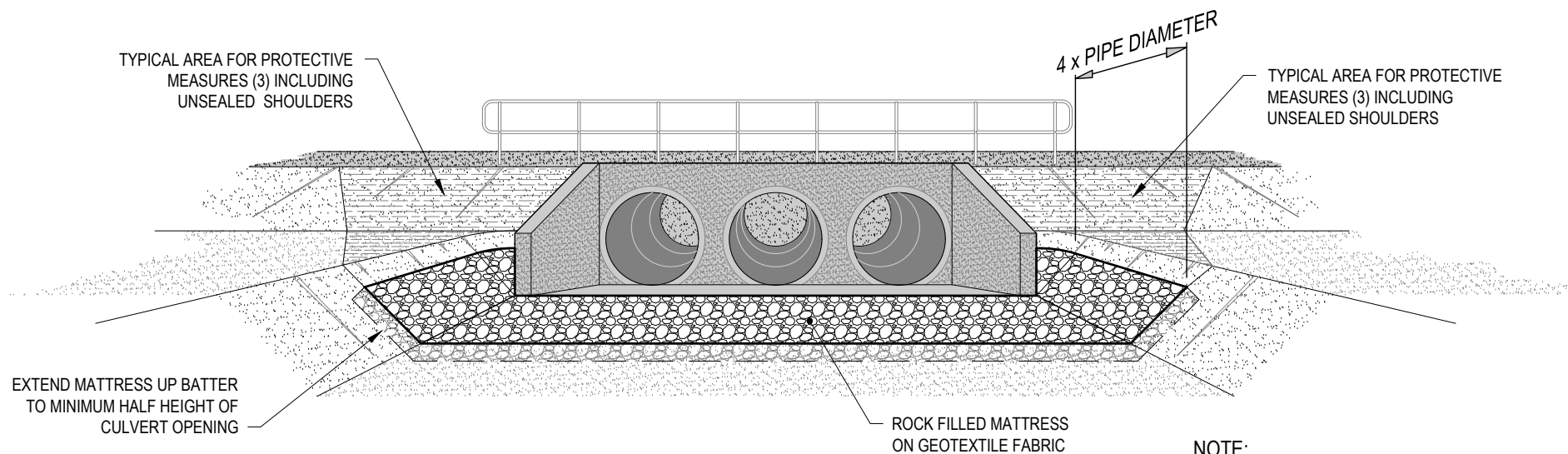
1. INTER-ALLOTMENT DRAINAGE PITS SHALL BE PROVIDED TO THE LOW CORNER OF EACH LOT UNLESS OTHERWISE PROVIDED.
2. PITS WILL ALSO BE PROVIDED AT CHANGES OF PIPE SIZE, CHANGES IN GRADE, CHANGED IN PIPE TYPE OR CLASS AND CHANGES IN DIRECTION OF 45° OR GREATER. SUCH PITS ARE TO BE A MINIMUM INTERNAL SIZE OF 450 x 450 APPROVED PRECAST OR CAST INSITU.
3. PITS SHALL BE COVERED BY AN APPROVED GRATE TO PROVIDE AN ADEQUATE SURFACE WATER INLET. ALL GRATES ARE TO BE PROVIDED WITH EITHER "J" BOLTS OR PINS TO PREVENT REMOVAL. PITS SURROUNDS WILL BE TURFED AND PEGGED OR NETTED TO A MINIMUM WIDTH OF 500mm.
4. PIT INLET GRATES SHALL BE DEPRESSED 100mm BELOW SURROUNDING GROUND LEVEL TO ASSIST SURFACE WATER COLLECTION.
5. PROVIDE STEP IRONS FOR PITS DEEPER THAN 1.2m. REFER TO SD039. SUCH PITS ARE TO HAVE A MINIMUM INTERNAL SIZE OF 900 x 600mm.
6. CONNECTION FOR ROOF WATER FOR SINGLE RESIDENTIAL DWELLINGS SHALL BE PROVIDED VIA A 150mm DIA. STUB INTO THE SIDE OF THE PIT.
7. PIPE CONNECTION TO PIT TO BE SEALED WITH MINIMUM 100mm MORTAR COLLAR FOR SEAL AND SUPPORT.

