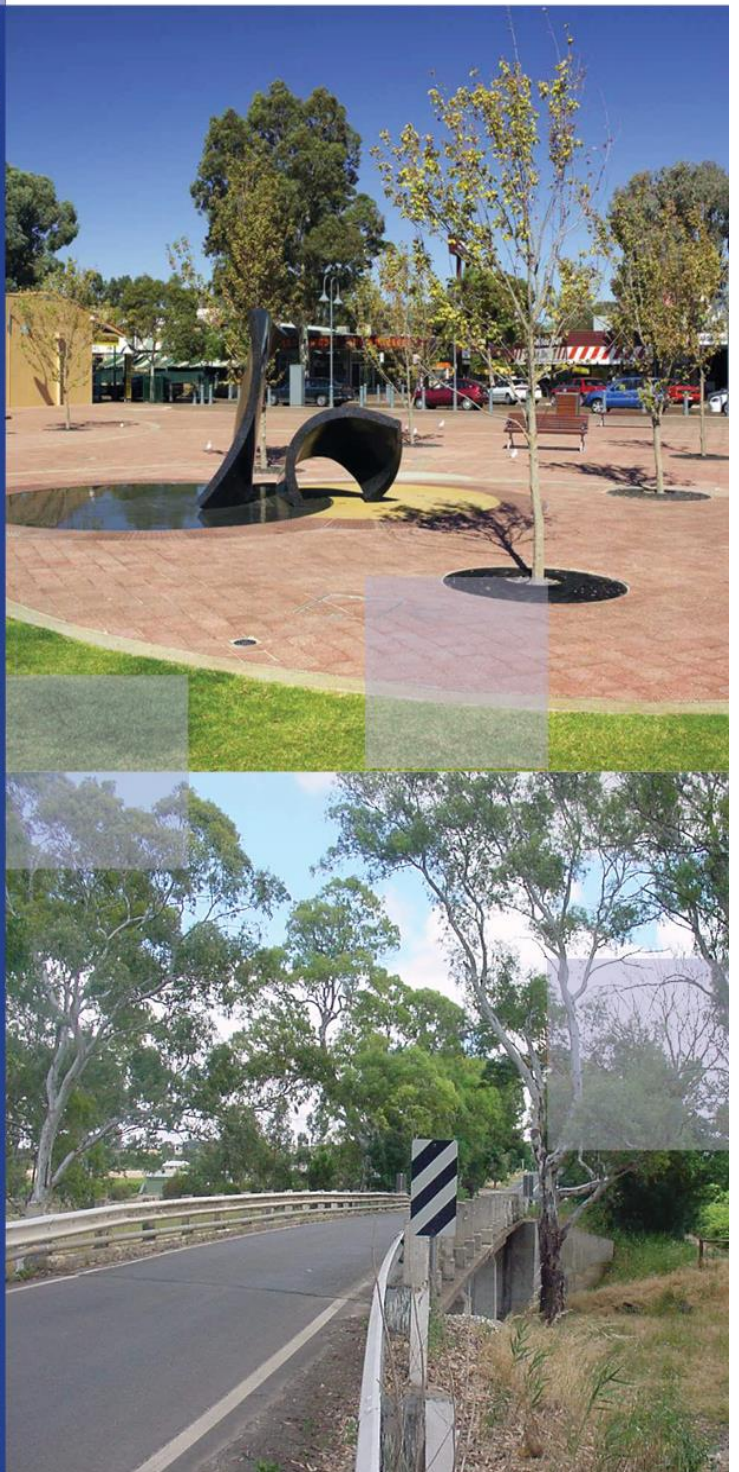




Infrastructure Guidelines SA

Standards and Requirements for the Design and Construction of Infrastructure Assets in South Australia

Revision 1.1, April 2020





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with the base document being based on the Victorian Infrastructure Design Manual

This Infrastructure Guideline (SA) was originally prepared by the Cities of Greater Bendigo and Greater Shepparton and the Shire of Campaspe. Their joint initiative was one which recognised the benefits of Council's working together towards consistent requirements and standards for the design and Development of Infrastructure. Since this time, the document has been modified to enable the use of the Infrastructure Guideline (SA) by South Australian Councils.

A draft version of the Infrastructure Guideline (SA) was released for comment in September 2015 when it was placed online. The feedback received was then reviewed and incorporated into the document where appropriate. A series of workshops were then held with relevant stakeholders and the guidelines further refined. A final working version Rev1.0 was released for use in December 2016.

Revision Number	Status	Date	Reviewed	Approved
1.0	Released for use	December 2016		IPWEA
1.1	Minor edits, drawings updated	April 2020	IPWEA	IPWEA

Consultation

This Infrastructure Guideline (SA) has been prepared following consultation and liaison with Councils, Council staff, Consultants and Developers. Each Council is responsible for its own consultation process prior to adoption. The consultative processes have ensured that the policies, procedures and guidelines in this Infrastructure Guidelines (SA) achieve as far as practical the three main aims of appropriate, affordable and equitable Infrastructure that serves the community and promotes growth.

Revision

The Infrastructure Guideline (SA) is a living document and may be revised and amended from time to time.

To ensure that everyone has access to the latest version of the Infrastructure Guideline (SA) it will only be available electronically on the IPWEA SA website at <https://www.ipwea.org/southaustralia/publications/ourlibrary>

Suggestions on how this Infrastructure Guideline (SA) can be improved can be forwarded by email to sa@ipwea.org.

Engineering queries relating to individual Development submissions, status of approvals or further technical direction regarding Infrastructure design should be directed to the appropriate Council staff member in the relevant Council.

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1 Introduction

These guidelines are designed for use by all Councils as well as consultants, developers, contractors and others engaged in civil infrastructure planning, design and construction throughout South Australia. They can be used for urban, regional, rural, commercial and industrial areas.

They have been developed to provide guidance for civil infrastructure works (roads, paths, traffic management, stormwater management, recycled/non-drinking water, public lighting, community wastewater management systems, landscaping and open space).

The guidelines can be applied to a Council's own infrastructure as well as that which is developed by others (statutory authorities, community and developers) but will ultimately be under a Council's care and control. For any works that impact on or interface with DPTI assets, contact shall be made with DPTI for advice, which may include design and documentation to DPTI standards and require DPTI approval.

1.1 The benefits of using these Guidelines

A set of common guidelines for civil infrastructure:

- Enables clarity and consistency in design standards within and across Councils, regardless of the creator or manager of the infrastructure. This assists Councils as well as developers and others who work across Council boundaries, all of whom can operate from the same set of guidelines;
- Assists in standardising development submissions and expediting Council engineering approvals;
- Ensures that new and upgraded infrastructure is of a consistent minimum standard that meets legislative requirements and achieves sustainability objectives;
- Provides considerable cost savings for both Councils and developers through the sharing of financial and human resources to develop and maintain a single comprehensive resource;
- Supports innovation and the sharing of best practice learning across the Councils;
- Contributes to good governance in local government. By documenting and publishing clear infrastructure standards, a Council demonstrates openness, transparency and accountability in its business;
- Provides a training document for all relevant staff.

The guidelines are flexible enough to meet specific situations and can be adapted to suit a Council's needs.

1.2 Using and applying the Guidelines

All South Australian Councils are encouraged to formally adopt these guidelines with the overall aim of reducing whole of life costs through efficiencies, good design, good construction and consideration of whole of life factors. Its primary objectives are to:

- Clearly document Council requirements for the design and development of infrastructure that is, or will become, the responsibility of the Council;
- Standardise development (as per the Development Act) submissions as much as possible and expedite Council's engineering approvals;
- Standardise presentation of as-constructed documentation for efficient integration with Council's asset management system;
- Ensure that minimum design criteria are met in the design and construction of infrastructure within the Council area;
- Recognise and address issues currently impacting on land development, in particular sustainability, integrated water cycle management, timeliness and affordability.

This document has been prepared as a performance based guide to be used by Councils for procurement of services and in-house design/construction. It also provides guidance to developers, third parties and their designers for land development and other infrastructure projects. The guidelines should be used for:

- Planning, design and construction of new civil infrastructure assets or landscape works that will ultimately be handed over to Council as owner or under its care and control;
- Planning, design and construction of renewal, replacement or upgrade of existing Council civil infrastructure assets or landscape works;
- Assessment of existing privately owned assets being handed over to Council as owner or under its care and control.

The guidelines do not cover the following:

- Works on private property that will not be handed over to Council, although the guidelines provides some guidance and may be used by Council staff to assess development applications;
- Buildings and large structures including swimming pools.

Councils should follow the requirements of, or assess development against, these guidelines unless there are circumstances that make it impractical or unreasonable to do so. On occasion, this may include:

- Renewing an existing asset which does not comply with these standards;
- Protecting native vegetation or the existing streetscape;
- Where adopting the manual's standards would result in detriment to the neighbourhood character of an area;
- Infrastructure in a Historic Conservation Zone/Area or State Heritage Area;
- Infill development where the Council wants to maintain the surrounding or abutting standards;
- Where a development uses innovative solutions or new technologies which do not comply with the manual's specific technical provisions but the Council is satisfied that the objectives of the manual have been met;
- Where it can be demonstrated that the objectives of the manual have been met.

For designers undertaking works on behalf of a Council, developers or third parties, it is recommended that a pre-design site inspection be held with a relevant Council representative to discuss specific issues and requirements for the site and surrounds.

Any proposal to deviate from these guidelines at any stage of the works should be agreed with Council staff prior to commencement of any work involving the proposed variation. However, it should be noted that the quality of design and construction will have an important bearing on the whole of life cost of any asset, including costs that Councils and their ratepayers subsequently face in order to maintain functional infrastructure over the design life.

For Council's internal design staff, the level of detail and specific requirements must be agreed upon prior to the design commencing. However, roads, community wastewater management systems and stormwater drainage designs should be in accordance with the following sections.

Unless specifically noted, all design and construction shall be in accordance with the relevant legislation, Australian Standards, BCA and where appropriate Austroads guidelines. Other guidelines published from time to time may also be referenced.

1.3 The Guidelines Structure

This Guideline include:

- Infrastructure guidelines
- Standard drawings (PDF and dwg)

Supporting documents that may be available from the relevant council include

- Developer requirements for land divisions;
- Standard specification;
- Draft statement of standard requirements;
- Fact sheets;
- Development flow chart;
- Check lists;
- Standard Bond Document (prepared by the LGA).

2 Definitions

AHD	The Australian Height Datum is a geodetic datum for altitude measurement in Australia.
AEP	The Annual Exceedance Probability is the probability that a given rainfall total accumulated over a given duration will be exceeded in any one year.
Asset	An Asset is an object (physical or intangible) that has an identifiable value and a design/useful life greater than 12 months, that is or could be used by the entity responsible for it to provide a service.
Asset Management Plan	A plan developed for the management of one or more infrastructure assets that combines multi-disciplinary management techniques (including technical & financial) over the lifecycle of the asset in the most cost effective manner to provide a specific level of service.
Asset Owner	The person, company or Council responsible for the future maintenance and renewal of the assets.
ARI	The Average Recurrence Interval is the average or expected value of the periods between exceedances of a given rainfall total accumulated over a given duration. It is implicit in this definition that the periods between exceedances are generally random. This is usually calculated as the reciprocal of the AEP.
Carriageway	Is the area of road reserve which is provided for the movement or parking of vehicles and determined by the invert of a kerb and channel and the point adjacent to the pavement edge for kerb (only) and edge strips.
Clear Zone	Is an area adjacent to the traffic lanes (Carriageway) which should be kept free from features that would be potentially hazardous to errant vehicles.
CWMS	A Community Wastewater Management System (CWMS) is a system for the collection and management of wastewater generated in a town, regional area or other community, but does not include – (a) SA Water sewerage infrastructure; or (b) after 1 July 2015 – a system with a capacity that exceeds 2000 EP.
Consultant(s)	A person or company appointed by the Developer or Council to provide expert and technical services.
Construction Engineer	Unless approved otherwise by the Council, all road and drainage Construction Supervision must be undertaken by a Qualified Engineer who will hereafter be referred to as the Construction Engineer.
Construction Supervision	Construction Supervision is a requirement of any infrastructure project and is to be carried out by the Construction Engineer or some other person as appointed and approved. Construction Supervision of Development related projects are not a Council responsibility.
Council	The relevant municipal organisation within whose boundaries the Infrastructure is to be constructed.
Council Engineer	An engineer appointed by Council to review and approve the Design Engineer's designs and/or to inspect works for compliance with the development approval and standards set out in this Infrastructure Guideline (SA).

Council's Planning Department	The department within each Council that is responsible for the processing and administration of Development approvals.
Council's Engineering Department	The department within each Council that is responsible for the review and approval of Infrastructure in relation to engineering and asset standards.
Design Engineer or Designer	In accordance with the Development Regulations (2008) - Section 55 and Local Government Act, unless approved otherwise by the Council, all road and drainage designs must be completed by a Qualified Engineer, who will hereafter be referred to as the Design Engineer or Designer.
Design/Useful Life	The Design Life of an asset is the estimated length of time during which the asset is able to deliver a given Level of Service, assuming an industry acceptable level and quality of maintenance is undertaken, thereby influencing its ability to deliver the desired Level of Service.
Desirable Maximum/Minimum	If a design demonstrates that the value is between the desirable maximum and minimum's, then it is considered 'deemed to comply'.
Developer(s)	Is the person or company that owns the land on which the Development is being undertaken, or is responsible for the design and construction of the Development.
Developer's Representative	The Developer's Representative is the Project Manager, Construction Engineer or the Design Engineer as required by the context.
Development	Is "the carrying out of building, engineering, mining or other operations in, over or under land or the making of any material change in the use of any building or other land".
DEWNR	Department of Environment, Water and Natural Resources are part of the Environment and Conservation Portfolio and report to the Minister for Sustainability, Environment and Conservation and the Minister for Water and the River Murray.
DPTI	The Department of Planning, Transport and Infrastructure works as part of the community to deliver effective planning policy, efficient transport and social and economic infrastructure.
EPA	The Environmental Protection Authority is the primary body responsible for licensing environmental activities and enforcing environmental standards that industries, companies and individuals must meet.
Green Infrastructure	Green Infrastructure describes strategically planned and managed networks of vegetation and water assets – like urban forests, greenways, parks, restored and constructed wetlands, waterways, green roofs, green walls, bioswales, and more – that provide society with benefits such as enhanced liveability, improved energy efficiency, improved air and water quality, reduced flooding, increased biodiversity and recreational opportunities.

Infrastructure	Is any long-life physical asset that consists of an entire system or network (including components), not otherwise defined, which provides the foundation to support public services and enhance the capacity of the economy. This may include roads, footpaths, CWMS, playground and recreation equipment, landscaping and stormwater drainage systems (including detention and treatment) and ancillary assets such as signs and lighting.
LATM	Local Area Traffic Management – the planning and management of road space usage within a local area, to reduce traffic volumes and speeds in local streets, to increase amenity and improve safety and access for residents, especially pedestrians and cyclists
Level of Service	Is the defined service quality for a particular activity (i.e. road roughness) or service area (i.e. street lighting) against which service performance may be measured. Service levels usually relate to quality, quantity, reliability, responsiveness, environmental acceptability and cost.
MUSIC	The Model for Urban Stormwater Improvement Conceptualisation (MUSIC) is a software tool that simulates the behaviour of stormwater in catchments.
NBN	NBN is a Government-owned company established to build infrastructure and manage the rollout of the National Broadband Network across Australia. NBN puts the infrastructure in place; then other internet service providers, establish a connection for customers.
Office of the Technical Regulator	(OTR) is responsible for the development, monitoring and regulation of the safety and technical standards in connection with the electricity, gas, water and plumbing industry. This includes, but is not limited to all related infrastructure and installations (in the case of water, sewerage and plumbing this includes associated equipment, products and materials.
Practical Completion	Is as described in Section 17.5.
PSM	A Permanent Survey Mark (PSM) is a major reference mark placed by surveyors to assist them in repegging land parcels and extending new surveys. They are also used for projects such as road construction, map production and mining development.
Public Open Space	Open Space in public ownership and accessible to many. May be further defined as; <ul style="list-style-type: none"> • Active public open space; • Conservation public open space; • Operational public open space; • Passive public open space.
Qualified Engineer	For the purposes of this document a Qualified Engineer means a person who is either a chartered member of Engineers Australia, who has appropriate experience and competence in the field of civil engineering; and/or a person who is registered on the State or National Professional Engineers Register and who has appropriate experience and competence in the field of civil engineering”.

Road Verge	Is the distance between the invert of kerb, or where no kerb exists the edge of shoulder and the near road reserve boundary.
SA Health	SA Health is the brand name for the health portfolio of services and agencies responsible to the Minister for Health, Minister for Mental Health & Substance Abuse and the Minister for Ageing.
SAPN	SA Power Networks, previously ETSA Utilities, is the operator of the South Australian electricity distribution network, delivering electricity from the high voltage transmission network of power lines, to residential and business customers throughout most of South Australia.
SMA	Stormwater Management Authority (division of the Local Government Association of South Australia).
Structure Plans	Structure Plans are designed to ensure compliance with Development Plan requirements. As well as to ensure that Developments provide effective and economical Infrastructure that services the area, while ensuring that staged or multi-development projects are able to be delivered in a safe, efficient and effective manner without unnecessary duplication or oversizing of Infrastructure.
Superintendent	The Construction Engineer, or another qualified and experienced person appointed by the Developer or Council to carry out the functions of the Superintendent as defined in the <i>General Conditions of Contract – AS/NZS 2124 or AS/NZS 4000</i> , noting all construction is to be signed off as being in accordance with Council requirements by a Qualified Engineer.
TMAR	Traffic Management Assessment Report is as described in Section 4.2.1.
TBM	A temporary benchmark (TBM) is a fixed point with a known elevation used for level control during construction works and surveys. Nails in road seals, or marks on kerb & channel are commonly used as temporary benchmarks.
TIS	Traffic Impact Statement (TIS) is as described in Section 4.2.2.
Utility	An entity (whether publicly or privately owned) which provides, or intends to provide, water, sewerage, drainage, gas, electricity, telephone, telecommunication or other like services under the authority of an Act of South Australia or the Commonwealth.
WSUD	Water-sensitive urban design (WSUD) is an approach to urban planning and design that integrates the management of the total water cycle into the land use, development, capital works and asset renewal processes. This type of design integrates water from all sources – including rainwater, stormwater, groundwater, potable water and wastewater – into the urban landscape.

3 Documentation

3.1 Objectives

The objectives of these documentation requirements are as follows:

- To provide consistency in the presentation of design information;
- To eliminate duplication of data entry into various record systems;
- To provide an 'as constructed' record of assets.

3.2 General Requirements

Council's Engineering Department will generally arrange or undertake the registration, storage and maintenance of engineering plans in hardcopy and electronic format, in their asset management system.

In addition to this, all Councils operate electronic data management systems for all correspondence to and from the organisation, including plans. Letters, forms, certificates and minor reports (generally up to 20 pages) that are received are transferred to electronic format by its records department; however, major reports and all plans larger than A3 are required to be submitted in electronic and hardcopy format.

Council's Engineering Department must be advised of the installation dates of any approved Major Traffic Control Item to enable advice to be forwarded to DPTI within 30 calendar days of enacting DPTI delegation.

3.3 Survey

The engineering survey must show all existing site features and levels to give a true representation of the site and include areas outside of the site that may be affected by the works or affect the site or are needed for design. This will include adjacent roads, above ground and underground infrastructure, watercourses, levels in adjoining properties etc.

The engineering survey shall be undertaken by an appropriately qualified and experienced surveyor.

Boundary pegs and encroachments should be shown together with any existing easements. Any installation, or changes to boundary pegs shall be undertaken by a licensed surveyor.

3.4 Plans

Plans must be prepared as outlined in the following sections. Electronic submissions of plans will be such that any reproduction from the electronic files will achieve a hardcopy that is an exact duplicate of any hardcopy submission.

For any works that impact on or interface with DPTI assets, contact shall be made with DPTI for advice, which may include design and documentation to DPTI standards and require DPTI approval.

3.4.1 Sheet Size

Plans must be submitted at a size that complies with *AS/NZS 1100 Part 3*, with most Council's preferring the drawings to be on A1 or A3 sheet.

3.4.2 Scales

Plans should be submitted so that they can be read and reproduced on an A3 sheet size. The plans should be prepared at a scale which allows sufficient detail and information to be clearly shown.

Scales adopted should allow plans to be reduced in size while retaining a standard scale.

For general consultation, prior to any approvals, plans may be submitted as A1 or A3 sheets.

Structure Plans should generally be submitted on A1 sheets at maximum scale of 1:2000.

When requesting approval of functional layout for developments, plans should be submitted on A1 sheets with the following maximum scales:

Lot Layout	1:2000
Roads Plan	1:1000
Intersection Plans	1:500
Stormwater drainage Plans	1:1000

When requesting detailed design approval or final design approval, or providing 'As Constructed' information, plans should be prepared at A1 size submitted with the following scales:

Layout Plans	1:500	
Longitudinal Sections	Horizontal 1:250	Vertical 1:50
Cross Sections	Horizontal 1:100	Vertical 1:50 or 1:100
Intersection Plans	1:200 or 1:100	
Details	1:10 or 1:25	

3.4.3 Planar Datum

Survey must be to AHD, GDA 2020, MGA. Plans should nominate a minimum of two (2) permanent survey marks (PSM's) and their respective numbers/identification, and any temporary benchmarks (TBM's) relevant to the works.

All survey marks including PSMs shown on a plan should be checked to confirm its coordinates and levels are correct.

For land divisions the plans must nominate all the permanent survey marks and their respective numbers/identification created to comply with the requirements of Survey Regulations 2007, and the Survey General issued Cadastral Survey Guidelines.

The origin of all road chainage must be nominated in the plans. Road chainages should commence at clearly designated and identifiable locations.

3.4.4 Standard Details

It is desirable that all construction details comply with the standard detail drawings (Appendix A), modified to suit the specific site requirements. Where special structures or modifications to standard drawings are required, details of such works are to be submitted with the detailed construction plans for detailed design approval.

Standard detail drawings are provided in the dwg format and should be included on the drawing set.

3.4.5 Drawing Numbers and Revisions

Where plans are for development, these should reference the planning consent numbers. This planning consent number will, as a minimum, be clearly shown on the cover sheet or face sheet of any drawing set and be contained within the title block of each drawing.

Councils will provide plan numbers for any plans prepared for them if this is required. There is no requirement for plan numbers for land division and Developments. Drawings to be lodged with DPTI shall comply with DPTI's Drawing and Sheet numbering system.

All drawing revisions and the status of drawings should be clearly shown on plans. Drawing revisions should be clouded and the drawing revision updated. The drawing electronic name should also reflect the revision.

3.5 Standard Drawings

The Design Engineer should adopt details as shown on the Council's standard drawings where possible. While standard infrastructure is considered highly desirable across the Council's, the standard drawings should only be used where the item/structure and application is considered standard. The standard drawings are not to be used in lieu of responsibly engineered and detailed structures. Where the standard drawings are not considered appropriate for the application, variations from the standard details should be fully documented to the satisfaction of the Council. Cross-referencing standard drawings with variations made by note will only be accepted where those variations are considered minor and where directions are clear.

It is the responsibility of the Design Engineer to ensure that the standard drawing used is correct for the application and consultation with Council's Engineering Department may be necessary.

3.6 Specifications

Project specifications must ensure that all works are undertaken to meet the requirements of the Council, and that there can be no outstanding liabilities when the projects are handed over at completion.

Specifications for contracted works must include a quality section nominating minimum hold points and witness points.

3.7 Safety in Design Report

Safety in Design (SiD) means the integration of control measures early in the design process to eliminate or, if this is not reasonably practicable, minimise risks to health and safety of workers and users throughout the life of the structure which is being designed.

Safety in Design begins at the concept development phase when making decisions about:

- The design and its intended purpose
- Materials to be used
- Possible methods of construction, maintenance, operation, demolition or dismantling and disposal.

- What legislation, codes of practice and standards need to be considered and complied with.

The WHS Act (2012) requires designers to ensure, so far as is reasonably practicable, that a structure is designed to be without risks to the health and safety of persons who:

- Use the structure for a purpose for which it was designed
- Construct the structure
- Carry out any reasonably foreseeable activity in relation to the manufacture, assembly, use, maintenance, proper demolition or disposal of the structure
- Are at or in the vicinity and are exposed to the structure or whose health and safety may be affected by an activity related to the structure.

The Safety in Design process involves a risk management approach where risks are identified, assessed and control measures formulated. The risk assessment is typically presented in a Risk Register and particular focus should be given to those risks that are not reasonably known, or atypical. A thorough risk assessment should include consultation with the architect/designer, constructor and maintenance crew/end user.

The complete Safety in Design process shall be fully documented in a Safety in Design Report. The report shall include the Risk Register and any atypical features or residual risks be clearly articulated. Even if no atypical features or residual risks are identified through the risk assessment, this shall be noted in the report. The report shall clearly identify the elements of the design that have been assessed, and note aspects that are designed and therefore are required to be assessed by other persons.

The Safety in Design report shall be circulated to any parties that receive the design drawings. It is the designer's responsibility to ensure the Safety in Design report is issued with the drawings initially, at which point the responsibility for transfer of information is passed on to the receiving person(s).

3.8 Design Basis Report

The designer shall prepare a design basis report describing the requirements of the design including design philosophy, agreed outcomes, agreed previous work, design assumptions, performance standards, relevant codes, standards, design loadings, design lives, work by others etc. This shall be submitted to the principal for approval prior to the commencement of the detailed design or at a later date as agreed with the principal.

The design basis report shall be updated if any significant design requirements change.

3.9 Design Report

Following completion of the design, a design report shall be provided to the principal which will incorporate the drawings, specification, calculations, safety in design report together with any major design assumptions and risks. This should also detail the approval process.

The design report should be approved by the principal.

3.10 Design Life

The design life of assets shall be agreed to by the ultimate asset owner.

Each asset to be handed over to Council should be generally designed and constructed to the design lives in accordance with the IPWEA Practice Note 12 –Useful Lives of Infrastructure Assets unless an alternate asset life is nominated. The assets shall be designed to consider the impacts of climate change (Practice Note 12.1).

Major infrastructure and infrastructure difficult to access for maintenance may require a higher design life.

In addition to design life, whole of life cost and level of service needs to be considered for the selection of appropriate infrastructure.

3.11 Information to be shown on Plans

The Design Engineer is responsible for ensuring that information on plans is shown in sufficient detail to enable plans to be assessed and works to be constructed in accordance with its design intent and to the satisfaction of the Council.

4 Traffic Management Strategy

4.1 Objectives

A Traffic Management Strategy may be outlined in a Traffic Management Assessment Report (TMAR) or a Traffic Impact Statement (TIS).

The objective of a Traffic Management Strategy is to:

- Provide the basis for managing traffic within an existing area, or a new Development and surrounds with respect to traffic volumes and speed;
- Provide efficient traffic flow and a safe road environment for all road users;
- Improve local amenity;
- Improve road safety, especially for pedestrians and cyclists;
- Improve access for local residents and businesses;
- Improve driver behaviour by influencing what is appropriate behaviour, especially in local streets.

Reference should be made to:

- Austroads “Guide to Traffic Management, Part 12: Traffic Impacts of Developments”;
- The New South Wales RTA/RMS Guide to Traffic Generating Developments to source appropriate trip generation rates for the associated land use;
- Austroads “Guide to Traffic Management, Part 8: Local Area Traffic Management”;
- The DPTI web-site <http://www.dpti.sa.gov.au/standards/tass>.

4.2 General

Existing Areas

An existing area may be the subject of a traffic management strategy in order to:

- Encourage motorists passing through the area to use the appropriately classified roads for their journey;
- Manage through and local traffic flows, in terms of both volume and speed;
- Address or improve safety hot-spots;
- Manage intersection and junction conflicts.

Such a strategy may be the outcome of concerns raised by the local community and may involve the conduct of a community consultation process. It may be applied on a street by street basis, or be incorporated into a Local Area Traffic Management scheme (LATM).

Depending on the size and scale of the traffic management strategy, a TMAR may be required, while a TIS will almost always be necessary as a result of introducing new, or modifying existing traffic control devices.

New Developments

Any new development proposal that will significantly change the traffic volume by an accumulated increment of 30% from existing on a road or creates new roads, must provide a Traffic Management Strategy.

The Developer may be required to provide new roads as part of their Development and/or upgrade existing roads, as identified by a TMAR which has made an assessment of the impact of the proposed development. Where mitigating works are required, these must be provided to the satisfaction of the Council.

A TMAR or TIS (which forms the basis of the Traffic Management Strategy) must be prepared by an appropriately qualified practitioner (that is, one who would meet the membership requirements of the Australian Institute of Traffic Management and Planning – AITPM). The practitioner should be experienced in traffic and transport management, noting that Council may request information regarding the proposed Consultant's experience prior to reviewing the Traffic Management Strategy.

A Traffic Management Strategy may be informed by one or both of the following:

- A TMAR that determines the road layout, road widths, functions and connectivity for all road users and/or;
- A TIS to determine impact on the adjacent / external road network and identify appropriate mitigating works.

Some Developments that do not create new roads or intersections may still generate sufficient traffic volume or traffic movement to warrant a traffic management assessment e.g. supermarket, transport hub etc. Such a Development may also require a TIS, noting that the scope for the TMAR and TIS, intent and degree of traffic impact will vary.

Where a TMAR is required to be prepared prior to issuing of the Planning Consent, the submitted Functional Layout plans must not receive endorsement until the traffic control requirements are approved in principle by the Council's Engineering Department.

The provisions of this section also apply to Development or local traffic management changes carried out by Council.

4.2.1 Traffic Management Assessment Report – TMAR

The role of a TMAR is to assess the adequacy of the existing or future transportation system to accommodate additional traffic generated by a proposed development, redevelopment or land use change.

It is also to assist in determining what improvements may be required to transport infrastructure (e.g. roadways, pathways, public transport and traffic facilities, parking etc.) to maintain a satisfactory level of service for the community.

A TMAR may be required where a development affects the function, safety and efficiency of the transport network.

The scope of a TMAR will depend on the location, type and size of the development, proposed access details and the ability of the road network to handle traffic generated by the development. Therefore, some developments will require an extensive and detailed TMAR, while others will require only a brief traffic impact assessment.

Some of the factors that may influence the matters considered within the TMAR may include:

- Whether the Development is based on the current land use zoning and character of the locality;
- The location of the development: CBD, urban, rural area;
- The existing and future planned transport network;
- The location and nature of the direct access to the external road system;
- The staging, size and type of the development;

- The traffic environment at the time of the proposal, and the likely impacts on existing traffic conditions or road safety, both during construction and on completion of the development;
- Existing approved (but not delivered) development within the area;
- Current development applications within the area;
- Any strategic planning determining future land uses such as the State Government development area.

The requirement for a TMAR should be indicated prior to requesting planning consent, with a view to assessing the adequacy of the existing or future transportation system to accommodate additional traffic generated by a proposed development, redevelopment or land use change.

It is also to assist in determining what improvements may be required to transport infrastructure (e.g. roadways, pathways, public transport and traffic facilities, parking etc.) to maintain a satisfactory level of service for the community.

The requirement for a TMAR may be triggered by, but not limited to, any of the following:

- Construction of a new road or road extension;
- Construction of a new intersection or turn in lane;
- Likely impacts on the adjacent road network, traffic environment or road safety;
- Construction of traffic management devices in an area;
- Potential for further development (may need a Structure Plan for assessment);
- Multiple developments within a specific locality;
- Large industry or retail/commercial development.

4.2.2 Traffic Impact Statement – TIS

The need for a TIS should be indicated prior to requesting planning consent, and may be triggered by the following:

- Where developments generate an overall increase in traffic volumes of 10% (AADT, Peak level, Heavy Vehicle etc.) or greater;
- Inconsistent land use development;
- Existing land use changes/extension;
- Possible road hierarchy change, i.e. trigger points by functionality and traffic volume;
- Public transport system changes or a new requirement, e.g. bus route/bus stop;
- Changes to existing car parking arrangements, which may result in either a loss or increase of on-site or on-street parking facilities;
- Additional accesses, or modification to existing accesses which provide connectivity to Major Collector or Sub-Arterial roads;
- Where in the opinion of the road authority the traffic increase will exceed the capacity of the road, affect the safety of road users or affect safe and convenient access to properties.

Where the traffic management and road safety conditions for all road users, including cyclists and pedestrians, will be affected by the installation, operation, alteration or removal of a traffic control device, where both DPTI and the Council require a TIS, one report may be prepared meeting the requirements of both organisations. Noting, DPTI/Council may request a more thorough analysis if negative impacts on traffic facilities have been identified or if particular factors of the development cause concern to the safety, efficiency and operation of their transport network.

If more details are required, DPTI/council encourages a pre-lodgement meeting to be arranged prior to commencing the Traffic Impact Study.

When preparing a TIS, reference should be made to:

- The DPTI web-site <http://www.dpti.sa.gov.au/standards/tass>;
- Austroads “Guide to Traffic Management Part 12: Traffic Impacts of Developments”.

4.3 Requirements

Provision for all road users including public transport, emergency vehicles, commercial vehicles, general traffic and pedestrians and cyclists is to be identified at the functional layout phase or in the Structure Plan. All collector roads must include bicycle paths/lanes, and/or shared paths, and should be designed as bus routes. All paths and walking routes should be developed in accordance with disability access principles, and in accordance with Planning best practice, pedestrian and bicycle paths should generally be located along streets fronted by dwellings. However, alternative routes may be established through Public Open Space as long as it can be demonstrated that safety and security of path users, local residents and property are maintained. Routes should be planned to achieve linkages to other existing and proposed bus, bicycle and pedestrian routes and be based on AUSTROADS principles.

Larger and more significant developments may be required to establish bicycle routes through the Development. Council must review and determine at the functional layout stage the need for these facilities. Development proposals should complement and enhance the principles of any Council Bike Strategy Plans or similar approved policy.

Smaller developments that have bicycle or pedestrian routes adjacent to them should ensure that continuity of the route is maintained and is not interrupted or degraded by the development. Any new routes should be integrated with the existing facilities.

Provision must be made to ensure that no emergency service vehicles, waste and recycling collection vehicles and street-sweepers are required to reverse any significant distance or mount kerbing within the Development. This is in response to recommendations made by the Coroner in relation to fatalities resulting from these types of vehicle movements. In addition to the Coroner’s recommendation Council believes that cul-de-sacs are beneficial to the amenity of the residents living in the cul-de-sac because of footpath connectivity and safer environments for children. Some Development Plans allow three point turns of service vehicles at T-head turn around facilities, therefore T-head facilities will be considered by Councils on their merit (subject to Council approval). Staging of works must not negate this requirement and temporary turning areas may need to be established between Development stages including Carriageway easements as necessary.

Austroads “Guide to Traffic Management, Part 12: Traffic Impacts of Developments” and the DPTI web-site <http://www.dpti.sa.gov.au/standards/tass> provides guidance on the preparation of Traffic Management Assessment Reports and Traffic Impact Statements, including the structure of the report, highlighting the issues that should be considered and addressed. The depth and extent to which the report analyses the impacts will be dependent on the size and nature of each development.

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

- An overall movement strategy for all forms of transport, including pedestrians, cyclists, public transport, service vehicles and private vehicles;
- Estimated traffic volumes;
- Major traffic control items;
- Proposed road closures;
- Road carriageway and reserve widths;
- Roads with direct or restricted property access;
- Determination of road function and connectivity;
- Impact of staged Development;
- Off street and on street parking;
- Pedestrian and cyclist movements within and outside the Development, including having consideration of the quality of the streetscape (including green infrastructure and potentially WSUD) to encourage/facilitate pedestrian and cyclist movement (this should include the provision of Walkability Scoring);
- Walking and cycling infrastructure should consider continuous levels of service for a range of users across a network, intuitive wayfinding and accessibility principles/requirements, particularly in terms of how the new development integrates with the existing facilities;
- Egress and entry to the Development;
- For large retail commercial and industrial Developments, loading and unloading of deliveries;
- Traffic calming devices should consider the following:
 - Roundabouts;
 - Traffic islands;
 - Parallel slow points;
 - Driveway links;
 - Road humps;
 - Bus routes, bus stops, and bus bays.

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

- Estimated traffic volumes;
- Proposed road closures;
- Impact of staged Development;
- Pedestrian and cyclist movements;
- Egress and entry to the Development;
- Emergency vehicle access;
- Details of the installation, removal or alteration to a traffic control device;
- Recommendations for appropriate mitigating works.

Swept path diagrams for vehicles accessing the site should be provided in all cases. In some instances, applicants may need to demonstrate that forward entry and egress, and that simultaneous opposing movements at access locations can be achieved.

TMAR's and TIS's should clearly present all recommendations resulting from the relevant investigation, which would normally be the responsibility of the Developer to implement. In some cases, the Designer may consider that some recommendations should not necessarily be the responsibility of the Developer, in which case, the reasons for such a conclusion should be clearly stated. Council may then consider those recommendation(s), and either:

- Disagree with the recommendation(s), in which case their reason for doing so should be documented and conveyed to the Developer, or
- Agree that the recommendation(s) in question do in fact, fall beyond the responsibility of the Developer, and they should therefore consider incorporating them into their own Capital Works Program.

The Traffic Management Strategy should also address the Council's current Development Plan objectives and standards.

All Traffic Control Devices require written approval from Council or in some cases, DPTI prior to implementation, in accordance with the requirements of the Instrument of General Approval and Delegation to Council, and DPTI's Code of Technical Requirements. However, it is the responsibility of the Designer to determine these needs and ensure that these approvals are obtained in a timely manner such that they do not impact on the programmed works.

Parking must be shown on a separate plan to the satisfaction of the Council at the time 'Approval of functional layout' is sought for a Development. Where Developments create new roads (e.g. land divisions) a parking plan must be submitted demonstrating that the Council Development Plan parking requirements are achieved, noting that this normally includes at least one practical space being provided per two allotments within a reasonable distance (refer Section 9), with the parking provisions being achieved outside of any cul-de-sacs.

For larger industrial, commercial and retail Developments the TMAR must consider:

- Traffic and pedestrian conflict points;
- Location of loading zones and movement of forklifts and other vehicles for loading and unloading;
- Ingress and egress from the site for both the general public and the commercial traffic;
- Provision of disabled parking, and
- Parking requirements overall.

Consideration must be had to AUSTRROADS "*Guidelines for Planning and Assessment of Road Freight Access in Industrial Areas*".

4.3.1 Traffic Generation

Although traffic generation is incorporated as part of Section 7.3.1, it should be noted that traffic forecasting requires a more comprehensive process, including trip generation, trip distribution, modal choice, trip assignment, to name a few considerations.

There are recognised guidelines that provide guidance on specific trip generation rates for various land uses, including the RTA NSW *Guide to Traffic Generating Developments 2002* or Empirical results.

All traffic modelling data should be calibrated and validated at the time of the assessment prior to using the data and details of this process are required to be included in the report.

5 Road Safety Audits

5.1 Objectives

A Road Safety Audit is a formal examination of an existing road or a proposal which will change or modify a road or the roadside conditions, in which an independent, qualified examiner reports on the collision potential and safety performance of the existing road / proposal.

The objective of a road safety audit is to identify and limit those circumstances that may lead to a collision, or in the event of a collision occurring, to limit the potential for and severity of injuries.

A Road Safety Audit can be carried out at any stage of a project and may consist of a multiple stage audit review process ranging from the audit of existing roads through to the principal stages of a design project – that is, Feasibility, Concept Design, Preliminary Design, Detailed Design and Post Construction.

The Road Safety Audit should be carried out with reference to:

- Austroads “Guide to Road Safety Part 6: Road Safety Audit.

5.2 General

Existing Roads

A Road Safety Audit can be conducted on an existing road which either has a poor safety history, or is perceived to have recognisable hazards and therefore the potential for crashes to occur. Similarly, a Network Road Safety Audit can be conducted on a network of roads to identify common hazards and issues that may apply across the broad network (for example, deep drainage swales close to the running edge of roads).

The purpose of conducting a Road Safety Audit on an existing road is to identify those hazards and issues which should be addressed as a matter of safety. Depending on the nature of the issue(s) identified, rectification may range from simple maintenance carried out within a relatively short timeframe (e.g. replacement of a sign), to inclusion of the project in the Capital Works Program, where the work will be carried out at a later date, subject to funding.

A Road Safety Audit can be used as a basis for seeking project funds, such as from a Black Spot program.

New Works

Road safety should be considered throughout all phases of a road upgrade or construction. Traffic safety must be formally considered at both the design and construction stages for all projects, and may also be required at a staged part of the construction (for example, where it is required to close one lane of a road). It should be noted that conducting a road safety audit at the design stage before a road is built provides the most cost-effective outcome in detecting and rectifying safety oversights.