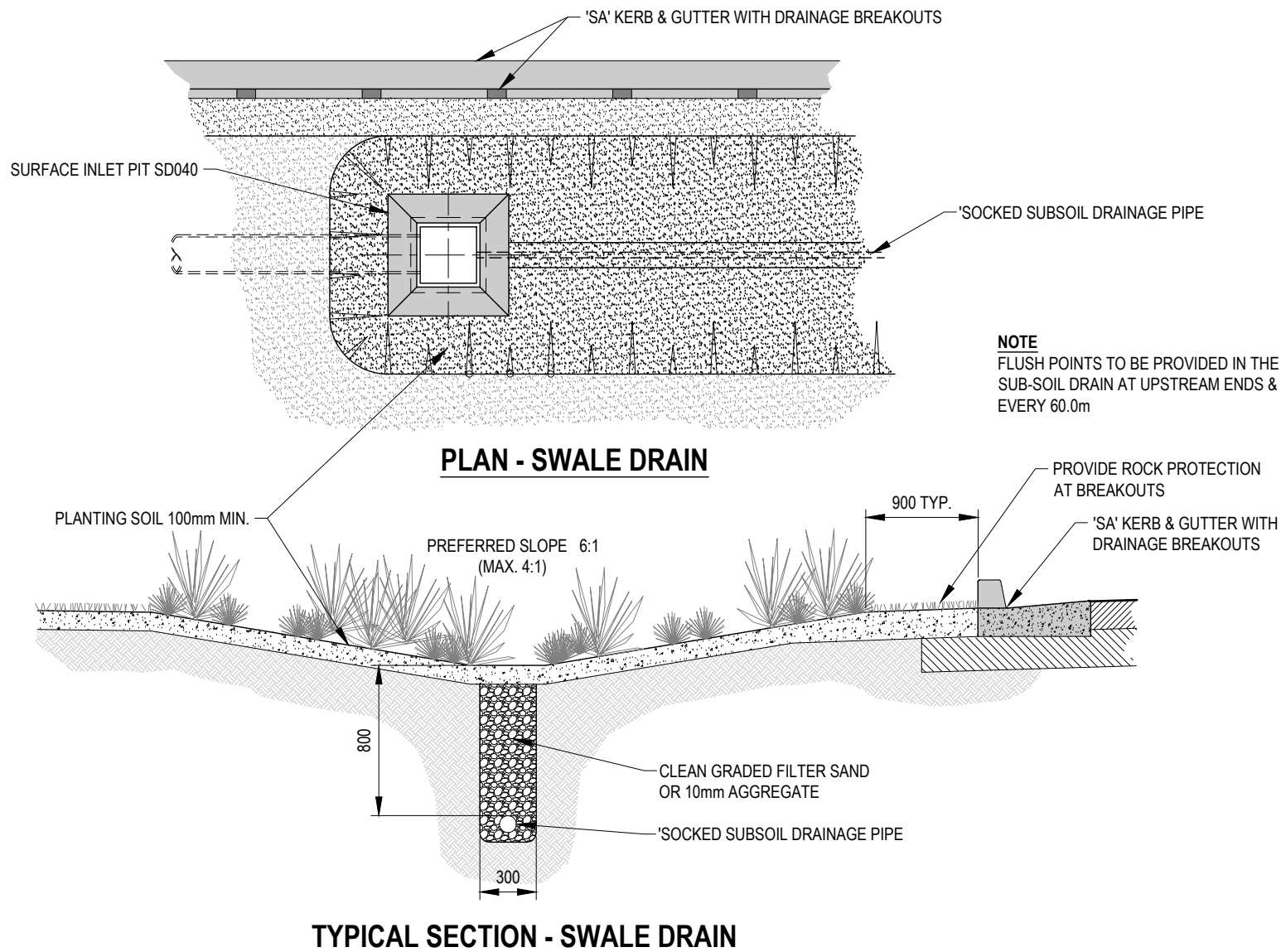


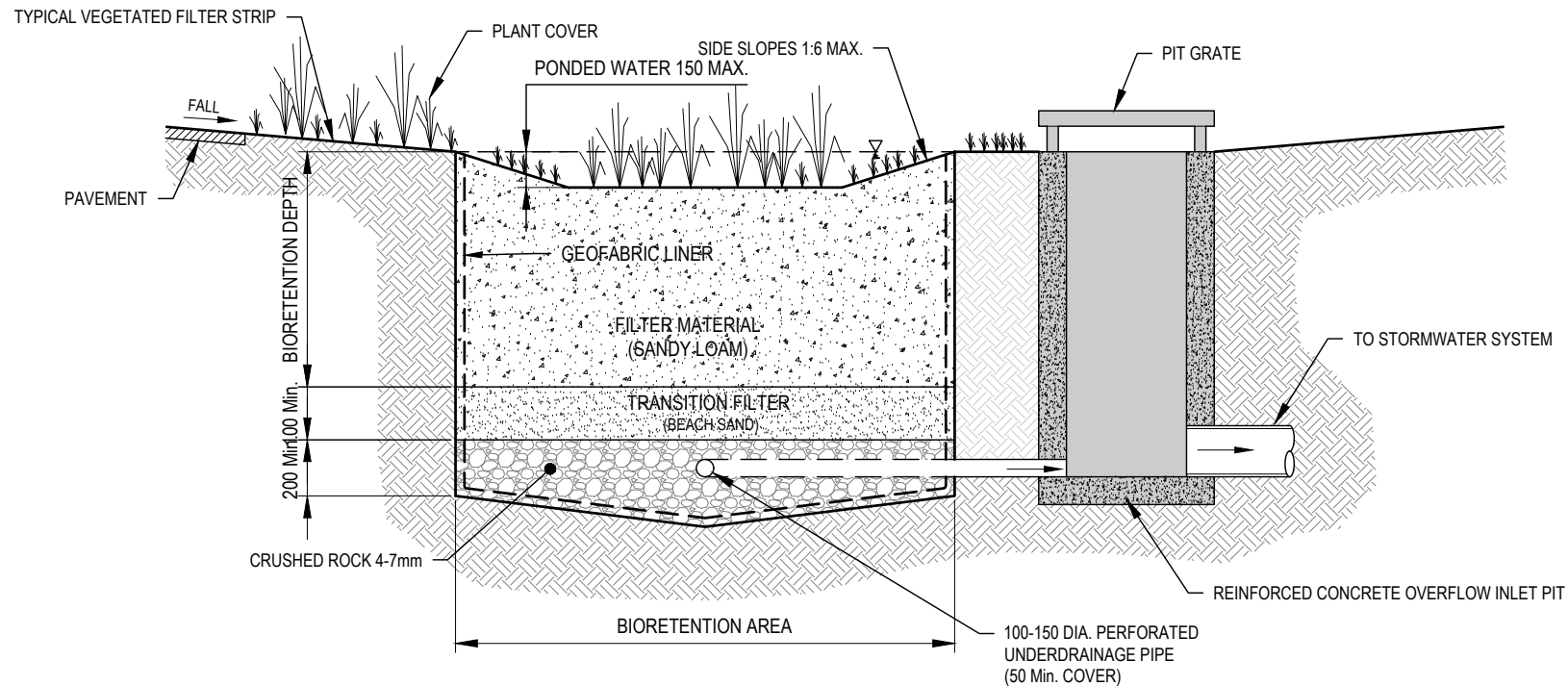
PLAN



SECTION A-A



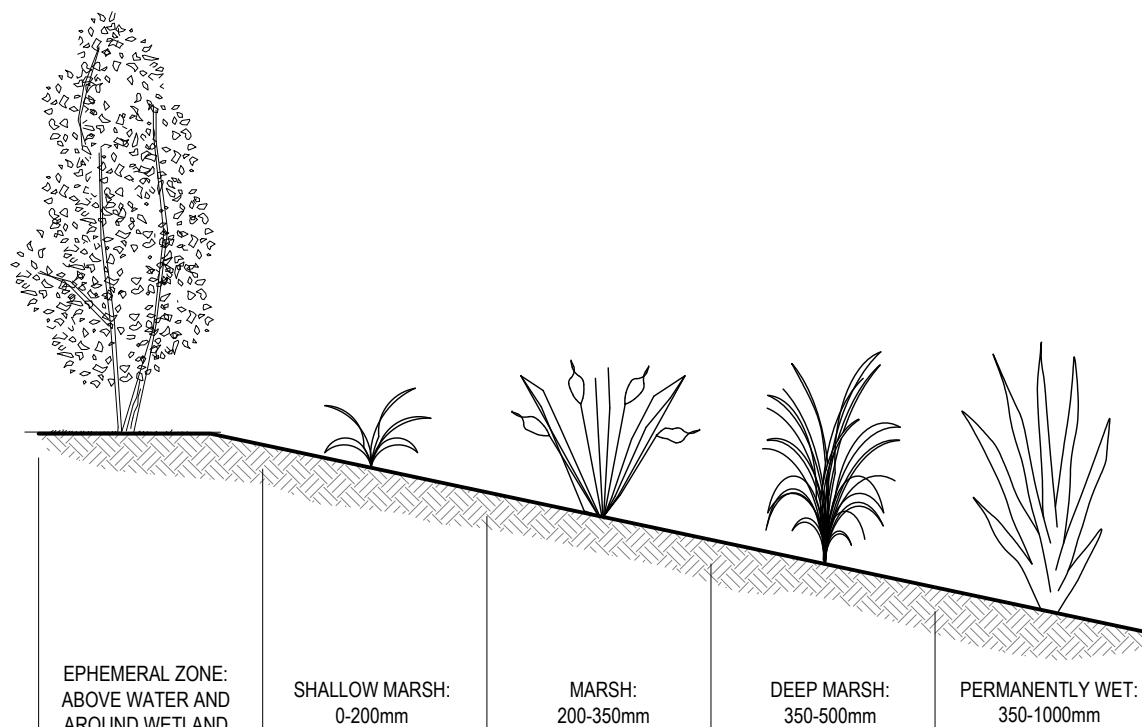




NOTE:

1. ALL DIMENSIONS IN MILLIMETRES UNLESS NOTED OTHERWISE
2. THE BIORETENTION SYSTEM SHALL BE DESIGNED BY A SUITABLY QUALIFIED ENVIRONMENTAL ENGINEER TAKING INTO ACCOUNT THE FOLLOWING:
 - TREATABLE VOLUME
 - TREATABLE FLOW RATE
 - MAXIMUM PONDED DEPTH (150mm)
 - MAXIMUM SIDE SLOPES (1:6)
 - FILTER MEDIA HYDRAULIC PERMEABILITY
 - PLANT SPECIES

- SURFACE AREA AND DIMENSIONS OF SYSTEM
 - FILTER AREA AND DEPTH
 - UNDERDRAINAGE PIPE SIZE
 - TRANSITION SAND LAYER
 - BACK FLUSH FOR UNDERDRAINAGE PIPES
 - HIGH FLOW BYPASS
 - LOW PERMEABILITY LINER (IF REQUIRED)
3. THE BIORETENTION SYSTEM SHALL NOT BE USED FOR SEDIMENT CONTROL DURING CONSTRUCTION.
 4. PITS AND GRATES IN ACCORDANCE WITH COUNCIL STANDARDS.



NOTE:

1. ANY TREES SURROUNDING WETLAND SHOULD BE DISTANCED TO ALLOW ACCESS BY MAINTENANCE PLAN IN AND AROUND WETLAND.
2. ALL WEATHER ACCESS IS REQUIRED TO WETLAND.

EPHEMERAL ZONE (ABOVE WATER LEVEL AND AROUND WETLAND):

- Eucalyptus camaldulensis Red River Gum
- Tristaniopsis laurina Water Gum
- Callistemon salignus Willow Bottlebrush
- Banksia integrifolia Coast Banksia
- Casuarina glauca Swamp Oak
- Syzygium paniculatum Magenta Lilly Pilly
- Melaleuca quinquenervia Broad-leaved Paperbark
- Melaleuca styphelioides Black Tea Tree

SHALLOW MARSH (0 - 200mm):

- Baumea articulata Jointed Twig-rush
- Bolboschoenus caldwellii Club-rush
- Bolboschoenus fluviatilis Stream Club-sedge
- Eleocharis acuta Spike-rush
- Juncus usitatus Common-rush
- Schoenoplectus validus River Club-rush

MARSH (200 - 350mm):

- Lepironia articulata
- Eleocharis acuta Spike-rush
- Carex inversa Knob Sedge

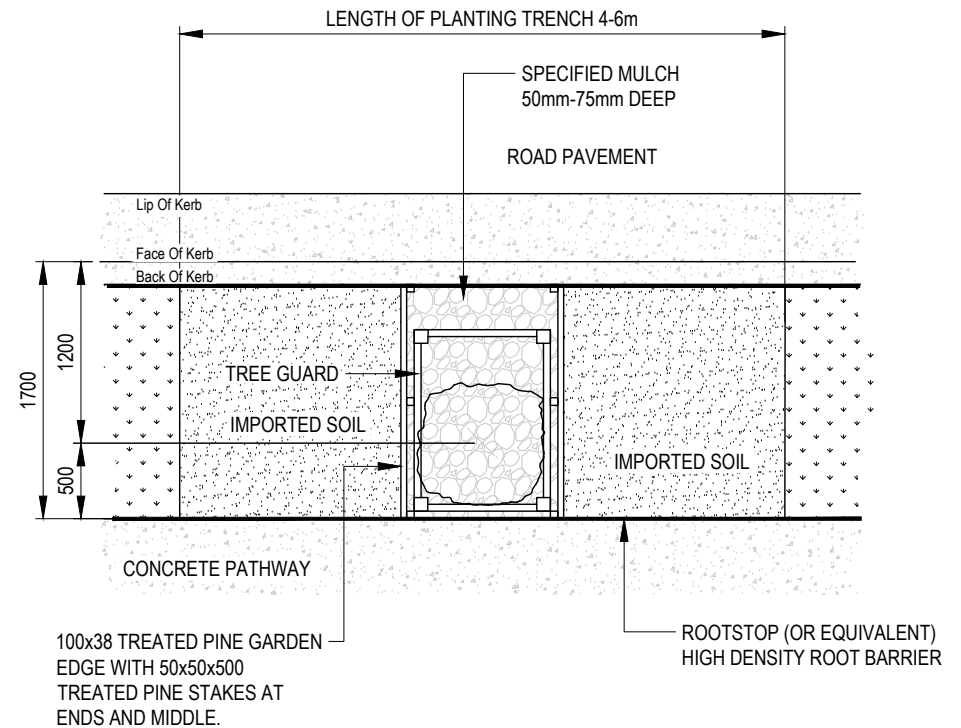
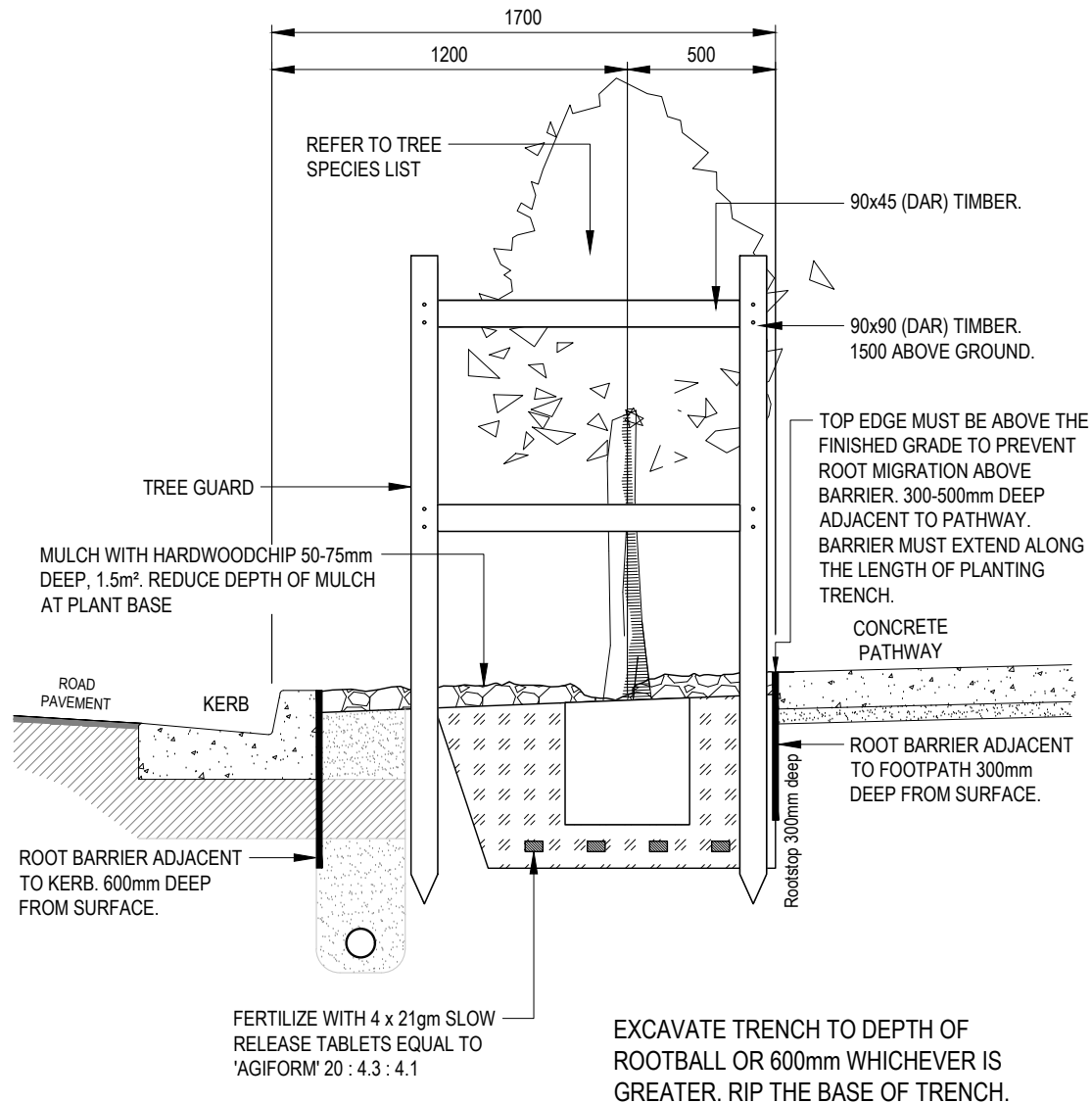
DEEP MARSH (350 - 500mm):

- Baumea articulata Jointed Twig-rush
- Bolboschoenus caldwellii Club-rush
- Eleocharis acuta Spike-rush
- Juncus usitatus Common-rush
- Schoenoplectus validus River Club-rush
- Triglochin procerum Water Ribbons
- Vallisneria gigantea Ribbonweed

PERMANENTLY WET (350 - 1000mm):

- Bolboschoenus caldwellii Club-rush
- Ceratophyllum demersum Hornwort
- Ranunculus inundatus Buttercup
- Triglochin procerum Water Ribbons
- Vallisneria gigantea Ribbonweed

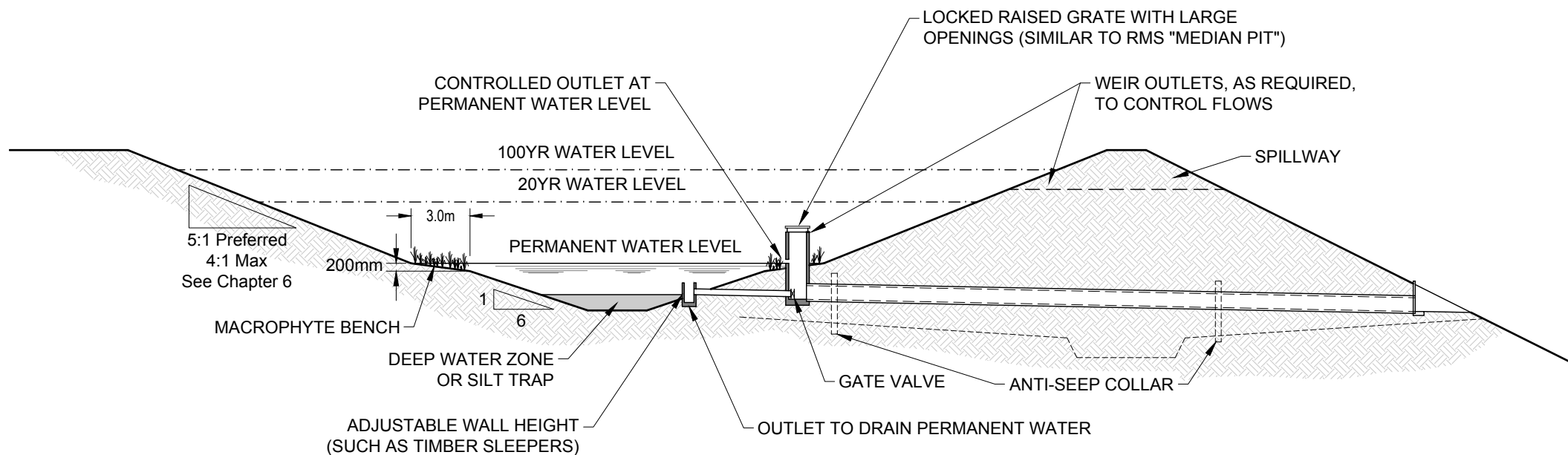




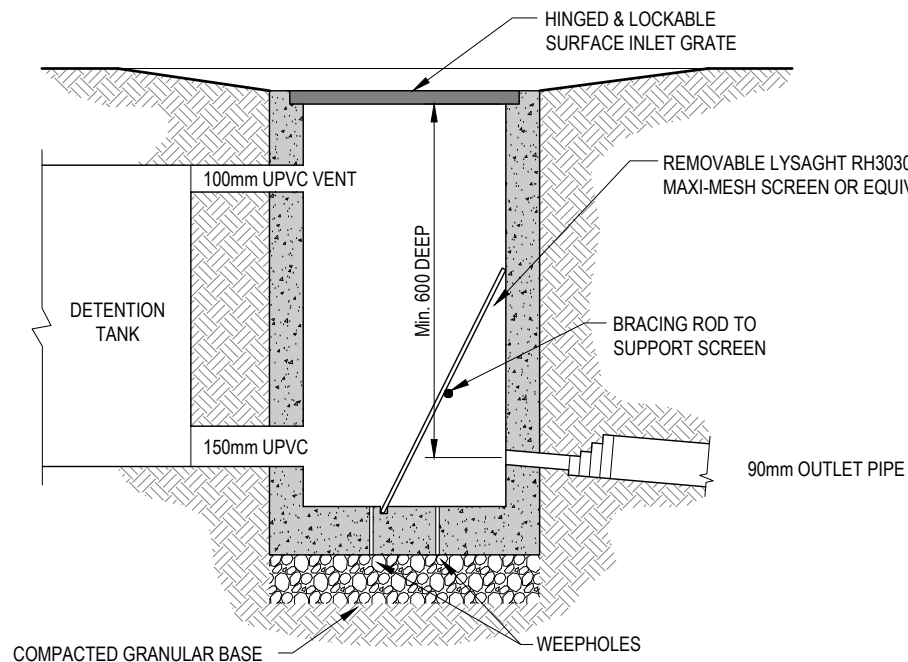
NOTE:

1. REFER TO SD001 PRIOR TO EXCAVATION WORKS.
2. ROOT BARRIER SHALL BE MANUFACTURED FROM 100% RECYCLED HIGH DENSITY POLYETHYLENE HDPE WITH MINIMUM THICKNESS OF 1mm.
3. NO BARRIER WHERE PATHWAY ARE NOT PRESENT.
4. 4m LENGTH OF PLANTING TRENCH FOR SMALL TREES AND 6m FOR MEDIUM TREES.
5. LANDSCAPE ARCHITECT TO PROVIDE FOR COUNCIL APPROVAL, SOIL SPECIFICATION FOR IMPORTED TRENCH SOIL.
6. ALL DIMENSIONS ARE IN MILLIMETRES (UNLESS SHOWN OTHERWISE)

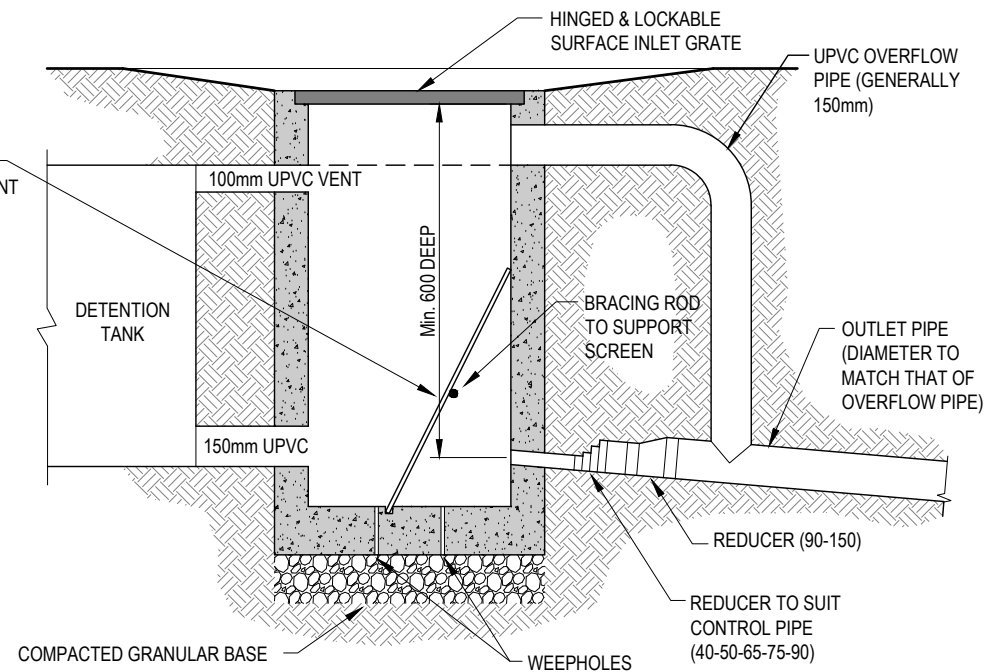




TYPICAL ARRANGEMENT



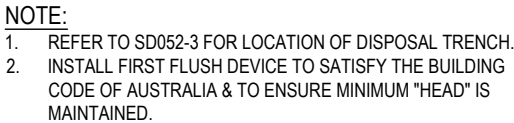
WITHOUT OVERFLOW PIPE
(WHERE SURFACE OVERFLOW AVAILABLE)

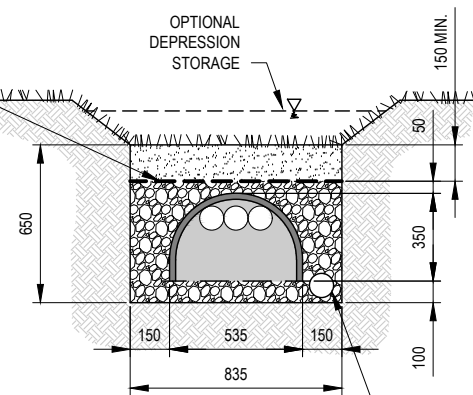
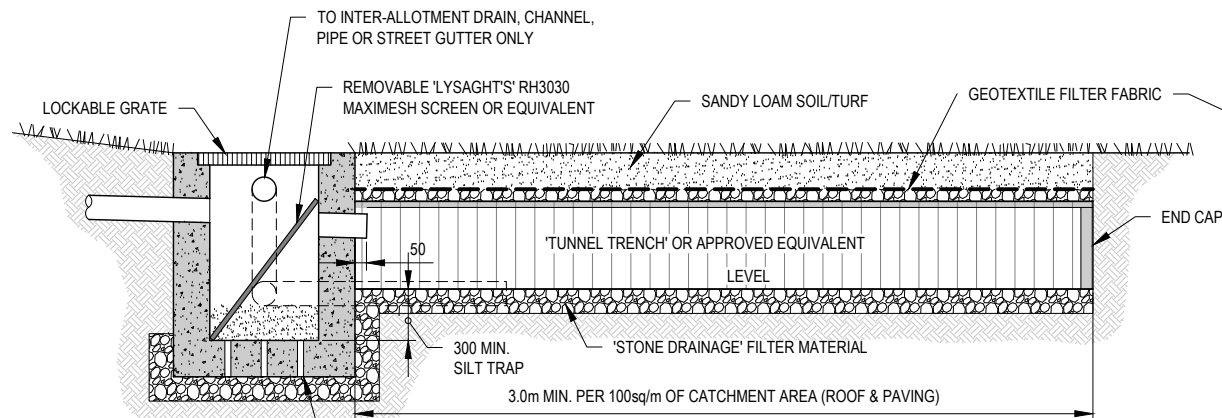


WITH OVERFLOW PIPE

NOTE:

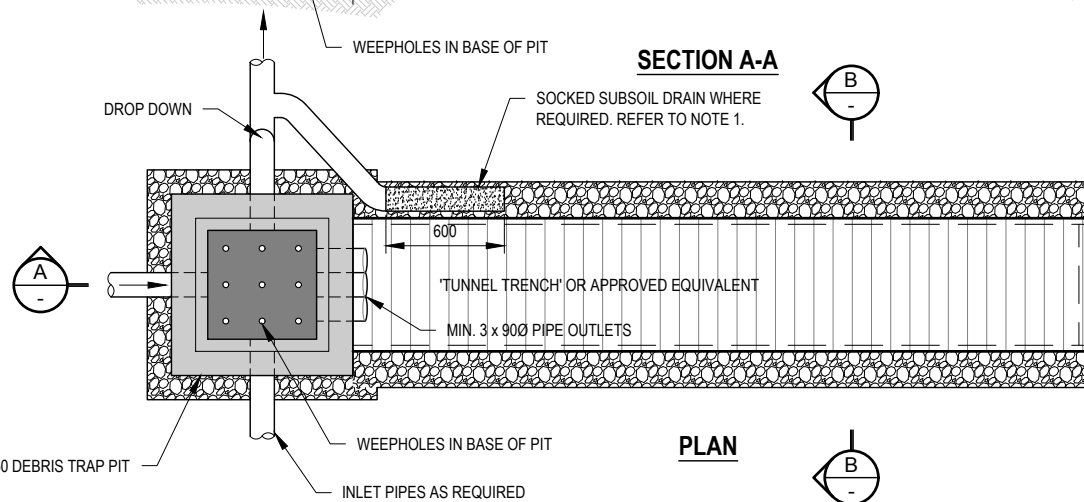
1. ALL DIMENSIONS ARE IN MILLIMETRES
2. STORMWATER PIPES TO BE SEWER GRADE ACROSS PUBLIC FOOTWAY.
3. CONCRETE COMPRESSIVE STRENGTH 32MPa.
SIDE WALLS OF ALL PITS DEEPER THAN 1500 ARE TO BE REINFORCED WITH ONE LAYER OF SL82 MESH RETURNED 300 INTO BASE. WHERE REQUIRED INCREASE CONCRETE STRENGTH TO 32MPa.
4. DEPTH OF PIT NOT TO EXCEED 2000mm.
5. PROVIDE STEP IRONS FOR PITS DEEPER THAN 1200mm REFER TO SD039.
6. ALL EXPOSED EDGES TO BE ROUNDED WITH 20mm RADIUS