5.3 Requirements

Road Safety Audits should be conducted with a view to identifying safety issues that could have an adverse impact on any road user, including vulnerable road users such as motor-cyclists, cyclists and pedestrians. They must be undertaken for all designs that require a Traffic Management Strategy (refer to Section 4) or where the Traffic Impact Statement indicates that significant safety issues may occur. They must be conducted at the detailed design stage and again after construction is completed. It may also be beneficial to carry out a Road Safety Audit at the Preliminary Design stage on larger developments that may have a degree of complexity involved in the design development. This will enable safety issues to be identified early in the design development, enabling them to be considered and addressed when detailed design is undertaken.

Audits must be conducted by an Accredited Road Safety Auditor, other than the road Designer, and must be carried out in accordance with AUSTROADS *“Guide to Road Safety Part 6: Road Safety Audit”* and any DPTI supplement to those guidelines.

For larger, more complex projects / developments, the Audit team should consist of two or more experienced, qualified people with at least one Senior Road Safety Auditor on the team. However, for smaller, relatively straight forward projects, the Audit may be undertaken by a single Auditor in order to maintain costs at a reasonable level. The decision as to whether the Audit is to be undertaken by a single Auditor or a two-man team should be made early in the development process, with the following factors being some of the considerations that may be taken into account:

- The overall size of the development;
- The staging of the development;
- The interface with Collector or Arterial roads;
- The terrain in which the Development is taking place;
- The likelihood of people visiting the Development (once it has been completed) not being familiar with the area.

When selecting the audit team the Design Engineer must be responsible for determining that the Senior Road Safety Auditor has suitable experience for the type of works proposed, or that such experience is incorporated into the audit team.

Audit teams must be independent of the design team but this does not preclude in-house audits on smaller projects. However, on larger projects it is preferable to ensure independence by requiring the Audit team to be from another organisation.

The Audit report should provide some contextual background to the project, the Audit process and the issues identified. Each of the issues should be discussed to explain why it is considered a safety hazard, and the degree to which it is considered so – that is, given a priority or urgency ranking.

While the presence of a safety issue may be identified, it is not necessarily the Auditor’s responsibility to provide a solution, although in many cases, some guidance may be given. However, the ultimate decision on the action taken to address the safety deficiency rests with the Designer in conjunction with the Project Manager. Consultation with Council’s Engineering Department is encouraged if recommendations are complicated or require community involvement. Having made the decision on the action to be taken, it is not necessary to seek the Auditor’s “approval” or acceptance, although it is considered good practice to inform the Audit team of the decisions that have been taken and the reasons for doing so.

To this end, the Designer / Project Manager must provide a formal response to the Audit Findings, stating clearly how it is intended to address each of the identified issues. If it is decided to reject a recommendation, the reasons for doing so must be clearly stated. The Audit and the Response should then be incorporated into the project file and retained for future reference. A copy of the road safety audit report, with documented responses to recommendations, must be provided to Council’s Engineering Department with the detailed design documentation.

An additional road safety audit post construction may be required by Council if the design / construction has a degree of complexity associated with it, or if changes have occurred during construction that may affect safety.

6 Stormwater Management Plans

6.1 Objectives

The objective of the Stormwater Management Plan is to identify solutions to address how the quantity and quality of stormwater must be managed for any catchment in which a Development occurs or stormwater drainage Infrastructure works take place, to deliver multiple benefits to the community including:

- Apply a risk management framework for hazards / flooding based on catchment characteristics and rigorous data collection;
- Facilitate more productive “fit for purpose” use of stormwater via retention, treatment and re-use at a range of scales;
- Reintegrate urban water into the landscape to facilitate a range of benefits including microclimate cooling, local habitat and provision of attractive spaces for community use and wellbeing;
- Minimise the environmental impacts of stormwater as a conveyor of pollution;
- Preservation, or enhancement, where possible, of the ecological function of the region’s natural watercourses and ecosystems.

6.2 General

The design solutions and management of stormwater runoff quantity and quality must be consistent with any relevant Council Stormwater Management Plan(s), details of which can be obtained from Council’s Engineering Department. In addition to Stormwater Management Plans, Council’s Engineering Department may have completed a number of additional stormwater drainage or flood studies for catchments within their Council area. Where appropriate and available, these will be provided by the Council.

Where the stormwater drainage system has not been previously defined for a proposed land division in a Structure Plan, Developers may be required to provide a separate Stormwater Management Plan. The Developer must engage a suitably qualified and experienced stormwater engineer to prepare the Stormwater Management Plan that addresses all runoff generated within the Development or project area, and/or or transmitted from upstream catchments through the project area. The Stormwater Management Plan submission must include catchment and sub-catchment plans, conceptual stormwater drainage systems including detention, retention, treatment, re-use at a range of scales, flood mitigation and the proposed location and method of stormwater discharge from the system. The plan should also consider water quality (of stormwater runoff and receiving environment), water sensitive urban design (WSUD), erosion management, watercourse protection and flood management.

The need for the Stormwater Management Plan should be provided prior to requesting Planning Consent, and may be triggered by the following:

- Whenever a Structure Plan is prepared;
- Whenever there is a request to have land rezoned;
- Increase in runoff peak flow, volume and quality as a result of a development;
- If there is a sensitive receiving water environment;
- If in the opinion of Council, the additional stormwater may exceed the capacity of the downstream network or adversely impact on water quality;
- If the discharge of stormwater water requires pumps
- If the discharge of stormwater requires easements through private property

- Where Developments include the construction of the following:
 - A new detention basin;
 - Retention and re-use systems;
 - Infiltration systems;
 - A new treatment facility;
 - Increase in outlet pipe size to Council stormwater drainage infrastructure or a watercourse or;
 - A new stormwater drainage outfall
 - A pumped stormwater solution.
- There is potential for significant further Development within the catchment;
- The catchment involves multiple Developers within a specific locality.

Where a Stormwater Management Plan is required to be prepared prior to the issuing of the Planning Consent, the submitted plans must not receive endorsement until the plan is approved in principle by the Council's Engineering Department and where applicable other State Agencies that own downstream drainage assets including SA Water, DPTI and DEWNR.

6.3 Requirements

Where stormwater Management plans are required to be prepared for submission the following applies:

Integration of stormwater and landscape

The Designer should ensure that:

- Stormwater treatment, flood management and detention systems, including basins, are well integrated within public open space to achieve multiple benefits and maximise multiple use opportunities;
- Stormwater management solutions are compatible with the type of public open space (POS): active, passive, conservation or operational. Refer to Section 13.3 for more guidance on relevant design criteria.

Flood risk and waterway protection

- The catchment area is to be carefully analysed and determined and the resultant defined area submitted to the Council's Engineering Department for review;
- The Designer is to base the calculated peak flow on the full potential Development of the project and upstream areas for normal flow situations as well as the overland flooding caused by pipe blockages, general flooding and high water levels;
- Where overland floodwaters or flood-storage is or will be altered or changed as part of a Development, compensatory works must be assessed and implemented;
- Where active floodway's, floodplains and/or flow paths are present, no Development will be approved without hydraulic modelling and analysis. The analysis must identify the extent, velocities and depth of overland flood flows on the Development as well as similar impact on the catchment external to the Development site. The Developer may be further required to submit a risk assessment report including details of proposed works to ensure that the potential for loss of life, risk to health and damage to property is minimised, and how the flood conveyance or storage will be accommodated.

- Changes to any existing wetland should only be considered after all other alternatives have been exhausted. The function of a floodplain is to convey and store flood waters and preserve the inherent values of wetlands. Assessment using the relevant authority's stormwater drainage lines will be undertaken to ensure active and passive flows and seepage are preserved in any application.

Water Quality

- Proposed outfall conditions including quality objectives are to be clearly documented for approval by Council's Engineering Department and other authorities if applicable;
- Stormwater quality treatment measures shall be in accordance with the pollution reduction targets set out in the South Australian Water Sensitive Urban Design Policy;
- Proposed outfall structures shall ensure protection of watercourses from erosion;
- Pumping stations will only be permitted subject to Council consent. The Designer should ensure that the number of retarding basins and pump stations are optimised to reduce Council's ongoing operating and maintenance costs, balanced against other multiple use objectives. Gravity systems are strongly preferred. If a pump station is proposed when a gravity system is possible, it should be justified with a whole of life cost assessment and appropriate consideration of the risk of equipment failure.
- Have consideration to the requirements stipulated for stormwater management plans as published by the SMA from time to time.

Volume of Discharge

Increasing volume of stormwater discharge to watercourses and the marine environment can have a negative impact on watercourse erosion and on the local riverine or marine biodiversity.

Appropriate measures to reduce volume of discharge or not increase volume of stormwater from pre-development flows should be implemented as part of any new development.

7 Road Infrastructure

7.1 Objectives

The objectives of the Road Infrastructure are as follows:

- To develop a network and alignment that meets the existing and future requirements or makes allowance for future requirements;
- To provide a serviceable pavement for the specified lifetime with minimal maintenance;
- To provide an integrated road design that compliments land use and road network environment and characteristics;
- To provide safe and convenient access to all allotments for pedestrians, vehicles and cyclists. Including disabled access where required by legislation;
- To provide for streetscape and amenity improvements;
- To promote connectivity, legibility and shared space;
- To ensure that staged construction methods are planned to meet the immediate, medium term and ultimate pavement and stormwater drainage design requirements;
- Road design meeting Austroads guidelines.

7.2 General

This section sets out the standard design criteria for road works, noting that it is not intended to restrict any alternative arrangements or approaches. Innovative or non-standard designs may be considered, but not necessarily accepted. Sufficient data and principles of design for any innovative or non-standard design must be provided to Council to allow Council's assessment of the merits of that proposal based on the design objectives above.

Aspects not specifically referred to in this Manual should be generally in accordance with the following documents:

- AUSTROADS: "*Guide to Road Design*", incorporating AGRD01 to AGRD07 and all subsections;
- Standard Drawings appended.

7.3 Urban Roads

The design and construction of roads and allotment accesses should meet or exceed the requirements of the AUSTROADS, the Planning, Development and Infrastructure Act, this Infrastructure Guideline (SA) and any other relevant Acts, Regulations and Australian Standards. Where the road or infrastructure interfaces with DPTI infrastructure, the requirements of DPTI's Code of Technical Requirements shall be met (which in some instances may override the fore mentioned documents).

7.3.1 Road Classification

The classification of residential streets within any Development should be in accordance with the 'Urban Road / Street Characteristics Tables' found within Section 7.3.2.

In response to the Development Regulations, Councils may have established a road hierarchy, as well as establishing the overall management of its road network. The road classification referred to within this Infrastructure Guideline (SA) relate specifically to the design and construction of new or upgraded roads.

Consideration of State Government documents including the Integrated Transport and Land Use Plan (www.transportplan.sa.gov.au) and A Functional Hierarchy for South Australia's Land Transport Network (www.sa.gov.au) should also be given when determining road class and how the network fits within the overall State/Federal network.

Ultimate traffic volumes for road classification and road design are to be based upon approved multipliers of existing traffic movements (measured), through traffic, and an estimate of traffic generated by proposed and future Development. Estimated traffic volumes for undeveloped areas must be based upon:

- Recognised guidelines;
- Residential allotments (a guide is trip generation of 6-10 vehicle movements per day per lot).

Where alternative traffic generations assumptions are used in the preparation of a Traffic Impact Study, details of alternatives must be provided to Council's Engineering Department for approval.

Where Council's Engineering Department holds traffic count data on relevant roads, this information may be made available to the Design Engineer. In some instances, the Developer may be asked to undertake additional traffic count data collection on affected roads to ascertain predevelopment traffic volumes and types. This will generally only be asked of the Developer when traffic count data is greater than three years old, or significant Development has taken place since traffic count data was last collected. Where traffic volumes and type vary seasonally, the Design Engineer must use data conservatively and clearly present assumptions with the request for approval of functional layout.

7.3.2 Road / Street Characteristics and Road Reserve Widths

Road reserve widths and road carriageway widths should be based on the road function and should consider the following:

- Ultimate traffic volume and the type and volume of commercial vehicles;
- Typical vehicle ownership in the area (i.e. predominate 4WD in some areas);
- Road carriageway width should include allowance for on street parking, cycle lanes, medians, sheltered lanes, service roads, footpaths, and underground services. Cycle lanes or widened kerb side lanes should be provided in conjunction with shared paths to allow for commuter cyclists.
- Road verges should include allowance for footpaths and shared paths, landscaping, WSUD, street trees, adequate separation from property to carriageway, above ground and underground services and stormwater pipes.
- Stormwater flood flows within the road reserve;
- Minimise impervious areas;
- Minimum verge width (see Tables 1 & 2) to provide for the mature growth of a street tree with significant canopy in accordance with the 30 Year Plan for Greater Adelaide canopy targets;
- Street trees should have a minimum 2.4 metres tree zone to allow for growth and pruning to provide vertical height clearances;
- Shared paths on higher order roads, typically 2.5-3.0 metres wide;
- Footpaths, minimum 1.5 metres wide and to be suitable for pedestrians and cyclists;
- Public lighting – located to adequately light footpaths and the carriageway, and consideration of future road widening;
- Connection of utilities and services to properties, including water, sewer, gas, telecommunications and power;

- Location for waste bins;
- Access for Australia Post.

Road carriageway width and design have variable properties dependent on the location, as a general rule Table 1 below details the Deemed to comply requirements for “Outer Metro Fringe & Townships” Road / Streets and Table 2 details the Deemed to comply requirements for ‘Metropolitan’ Road / Streets. Clever design, for example incorporating indented parking bays with street trees inline and either side, can result in the objectives being met with lesser road widths. Such design is encouraged.

These tables nominate typical parking provisions, footpath provisions and cycle provisions for the given street type, and the minimum carriageway and road reserve widths reflect these provisions. Where the provisions are considered not appropriate (i.e. if there is no demand for on-street parking or no benefit for providing a cycle lane etc.), Council will consider a reduction based on engineering best practice.

Footpath, bus, bicycle and pedestrian provisions are detailed elsewhere in the Infrastructure Guideline (SA). Minimum road reserve widths will not be allowed where they compromise the provision and standard of these road users.

Note that current state legislation permits the use of bicycles on footpaths, in some instances reducing the requirement for on-street cycle lanes. If cycle use is anticipated to be high a shared path configuration may be more appropriate. Where the footpath frequently crosses property driveways or provides access to commercial premises including shop fronts, on-street cycle lanes remain the preferred method of providing cycle provisions.

There is a distinct difference between the function and usage of a shared use path compared to on-street cycle lane. The on-street cycle lane is for the conveyance of commuter cyclists, while a shared use path is primarily used by at risk or social cyclists.

Road reserve boundaries may be curved around cul-de-sacs, but where they are to be fenced as chords, these should not be less than 10 metres. Where a number of such chords occur adjacent to each other, they should, as far as possible, be practically equal.

Cross sections of the various street types shown can be found in Standard Drawings numbered SD500-520.

Classifications and construction of new roads are to be in accordance with Council’s Roads Management Plan and Road Asset Management Plan.

Table 1 – ‘Outer Metro Fringe & Townships’ Road / Street Characteristics – Deemed to comply

Street Type	Indicative Maximum Traffic Volume	Minimum Carriageway Width	Minimum Reserve Width	Minimum Verge Width ¹	Parking Provision within Carriageway	Comments ²
Access Lane (second road frontage)	50 veh/day	5.5 m ³	8.0 m	0.5 m	Yes one side	No footpath unless a pedestrian link
Access Street	1500 veh/day max	7.6 m	15.0 m	3.5 m	Yes (both sides)	Footpath one side. No separate cycle provision
Level 1 Collector/Connector Street	3000 veh/day max	11.0 m	20.0 m	3.5 m	Yes (both sides)	Widened kerbside lane for cyclists. Footpath both sides
Level 2 Collector/Connector Street	15,000 veh/day max	2 x 7.0 m + 5.0 m median + 2 x 1.5 m cycle lanes	29.0 m	3.5 m	Yes (both sides)	Forward access / egress to properties. Footpath both sides. Cycle lanes both sides
Level 2 Collector/Connector Street	>15,000 veh/day max	To be designed, 2 lanes minimum each way	To be designed	3.5 m	Yes (both sides)	No direct property access or service road. Footpath both sides. Cycle lanes both sides
Residential Cul-de-sac		9.0 m radius	25.0 m (31.0 m with parking)	3.5 m	12.0 m radius if parking in the bowl	Footpath one side. No separate cycle provision
Commercial Street (with angled parking)	n/a	12.0 m (19.0 m)	20.0 m (26.0m)	3.5 m	Yes (both sides)	Footpath both sides. Cycle provision where directed
Industrial Street	n/a	10.2 m ⁴	20.0 m	3.5 m	Yes (both sides)	
Industrial Cul-de-sac	n/a	15.0 m radius	37.0 m	3.5 m	n/a	

¹ Minimum Road Verges widths shall be increased where practical to typically 4.5 metres to allow for a footpath/shared path, street tree and waste bin. Road verge widths need not be the same on both sides of the road and the road carriageway can be off set within the road reserve. The Designer must ensure that verge widths are sufficient to accommodate all services that are required to be located within the verge.

² Footpath and cycle lane provisions have been noted, but where appropriate a footpath and/or a cycle lane may be substituted with a shared path.

³ Designers need to ensure that the road reserve width adopted complies with the requirements of the following documents and Authority requirements:

- DPTI - Public Transport Guidelines;
- Various walkability and bicycle strategies;
- Country Fire Service / Metropolitan Fire Service may require the minimum Carriageway width to be 7.3 metres in certain areas unless parking is restricted to one side.

⁴ Lesser width industrial road reserve may be permitted for short industrial cul-de-sacs however turning at the cul-de-sac will not be compromised.

Conversely higher traffic volumes and intended use/s of the carriageway may require greater carriageway widths.

Table 2 – ‘Metro’ Road / Street Characteristics – Deemed to comply

Street Type	Indicative Maximum Traffic Volume	Minimum Carriageway Width	Minimum Reserve Width	Minimum Verge Width ⁵	Parking Provision within Carriageway	Comments ⁶
Access Lane (second road frontage)	50 veh/day	5.5 m ⁷	8.0 m	0.5 m	Yes one side	No footpath unless a pedestrian link
Access Street	1500 veh/day max	7.2 m	14.0 m	2.6 m	Yes (both sides)	Footpath one side. No separate cycle provision
Level 1 Collector/ Connector Street	3000 veh/day max	11.0 m	16.2 m	2.6 m	Yes (both sides)	Footpath on both sides no cycle lanes
Level 2 Collector/ Connector Street	15,000 veh/day max	14.0 m	20 m	2.6 m	Yes (both sides)	Footpath on both sides Cycle lanes on both sides
Level 2 Collector/ Connector Street	>15,000 veh/day max	To be designed, 2 lanes minimum each way	To be designed	2.6 m	Yes (both sides)	Footpath on both sides. Cycle lanes on both sides
Residential Cul-de-sac		9.0 m radius	24.0 m	2.6 m	n/a	Footpath one side. No separate cycle provision
Commercial Street (with angled parking)	n/a	12.0 m (19.0m)	20.0 m (25.0m)	3.0 m	Yes (both sides)	Footpath both sides. Cycle provision where directed
Industrial Street	n/a	10.2 m ⁸	20.0 m	2.6 m	Yes	
Industrial Cul-de-sac	n/a	12.5 m radius	32.0 m	3.5 m	n/a	

⁵ Minimum Road Verges widths shall be increased where practical to typically 4.5 metres to allow for a footpath/shared path, street tree and waste bin. Road verge widths need not be the same on both sides of the road and the road carriageway can be off set within the road reserve. The Designer must ensure that verge widths are sufficient to accommodate all services that are required to be located within the verge.

⁶ Footpath and cycle lane provisions have been noted, but where appropriate a footpath and/or a cycle lane may be substituted with a shared path.

⁷ Designers need to ensure that the road reserve width adopted complies with the requirements of the following documents and Authority requirements:

- DPTI - Public Transport Guidelines;
- Various walkability and bicycle strategies;
- Country Fire Service / Metropolitan Fire Service may require the minimum Carriageway width to be 7.3 metres in certain areas unless parking is restricted to one side.

⁸ Lesser width industrial road reserve may be permitted for short industrial cul-de-sacs however turning at the cul-de-sac will not be compromised.

Conversely higher traffic volumes and intended use/s of the carriageway may require greater carriageway widths.

7.3.3 Widths and Treatments of Other Reserves

The widths and treatments of other reserves are to be determined utilising good urban design principles such as ‘Creating Places for People’, ‘Active by Design’ and other relevant guidelines to reduce crime, improve public safety and enhance the local amenity.

Where pedestrian and/or bicycle access reserves are incorporated into Development the minimum reserve width is 10 metres, noting that the width may need to be increased for reserves deeper than one average allotment see Section 13. A vehicle crossing layback and full concrete crossing to title boundary must be provided to all pedestrian and bicycle reserves. Removable bollards must be provided within the reserve 1 metre offset from each adjacent road reserve in sufficient numbers and spacing to prevent vehicular access. Where mountable kerb and channel is used, the layback may be omitted, although the sealed crossing must still be constructed from the back of kerb to the Title boundary, noting that the use of semi-mountable kerb in lieu of driveway inverts is not supported, due to it not conforming with accessibility principles.

A landscaping and lighting plan should be provided to the satisfaction of Council’s Engineering Department for all proposed reserves.

Where reserves are required specifically for provision of services other than those under Council’s responsibility, those reserves must be vested with the relevant authority.

7.3.4 Road Geometry

The geometric design of arterial roads must be in accordance with the AUSTROADS “*Guide to Road Design Part 3: Geometrical Design*” and any DPTI supplement to that publication. For roads that are the responsibility of Council, road geometry must provide sufficient space such that emergency service vehicles, waste collection vehicles and street-cleaning vehicles may carry out their functions while travelling in a forward-only direction throughout the area. Cul-de-sacs strongly preferred to be of bowl geometry.

Staging of works does not negate this requirement and temporary turning areas may need to be established between development stages as required. Where temporary turning areas are to be provided on private land and not in the road reserve an agreement may need to be provided to provide turning areas until such time as the road is extended and/or a permanent turning area is established.

Within urban areas the road network should be designed such that at least 90% of dwellings must be within 500 metres safe walking distance from an existing or proposed bus or tram route and from existing or proposed Active Public Open Space facilities. Pedestrian path mapping should be provided to support the proposed road network layout.

The horizontal alignment of all roads is to be designed in accordance with the requirements of AUSTROADS “*Urban Road Design Manual Part 3: Geometric Design*”.

Where horizontal curves are superelevated, the Design Engineer must ensure that any low points in the kerb and channel resulting from the application of superelevation are adequately drained.

7.3.5 Sight Distances

Consideration must be given to sight distances, particularly at street intersections, horizontal curves, on crest vertical curves and to driveways. Reference must be made to the relevant AUSTROADS “*Guide to Road Design*” and any DPTI supplement to those guidelines as follows:

- General road design AUSTROADS “*Guide to Road Design Part 3: Geometric Design*”;
- Intersections – AUSTROADS “*Guide to Road Design Part 4A: Signalised and Un-signalised Intersections*”;
- Roundabouts – AUSTROADS “*Guide to Road Design Part 4B: Roundabouts*”.

Landscaping plans must be prepared with consideration to sight distance requirements, as must any proposal for ‘Estate Entrance Structures’. Consideration shall also be given to parked vehicles.

Plans submitted for approval must show all existing and proposed features in sufficient detail to demonstrate that appropriate sight distances are achieved.

Sight distances should be based on the posted speed limit plus 10 km/hr or the 85 percentile speed.

7.3.6 Operating Speed

All roads in new developments should be designed to achieve the following target operating speeds. The target operating speed is the desirable average vehicle speed and is to be achieved through the geometric design of the road and may require the inclusion of traffic control devices to achieve / restrict speeds to the target operating speed. It is not the legal speed limit nor is it the design speed (typically the speed limit plus 10 km/hr). Refer also *The Streets for People Compendium* for advice on best practice target street speeds.

Table 3 – Target Operating Speed

Type of Street	Target Operating Speed km/hr
Shared Space	Less than 25
Access Place or Access Street	30
Collector Street Level 1	40
Collector Street Level 2	50
Industrial area	50
Sub-arterial (no direct access)	60

Any sign indicating a speed limit require DPTI approval, noting that if no speed signs are posted then the default within an urban environment is 50 km/hr, or 100 km/hr in a rural environment.

It is preferential to achieve appropriate car volumes and speeds through integrated design, rather than retrofitting local traffic management devices. Speed management using LATM focuses on retrofitting devices to achieve slow or near stop conditions along a street. Traffic calming on a street through an integrated street redesign and reconstruction can create a continuously slower street environment. Key principles for an integrated approach to managing vehicle speeds along a street include:

- Reducing freedom of motor vehicles to speed by limiting total street length, and limiting street carriageway width;
- Limiting the lengths of straight sections (by introducing low-speed bends in the design);
- Introducing slow or stop conditions along the street length to simulate shorter street section lengths or lower-speed alignments;
- Limiting forward sight lines and driver's field of vision.

These design techniques are the key to developing best practice in design of streets for pedestrians and cyclists.

7.3.7 Vertical Alignment and Vertical Curve Requirements

The maximum permissible grade on an arterial road must be in accordance with AUSTROADS "*Guide to Road Design Part 3: Geometric Design*" and any DPTI supplement to those guidelines.

Road design grading should be extended a minimum of 100 metres beyond the end of the street where such street is to be extended in the future. Where new roads meet existing roads, the Designer must check the grading for a distance of 50 metres to check that roads match well and that no abrupt change in grade occurs.

Vertical curves must be provided at all changes of grade in road centreline greater than 1.0%, or changes in grade of kerb and channel greater than 0.5% and comply with the design guidelines set out in the AUSTROADS publication '*Guide to Road Design Part3: Geometric Design*' and any DPTI supplement to that publication. In particular, vertical curves on land division streets must provide the following Stopping Sight Distances:

7.3.8 Limiting Longitudinal Gradients

Where kerb and channel is installed, road grades must fall within the limits shown in Table 4, deviation from the requirements of Table 4 must be discussed specifically with the Council.

Table 4 - Limiting Longitudinal Gradients

Type of Grade	Road Longitudinal Grade
Desirable minimum grade	0.5 % (1:200)
Absolute minimum grade	0.3 % (1:333)
Desirable maximum grade	10 % (1:10)
Absolute maximum grade	16% (1:6) or greater with specific Council approval. (note requirement for DDA complaint footpaths)

The kerb and channel grades on curves must be calculated along the outer kerb for minimum grade and along the inner kerb when grades approach maximum limits.

At intersections, each kerb is to be graded individually around the return and designed to match the kerb grade of the adjoining street and to follow as closely as possible the vertical curve produced on the pavement by designing to match the through street.

7.3.9 Vehicle Turning Movements

Vehicle turning movements are to be examined for design vehicles and check vehicles using the current AUSTROADS Design Vehicle and Turning Path Templates. Road space should be provided such that the design vehicle is able to negotiate a left turn from the left lane without crossing opposite direction lanes or medians and without the need to reverse to complete the turning movement⁹⁹. The identified *Checking Vehicle* may impinge upon opposite lanes except where a median is present as they represent infrequent vehicles accessing local streets, such as articulated vehicles delivering building materials in new estates or furniture carrying vehicles.

All intersection designs must be such that additional clearance from above ground structures is applied to the total swept path of the design vehicle, and not just to the wheel path. The additional clearance required is typically 600 mm, but it is site specific and justification of the adopted additional clearance shall be provided. Vehicle accesses and driveways are NOT to be used for turning movements (despite some Development Plans allowing tree-point turns, this practice is discouraged due to safety concerns). All roadways, right-of-way's and vehicle crossings are to be designed to accommodate a standard vehicle (car).

Turning movement plans must be provided to Council's Engineering Department with the approval of functional layout submission and must show turning movements as nominated in Table 5.

Where a vehicle may cross onto the opposite lane, adequate sight distance should be provided to allow the manoeuvre to be undertaken safely.

⁹⁹ Some Development Plans allow use of any part of the pavement for turning movements in some street types, however, wherever possible this practice is discouraged due to safety concerns.

Table 5 – Selection of appropriate design and checking vehicle and the recommended turning radii

Intersecting Road Types	Design Vehicle	Checking Vehicle
Access St ¹⁰ - Outer Metro Fringe & Township Residential	Single Unit Truck/Bus (12.5 m) Radius 12.5m	Single articulated (19 m) Radius 12.5 m
Access St ¹¹ – Metro Residential	Service Vehicle (8.8 m) Radius 9m	Single articulated (19 m) Radius 12.5m
Industrial ¹²	Single articulated (19 m) Radius 12.5m	Extended single articulated (25 m)
Collector Street / Access Street or Collector Street / Access Place (residential)	Single Unit Truck/Bus (12.5 m) Radius 12.5m	Single articulated (19 m) Radius 12.5m
Collector Street / Collector Street (residential)	Single Unit Truck/Bus (12.5 m) Radius 12.5m	Single articulated (19 m) Radius 12.5m

¹⁰ Special consideration required for streets where a bus route is intended. The designer shall consult with the relevant bus authority to determine if a bus route is likely or not, and design accordingly

¹¹ Special consideration required for streets where a bus route is intended. The designer shall consult with the relevant bus authority to determine if a bus route is likely or not, and design accordingly

¹² Use these for intersections within industrial land use for local/collector intersections. If the precinct is designed for B-Double or larger vehicles, roads intersections should be designed accordingly (refer *Austroads Design Vehicles and Turning Path Templates Guide*).

7.3.10 Cross Section Profiles

Cross-sections must accord with road Carriageway and road reserve widths nominated elsewhere within this Infrastructure Guideline (SA). Typical cross-sections should be included in the documentation and should nominate:

- Type of kerb and channel;
- Pavement construction including material type and depth;
- Surface details;
- Subsoil stormwater drainage, if required;
- Typical footpath offsets;
- Typical service corridors;
- Typical landscaping corridors;
- Cross falls.

The normal cross fall on bituminous pavements should be 3%. Should design speeds require super-elevation of horizontal curves, design of cross fall should be based on the AUSTROADS *“Guide to Road Design Part 3: Geometric Design”*.

Shoulder cross falls should be 5%. Where shoulder cross falls greater than 6% are proposed to be used, at intersections or horizontal curves, approval should be sought from Council’s Engineering Department.

The relative change in grade of kerb line and centreline is not to exceed 0.5%.

Central spoon drains in the road pavement without edge kerbs will only be permitted for road pavements that have no direct property drainage outlets.

Verge cross falls between footpath and back of kerb must be 1:15 desirable maximum and 1:10 absolute maximum, and across the footpath shall be a maximum of 2.5% to achieve DDA compliance. At driveways the maximum grade shall extend a minimum of 500 mm past the property boundary. Should steeper verges be proposed, the Designer is to demonstrate that car access can be provided to effected allotments. Steep driveways shall be checked using the ground clearance template for a B85 vehicle.

Wherever new kerb and channel or footpath is to be constructed adjacent to existing roadways and/or wherever excessive cross falls occur on either the road pavement or road verge, all vehicle crossings to allotments must be checked using standard car templates to ensure that car access can be provided.

Batter slopes should be as is appropriate for the predominant use of the locality, but in areas within the Clear Zone maximum batter slopes are as follows:

- Desirable: 1:6; Maximum 1:4 (investigation required to determine if an errant vehicle can recover or if guard rails are required);
- Residential area driveway slopes 1:10 maximum (within verge).

Whenever it is impractical to provide batters flatter than the maximum slopes specified, the Design Engineer shall consider special treatments such as retaining walls within the property, and in areas prone to erosion consideration must be given to erosion control measures. Where a steeper grade is proposed the Design Engineer shall demonstrate that safety and functionality will not be compromised and seek approval from Council. Where it is desirable to fill on the low side of the road, special consideration to driveway grades is required to demonstrate that access is not compromised.

7.3.11 Footpaths

Footpath cross falls must be 1:50 desirable and 1:40 maximum to be DDA compliant and in conformance with AS/NZS 1428 and AUSTROADS “*Guide to Road Design Part 6A: Pedestrian and Cyclist Paths*”, unless approved otherwise on a site-specific basis.

In areas serviced by SA Water or Council owned CWMS the footpath alignment shall consider the location of the property connection inspection point (which is typically 300 mm offset from boundary) and either be clear of or completely encompass the inspection point for new roads/streets, and ideally located away from overhanging street tree canopies (where existing trees are prone to drop seeds or branches) and on the same side of the road as the public lighting. The alignment should consider safe and convenient access for the sight impaired.

In accordance with Austroads, Healthy by Design principles and best practise the footpath width should be the following widths:

- 3.5 metres or wider along busy shopping strips;
- 3 metres alongside bus stop areas;
- 2 metres for two wheelchairs to pass one another;
- 1.5 metres for a wheelchair user and accompanying guiding person.

The desirable minimum pedestrian path width for movement is 2 metres or greater which allows space for pedestrians and cyclists. Place-related pedestrian activities on the footpath require additional width.

Wherever possible footpaths should be constructed of permeable materials to maximise infiltration of stormwater runoff.

7.3.12 Kerb and Channel

All urban streets must be constructed with a sealed pavement and provided with kerb and channel unless the street is a laneway with a central spoon drain for stormwater drainage or where alternative treatment is integral to a WSUD application.

Kerb and channel must be such that adequate and safe access to each allotment is available to vehicles, bicycles and pedestrians, and that stormwater drainage needs are fulfilled. Kerb and channel types are to be constructed in accordance with the Standard Drawings as found in Appendix A, and with the following:

- Barrier kerb with constructed driveway inverts is strongly preferred for all kerbing. Semi-mountable kerb and channel may be used for urban residential areas with the approval of Council;
- The provisions for vehicular access must comply with Section 7.8 of this Infrastructure Guideline (SA);
- The transition between differing types of kerb and channel should be either (i) immediately after a kerb crossing, or (ii) over a 3 metre length after a Side Entry Pit (SEP) where pit has standard/barrier lintel and pit is located at tangent point of kerb return;
- Semi-mountable kerb must be used for medians and traffic islands to prevent damage to the infrastructure.

Subsoil stormwater drainage must be provided below all kerb and channel where there is a potential for groundwater to migrate under the pavement.

Where non-standard kerb profiles are to be matched (including bluestone kerbing), consultation with Council’s Engineering Department shall be required to determine the most appropriate kerb to be used.

Developments in areas with heritage characteristics may require heritage style kerb and channel construction. Heritage style kerb and channel should comply with Council's Standard Drawings unless otherwise approved.

Where coloured concrete is to be used, the colour should be 'standard' to allow future maintenance.

Kerb crossings must be constructed at approved locations and must comply with the Standard Drawings as found in Appendix A. Kerb crossings near intersections must be located far enough from the intersection such that each ramp is fully constructed to height of back of kerb, as per standard drawings and Australian Standards.

Control joints must be constructed as per the Standard Drawings, refer Appendix A.

7.4 Rural Roads

The following requirements generally apply to new roads and upgrading of existing roads in rural areas or serving rural living developments. Rural roads are considered as any road not identified through the Council's development plan as being part of a township, or metropolitan area.

7.4.1 General

The design and construction of roads and allotment accesses should meet or exceed the requirements of the AUSTROADS "*Guide to Road Design*", this Infrastructure Guideline (SA) and any relevant Acts, Regulations and Australian Standards. Where the road or infrastructure interfaces with DPTI infrastructure, the requirements of DPTI's Code of Technical Requirements shall be met (in some instances may override the fore mentioned documents).

New and upgraded roads in Rural Living Developments must be to full road construction standards although spray seal roads and swale drains in place of kerbing may be acceptable.

All new roads are to be designed to ensure no cut off swales are directed into open space, or private property. Discharge shall be directed to a legal point of discharge at all times.

Every property (both private and public) must have an appropriately designed and constructed access through or over swales, in accordance with Section 7.8.

Traffic generated as a result of a Rural Development or Rural Living Developments must be encouraged to use the route as identified for access in the submitted documents. To that end, if the development cannot be appropriately serviced by existing infrastructure, Council may require affected off-site intersections to be upgraded and appropriate additional signage be provided.

Where works are proposed within an existing road reserve, the Developer must obtain approval through Section 221 of the Local Government Act from the relevant authority before commencement of works.

7.4.2 Road Reserves

Road reserve widths must be sufficient to accommodate the road Carriageway, required services with approved clearances, pedestrian and bicycle access where appropriate, parking, stormwater drainage and bus routes where Development is significant. Should the design incorporate WSUD devices, an increased road reserve width may be required.

Minimum road reserve widths in rural living Developments must be 20 metres, however additional reserve width is encouraged to facilitate landscaping and pedestrian/bicycle facilities.

Splays at intersections must be in accordance with Section 7.5.5 of this Infrastructure Guideline (SA).

Table 6 - Rural Road Characteristics

Road Type	Indicative Maximum Traffic Volume	Minimum Reserve Width	Minimum Seal Width	Minimum Shoulder Width	Kerbing
Rural Living Access Road	500 veh/day max. (maximum length 1000 m)	20.0 m	6.2 m	1.0 m	nil
Rural Living Collector Road	1500 veh/day max.	20.0 m	7.2 m	1.5 m	nil
Rural Living Cul-de-sacs ¹³	n/a	25.0 m	9.5 m	1.5 m	n/a

Cross sections for the above road types can be viewed in the Standard Drawings.

7.4.3 Rural Living Development within a Bushfire Protection Area

In accordance with the Minister's Code: "Undertaking Development in Bushfire Protection Areas" it is essential that all residents in Bushfire Protection Areas, as well as fire-fighting and emergency services (personnel and vehicles), can safely enter and exit the allotments proposed to be created by the land division. For this reason, public roads created by land divisions shall:

- Be constructed with a formed, all-weather surface;
- Be constructed away from hazardous vegetation such as overhanging limbs and continuous cover of thick vegetation;
- Be located such that the need to clear native vegetation or a significant tree is minimised;
- Have a minimum formed road width of 6 metres;
- Have a gradient of not more than 16 degrees (i.e. a maximum slope of 1:3.5) at any point along the road or driveway;
- Allow fire-fighting services (personnel and vehicles) to travel in a continuous forward movement around road curves by constructing the curves with a minimum external radius of 12.5 metres;
- Provide for a mainly continuous street pattern serving new allotments that eliminates the use of cul-de-sac or dead end roads. Where this is not practicable such roads must not exceed 200 metres in length and the end of the road should have a turning area with a minimum formed surface radius of 12.5 metres;
- Incorporate solid, all-weather crossings that are capable of supporting fire-fighting vehicles with a gross vehicle mass (GVM) of 21 tonnes, over any watercourse identified on either a current State Government topographic map (1: 50 000) or otherwise identified as a crossing required to provide appropriate access for fire-fighting vehicles.

¹³ Where the Development is located within a Bushfire Protection Areas, please refer to section 7.4.3 for further details.

7.4.4 Road Geometry, Horizontal and Vertical Alignments

The geometric design of rural roads, including horizontal and vertical alignments, is to be based on AUSTROADS “*Guide to Road Design Part 3: Geometric Design*” and any DPTI supplement to those guidelines, unless otherwise noted within this Infrastructure Guideline (SA).

Widths must be in accordance with Table 6, with road geometry in rural living Developments providing sufficient space such that emergency service vehicles and waste collection vehicles may carry out their functions while travelling in a forward-only direction throughout the Development. Significant Rural Living Developments may require provision for school buses. Roads must be designed such that these vehicles do not need to reverse.

Staging of works does not negate the requirement for forward only turning and temporary turning areas may need to be established between Development stages including Carriageway easements as required. This may therefore require temporary table drains around these turning areas.

Road design grading should be extended a minimum of 100 metres beyond the end of the street where such street is to be extended in the future. Where new roads meet existing roads, the Designer must check the grading for a distance of 100 metres to check that roads match well and that no abrupt change in grade occurs.

7.4.5 Sight Distances

Adequate horizontal and vertical sight distance should be provided for the design speed in accordance with AUSTROADS publication ‘*Guide to Road Design Part 3: Geometric Design*’ and any DPTI supplement to those guidelines.

Landscaping plans must be prepared with consideration to sight distance requirements, as must any proposal for ‘Estate Entrance Structures’. Consideration shall also be given to parked vehicles. Plans submitted for approval must show all existing and proposed features in sufficient detail to demonstrate that appropriate sight distances are achieved.

7.4.6 Vertical Curve Requirements

Vertical curve design should comply with AUSTROADS publication ‘*Guide to Road Design Part 3: Geometric Design*’ and any DPTI supplement to those guidelines. Vertical curves on rural roads must be designed to provide Stopping Sight Distances for the design speed for the particular road. Vertical curves should coincide with the horizontal curves wherever practical.

7.4.7 Limiting Longitudinal Gradients

Rural type roads without kerb and channel may have a minimum longitudinal grade of 0.2%, unless otherwise agreed in writing, subject to the table drains being independently graded at a minimum of 0.5%. The maximum longitudinal grade for rural roads is 15%, and must be restricted to a distance of 150 metres maximum. The maximum longitudinal grade for rural roads adjacent to intersections is 10%.

7.4.8 Cross Section Profiles

There must be two lanes of traffic on Rural Living roads.

The normal cross fall on bituminous pavements should be 3%. Should design speeds require super-elevation of horizontal curves, design of cross fall should be based on the current AUSTROADS “*Guide to Road Design Part 3: Geometric Design*” and any DPTI supplement to those guidelines.

Where cross falls of greater than 6% at intersections or horizontal curves are proposed, approval should be sought from Council's Engineering Department.

Batter slopes are to be as is appropriate for the predominant use of the locality and must be designed with consideration to Clear Zones as defined in AUSTROADS "*Guide to Road Safety Part 6: Roadside Design, Safety Barriers*" and any DPTI supplement to those guidelines.

7.4.9 Vehicle Turning Movements

The Design Engineer must be responsible for identifying all possible turning movements and make allowance for these in the road design. Turning movements must be shown on plans and provided at the Council's Engineering Department request. Noting that Rural and Rural Living Areas are often utilised by sole trading truck companies due to the large allotment sizes.

7.4.10 Kerb and Channel at Cut Embankments

Where steep sections of road are in cut (embankments), consideration should be given to the placement of kerb and channel to prevent the scouring of roadside drains.

7.5 Intersection Design

7.5.1 General

Intersections are to be designed and constructed such that they function in a safe, convenient and appropriate manner for the type of street/road. They are to be designed in accordance with AUSTROADS publication '*Guide to Road Design Part 4A: Non-Signalised and Signalised Intersections*' and AUSTROADS "*Guide to Road Design Part 4B: Roundabouts*" and any DPTI supplement to those guidelines.

Intersections with state rural or urban roads or national highways are to be designed, approved and constructed in accordance with DPTI requirements and approval process.

'T'-junctions should be adopted in preference to four-way intersections. Where 4-way intersections, or cross intersections, are to be constructed, traffic control treatment may be required.

Where existing or future intersections are in a configuration deemed likely to cause traffic problems, the Developer may be required to construct traffic islands, or such traffic facilities to provide traffic control and safety. Road centrelines should intersect at an angle between 70 and -110 degrees.

7.5.2 Level of Treatment

The appropriate level of treatment at intersections depends on the characteristics of existing and proposed connecting roads. Consideration must be given to AUSTROADS publication '*Guide to Road Design Part 4A: Non-Signalised and Signalised Intersections*' and any DPTI supplement to those guidelines when determining the level of treatment at intersections.

If roundabouts are incorporated into intersections, the roundabout must be designed in accordance with the current edition of AUSTROADS publication '*Guide to Road Design Part 4B: Roundabouts*' and any DPTI supplement to those guidelines.

On Council roads, DPTI has provided delegated approval for the installation of certain types of roundabout (excludes non-standard, mini, and dog-bone roundabouts); however this approval to Councils has a number of conditions, one of which requires timely reporting back to DPTI. Any roundabout excluded from the delegated approval given to Council must seek approval from DPTI; the onus of gaining approval is on the developer.

7.5.3 Special Considerations

For intersections where the proportion of over-dimension or large combination vehicles is higher than the normal percentage in the traffic stream or there is significant seasonal commercial traffic the intersection requirements may be more significant. The Traffic Management Strategy should address this issue and make recommendation regarding these intersections (see Section 4).

7.5.4 Intersection Spacing

The spacing of intersections should generally comply with the requirements of the Councils Development Plan, unless otherwise agreed with Council's Engineering Department.

Intersection spacing on State Arterials requires DPTI approval. Access to State Arterials will be in accordance with Access Management Policies that may apply. Developers are encouraged to discuss access to State Arterials early in the Planning application process.

Intersections must be designed and located to provide a safe environment for all street users, with clear indication of right-of-way priority for pedestrians, cyclists and vehicles.

7.5.5 Splays / Corner cut-off

Splays of suitable dimensions must be provided at all corners of new or upgraded intersections considering traffic safety, sight distance, provide adequate verge for a footpath (if required) and/or accommodate the provision of services (including street lighting). Splays should typically not be less than 4 metres x 4 metres, and for higher speed roads will be greater. The Design Engineer is to justify the proposed splay and seek Council approval where proposing less than 4 metres x 4 metres or where traffic speed exceeds 60 km/hr.

7.5.6 Kerb Returns

At intersections, the minimum kerb return or edge of seal radius is as follows:

- | | |
|--|----------|
| • Residential areas (inner metro) | 6.0 m; |
| • Residential areas (outer metro/fringe/townships/rural) | 9.0 m; |
| • Collector Street | 12.50 m; |
| • Arterial Road | 15.0 m; |
| • Industrial / Rural areas | 12.5 m. |

Further to this, kerb radii must be designed based upon turning movement requirements as detailed in Section 7.3.9.

7.5.7 Traffic Calming

All roads should be designed to remove the need for Local Area Traffic Management devices in accordance with best practise; however, where traffic calming devices are required due to the road layout not naturally creating a low speed (safe) environment, the Design Engineer shall identify these and prepare a Traffic Impact Statement (TIS).

The Design Engineer must determine any necessary traffic calming devices (slow points, road humps, roundabouts, chicanes and splitter islands, etc.) in accordance with AUSTROADS "*Guide to Traffic Management Part 8: Local Area Traffic Management*" and any DPTI supplement to those guidelines and DPTI "Manual of Legal Responsibilities and Technical Requirements for Traffic Control Devices – Part 2 Code of Technical Requirements". The supply and installation of traffic control devices must comply with

AS/NZS 1742 Parts 1-15 *Manual of Uniform Traffic Control Devices*. The subdivisional layout should be the primary means of limiting vehicle speeds in residential and rural living streets.

Where traffic calming devices can be approved by Council's Engineering Department, the following issues need to be addressed as part of the submitted Traffic Impact Statement (TIS) as a minimum:

- Streetscape
 - Reduce the linearity of the street by segmentation;
 - Avoid continuous long straight lines (e.g. kerb lines);
 - Enhance existing landscape character;
 - Impact from traffic calming device on surrounding local network due to possible traffic diversion;
 - Any changes to traffic noise as a result of the traffic calming device on existing networks;
 - Maximise continuity between existing and new landscape areas;
 - Integrate with WSUD features e.g. raingarden wherever possible.
- Location of Devices/Changes
 - Devices other than at intersections should be located to be consistent with streetscape requirements;
 - Existing street lighting, stormwater drainage pits, driveways, and services may decide the exact location of devices;
 - Confirmation of the existing/future network hierarchy and the impact the traffic calming may have on the hierarchy.
- Design Vehicles
 - Emergency vehicles must be able to reach all residences and properties;
 - The design vehicle and checking vehicle in 7.3.9 should be able to manoeuvre through the devices at low speed without damaging the device or any landscaping (including turning paths at clash points);
 - Where bus routes are involved, buses should be able to pass without mounting kerbs and with minimised discomfort to passengers.
- In newly developing areas where street systems are being developed in line with Local Area Traffic Management principles, provision should be made for building construction traffic, including control of Vehicle Speeds
 - Maximum vehicle speeds can only be reduced by deviation of the travelled path. Pavement narrowing's have only minor effects on average speeds, and usually little or no effect on maximum speeds;
 - Speed reduction can be achieved using devices that shift vehicle paths laterally (slow points, roundabouts, corners) or vertically (humps, platform intersections, platforms pedestrian/school/bicycle crossings);
 - Speed reduction can be helped by creating a visual environment conducive to lower speeds. This can be achieved by 'segmenting' streets into relatively short lengths (less than 300 metres) using appropriate devices, streetscapes, or street alignment to create short sight lines.
- Visibility Requirements (sight distance)
 - Adequate sight distances should be provided for pedestrians, cyclists and drivers to allow evasive action by either party in a potential conflict situation and must reflect the likely operating speeds;

- Sight distances to be considered include those of and for pedestrians and cyclists, as well as for others;
- Night time visibility of street features must be adequate. Speed control devices particularly should be located near existing street lighting if practicable and all street features/furniture should be delineated for night time operation. Additional street lighting must be provided at proposed new speed control devices located away from existing street lighting.

It should be noted that all traffic calming devices require Council approval, and certain devices require DPTI approval. It is the Designer's responsibility to obtain the necessary approvals. Designers should refer to the DPTI "*Manual of Legal Responsibilities and Technical Requirements for Traffic Control Devices – Part 2 Code of Technical Requirements*".

7.6 Pavement Design

The minimum depth of flexible or rigid pavement for the proposed pavement and proposed pavement materials must be determined by design by a Qualified Engineer, with the pavement design submitted to Council's Engineering Department for approval.

Geotechnical information on the subgrade material and any non-standard pavement materials should be provided with the design.

7.6.1 Sub-Grade Analyses

Pavement design must be based on the results of sub-grade analysis, which typically includes dynamic cone penetrometer (DCP) tests as a relatively low cost test to obtain in situ strength of the subgrade materials, and 4 Day soaked Californian Bearing Ratio (CBR) tests carried out by a NATA registered testing laboratory. The location and frequency of sub-grade soil sampling is required to be determined taking into account local soil conditions and geology, terrain, presence of fill and existing pavement type (if present). Subgrade samples are typically taken at intervals of 100-200 metres, in the turning head of all cul-de-sacs, at all intersections and at all obvious locations where existing sub-grade material changes suddenly. Core samples must be bored to a minimum depth of 1.0 metre below final road sub-grade level, with cores logged to note any changes in material classification, plasticity, moisture content and presence of gravels etc. The soil sample used for laboratory testing must be taken from the core at sub-grade level. The design CBR adopted should consider all sub-grade test results, but be conservative in the adoption. Full details of sub-grade test results and core samples must be submitted to Council with the detailed design plans.

If a pavement subgrade is considered highly reactive, the pavement design should be designed accordingly.

7.6.2 Flexible Sealed Road Pavements

Flexible sealed road pavement designs must be undertaken in accordance with the current version of AUSTROADS '*Guide to Pavement Technology Part 2 – Pavement Structural Design*'. Pavement design must be carried out using equivalent standard axle loadings based on the ultimate design traffic and a 40 year minimum design life for residential and commercial roads. Pavement design for industrial roads must be based on a 40 year minimum design life. The DPTI Supplement to Austroads Guide to Pavement Technology Part 2 should also be referred to, as this document contains a range of specific information relevant to South Australia.

To take into account the heavy vehicle traffic generated by construction during the development of land divisions, the Design Traffic computed for design of flexible pavements, DESA, shall be increased by not less than the values outlined below:

- Access Lane 5%;
- Access Street 3%

For low volume residential roads DPTI's Fine AC mix is recommended. The use of polymer modified binders in the asphalt is encouraged, and can be particularly relevant for heavy duty pavements. The DPTI Supplement to Austroads Guide to Pavement Technology Part 2 also contains some commentary on appropriate polymer modified binders for South Australia.

For high volume collector roads deep lift asphalt will typically be required to resist fatigue of the wearing course. Deep lift or full depth asphalt pavements may also be desirable to provide sufficient pavement strength for a minimum of pavement thickness where there are shallow services.

7.6.3 Concrete Street Pavements

Concrete street pavement design must be based on the current version of AUSTROADS *'Guide to Pavement Technology – Part 2'*, and for a minimum 50 year design life.

7.6.4 Interlocking Pavers

For safety, operational, noise and maintenance requirements, interlocking block street pavements are not the preferred pavement surfacing, and approval for use shall be sought from Council. However, in situations such as traffic calming devices and where WSUD principles are to be incorporated their use may be desirable. Where approval is given the pavement and pavers must be designed in accordance with the CMAA Segmental Paving Technical Manuals, to a minimum 40 year design life. Note the paver thickness is not included in the road pavement design thickness (i.e. overall thickness = design pavement thickness + paver thickness).

Interlocking paving shall be shape type A, and desirably constructed in a herringbone pattern. The road slope desirably should not exceed 10% (or in accordance with manufacturers specifications) and on slopes exceeding 5% suitable drainage shall be installed to minimise sand and water migration.

Concrete paving units shall comply with the specifications CMAA Segmental Paving Technical Manuals and AS/NZS 4455.2 Masonry Units, Pavers, Flags and Segmental Retaining Wall Units – Part 2 Pavers and Flags. They shall be a minimum of 80 mm thick for trafficable areas. The colour and shape are to be agreed with Council.

Paving bedding sand shall be an approved washed or unwashed pit, river or quarry material. It shall be free of pebbles, clay lumps, organic or deleterious matter, soluble salts or other contaminants likely to cause efflorescence or lead to reduced skid resistance. It shall comply with the DPTI standard specification for sand (Sa-A) as per the DPTI Master Specification.

The material used for filling between pavers shall be an approved proprietary silicone based sand product, which may be broomed and vibrated into place but which ultimately provides an effective, flexible, bound sealant that will resist unintended extraction by vacuum street cleaning equipment.

The finished levels of the block paving shall be to an even and plane surface to within +3 mm, -0 mm from the design levels shown on the drawings. Particular care shall be taken to ensure that the levels of adjoining units correspond and that the units along the edges are between 5 and 10 mm above the lip of the adjacent concrete gutter to provide proper stormwater drainage of the pavement.

The skid resistance of the final block paved surface shall be at least equal to that of the adjoining asphalt surfaces.

Permeable Pavers may be used with prior Council approval, but are not recommended for use over clay or reactive subgrades. Permeable Paver pavements shall be designed in accordance with the Permeable Interlocking Concrete Pavements – Design and Construction Guide published by the CMAA.

7.6.5 Unsealed Pavements

Unsealed road pavements shall be designed in accordance with the current version of AUSTROADS '*Guide to Pavement Technology Part 6 – Unsealed Pavements*'.

7.6.6 Stabilised Pavements

Pavement strength can often be improved by stabilising a reactive subgrade or stabilising the actual pavement materials. Typical forms of stabilisation may include the addition of lime, cement or foamed bitumen.

Geotextiles and geogrids are another means to increase pavement strength over particularly soft or reactive subgrades.

Austrorads *Guide to Pavement Technology Part 5 – Pavement Evaluation and Treatment Design* provides guidance along with various Technical Notes produced by Austrorads.

7.6.7 Minimum Pavement Thickness

Where the pavement design suggests a minimalistic pavement thickness, the pavement thickness adopted shall not be less than 300 mm for roads in which kerb and channel is to be constructed, 200 mm for non-kerbed roads, and 180 mm for car parks. If the asset is to be transferred to DPTI or interfaces with DPTI, DPTI minimum requirements may govern. The sub base layer must extend a minimum of 300 mm past the rear face of any kerb and/or guttering. Note minimum thicknesses are based on unbound granular pavement configurations, and lesser thicknesses may be appropriate for full depth asphalt or rigid pavements.

7.6.8 Minimum Shoulder Thickness

For non-kerbed roads, the pavement must extend at least to the nominated width of the shoulder, and must be a minimum thickness of 180 mm, except in rural cul-de-sacs where the full pavement thickness may be required to extend to the full width of the shoulder (See Section 7.4.4).

7.6.9 Compaction Requirements

Depending on traffic volumes and actual pavement design, compaction will be in accordance with DPTI Master Specification. Compaction testing of subgrade, sub-base and base material must be carried out by a NATA approved laboratory. Different test procedures are required for unbound (granular) and bound (asphalt) pavement layers. Reference shall be made to the DPTI Master Specification for typical testing frequencies and acceptance criteria, and the relevant Australian Standards for test procedures. Tests should be taken at $\frac{2}{3}$ depth of the pavement layer where possible. Copies of all test results are to be submitted to Council's Engineering Department.

7.6.10 Road Material

Roads shall be constructed using materials conforming to the requirements of the DPTI Master Specification, named Supply of Pavement Materials for quarry and recycled materials. For isolated locations supply of compliant materials may be uneconomical and alternative materials may be appropriate, subject to Council approval.

Typical pavement materials used are PM 1 / 20QG for the base course layer and PM 2 / 20QG for sub-base layers, however, a number of variations are generally acceptable. Larger aggregate mixes such as PM 2 / 30QG or PM 2 / 40QG are typically acceptable for heavy duty or industrial pavements. Recycled pavement materials such as PM 2 / 20RG and PM 2 / 30RG are typically acceptable for sub-base layers or working platforms, but are not suitable for the base material directly under a seal. PM3 (Class 3) materials are acceptable for creating a working platform. The selection of materials shall form part of the overall pavement design

which is required to be approved by Council's Engineering Department prior to construction. If materials other than those specifically listed above are proposed to be used, Council approval is required before they can be specified.

The construction of the rubble pavements shall be in conformance with DPTI Master Specification, named Construction of Unstabilised Granular Pavement.

7.6.11 Sub-Grade

The subgrade must be compacted to 98% standard maximum dry density (SMDD) in accordance with AS 1289.5.1.1.

7.6.12 Sub-Base

The typical flexible pavement sub-base consisting of quarry rubble must be compacted to the modified maximum dry density (MMDD) of 96% in accordance with AS 1289.5.2.1.

The number of tests to be undertaken shall be in accordance with DPTI's Master Specification with particular consideration given to intersections and cul-de-sacs. Tests must be taken on alternate sides of the road and be evenly spaced.

7.6.13 Base

The typical flexible pavement base consisting of fine crushed rock must be compacted to the modified maximum dry density (MMDD) of 98% in accordance with AS 1289.5.2.1.

The number of tests to be undertaken shall be in accordance with DPTI's Master Specification with particular consideration given to intersections and cul-de-sacs. Tests must be evenly spaced and taken on alternate sides of the road with test locations to be approximately one (1) metre offset from the kerb or edge of seal and measured at 2/3rd the depth of the layer.

7.6.14 Proof-Rolling

Proof rolling of the subgrade, sub-base and base must be undertaken at the expense of the contractor, in accordance with AS/NZS 3798 and in accordance with the requirements of the DPTI Master Specification. The subgrade must not deflect more than 2 mm vertically within 300 mm of the test roller in isolated locations. Localised areas should be remediated. If deflection of the subgrade is found in more than 20% of the project area, then the total area must be reworked. There must be no visible deformation or cracking of the pavement during a sub-base or base proof roll. Areas that fail a proof roll test are the responsibility of the contractor to rectify. Adequate notice must be given to Council's Engineering Department representatives for attendance of proof-rolling inspections, refer to Section 17.4. If the proof-rolling test fails due to excessive moisture etc. then another Council inspection is required and appropriate notice should be given.

7.6.15 Soft Areas in Pavements

Where unsuitable material exists or develops during construction, it must be rectified to the satisfaction of the Council. Possible treatment methods include cement (except within the top 175 mm of the pavement) and/or lime stabilisation, replacement of the underlying material with pavement, the use of geotextiles/GeoGrid and/or the lowering of sub-surface stormwater drainage to below the level of the area to be rectified. Rectified pavements must achieve the required levels of compaction as specified above and pass a proof roll.

7.6.16 Pavement Wearing Course

Pavements must have passed all compaction testing, proof rolls and the base material shall have dried back to 70% of optimum moisture content (OMC) prior to proceeding with the wearing course.

Pavements must be trimmed to shape, swept and have a surface consistency suitable for priming. Adequate protection should be provided for signs, concrete edgings, and traffic control devices to prevent over-spray during priming or tack coating.

The preferred road surface for all urban residential roads is a minimum of 30 mm AC10 Asphaltic Concrete seal. The surface of the final wearing course must be between 5-10 mm above the concrete edging as detailed on the construction plans for each edging type. The wearing course must be flush with the lip of the kerb and channel at all footpath kerb crossings (to eliminate any trip hazard).

DPTI, through collaboration with Local Government have released a revised standard for the supply and construction of Fine Dense Mix AC10 Asphalt. All AC10 Asphaltic Concrete placed on local low traffic roads shall be in conformance with the Fine Dense Mix AC10 of the DPTI Master Specification.

All new and upgraded roads, including widened roads, that are located in or adjacent to commercial or industrial Developments or any Collector Street must be sealed with an AC10H Asphaltic Concrete of suitable thickness for the expected traffic loading (minimum thickness to be 40 mm).

All new or upgraded roundabouts must be sealed with an AC10 heavy duty mix Asphaltic Concrete preferably with a polymer modified binder (A35P), and shall be of suitable thickness for the expected traffic loading (minimum thickness to be 40 mm).

A two-coat bitumen seal may be considered as an alternative in some residential roads/streets, such as those located in heritage areas, subject to the approval of Council. New and upgraded roads constructed in areas with heritage characteristics may require specific colours of gravel to be used. Liaison with Council's Engineering Department and Council's Planning Department shall be required in these instances.

Where a dispute arises concerning the finished surface texture or construction methods, wearing course core samples and compaction testing may be required. The Consultant must, prior to construction, specify the hotmix design or attention to the design mix including aggregate size and any additives e.g. colour additives.

For all new and upgraded roads, including widened roads, located in or adjacent to Rural Living Developments, the minimum required wearing surface must be a two coat seal in accordance with the DPTI Master Specification. The first coat should use a 14 mm nominal size aggregate, followed by a final coat of using 7 mm aggregate. The minimum required wearing surface of any cul-de-sacs constructed within a Rural Living Development must be sealed with an AC10 Asphaltic Concrete of suitable thickness for the expected traffic loading, with the minimum thickness to be 30 mm.

Where roadways under this section may in Council's Engineering Department opinion be subject to turning movements that will cause stone loss from a spray seal finish, there may be a requirement to provide an asphalt wearing course.

7.7 Traffic Control Devices

The Design Engineer must determine any necessary traffic control devices in accordance with AUSTROADS *“Guide to Traffic Management”*, DPTI *“Manual of Legal Responsibilities and Technical Requirements for Traffic Control Devices – Part 2 Code of Technical Requirements”* and any DPTI supplement to those guidelines. The supply and installation of traffic control devices must comply with *AS/NZS 1742 Parts 1-15 ‘Manual of Uniform Traffic Control Devices’*.

Where possible traffic control devices should incorporate or be integrated with WSUD principles.

It should be noted that in accordance with the Instrument of General Approval and Delegation to Council, “before any traffic control device is installed, altered or removed, a Traffic Impact Statement must be prepared by a person, who in the Council’s opinion is an experienced traffic engineering practitioner. The Traffic Impact Statement must be endorsed by a person authorised by Council”. It should be noted that the relevant Council is generally the approving authority for traffic control devices with the exception of DPTI owned roads and for excluded devices as described in the Instrument or the Code (Manual of Legal Responsibilities and Technical Requirements for Traffic Control Devices). All requirements for traffic control devices should reference the Act and the Code as the primary control documents. Implementation of road closures and one way conditions also carries legislative requirements in accordance with the Road Traffic Act 1961 or alternately Roads (Opening and Closing) Act 1991. Also Refer Section 4 Traffic Management Strategy for further requirements for Traffic Impact Statements. It is the Designer’s responsibility to obtain the necessary approvals.

7.7.1 Signposting and Pavement Marking

Signposting and pavement marking should generally be provided to roads, intersections, traffic control devices, cycleways and car parks in accordance with *AS/NZS 1742 Parts 1 – 15*, DPTI *“Manual of Legal Responsibilities and Technical Requirements for Traffic Control Devices – Part 2 Code of Technical Requirements”*, DPTI’s Pavement Marking Manual, and the DPTI *“Master Specifications”*. Street name plates are to be the standard type throughout the relevant Council, unless otherwise approved in writing.

7.7.2 Road Naming

Road naming should be in accordance with the Council Road Naming policy or the standard LGA policy if no Council policy is available.

7.7.3 Guard fence

Where there is a warrant (e.g. an identified hazard in the Clear Zone) and no reasonable alternative guard fence is to be installed in accordance with the DPTI Master Specification, where shown on the approved engineering plan or as directed by Council’s Engineering Department. The extent and design is to be shown on the design plans.

Property access and pedestrian movements shall be considered as part of the design of the guard fence.

7.8 Vehicular Access

Vehicular access to each and every allotment within a land division Development must be provided at the time of Development. Vehicle crossings however are not required to be constructed at the time of construction where mountable or semi mountable kerb and channel is used, as these may be constructed during later building works when the final location is known.

Where a new or upgrade to a road includes construction of barrier kerb and channel or semi-mountable kerb and channel, a vehicle crossing and layback section in the kerb and channel must be provided to each allotment frontage.

The horizontal design or layout of all driveways shall be in accordance with *AS/NZS 2890.1*, *AS/NZS 1428.1 'Design for Access and Mobility'*, and B85 Template Swept Path with 300 mm minimum clearance each side.

Within any subdivision where the final surface level at the edge of the road reserve will be substantially different to the natural surface level, Council requires the Developer to demonstrate how vehicular access will be achieved in accordance with *AS/NZS 2890.1*. This shall be required to be provided to each and every lot so affected by the planned earthworks. This will need to be demonstrated on a civil 'longitudinal section' identifying individual transitions and must be based on a realistic finished floor level and the requirements of the development plan. If the Finished floor level is restricted this shall desirably be noted on the design plans.

All access to the properties must provide safe and convenient access in accordance with Council's Development Plan. Driveways providing access and egress to allotments on the low side of the road shall be designed to ensure that there is a sufficient vehicle standing area within the property to provide adequate visibility for motorists when exiting the property.

The provision for vehicle crossovers and inverts, and the reinstatement of existing crossovers not required by the Development shall be carried out by the Developer to the satisfaction of Council.

The construction and finish of driveways between the kerb and the property boundary shall either be consistent with the driveway or existing footpath and sympathetic to the existing streetscape.

Vehicle crossings must be constructed in accordance with the Standard Drawings.

7.8.1 Urban Vehicle Crossings

This section applies to urban areas regardless of whether there is kerb and channel.

Driveways and direct vehicle access to trunk collector streets or DPTI managed roads should be designed to allow forward entry and exit from properties. The maximum number of vehicle crossings to residential properties is two (2) crossings, neither of which exceeds 4 metres in width. Where two crossings are provided, the minimum distance between them should be 9 metres. The maximum width of a single crossing must be 6 metres. Crossings must be constructed in accordance with the requirements of Standard Drawing Numbers 235, 240 and 245.

Crossings to adjacent properties should either be fully combined, with a maximum width of 6.0 metres, or have a minimum separation to allow an on street park between driveways.

Vehicle crossings to residential, industrial and commercial corner allotments are to be located a minimum of 6 metres from the tangent point of the kerb return at intersection of road reserves and 2 metres clear of pedestrian kerb crossings in accordance with *AS 2890.1*.

All crossings must be constructed with an all-weather surface for that section of crossing contained within the road reserve. That portion of the crossing that passes through the footpath zone must conform to the requirements of *Australian Standard AS/NZS 1428.1 'Design for Access and Mobility'*. A surface that matches

the texture and colour of the adjacent footpaths is preferred; however alternative surfaces may be approved conditional upon compliance with *AS/NZS 1428.1 'Design for Access and Mobility'*. Patterns that result in surface irregularities of greater than 5 mm are prohibited. Coloured edge strips will only be permitted adjacent and parallel to the alignment of footpaths. Feature edge strips must not cross the path of travel along the footpath.

Where grades through vehicle crossings exceeding 1:15 the Design Engineer must demonstrate using standard car templates that car access can be provided to all allotments.

7.8.2 Rural Vehicle Crossings

Roads should be located and designed such that vehicular access can be readily obtained at every allotment. Where the natural surface slopes steeply to or from the road, the access to each lot should be given special consideration. The locating of an access onto a vertical curve along the road is to be avoided where there is inadequate sight distance for safe entry and exit from the property.

All rural vehicle access crossings must include a culvert unless the location of the access is at an obvious high point. The minimum width of culvert is 4.88 metres. . All culverts must have an end wall at each end of the pipe. Trafficable end walls must be used wherever the culvert/end wall is located within the Clear Zone.

The minimum pipe size varies according to the slope of the terrain. In flat terrain the minimum pipe size is Ø375 mm in rural and rural living zones, and pipes must be laid such that the pipe invert matches the table drain invert. In steeper terrain the minimum pipe size may be reduced to Ø300 mm where the steeper grades reduce the risk of silting, and provided the risk of debris movement and blockage is adequately managed.

Reinforced concrete swale crossings can be used where the depth of the table drain is less than 350 mm deep and the product of the depth and the peak flow velocity is less than 0.35 provided that Council's Engineering Department is satisfied that the crossing can be safely and conveniently negotiated by standard cars. At existing entrances with either a Ø300 mm or Ø375 mm culvert, new end walls may be added to the existing culvert as long as the existing pipes are in good condition, are laid at the correct level, and are demonstrated to have sufficient hydraulic capacity.

Culverts must be designed in accordance with Table 7.

Table 7 - Rural vehicle crossover capacity

Hydraulic Capacity	Capacity (Minor event)
Capacity before property culvert overtops	5 year ARI
Capacity results in overtopping of maximum depth of 300 mm	20 year ARI
Capacity before water may flood properties	100 year ARI

Rural vehicle crossings should be upgraded to meet current standards whenever rural land is subdivided and stormwater flows increased, unless the location of the access is at an obvious high point. Where a planning consent relates to boundary realignment only, there will generally be no engineering requirement for upgrade to accesses, unless the proposed realignment would see a significant change in the use of such access.

7.9 Requirement for Dust Suppression Works

Dust suppression works may be required where a proposed new house or an existing dwelling is likely to experience significant detrimental impacts arising from the dust generated by traffic travelling along a gravel road created from either:

- Additional traffic resulting from a proposed Development e.g. traffic generated from a new land use with higher traffic;
- Existing traffic.

The requirement for dust suppression works will vary from Council to Council due to variation in road making materials used and the annual rainfall expected. Contact should be made with the Council's Engineering Department if clarity is needed to conform to EPA and Council requirements.

7.10 Verges

All verges shall slope down from the property boundary to the top of kerb level to ensure appropriate flood flow path management, and prevent stormwater flowing into private property. For properties which fall away from the road reserve, the verge shall have a minimum fall to the kerb from the property boundary of 2%.

As verges are expected to drain to the street water table, the verge design needs to consider the importance of minimising potential export of pollutants to the drainage system (and subsequent waterways) including suspended solids loads, and herbicide pollutants.

Any resulting differences between the finished surface and natural surface at the property alignment shall be battering up or down to the natural surface level, as required, and within the proposed allotments or reserves (external to the road reserve). Such batters shall have sufficiently flat slopes so that:

- They can be reasonably maintained;
- They will have long term stability having regard to the topographical form and geotechnical properties of the site.

All verges shall be excavated to a depth of 75 mm below the surface of the footpath and the top of kerb and backfilled with Council approved topsoil to provide a growing medium with a raked finish and containing no material with a particle size greater than 20 mm.

Following filling, spreading and levelling of topsoil, all exposed batter slopes, excavated and filled areas shall be reseeded.

Fertiliser shall be applied to the areas to be grassed at the rate of 30 g of 2:1 Superphosphate and sulphate of Ammonia or other approved fertiliser per square metre. The area shall then be raked, seed spread and lightly raked again.

A seed mix containing couch and perennial rye grasses or an approved alternative mix, shall be spread at a rate of 30g per square metre and watered to ensure germination and growth during the establishment period.

As an alternative method of application, hydro mulching using a seed/fertiliser mix similar to that specified above may be used.

8 Passive Transport Network Design

8.1 Objectives

The objective of passive transport network design is to provide a network of footpaths, walking and cycling paths that provide continuous connectivity so as to:

- Promote walking and cycling as a normal part of a person's daily activities;
- Promote universal access for all members of the community;
- Promote community health and wellbeing associated with increased physical activity.

The following documents are referenced within this section:

- AS 1428.1 “*Design for Access and Mobility – Part 1 – General requirements for access – New building work*”;
- AS 1428.2 “*Design for Access and Mobility – Part 2 – Enhanced and additional requirements – Buildings and facilities*”;
- AS/NZS 1428.4.1 “*Design for Access and Mobility – Part 4.1 – Means to assist the orientation of people with vision impairment – Tactile Ground Surface Indicators*”;
- AUSTROADS “*Guide to Road Design Part 6A: Pedestrian and Cyclist Paths*”.

8.2 General

This section deals with those pedestrian and cycle routes that do not form an integral part of the vehicular road way.

The Developer and Council must provide continuous footpaths for all roads in urban residential and commercial areas in accordance with Table 1 in Section 7.3.2. Developers may also be required to establish connective links to existing footpaths where demand is directly related to the Development. Connective links are generally required from commercial areas to off-site car parking related to the Development.

8.3 Requirements

The following requirements apply to footpaths and pedestrian accesses:

- Footpaths are to be constructed at the time of the road construction in accordance with Section 7.3.11 Footpaths. Footpath alignments are preferred to be a minimum 50 mm offset from property boundaries in new areas and between the light pole and kerb for existing areas. Where the footpath is located adjacent the property boundary its location shall have provision for future construction of a front fence, and the sewer inspection point shall either be completely encapsulated in the footpath or completely outside the footpath.
- The minimum footpath width is to be 1.5 m in residential areas and 2.0 m in commercial areas or areas of high pedestrian activity, and wider where identified in Austroads;
- In general, the requirements and qualities prescribed in AS 1428.1, AS 1428.2 and, AUSTROADS “*Guide to Road Design Part 6A: Pedestrian and Cyclist Paths*”, should be met. In particular, the requirements of Section 6 (Circulation Spaces) and Section 7 (Continuous Accessible Path of Travel) of AS 1428.2 are expected to be met along all paths. Whilst it is appreciated that accessible grades can be difficult to achieve on sloping sites, accessible paths of travel should be investigated and designed for in accordance with the Disability Discrimination Act 1992.

- The desirable maximum cross fall on footpaths is 1:50 and the absolute maximum cross fall is 1:40, including kerb crossings. A minimum cross fall gradient of 1:200 should be provided to ensure drainage of the footpath.
- Kerb crossings must be provided in accordance with AS/NZS 1428.4.1 at road / street intersections and at locations identified in consultation with the Council's Engineering Department. The location of kerb crossings shall take into account the pedestrian desire line with the objective of providing a continuous and uninterrupted path of travel. Kerb ramps shall be provided as "matching pairs" at 90° to the road alignment, and shall be directly opposite each other.
- Footpaths must be constructed of either concrete¹⁴, block paving or asphalt¹⁵, and must conform to AS/NZS 1428.4.1 for surface finish. Permeable paving can be used as long as it provides an even and uniform surface with no trip hazards or open recesses. Footpaths may be integrated with "green infrastructure" (linking with WSUD where appropriate) to support the overall objective of encouraging active mobility.
- Tactile Ground Surface Indicators (TGSI's) are to be provided in accordance with AS/NZS 1428.4.1, and Appendix A;
- Footpaths must slope away from the property boundary, and be elevated above the adjacent road verge. In general, reverse fall on road verges is undesirable and will only be approved where no other practical alternative is available. In such cases, additional treatment may be required to ensure that surface stormwater from the verge or footpath is managed in an appropriate manner.
- Services within the footpath or pedestrian areas are to be avoided where possible. Sewer inspection points are acceptable provided they are completely encapsulated within the footpath and are securely located. It is also acceptable for the common services trench to be located underneath the footpath.
- Patterned finished to footpaths or pedestrian accesses will require the specific approval of the Council's Engineering Department. However, in general they should provide an even and uniform surface and be free trip hazards or indentations.
- The minimum width for shared paths is to be 2.5 metres and they are to be designed and constructed in accordance with the AUSTROADS publication '*Guide to Road Design Part 6A: Pedestrian and Cyclist Paths, 2010*' and any DPTI supplement to those guidelines. Where a shared path crosses a pedestrian bridge a minimum lateral clearance of 0.5 metres on both sides of the shared path must be provided where the speed of cyclists is less than 20 km/hr. Where higher bicycle speeds are likely a minimum lateral clearance of 1m on both sides of the shared path must be provided.
- It is highly desirable that footpaths are located away from kerbs to allow streetscape improvements and to provide increased safety for pedestrians;
- Stormwater runoff from footpaths should be directed to a permeable surface area to minimise stormwater runoff wherever possible.

¹⁴ Joints in concrete paths in reactive soils and around trees should be designed to control movement and minimise trip hazards

¹⁵ In areas of reactive soils or trees, use of asphalt for footpaths is not recommended due to surface movement leading to trip hazards.

9 Parking

9.1 Objectives

To ensure that parking

1. Is provided of sufficient number and standard that services residents, visitors, staff, customers, service vehicles and other users. Including designated parking for bicycle's and disabled persons where warranted.
2. Provides multiple benefits to the community by contributing to tree canopy cover targets and stormwater management objectives.

9.2 General

The number of on and off street parking spaces to be provided for any area should be in accordance with the Council's Development Plan or in accordance with an approved Traffic Impact Assessment Report. All required physical works should be constructed as part of any area upgrade or Development and must be in accordance with approved plans and specifications to the satisfaction of Council's Engineering Department. The design must ensure that parked vehicles do not obstruct the passage of vehicles, do not create traffic hazards or undue pedestrian hazards and do not detract from the streetscape amenity.

In general terms, Rule 208 of the Road Traffic Act, implies that a vehicle cannot be parked where there would be less than 3.0 metres (lane width) available to moving traffic, i.e. between a parked vehicle and a median, or between two parked vehicles.

If the Developer is unable to provide the required on-site car parking spaces for residents, staff and visitors, and Council has not identified and not addressed an existing or future need in the vicinity of the Development, then the Development may be refused. In some instances the Development may be permitted to proceed on the basis that alternative car parking can be provided that meets the following requirements detailed in Section 9.3.

Estimates of the number of car park spaces provided by the design proposal shall:

- Not include bays which intrude upon the driveway swept path requirements;
- Have regard to the Road Traffic Act.

If the Council has a Parking Strategy that identifies existing or proposed parking within 100 metres of the proposed Development, the Developer may be required to contribute to the actual costs for the provision of off-site vehicle spaces.

Carparks contribute significantly to loss of green space, stormwater runoff peak flows, and stormwater pollutant loads to waterways and the marine environment. With an integrated approach to carpark design we can take this "underperforming asphalt" and turn "grey to green" providing amenity and functionality through water sensitive urban design that enhances water quality and sustains green infrastructure.

9.3 Requirements

The following parking requirements apply to all parking:

- The parking requirements for normal levels of activity associated with any land use should be accommodated on-site and should be located and of dimensions that allow convenient and safe access and usage;

- Disability parking requirements should consider appropriate distances to key destinations/building entrances, continuous accessible paths of travel and how this can be achieved either on or off-street;
- All parking, both on and off site, must be finished with an all-weather seal and line marked. Unsealed all weather surfaces may be permitted in extenuating circumstances however delineation of bays and aisles should be provided and will only be permitted with written permission of Council's Engineering Department. Council may consider the use of paving, including permeable, where prior approval is sought, noting that paving/permeable paving is not to be used on highly reactive soils. If permeable paving is sought, the design shall conform to the Concrete Masonry Association of Australia – Permeable Paving Technical Manuals.
- Water quality targets and discharge rate limitations, as defined in Section 11 should be met through appropriately designed WSUD principles;
- Design and construction of landscaping for car parking areas should incorporate stormwater treatment and harvesting techniques;
- The layout and access arrangements for all on-street and off-street parking areas should conform to AUSTROADS publication '*Guide to Traffic Management: Part 11 Parking*', AS/NZS 2890.1 –*Off Street Parking*, AS/NZS 2890.2 –*Off Street Commercial Vehicle Parking*, AS/NZS 2890.3 *Bicycle Parking Facilities*, AS/NZS 2890.5 –*On Street Parking* and AS/NZS 2890.6 *Off Street Parking for People with Disabilities*.
- The number of on-site parking and off-site parking spaces for non-residential land uses should conform to parking standards as specified on the planning consent where applicable, or in accordance with Council's relevant Parking Strategies;
- If lighting is required it shall be provided to the satisfaction of Council's Engineering Department;
- Loading/unloading requirements should consider forklift/ pedestrian conflicts and other movements on the site;
- Carparks should be designed to include medians and landscape bays to avoid large expanses of open areas.

In addition to the above, the following parking requirements apply to all residential areas:

- The availability of parking should be adequate to minimise the possibility of driveway access being obstructed by cars parked on the opposite side of the street;
- Where a particular development may generate a high demand for parking, the Developer may provide adequate additional parking within the road reserve for visitors, service vehicles and any excess resident parking. Such parking is to be convenient to dwellings;
- The on-street car park for any given allotment shall be no further than 30 metres from the front boundary of that allotment, without prior Council approval;
- All verge spaces and indented parking must be constructed of concrete, interlocking pavers, bitumen or asphalt with crushed rock pavement base, and are designed to withstand the loads and manoeuvring stresses of vehicles expected to use those spaces;
- The Developer must identify the measures proposed to set aside resident parking and ensure casual visitor access is limited to people proposing to use the Development.

In addition to the general requirements, the following parking requirements apply to all on-site parking:

- In designing the pavement, the Design Engineer must make specific allowance for traffic load concentrations within car park areas such as entrances and exits, and have consideration of construction traffic for surrounding buildings;
- All loading/unloading zones are to be constructed of concrete pavement or concrete segmental pavers to resist damage from diesel and fuel spills. Paving should be mottled to mask spills.