SECTION B-B

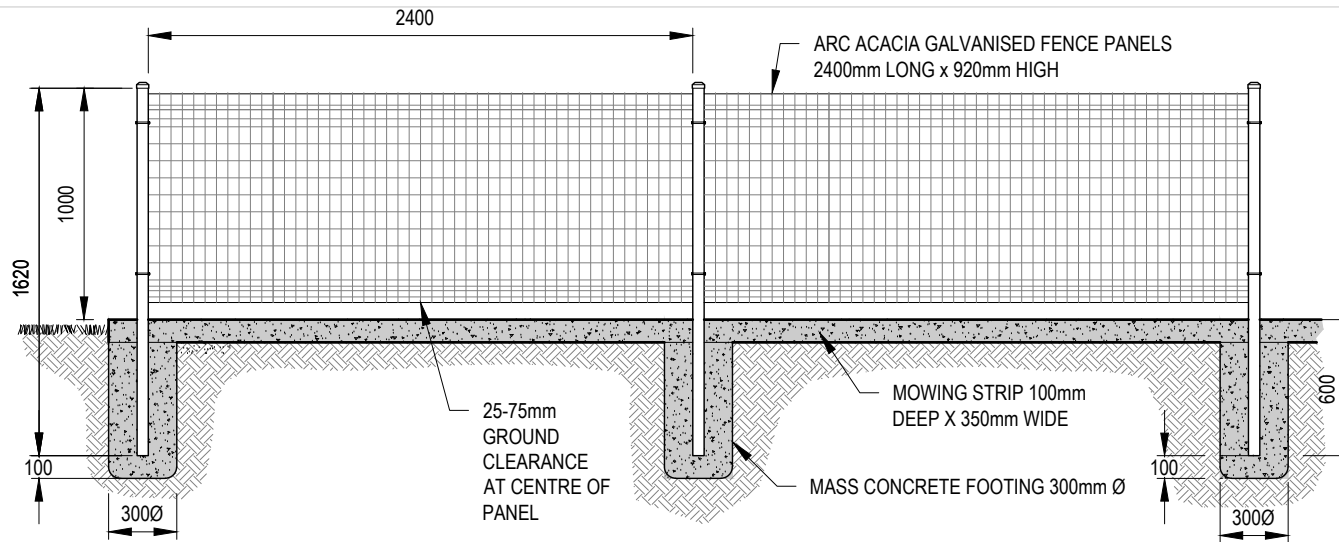
SOCKED SUBSOIL DRAIN WHERE REQUIRED REFER TO NOTE 1



PLAN

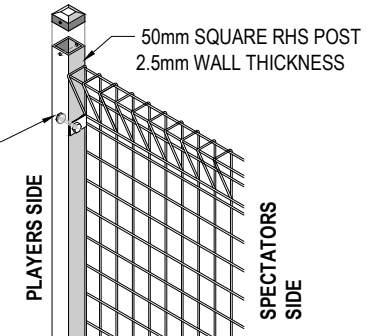
NOTE:

1. IN CLEAN SAND CONDITIONS, TRENCHING SHALL BE A MIN OF 1.0m CLEAR OF STRUCTURAL FOUNDATIONS AND PROPERTY BOUNDARIES
2. IN CLAY CONDITIONS, TRENCHING SHALL BE A MIN. OF 3.0m CLEAR OF STRUCTURAL FOUNDATIONS WITH A SOCKED SUBSOIL DRAIN INSTALLED
3. REFER TO AUSTRALIAN RUNOFF QUALITY SECTION 11.
4. THE TRENCHING SHALL BE PLACED LEVEL, WHERE POSSIBLE & ALONG THE CONTOUR OF THE LAND. DEPTH MAY BE VARIED TO SUIT.
5. THE TRENCHING SHALL BE PLACED DOWNHILL OF BUILDINGS AND TO ACHIEVE MAXIMUM AREA, SLOPING AWAY FROM THE TRENCH, FOR DISPERSAL OF WATER.
6. THE DISPERSAL AREA SHOULD BE CHOSEN TO AVOID OVERFLOW TOWARD A BUILDING OR ONTO ADJOINING PROPERTIES.



SECURE WITH 'U' CLIPS AND
WELD NUT TO THE TOP AND
BOTTOM OF POSTS

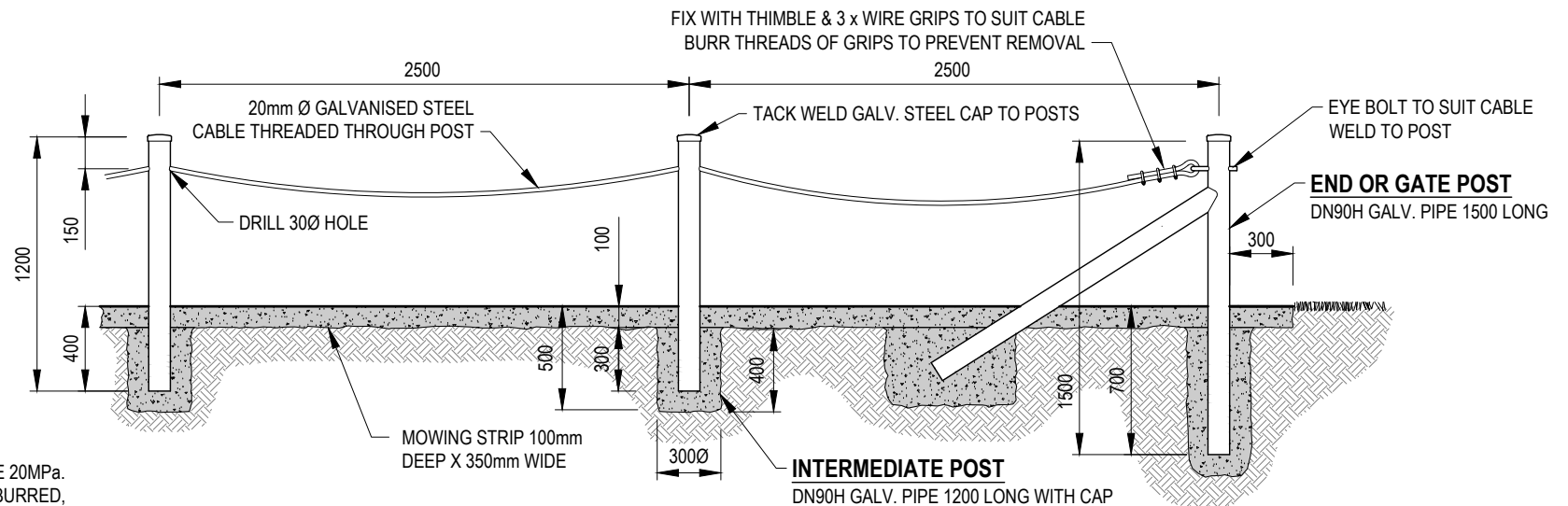
FIXING DETAIL (NOT TO SCALE)



NOTE

1. ALL DIMENSIONS ARE IN MILLIMETRES
2. 20MPa CONCRETE
3. INSTALL CONTROL JOINT AT EACH POST
4. INSTALL EXPANSION JOINT AT EVERY 6th POST

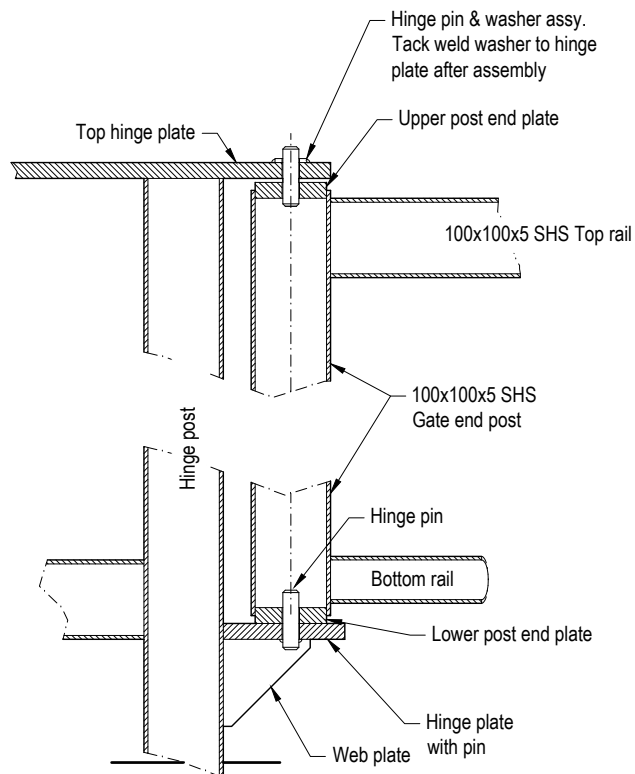
WELDMESH FENCE (NOT TO SCALE)



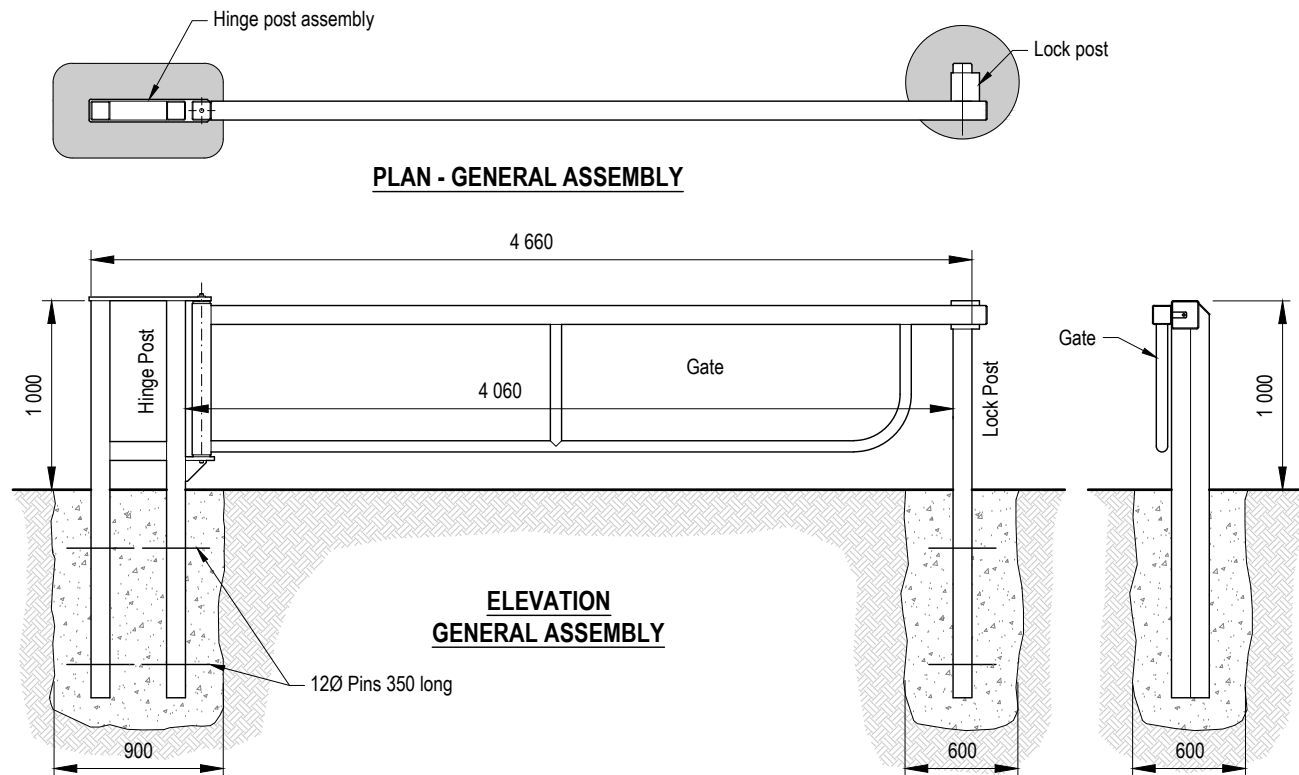
NOTE

1. FOOTING CONCRETE TO BE 20MPa.
2. ALL WELDS ARE TO BE DEBURRED, CLEANED & PROTECTED WITH COLD GALVANISED PAINT.

POST & CABLE FENCE (NOT TO SCALE)