Where parking is to be provided by contribution to Council in accordance with an identified Parking Strategy, the following requirements must apply:

- Customer parking spaces must be located within 100 metres of the Development site;
- Dedicated permanent staff parking spaces can be provided within 500 metres of the site at the Developer's cost;
- There is a direct pedestrian linkage with the Development, or one must be provided by the Developer;
- Disabled parking spaces are provided in accordance with the requirements of the *Disability and Discrimination Act* and relevant Australian Standards;
- The level and standard of lighting shall be determined according to Standards Association of Australia (SAA) codes and AS/NZS 1158 Series to reflect Councils policy of pursuing lighting standards that are energy efficient and environmentally sustainable to the satisfaction of Council's Engineering Department;
- The carpark design includes retention of significant existing vegetation, proposed landscaping, the selection of colours and materials for any structures on the site;
- The status of each element within the proposed car park, including common property, Council reserves, indented road reserves, and parking spaces, must be confirmed in writing by Council's Engineering Department;
- Agreement is reached regarding public indemnity for the carpark;
- Access and availability to Public Transport systems should be considered. This may include consideration of end user facilities (e.g. Locker / shower facilities).
- The proposal must accommodate existing or future location of non-residential uses such as schools, commercial and industrial premises and local shops in, or likely to be developed in the area;
- The effect of on-street parking works is to slow vehicle speeds and enhance the pedestrian environment.

The Designer shall consider and document all Regulatory and non-Regulatory signage required for the safe and efficient operation of the carpark facility.

10 Earthworks and Lot filling

10.1 Objectives

Typical earthworks may include lot filling and/or the construction of basins, open channel stormwater drainage systems, levee banks, access tracks, flood protection devices and overland flow paths.

The objectives of the earthworks and lot filling requirements are as follows:

- To ensure that the earthworks, lot filling or Development does not cause or aggravate the flooding of other properties and that, in particular, existing runoff storage areas and/or flow paths are not filled unless the Relevant Authority has consented to the proposed action, and the necessary permits have been obtained.
- To ensure that buildings are located on a natural surface or on approved filled ground above the 1% flood level to comply with Council's Development Plan;
- To ensure compliance with the recommendations of the Catchment Management Authorities or other relevant agencies or organisations;
- To ensure that earthworks and lot filling works does not result in erosion, dust, mud or debris to be released from the site;
- To ensure any fill material proposed has achieved all necessary approvals;
- To maintain privacy and security of adjacent landowners.

10.2 General

Approval of engineering plans by Council's Engineering and/or Asset Department relates only to the capacity of earthworks to accommodate road and stormwater drainage systems to the satisfaction of Council, and does not negate the need for Development Plan consent of such earthworks. The Developer must ensure that a planning consent is obtained where required for any earthworks. Where works are to be staged the planning consent should, wherever possible, be obtained for the entire site, rather than for each individual stage in turn.

Where roads, footpaths or shared paths are constructed over filled areas, the pavement materials, structure and geometry must be designed by a Qualified Engineer, and the relevant drawings and calculations submitted for approval to Council's Engineering Department.

The horizontal design or layout of all driveways shall be in accordance with *AS/NZS 2890.1*, *AS/NZS 1428.1 "Design for Access and Mobility"*, and B85 Template Swept Path with 300 mm minimum clearance each side. Where driveway gradients exceed 1:10, vehicle clearances should be checked in accordance with the *AUSTROADS Guide to Road Design: Part 3: Geometric Design (Section 8.2.5)*. Batter slopes must not exceed 1:5 unless approved by Council, and special treatments such as retaining walls, and appropriate erosion control measures may be required.

10.3 Requirements

The following relate to all earthworks and lot filling:

- All work must be undertaken in accordance with *AS/NZS 3798 - "Guidelines on Earthworks for Commercial and Residential Developments"*;
- Earthworks within an area of land liable to flooding must not adversely impact on the Floodplain characteristics. Existing depressions must not be filled either temporarily or permanently unless the consent of the Relevant Authority is given in writing and any relevant planning consent obtained.

- Any earthworks or filling within a floodway should ensure that there is no impact on the 1 in 100 year ARI flood level;
- Where works are proposed over an existing easement, no fill shall be placed such that the distance from the new surface level to the base of the existing infrastructure exceeds 1.5 metres, noting that fill in addition to 200 mm will require separate approval;
- Where works are proposed over a new easement, fill level and grade shall be kept in line with allotment levels, with no battering down over existing easements being permitted without approval;
- All new urban land division allotments must be graded, cut or filled, such that a desired minimum grade of 1:200, and absolute minimum grade of 1:285 is achieved along the low side of the allotment toward the stormwater drainage outlet;
- The finished surface level of new buildings should as a default be a minimum of 300 mm above the top of kerb or the major storm (in accordance with Table 8 and Table 11) flood level (whichever is greater). Where buildings are to be constructed on the road reserve boundary, freeboard requirements may need to be reduced. Such instances are to be designed on a case by case basis and are subject to Council approval. Note for around openings for basements and lower levels it is highly recommended that greater freeboard be maintained.
- The finished surface of lot filling must be equal to or above the Major storm (in accordance with Table 8 and Table 11) flood level subject to the requirements of the relevant Catchment Management Authority or responsible authority;
- The extent and depth of all proposed lot filling must be denoted on the construction plans. Where depths of fill on allotments exceed 300 mm, those areas are to be clearly differentiated from fill of depth less than 300 mm.
- Full records must be kept of all areas filled and the information must be recorded on the ‘as constructed’ plans;
- Where the depth of fill is greater than 300 mm lot filling must be compacted to the requirements of AS/NZS 3798- “*Guidelines on Earthworks for Commercial and Residential Developments*” and trimmed and shaped to match existing site levels, except in areas nominated for soft landscaping. Level 1 compaction and a controlled fill certificate is highly desirable for all filling of allotments and public roads.
- Earthworks and Lot fill testing must be included in the Contractor’s Inspection and Test Plans submitted for Council’s consideration;
- The requirements for the backfilling of stormwater drainage trenches are specified in the Standard Drawing;
- Where earthworks abut structures, the Design Engineer must demonstrate the continued safety and integrity of those structures to the satisfaction of Council’s Engineering Department;
- The desirable maximum depth of fill allowable against fencing is 200 mm and requires a plinth at the bottom of the fencing;
- Retaining walls must be provided when the depth of fill exceeds 200 mm or maximum batter slopes are exceeded;
- No water is to be directed to flow into adjoining properties;
- Ideally no fill should be imported onto any Development site. Where fill is imported onto any Development then written records must be provided to indicate the source of the fill and to provide evidence that the soil is not contaminated as per EPA waste fill requirements.
- All reasonable precautions must be taken to prevent the spread of noxious weeds from or to the worksite. (Refer also Section 12.13). Special requirements may apply in certain areas;

- Dust, mud and debris must be prevented from leaving any site during and after construction (refer also Section 12.3);
- All areas that are to involve earthworks must have the topsoil stripped, stockpiled and reinstated. Before completing the site works the depth of topsoil replicating predevelopment depths must be placed and rehabilitated over all areas where there have been earth works.
- Special consideration must be given to sites that may have been subject to biological or chemical contamination. Council's Engineering Department, EPA or other Relevant Authorities may require a full analysis of any potentially effected sites and in some circumstances require an Environmental Impact Statement.

11 Stormwater Management

This section has been prepared prior to adoption the new ARR 2016 (Australian Rainfall and Runoff). The adoption of the final ARR will bring about a new preferred methodology for investigating, analysing and designing stormwater, riverine and flood systems at all levels.

This document refers to ARI rather than the new reference AEP. If design standards are unclear please refer to the relevant Council for guidance.

11.1.1 Objectives

To support the statewide policy and objectives of WSUD namely:

- To develop solutions to address how the quantity and quality of stormwater must be managed, to deliver multiple benefits to the community including:
 - Apply a risk management framework for hazards / flooding based on catchment characteristics and rigorous data collection;
 - Facilitate more productive “fit for purpose” use of stormwater via retention, treatment and re-use at a range of scales;
 - Reintegrate stormwater into the landscape (including via passive infiltration or re-use of harvested stormwater) to facilitate a range of benefits including supporting the establishment of greater tree canopy in urban areas, microclimate cooling, local habitat and provision of attractive spaces for community use and wellbeing;
 - Minimise the environmental impacts of stormwater as a conveyor of pollution;
 - Preservation, or enhancement, where possible, of the ecological function of the region’s natural watercourses and ecosystems.
- To provide integrated designs that encourage at source solutions e.g. allotment or street scale in conjunction with precinct scale solutions;
- To improve the quality of stormwater runoff being discharged from a particular Catchment using WSUD principles in accordance with the SA WSUD Policy;
- To support the sustainable use of natural water resources that provide our water supplies and to help ensure that our water supplies are resilient to climate variation through water conservation by:
 - Encouraging best practice in the use and management of water to minimise reliance on imported water;
 - Promoting safe, sustainable use of rainwater, recycled stormwater and wastewater.
- To help protect the health of water bodies, marine environment and associated ecosystems in or downstream of urban areas, by managing and maintaining or improving runoff quality by:
 - Mimicking a more natural runoff regime, both flow rate and volume;
 - Maintaining and enhancing water quality.
- To assist the management of flood-related risk associated with urbanisation, by controlling runoff quantity by:
 - Mimicking a more natural runoff regime;
 - Managing rainfall runoff so that it does not increase the potential for flooding.
- To implement the design requirements of the Council’s Stormwater Management Plan;

- To collect and control all stormwater generated within the catchment to ensure that it is discharged from the catchment in a way that does not detrimentally impact on any upstream or downstream properties
- To protect Council's existing stormwater drainage assets from overloading as a result of new Developments, road upgrades, or Council projects which increase the flow rate and volume of stormwater being generated from a particular catchment. This can be achieved through on-site retention and re-use, infiltration (where soils permit), detention or increasing outfall stormwater drainage capacities.
- To protect property and infrastructure from flooding occurring from a nominated rainfall event by the provision of retention/detention basins where required;
- Prevent flooding of public and private property both within the catchment and downstream;
- To provide safety for traffic and pedestrians by controlling frequent stormwater flow;
- To ensure treatment methods and associated structures are cost effective from a maintenance and operational perspective and that the risk to the public is minimised as far as practicable;
- Protect and enhance natural water systems within urban environments;
- Integrate stormwater treatment into the landscape, maximizing the visual and recreational amenity;
- To protect the public from risk of injury or death.

11.1.2 General

Detailed design and documentation of stormwater basins and/or similar detention facilities are to be prepared by the Design Engineer.

For Development the Structure Plan must demonstrate that any required stormwater retention or detention systems can be integrated into the existing stormwater drainage system. The retention/detention basin location must be in accordance with an approved Structure Plan/Relevant Council Strategy/Stormwater Management Plan. Where a Structure Plan has not been prepared and approved for the subject land, the Developer must liaise with Council to obtain approval for the siting of retention/detention basins. Stormwater drainage catchment boundaries may be increased or decreased through earthworks or changes to pipe networks etc. Where developers modify the catchments, written approval is to be obtained from the relevant stormwater drainage authority.

Any design must be consistent with the requirements of Council(s) and other authorities such as NRM Boards, with discharge limits as defined by the Council or based on a capacity assessment.

Land that has been identified for stormwater retention/detention basins to be maintained by Council, whether existing or proposed, must be shown on a Plan of Land division as a Council Drainage Reserve for stormwater drainage purposes and is vested to the Council.

In circumstances where retention/detention basins are not to be maintained by Council and are located within land that is on a private title or common property for a community title development, the landowner(s) are responsible for the regular inspection and maintenance of the asset.

When a retention/detention basin is required for any Development, the basin and any overland flow paths should be constructed as part of stage one works. If the basin is used as part of the construction soil erosion

and drainage management, dredging may be required prior to handover to ensure the maximum/design capacity for the operational phase. Where the Design Engineer considers that the retention/detention basin is not required to service the first stage of the works, they must submit plans, computations, and approvals from the relevant authorities to Council, demonstrating that satisfactory alternate provisions can be made for storage and outfall.

11.2 Urban Stormwater Drainage

11.2.1 General

Stormwater drainage design must be in accordance with the current provisions of *'Australian Rainfall and Runoff'*, and EPA – *Environment Protection (Water Quality) Policy 2015*.

Stormwater drainage Designers should also refer to *'Water Sensitive Urban Design in Greater Adelaide Technical Manual'* published by DPTI, *'Urban Stormwater Best Practice Environmental Management Guidelines 2006'*, published by the CSIRO 1999, AS/NZS 3500.3 *Stormwater drainage*, DEWNR – *Water Sensitive Urban Design Policy*, and where relevant the EPA – *Adelaide Coastal Water Quality Improvement Plan*.

Stormwater drainage design must take the entire stormwater drainage catchment into account, not just the area included in the Development or project. Design Engineers must base the calculated peak flow on the ultimate Development potential of the project (based on current zoning) and upstream areas for normal flow situations as well as the overland flooding caused by pipe blockages, general flooding and high water levels. Staged upgrading of the system can only be undertaken with the approval of Council's Engineering Department.

New building Development or re-Development generally increases the stormwater runoff from the site due to the increase in impervious areas such as roofs and pavement. Direct discharge of this increased runoff into the existing stormwater drainage system may increase the risk of flooding to downstream properties; and may have adverse effects on the natural watercourses and downstream stormwater drainage Infrastructure. External stormwater drainage head works may need to be undertaken to improve the downstream system to cater for these increased flows otherwise on-site detention to pre-developed peak flow rates will need to be adhered to. Such works are the responsibility of the Developer, inclusive of associated costs.

Prior to commencing detailed design, the Design Engineer must determine the possible ultimate zoning of all external catchment areas contributing to the stormwater drainage system. This may require consultation with the Council's Engineering Department and Council's Planning Department.

11.2.2 Major and Minor Stormwater Drainage Systems

The Design Engineer must adopt the 'major/minor' approach to urban stormwater drainage systems as outlined in *'Australian Rainfall and Runoff'*. The 'Minor' system refers to the underground system, designed to an ARI as determined in Table 8. The 'Major' system refers to overland flow paths that are to be designed to convey the major storm flows when the capacity of the minor system is exceeded.

The stormwater drainage system should be designed in accordance with the current requirements of Engineers Australia publications, Australian Rainfall and Runoff, and Australian Run-off Quality, a guide to Water Sensitive Urban Design also stormwater drainage should be in accordance with the National Plumbing and Drainage Code, and AS/NZS 3500.3.

The minor system generally refers to a pipeline network with sufficient capacity to collect and convey the flows from nominated design storm events (see Table 8). These pipelines prevent stormwater damage to properties and also limit the frequency and quantity of surface water to a level that is acceptable to the community. The pipelines do not always follow the natural stormwater drainage paths and are usually aligned along property boundaries and the roadway kerb and channels.

A major stormwater drainage system caters for the runoff from storms of higher intensity than for which the minor stormwater drainage system has been designed. The major stormwater drainage system is designed to handle flows resulting from storms Major storm identified within Table 8, with consideration given to larger storm events when the project will incorporate sensitive Development. These flows must follow a designated overland flow path, which must be:

- A road if the catchment area is small and/or;
- A stormwater drainage reserve if it is impractical or unsafe for a road to carry the excess flows.

The finished floor level of buildings must be at least 300 mm above the Major storm (in accordance with Table 8 and Table 11) or 300 mm above the flood mapping levels (whichever is higher) flooding level or in accordance with the requirements of the relevant authority and codes. Council to confirm the requirement prior to the stormwater design.

11.2.3 Hydrology

The stormwater drainage design must include a stormwater drainage catchment plan showing the total catchment area and sub areas that are the basis of the design, together with a stormwater drainage computations sheet.

Partial areas must be taken into account when determining peak flow sites; particularly in instances where the catchment contains sub areas, such as reserves, that may have relatively large time of concentration in conjunction with a small coefficient of runoff. In some instances a partial area design discharge may result in runoff that is less (or the same) than a discharge that has been calculated at some upstream point. Careful checking of the partial area flows may be required to determine the largest flow. The largest flow must be used for the design of the stormwater system downstream of the connection point.

Particularly when assessing the major stormwater drainage system it may be more appropriate to use a Unit Hydrograph or Non-Linear Run-Off Routing model. The Design Engineer must determine the most appropriate methodology for each application. Various stormwater drainage tools, programs and construction methods are available to the Design Engineer to achieve the objectives of the stormwater drainage system. Regardless of the technique or method used, detailed documentation must be submitted for detailed design approval.

For catchment areas greater than 50 Ha, two separate recognised runoff estimation methods must be used to enable comparison of runoff estimates.

11.2.4 Rainfall Data

Intensity/Frequency/Duration curves (IFD) are available from the Bureau of Meteorology Website

Online resources are provided that allow curves to be established for any Australian location based on its latitude and longitude.

11.2.5 Average Recurrence Interval

The design of underground stormwater drainage systems should be based on the ARIs¹⁶ shown in Table 8, unless specified otherwise by Council. It should be noted that due to site and/or catchment constraints Council may specify 10 yr ARI minor storm event capacity, and this practice is not uncommon in existing built up areas. The project ARI storm events are to be verified by Council prior to proceeding with the stormwater design.

Table 8 - Average Recurrence Intervals for Stormwater Drainage in Urban Areas

Stormwater Drainage System	Capacity (Minor event)	Capacity (Major event)
Urban Residential Areas and minor Commercial centres of 10 shops or less	5 yr. ARI (18% AEP)	100 yr. ARI (1% AEP)
Local Emergency Facilities (CBD)	20 yr. ARI (4.9% AEP)	200 yr. ARI (0.5% AEP)
Industrial areas	5 yr. ARI (18% AEP)	100 yr. ARI (1% AEP)
Low points where there is no overflow path and overflow may flood properties	100 yr. ARI (1% AEP)	100 yr. ARI (1% AEP)
Commercial areas	20 yr. ARI (4.9% AEP)	100 yr. ARI (1% AEP)

The initial time of concentration from building to property boundary is assumed to be six (6) minutes in urban residential areas. Special consideration will be necessary for other areas and/or circumstances.

The capacity of the road reserve in urban and rural living areas, inclusive of the underground system, must be in accordance with Table 8 and Table 11.

¹⁶ The new draft ARR references AEP and to assist this transition the equivalent AEP event has been included in brackets in Table 8

11.2.6 Coefficients of Run-Off

Table 9 specifies a range and typical coefficients of runoff to be used in the design of stormwater drainage systems. The Coefficient of runoff is to be assessed by the engineer based on the locality. Sites with steeper slopes, clay or rock surfaces (less infiltration) less vegetation or higher rainfall intensities will all have higher coefficient of runoff.

Consideration should be given to the future properties of the catchment over the lifetime of any proposed drainage infrastructure to allow an adequate level of service over the life of the asset.

Table 9 - Coefficients of Runoff

Catchment Type	Coefficient of Runoff
<i>Predevelopment conditions</i>	0.1-0.5 (0.25)
<i>Low density residential areas - lot areas >2000 m² to 4000 m²</i>	0.2-0.5 (0.3)
<i>Residential areas - lot areas > 1000 m² to 2000 m²</i>	0.3-0.7 (0.5)
<i>Residential areas - lot areas > 600 m² to 1000 m²</i>	0.4-0.8 (0.6)
<i>Residential areas - lot areas > 450 m² to 600 m²</i>	0.5-0.8 (0.75)
<i>Residential areas - lot areas > 300m² to 450m²</i>	0.6-0.9 (0.8)
<i>Residential areas - lot areas <300 m²</i>	0.7-0.9 (0.9)
<i>Residential areas (medium density i.e. Units, including potential unit Development sites)</i>	0.7-0.9 (0.9)
<i>Commercial zones</i>	0.7-0.9 (0.9)
<i>Industrial zones</i>	0.9
<i>CBD</i>	0.9
<i>Residential road reserves</i>	0.75 -0.9
<i>Landscaped areas</i>	0.2-0.5 (0.35)
<i>Paved areas</i>	0.9
<i>Swimming pools, retention/detention basin, open channels, ornamental lake/wetlands</i>	1.0

In all cases the co-efficient of runoff must be checked against 'Australian Rainfall and Runoff'. For areas of special use, e.g. schools, community centres, sporting developments etc., an investigation is to be carried out to determine the likely percentage of impervious area and pervious areas to determine the appropriate co-efficient of runoff.

11.2.7 Hydraulic Design

Designs must be based on hydraulic grade line (H.G.L) analysis using appropriate pipe friction and stormwater drainage structure head loss coefficients.

- The H.G.L. must be greater than 150 mm below the invert of the kerb for minor flows;
- The H.G.L. must be within the road reserve for major flows, or within the road carriageway where there are a large number of pedestrians;
- The H.G.L. due to partial full flows is to be ignored, and is assumed to match the obvert of the pipe. However part full velocities must be checked.

Pipe designs are to be based on hydraulic grade line analysis, using the appropriate pipe parameters for Colebrook – White formula or Manning’s formula as shown in Table 10.

Table 10 - Pipe Roughness Values

Pipe Material	N	K
Spun precast concrete	0.013	0.6
Fibre reinforced concrete	0.012	0.3
PVC-U	0.011	0.06

Note that Table 10 does not preclude other pipe materials from being used.

Where surcharge due to blockage of the primary stormwater drainage system could flood existing or future buildings on an allotment, a secondary protection stormwater drainage flow path shall be provided (in addition to any rear of allotment stormwater drainage system) in the following circumstances;

- Where the pipe(s) of the primary stormwater drainage system adjacent the relevant allotment has a diameter equal to or greater than 525 mm and surcharge due to 25% blockage of the pipe could flood the allotment;
- Where the pipe(s) of the primary stormwater drainage system adjacent the relevant allotments have a diameter less than 525 mm and surcharge due to 50% blockage of the pipe could flood the allotment;
- Where blockage of the inlet pits could flood the allotment; 50% for GIP’s or SAG pits, and 20% for on-grade side entry pits.

Pipe Velocities

The design pipe velocities are:

- Minimum – pipe running $\frac{1}{2}$ full or greater – 0.75 m/s;
- Minimum – pipe less than $\frac{1}{2}$ full - 1.00 m/s;
- Maximum – 5.00 m/s (unless otherwise advised by the manufacturer based on material type).

Minimum Pipe Grades

In general the minimum grade of a stormwater pipe is 0.5% to ensure that water velocities are sufficient for self-cleansing; flatter grades may be considered where it is demonstrated the velocities are greater than 0.75 m/s.

Designer must consult with the Council’s Engineering Department if these minimum pipe grades cannot be met.

Minimum Pipe Cover

The minimum cover will be the greater between the manufacturer's recommendation, Australian Standards and the Standard Drawings, additional cover should be provided wherever crossings with large sized services are anticipated.

The minimum vertical and horizontal clearances between a stormwater pipe and any other pipe or service conduit shall be 150 mm or larger as required by the service provider.

Pipe classes must be determined having regard to the proposed cover, and loading. Class 3 is recommended minimum for all road crossings and pipes within the existing or future carriageway.

Wherever an external area contributes to the system, the drain must be designed at a depth sufficient to serve the total upstream area.

Any exceptions to the minimum cover requirements are to be discussed with Council's Engineering Department at approval of functional layout stage.

Curved Pipelines

Curved pipelines are permitted only where they are of constant radius in the horizontal direction only, and are in accordance with the pipe manufacturer's specifications.

Factory manufactured splays or mitres are permitted. Splays or double mitres should be provided for all deflections exceeding 45 degrees.

Pipe Alignments at Pits

The following considerations apply to the alignment of pipes at pits:

- Generally, when designing the pipe system under pressure, the pipe obverts should coincide at junctions, but in flat terrain, the inverts may coincide;
- Where practical, the pipes at junctions should be aligned such that the projected area of the upstream pipe is wholly contained within the downstream pipe.

Generally, side entry pits should be spaced so that the pits are able to deliver the design flows into the pipes. It may be necessary to consult inlet capacity charts to confirm their capacities.

Pit Losses

Pit losses to be allowed for and must be calculated in accordance with AUSTROADS "*Road Design Guidelines - Part 5 General and Hydrology Considerations*".

Pit Locations

Generally side entry pits are to be spaced so that the length of flow in channels does not exceed 120 metres, or the "depth x velocity" does not exceed safe levels (typically 0.4 m/s^2), or depth of flow is more than 2/3 the kerb height whichever is less distance.

Junction boxes shall be provided at all junctions and to provide access to the pipe at distances not exceeding 120 metres when there is no accessible side entry pits.

The location of pits should be in conjunction with Council and should consider traffic management and Safety in Design.

Channel flow approaching an intersection is to be collected before the tangent point, except where it can be demonstrated that adequate capacity is available in the kerb and channel to carry water around the return.

Side Entry Pits are to be clear of radials, kerb crossings and driveways and a minimum of 1.0 metre clearance from any driveways.

Double side entry pits must be used where approach grades to intersections are in excess of 6% and at all low points in roads, unless the Designer demonstrates that a single side entry pit provides sufficient inlet capacity for the pipes to operate at their required capacity.

In all cases, design consideration must be given to pit location and pit inlet capacities.

Pits should be installed upstream of kerb ramps and pedestrian crossings to minimise nuisance flows.

11.2.8 Main Drains

Pipes of Ø750 mm or greater are to be considered as main drains and as such, direction changes through standard pits are undesirable. Consideration should be given to use of special manholes, additional pits, streamlining and/or bends at all changes of direction.

Design criteria for main outfall drains must be determined after discussion with the Council's Engineering Department.

Alignment of network drains, other than rear of allotment drains – all drains to be constructed on public land either open space reserve or road reserve, or dedicated drainage reserve.

Pipe Type

Reinforced Concrete Pipes and Culverts

Reinforced concrete pipes with spigot-and-socket profile and rubber ring joints, manufactured to meet the requirements of *AS/NZS 4058*, *AS/NZS 1597*, *AS/NZS 2041*, and *AS/NZS 5100*, are approved for use by all Councils. Flush-jointed reinforced concrete pipes with external bands, manufactured, designed and installed to the above standards may be used for culverts and other specific applications, subject to the prior approval of Council's Engineering Department.

Other Profiles and/or Materials

Prior approval in writing from Council's Engineering Department is required for all other pipe profiles and/or materials.

Any application for the approval of other profiles and/or materials must include:

- Details of any Australian or overseas Standards covering the design and installation of the pipeline;
- The manufacturer's recommendations for type, class, loading, cover, and installation procedures;
- Details of where, by whom, and for what purposes similar pipes have previously been approved;
- Details of testing and inspection proposed to be undertaken;
- Other details as required by the Council.

Pipe Diameters

The minimum pipe diameter is generally 100 mm PVC-U for property inlets serving a single dwelling and 150 mm PVC-U for property inlets serving two dwellings (Council to confirm minimum pipe diameters). The minimum pipe size for rear of allotment drains should be determined on merit, with a minimum diameter of 150 mm and be of DWV class or better. Note: rear of allotment drains should be avoided where possible. Councils may require larger diameter property inlets where the runoff being generated from the property so dictates.

Pipes that are or will become Council assets, and are not required to convey runoff from a road or street, must have a minimum diameter of 150 mm. Pipes that are or will become Council assets, and do convey runoff from a road or street, must have a minimum diameter of 375 mm, to reduce the risk of blockage.

The Design Engineer may apply in writing to Council's Engineering Department for approval to vary the above minimum sizes. Such applications must be accompanied by computations to show that the required minimum flow velocities have been achieved, and the capacity of each pipe is adequate for its intended purpose. The application must also detail how blockages are to be avoided when the pipes in question are required to convey runoff from a road or street.

Standards for Design and Installation of Stormwater Pipes

Relevant Standards and Guidelines:

- AS/NZS 3725 Design for installation of buried concrete pipes;
- AS/NZS 2566 Buried flexible pipelines Part 2.

General

All pipes must be designed and installed according to the relevant Australian Standards, utility design guidelines and manufacturers specifications. When selecting the type and class of pipe to be used, due regard must be had to the external loading, the pipe characteristics and the construction techniques to be used. The pipe embedment materials and procedures must comply with any specific recommendations published by the pipe manufacturer, and all relevant controls must be applied to plant and compaction techniques when required for a particular type and class of pipe.

Reinforced Concrete Pipes

Reinforced concrete pipes must be designed and installed in accordance with AS/NZS 3725 and with the guidelines published by the Concrete Pipe Association of Australasia at: <http://www.cpa.asn.au/General/technical-publications.html>.

Rubber Ring Jointed (spigot and Socket) pipes should be used typically in road reserves and easements where tree roots may infiltrate or cost of maintenance is high..

External band (EB) jointed concrete pipes or other joints agreed may be used except in those circumstances listed below, in which case rubber ring jointed (RRJ) concrete pipes must be used;

- Where Hydraulic Grade Line exceeds 0.5 metres above the pipe;
- Where tree growth in the vicinity of the pipe is likely (e.g. in road reserves, easements and reserves);
- Where pipe grade exceeds 20%, except if anchor blocks provided;
- Where a Geotechnical investigation shows highly reactive clays, and/or a high water table within the pipe location;

Anchor blocks should be used on all RRJ pipes with grades exceeding 30%.

11.2.9 Structures

Storm water Drainage Structures

Stormwater drainage structures must comply with Council's standard drawings for such structures. Where modification to details or special structures is required, details must be submitted with the detailed design documentation. Acute intersection angles between stormwater drainage lines at pits will not be permitted.

Minimum Drops at Pits

Minimum drops at pits are required to provide sufficient slope along the pit inverts to clear debris, and to provide tolerance in setting pipe invert levels. Generally the minimum drop through pits is 20 mm. However, in all circumstances where changes in direction occur, a number of pipes enter the one pit, large inlet and outlet velocity differences exist or grated or side-entry pits are used, losses must be considered and provided for.

Consideration for allowing CCTV vehicles through the network may require no drop across the pits.

Maximum Drops at Pits

Where drop pits are proposed with a level difference greater than 2 metres between any incoming pipe and the pit outlet, pits must be designed in accordance with the AUSTROADS “*Road Design Guidelines - Part 5 – General and Hydrology Considerations*” and any DPTI Supplement to those guidelines.

Side Entry Pits and Grated Pits

Pit functions and capacities must be in accordance with AUSTROADS “*Road Design Guidelines - Part 5A Drainage – Road Surfaces, Networks, Basins and Subsurface*” and any DPTI Supplement to those guidelines. Pit construction must be in accordance with Council’s Standard Drawings or the standard drawings in Appendix A.

Prefabricated pits may be used subject to approval by Council’s Engineering Department. Technical details including material, specification, dimensions, product data sheet, any advantages or disadvantages, and the location must be submitted prior to approval. Council’s Engineering Department may require that a certificate be provided by a Qualified Engineer to confirm the structural integrity of the pits in the proposed application.

All pits shall be designed for the road class and include some redundancy to allow for minor site modifications typical to construction.

Pit Covers

Pit covers must have a clear opening of sufficient dimension and orientation to comply with WHS and confined space entry requirements.

Heavy duty lids or plastic lock-down lids may be required in high risk areas such as Public Open Spaces, recreation reserves, school areas etc.

Pits and inlets are to have a minimum Class D loading unless otherwise agreed by Council. Elsewhere covers are to be installed with class rating in accordance with potential traffic loadings as per AS3996 – 2006 Access Covers & Grates. Trafficable load bearing covers are to be provided on all side entry pits located in exposed kerb areas, e.g. at intersections, and on all pits located in industrial Developments. The stormwater drainage network should be designed to locate pits away from exposed kerb areas wherever possible.

11.2.10 Outfall Structures and Energy Dissipaters

Outfall structures or discharge points for floodway’s at receiving waters must be designed in accordance with the requirements of the responsible authorities for the relevant land and receiving waters. Energy dissipaters for pipes should be designed to reduce the flow velocity and energy head to below acceptable scour rates for natural creeks and streams.

11.2.11 Stormwater Pump Stations

Due to the high ongoing operation and maintenance cost, stormwater pump stations will only be approved where a gravity system is not possible.

All stormwater pump stations must comply with the following requirements:

- Secure site;
- Be designed based on a safety in design risk assessment which includes operation and maintenance;
- Pump station to be either prefabricated (preferable) or constructed on site (as required);
- Pump stations must be constructed at a level above the 100 year ARI flood level;
- All pump stations must be capable of being isolated with an approved penstock;
- Typically fully submersible pumps would be required in a wet well;
- For large discharge rates Council may require an above ground roofed or weather protected pump in a double chamber pit including a penstock for back-flow isolation;
- Be equipped with identical pump sets;
- Be designed with consideration of minimising the long term maintenance and operational costs;
- Have access for a vehicle to remove any pumps for repair, replacement or maintenance;
- Pumps must include duty and standby units, which are alternated regularly and must be:
 - Be designed for up to 12 pump starts per hour;
 - Be rated for continuous operation;
 - Be designed with non-overloading characteristics beyond the duty point close to zero head;
 - Be 3 phase, unless otherwise specified by the Council;
 - Have a power rating 15% greater than the maximum required;
 - Incorporate thermistors;
 - Have starting characteristics acceptable to the electricity supply company and the Council;
 - Drywell installations with self-priming pump sets.
- Float level controls with capacity to switch pump sets on and off at various levels shall be installed. The selection of a pump(s) must comply with outfall requirements including cut-in and cut-out probes to ensure that the pump(s) does not operate if the outfall drain(s) is running full.
- Switching equipment to include connection to telephone landline and appropriate alarm systems, as part of Council's emergency on-call system;
- Include back up power if a power failure will flood properties;
- Storage to accommodate a power failure / equipment failure based on average call out and repair time for the locality;
- Provision must be made for the alarm system to be converted to a telemetry system, able to supply operational data on a regular basis, and/or upon interrogation, by a radio link or, with the written consent of Council, by mobile phone;
- The pump station electrical cabinet must include:
 - Main switch and distribution circuit breakers and supply authority meters;
 - Vandal shielded warning lights;

- Lights and cabinet are to be visible from the nearest roadway during daylight hours and must show the following: Green constant-normal operation. Red constant-fault. Red flashing-high water level;
 - Door operated cubicle light;
 - General power outlets accessible from outside of the switchboard but within the cabinet (10 amp);
 - Orientation of the cabinet to ensure that the pump station manhole is visible from the position required to operate the control panel;
 - A vandal proof lockable handle is to be installed on the door to the cabinet. Contact with the Council must be made to obtain the details of the key type to be used;
 - An external connection for an alternate power supply including phase reversal switch;
 - A selector switch for automatic or manual operation. Thermistor motor over-temperature protection relays;
 - Auto cyclic duty/stand-by controller for multiple pump facility;
 - Sufficient space to allow installation of a future telemetric monitoring system;
 - A controller to monitor high basin water level alarm, high outfall water level alarm, low level alarm, duty start and stop, no flow condition or power off condition.
- A velocity or energy dissipation system acceptable to the Council's Engineering Department must be provided to ensure that the incoming stormwater will not cause erosion to the bed or banks of the basin;
 - The inlet(s) to the pump(s) should be appropriately screened to prevent the pump(s) being fouled;
 - An assessment of the most cost effective power source must be undertaken for pump stations with significant power demands considering SAPN ongoing supply charges.

11.2.12 Subsoil Stormwater Drainage

Appropriate sub-surface stormwater drainage must be installed where ground water or overland flows may adversely affect the performance of areas set aside as Public Open Space or Reserves. All sub-surface stormwater drainage must be installed in accordance with AUSTROAD and DPTI Standards and must include flushing points at the remote end from the outlet pit. Subsoil Stormwater Drainage system may be deemed to be Water Affecting Activity and permits/ licenses may be required from relevant State Departments.

The desirable minimum grade for any sub-surface stormwater drainage for pavements is 1:250 with an absolute minimum of 1:300. Typically, circular 100 mm rigid wall or flexible UPVC Class 1000 slotted including geotextile sock where required, is installed under each concrete pavement edging to a minimum depth of subgrade level.

The Developer's Consultant must include and submit to the Council, full details of all sub-surface stormwater drainage proposed to be used in the Development.

11.2.13 Property Drains

A stormwater connection point shall be provided for each and every allotment. The location of the legal point of discharge and design of the property connection is at the discretion of Council and shall be undertaken in accordance with Council's standards and guidelines.

Where a property drains via gravity to an existing Council drainage network, road reserve or existing easement this will be the preferred method of discharge.

Where residential properties drain naturally to the street, two (2) galvanised steel kerb adaptors (to be cast into concrete) shall be provided per allotment. Such adaptors shall be cast into the kerb on both sides of the allotment, the location of which shall be within approximately one and a half metres from the alignment of adjoining property boundaries.

For hammerhead style residential allotments with stormwater drainage to the road, a 300 mm x 300 mm grated inlet pit/junction box is to be located at the lowest corner of the allotment and a 150 mm minimum diameter pipe shall be installed within the allotment access or within an easement.

Where any allotment grades to the rear and there is no rear of allotment stormwater drainage provided, if not established, a stormwater drainage easement will need to be obtained for the outfall pipe drain through the rear property for connection to the street water table at the Developer's expense. Rear of allotment drains are at the discretion of Council.

- Such drains shall be designed to accommodate stormwater from the entirety of the respective developed allotments in the occurrence of a 20 year ARI storm event. The minimum diameter of the pipe shall be 150 mm and each allotment shall be provided with a 300 mm x 300 mm grated inlet pit/junction box, located at the lowest corner of each respective allotment.

Rear of allotment stormwater drainage shall also be provided where the allotments back onto reserves.

Front of allotment drains are acceptable where gravity discharge to the kerb is not possible or there is no kerbing.

Stormwater discharge from industrial/commercial properties (including car parking areas) must pass through an appropriately treatment chain to achieve water quality targets set by EPA/Coastal waters Water Quality Improvement plan/WSUD policy, located within the property to remove grit and contaminants prior to entering the stormwater system via a minimum 300 mm diameter Reinforced Concrete Pipe connection to the piped stormwater drainage system.

The outfall pipe drain should be connected to Council's drain, subject to Council approval, by breaking into an existing junction box or side entry pit or by constructing a new junction box on the existing drain. Where there is no existing stormwater infrastructure located adjacent to commercial/ industrial facilities the legal point of discharge shall be agreed with Council prior to design and documented in the Stormwater Management Plan.

In some cases the outfall may discharge to an open channel or natural watercourse via a headwall with appropriate scour protection with the written approval of the Council's Engineering Department.

Easement drains must be provided to all allotments that fall to the rear and must be deep enough to serve the entire allotment. A property inlet, as per Council's Standard Drawings, must be constructed at the low corner of each allotment. The minimum fall towards the underground stormwater drainage outlet along the low side of allotments is 1:200.

11.2.14 Major Stormwater Drainage Requirements

The major stormwater drainage system must collect major storm runoff from a catchment, in excess of the capacity of the minor stormwater drainage system, and convey this runoff to the receiving waters with minimal nuisance, danger or damage. The major stormwater drainage system must be so designed and constructed as to ensure a reasonable level of safety and access for pedestrian and vehicular traffic, limit flooding of private and public property and minimises the inflow of pollutants to receiving waters.

The design of major stormwater drainage systems should take into account the potential use of wetlands, gross pollutant traps and sediment interception ponds, particularly immediately downstream of urban areas.

Major Stormwater drainage within railway reserves should be limited to cross track stormwater drainage rather than longitudinal stormwater drainage. The Design Engineer must obtain approval from the relevant authority

for all Infrastructure proposed to be located in railway reserves before seeking detailed design approval from Council Engineering Department. Where the works are required for a Development the Developer must pay all associated costs for such stormwater drainage works, including any once off and ongoing fees specified by the relevant authority.

Minimum requirements of the major stormwater drainage system are as follows:

- Design of major stormwater drainage systems must be based on the critical major storm in accordance with Table 8 and Table 11 with some consideration given to the impact of a rarer storm event (Q500). The critical storm must be determined by routing storms of varying duration until major peak flows (in accordance with Table 8 and Table 11) are identified. Two recognised flow estimation methods (runoff routing computer models) in addition to the Rational Method must be used for comparative purposes for urban catchments or sub-catchments greater than 50 Ha.
- Hydraulic Grade Line analysis must be used for design of floodway's, low flow pipes and detention/retention basins. The width of major floodway's must be governed by the greater of the hydraulic requirements or the width for suitable maintenance (including mowing of grassed trapezoidal drains).
- Street stormwater drainage in urban areas must not be directed into easements drains;
- The depth of overland flows in urban areas must be controlled by freeboard to properties or upper limits of surface flow depth/velocity criteria for public safety as detailed in AUSTROADS "*Road Design Guidelines - Part 5A Drainage – Road Surfaces, Networks, Basins and Subsurface*" and any DPTI supplement to those guidelines. As a guide, flows conveyed through the road network during the critical major storm (in accordance with Table 8 and Table 11) must be kept below a flow "depth x velocity" limit of 0.4 m²/second and maximum allowed ponding of 0.15 metres corresponding to the kerb heights parallel to the flow.

11.2.15 Floodway Design

A major floodway generally comprises engineered open waterways, and often make use of roadways, trapezoidal channels and sometimes sheet flow through open spaces. Major floodway's are generally located within road reserves, stormwater drainage reserves or Public Open Space. Council will not accept major floodway's through easements on private land in urban situations and major flows in accordance with Table 8 and Table 11 must be contained entirely within reserves for urban areas.