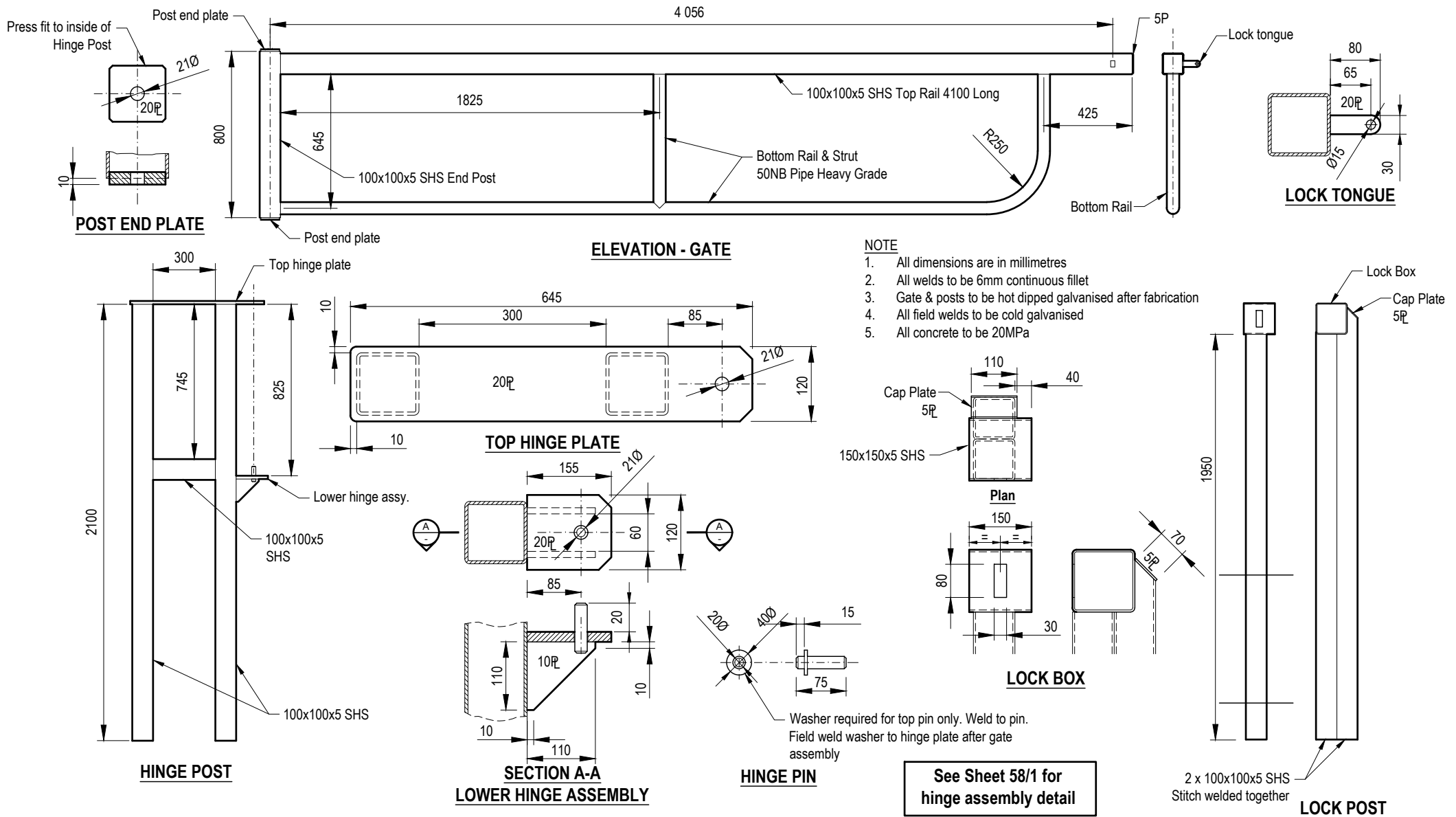
HINGE ASSEMBLY DETAIL



LOCK POST

NOTE

1. All dimensions are in millimetres
2. All welds to be 6mm continuous fillet
3. Gate & posts to be hot dipped galvanised after fabrication
4. All field welds to be cold galvanised
5. All concrete to be 20MPa



Date Adopted: 17 March 2026

Implementation Date: 14 April 2026

Version: 1.0

Technical Document: Street Lighting

- Street lighting shall be provided in accordance with Council's requirements (low-cost and efficient) and be designed by a suitability qualified consultant.
- According to Australian Standards, the primary purpose of street lighting is to *"assist pedestrians to orientate themselves and detect potential hazards and to discourage fear of crime and crime against the person while protecting the integrity of the nighttime environment through control of light spill and glare"*.
- Street lighting shall be constructed as a standard (height and style) galvanised pole. Black powder coating is allowable but will be replaced without powder coating when/if replacement occurs.
- Decorative luminaries/columns, paint and coloured column treatments are not permitted or supported.
- The default globe type shall be the one nominated by Council and supplied by Ausgrid generally based on energy efficiency. The street lighting design must incorporate cut-off luminaires to reduce glare and ensure adequate illumination for pedestrian activities, with the default lamp type being that provided by Ausgrid.
- Street lighting for new subdivisions shall be provided in accordance with AS1158 series, Ausgrid NS119, Council's Standard Drawing SD001 (for pole location and footing) and this Technical Document:

Road Type	Road Width	Mid-Block Lighting Category	Intersection Lighting Category ^B
Pedestrian Crossings	-	PX1 Arterial/Sub-Art ^F PX2 Local Collector/Sub-Art ^G PX3 Local Road	-
Pedestrian Refuges	-	A minimum horizontal illuminance of 3.5 lx or greater AS1158.3.1	-

Pedestrian Paths and Shared Paths (off road)	-	As required by council, use Tables 2.2 and 3.4 in AS1158.3	-
Cul-de-sacs (on L8 Yield or L10 Local streets)	8 m	PR5 PR4 with pedestrian through traffic	Same as mid-block
L8 Yield and L10 Local Street (at Council's discretion considering pedestrian traffic)	8 to <11 m	PR4	Same as mid-block
LT11 Local Collector	11 m	PR4	Same as mid-block
T12 Local Distributor (Public Bus Route)	12 m	PR3	V5 ^{A, B, C}
T14 Secondary Distributor	14 m	PR3	V5 ^{A, B, C} V4 ^D
T15 Primary Distributor	15 m	PR3	V5 ^{A, B, C} V4 ^D
≥T15.4 Minor Sub-Arterial	≥15.4 m ^E	PR3	V5 ^{A, B, C} V4 ^D
I13 Industrial Areas	13 m & other	PR4 Minor Industrial PR3 Trunk/pedestrian traffic	V5 ^{A, B, C} V4 ^D
Business / School Precinct	13 m & other	PR3	V5 ^{A, B, C} V4 ^D
Laneways (residential)	-	As required by council, consider PR5 for pedestrian activity and/or with development adjoining laneways and PR6 for lower pedestrian activity and no development adjoining laneways.	-

A. Consider trunk road to trunk road intersections. (Not local to trunk which uses mid-block

requirements)

- B. For Channelised intersections and roundabouts on local distributors and above.
- C. Intersections with state roads/highways require consultation with TfNSW for suitable illumination.
- D. Posted speed limit greater than or equal to 80 km/h.
- E. Road connecting Arterial Roads to urban districts and carrying traffic directly from one district or precinct to another, for example Settles Boulevard.
- F. Sub-Arterial with a posted speed limit greater than 60 km/h.
- G. Sub-Arterial with a posted speed limit less than or equal to 60 km/h.

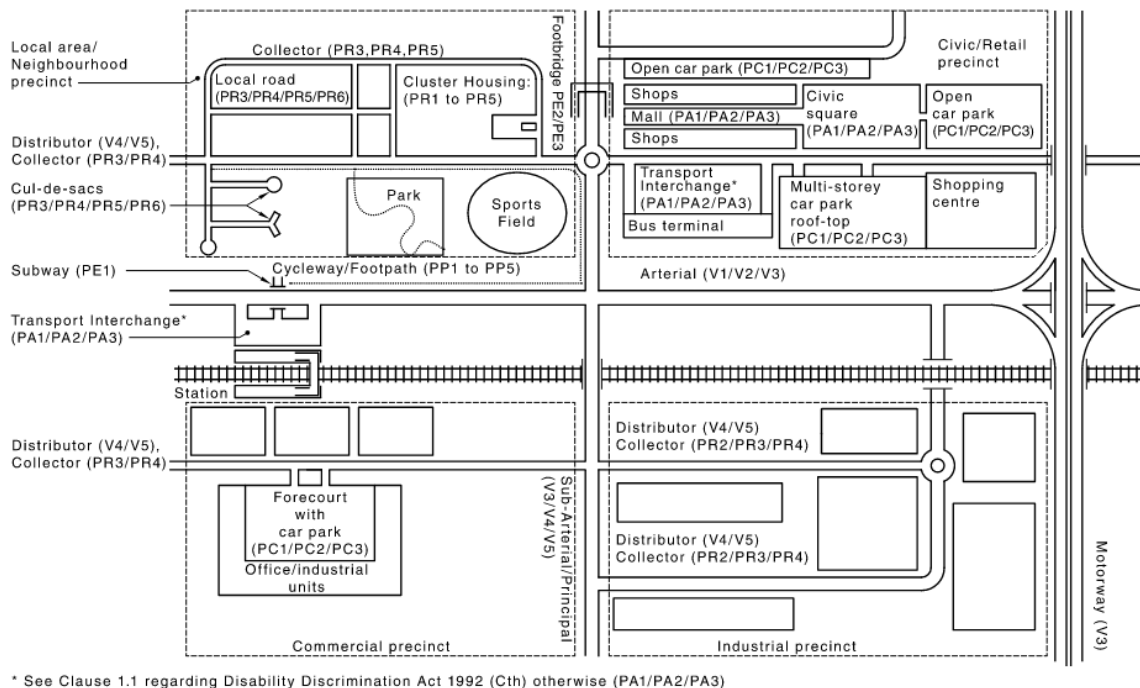


FIGURE 2.1 EXAMPLE OF ROAD AND PUBLIC SPACE TYPES AND INDICATIVE LIGHTING CATEGORIES AND SUBCATEGORIES

AS/NZS 1158.3.1:2020

- Street lighting may require a higher standard at the following locations:
 - Major road intersections
 - Minor rural road intersections (consider flag-lit subject to speed zone and safety)
 - Pathways and underpasses
 - Public carparks
 - Taxi ranks
 - Bus stops/shelters
 - Stairways

- Luminaires shall be the default supply of Ausgrid (Light Emitting Diode Type) that contain both a NEMA and Zhaga Book 18 Receptacle.
- Solar-powered street lighting is not generally accepted. Special circumstances may only be considered following extensive consultation with Council.
- Street lighting is generally not supported in Large Lot (R5) and Rural (RU1 and RU2) zone areas. Lighting in these areas may be required by Council, subject to adequate warrants, where special circumstances exist such as proximity to destination points for potential nighttime pedestrian traffic.
- Lighting in the vicinity of the Rutherford aerodrome shall comply with the Civil Aviation Safety Authority's Civil Aviation Regulations, specifically the "Manual of Standards Part 139."
- Street lighting shall be placed at the entrance and termination of new laneways with an appropriate lighting category as determined by Council.
- Consideration shall be given to roads with central medians ensuring that street lighting design accounts for the required landscape and trees in the medians while still providing adequate illumination to the public areas.
- Street lighting shall be located:
 - Complementary with tree planting locations, medians, footpaths, and tram ramps that optimise pedestrian safety and complement lighting spillage.
 - On trunk roads, generally one (1) lux for public footpaths and three (3) lux for minor intersections to enhance safety and minimise areas of low visibility.
 - At sharp bends and traffic control devices (kerb blisters etc.).
 - Generally, in line with abutting property boundaries and offset from the face of the kerb as per Council's Standard Drawings.
 - in a staggered pattern alternating from one side of the road to the other.
- Electrical conduits:
 - Shall be found no less than 750 mm from the finished surface level under roads.
 - Shall be found no less than 600 mm from the finished surface level under footpaths.
- Any major utility items (kiosks and the like) larger than individual lot scale provisions, are to be located within the private lots covered by easements and are not to be located on the public road reserve and public drainage reserve. All kiosk substation sites shall comply with the Ausgrid Technical Guide NS141 and the Standards Australia Handbook SAA HB100 (CJC4). Note: Typically, Council does not accept major utility items in parks. If no suitable alternative solution is available, approval from Council's recreational team shall be obtained.
- A Lighting Spill Diagram is required to be submitted to Council with any public lighting designs. The performance criteria for public lighting designs include facilitating safe movement and reducing the fear of nighttime crime by eliminating significant dark spots.