Where overland floodwaters or flood-storage is or will be altered or changed as part of a Development, compensatory works must be assessed and implemented.

Where active floodway's are present it is unlikely that Development will be approved without hydraulic modelling and analysis. The Designer may also be requested to submit a risk assessment report including details of proposed works to ensure that the potential for loss of life, risk to health and damage to property is minimised, and how the flood conveyance or storage will be accommodated.

The Designer must ensure that the hydraulic modelling, analysis and resulting works does not detrimentally affect any adjacent landholders as a result of the proposal. For Developments, the analysis must also identify the extent, velocities and depth of overland flood flows on the Development.

The alteration or change to any existing wetland must only be considered after all other alternatives have been considered. The function of a floodplain is to convey and store floodwater and preserve the inherent values of wetlands.

The minimum requirements that apply to the design and treatment of floodway's, and open unlined drains, are as follows:

- Depth of floodway's should be kept to a minimum (generally less than 1.2 metres);
- Desirable minimum batter slope is 1:8; absolute minimum batter slopes must be 1:5. Desirable minimum cross fall for inverts is 1:40. Minimum bed width is to be 2.5 metres;
- Permissible scour velocities and minimum permissible velocities for public safety must govern maximum longitudinal grades for major floodway's;
- Desirable minimum longitudinal grade for major floodway's is 1:200 in order to minimise the likelihood of ponding and siltation. Absolute minimum grade is 1:300;
- Flexible structures, utilising rock gabions, rock mattresses and geotextile fabric are preferred for grade control structures, minor energy dissipaters and major erosion/scour protection measures;
- Floodway Design utilising a low flow pipe must be sized for the entire major ARI design flow (in accordance with Table 8 and Table 11) based on the assumption that the low flow pipeline is fully blocked during major storms. Low flow pipes must be designed in accordance with the following:
 - Desirable minimum cover for low flow pipes is 450 mm and absolute minimum cover is 350 mm. Appropriate pipe classes should be adopted accordingly for the design circumstance, and with due consideration to plant used for drain maintenance.
 - Low flow pipes providing outlet stormwater drainage for detention basins must be designed with invert levels of adequate depth to command the pipes located within the basin;
 - The design flow for low flow pipes must be for a 3 month ARI flow as an absolute minimum;
 - Minimum grade of low flow pipes must be sufficient to generate self-cleansing velocities;
 - Minimum size of low flow pipes is Ø375 mm to reduce the potential for blockage;
 - Maximum spacing of pits on straight sections of low flow pipes is 80 meters;
 - Low flow pipelines, including pits and other structures should be aligned to minimise hydraulic losses. In some cases however, pits/structures may be specifically designed to dissipate energy, e.g. drop chamber energy dissipaters (with large diameter/minimum grade outlets) may be included.
- Major floodway's that cannot be provided with a low flow pipe due to inadequate longitudinal grades or level constraints must be designed with a lined low flow invert or trickle flow channel where feasible. Subsurface stormwater drainage is generally required in this instance.
- Pipes discharging into major floodway's must be connected to the low flow pipe with surcharge pits provided as necessary.

11.2.16 Stormwater Drainage Reserves

Where stormwater drainage reserves are incorporated into Developments the minimum reserve width should allow for a minimum horizontal and vertical clearance either side of that asset (watercourse, drain etc.). Reserve widths must accommodate a drain with sufficient capacity to cater for a major storm event (in accordance with Table 8 and Table 11. A 3 metre wide all-weather access track may be required on both sides of the drain with batter slopes greater than 1:8. Pump stations, electrical supplies, water-quality treatment Infrastructure must be sited with sufficient room for construction and maintenance vehicle turning at an appropriate location, refer to Section 11.4.8.

Wherever possible stormwater drainage reserves should generally be sited to abut Public Open Space areas, but will only contribute to the provision of Public Open Space in accordance with requirements of Section 13. Consideration should be given to increasing reserve width for conservation and landscaping purposes.

Where stormwater drainage Infrastructure within the stormwater drainage reserve does not comply with standards for public access, the reserve must be fenced to prohibit public access. A landscaping plan and fencing details must be provided to the Council Engineering Department for approval. Fencing and landscaping must be completed at the full cost of the project, or Developer for Development related works.

11.2.17 Building Over Council Stormwater Drainage Easements

Consent from Council Engineering Department is required to construct a permanent building/structure over a Council stormwater drainage easement. Building over Council drainage infrastructure will only be considered where all other opportunities have been exhausted and design considerations must consider the ongoing upkeep and maintenance of both assets.

11.2.18 Urban Stormwater Drainage Easements

Where stormwater drainage easements are required to facilitate future access to the stormwater drainage network the Council/Developer will take the necessary measures to ensure that the stormwater drainage reserve/easement/allotment be vested in Council ownership.

Easements shall only be considered where discharge to the road reserve or existing drainage reserve is not feasible. Construction of easements is at the discretion of Council.

Easements shall be provided over all drains in any allotments not being a road reserve. Council easements shall be a minimum of 3 metres wide when the easement contains only a single drain or pipe and at least 4 metres wide when the easement contains more than one drain or pipe.

Easements shall be matched and aligned with those existing on adjacent properties to provide continuity for utility services and ensure the proposed use for which the easement is created can be achieved.

No stormwater management infrastructure (e.g. GPTs, detention basins, wetlands, biofilters etc.) are to be in located in drainage easements.

11.3 Rural Stormwater Drainage

11.3.1 General

Stormwater drainage design must give consideration to the entire stormwater drainage catchment, not just the area included in any individual project, Development or land division and must be in accordance with the provisions of the AUSTROADS “*Road Design Guidelines - Part 5 Drainage – General and Hydrology Considerations*” and any DPTI Supplement to those guidelines.

The Design Engineer must consider potential upstream Developments, overland flow paths, natural stormwater drainage lines, the possible removal of unnatural stormwater drainage obstructions, the depth of flooding that may occur on roads and private property and other factors which may impact on or be affected by the design of any rural stormwater drainage system.

11.3.2 Requirements

Stormwater runoff estimation for rural catchments (undeveloped areas) must be based upon hydrological methods and data contained within the latest issue of AUSTROADS “*Road Design Guidelines - Part 5 Drainage – General and Hydrology Considerations*” and any DPTI Supplement to those guidelines, unless otherwise specified within this Infrastructure Guideline (SA).

Two recognised flow estimation methods (runoff routing computer models) must be used for comparative purposes when dealing with rural farming catchments or sub-catchments greater than 50Ha.

11.3.3 Minor Stormwater Drainage

In addition to relevant sections of Section Table 11 the following requirements apply to the minor stormwater drainage systems in rural living, low density and rural areas:

- The minimum pipe size for road cross-culverts is Ø375 mm in order that maintenance of the culvert is facilitated and the chance of blockage is reduced;
- The minimum slope of earth drains is to be 1:500;
- The minimum bed width of the drain is 1 metre unless otherwise approved;
- The desirable maximum batter slope of earth drains within the Clear Zone is 1:6, with the absolute maximum batter slope of 1:4. Where the drain is located outside the Clear Zone the maximum batter slope is 1:3 without bank stabilisation being undertaken.
- Wherever possible cross-culverts should be extended to terminate outside of the Clear Zone. Driveable endwalls complying with Council's standard drawings must be provided for cross-culverts that are parallel to the traffic flow and whose ends are located within the Clear Zone.
- The discharge of any roadside table drain into a stormwater drainage authority drain requires that authority's approval and the structure must be constructed in accordance with their requirements;
- Property connections in rural living residential Developments must discharge through the side of the vehicle crossover endwall and not directly into the table drain.

Culverts must be sized with the following capacities:

Table 11 - Average Recurrence Intervals for Rural Stormwater Drainage

Stormwater Drainage System	Capacity
Rural road culverts	20 yr. ARI
Major rural culverts	50 yr. ARI
Major rural culverts (DPTI Roads)	100 yr. ARI

The design should consider how to provide for flows exceeding the capacity of the pipe so as to avoid flooding in these events e.g. floodway to be incorporated with culvert installation.

11.3.4 Major Stormwater Drainage

The major stormwater drainage system must collect major storm runoff from a catchment, in excess of the capacity of the minor stormwater drainage system, and convey this runoff to the receiving waters with minimal nuisance, danger or damage. The major stormwater drainage system must be designed and constructed such that its function ensures a reasonable level of vehicular traffic safety and accessibility limits flooding of private and public property and minimises pollutants inflows to receiving waters.

Design of major stormwater drainage systems must consider use of wetlands, gross pollutant traps and sediment interception ponds.

Major storm water drainage within railway reserves should be limited to cross track stormwater drainage rather than longitudinal stormwater drainage and the Design Engineer must obtain approval from the relevant authority for all such Infrastructure before seeking detailed design approval from the Council Engineering Department. The Developer must pay all associated costs for such stormwater drainage specified by the relevant authority for new Infrastructure associated with their Development.

Council will consider major floodway's through easements in private land in rural living Developments where alternatives are not practicable.

Minimum requirements of the major stormwater drainage system in rural areas are as follows:

- Design of major stormwater drainage systems must be based on the critical major storm (in accordance with Table 8 and Table 11) with some consideration given to the impact of a rarer storm event (Q500). The critical storm must be determined by routing storms of varying duration until major peak flows (in accordance with Table 8 and Table 11) are identified.
- Hydraulic Grade Line analysis must be used for design of floodway's, low flow pipes and detention/retention basins. The width of major floodway's must be governed by the greater of the hydraulic requirements or the width for suitable maintenance (including mowing of grassed trapezoidal drains).
- The depth of overland flows must be controlled so as to maintain public safety and avoid damage to properties, having regard to the criteria in AUSTROADS "*Road Design Guidelines - Part 5 – General and Hydrology Considerations*", SCARM Report "*Floodplain management in Australia: best practice principles and guidelines*" and any DPTI Supplement to these guidelines;
- Road stormwater drainage in Rural Living areas may be directed into drainage reserves;
- Minimum width of drainage reserves for open drains in rural areas is 5 metres, or allowance for the open drain and 2.5 metres wide access track within the drainage reserve, whichever is greater.

11.4 Retention/Detention Basin Design Requirements

11.4.1 Location and Siting

Retention/Detention basins generally should not be sited in areas identified as being affected by overland flooding. Siting basins within an area affected by inundation requires specific prior approval from Council and all other relevant authorities.

Retention/Detention basins may need to be protected from unrelated overland flows entering the basin and therefore, apart from the above limitations, must not be located in areas designated on the floodplain maps maintained by the relevant authority as an active floodway. Works must be carried out to minimise erosion and maintenance resulting from overland flows entering the basin.

Where possible the number of retention/detention basins servicing an area shall be minimalised in order to reduce Council's future maintenance expenditure.

Where feasible and through negotiation with Council the detention basin should have a dual use as a public open space area and integrating landscaping features should be considered.

Siting of retention/detention basins must have regard to:

- The physical dimensions required for storage volume including the flattest possible batters, access to the basin bed, and maintenance of batters and edges;
- Predevelopment catchments;
- Existing developed catchments;
- Grade and earthworks;
- Operational invert of the basin and maximum water level;
- Existing stormwater drainage including piped, swale drains, or flow paths;
- Existing and proposed stormwater drainage easements;
- High flow bypass where outlet is blocked;

- High flow bypass for major events;
- Ground water depth and seasonal fluctuations (EPA requires a minimum clearance of 2 metres between potentially contaminated stormwater and the seasonal water table, unless otherwise approved by the EPA);
- Basins containing potentially contaminated stormwater to be greater than 100 metres from a major watercourse or 50 metres from a minor watercourse, unless otherwise approved by the EPA;
- Subsoil characteristics;
- Location and point of discharge;
- Soil type and infiltration rate;
- Land uses and zoning;
- Be aesthetically pleasing;
- Be designed to form part of the open space;
- Provide emergency access/egress for trapped animals and people;
- Be located and designed to be safe and readily accessible for maintenance and repairs (fencing etc. to be considered);
- Avoid any adverse impact on amenity in the surrounding areas, such as odour and mosquitoes;
- Effect of overland flows external to the catchment;
- Potential risk or effect on people, fauna and flora;
- Amenity of the area;
- Benefiting landholder issues;
- Provision of a suitable discharge method by:
 - Selection of a suitable pump station and associated electrical equipment location capable of being situated in close proximity to public view;
 - Gravity;
 - A combination of gravity and a pumped outfall.
- Availability of mains electricity for pumping and/or future telemetry;
- Safe access for maintenance and maintenance issues and all weather access;
- Water quality;
- Whether or not the retention/detention basin is proposed to be used or included in the calculation for Public Open Space for Development;
- The location of overland flows into the basin and the treatment(s) to minimise erosion;
- Consider incorporation of stormwater treatment, sedimentation traps and litter traps;
- Inlet and outlet velocity and the need to install energy dissipation structures;
- 1% flood level or highest recorded flood level information.

11.4.2 Design Criteria

Detention basins must be designed with regard for the critical major storm (in accordance with Table 8 and Table 11) Typical detention basins are designed to reduce post development flows to the equivalent pre-development flows but this will depend on the location and sensitivity of the receiving stormwater system.

Detention basins should be designed to ensure that standalone detention basins drain completely within a reasonable time following each rainfall event and, wherever practicable, are constructed so that the area can be used for passive or active recreation or other uses as determined by Council.

Typically outflows from detention basins are controlled via an orifice which designed to reduce peak flows to pre-development conditions.

Retention/Detention basins with established areas downstream and no clear and safe overland flow paths must be designed to minimise the risk in the event of a storm above the major design storm event.

Where it can be demonstrated that during a major storm event the detention basin will be inundated by external overland flows; the detention basin may be designed to detain stormwater runoff for a minor storm event. The criteria for sizing the detention basin are at the discretion of the Council Engineering Department.

The minimum freeboard must be 300 mm for earth structures and 200 mm for hard structures, noting that allowance for wind action shall be required for retention basins. Council Engineering Department will require a minimum freeboard to top basin water level (following a major peak storm in accordance with Table 8 and Table 11, no outfall condition) equal to lowest kerb invert level or property level in the catchment area. Furthermore:

- The top water level in the retention/detention basin resulting from the minor stormwater drainage storm event as detailed in Table 8 and Table 11 must be no higher than the invert of the lowest inlet pipe to the basin.
- The overland flow path for a major storm must be designed such that the minor system contribution to flow is ignored, i.e. inlet pipe is blocked.
- Long term storage in upstream pipes and pits is discouraged. For storage calculations, the volume of storage in pits and pipes in the minor system is ignored.

11.4.3 Inlet Structures

Any inlet to a basin must have an approved inlet stormwater drainage structure and may have a low-flow pipe, where practicable, connected to the pump station capable of a flow (not under head) equal to the maximum pump discharge rate.

Any inlet pipe to a basin must be fitted with a headwall and an approved guard structure that will allow debris escape and impede the entry of children.

Where there is a safety risk of a person falling, inlet headwalls shall be fitted with an approved post and rail barrier to prevent falls and to identify the location of headwalls and wingwalls.

All inlet headwalls will be fitted with appropriate energy dissipation structures.

11.4.4 Low Flow Pipes

Detention basins discharging into or located adjacent a natural creek or waterway must incorporate a minimum outlet pipe size of 300 mm diameter to reduce the risk of blockage.

11.4.5 Overflow Systems

A suitable overflow system must be provided to cater for rarer storm events above the major design storm and to provide for a blockage in the system.

Overflows from basins should consider:

- The design of the weir including providing adequate length and freeboard such that flows will be conveyed over the weir without over topping;
- The maximum depth of overland flow must be designed so that it is no higher than 300 mm below the lowest floor level of any dwelling impacted by the overflow;
- Adequate scour protection of the spillway;
- Wherever practical, design of the spillway should assume full blockage of the low-flow outlet.

11.4.6 Depth of Retention/Detention Basins

Where it is recognised that there is a localised elevated ground water table, it will be necessary that all excavations are limited to 0.5 metres above the water table.

Retention/Detention basins may require an impervious lining or other treatment to the approval of Council Engineering Department to prevent the ingress of groundwater.

Groundwater may be able to be extracted and used, subject to the relevant authority's requirements.

Solutions that require ongoing dewatering will only be considered where a whole of life cost has been undertaken which demonstrate that this is the best long term solution.

Any structure that penetrates the groundwater zone such as footings and stormwater drainage must be appropriately treated to prevent possible damage caused by contact with ground water.

If the use of the land changes from that of agricultural production, then any former grants for subsoil/groundwater pumps may be required to be refunded. Any Development that does not retain an irrigation right shall be required to finalise any outstanding debts or annual maintenance charges for ground water pumps. The Council will not accept any future charges in this regard unless written approval has been obtained.

The depth of all other retention/detention basins for which the public have access will be determined having regard to the safety of persons who may fall into or enter into the basin during times of operation in accordance with 11.4.9. To allow for this contingency, basins within a public space must be designed with inside batters having a maximum slope of 1:8. This slope will determine the maximum depth of any retention/detention basins.

11.4.7 Batter Slopes in Earthen Basins

Where public access is to be provided the desirable minimum batter slope for retention/detention basins is 1:8 for both cut and fill situations, with the absolute minimum batter slope being 1:4 for both cut and fill situations. The use of the absolute minimum batter slope must only be permitted after approval in writing has been obtained from the Council Engineering Department. The desirable minimum cross fall for floor is 1:400 graded to the outlet point.

The batter slopes for retention/detention basins which are securely fenced must have regard to the following factors:

- Soil type;
- Erosion;
- Maintenance;
- Safety and minimisation of risk.

11.4.8 Access Requirements

All weather access is to be provided to the retention/detention basin and any associated structures and pumps to enable maintenance to be carried out. The access must be designed so that there is no need to reverse at any time, other than manoeuvring to turn a vehicle around.

To ensure that maintenance of any portion of the basin and its associated works can be safely carried out, a 5 metre wide reserve is required around the perimeter of any retention/detention basin, unless the Council has given prior written approval for alternative arrangements.

11.4.9 Risk Analysis

A risk assessment report is to be prepared by the Design Engineer for all retention/detention structures, including basins and associated structures. The risk assessment should be undertaken in accordance with the principles of *AS/NZS 31000, Risk Management*, “Guidelines for the prevention of accidental injury associated with artificial or altered water features in public places” (Department for Planning and Local Government) and the Royal Lifesaving Publication Guidelines for Water Safety – Urban Water Developments.

The Design Engineer is responsible for deciding on the action required in response to the risk assessment report and its recommendations, however consultation with Council Engineering Department is encouraged if recommendations are complicated, require community involvement, or have significant ongoing maintenance issues.

A copy of the risk assessment report, with recommendations and associated works, must be provided to Council with the detailed design documentation.

11.4.10 Fencing and Security

Unless prior written approval has been obtained from the Council Engineering Department, retention/detention basins which are not accessible to the public must be fenced and secured against casual entrance.

Where batters are steeper than those specified in Section 11.4.7 a full risk assessment must be submitted to the Council for consideration.

Where the risk assessment determines that the above ground storage system or retention/detention basin should be fenced due to public risk, an 1800 mm high chainmesh security fence must be installed for the entire perimeter. Suitable access via lockable gates must be provided for maintenance purposes.

11.4.11 Landscaping

A fully detailed landscape plan for all retention/detention basins must be submitted to Council for approval. Landscaping to be local species agreed by Council’s Landscaping department.

11.4.12 Maintenance

A heavy duty grate or cover must be provided for each pit that is located in the wheel path of vehicles (Class D as a minimum). Elsewhere covers are to be installed with class rating in accordance with potential traffic loadings as per AS3996 – 2006 Access Covers & Grates". Access covers and grates are to be designed such as to provide a 'standard' lifting system approved by Council.

Any large pipe inlets into the basin must be appropriately secured to prevent entry to the stormwater drain. If proposing to use grates these must be designed so that they can easily be maintained and so that they will not cause blockages during storm events.

Pits, pipes and screens that require regular cleaning and maintenance are to be readily accessible with all openings of suitable geometry to allow for cleaning and removal of debris and silt accumulations.

11.5 On-site Detention Systems

11.5.1 Objectives

The objectives of on-site detention systems are as follows:

- The ensure that the capacity of existing stormwater drainage infrastructure is not to be exceeded as a result of Council projects or development which increase the volume and rate of stormwater runoff beyond the capacities for which the infrastructure was originally designed;
- To ensure that the likely cumulative impact of similar projects or Development will not exceed the capacity of the existing stormwater drainage system;
- To reduce runoff and peak flows from urban and rural catchments into receiving waters;
- To minimise costs of stormwater drainage Infrastructure by reducing peak outflows;
- To ensure that on-site detention systems can be effectively maintained by landowners and provide a cost effective method of meeting the other objectives of this section.

11.5.2 General

Types of Developments requiring on-site detention

The following types of Development typically require on-site detention:

- Multi-unit Development in new residential areas where this has not been incorporated into the design of the stormwater drainage system for these areas;
- Multi-unit Development in older residential estates where the stormwater drainage system at the time of design and construction provided a capacity less than the current standard identified in Table 8;
- Industrial Development where the pipes have been designed for less than the current design recurrence interval identified in 11.2.6;
- Commercial Development where the pipes have been designed for less than the current design recurrence identified in 11.2.6;
- New carpark or road widening projects that increase the impervious area of the local catchment greater than 10%;
- Existing development where there is a known deficiency in Councils stormwater drainage systems;
- Development proposing siphonic drainage where there were previously gravitational systems and where the volume and intensity of stormwater runoff is increased.

Specific Design Requirements

No section of pipe system within a detention system, which conveys water, may be less than 100 mm in diameter unless it is part of an approved manufactured system or it is part of the restriction to achieve to design flow rate e.g. orifice plates or pipes discharging from an above ground tank.

The outlet orifice is to have an access point for the inspection and maintenance in the event of a blockage.

A suitable overflow system must be provided to cater for rarer storm events than what the system has been designed for, up to and including a major storm event (in accordance with Table 8 and Table 11) and to provide for a blockage in the system. All overflows are to be directed away from buildings, adjoining properties and associated Infrastructure. The overflow system must be designed so that the maximum depth of overland flow is no higher than 300 mm below the lowest floor level of any dwelling impacted by the overflow.

Time of Concentration

The time of concentration for the **Critical Storm** of whole catchment and from the top end of the catchment downstream to the site is to be calculated and submitted with the design calculations.

Stormwater Management Plan Checklist

The following minimum information is to be supplied to Council's Engineering Department for approval:

- Plan showing invert levels of all pipes 100 mm or over;
- Plan showing the designed finished surface level of all driveways, car parking areas, landscaping areas and lawns;
- Plan showing floor levels of all buildings whether existing or proposed. Note all floor levels must be at least 300 mm above the top water level of the detention device when it is full to its design capacity;
- Cross section of the detention device;
- Existing surface levels at intervals not exceeding 10 metres. Note this is also required for adjoining properties;
- Plan showing location of detention device, position of all pipes and pits, pervious and impervious areas, buildings, driveways etc.;
- Driveways, where these are used for on-site detention, must be bounded by kerbs of not less than 100 mm in height, and must be cast integrally with the main slab unless otherwise approved;
- One copy of stormwater drainage computations;
- One copy of structural computations where underground storage tanks are to be used for stormwater detention;
- Three copies of final engineering plans for final approval.

Approved Types of On-Site Detention Systems

There are various systems that have been approved for use as follows:

- Above-ground water storage tanks;
- Driveways bounded by kerbs of not less than 100 mm in width, cast integrally with the main slab unless otherwise approved, and discharging through a multi-cell unit or orifice plate which restricts the flow as required;
- Underground tanks of various configurations discharging by gravity through an orifice plate or multi-cell unit;

- Underground tanks with pumped outfalls;
- Lined, in-ground storage basins with pumped outfalls;
- Excavated earthen basins with gravity outfalls (in rural living Developments or carparks).

Maintenance of On-Site Detention Systems

For on-site allotment detention systems to remain effective it is important that they can be inspected and maintained.

For private properties, the onus is on the landowner to regularly inspect and maintain the asset. If the asset is not adequately maintained and damage occurs downstream of the private property as a result, the landowner may be liable.

11.6 Water Sensitive Urban Design

11.6.1 Objectives

- To support the statewide policy and objectives of WSUD namely:
 - Encouraging best practice in the use and management of water to minimise reliance on potable water;
 - Promoting safe, sustainable use of rainwater, recycled stormwater;
 - To assist in protecting the health of water bodies and associated ecosystems by managing and maintaining or improving runoff quality;
 - To assist the management of flood-related risk associated with urbanisation, by controlling runoff volumes;
 - Managing peak flows to reduce the risk of flooding.
- To ensure that all stormwater discharged to natural watercourses and other stormwater drainage authority's drains meet the requirements of the Natural Resources Management Act 2004, Environment Protection Act 1993, and the water quality performance objectives for individual stormwater drainage catchments to comply with the Environment Protection (Water Quality) Policy 2015.
- To implement the design requirements of the Council's Stormwater Management Plan;
- To ensure all designs incorporate consistent best practice WSUD measures and principles;
- To ensure treatment methods and associated structures are cost effective from a maintenance and operational perspective and that the risk to the public is minimised as far as practicable;
- Protect and enhance natural water systems within urban environments;
- Integrate stormwater treatment into the landscape, maximizing the visual and recreational amenity.

11.6.2 General

All Designers must make provision for the improvement of water quality leaving the project site, wherever possible treatment should be achieved by works located close to the nominated point of discharge for the catchment. For Developments these works must be maintained, to the satisfaction of the Council, by the Developer until the end of the maintenance period or as agreed with Council.

All new urban Developments and Council projects shall meet the requirements of the Environment Protection Act 1993 and Environment Protection (Water Quality) Policy 2015, and should meet the '*Water Sensitive Urban Design in Greater Adelaide Technical Manual*' prepared for South Australian Council's.

It is recommended that the Office of the Technical Regulator is contacted to understand any additional WSUD design requirements for developments.

It is recommended that a treatment train approach be adopted to meet the requirements and targets for stormwater quality; this may involve construction of primary, secondary and tertiary interventions to remove a broad spectrum of water bourn pollutants.

The following stormwater treatment methods may be considered, subject to Council's Engineering Department approval, to enable compliance with the codes and guidelines:

- Bio-retention swales;
- Bio-retention basins;
- Vegetated swales;
- Underground sand filters;
- Sedimentation basins;
- Constructed wetlands;
- Pond system with edge vegetation;
- Water tanks;
- Gross pollutant traps;
- Litter traps;
- Oil and Grease Separation device;
- Creek rehabilitation including revegetation and WSUD.

Further to this Council may require setting aside areas of land and construction of works within a land division and/or Development application for the specific purpose of stormwater treatment to ensure appropriate discharge water quality.

The concept and detailed design should be undertaken by an appropriately qualified and experienced Specialist to determine the water quality infrastructure needed for the project to meet the objectives.

11.6.3 General Requirements

The following are general requirements for the provision of stormwater treatment:

- Developments and Council projects should comply with principles and recommendations of *Water Sensitive Urban Design in Greater Adelaide Technical Manual* and Council's Stormwater Management Plans to achieve the following water quality standards:
 - 80% retention of the typical urban annual load for Total Suspended Solids (TSS);
 - 60% retention of the typical urban annual load for Total Phosphorus (TP);
 - 45% retention of the typical urban annual load for Total Nitrogen (TN);
 - 90% retention of the typical urban annual load for gross pollutants (litter);
 - No visible oil flows up to the 3 month ARI peak flow.
- Discharges for an average 2 year ARI are to be maintained at predevelopment levels for stormwater quality treatments;
- Treatment types are determined by the Designer, subject to approval by Council's Engineering Department and must satisfy Council wide standards for (1) maintenance (2) ongoing costs and (3) stormwater quality;
- Developers of industrial estates shall be required to contribute to treatment off site if Council has whole of catchment treatment, noting that pre-treatment within the proposed Development catchment in accordance with the requirements of Council's Stormwater Management Plan may be required. Where whole of catchment treatment is not available Developers shall be required to provide separate treatment for their Development. Industrial developments may require oil/water separators or other inbuilt treatment devices to treat the stormwater.
- Staging and construction of Developments should be considered as part of the water quality planning, ensuring that treatment is only constructed when there are adequate houses built to generate sufficient runoff to keep plants alive. Council may wish to bond the value of the plantings in preference to have planting at an inappropriate time.
- No manual handling is to be involved for the cleaning and maintenance of structures and equipment associated with the treatment of stormwater. Routine maintenance must be carried out without need for access of confined spaces where feasible.
- Designers must undertake a risk assessment for all treatment sites, including but not limited to fencing, grates across drains, wetlands, retention/detention basins, pumping stations, and other associated structures;
- Operational documentation and manuals to be provided prior to the issue of Practical Completion;
- Ability to be maintained during summer and winter;
- Larger well designed sites treating larger catchments are preferred.

11.6.4 Gross Pollutant Traps

Approved gross pollutant traps must be provided towards the end of any stormwater drainage line that discharges to a watercourse and/or stormwater drainage basin, but should not be the only form of treatment, instead being part of an overarching treatment chain. The pit must be located such that safe and convenient access by maintenance vehicles is achieved. Access is highly desirable to be in a forward only direction where the pit is located in road reserves, stormwater drainage reserves or other areas with public access.

Gross pollutant traps should be designed to treat a 6 month ARI event, to be cleanable by Vac truck or removable basket, have a suitable overflow mechanism for the stormwater pipework capacity, and have its 'k' factor considered in the hydraulic design.

The default period for the cleaning of gross pollutant traps is 3 months for design purposes.

Council may nominate a Gross Pollutant trap supplier to maintain consistency with other devices in the Council area.

The design requirements for gross pollutant traps are as follows, in addition to the general requirements:

- For sizing gross pollutant trap (GPT) units the following design flows, depending upon the degree of hydraulic effectiveness required, are used:
 - Q (3 months) = $0.2 \times Q_5$ year design flow typically has a hydraulic effectiveness of greater than 97%;
 - Q (6 months) = $0.33 \times Q_5$ year design flow typically has a hydraulic effectiveness of greater than 98.5%;
 - Q (1 year) = $0.5 \times Q_5$ year design flow typically has a hydraulic effectiveness of greater than 99%.
- Selecting a design flow rate is a trade-off between the cost and space requirements of the device (a higher design flow will usually require a larger facility with additional costs) and the volume of water that could potentially bypass the measure and avoid treatment. GPTs will generally be designed to treat a minimum design flow of a 6 month ARI, the Designer will provide all weather access to all treatment sites to the satisfaction of Council's Engineering Department and should allow for crane access to GPT's. Access must not require maintenance vehicles to reverse in/through public areas, other than manoeuvring to turn a vehicle around.
- Discharge water quality standards must meet the requirements of the relevant stormwater drainage authority;
- For design purposes the cleaning frequency of GPT's is 3 months however this may be negotiable and is considered site specific.

11.6.5 Bio-retention Swales

Bio-retention design requirements are as follows in addition to the general requirements:

- Typically bio-retention swales are best suited to slopes of 1% to 4% or where velocities during major storm events do not exceed 2 m/s. Where excessive grades are identified as a constraint, check basins may be required to reduce velocities;
- Water ponding at entry points to the swale should not occur for longer than 1 hour after the cessation of rainfall;
- For maintenance requirements, grass swales requiring mowing must not have side slopes no steeper than 1:5;
- Should be in accordance with the guidelines set out in Water Sensitive Urban Design in Greater Adelaide Technical Manual.

11.6.6 Bio-retention Basins and Rain Gardens

The design requirements for bio-retention basins and rain gardens are as follows in addition to the general requirements:

- Water ponding at entry points to the swale should not occur for longer than 1 hour after the cessation of rainfall;
- Should be in accordance with the guidelines set out in Water Sensitive Urban Design in Greater Adelaide Technical Manual;
- The use of bio-retention basins and rain gardens requires approval from the Council's Engineering Department to ensure only appropriate locations and sizes are selected;
- Any infiltrated water does not have a negative impact on adjoining infrastructure or private property.

11.6.7 Vegetated Swales/Grass Swales/Buffer Strips

The design requirements for vegetated swales/buffer strips are as follows in addition to the general requirements:

- The longitudinal slope of a swale is the most important consideration, noting that swales with slopes of 1% to 4% are considered the most efficient. Lower than this, swales become waterlogged and/or have stagnant pooling, while steeper slopes may have high velocities (with potential erosion and vegetation damage risks). Check banks (small porous walls) may be constructed to distribute flows evenly across the swale if they are identified as the most suitable treatment option in such areas.
- Swale side slopes are typically 1:9, however for maintenance, grassed swales requiring mowing must not have side slopes no steeper than 1:4;
- Should be in accordance with the guidelines set out in Water Sensitive Urban Design in Greater Adelaide Technical Manual.

Approval for the use of vegetated swales/grass swales/buffer strips require approval from the Council's Engineering Department to ensure only appropriate locations and sizes are selected.

11.6.8 Sand Filters

The design requirements for sand filters are as follows in addition to the general requirements:

- Should be in accordance with the guidelines set out in Water Sensitive Urban Design in Greater Adelaide Technical Manual.

11.6.9 Sedimentation Basins

The design requirements for sedimentation basins are as follows in addition to the general requirements:

- The design operation discharge for the basin should be a minimum of 1 year ARI peak discharge.
- An additional storage volume should allow for storage of sediment; generally this is approximately 50% of the total storage volume however this will depend on the cleaning regime;
- Consideration should be given to the potential for leaching into the existing in-situ soil profile, where this is an issue consideration should be given to incorporating a liner;
- Where a liner is incorporated consideration should be given to how the basin will be cleaned without damage to the liner;
- Wet sedimentation basins can be problematic to maintain and may cause a nuisance with odours and mosquitoes etc. Consideration should be given to draining the basin regularly;
- A bypass structure should provide for flow bypass of downstream macrophyte zones and wetlands for events up to the major storm event (in accordance with Table 8 and Table 11);
- The sedimentation basin is to be designed to remove 95% of the particles less than 125 µm in a 1 year ARI storm event;
- Approach batter slopes should be no steeper than 1:4 with all edges having safety benches of at least 1.5 to 3.0 metres wide from the edge of the normal top water level;
- Safety benches should have a maximum grade of 1:8 for the first 1.5 – 3.0 metres before changing to 1:4 grade for at least the next 0.5 metres. Beyond this the grade may be to a maximum of 1:3;
- An independent safety audit must be conducted for each design;
- The hard stand should be at least 3 m wide and be designed to be capable of supporting 20 tonne excavation plant. Multiple areas should be considered where the pond is greater than 7 metres wide, including adequate space for dewatering. Access ramps and tracks into pond cells and to all hardstand areas are required and must be capable of supporting 20 tonne excavation plant for maintenance.
- Where sedimentation basins double as a landscape element, a weir is recommended as an appropriate discharge control structure;
- The installation of a rock layer or rubble on the base of the basin, above clay liner, should be incorporated within the design to indicate the limit of sediment (this reduces the risk of damage to the clay liner during future maintenance activities);
- For sedimentation basins less than 14 metres wide, access is to be provided along both edges for maintenance vehicles;
- For sedimentation basins greater than 14m wide, drawdown of the basin is required with vehicular access available in the base of the facility;
- Should be in accordance with the guidelines set out in Water Sensitive Urban Design in Greater Adelaide Technical Manual;
- Not constructed on steep land or as a permanent treatment where there is no maintenance regime in place to ensure regular removal of silt, debris etc.

11.6.10 Constructed Wetlands

The design requirements for constructed wetlands are as follows:

- The constructed wetland should treat at least 90% of Mean Annual Runoff (MAR) through the use of a stored event volume above the normal standing water level of the wetland;
- A high flow bypass should be provided capable of taking flows in excess of design flows (typically a 1 year ARI event);
- The wetland design must meet safety requirements and implement reasonable safety measures; this may include fencing, safety barriers, signage and benching;
- An independent safety audit must be conducted for each design;
- Approach batter slopes should be no steeper than 1:4 with all edges having safety benches of at least 1.5 to 3.0 metres wide from the edge of the normal top water level;
- Safety benches should have a maximum grade of 1:8 for the first 1.5 – 3.0 metres before changing to 1:4 grade for at least the next 0.5 metres. Beyond this the grade may be to a maximum of 1:3;
- Hard stand areas should be provided adjacent to the inlet zone to allow for the maintenance and clean out of this zone;
- The riser outlet pipe should be sized to act as an emergency overflow equivalent to the one year ARI peak discharge;
- A minimum of a 0.3 metres freeboard on the embankment is required;
- When considering macrophyte layout it is important to optimise hydraulic efficiency (i.e. reduce dead zones and short circuiting of water). The optimal hydraulic efficiency value for constructed wetlands should be not less than 0.5 metres or greater than 0.7 metres where possible. Refer to Water Sensitive Urban Design in Greater Adelaide Technical Manual.
- The wetland should be divided into four macrophyte zones, an open water zone and a littoral zone. The percentage allocation of each zone is outlined in Water Sensitive Urban Design in Greater Adelaide Technical Manual and should be followed.
- Suitable plant species options are listed in the Water Sensitive Urban Design in Greater Adelaide Technical Manual;
- A geotechnical investigation is required prior to design to determine soil profiles and infiltration rates. Hydrogeological investigations may also be required in areas where there is a likelihood of groundwater discharge or high seasonable water tables.
- Should be in accordance with the guidelines set out in Water Sensitive Urban Design in Greater Adelaide Technical Manual;
- Not constructed on steep land;
- Where appropriate aquatic fauna is encouraged to thrive.

11.6.11 Ponds and Shallow Lake Systems

The design requirements for ponds and shallow lake systems are as follows:

- When considering macrophyte layout it is important to optimise hydraulic efficiency (i.e. reduce dead zones and short circuiting of water). The optimal hydraulic efficiency value for constructed wetlands should be not less than 0.5 metres or greater than 0.7 metres where possible. Refer to Water Sensitive Urban Design in Greater Adelaide Technical Manual.
- Gentle slopes, safety benching, handrails and vegetation planting are methods that may be employed to account for public safety;
- An independent safety audit must be conducted for each design;
- Should be in accordance with the guidelines set out in Water Sensitive Urban Design in Greater Adelaide Technical Manual;
- Not constructed on steep land.

11.6.12 Rainwater Tanks

The design requirements for rainwater tanks are as follows:

- Continual water balance assessments should be performed to determine how much runoff rainwater tanks are removing from the catchment in terms of runoff volumes and associated pollutant loads;
- Rainwater tanks should be sized using the appropriate reference curves for the region;
- Should be in accordance with the guidelines set out in Water Sensitive Urban Design in Greater Adelaide Technical Manual;
- Water tanks for firefighting purposes should be designed and constructed in accordance with the technical requirements are provided in Minister's Specification 78, Additional requirements in designated bushfire prone areas.

11.7 Stormwater Discharge Points

11.7.1 Objectives

Stormwater discharge points will be set by Council's Engineering Department for all Developments and Council projects. Where the capacity of the downstream system is not known and the expected flow rate and/or volume of flow are likely to be increased, the designer will need to confirm the downstream capacity.

Stormwater and legal points of discharge will be determined by Council's Engineering Department having regard to the following objectives:

- To avoid the capacity of existing stormwater drainage Infrastructure being exceeded as a result of an increase to the catchment impervious area beyond the levels for which the Infrastructure was originally designed for;
- To limit the percentage increase of the stormwater flow being generated when compared to the whole catchment;
- Provide details of any stormwater pump system including backflow prevention and power loss considerations;
- To ensure that Councils minor system hydraulic grade line or Councils major system design surface levels do not cause back flooding to properties;

- To ensure that the likely cumulative impact of similar Developments or Council projects will not adversely impact on the capacity of the existing stormwater drainage system;
- To provide on-site detention in order to protect the existing stormwater drainage system capacity for the uses and areas for which it was originally designed;
- To achieve the best balance between cost and effectiveness of draining to each of the stormwater drainage systems capable of accepting additional stormwater flow;
- To ensure that any new drain required to be constructed has been assessed from the perspective of serving future catchment Development and avoiding duplication of infrastructure. Where possible equitable cost sharing arrangements must be determined on a case-by-case basis should drain sizes be increased to service other properties in the future. To ensure that stormwater is effectively treated, and that neither the resultant discharge nor the treatment processes themselves have an adverse impact on the environment and surrounding properties.

The low point of every allotment, including reserves and balance lots shall be drained to the stormwater drainage connection point nominated by the relevant Council, and typically located either in the adjoining street stormwater drainage or in a stormwater drainage easement.

11.7.2 General

Since existing Council stormwater drainage systems have been designed to different design standards and further land intensification have taken place that have increased the volume and rate of stormwater runoff beyond the levels for which the existing stormwater drainage networks were designed, the impact of new Developments and Council projects on the existing stormwater drainage systems must be assessed prior to allowing them to discharge directly into these networks.

An important objective for Council's Engineering Department will be to ensure that more frequent flooding does not occur and that existing stormwater drainage problems are not increased as a result of additional runoff and volume from Developments or Council projects.

Council may need to determine the impact of new Developments and Council projects on existing stormwater drainage systems prior to determining the legal point of discharge. The impact will need to be assessed from both a volumetric and rate of flow perspectives by the Designer.

Where the impact is likely to cause increased flooding frequency or flooding extent then Council's Engineering Department or the Designer will determine what works are necessary for a particular point in a stormwater drainage system to be the nominated point of discharge.

11.7.3 Requirements

Applications for nomination of point of discharge should include the following information:

- Site plan showing the extent of works, including proposed pervious and impervious areas;
- Existing and proposed surface levels at an interval not exceeding 10 metres;
- Provide design details of any stormwater pump systems including methods of backflow prevention;
- Description of the proposed Development or Council project;
- Locality plan showing the Development or Council project location and catchment boundaries;
- Location and size of existing drains and easements and reserves within and adjacent to the Development or Council project;

- For Developments, stormwater drainage rights and/or easements must be obtained by the Developer from all downstream owners who may be affected by the discharge of stormwater wherever the point of discharge is not to either a Council-owned drain or watercourse.

Where Council's Engineering Department determines that the Development or Council project is likely to adversely impact the existing stormwater drainage system Council's Engineering Department may require the Designer to provide further information including computations to determine the works that are necessary to minimise the impact on the existing stormwater drainage system. These may include providing on-site detention designed in accordance with the provisions of Section 11.5 of this Infrastructure Guideline (SA).

12 Environment Management during Construction

12.1 Objectives

The key performance objective is to ensure compliance with all environmental legislation and approvals, minimise the potential for pollution, reduce waste, and implement effective controls to mitigate environmental impact. A Construction Environmental Management Plan (CEMP) is typically prepared at the commencement of the project (before any site works are undertaken) to outline how this can be achieved and who is responsible for particular activities.

The general objectives of environment management are to ensure that:

- The project should aim to achieve sustainable waste management by applying the waste management hierarchy consistently with the principles of ecologically sustainable development set out in section 10 of the Environment Protection Act 1993 (the Act);
- All waste generated will be removed and disposed of in accordance with the relevant Australian Standards, Acts, Regulations, Guidelines and Codes of Practice in such a way as to avoid nuisance, pollution or loss of amenity to the surrounding area. Waste materials should not be disposed by burning unless approved by the Council.
- Construction sites are managed in a way to minimise the impact of construction works on the environment;
- The relevant provisions of Council's Stormwater Management Plan are complied with during construction;
- Fauna and existing vegetation which is to be retained is adequately protected during construction;
- The impacts of stormwater discharges on receiving waters are minimised during construction;
- WSUD and vegetated assets are protected from siltation;
- The impact of crushed rock or debris being carried onto public roads or footpaths is minimised and to ensure no mud is removed from the site;
- Declared noxious weeds (or parts of), are not transported either to or from the worksite, either on vehicles or machinery or within soil or materials;
- Existing contaminated soils are identified and managed or disposed of appropriately, in accordance with the Environment Protection Act and relevant National Environmental Protection Measures;
- Appropriate measures are taken to avoid damaging Aboriginal sites, objects and remains;
- Motorists are not put at risk as a result of dust, reducing visibility when construction works are carried out on or adjacent roadways and streets that are open to the traffic;
- All reasonable and practical steps are taken to minimise disruption to landowners and residents within the vicinity of the construction, in accordance with the requirements of any regulation or guideline or Code of Practice from the Environment Protection Authority.

12.2 General

The Construction Engineer and Contractors engaged must ensure that all appropriate steps outlined in the CEMP are taken to minimise any detrimental impact on the environment resulting from construction works.

Unless otherwise advised in writing, it is the Construction Engineers responsibility to undertake the necessary investigations, obtain the necessary approvals or permits, and comply with the requirements of all applicable environmental legislation, including (but not limited to):

1. *Aboriginal Heritage Act 1988 (SA);*
2. *Development Act 1993 (SA);*
3. *Environment Protection Act 1993 (SA);*
4. *Environment Protection and Biodiversity Conservation Act 1999 (Cwth);*
5. *Native Vegetation Act 1991(SA);* and
6. *Natural Resources Management Act, 2004 (SA).*

All earthworks must be undertaken in accordance with the provisions of *AS/NZS 3798 'Guidelines on Earthworks for Commercial and Residential Developments'*.

The Contractor / Construction Engineer shall, prior to the commencement of work on the site, submit to the Council their proposals for traffic movement, temporary structures, cleaning up, erosion control and the like. After the proposals have been approved by Council's Engineering Department, the Contractor / Construction Engineer shall be responsible for ensuring that the approved proposals are observed. Any changes to the approved proposals shall be subject to the prior agreement of Council.

12.3 Erosion Control and Sediment Discharge

The Contractor / Construction Engineer is responsible for developing and maintaining effective erosion control measures for the works. This involves planning and carrying out the whole of works to minimise the effects of runoff and erosion on the site and downstream areas. A 'treatment train' approach should be used, implementing the following measures, as appropriate:

- Stage earthworks and undertake rehabilitation/stabilisation as soon as practicable to minimise the area of bare earth;
- Establish sediment control structures around all areas prone to erosion, including stockpiles, batters and drainage lines;
- Install cut-off drains to intercept surface water before it reaches areas of disturbed earth;
- Install silt control measures prior to the entrance of all drains to minimise the discharge of silt off-site. All measures should be inspected after rain events and repaired as required. Typical measures may include one or more of the following:
 - Settlement ponds;
 - Fence filters;
 - Gravel sausages made from a geo-textile sleeve for placement at kerbside stormwater drainage pits;
 - Straw bales on open, cut-off or diversions drains;
 - Temporary sumps in selected and approved stormwater drainage pits;
 - Landscaping or the promotion of vegetation downstream of the works but still within the site.

- Locate any stockpiles away from drainage lines and in locations with minimal susceptibility to wind. Consider covering to reduce wind/ rain erosion and limiting height;
- Ensure erosion control measures are fully operational prior to commencing earthworks and for the duration of the works;
- Biofiltration systems, including raingardens, must be protected from siltation by measures that may include one or more of the following:
 - Installation of a bund, excluding silt laden stormwater from entering treatment zones;
 - Installation of temporary turf over treatment zones to protect filter media.

Consideration should be given to recommendations within AUSTROADS “*Road Design Guidelines - Part 5 – General and Hydrology Considerations*” and any DPTI Supplement to those guidelines and EPA Publications.

Dust, mud and debris must be prevented from leaving any site during and after construction.

Access points are to be kept to a minimum to minimise the number of areas required for stabilisation, vehicle cleaning and areas of road to be targeted for cleaning in the event that mud is tracked onto the road.

Soil movement at access and exit points is to be controlled through appropriate means, which may include using a rumble grid or by requiring vehicles to travel the length of a stabilised access track.

All machinery should be prevented from accessing non-essential parts of the site.

Batter slopes should be kept at a grade of not more than 2:1 as per EPA guidelines and finished as soon as possible with a minimum thickness of 75 mm of weed-free topsoil topped with either weed mat, mulch or hydro-mulched to establish vegetation such as suitable grass species to ensure that erosion is minimised.

All land division public land boundaries are to be suitably protected and maintained with adequate sediment control measures (i.e. sediment fence) as soon as is practical upon completion of works.

12.4 Site Control

The Superintendent / Contractor / Construction Engineer shall observe all rules and regulations in force on the site and shall comply with all notices and instructions issued by Council’s Engineering Department in relation to such rules and regulations.

Except as otherwise provided in the contract, space for the storage of materials and for building sheds, offices and workshops will be allowed only as arranged between the Superintendent and Council’s Engineering Department and must be in accordance with the Structure Plan for Developments.

No new tracks shall be formed, existing tracks altered, camps erected, trees or shrubs removed, fences cut, water, sewerage or power lines cut or any other such things done without the prior approval of the Council’s Engineering Department as well as relevant service provider.

Under no circumstances whatsoever shall fire be lit without the prior approval in writing of the Country Fire Service or Metropolitan Fire Service and notification provided to Council.

12.5 Water Conservation

Water shall at all times be used in a judicious manner to avoid wastage. Temporary devices used to control or shut off water flow whether installed in hose lines or otherwise shall comply with the Office of the Technical Regulator and where appropriate SA Water Corporation requirements.

The use of sustainable water sources for construction as an alternative to potable and prescribed water sources is encouraged. It is the Contractor / Construction Engineers responsibility to obtain any necessary approvals, licences or permits as required.

12.6 Environmental Control

The Contractor / Construction Engineer shall be responsible for ensuring that the provisions of this section and any other environmental protection provisions in the contract are complied with and that the requirements of any statute, by-law, standard and the like related to environmental protection are observed.

The Contractor shall carry out the work with reference to the EPA Codes of Practice.

The Contractor shall ensure that pollutants such as dust, sediment, litter and wash down water do not leave the site during construction of the works.

The Contractor / Construction Engineer shall prepare a Soil Erosion and Drainage Management Plan (SEDMP) showing how this is to be achieved. The plan shall include a site layout together with a written procedure and implementation plan, and be submitted to Council's Engineering Department prior to work commencing. These shall include all aspects of site management including;

- Site access from public or private roads;
- Access around the site;
- Areas of earthworks, stockpiles, loading areas;
- Site stormwater drainage including all relevant information including sediment collection devices, stormwater drainage lines and discharge points;
- Management of creek or river flows.

The Contractor / Construction Engineer shall ensure that the following principles are included in the SEDMP and achieved on the site throughout the construction period. This will need to be documented in a construction management plan with Council approval being sought before works commence:

- Limit site access to nominated and controlled locations and ensure that sediment is not transported off the site on vehicles or by vehicle wash down activities;
- Locate all stockpiles away from concentrated water flow paths;
- Ensure that the least amount of land is exposed to the risk of erosion for the shortest period of time;
- Effectively control surface runoff entering and leaving the site;
- Ensure that erosion control and sediment collection structures are located to maximise their effectiveness and are in place prior to the commencement of site clearing works;
- Locate sediment traps and basins in locations that will not create flood risks to adjoining properties;
- Where control of creek or river flows is necessary, ensure that both low and high flows are managed to minimise erosion. For example if access across a creek is required; construction of a ford may be preferable to construction of a culvert and roadway.

- Rehabilitate all disturbed areas, with approved topsoil, as soon as possible including the reinstatement of riparian areas and the installation of ground cover planting progressively as earthworks are completed;
- Batter slopes should be kept at a grade of not more than 2:1 as per EPA guidelines and finished as soon as possible with a minimum thickness of 75 mm of weed-free topsoil topped with either weed mat, mulch or hydro-mulched to establish vegetation such as suitable grass species to ensure that erosion is minimised.
- Divert silt laden stormwater runoff away from vegetated stormwater management assets;
- All subdivision public land boundaries are to be suitably protected and maintained with adequate sediment control measures (i.e. sediment fence) as soon as is practical upon completion of works;
- Effectively maintain the erosion control and sediment collection devices;
- Decommission sediment traps and basins only after completion of final works and as approved by the Council.

12.7 Waste Management and Pollution Control

The Contractor must:

- Keep the Site in a clean and tidy condition;
- Regularly remove and dispose all site rubbish and waste;
- Provide bins with fitted lids to prevent windblown litter and attraction of pest animals;
- Carry out the work in a manner which minimises the generation of waste materials;
- Whenever practicable, re-use or recycle materials from the Works to prevent their inclusion on landfill; and dispose of rubbish, waste materials, hazardous wastes and contaminated material in accordance with Environment Protection Authority requirements.

Construction plant and equipment will be maintained and operated in a manner that minimises smoke emissions and fumes into the atmosphere. This includes switching off plant and equipment when not in use and undertaking regular maintenance services.

All liquids encountered on site displaying or suspected of being contaminated whether they be pooled rainwater collected within earthen sumps, perched groundwater or the contents of underground structures (including any unidentified tanks) must be considered potentially hazardous and therefore be transported to a liquid waste treatment facility. Persons transporting liquid waste are required to be licensed to do so under the Environment Protection Act. All liquids as defined above, not displaying obvious signs of contamination should be retained on site where possible for inspection and testing by a qualified Environmental Consultant prior to disposal.

12.8 Preservation of Flora

The Superintendent is responsible for checking whether vegetation to be cleared is protected under the Native Vegetation Act or Environment Protection and Biodiversity Conservation Act, and obtaining and complying with any approvals required under those acts.

Areas to be cleared shall be inspected by the Superintendent, and approval of Council's horticulture team leader (or equivalent) obtained before any trees or shrubs are removed, cleared or destroyed. If the vegetation to be cleared is on land under the care and control of the Department of Planning, Transport and Infrastructure, approval shall be sought from the Senior Environmental Management Officer, Asset Management Directorate (Stormwater, Environment and Heritage Services Unit) as land manager (note that this is *in addition to* any approvals required under applicable legislation).

The Construction Engineer shall refrain from destroying, removing or clearing trees and shrubs to an extent greater than the approved plans. The Superintendent must ensure that any remaining vegetation is protected from potential damage from construction activities by adhering to the following vegetation protection measures:

- Fencing the tree protection zones prior to commencement of any demolition, construction, building or civil works;
- Not allowing parking of vehicles under the drip lines of trees;
- Not allowing storage of equipment or material under or against trees, or on native grasses, shrubs and groundcover plants;
- Not placing fill under the drip line of trees unless indicated in the design drawings;
- Minimise root damage of any excavations (including trenching and grading) undertaken within the drip lines of trees (before any excavation is carried out over roots of trees to be retained, obtain a ruling from the Design Engineer as to whether the levels in the vicinity of the tree can be adjusted to protect the roots);
- Any roots exposed in excavations must be trimmed with a clean saw cut in accordance with AS 4373;
- Where branches intrude onto the working area and are likely to be damaged during the construction of the works, the branches must be trimmed to the branch collar with a clean saw cut in accordance with AS 4373. If necessary, work close to trees must be carried out by hand to avoid damage by equipment.

Council may direct the Contractor to repair any damage or injury to a tree that is to remain. This work shall be carried out by a tree surgeon engaged by the Contractor and approved by Council. Should the tree not be able to be saved, the Contractor shall be responsible for removing the dead/ damaged tree, and purchasing and planting suitable advanced replacement tree(s) at or near the same location. If the Contractor is subject to a defects and liability period on associated works the Contractor shall be responsible for establishing and maintaining the replacement trees for the duration of the defects and liability period.

12.9 Working Hours

Unless otherwise stipulated by EPA/DPTI, construction activities on the site shall generally be carried out between the following hours;

- Monday to Friday - 7am to 5pm;
- Saturday - 9am to 5pm;
- Sunday, Public Holidays - no work shall be undertaken other than necessary watering for dust control and any emergency activities.

Night work, or works on Sundays will be assessed on a case by case basis based on the benefit to the local community. Additional advance notification may be required.

12.10 Dust during Construction

The Contractor must suppress nuisance dust from disturbed sites within the construction area including access tracks, haul roads and stockpile sites and ensure that effective dust control measures are in place, particularly where the safety and convenience of people are affected.

Where applicable to the work under the Contract, the Contractor must implement the following measures to minimise air pollution from the construction works:

- Stabilise materials to be stockpiled for longer than a period of 1month by grass seeding, covering or other appropriate means to prevent generation of dust;
- The progressive revegetation of the Site as work proceeds where this forms part of the Contract;
- Watering of the Works areas and temporary paving of haul roads to suppress dust;
- Restricting vehicle speeds onsite;
- Restricting vehicles to authorised access roads;
- Covering vehicle loads;
- Avoid or minimise dust-generating activities during dry and windy conditions;
- Minimise the extent of exposed, stripped surface until covered with appropriate fill material.

12.11 Pollution

The Environmental Management Plans must address all possible sources of pollution and methods of control.

12.12 Noise

The Contractor is required to take all reasonable and practicable measures to ensure that all noise emitted from the site is within the specified limits, set by the EPA for the relevant activity, at all times.

The Contractor / Construction Engineer must ensure all works which may adversely impact on the amenity of the area (e.g. through noise) are programmed to occur during normal construction hours as noted in Section 12.3. Where it is necessary to undertake certain construction works outside of these hours (e.g. to avoid unreasonable interruption to traffic movements), the Contractor shall adhere to the Environment Protection (Noise) Policy for specific requirements, and obtain EPA approval if required.

The Contractor must use its best endeavours to minimise noise and vibration impacts of construction works, including:

- Selecting low noise plant and ensuring that equipment has appropriate measures fitted and effectively maintained to minimise noise and vibration;
- Locating noisy plant, site access roads and site compounds as far away as possible from noise sensitive receptors;
- Orienting plant known to emit noise strongly in one direction so that noise is directed away from noise sensitive areas;
- Limiting truck movements on streets with sensitive receptors where possible;
- Ensuring that staff adopt noise mitigation practices, such as ensuring that tailgates are cleared and locked at the point of unloading, shutting down or throttling down machines that are used intermittently in the intervening periods between works; etc.

- Using noise attenuating enclosures for stationary items of plant normally operating continuously, such as generators and compressors.

If the Council receives a complaint from the public relating to noise generated from the site the Contractor must review current noise mitigation measures to check that all reasonable and practicable measures are being implemented. Reprogramming works to minimise the impact of noise may be required if the noise cannot reasonably be reduced. Council may require noise testing to be undertaken to determine if any further actions is required. Depending on the nature and location of the site, the Contractor may be required to install noise attenuation buffers/barriers and/or buffer zone.

12.13 Weed Importation and Transportation

The Contractor / Construction Engineer must ensure that earthworks activities do not deposit noxious weeds or seeds of noxious weeds onto land. Ideally, no fill should be imported onto any site. Areas that are to involve earthworks must have the topsoil stripped and stockpiled for reuse. Where insufficient material can be won from the site, material must be imported from a reputable supplier or from a site that is known to be free of weeds.

The key legislation relating to weed spread in South Australia is the Natural Resources Management Act 2004. Many of the provisions relating to weed spread are found in Section 175 of that Act. Among the provisions, this Act provides information relating to precautions that must be taken when dealing with declared plants or moving soil, sand, gravel or stone which may be infested with declared plants. Accordingly appropriate measures in accordance with the requirements of the approved construction plan (refer to Section 17.2) must be undertaken to ensure that weed species are not transported on earthworks equipment or in soil or material leaving or entering the worksite.

12.14 Contamination

Removal of surplus fill from the site, or importation of fill from sites (other than commercial quarries/suppliers) must comply with the EPA Standard for the Production and Use of Waste Derived Fill, including appropriate testing. No soil is to be transported from Site for disposal without classification and prior approval by the Environmental Management Representative.

If contaminated material is found or suspected (including contaminated soils or groundwater, rubbish, or asbestos) it must be managed in accordance with EPA requirements. Burying or dilution of contaminated material on site is generally not acceptable. The exception may be if a suitably qualified site contamination consultant has assessed the material and prepared a complying environmental management plan allowing the material to remain in place.

If contaminated fill is identified on a residential allotment then an Environmental Representative should be contacted who would assess the material in accordance with the NEPM and determine what action is required. Any proposed actions shall be approved / reviewed by an SA EPA appointed Site Contamination Auditor.

12.15 Incident Reporting

The Developer, Superintendent, Contractor and Construction Engineer are individually and severally responsible for informing the Council and/or the EPA of any incidents relating to environmental management, as soon as practicable after the incident.

12.16 Protection of Fauna

The Contractor / Construction Engineer must:

- (a) Implement all reasonably practicable measures to prevent injury to fauna;
- (b) Contact Fauna Rescue SA, the RSPCA or a veterinarian for advice if any injured fauna is found on the Site;
- (c) Under the supervision of a suitably qualified person, relocate any native fauna to a similar habitat if that fauna's habitat will be destroyed by the Contractor's work.

12.17 Protection of sites of cultural heritage significance

The Contractor / Construction Engineer must exercise due care and make the necessary allowance for the preservation of any sites of cultural heritage significance that may be encountered during construction works. This includes all Aboriginal sites, objects and remains as defined under the Aboriginal Heritage Act. Appropriate risk management steps prior to and during construction are outlined in the Department of State Development – Aboriginal Affairs and Reconciliation's Risk management guideline, available at: <http://www.statedevelopment.sa.gov.au/upload/aard/publications/10-risk-management.pdf>.

If, at any time, an Aboriginal site or a site containing items associated with Aboriginal occupation is uncovered, the Contractor must stop work in the immediate area and redirect works to avoid further impact, until an assessment has been made as to the significance of the site and an appropriate course of action has been agreed upon with the relevant Aboriginal group and any necessary authorisation(s) obtained under the Aboriginal Heritage Act 1988.

13 Landscaping and Road Furniture

13.1 Objectives

The general objectives for landscaping requirements are as follows:

- An integrated approach to design be sought that delivers multiple benefits from any Public Open Space or other landscaped areas;
- Public open space shall be designed to provide for community connectivity that aids the walkability and of a development or precinct;
- All landscaping is suitable for the proposed use of the land on which it is located;
- The development of sustainable, fit for purpose and quality landscaping that complies with all safety requirements is encouraged;
- The landscaping is able to be effectively and economically maintained (level of maintenance to be appropriate for location and profile);
- The landscaping is compatible with the character of the area and with any structure plans, Structure Plans and urban design guidelines;
- The standard of Infrastructure to be provided for landscape works is clearly specified;
- The risk to the public from any landscaping on public lands or lands maintained by Council is minimised;
- All landscaping complies with the requirements of Disability and Discrimination legislation;
- Open space is provided which will encourage usage by providing a relaxing, aesthetically enjoyable environment;
- To have regard to safe site distances for drivers / pedestrians at intersections and driveways;
- All landscaping incorporates best practice design and environmental principles (WSUD principles should be considered);
- A selection of plant species is identified for planting in landscapes having regard to indigenous species where practical, in accordance with the Planting Indigenous Species Policy by the Government of SA;
- Active and Passive Public Open Space areas are provided;
- Areas of native vegetation are to be protected and enhanced where possible;
- Where appropriate it encourages native fauna;
- CPTED principles including public lighting are implemented.
- In areas where stormwater management is integrated with public open space:
 - WSUD and flood management assets should improve the overall amenity of the area;
 - Waterway connectivity should be retained;
 - Design should allow for the public to safely and easily exist an area before it becomes dangerously inundated.

13.2 General

Landscaping plans must be prepared and submitted to Council's Engineering, Landscape Architects and Environmental Departments for approval for any of the following:

- Land vested to Council e.g. road reserve, Public Open Space, stormwater drainage reserves;
- Multi-unit Developments;
- Commercial Developments incorporating a Carpark;
- Industrial Developments;
- Other types of Development as per the requirements of any Development approval issued for that Development;
- Structure Plans for an area. (Concept plans only);
- Public Open Space development or upgrade;
- Sporting grounds.

Multiple use of Public Open Space can deliver higher quality public realm such that stormwater and management can be integrated into Public Open Space with consideration to the design criteria in Section 13.3.4.

Landscaping works must not commence until the landscaping plans submitted have been approved in writing by Council. Design, construction and maintenance issues must be documented prior to approval.

The definitions for local, large and district parks can be found in the relevant Development Plan.

Playgrounds must be provided in Public Open Space in accordance with Council's playground strategy and in accordance with the Australian Standards. Contact should be made with Council to determine their requirements in relation to this section.

All landscaping areas including playgrounds must be designed to comply with the requirements of Disability and Discrimination Legislation.

Items of consideration to inform the design and provision of Public Open Space in residential areas include:

- Large shade trees or planting for future provision of shade trees;
- Seat/s;
- Litter bin/s;
- BBQs;
- Bus Stop Shelters (in accordance with DPTI "Bus Stop Layout Plan");
- Shelters;
- No linear open space reserves provided to carry a path should be less than 10 m wide where practical, and where practical locate paths along routes where clear sightlines are possible to assist navigation, to enhance security, and to provide visibility of potential hazards (i.e. people and cars).
- Dense shrubbery along linear paths must be avoided and plantings set well back from path edge;
- Linear paths should primarily be provided to add to and or link to strategic paths that connect residential areas with community facilities, shopping and commercial areas, other residential areas and or other key destinations or attractions.

In determining whether approval is to be granted, Council will have regard to the estimated ongoing maintenance costs to be incurred by Council resulting from the proposed landscape and whether the proposed level of service is sustainable in the long term.

To assist Council in determining the maintenance costs the Designer must provide Council with the level of service to be provided including details, where applicable, of:

- Irrigation details – manufacturer details, model numbers, degree of automation, conformance (including calculations) with the *Code of Practice for Irrigated Public Open Space (IPOS)*, efficiency of irrigation, etc.
- Water supply. Irrigation using recycled or non-drinking water is encouraged and recycled or non-drinking water should be extended to the site if an adequate supply is nearby;
- Recommended watering frequencies;
- Recommended mowing frequencies;
- Types of grasses to be sowed;
- Recommended maintenance of rain gardens;
- Type of furniture;
- Lighting details;
- Playground equipment details;
- Water sensitive urban design.

An independent playground audit certification is to be provided before Council will issue Practical Completion.

All playground equipment created through a Development is to be maintained by the Developer to the end of the maintenance period.

All landscaped areas and playgrounds are to be graded to ensure appropriate stormwater drainage and the design should incorporate possible retention for irrigation purposes, considering public risk. Where grades are too steep for maintenance mowing (typically when greater than 1 in 4) consider planting garden beds instead.

At practical completion the Superintendent will provide an asset list identifying the nature, quantities, dimensions, manufacturers and other parameters relevant to each asset and the costs of constructing those assets.

13.3 Requirements

13.3.1 Respect for Surrounding Environment

A design that respects the individual site, the local context and the regional characteristics is encouraged. This includes, but is not limited to, the following:

- The retention of existing high quality vegetation (trees, understorey and grasses);
- Removal and/or control of weed species and identified native weeds close to water ways;
- The use of indigenous plants in close proximity (i.e. 20 metres or other distance as determined on a case by case basis) to a Nature or Bushland Reserve including National Park, Regional Park and State Forest;
- The use of locally indigenous species close to waterways and streams;
- The preservation and integration of heritage elements with a landscape design;

The respect for the location and the enhancement of our natural environment will help to develop fauna and flora habitat through the Council.

13.3.2 Environmentally Sustainable Landscape Design

Council is committed to an environmentally sustainable Council, it encourages innovative landscape solutions to conserve water and energy and reduce waste in all private gardens. Measures for energy conservation in private gardens may be included in the encumbrances for new developments and may include:

- Use of materials produced from renewable resources;
- Use of recycled materials;
- Use of plants and planting patterns that contribute to the solar efficiency of the building;
- Use of mulch to improve water efficiency and reduce weed competition;
- Use of 'best practice' in water sensitive design.

13.3.3 Multiple use of Public Open Space

All Public Open Spaces that seek to deliver multiple objectives should address the suggestions contained in the [Water by Design – Framework for the integration of Flood and Stormwater Management](#) produced by Healthy Waterways (2011). The framework considers performance objectives under different scenarios including Normal (Dry) Conditions, Minor Storm Event and Major Storm Event.

13.3.4 Protection of Existing Vegetation

Healthy, pre-existing vegetation can be a significant asset. Healthy native vegetation can be home to a host of native fauna, especially if large trees include natural hollows etc. The Council encourages the retention of significant vegetation on site and advises that under native vegetation legislation the removal of native vegetation is to be avoided and if this cannot be achieved then minimised. The removal of both native and non-native trees may require a Development approval and must comply with any requirements of the relevant Development Plan.

The following points are Council's requirements for protecting vegetation.

13.3.4.1 Trees

The drip line of a tree canopy delineates the zone from which all works including storage and parking must be excluded. All trees determined by Council to be protected must be fenced off at the tree protection zone for (at least) the duration of construction and perhaps longer. Such protection shall be in accordance with AS4970 '*Protection of trees on development sites*'.

Works that impact on the Tree Protection Zone shall be inspected by an arborist. Works impacting on the Structural Root Zone shall be supervised by an arborist.

13.3.4.2 Significant and Regulated Trees – Guidelines for Information

All works that may affect existing street trees or trees within the development site should be assessed by a qualified arborist. This assessment should include identifying heritage status of trees as well as impact on native fauna.

The following is a guideline for information

The Development Act 1993 (SA) provides that any activity that damages a significant or regulated tree is development.

A 'regulated tree' is:

- Any tree in Metropolitan Adelaide or townships in the Adelaide Hills Council or parts of the Mount Barker Council with a trunk circumference of 2 metres or more. In the case of trees with multiple trunks, those with trunks with a total circumference of 2 metres or more and an average circumference 625 mm or more. The circumference is measured at a point 1 metre above natural ground level.

A 'significant tree' is:

- Any tree in Metropolitan Adelaide or townships in the Adelaide Hills Council or parts of the Mount Barker Council with a trunk circumference of 3 metres or more. In the case of trees with multiple trunks, those with trunks with a total circumference of 3 metres or more and an average circumference 625 mm or more. The circumference is measured at a point 1 metre above natural ground level.

OR

Any tree identified as a significant tree in the City of Adelaide, City of Burnside, City of Prospect or City of Unley Development Plans.

Any activity that could damage these trees is prohibited without development approval. Under the Section 4 of Development Act 1993 (SA) 'tree damaging activity' is defined as:

- Killing or destruction;
- Removal;
- Severing of branches, limbs, stems or the trunk of a tree;
- Ringbarking, topping or lopping;
- Any other substantial damage.

In addition, excessive pruning can also meet the definition of 'tree damaging activity'. Under Regulation 6A (8) of the Development Regulations 2008 (SA) pruning that does not remove more than 30% of the crown of the tree and is required to remove dead/diseased wood or branches posing a risk to buildings or persons is excluded from the definition.

There are heavy penalties for doing prohibited work on a significant or regulated tree without permission. Urgent work may be done if necessary to protect persons or buildings, but must, so far as is reasonably practical, be undertaken to cause the minimum amount of damage to the tree. Approval must be applied for afterwards [Development Act 1993 (SA) s 54A].

Exemptions

There are a number of exemptions listed in the Development Regulations 2008 (SA) which exclude certain trees from the provisions concerning regulated and significant trees.

Council approval is not required to remove a significant or regulated tree if it is:

- One of the 22 species of exotic trees (such as Box Elder, Silver Maple, London Plane, Weeping Willow) listed in regulation 6A of the Development Regulations 2008 (SA);
- Located within 10 metres of an existing dwelling or in-ground swimming pool (except if the tree is either a Willow Myrtle or any Eucalyptus);
- Within 20 metres of a dwelling in Medium or High Bushfire Protection Areas;
- Dead.

13.3.4.3 Shrubs and Groundcover Plants

An established layer of shrubs and groundcovers in undisturbed soil provides the benefits of resisting weed invasion, preserving habitat values and broader landscape aesthetic values.

Vegetation of this nature deemed by the Council to be protected is to be fenced during construction.

As a minimum, if long term fencing of vegetation to be retained it must encompass the area designated on the approved plans and should consist of the following where possible:

- Treated pine strainer posts;
- Star picket intermediate posts;
- Four strands of 12-gauge fencing wire.

Short term fencing may consist of securely placed barrier mesh.

The overall design and planning of the site should ensure all spaces are useable, adequately proportioned and maximize planting opportunities.

The Designer must:

- Ensure type and size of planting, especially trees, is appropriate to the space available (consider clearances to prevent damage from vehicles);
- Use small trees and shrubs to effectively screen service areas and block unwanted views;
- Use small trees and shrubs to reduce the visual impact of traffic along driveways and adjoining streets;
- Ensure that the location and mature size of plantings do not conflict with structures and services;
- Locate lawn areas only where they provide functional or visual benefit.



Fig 2 - Small spaces: small shrubs & climbers

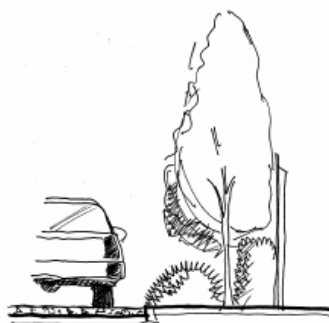


Fig 3 - Medium spaces: small trees, medium-small shrubs

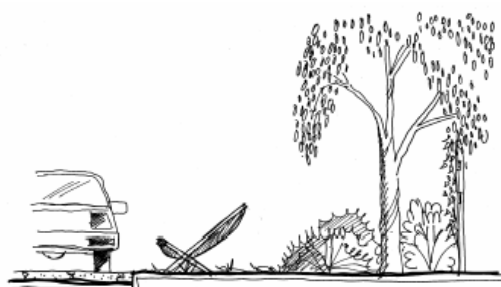


Fig 4 - Large spaces: trees, shrubs, ground covers, grasses

Where trees are planted in car parks the minimum distance around the tree to be without pavement or seal is defined by the drip of the mature tree to be planted unless otherwise approved by Council. Where shading is desirable or other justification is provided, a reduction to the clearance is typically acceptable. Particularly where the impacts of the pavement are reduced by utilising permeable pavements or similar.

13.3.5 Plant Selection

Tree selection should be in accordance with Council's Street Tree Policy (or equivalent) unless otherwise approved by Council.

When selecting trees and tall shrubs it is essential that the mature height and trunk diameter is appropriate for the location. Care should be taken to avoid potential damage to structures and services by planting trees away from buildings and services, including sewers, drains, gas and electricity services.

As a general rule, local indigenous plant species are to be considered as the first choice for plants. These are plant species that would have occurred in the region prior to European settlement.

In some situations indigenous plantings do not meet the functional, horticultural, or heritage requirements and either other Australian natives, or exotic plants may be considered.

Points to consider when choosing plant species.

- Select drought tolerant species;
- Plants that have similar water requirements can be grouped together to reduce the water demands of a landscape;
- Limit high water demanding plants to small focal areas;
- Flowering local trees and shrubs should be included in the design where appropriate as they provide food for many native bird species;
- Impacts of leaf and nut fall, and associated maintenance;
- Impacts of invasive tree root systems;
- Match species growing requirements to site conditions to ensure successful growth e.g. sun-loving plants in shaded locations will perform poorly;
- Selection to include some plants that will grow quickly to achieve an immediate effect and some that take longer to achieve a desired form and are longer lived.

13.3.6 Timing of Tree Planting

Tree planting should ideally occur between the months of April to September inclusive. If trees are planted outside this period then supplementary watering must be provided as agreed with Council..

13.3.7 Planting Principles

Tree planting guidelines are based on the urban design concept that a strong visual effect can be obtained by using a bold and simple layout without complicated and numerous variations in style and materials. The following tree planting principles have been developed to address the various site conditions found in our streetscapes.

- Symmetrical planting- similar tree species on both sides of the road. This is the preferred layout but is not always possible because of site constraints;
- Asymmetrical planting- different sized species and/or form on either side of the road. This layout is appropriate where power lines occupy one side of a road, or where a narrow street allows planting on one side only;
- Formal planting- a formal streetscape is created where the roadway forms a grid pattern, usually at right angles to each other. Formal planting should be symmetrical and use a single tree species at regular spacing intervals;
- Informal planting- random placement of trees. Appropriate in some urban road settings where street locations have a direct or visual relationship to a natural environment, such as a river or bushland;
- Single tree species per street- generally a single street tree species is desirable, and should be pursued unless restricted by site constraints. Feature specimen planting may be considered at key intersections, central business zones, pedestrian crossings and the like.
- Solar orientation in certain situations street planting can be designed to provide shade and also allow winter sun;
- Refer DPTI operational guides for planting in median islands

13.3.8 Vehicular Access

Vehicle access to land vested in Council for Public Open Space must be restricted except for maintenance purposes via use of appropriate fencing and bollards (refer to Council Style Guide (or similar) for styles). Locks are to be provided as per Council's standard key system.

13.3.9 Clear Zones

The design of all landscaped areas should ensure the following concerns are adequately addressed:

- Safety of employees maintaining these areas;
- Safety of motorists within the vicinity of these areas;
- Clear Zones appropriate to the speed of vehicles are maintained where landscaping areas are adjacent to roads.

13.3.10 Entrance Features

All entrance features should be located on private property and be maintained by the land owner. Where this is not desirable Council may allow it to be on public land, subject to Council approval.

The design of entry structures should consider:

- Maintain sight distance;
- Useful life – 50 years nominally;
- Estate name should include suburb name / town name;
- Comply with building rules / planning requirements;
- Include mowing strip;
- Aesthetically pleasing to suit local environment.

13.3.11 Maintenance Responsibility

At the time of practical completion for the privately created landscapes on public land a defects period of 24 months will commence and the contractor will be responsible for the maintenance of the landscaping works. The designer / contractor will provide Council with all documentation on pumps, controllers, playgrounds and any other document that will assist in the maintenance of landscaped areas.

Some tree planting can be carried out after the time of practical completion and Section 51 clearance with the approval of Council to suit plant availability and growing season.

13.3.12 Irrigation Systems

Any irrigation system must be automatic and of a type approved by Council and must be fully operational before the use commences. The irrigation system should be designed for the anticipated water quality in the area including the use of recycled or non-drinking water.

An irrigation management plan for the reserves is required by Council prior to installation. The plan needs to encompass water management best practices (for mains and reclaimed water) as outlined in the SA Water Code of Practice for Irrigated Open Space, include requirements as set out in the South Australian Reclaimed Water Guidelines, and where appropriate be submitted to the Office of the Technical Regulator Plumbing Section prior to installation. It should incorporate the following features;

- Irrigation plans;
- Design parameters (flow, pressure, distribution uniformity, precipitation rate);
- Installation specification including component specification to meet appropriate Australian Standards;
- Quality control inspection procedures;
- Water budget;
- Irrigation schedule;
- Best practice water management features and water sensitive design;
- Valves, fittings and backflow prevention devices suitable for automatic operation and, if needed, capable of utilising reclaimed water (class B) and mains water;
- Irrigation of grassed areas to be carried out using rising sprinklers, or as approved by Council;
- Irrigation of planted garden beds to be via subsoil dripper, or as approved by Council;

- Adherence with the guidelines set out in the Stormwater Pollution Prevention Code of Practice for the Building and Construction Industry to reduce the impact of irrigation water on the stormwater system.

The following requirements need to be addressed;

- A service connection and water meter are required to all open spaces and reserves and must be a minimum of 40 mm with an appropriate backflow device fitted (to comply with AS/NZS 3500.1 - part 7);
- A minimum of one connection is to be provided for each 2000 square metres of the park;
- The installation of an irrigation system to all landscaped traffic islands and roundabouts is mandatory;
- Lower Quarter Distribution Uniformity (DU) measure of >85%.

Irrigation systems are to be installed to Council satisfaction and maintained throughout the defects liability stage (2 years).

An irrigation design is to be provided for Council approval prior to commencement of any project on site. The design is to take into consideration the following factors:

- Pump design and location;
- Back flow devices and meters, if required, are to be located below ground and located to allow access and the type and manufacture must be approved by Council prior to installation. It is noted that some backflow devices such as Reduced Pressure Zone devices (RPZs) have ports and these devices must be 300 mm above the finished surface level.
- Minimum diameter of irrigation line for areas with greater than 8 stations is to be 32 mm;
- Moisture sensors to be included (unless excluded by Council).

All materials used in the construction of the irrigation system are to be of commercial quality and to a standard acceptable to Council. The following is provided as a guide; however each Council is likely to have a preferred manufacturer:

- ICC Controllers;
- Sprinkler heads on articulated risers;
- Class 9 min material to solenoids;
- Controllers are to be placed within a secure lockable box;
- Stainless steel clamps/clips are to be used throughout;
- Sprinklers are to be set so that when in operation they extend above the natural surface by 100 mm, but are flush with the surround surface when not in operation;
- Solar Powered irrigation systems may be considered by Councils where the Designer can demonstrate adequate robustness.

13.3.13 Referred Documents

Designers are advised that Council has specific policies and requirements in relation to landscape designs and contact should be made with the relevant Council to obtain the details of their specific requirements.

13.3.14 Landscaping on Existing Road Reserves

No landscaping other than lawn must be permitted on road verges and Council's reserves without the approval of Council and in accordance with the Local Government Act 1999. To obtain approval for landscaping other than lawn the Designer must satisfy Council that the material can meet the following performance criteria:

- There will be no increase to public risk (e.g. stones on footpaths increase tripping hazard);
- The road verge must be able to be used safely by pedestrians;
- The product or material must not be able to be easily removed or used for nuisance purposes;
- There must be a consistent neighbourhood landscaping approach.

13.3.15 Soft Landscaping

Grass species must be approved by Council prior to placement. Design should generally allow for a maximum of 50% of the area to be irrigated to minimise water use, unless approved otherwise (such as on site retention for re-use).

Planting of garden beds is to contain native species as approved by Council, with a minimum 100 mm (imported if necessary) approved top soil to be used, noting that any existing vegetation is to be treated to remove weeds.

Garden beds are to be designed to appropriately manage weeds and non-planted growth, this should be to minimise ongoing maintenance issues, and therefore the use of weed mats placed between the top soil and mulch should only be considered a secondary measure.

Mulch is to be one of the following:

- An approved first grade clean chipped bark material 75 mm min in depth and average diameter of 20 mm;
- Crushed brick, stone or inorganic material, if approved;
- Other materials approved by Council.