Date Adopted: 17 March 2026

Implementation Date: 14 April 2026

Version: 1.0

Technical Guideline: Street Trees

- This technical guideline provides guidelines for future tree plantings to enhance landscapes and streetscapes with appropriate species that minimise maintenance requirements and Council's liability. This guideline applies to all trees on public roads, under the control of Maitland City Council.
- Unless directed otherwise by Council, all new road reserves are to be landscaped with street trees as per this Technical Guideline.
- Council's policies including the Development Control Plan and its associated Appendix for Canopy Cover, the Environmental Sustainability Strategy and the Manual of Engineering Standards may provide additional requirements for planting or other supplement background information.
- For new streets, the design approach shall prioritise the creation and preservation of an effective tree canopy. Infrastructure and utility policies should focus on maximising both above ground and underground space to support and protect urban street trees.
- Subdivision creating new street or lots shall be designed with appropriate soil volume and space to support healthy tree growth. To achieve this, utility services should be consolidated into shared trenches, and power lines should be placed underground.
- One of the main challenges in planting public trees is ensuring adequate space for their growth at maturity. The key to creating a resilient and aesthetically pleasing urban forest lies not just in planting more trees, but in planting the 'right' trees in the 'right' locations, where they can become established and thrive. Therefore, no tree should be 'shoehorned' into an impractical or inadequate planting space simply to meet targets.

1. Approved Species Matrix

- 1.1 Street trees are to be selected from Council's Tree Species List (available on Council's website) and should complement the existing streetscape. Council has an approved list of species ensuring that their expected mature size is appropriate for the available footway space. Preference shall be given to tree species that occur naturally in Council's local environment.
- 1.2 Greenfield subdivisions and other developments are to provide a landscape plan prepared by an experienced landscape designer and be approved by Council. Minimum requirements for a landscape plan are provided in Appendix A: Application Requirements – Other Development of Council's DCP.
- 1.3 The landscape designer shall use a variety of species in the designs. Variations to approved species would generally be for a feature tree such as in a roundabout, or due to supply issues of other approved species. Any species not included in the approved list must be preapproved in

writing by Maitland City Council. This will be at the discretion of Council and based on its suitability, safety, maintenance, and liability.

2. Pot Size

- 2.1 Ideally, small street trees should be chosen that reach a mature height of 10 to 15 metres and be able to be undercut to a specified height for safe sightlines for pedestrians and vehicular traffic. When mature, street trees must be of a size that will sustain foliage undercut to a minimum height of 2 metres. Where shrubs are provided, they shall be of a kind able to be maintained through trimming below a height of 1.2 metres. Greater consideration is required for trunk roads and any overhang into trafficable lanes.
- 2.2 For street tree planting in the verge, a minimum pot size of 45 litres (L) is required, however 75L or 100L pots may be provided if preferred by the Proponent.
- 2.3 For trees planted in pavement areas, such as central landscape medians and roundabouts, a minimum pot size of 100L is required. Council is required to be consulted with in these circumstances to confirm any specific requirements. *Note: Tree pits in pavement areas must be constructed with concrete and as an integrated structure into the road pavement.*

3. Soil Volume

The following terms and requirements are used in defining the available area and volume for plantings:

- 3.1 **Soil Volume (Unobstructed root area)** – the available volume for root to spread. Obstructions up to 300 mm in diameter such as a utility crossing (conduit) or reticulated water main (located behind kerb) are permitted within the volume but must be positioned toward the outer edges of the soil volume, away from the tree trunk. Unless otherwise specified, when multiple trees share the same soil volume, the required volume may be reduced to 66.7% of the individual requirement per tree. This reduction does not apply to imported soil volumes.
- 3.2 **Imported Soil Volume or Improved Soil Volume** – a smaller volume within the unobstructed root area that consists of either imported soil or existing soil that has been improved (improved soil) to enhance and support healthy root growth.
- 3.3 **Planting Width** – an unpaved area with mulch and/or grass that allows surface water and irrigation to penetrate the soil. A planting width of 1.5 m is used between the footpath and the kerb to simplify calculations. This allows the width of the kerb including the kerb track to be included within the 1.7 m setback from the face of kerb to the footpath.

In confined spaces such as larger carparks and commercial areas, where wider footpaths or pavements are required, the planting width may be reduced to 1.0 metre only if the soil volume, and ability to get moisture into that volume, is achieved under the footpath through the use of structural cells or structural soils. In these circumstances, passive watering systems are required.

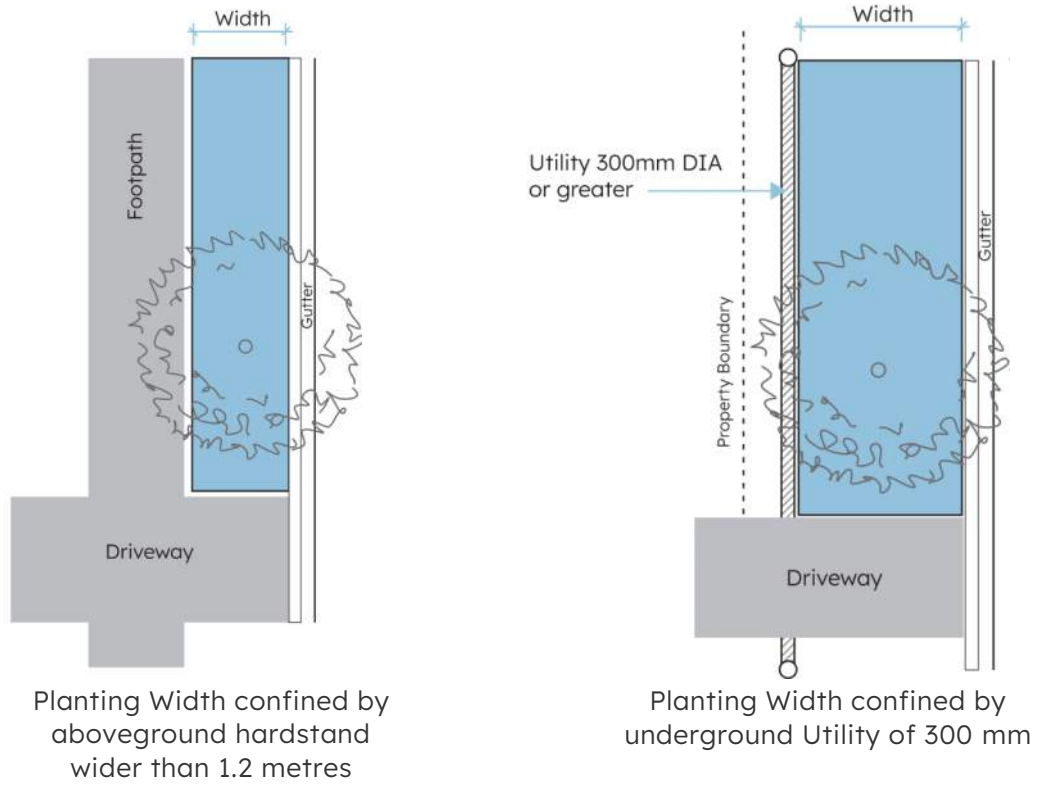


Figure 1: Planting Width

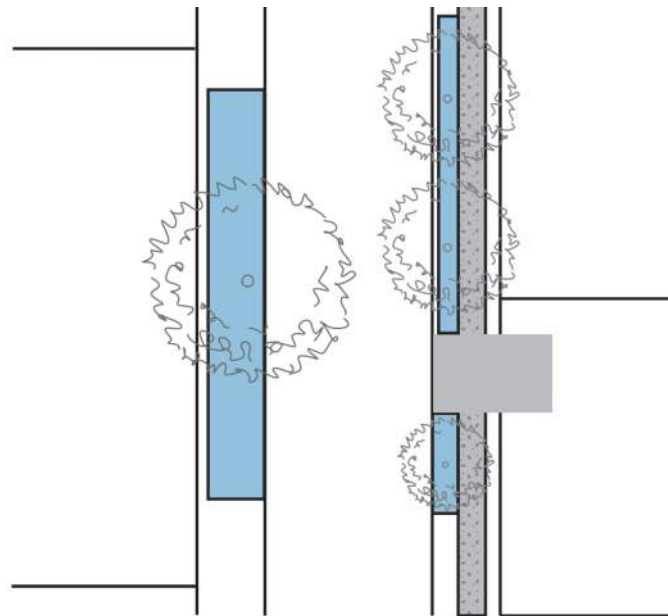


Figure 2: Soil Volume and Canopy Cover on Local Roads with Footpaths

4. Design

Planting Width (minimum width of unobstructed root volume)	1.5 m minimum width (<i>back of kerb to footpath</i>) <i>1.0 m in approved commercial areas if structural soils or structural cells are placed under footpath/concrete to achieve 1.5 m or greater soil volume width.</i>
Soil Volume (Unobstructed Root Volume)	Soil volumes specific to each species are provided in Council's Tree Species List.
Max depth for Soil Volume calculations	1 m depth for calculations <i>Tree roots typically grow within the top 500-600 mm of soil depth and occasionally to a greater depth. Soil volume below 1 m depth is not included in any calculations.</i>
Imported soil volume (improved soil volume)	See MoES Standard Drawing.
Planting (pot) sizes for DA requirements – Litres (minimums)	- Street trees in verge: 45L minimum pot size, with the option for 75L or 100L pot size. - Medians, Roundabouts, Sealed tree pits: 100L minimum pot size.
Offsets behind face of kerb	<u>Greenfield Subdivision</u> 1.2 m for road reserves with footpaths (small trees) 1.7 m for road reserves with no footpath on Local Streets (Small/Medium trees) <u>Existing Streets</u> 1.2 m ideally for small trees. Utility locations and potential footpath locations shall be checked.
Offsets to footpath (i.e. footpath parallel to kerb)	See MoES Standard Drawings (SD049, SD001, SD002) minimum 500 m for small tree between footpath
Offsets to driveways (perpendicular to kerb)	2 m
Offsets to street lighting	4 m (minimum) or outside matured tree canopy
Offsets to electricity and communication poles	4 m
Offsets to intersections	10 m measured from the face of kerb of the adjoining street

5. Canopy Cover Targets in Roads

Council's Canopy Cover Guidelines, which is appended to Council's DCP, provides methods to assist in achieving canopy cover targets for different Land uses, including certain road reserves, mainly within towns and Urban Release Areas. To achieve these targets, it may take a couple of actions to get to the ultimate coverage. For example, it may be a multi-phase implementation program: being at the greenfield subdivision, additional planting by multi-dwelling approvals, and then supplementary planting programs by the community or Council.

For greenfield subdivision, the majority of driveway locations have not yet been determined, so a lesser canopy cover may be required in locations where driveways will not be located.

Greenfield Subdivisions will be required to plant the following as a minimum:

- 5.1 1 tree in the middle of each proposed and/or registered lot frontage to the maximum size allowable.
- 5.2 1 small tree on every second common (side) boundary. Utility crossing can be restricted to every second lot corner. A small tree should have sufficient volume even if future driveways are close to both sides of the tree.
- 5.3 Within new Laneways provide 1 small tree on every common (side) boundary (e.g. for new medium density lots).

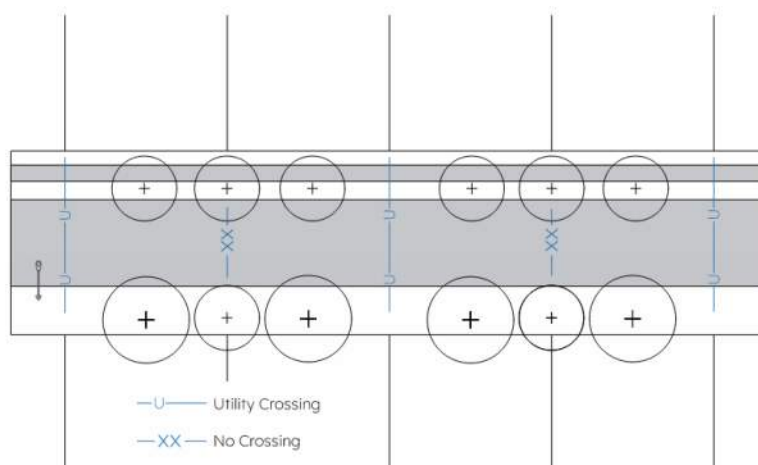


Figure 3: Indicative Planting at Greenfield Subdivision (driveway locations unknown)

Note: Additional trees on alternate side boundary lines are subject to utility crossings.