13.3.16 Hard Landscaping

Footpaths and shared paths widths are to be in accordance with Section 7 of this Infrastructure Guideline (SA).

Approved granitic sand when used must be a minimum 100 mm in depth compacted to 95% of MMDD.

Paths constructed from materials other than concrete must be edged so that material does not spill into adjacent areas. Timber edging may be used only when the design and construction have been approved by Council.

13.3.17 Furniture

Furniture used in landscaped areas is to be in accordance with the relevant Council's Style Guide, or as approved by Council.

The Council style guide is to be used to identify the styles of furniture to be used and include seats, barbeques, bins, dog bins, bollards, post and rail fences, bus stops etc. relevant to the location. If no information is available for the site, approval shall be required from Council on a case by case basis. Susceptibility to vandalism will be considered by Council before giving approval for any furniture.

Consideration should be given to the context in which furniture is to be installed. Relevant matters may, for example, include bus stop capacity, proximity to hospitals, and the proportion of senior citizens wishing to access the area concerned.

13.3.18 Other Matters

Urban art and information boards must be provided to encourage use of the Public Open Space. Urban art located on a road verge must satisfy the Clear Zone requirements under the road design sections of this Infrastructure Guideline (SA). Arrangements of such items must be approved by Council prior to installation. Specific approval must be obtained from Council's Engineering Department to locate urban or public art on the road verge.

Park name boards are to be in accordance with Council's standard drawing (where available) and are to be approved by Council.

14 Associated Infrastructure

14.1 Objectives

The objectives of associated Infrastructure are as follows:

- All associated Infrastructure that is to be vested to the Council must meet Council's requirements and standards as set out in this Infrastructure Guideline (SA);
- In giving approval for associated Infrastructure Council will have regard to any future maintenance and operating costs, the likely availability of replacement parts and conformity with any Council policy or strategy e.g. greenhouse emissions;
- The urban character and amenity of a locality or neighbourhood should not be adversely impacted by the proposed associated Infrastructure;
- The location of the proposed associated Infrastructure must not conflict with other existing or proposed services or Council Infrastructure;
- Council will consider the requirements of all servicing authorities before giving approval for any particular service;
- The requirements of any relevant Codes of Practice, Australian Standard, regulation or act of parliament is considered by Council before approving the type and location of any associated Infrastructure.

14.2 General

The design, documentation and installation of all related Infrastructure must be in accordance with the relevant regulatory authorities' criteria, specifications and instructions. It is the Designers responsibility to liaise and coordinate the design and integration of all associated infrastructure, including gas, telecommunications, electrical, drinking water, non-drinking water and sewage.

14.3 Fire Hydrants

The location and spacing of fire hydrants are to be to the satisfaction of the Metropolitan or Country Fire Service and where applicable SA Water.

14.4 Recycled (non-drinking) Water

Recycled or non-drinking water systems and/or infrastructure shall be designed to meet the legislative requirements of the relevant authorities, including but not limited to the Office of the Technical Regulator, Department for Health and Ageing, Environment Protection Authority and Department of Environment, Water and Natural Resources.

14.5 Electrical

For Commercial and Industrial Developments, a power supply plan must be provided documenting the supply standard for each lot. Each allotment should be provided with a connection serviced underground.

Solar power should be considered for new buildings and structures.

14.6 Emergency Markers

Emergency markers are markers to allow a person in distress to accurately advise an emergency service of their location.

The Designer must be responsible for the provision of emergency markers in accordance with the provisions of the Emergency Marker Signage Guidelines.

Emergency Markers can be located, but not be restricted to the following locations:

- Locations with a history of emergency events or known incident sites;
- Locations offering higher risk activities to the visitor, e.g. mountain bike riding, rock climbing, abseiling etc.;
- Walking trails and shared paths – Emergency Markers should be located at major trail heads, significant features, or intersections. Emergency Markers on linear trails should be placed approximately every 500 metres;
- Water bodies, swimming holes, and beach, river or lake access & egress points;
- Piers and Jetties should have a marker at the beginning and end of the Infrastructure. Emergency Markers may be placed at intervals of 250 – 500 metres if the length of the asset warrants;
- Remote areas that act as a thoroughfare or receive significant visitation;
- Recreational playgrounds with no verifiable address points or visible naming convention e.g., a person could not see the signage, describe with certainty the unique feature or the open space was that of a linear path, or large recreation facility with multiple recreations uses, such as more than one oval, barbeque area, playgrounds.

15 Waste Water

15.1 Council owned Community Waste Management Systems (CWMS)

Some Council areas are not connected to a SA Water sewerage system, and instead own and operate their own wastewater management systems. Where a development is within a CWMS area the developer will be required to meet certain costs in relation to the provision of sewerage infrastructure, namely;

- A connection fee set by Council annually per allotment for connection into Councils existing CWMS;
- All internal pipe network and pumping station costs and the connecting main costs from the Development to a point (determined by Council) into the existing CWMS.

In the event that the capacity of Councils existing CWMS is not sufficient to accommodate the new development and significant Waste Water Treatment Plant upgrading is required, then Council may require the Developer to meet these costs in lieu of the “per allotment” fee.

Designers are required to identify the methodology to be used to collect and dispose of sewerage from the site as part of the approval process.

Designers are directed to the following publications which are available on the Local Government Association Web Site (www.lga.sa.gov.au) for the design of the sewerage network;

- Community Wastewater Management Systems Code (Department of Health and Ageing);
- On-site Wastewater Systems Code (Department of Health and Ageing);
- WSA Codes
- Any other relevant codes, guidelines, standards and supporting technical information as required by the relevant authority (Department for Health and Ageing, Environment Protection Authority, Office of the Technical Regulator, Department of Environment, Water and Natural Resources).

16 Public Lighting

16.1 Objectives

The objective of this section is to ensure the consistent, equitable and environmentally responsible provision of public lighting and to provide public lighting to the appropriate standards that considers the safety and security of all sectors of the community.

16.2 Provision for Public Lighting

All new roads created through the land divisions process must be provided with public lighting in accordance with the requirements of the relevant Australian Standards to the boundary of the Development. Provision should be given as part of any Council road upgrade/renewal project for the upgrade and replacement of public lighting to conform to the relevant Australian Standards.

New lighting must be located outside the Clear Zones wherever possible, and must meet the standards for Category V or Category P lighting, as appropriate.

Category V lighting is applicable on roads where visual requirements of motorists are dominant, such as sub-arterial and collector roads. Category P lighting is applicable on roads (and other public outdoor areas) where the visual requirements of pedestrians are dominant, such as local roads and outdoor shopping precincts.

All public lighting must incorporate the use of energy efficient luminaires, and be designed in accordance with the IPWEA Practice Note 11 “Towards more sustainable lighting”.

16.3 Lighting Design

Public lighting shall be required in reserves under 1Ha in size or where access to structures within the park is a feature, or paths within the park form a linear link.

The level and standard of lighting shall be determined according to Standards Association of Australia (SAA) codes and *AS/NZS 1158* Series to reflect Councils policy of pursuing lighting standards that are energy efficient and environmentally sustainable. Prior to commencing detailed design, the Design Engineer must consult with the Council’s Engineering Department.

The Designer shall be responsible for liaison with SAPN in respect to public lighting. Allowance for light pole locations must be provided within all road reserves and offsets must be shown in ‘Service Location Tables’ on Road Construction Plans or as specified on the Road Lighting plans (where applicable).

Lighting location is to have consideration of clear zones as outlined within Austroads ‘Guide to Road Safety’ and AS 1158.

Provision of public lighting is required for all principal footpaths and bike paths within parks and reserves. All cabling for this purpose must be from an un-metered point of supply at the reserve boundary and Council will accept responsibility for the tariff.

Bollard lighting is acceptable only in reserves where vertical illumination is not required for the relevant lighting category.

Lighting obstructions (e.g. from existing or proposed large trees) must be taken into account when locating poles and assessing luminance requirements.

It is considered best practise that in rural living areas there should, as a minimum, be one light at all intersections and one light at the end of the cul-de-sac. This principle has been adopted to cover the gap in the various standards and to meet community expectations. This number may be reduced for short cul-de-sacs where it can be demonstrated that lesser lighting is sufficient.

The amount and type of lighting, including recommended light technical parameters, in any external public area, is driven by three main considerations:

- The type and quantity of pedestrian and vehicular traffic in the area (to facilitate safe movement);
- The security risk of the area (to discourage illegal acts);
- The need to enhance the amenity of the area (to increase aesthetic appeal).

Please refer to Table 12 which illustrates the minimum public lighting serviceability classification in reference to the road layout.

Table 12 - Minimum “Deemed to Comply” Public Lighting Serviceability

Road Classification	Public Lighting Level of Serviceability
Rural roads/developments	As a minimum, flag lighting at intersections and cul-de-sacs
Access Place / Street	P4 - In accordance to AS/NZS 1158
Pedestrian areas and Shared Paths (where high night time use)	P4 - In accordance to AS/NZS 1158
Collector Street – Level 1	V4 - In accordance to AS/NZS 1158
Collector Street – Level 2	V3 - In accordance to AS/NZS 1158

Proposed Luminaires should:

- Conform to TS1158.6 and be NATA accredited & tested;
- Have CIE or IES files associated with the proposed Luminaire product available;
- Be listed on the AEMO Load table.

Designs should readily be able to be checked using either Isolux or spacing calculations, which should be supplied as part of the design submission.

Where a Council initiated design interfaces with a DPTI road, the design is required to comply with DPTI standards for road lighting.

16.4 SAPN Public Lighting

Where a Council has nominated SAPN public lighting and the Council will pay a tariff to SAPN for the care and maintenance of the lighting, all lighting should be provided in accordance with the SAPN requirements. As the tariff varies based on the luminaire and fitting, the luminaire and pole will be subject to the Council approval.

The Energy Only tariff should be utilised where the lighting is installed upon standalone columns, as this provides the least lifecycle costs and provides public lighting customers with choice of technology.

Council may determine the boundaries of a street lighting precinct within its urban area so as to have a consistent lighting standard within that precinct.

All initial costs to design, provide and install the lighting are the responsibility of the applicant.

16.5 Non Standard Lighting (including Decorative Lighting)

Where Council requires a non-standard lighting scheme or the applicant requests a non-standard lighting scheme, Council approval is required to use non-standard (decorative) lighting in any public area. This lighting may include an Energy Only tariff or a CLER scheme.

Council may determine the boundaries of a street lighting precinct within its urban area so as to have a consistent lighting standard within that precinct.

A Council may not allow a non-standard lighting scheme if it does not have the capacity, staff or suitable contractors to maintain the lights and light poles.

The manufacture, type and model of the non-standard (Decorative) lighting must be determined after consultation with the Developers/landowners within the boundaries of the precinct at the time the precinct boundaries are being determined.

Decorative or non-standard lighting, lamps and luminaries must comply with TS1158.6 requirements, be listed on the AEMO load table and must be approved by Council.

Light poles and fittings should be designed for a 20 year design life and spare parts should be readily available in Australia. Lights should be cost competitive and preferably available from more than one supplier. The Poles and fittings should be designed for the conditions in which they are installed, i.e. seaside, high vandalism area etc.

Council will consider approving use of non-standard (decorative) lighting when land divisions have a minimum of 50 allotments and when the Developer has submitted to Council:

- The street lighting design;
- The type of the decorative lighting Infrastructure and fittings;
- The applicability of the Energy Only lighting tariff.

SAPN will only energise public lighting after receiving an authorised tariff offer letter from the Council confirming that the proposed design has been approved.

Unless otherwise specified, all new standard street lighting will be supplied from an underground supply.

In the event of a replacement of the pole or fitting, Council will use reasonable endeavours to locate an equivalent pole and fitting although if these are not readily available within a reasonable time will use a pole and fitting of its choice.

16.5.1 Decorative (Non Standard Lighting Fees)

Under SAPN guidelines, the Council remains responsible for the ongoing supply and replacement of non-standard (decorative) poles and fittings.

If additional costs for the non-standard (decorative) lights are expected over the life of the light compared with a standard SAPN decorative light, Council may, at its discretion, request the applicant to provide spare poles and fittings or a maintenance contribution to be negotiated with the applicant:

The applicant must:

- Supply all initial stock of poles, lamps, photo electric cells and other fittings;
- Arrange for and meet the cost of all installation to the satisfaction of the Council and SAPN;
- Accept responsibility for all maintenance and replacement costs of poles and lanterns until the expiry of the defects liability period including vandalism and accidental damage. Developers must arrange replacement or damaged or non-operational poles or fittings within 48 hours from notice given by Council.

16.6 Pre-Submission Requirements

Prior to the submission of Public Lighting Plans the following must be confirmed with Council:

- Lighting design categories for all roads and pathways;
- Locations of all principal pathways in parks/reserves outside road reserves;
- Locations and type of other items/structures that may require public lighting;
- The required public lighting tariff.

For any lighting type not previously accepted by Council provide full information on the proposed pole and lantern together with details of the current supply and delivery cost of a single unit and likely availability into the future.

Council will not normally accept items from a limited production line.

A Functional Layout Plan has been endorsed in accordance with the Development approval.

17 Construction Phase

17.1 Objectives

The objectives of these construction requirements are as follows:

- To ensure that the works are constructed such that they fulfil the purpose for which they were intended and the design intent is maintained;
- To ensure that long-term maintenance requirements are not compromised through poor construction standards;
- To ensure that there is no detrimental effect on other existing assets in the locality;
- To ensure that the works are safe, both during and after construction;
- To ensure that environmental impacts are minimised both during and after construction.

17.2 Commencement of Construction for Developers

Where construction is related to Development, construction must not commence until Council has granted Final Design approval and where a land division is involved, the Plan of Division has been granted planning consent. Any premature commencement of works must be wholly at the Developer's risk.

The Construction Engineer must notify the Council's Engineering Department of commencement of construction by providing the following documents:

- 'Intention to Commence Construction' advice;
- Construction Management Plan incorporating the following:
 - Construction Program;
 - Inspection and Test Plans;
 - Traffic Management Plans;
 - Environmental Management provisions including protection of trees and vegetation, stormwater quality and measures to prevent the spread of noxious weeds.
- Copy of Local Government Act 1999 Section 221 Application "Consent for Works within Road Reserves";
- Copy of relevant insurance certificates.

It is recommended that the Design Engineer arranges a start-up on site meeting with the Contractor and Council.

17.3 Public Liability Insurances

Contractors engaged for works within Council owned or maintained land must take out Public Liability Insurance to the minimum value of \$20 million in respect of any one claim with a registered insurer carrying on business in South Australia. The policy should specifically indemnify Council from all claims arising from the execution of the works.

17.4 Construction Supervision

The Construction Engineer must supervise the construction of all roads and drains within a project, and either the Construction Engineer, or another person appointed by the Developer/Council, must act as the Superintendent. For development related projects neither Council's Engineering Department or any member of that department can be responsible for these functions. The functions of the Superintendent will not be deemed to be completed until the end of the Defects Liability Period. All correspondence during the defects liability period will be directed to the Superintendent.

For all projects, a representative of the Council's Engineering Department must inspect the works at critical milestones and may inspect at witness points to ensure that they are satisfied that Council will be accepting works that are constructed in accordance with general Council requirements and the approved drawings and technical specification. The Construction Engineer must contact the Council's Engineering Department to arrange for joint inspections at each hold point relating to road, stormwater drainage and CWMS construction and for advising of witness points as detailed in the technical specification, and must be present at all joint inspections. It is not the role of Council's Engineering Department to give a Contractor a direct instruction regarding the works, however if possible guidance and assistance may be given on site to assist the construction program.

Generally a minimum of 48 hours' notice should be given when requesting a representative from the Council Engineering Department to attend a construction inspection or advising of a witness point, unless noted otherwise within this Infrastructure Guideline (SA).

17.5 Practical Completion

When the works are completed the Construction Engineer must arrange for acceptance of the works by the Council. Acceptance will be subject to timely provision of "As Constructed" documentation and compliance with the procedures detailed in this Infrastructure Guideline (SA). Council reserves the right not to accept the works if other construction activities such as lot-filling, verge reinstatement, installation of utility services or provision of street lighting have not been completed.

The Construction Engineer must arrange for a joint inspection of the works to be made, together with the Council Representative and the Contractor, for Development related projects the Developer should be invited to attend. The purpose of the visit must be to identify any outstanding items or minor defects for recording, and to determine whether works are completed to the Council's satisfaction such that they may be accepted into Council's asset systems. Council requires one (1) weeks' notice for the Practical Completion inspection.

The Construction Engineer must determine that all works are completed in accordance with the approved plans, prior to calling for the joint inspection. The whole of the site must be completed in a tidy manner, including all required reinstatement of existing surfaces, erection of all signs and street lighting. Pump stations may be commissioned at this inspection, but the relevant operational and maintenance information must be provided to Council at least one week prior to the date of inspection. Streets should be swept prior to the final inspection for new streets.

If Council or the Construction Engineer is not satisfied that physical works have been completed and are of sufficient standard that they may be incorporated into the Council's asset system, further actions by the Contractor may be required and subsequent joint inspection of the works required. Subsequent inspections may be at the Contractors expense, including re-attendance by the Construction Engineer.

Subsequent to the Practical Completion inspection the following must forward to the Council's Engineering Department:

- Certification that the works have been completed in accordance with the documents previously approved by the Council
- 'As Constructed' drawings in hardcopy format and in electronic format compatible with Council's Asset Management system and also in AutoCAD format;
- Operation and Maintenance (O&M) Manuals for pump stations, control units, detention basins, wetlands, GPT's etc.;
- Asset Record Sheets for all assets classes including roads, stormwater drainage, lighting, street trees, playgrounds, irrigation systems, structures, landscaping, CWMS, recycled (non-drinking) water etc.

Operations and Maintenance Manuals are to be handed over to Council at commencement of the Defects Liability Period. Training of Council staff may be required for specific Infrastructure, however, this training shall be undertaken at the cost of the Developer for Development projects, and should be undertaken at, or prior to, the Practical Completion inspection.

Following the inspection, and after receipt of the above-mentioned documentation, the Council must forward a letter to the Contractor or Developer's Representative advising of Council's Practical Completion, thus indicating that physical works have been completed and are of sufficient standard that they may be incorporated into the Council's asset system. The Letter of Acceptance may include a list of minor defects and omissions that are to be corrected within one month of the inspection, or other period nominated within this letter.

Council's Engineering Department will forward a copy of the Practical Completion Certificate to the Planning Department and the operations areas of Council.

Satisfactory site inspection and issue of a Letter of Acceptance is not to be taken as engineering approval for Section 51 clearance to be issued for the Development. It is only one step in the Section 51 clearance process, as there may be other conditions on the Development approval to be addressed.

17.6 As Constructed Information

Following the completion of civil works in a land division, Development, or Council project "As Constructed" information must be prepared by a registered surveyor/Qualified Engineer. The "As Constructed" plans must be endorsed by the Superintendent/Construction Engineer and the Contractor's Representative and forwarded to Council's Engineering Department prior to Council's Practical Completion being issued.

The Superintendent shall cross reference the "As Constructed" and the "Approved" plans to identify any issues that are out of specifications/tolerance. If any works out of tolerance or non-compliant with Specifications have not been accepted by Council during the construction process, the Superintendent is to prepare a report with remediation proposals to Council.

17.7 Locating Underground Assets

Any person or organisation that owns underground assets including pipes and cables has a responsibility or duty of care to ensure that information about the location of these services is easily available for people intending to undertake excavation activities.

People who represent a company responsible for any excavation work also have a duty of care to locate underground services or assets that are in the vicinity of the dig site, and then find and expose them before excavating near or around them. The duty of care is:

- To protect workers and the public from serious injury due to the rupture of an underground asset such as a natural gas pipe, high voltage electricity cable, petroleum or industrial gas pipe. Any damage to these assets can cause very serious damage to structures and potential injury to many people.
- To minimise the potential for damage and loss of service due to damage or rupture of the same assets. Extensive networks can be closed down for long periods with serious consequences of disruption and incurring penalties. The repair and replacement costs can also be very expensive.

The preferred method of obtaining information about the location of underground assets is the Dial Before You Dig service.

It should be noted that not all services are covered by the Dial Before You Dig service and in particular some Council's underground stormwater drainage and CWMS services are not covered. In such cases contact should be made with the Council for information concerning the location of their underground assets.

Features of the Dial Before You Dig service are:

- It is often the only method used by people intending to carry out excavation works when searching for information about the location of underground pipes and cables at a proposed dig site;
- It is referred to in publications from Safe Work SA as best practice;
- The service aims to provide all excavators with the best possible access to plans and information direct from asset owners of underground services using a national enquiry service;
- Its overall purpose is to educate and promote the importance of safe digging practices to the excavation community and to develop its membership base to include all asset owners of underground services;
- A request for information can be made by logging on at the web site (www.1100.com.au) or by phoning 1100. Customer details and the proposed area of the dig site will be sent to all asset owners registered with Dial Before You Dig in that area and information will be sent back directly by the asset owner within two working days for excavation works. This may take up to 10 working days for planning and design requests.

Dial Before You Dig's Service Guidelines for South Australia outlines the responsibilities of all underground asset owners to register assets and provide information when requested, and also the responsibilities of people intending to undertake excavation work to obtain information about underground assets in the area and follow safe work practices.

To confirm services and depth to services refer to the Dial Before You Dig publication – Best Practice Guide for Locating Underground Services.

APPENDIX A: STANDARD DRAWINGS

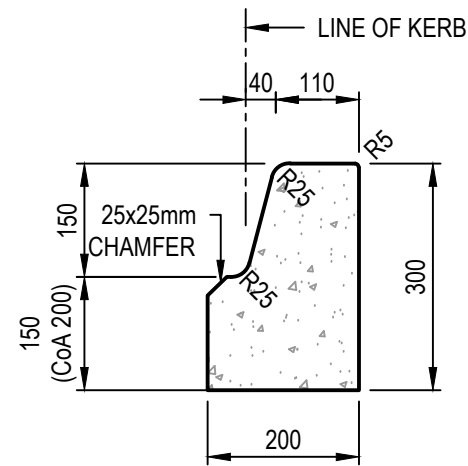
STANDARD DRAWING INDEX

DRAWING NUMBER	DESCRIPTION	DATE LAST MODIFIED
100	KERBS	
SD 100	TYPICAL RESIDENTIAL KERB PROFILES	06.11.18
SD 105	TYPICAL INDUSTRIAL KERB PROFILES	06.11.18
SD 110	KERB & WATERTABLE INSTALLATION ABUTTING EXISTING PAVEMENT	06.11.18
SD 115	STANDARD STORMWATER KERB OUTLET DETAILS - INSTALLED DURING CONSTRUCTION	06.11.18
SD 120	HEAVY DUTY STORMWATER KERB OUTLET DETAILS - EXISTING KERB	10.05.16
SD 125	KERB RAMP SPECIFICATIONS SHEET 1 OF 2	06.11.18
SD 130	KERB RAMP SPECIFICATIONS SHEET 2 OF 2	18.07.17
200	PAVEMENTS	
SD 200	TYPICAL PEDESTRIAN CROSSING ARRANGEMENT DETAIL	18.07.17
SD 205	TYPICAL CONCRETE FOOTPATH DETAIL SHEET 1 OF 2	06.11.18
SD 210	TYPICAL CONCRETE FOOTPATH DETAIL SHEET 2 OF 2	18.07.17
SD 215	TYPICAL HOT MIX ASPHALT FOOTPATH	18.07.17
SD 220	BLOCK PAVED FOOTPATH	06.11.18
SD 225	RETROFIT RESIDENTIAL VEHICLE CROSSING DETAIL	06.11.18
SD 235	VEHICLE BLOCK PAVED CROSSING DETAIL	06.11.18
SD 240	INDUSTRIAL VEHICLE CROSSING DETAIL	06.11.18
SD 245	VEHICLE CROSSING LONGITUDINAL SECTIONS	18.07.17
SD 250	TYPICAL SWALE DRAIN RESIDENTIAL VEHICLE CROSSING (RURAL ENTRANCE)	06.11.18
SD 255	TYPICAL SWALE DRAIN RESIDENTIAL VEHICLE CROSSING (URBAN ENTRANCE)	06.11.18
SD 260	TYPICAL SWALE DRAIN HEAVY VEHICLE CROSSING (RURAL ENTRANCE)	10.05.16
SD 265	TYPICAL PAVEMENT SUBSOIL DRAINAGE	06.11.18
SD 270	TYPICAL ROAD CROSSING TRENCH BACKFILL REQUIREMENTS	06.11.18
SD 275	TYPICAL BUS STOP DETAIL	18.07.17
300	PITS AND DRAINAGE STRUCTURES	
SD 300	STORMWATER PITS REINFORCEMENT DETAILS	06.11.18
SD 305	STORMWATER JUNCTION PIT	06.11.18
SD 310	STORMWATER DEPRESSED GRATED PIT	18.07.17
SD 315	STORMWATER INLET CATCH PIT / FIELD GULLY	18.07.17
SD 320	STORMWATER SIDE ENTRY PIT 900mm INLET	18.07.17
SD 325	STORMWATER SIDE ENTRY PIT AND LIDS WITH PRECAST LINTEL	06.11.18
SD 330	STORMWATER DOUBLE SIDE ENTRY PIT 1900mm INLET	18.07.17
SD 335	PRECAST SIDE ENTRY PIT INLET WITH GRATE INLINE	18.07.17
SD 340	OFFSET SIDE ENTRY PIT WITH 900mm INLET GRATE	06.11.18
SD 341	BANDAGE JOINT	06.11.18
SD 345	STANDARD HEADWALL FOR PIPES 300-375 DIAMETER	06.11.18
SD 350	STANDARD HEADWALL FOR PIPES 450-750 DIAMETER	06.11.18
SD 351	STANDARD HEADWALL FOR SINGLE PIPES 825-1800 DIAMETER	06.11.18
SD 355	STANDARD HEADWALL FOR TWIN PIPES 825-1800 DIAMETER	17.07.17

DRAWING NUMBER	DESCRIPTION	DATE LAST MODIFIED
300	PITS AND DRAINAGE STRUCTURES CONTINUED.	
SD 365	CONCRETE ENDWALL FOR PIPES UP TO 300mmØ (WALKWAYS,PATHS AND TRACKS)	10.06.16
SD 370	NATURAL LOOK CONCRETE AND BOULDER HEADWALL	10.06.16
SD 375	STORMWATER CATCH DRAIN DETAILS	18.07.17
SD 380	DRAIN STORMWATER ALLOTMENT TO KERB AND CHANNEL CONNECTION	18.07.17
SD 385	STORMWATER ALLOTMENT DRAIN CONNECTION TO AUTHORITY PIPELINE	06.11.18
SD 390	STORMWATER ALLOTMENT CONNECTION IN EASEMENT DETAIL	06.11.18
SD 395	SUBSOIL DRAINAGE FLUSHOUT RISER DETAIL	10.05.16
400	PITS AND DRAINAGE STRUCTURES	
SD 400	STORMWATER DRAINAGE PIPE ANCHOR BLOCK	18.07.17
500	TYPICAL ROAD PROFILES	
SD 500	TYPICAL ROAD SECTIONS	06.11.18
SD 505	TYPICAL ROAD SECTION LAYOUT	06.11.18
SD 510	TYPICAL ROAD PROFILES RURAL LIVING & LOW DENSITY RESIDENTIAL AREAS	10.05.16
SD 515	TYPICAL ROAD SECTIONS URBAN AREAS	18.07.17
SD 520	TYPICAL ROAD PROFILES COMMERCIAL STREET / INDUSTRIAL STREET	18.07.17
600	FLOODWAY DETAILS	
SD 600	FLOODWAY - GENERAL ARRANGEMENT LOW VOLUME RURAL ROADS	06.11.18
SD 605	FLOODWAY - DETAILS LOW VOLUME RURAL ROADS	10.05.16
700	COMMUNITY WASTE WATER MANAGEMENT SYSTEMS	
SD 700	TRENCH AND BACKFILL DETAILS	06.11.18
SD 705	NEW CONNECTION / EXISTING OF MAINS	06.11.18
SD 710	TYPICAL CONNECTION I.P. LOCATIONS	06.11.18
SD 715	'Y' CONNECTION OFF AN EXISTING CONNECTION	06.11.18
SD 720	SEALING CAP DETAILS AND IN LINE FLUSHING POINT LOCATIONS	06.11.18
SD 725	TYPICAL CONNECTION AND FLUSHING POINT COVER DETAILS	06.11.18
SD 730	FLUSHING POINT OR MAXIMUM DEPTH CONNECTIONS	06.11.18
SD 735	TERMINAL OF DRAIN LINE & FLUSH POINT	06.11.18
SD 740	TYPICAL CONCRETE ENCASEMENT OF DRAIN OR RISING MAIN THROUGH CREEKS	06.11.18
SD 745	MAINTENANCE HOLE / ACCESS CHAMBER (MH / AC)	06.11.18

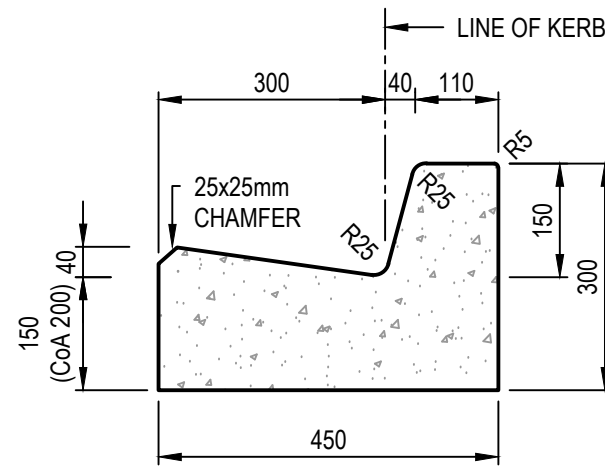
WHILE ALL REASONABLE ATTEMPTS HAVE BEEN MADE TO ENSURE THESE STANDARD DETAILS ARE FIT FOR PURPOSE, THEY SHOULD BE REVIEWED WITH SPECIFIC SITE CONDITIONS IN MIND. IF THE DETAIL IS TRANSFERRED INTO ANOTHER DRAWING WITH OR WITHOUT MODIFICATION, THE USER TAKES FULL RESPONSIBILITY FOR DESIGN CONSIDERATIONS SHOWN IN THE DETAIL.

G	MINOR AMENDMENTS	06.11.2018	AF	AF	MDH	INFRASTRUCTURE GUIDELINES (SA)	SHEET TITLE STANDARD DRAWING INDEX		
F	MINOR AMENDMENTS	18.07.2017	JZ	SGP	DSL				
E	ISSUED FOR REVIEW	07.07.2016	JZ	SGP	DSL				
D	ISSUED FOR REVIEW	05.07.2016	JZ	DL	DSL			SCALE N/A @ A3	
C	ISSUED FOR REVIEW	10.06.2016	JZ	DL	DSL			DRAWING No. SD 000	
REV	DESCRIPTION	DATE	DES	DRW	APP			REV G	
THIS PROJECT HAS BEEN ASSISTED BY THE LOCAL GOVERNMENT RESEARCH AND DEVELOPMENT SCHEME AND INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA									



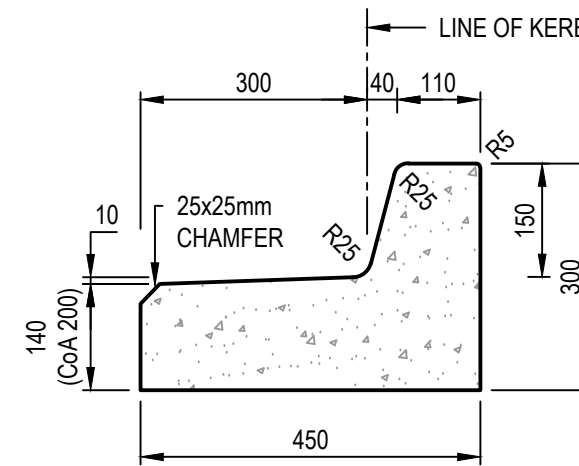
150mm BARRIER KERB ONLY

①



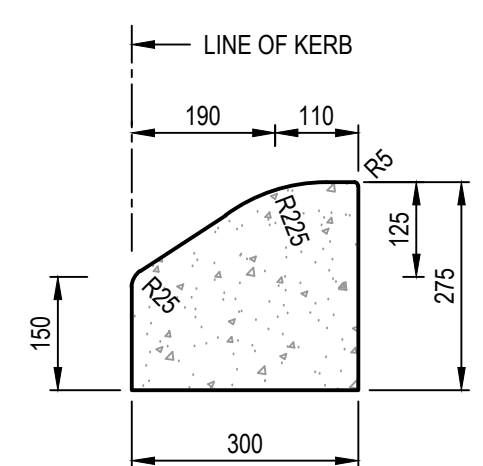
150mm BARRIER KERB AND WATER TABLE

②



150mm BARRIER KERB AND TRAY

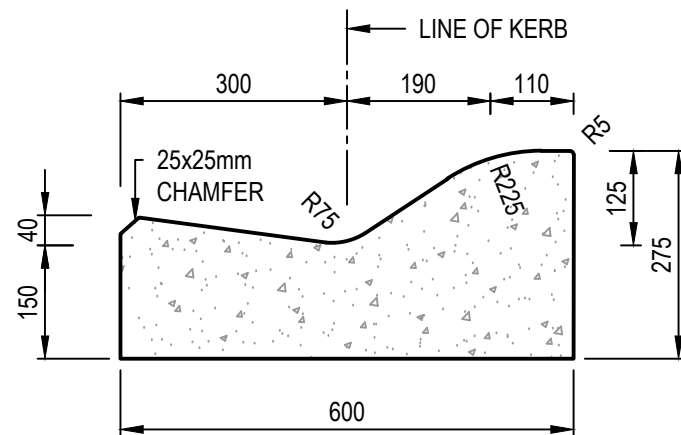
③



SEMI-MOUNTABLE KERB ONLY

*NOT TO BE USED FOR PROPERTY ACCESS OR AT BUS STOPS

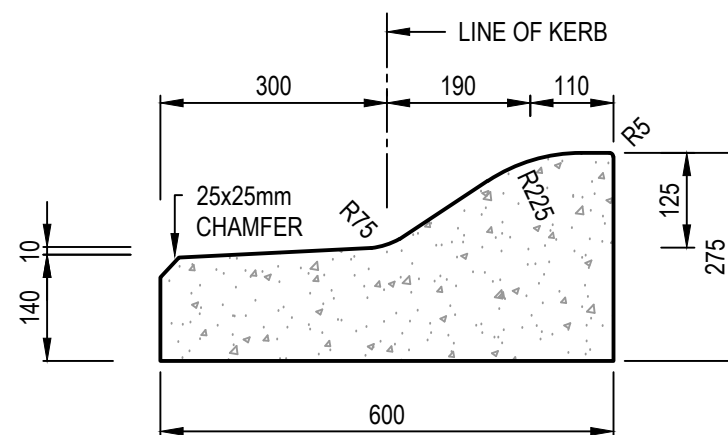
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SEMI-MOUNTABLE KERB AND WATERTABLE

*NOT TO BE USED FOR PROPERTY ACCESS OR AT BUS STOPS

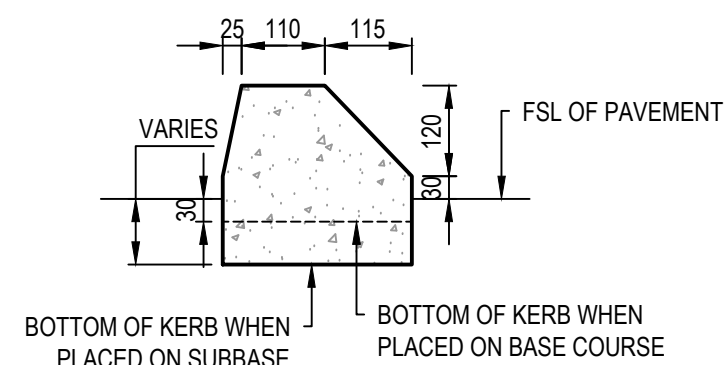
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SEMI-MOUNTABLE KERB AND TRAY

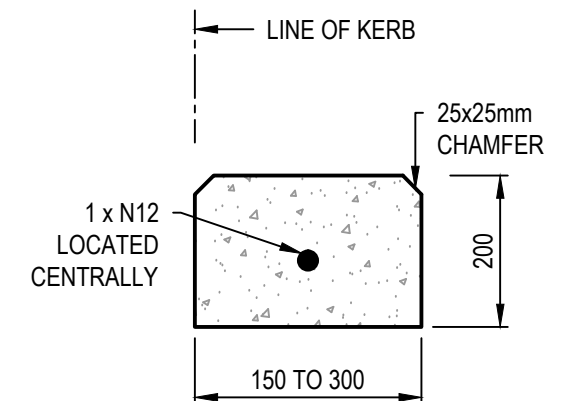
*NOT TO BE USED FOR PROPERTY ACCESS OR AT BUS STOPS

⑥



MEDIAN KERB

⑦

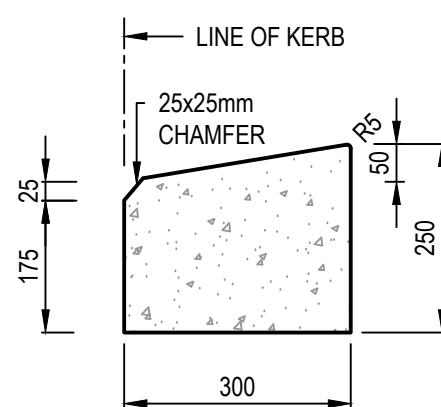


EDGE STRIP

⑧

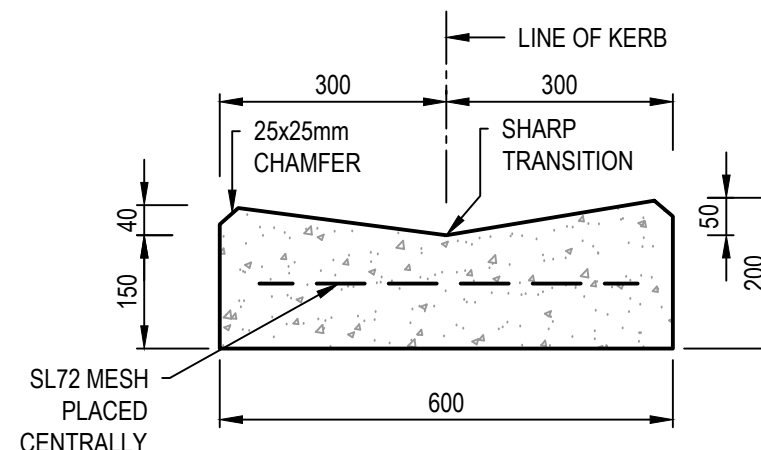
NOTES:

1. CONCRETE SHALL BE NORMAL CLASS N25 STANDARD STRENGTH GRADE COMPLYING WITH THE REQUIREMENTS OF AS. 1379.
2. BEDDING TO BE PM2 / 20 QG COMPACTED TO 96% MMDD TO AS1289 METHOD 5.2.1. BEDDING TO EXTEND MIN. 300mm BEHIND BACK OF KERB. THICKNESS MIN. 100mm TO MATCH EXISTING PAVEMENT SUBBASE, WHICHEVER IS GREATER. PM2 / 20 RG TO BE USED ONLY WHEN SPECIFICALLY APPROVED BY COUNCIL
3. CONCRETE TO BE SMOOTH TROWELLED FINISHED ON TRAY AND KERB.
4. CONCRETE SPONGE FINISHED ON LAYBACK.
5. SHRINKAGE CONTROL JOINTS (TOOLED JOINT) LOCATED AT 2500mm MAXIMUM SPACING. MIN. 50% OF SECTION AREA TO BE CUT. FINISHED WITH TOOLED JOINT 20mm DEPTH TO PRODUCE NEAT GROOVE NOT LESS THAN 5mm WIDE.
6. CONSTRUCTION JOINTS AS REQUIRED TO BE IN ACCORDANCE WITH AS 2876-2000.
7. LINE OF KERB IS USED TO DETERMINE CARRIAGEWAY WIDTHS.
8. WHERE ADJACENT PAVEMENT IS BLOCK PAVED OR CONCRETE, DELETE 25 x 25mm CHAMFER AND REPLACE WITH R5.
9. BACKFILL BEHIND KERB UNTIL FLUSH WITH COMPACTED APPROVED IN-SITU SITE MATERIAL OR PM2 / 20 QG COMPACTED TO 95% MMDD TO AS1289 METHOD 5.2.1.
10. COA = CITY OF ADELAIDE



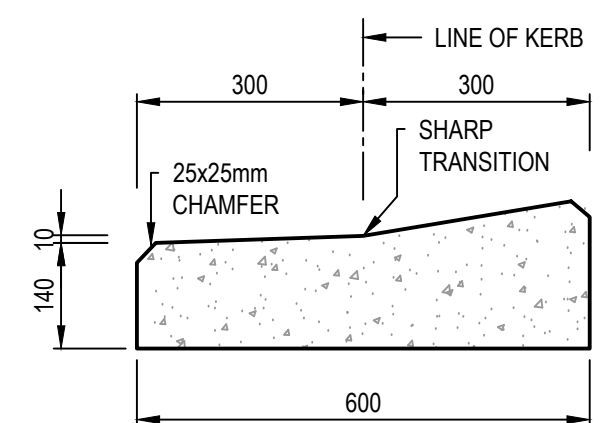
MOUNTABLE KERB

⑨



600mm WIDE SPOON DRAIN

⑩



MOUNTABLE KERB AND TRAY

⑪

ALL MEASUREMENTS IN MILLIMETRES

REV	DESCRIPTION	DATE	DES	DRW	APP
D	MINOR AMENDMENTS	06.11.2018	AF	AF	MDH
C	MINOR AMENDMENTS	18.07.2017	JZ	JC	DSL
B	ISSUED FOR REVIEW	10.05.2016	JZ	DL	DSL
A	ISSUED FOR REVIEW	15.03.2016	JZ	DL	DSL
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INFRASTRUCTURE GUIDELINES (SA)

SHEET TITLE

TYPICAL RESIDENTIAL KERB PROFILES

SCALE

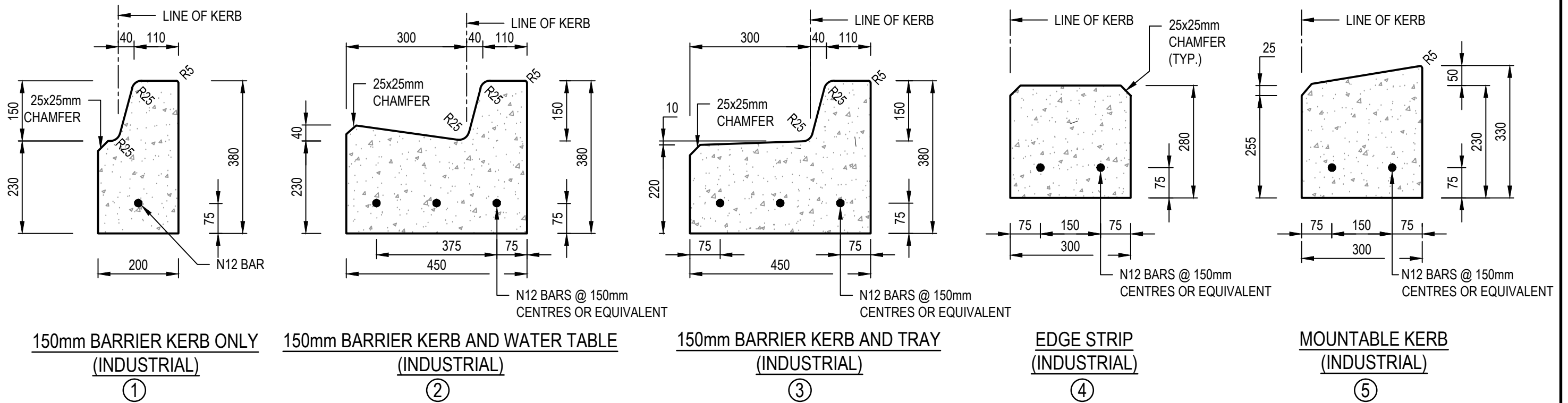
1:10 @ A3

DRAWING No.