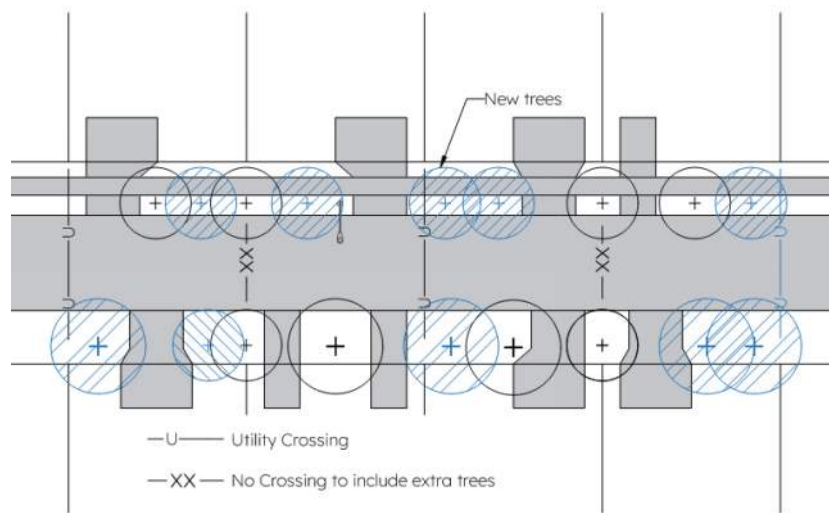


Figure 4: Indicative Infill Planting (once driveway locations are confirmed or built)

Additionally, the following design criteria for canopy cover is to be followed:

- 5.4 Maximise canopy in local street intersection blisters (See example below).

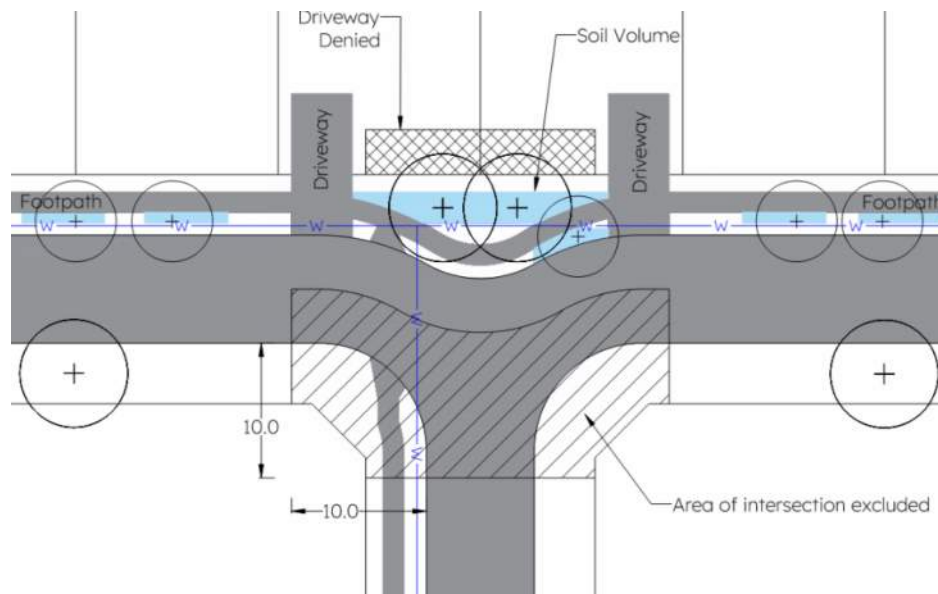


Figure 5: Indicative Planting at Intersection Blister

Note: Driveways must be located outside the blister by an 88b restriction.

- 5.5 Maximise coverage (by soil volume) in all lots where driveways are pre-determined including access denied (vehicle) frontages.
- 5.6 Maximise coverage (by soil volume) to non-residential lots and access denied frontages. e.g. reserves, access denied, public land.

The following additional considerations apply to the above:

- 5.7 Utility plans and civil plans (utilities above and below ground including streetlights, civil plans including stormwater pits pipes, pathways, structures) will need to be overlayed on landscape plans to demonstrate consideration and conflicts.
- 5.8 Trees are to be located with sufficient spacing from relevant utilities.
- 5.9 Utilities will be located to maximise tree canopy coverage.
- 5.10 The applicant is to provide indicative locations for the DA and detailed plans for construction approvals (e.g. SWC).
- 5.11 Bushfire areas subject to flame zone are excluded from achieving the full target and will provide the upper limit specified by RFS GTA's. Generally, this will be one tree in the centre of the proposed and/or registered lot frontage at a maximum size to meet Council soil volume, and the applicable RFS bushfire canopy limit.
- 5.12 The location of trees in the footway (verge) should consider street intersection sightlines, utilities, and street furniture, and are not to impede personal surveillance or public safety.
Note: This includes items such as stormwater pits, pedestrian ramps, power & street light poles, driveways, utility services.
- 5.13 Trees shall be planted and located in the footway in accordance with Standard Drawings SD001, SD002, and SD049 (subject to satisfying standard "clear zone" requirements).
- 5.14 Prior to any excavation work commencing, the existence and location of any underground services must be established.
- 5.15 Where overhead power supply mains exist, consideration must be given to the location of the trees and the mature height of proposed trees, such that the street infrastructure is not affected.
- 5.16 Tree planting locations should be complementary to street lighting to optimise pedestrian safety. Planting locations should be planned around light locations.
- 5.17 Tree-guards (other than supporting stakes) are not encouraged when infilling residential areas where driveways are already established.
- 5.18 Tree-guards are required in new subdivisions and will generally be required to be removed by the developer at the end of the maintenance period of the final stage of the development.
- 5.19 Shrubs, if approved, must satisfy sightline and CPTED requirements. Hedges are not permitted in the road reserve.
- 5.20 Designs must provide sufficient deep (imported) soil to support an urban tree canopy. For the purpose of calculating deep soil at least 1.5 metres width of clear deep soil is required. The following can be included in the width/volume:
 - A path, access ramp, or paved area with a maximum width of 1.2 metres.
 - Essential services infrastructure (e.g., stormwater pipes) with a maximum diameter of 300 mm.
 - Landscape structures (e.g., lightweight fences, light poles, or seating) that require a footing

with a maximum size of 300 mm x 300 mm in cross-section.

- 5.21 Certification by a qualified arborist or a qualified landscape designer/architect confirming that street trees and landscaping have been completed in accordance with the approved plans and Council's specifications, may be required for subdivision works and development projects at the discretion of Council.

6. Tree Establishment

- 6.1 Mulching to a depth of 50-75 mm over the root zone is required to help retain moisture, inhibit weeds, and reduce damage from mowers and whipper snippers. This is particularly importance for establishing younger trees.
- 6.2 New plantings need to be thoroughly watered at the time of implementation. For the first two (2) months, watering should occur weekly, then fortnightly for the next three (3) months during summer, or monthly for three (3) months in other seasons. Watering of new plantings is required for a minimum of five (5) months.

7. Grasses

- 7.1 In cases where disturbed areas require coverage or new grass is provided and will be maintained by Council, Couch (*Cynodon dactylon*) must be used. Such areas may include drainage reserves, public reserves, and road reserves adjacent to those public land reserves. Other turf grasses such as buffalo and kikuyu are optional for lot frontages and areas outside of perimeter roads.

8. Maintenance

- 8.1 Council's approval must be obtained for pruning and removal of public trees.
- 8.2 Performance bonds may be required as security for completed public trees and landscape features.

Date Adopted: 17 March 2026

Implementation Date: 14 April 2026

Version: 1.0

Tree Species List (Public Land)

This document is the pre-approved list of trees that can be used in public land including road reserves and open Space and recreational land. The document provides criteria for where a certain tree is suitable. This document needs to be read in conjunction with:

- MoES Technical Guideline: Street Trees
- Canopy Cover and Maitland City Council DCP

FIELD	DESCRIPTION
Location Type	L1 (Small): 1.2 – 2.5 m soil width (e.g., verge on footpath side between kerb and footpath)
	L2 (Medium): >2.5 – 3.5 m soil width (e.g., verge on non-footpath side or blisters)
	L3 (Large): >3.5 – 4.5 m soil width (e.g., blister on non-footpath side, medians)
	L4 (Parks & Open Spaces): > 4.5 m wide soil width – not suitable for street tree planting
Under Power Lines	Indicates if species are suitable for growing under or near power lines. Species may still require trimming but can tolerate regular crown reduction (AS4373).
Height	Estimated mature height (in metres) under typical street conditions. Influenced by soil quality and surrounding environmental conditions.
Width	Estimated mature canopy spread (diameter in metres).
Minimum Soil Volume	The minimum soil volume (in cubic metres) needed to support basic tree health and growth for the species.
Desirable Soil Volume	The recommended optimal soil volume (in cubic metres) for long-term tree health, growth, and canopy development.
Predicted Canopy Area	The expected canopy area (in square metres) at maturity under typical growing conditions.
Origin	A = Australian (non-local)
	L = Locally Native
	E = Exotic
Restrictions	Any site or species-specific limitations, including infrastructure conflicts, invasive tendencies, or unsuitable conditions.

*Maitland City Council acknowledges that its Tree Selection Matrix has drawn upon information and guidance provided in the Newcastle City Council Street Tree Selection Manual (March 2016). We appreciate the valuable work undertaken by Newcastle City Council in developing this resource and recognise its contribution to promoting best practice in urban tree selection and management.

SCIENTIFIC NAME	COMMON NAME	FAMILY	LOCATION	UNDER POWERLINES	HEIGHT	WIDTH	MINIMUM SOIL VOLUME (M ³)	DESIRABLE SOIL VOLUME	PREDICTED CANOPY AREA	ORIGIN	RESTRICTIONS
<i>Acer rubrum</i> (varieties)	Maple varieties	Aceraceae	L1	N	12-15	6-8	20	40	50	E	
<i>Acer rubrum</i> 'Fairview Flame'	Red Maple	Aceraceae	L1	N	12-15	6-8	20	40	50	E	
<i>Alphitonia excelsa</i>	Red Ash	Rhamnaceae	L1	N	8-12	6-8	20	40	50	L	
<i>Alphitonia petriei</i>	Pink Almond	Rhamnaceae	L1	N	8-12	3-6	5	15	28	A	
<i>Auranticarpa rhombifolia</i>	Diamond-Leaf Laurel	Pittosporaceae	L1	N	8-12	3-6	5	15	28	A	Columnar form - not to be used where shade tree required. <i>prev. Pittosporum rhombifolium</i> .
<i>Elaeocarpus eumundii</i>	Smooth-leaved Quandong	Eleocarpaceae	L1	N	8-12	3-6	5	15	28	A	
<i>Elaeocarpus obovatus</i>	Hard Quandong	Eleocarpaceae	L1	N	8-12	3-6	5	15	28	L	
<i>Grevillea baileyana</i>	White Oak	Proteaceae	L1	N	8-12	6-8	20	40	50	A	
<i>Acacia maidenii</i>	Maidens Wattle	Mimosaceae	L1	Y	8-12	6-8	20	40	50	L	
<i>Acmena hemilampyra</i>	Broad-leaved Lillypilly	Myrtaceae	L1	Y	< 8	3-6	5	15	28	A	
<i>Angophora hispida</i>	Dwarf Apple	Myrtaceae	L1	Y	< 8	3-6	5	15	28	L	
<i>Backhousia citriodora</i>	Lemon Myrtle	Myrtaceae	L1	Y	< 8	3-6	5	15	28	A	
<i>Backhousia myrtifolia</i>	Grey Myrtle	Myrtaceae	L1	Y	< 8	3-6	5	15	28	L	
<i>Banksia integrifolia</i>	Coastal Banksia	Proteaceae	L1	Y	< 8	3-6	5	15	28	L	Does not tolerate waterlogged soils. Must review soil type and drainage in planting area.
<i>Buckinghamia celsissima</i>	Ivory Curl Flower	Proteaceae	L1	Y	< 8	3-6	5	15	28	A	
<i>Buckinghamia ferruginiflora</i>	Noah's Oak	Proteaceae	L1	Y	< 8	3-6	5	15	28	A	
<i>Callistemon salignus</i>	Willow Bottlebrush	Myrtaceae	L1	Y	8-12	3-6	5	15	28	L	
<i>Cupaniopsis anacardioides</i>	Tuckeroo	Sapindaceae	L1	Y	< 8	3-6	5	15	28	L	
<i>Eleaocarpus reticulatus</i>	Blueberry Ash	Eleocarpaceae	L1	Y	< 8	3-6	5	15	28	L	
<i>Geijera parviflora</i>	Wilga Wilga	Rutaceae	L1	Y	< 8	3-6	5	15	28	A	
<i>Glochidion ferdinandi</i>	Cheese Tree	Phyllanthaceae	L1	Y	8-12	3-6	5	15	28	L	
<i>Gordonia axillaris</i>	Gordonia	Theaceae	L1	Y	<8	3-6	5	15	28	E	
<i>Harpullia pendula</i>	Tulipwood	Sapindaceae	L1	Y	< 8	6-8	20	40	50	A	
<i>Lagerstroemia indica</i> (varieties)	Crepe Myrtle	Lythraceae	L1	Y	< 8	3-6	5	15	28	E	
<i>Lagerstroemia indica</i> 'Biloxi	Crepe Myrtle	Lythraceae	L1	Y	< 8	3-6	5	15	28	E	
<i>Magnolia grandiflora</i> 'Little Gem'	Little Gem Magnolia	Magnoliaceae	L1	Y	8-12	3-6	5	15	28	E	
<i>Melicope elleryana</i>	Pink Euodia	Rutaceae	L1	Y	< 8	3-6	5	15	28	A	
<i>Pistacia chinensis</i>	Chinese Pistachio	Anacardiaceae	L1	Y	< 8	3-6	5	15	28	E	
<i>Tristaniaopsis laurina</i>	Watergum	Myrtaceae	L1	Y	< 8	3-6	5	15	28	L	
<i>Tristaniaopsis laurina</i> 'Luscious'	Luscious Watergum	Myrtaceae	L1	Y	< 8	3-6	5	15	28	L	
<i>Backhousia anisata</i> (syn <i>Anetholia</i>)	Aniseed Tree	Myrtaceae	L2	N	8-12	6-8	20	40	50	A	
<i>Brachychiton acerifolius</i>	Illawarra Flame Tree	Sterculiaceae	L2	N	8-12	6-8	20	40	50	L	

SCIENTIFIC NAME	COMMON NAME	FAMILY	LOCATION	UNDER POWERLINES	HEIGHT	WIDTH	MINIMUM SOIL VOLUME (M³)	DESIRABLE SOIL VOLUME (M³)	PREDICTED CANOPY AREA	ORIGIN	RESTRICTIONS
<i>Brachychiton discolor</i>	Lacebark	Sterculiaceae	L2	N	12-15	6-8	20	40	50	L	
<i>Brachychiton populneus</i>	Kurrajong	Sterculiaceae	L2	N	12-15	6-8	20	40	50	L	Not suitable as shade tree due to leaf loss in hot/dry periods.
<i>Grevillea hilliana</i>	White Silky Oak	Proteaceae	L2	N	12-15	6-8	20	40	50	A	
<i>Lophostemon confertus</i>	Brushbox	Myrtaceae	L2	N	12-15	6-8	20	40	50	A	
<i>Rhodospaera rhodanthema</i>	Tulip Satinwood	Anacardiaceae	L2	N	8-12	6-8	20	40	50	A	
<i>Streblus brunonianus</i>	Whalebone Tree	Moraceae	L2	N	8-12	3-6	20	40	28	L	
<i>Waterhousea floribunda</i>	Weeping Lilly Pilly	Myrtaceae	L2	N	12-15	3-6	20	40	79	L	
<i>Xanthostemon chrysanthus</i>	Golden Penda	Myrtaceae	L2	N	8-12	6-8	20	40	50	A	
<i>Zelkova serrata</i> 'Green Vase'	Japanese Zelkova	Ulmaceae	L2	N	12-15	8-10	20	40	79	E	
<i>Acmena smithii</i>	Lilly Pilly	Myrtaceae	L2	Y	8-12	6-8	20	40	50	L	
<i>Koelreuteria paniculata</i>	Golden Rain	Sapindaceae	L2	Y	< 8	3-6	5	15	28	E	
<i>Acer rubrum</i> (varieties)	Maple varieties	Aceraceae	L3	N	12-15	6-8	20	40	50	E	
<i>Acer rubrum</i> 'Fairview Flame'	Red Maple	Aceraceae	L3	N	12-15	6-8	20	40	50	E	
<i>Araucaria heterophylla</i>	Norfolk Pine	Araucariaceae	L3	N	20+	6-8	20	40	50	A	
<i>Caesalpinia ferrea</i>	Leopard Tree	Ceasalpinaceae	L3	N	8-12	6-8	20	40	50	E	
<i>Calodendrum capense</i>	Cape Chestnut	Rutaceae	L3	N	8-12	6-8	20	40	50	E	
<i>Corymbia eximia</i>	Yellow Bloodwood	Myrtaceae	L3	N	12-15	6-8	20	40	50	L	
<i>Corymbia maculata</i>	Spotted Gum	Myrtaceae	L3	N	15-20	6-8	20	40	50	L	
<i>Drypetes deplanchei</i>	Yellow Tulipwood	Putranjivaceae	L3	N	8-12	3-6	20	40	28	L	
<i>Eucalyptus microcorys</i>	Tallowwood	Myrtaceae	L3	N	15-20	6-8	20	40	50	L	
<i>Eucalyptus punctata</i>	Grey Gum	Myrtaceae	L3	N	15-20	6-8	20	40	50	L	
<i>Eucalyptus sideroxylon</i> 'Rosea'	Ironbark	Myrtaceae	L3	N	12-15	6-8	20	40	50	L	Not for exposed areas, prevailing winds due to high prevalence of branch drop.
<i>Flindersia australis</i>	Crows Ash	Rutaceae	L3	N	12-15	8-10	20	40	79	A	
<i>Flindersia xanthoxyla</i>	Yellowwood	Rutaceae	L3	N	15-20	6-8	20	40	50	A	
<i>Magnolia grandiflora</i> 'Exmouth'	Evergreen Magnolia	Magnoliaceae	L3	N	12-15	6-8	20	40	50	E	
<i>Syzygium australe</i>	Brush Cherry	Myrtaceae	L3	N	8-12	6-8	20	40	50	L	
<i>Syzygium jambos</i>	Rose Apple	Myrtaceae	L3	N	8-12	6-8	20	40	50	A	
<i>Syzygium luehmannii</i>	Small-leaved Lilly Pilly	Myrtaceae	L3	N	8-12	6-8	20	40	50	A	
<i>Syzygium moorei</i>	Rose Apple	Myrtaceae	L3	N	8-12	6-8	20	40	50	A	
<i>Syzygium oleosum</i>	Blue Lilly Pilly	Myrtaceae	L3	N	8-12	6-8	20	40	50	L	
<i>Syzygium paniculatum</i>	Magenta Cherry	Myrtaceae	L3	N	8-12	6-8	20	40	50	L	
<i>Ulmus parvifolia</i> 'Burnley Select'	Chinese Elm	Ulmaceae	L3	N	8-12	6-8	20	40	50	E	

SCIENTIFIC NAME	COMMON NAME	FAMILY	LOCATION	UNDER POWERLINES	HEIGHT	WIDTH	MINIMUM SOIL VOLUME (M ³)	DESIRABLE SOIL VOLUME	PREDICTED CANOPY AREA	ORIGIN	RESTRICTIONS
<i>Zelkova serrata</i> 'Green Vase'	Japanese Zelkova	Ulmaceae	L3	N	12-15	8-10	20	40	79	E	Columnar form - not to be used where shade tree required.
<i>Agathis robusta</i>	Kauri Pine	Araucariaceae	L4	N	20+	6-8	50	80	50	A	
<i>Alloxylon flammeum</i>	Tree Waratah	Proteaceae	L4	N	12-15	6-8	50	80	50	A	
<i>Angophora costata</i>	Smooth-barked Apple	Myrtaceae	L4	N	12-15	8-10	50	80	79	L	
<i>Araucaria columnaris</i>	Cook Pine	Araucariaceae	L4	N	15-20	3-6	50	80	28	A	
<i>Araucaria cunninghamii</i>	Hoop Pine	Araucariaceae	L4	N	20+	8-10	50	80	79	A	
<i>Argyrodendron actinophyllum</i>	Black Booyong	Sterculiaceae	L4	N	15-20	12-15	50	80	177	A	
<i>Carya illinoensis</i>	Pecan	Juglandaceae	L4	N	12-15	8-10	50	80	79	E	Not to be planted adjacent to footpaths due to seed drop.
<i>Castanospermum australe</i>	Blackbean	Fabaceae	L4	N	15-20	10-12	50	80	113	A	Not to be planted adjacent to footpaths due to seed drop.
<i>Doryphora sassafras</i>	Sassafras	Antherosperataceae	L4	N	15-20	6-8	50	80	50	L	
<i>Elaeocarpus grandis</i>	Blue Quandong	Eleocarpaceae	L4	N	15-20	6-8	50	80	50	A	
<i>Eucalyptus capitellata</i>	Brown Stringybark	Myrtaceae	L4	N	8-12	6-8	50	80	50	L	Not to be planted adjacent to footpaths due to seed drop.
<i>Ficus macrophylla</i>	Moreton Bay Fig	Moraceae	L4	N	20+	15-20	50	80	314	L	
<i>Ficus microcarpa</i> var. 'Hillii'	Hills Weeping Fig	Moraceae	L4	N	15-20	15-20	50	80	314	L	
<i>Ficus rubiginosa</i>	Port Jackson Fig	Moraceae	L4	N	12-15	10-12	50	80	113	L	
<i>Ficus superba</i> var <i>Henneana</i>	Deciduous Fig	Moraceae	L4	N	12-15	10-12	50	80	113	L	
<i>Gmelina leichhardtii</i>	White Beech	Verbenaceae	L4	N	8-12	6-8	50	80	50	L	
<i>Grevillea robusta</i>	Silky Oak	Proteaceae	L4	N	12-15	6-8	50	80	50	A	Should not be planted adjacent to natural areas due to potential to be invasive.
<i>Jacaranda mimosifolia</i>	Jacaranda	Mimosaceae	L4	N	8-12	6-8	50	80	50	E	May replace existing Jacaranda street tree, otherwise only for parks/open spaces. Not adjacent to footpaths due to slippery flowers.
<i>Liquidambar formosana</i>	Formosan Sweetgum	Altingiaceae	L4	N	12-15	6-8	50	80	50	E	
<i>Melaleuca quinquenervia</i>	Swamp Paperbark	Myrtaceae	L4	N	12-15	6-8	50	80	50	L	
<i>Melaleuca styphelioidies</i>	Prickly Paperbark	Myrtaceae	L4	N	3-6	3-6	50	80	28	L	
<i>Nyssa sylvatica</i>	Blackgum	Cornaceae	L4	N	8-12	3-6	50	80	28	E	
<i>Podocarpus elatus</i>	Plum Pine	Podocarpaceae	L4	N	8-12	6-8	50	80	50	L	
<i>Quercus ilex</i>	Holm Oak	Fagaceae	L4	N	15-20	10-12	50	80	113	E	
<i>Syncarpia glomulifera</i>	Turpentine	Myrtaceae	L4	N	12-15	6-8	50	80	50	L	
<i>Synoum glandulosum</i>	Scentless Rosewood	Meliaceae	L4	N	8-12	3-6	20	40	28	L	
<i>Taxodium distichum</i>	Swamp Cyprus	Cupressaceae	L4	N	15-20	6-8	50	80	50	E	
<i>Toona ciliata</i>	Red Cedar	Meliaceae	L4	N	8-12	6-8	20	40	50	L	
<i>Pararchidendron pruinsum</i>	Snowwood	Fabaceae	L4	Y	< 8	3-6	50	80	28	L	
<i>Rapanea variabilis</i>	Muttonwood	Myrsinaceae	L4	Y	8-12	3-6	50	80	28	L	