SD 100

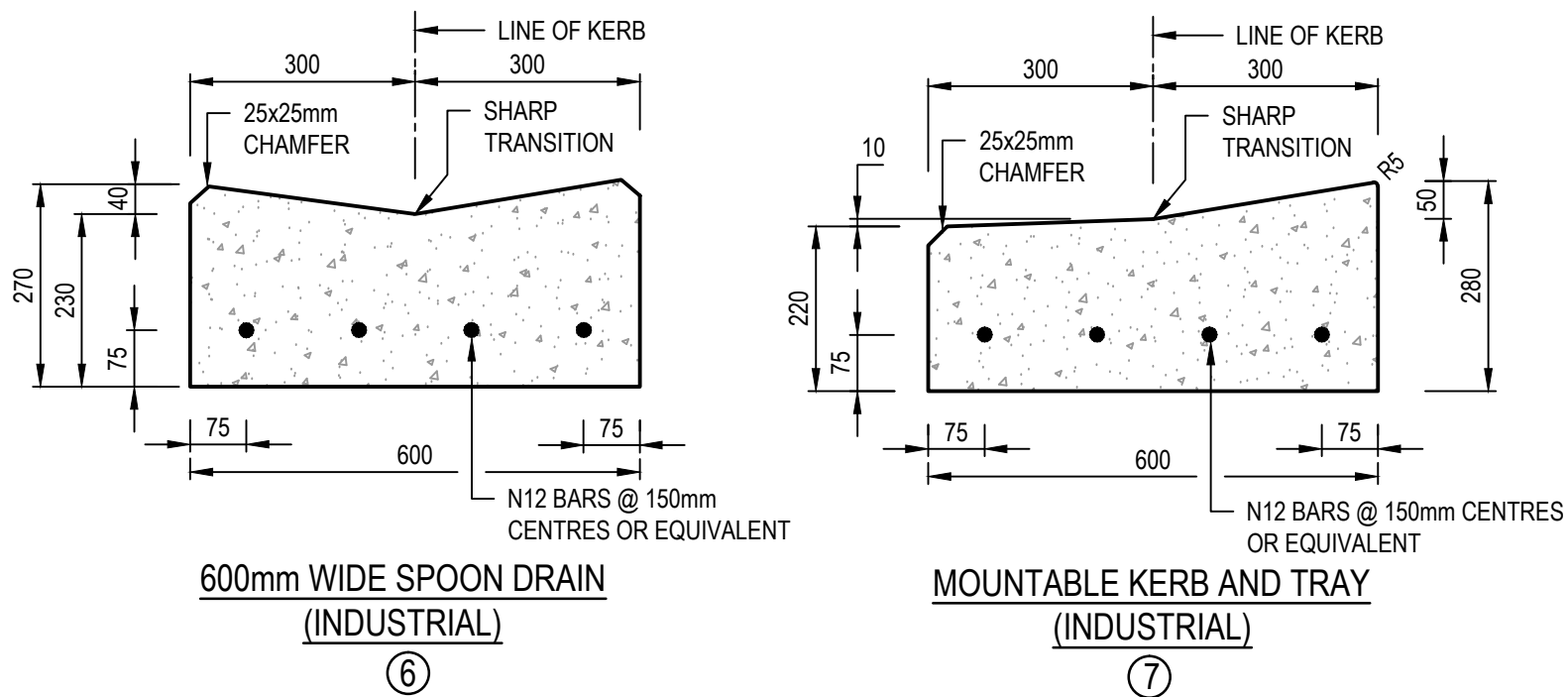
REV

D



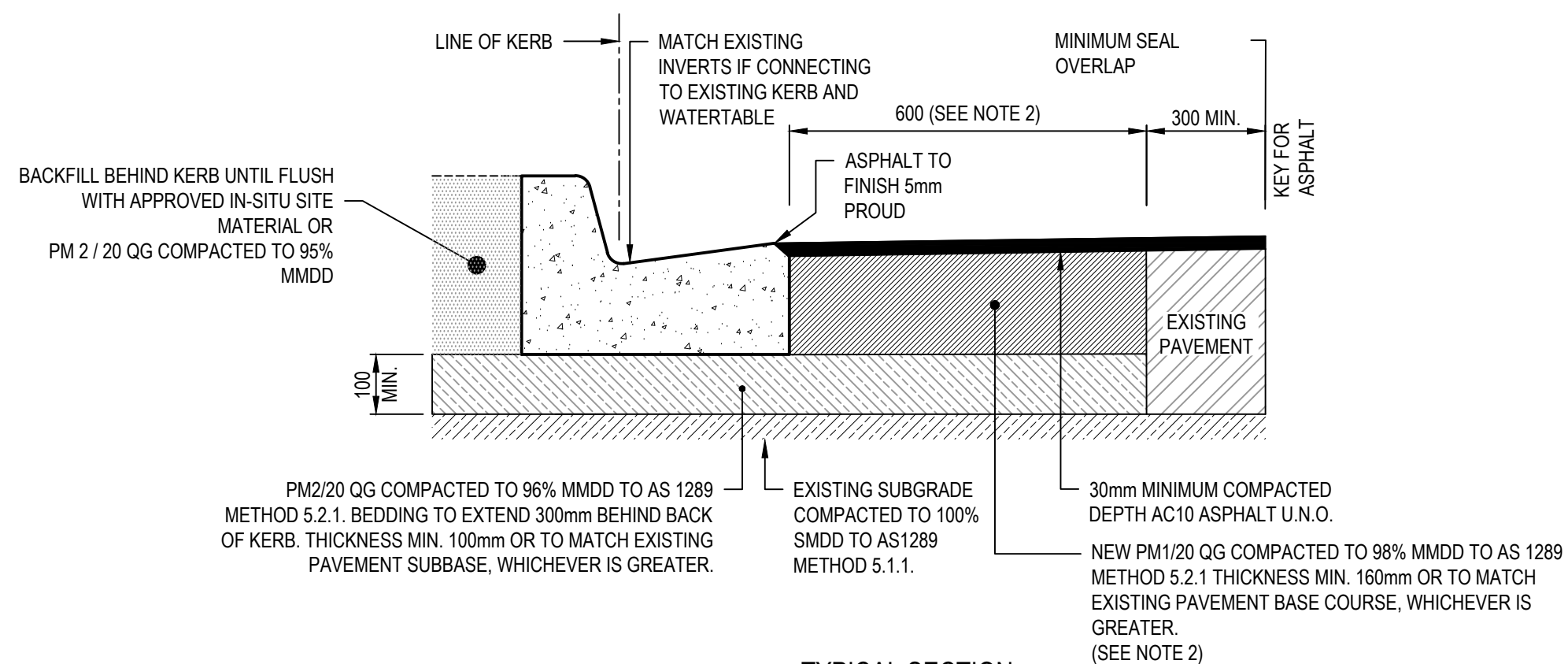
NOTES:

1. REFER TYPICAL RESIDENTIAL KERB PROFILE DRAWING SD 100



ALL MEASUREMENTS IN MILLIMETRES

						INFRASTRUCTURE GUIDELINES (SA)			
D	MINOR AMENDMENTS	06.11.2018	AF	AF	MDH	SHEET TITLE			
C	MINOR AMENDMENTS	18.07.2017	JZ	JC	DSL	TYPICAL INDUSTRIAL KERB PROFILES			
B	ISSUED FOR REVIEW	10.05.2016	JZ	DL	DSL			SCALE	
A	ISSUED FOR REVIEW	15.03.2016	JZ	DL	DSL			1:10 @ A3	
REV	DESCRIPTION	DATE	DES	DRW	APP			DRAWING No.	REV
THIS PROJECT HAS BEEN ASSISTED BY THE LOCAL GOVERNMENT RESEARCH AND DEVELOPMENT SCHEME AND INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA								SD 105	D



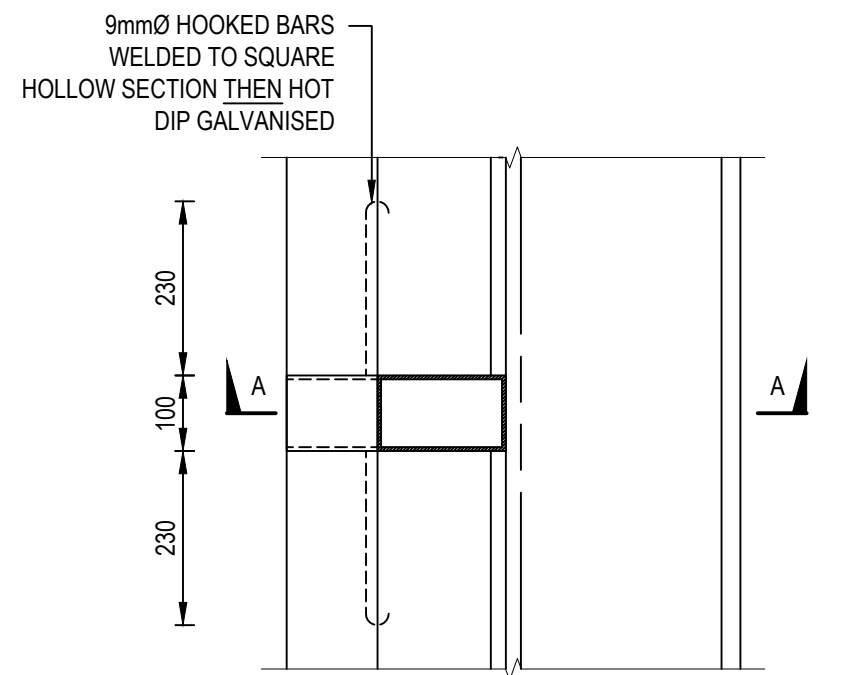
TYPICAL SECTION

ALL MEASUREMENTS IN MILLIMETRES

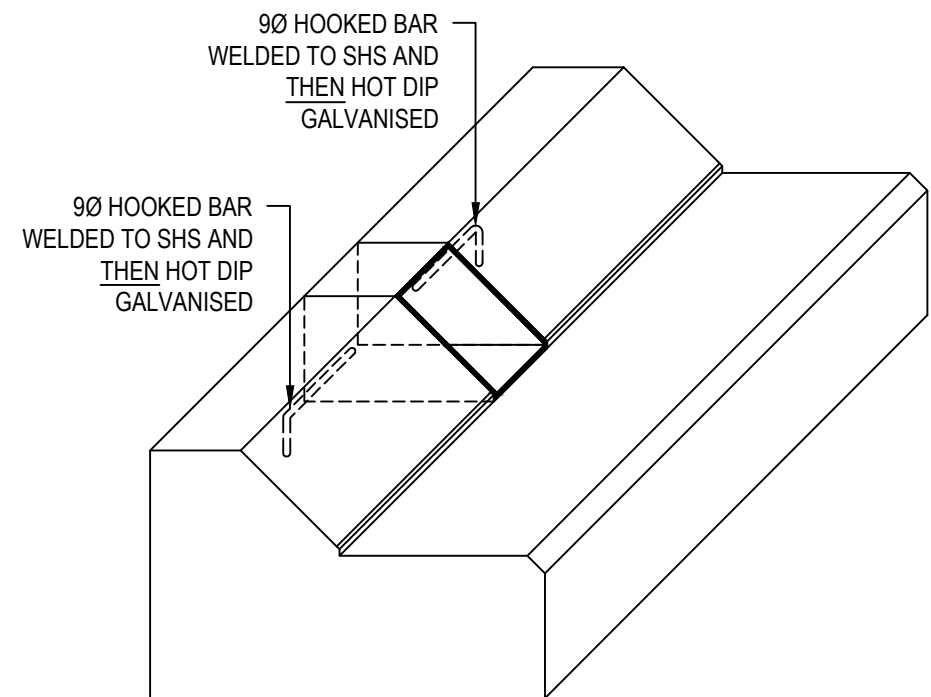
NOTES:

1. REFER TO SD 100 OR SD 105 FOR KERB DETAILS.
2. FOR WIDTH MINIMUM OF 100 TO 350mm USE CONTROLLED LOW STRENGTH MATERIAL (CLSM) INFILL.
3. PM 2 / 20 RG TO BE USED INSTEAD OF PM 2 / 20 QG ONLY WHEN SPECIFICALLY APPROVED BY COUNCIL.
4. REFER PAVEMENT DESIGN FOR PAVEMENT THICKNESS

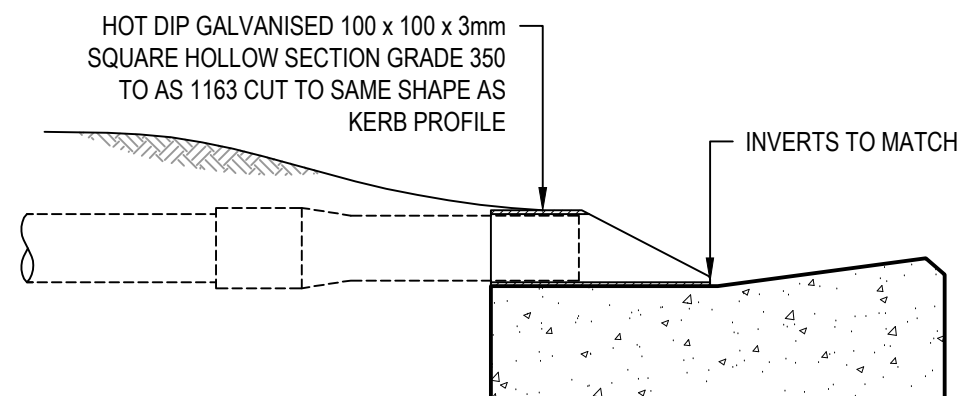
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C	MINOR AMENDMENTS	18.07.2017	JZ	JC	DSL	KERB & WATERTABLE INSTALLATION			
B	ISSUED FOR REVIEW	10.05.2016	JZ	DL	DSL	ABUTTING EXISTING PAVEMENT			
A	ISSUED FOR REVIEW	15.03.2016	JZ	DL	DSL				
REV	DESCRIPTION	DATE	DES	DRW	APP				
THIS PROJECT HAS BEEN ASSISTED BY THE LOCAL GOVERNMENT RESEARCH AND DEVELOPMENT SCHEME AND INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA									



RESIDENTIAL STORMWATER OUTLET CONNECTION



STORMWATER OUTLET DETAIL

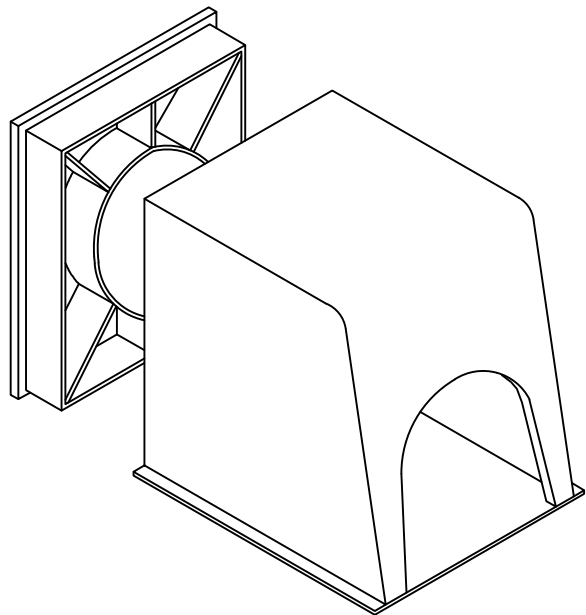


SECTION
A-A

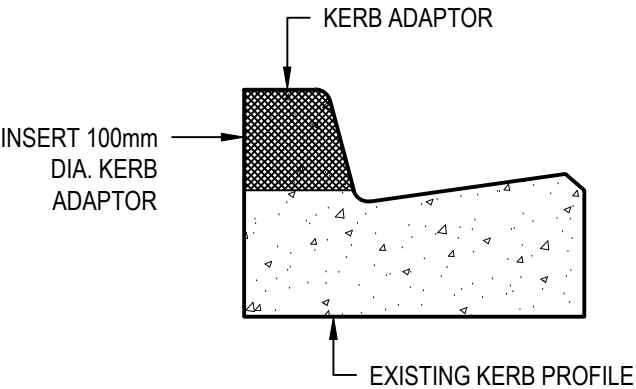
PROVIDE ONE OUTLET PER 10m OF FRONTAGE
ON LOW SIDE OF LOT (UP TO 2 OUTLETS PER LOT)

ALL MEASUREMENTS IN MILLIMETRES

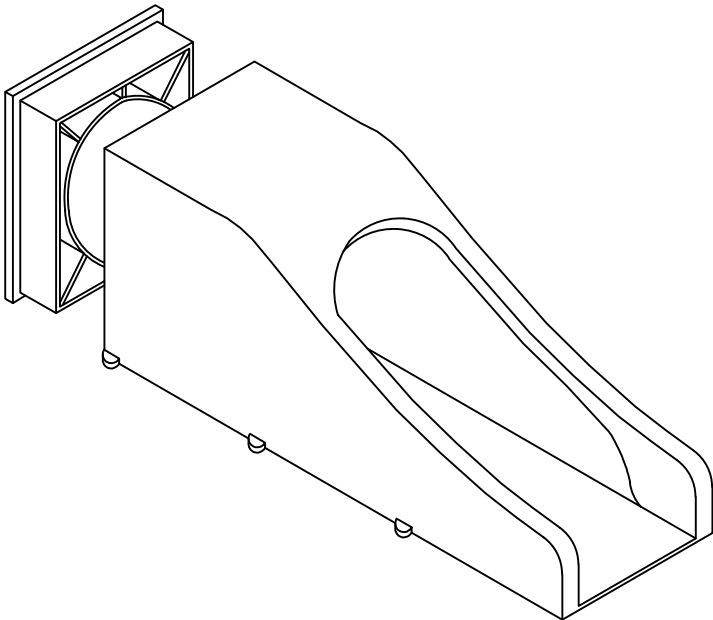
						INFRASTRUCTURE GUIDELINES (SA)		SCALE 1:10 @ A3 DRAWING No. SD 115 REV D	
D	MINOR AMENDMENTS	06.11.2018	AF	AF	MDH	SHEET TITLE STANDARD STORMWATER KERB OUTLET DETAILS - INSTALLED DURING CONSTRUCTION			
C	MINOR AMENDMENTS	18.07.2017	JZ	JC	DSL				
B	ISSUED FOR REVIEW	10.05.2016	JZ	DL	DSL				
A	ISSUED FOR REVIEW	15.03.2016	JZ	DL	DSL				
REV	DESCRIPTION	DATE	DES	DRW	APP				
THIS PROJECT HAS BEEN ASSISTED BY THE LOCAL GOVERNMENT RESEARCH AND DEVELOPMENT SCHEME AND INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA									



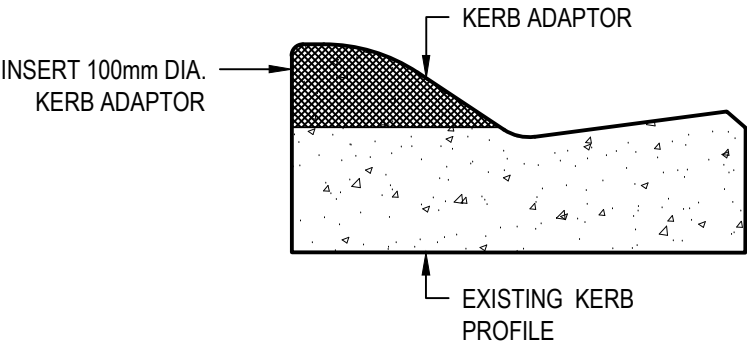
KERB ADAPTOR - UPRIGHT KERB



UPRIGHT KERB WITH KERB ADAPTOR
SECTIONAL VIEW



KERB ADAPTOR - SEMI MOUNTABLE KERB



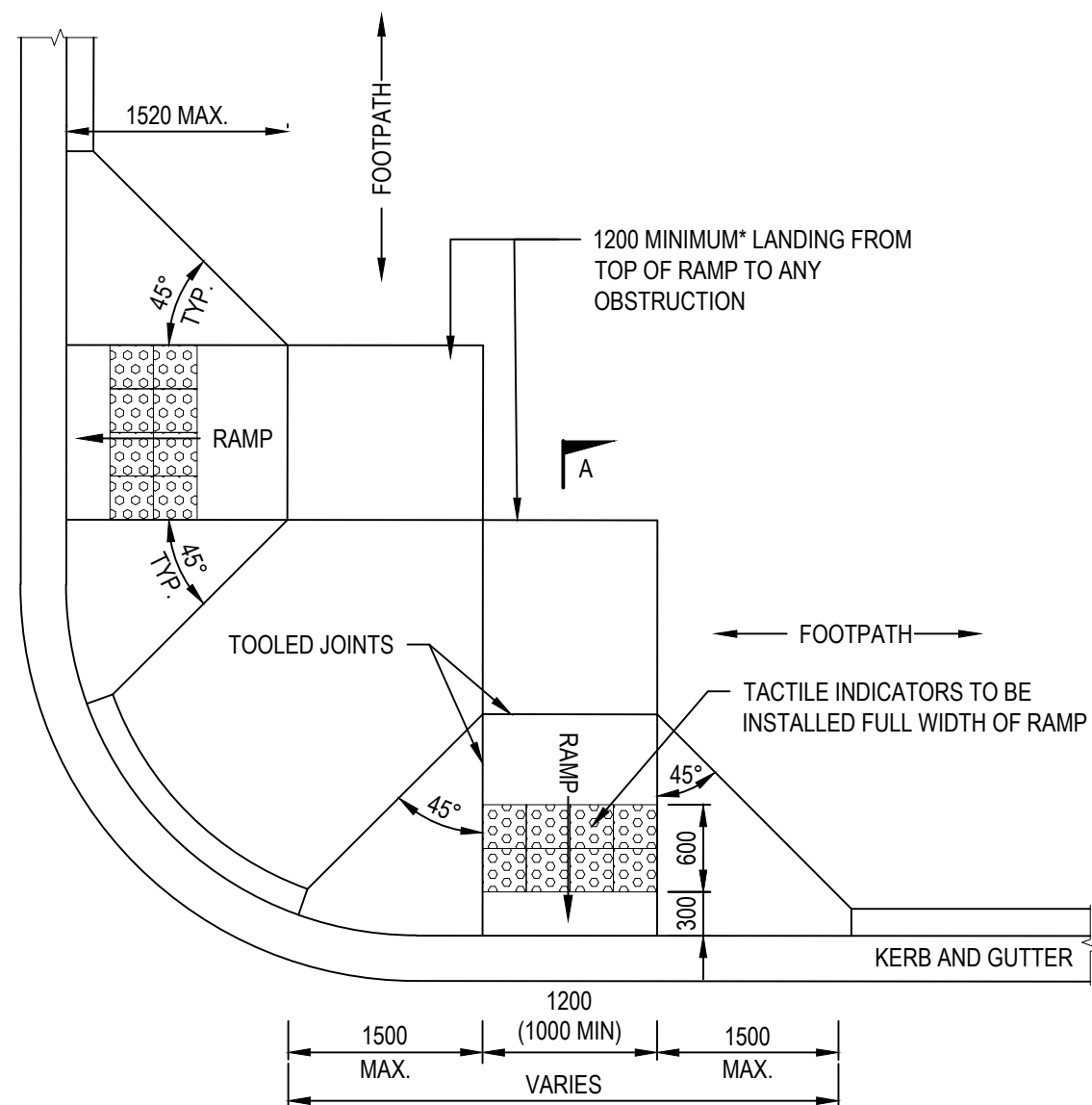
SEMI MOUNTABLE KERB WITH KERB ADAPTOR
SECTIONAL VIEW

NOTES:

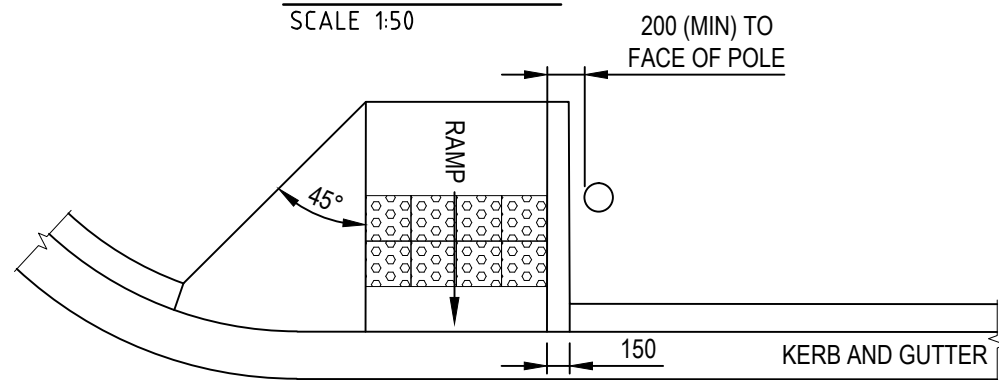
- 1. ALL KERB ADAPTORS ARE TO BE AN APPROVED PROPRIETARY PRODUCT CONSTRUCTED FROM EITHER HEAVY DUTY UPVC OR HOT DIPPED GALVANIZED MILD STEEL.
- 2. KERB IS TO BE NEATLY SAW CUT & KERB ADAPTOR EPOXIED INTO POSITION.

ALL MEASUREMENTS IN MILLIMETRES

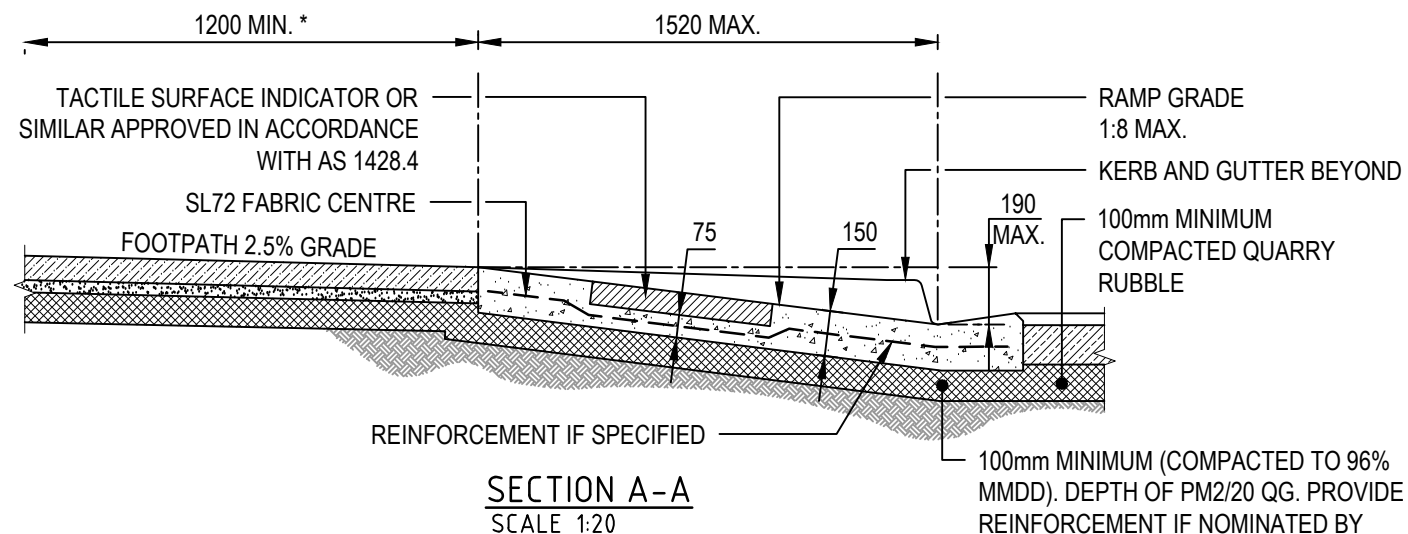
						INFRASTRUCTURE GUIDELINES (SA)	SCALE 1:10 @ A3 DRAWING No. SD 120 REV B
						SHEET TITLE	
						STORMWATER KERB OUTLET DETAILS	
						- EXISTING KERB	
B	ISSUED FOR REVIEW	10.05.2016	JZ	DL	DSL	THIS PROJECT HAS BEEN ASSISTED BY THE LOCAL GOVERNMENT RESEARCH AND DEVELOPMENT SCHEME AND INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA	
A	ISSUED FOR REVIEW	15.03.2016	JZ	DL	DSL		
REV	DESCRIPTION	DATE	DES	DRW	APP		



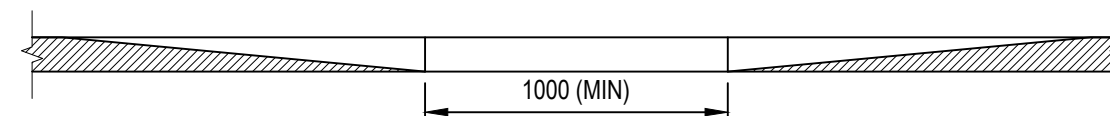
KERB RAMP PLAN
SCALE 1:50



KERB RAMP WITH VERTICAL SIDE - PLAN
SCALE 1:50



SECTION A-A
SCALE 1:20



ELEVATION B
SCALE 1:20

* DENOTES MINIMUM DIMENSION. TO BE 1500 IF A TURN IN DIRECTION OF TRAVEL IS REQUIRED.

NOTES:

1. RAMPS GIVING ACCESS TO ROADWAYS HAVING KERBS EACH SIDE SHALL BE PROVIDED IN PAIRS. ONE IN EACH FOOTWAY AND DIRECTLY OPPOSITE EACH OTHER.
2. RAMPS OR OPENINGS SHALL BE PROVIDED IN ISLANDS WHICH LIE ON THE ROUTE ACROSS THE ROAD. THE OPENING SHALL NOT BE LESS THAN 1000mm WIDE (1200mm PREFERRED)
3. TOP AND BOTTOM KERB RAMPS SHALL HAVE A SHARP GRADIENT TRANSITION.
4. THE RAMP AND SLOPING SIDES SHALL BE SLIP RESISTANT WITH TACTILE SURFACE INDICATORS (CONTRASTING COLOUR), TYPE 'B' AND SHALL BE INSTALLED IN ACCORDANCE WITH AS 1428.4-2009.
5. CONCRETE GRADE SHALL BE N32 FOR KERB, GUTTERS AND RAMPS.
6. KERB RAMPS MUST CONFORM WITH AS1428.
7. KERB RAMP WINGS CAN BE STEEPENED AND A HAND RAIL PROVIDED IN LOCATIONS WHERE ACCESS FROM THE SIDES IS NOT POSSIBLE, OR ON CURVES.

ALL MEASUREMENTS IN MILLIMETRES

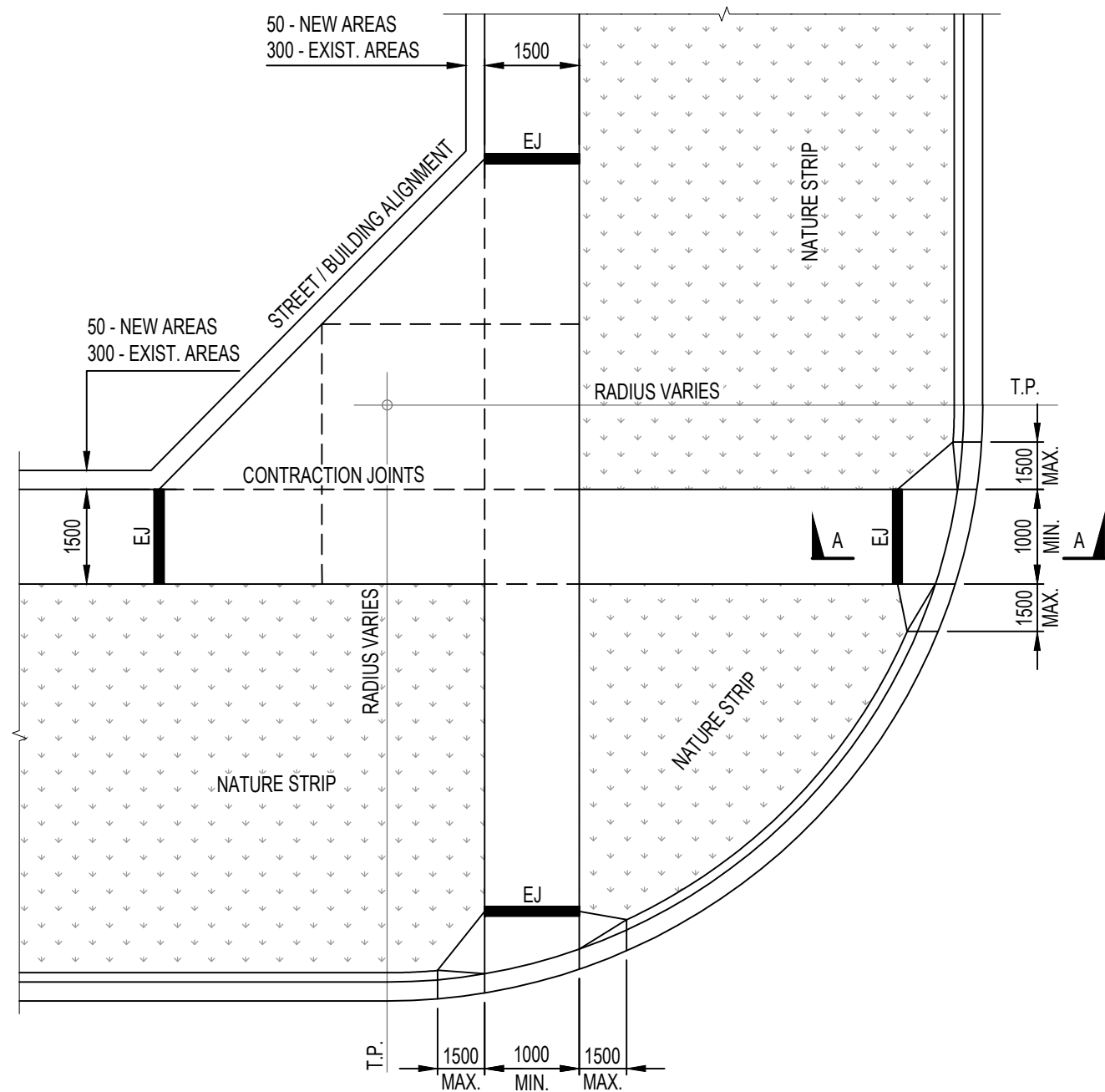
REV	DESCRIPTION	DATE	DES	DRW	APP
D	MINOR AMENDMENTS	06.11.2018	AF	AF	MDH
C	MINOR AMENDMENTS	18.07.2017	JZ	JC	DSL
B	ISSUED FOR REVIEW	10.05.2016	JZ	DL	DSL
A	ISSUED FOR REVIEW	15.03.2016	JZ	DL	DSL
THIS PROJECT HAS BEEN ASSISTED BY THE LOCAL GOVERNMENT RESEARCH AND DEVELOPMENT SCHEME AND INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA					

INFRASTRUCTURE GUIDELINES (SA)			
SHEET TITLE			
KERB RAMP SPECIFICATIONS			
SHEET 1 OF 2			
SCALE			
AS SHOWN @ A3			
DRAWING No.			REV
SD 125			D

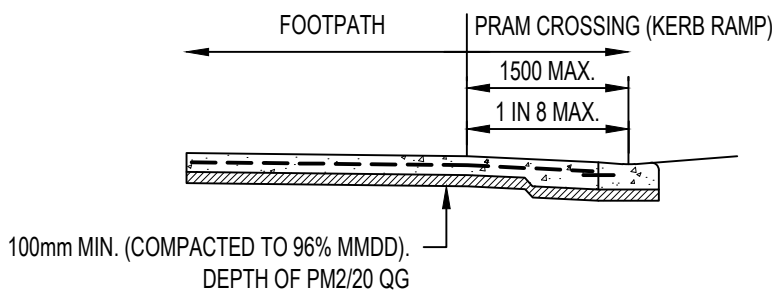
LEGEND:

EXPANSION JOINT EJ

CONTRACTION JOINTS



TYPICAL ARRANGEMENT PLAN
SCALE 1:100



SECTION A-A
SCALE NTS

NOTE:
KERB RAMP DETAILS. REFER TO SD 125 AND SD 130.

NOTES:

1. LOCATION OF CROSSINGS TO BE CASE BY CASE & TO BE APPROVED BY COUNCIL.
2. CROSSING GENERALLY TO BE LOCATED AT TANGENT POINTS.
3. CONCRETE TO BE SMOOTH TROWELLED FINISH ON TRAY.
4. CONCRETE TO BE FINE SOFT HAIR BROOM FINISH ON LAYBACK.
5. MINIMUM CONCRETE STRENGTH TO BE 32 MPA.
6. BEDDING TO BE COMPACTED PM2/20 QG 100mm MIN. THICKNESS.
7. IF SPLAY IS NOT REQUIRED FOOTPATH IS TO CONTINUE THROUGH TO LAYBACKS.
8. TGI'S (TILES), WHERE REQUIRED, ARE TO BE TO BE INSTALLED TO AS1428.4

ALL MEASUREMENTS IN MILLIMETRES

B	ISSUED FOR REVIEW	18.07.2017	JZ	DL	DSL
B	ISSUED FOR REVIEW	10.05.2016	JZ	DL	DSL
A	ISSUED FOR REVIEW	15.03.2016	JZ	DL	DSL
REV	DESCRIPTION	DATE	DES	DRW	APP
THIS PROJECT HAS BEEN ASSISTED BY THE LOCAL GOVERNMENT RESEARCH AND DEVELOPMENT SCHEME AND INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA					

INFRASTRUCTURE GUIDELINES (SA)

SHEET TITLE

TYPICAL PEDESTRIAN CROSSING
ARRANGEMENT DETAIL

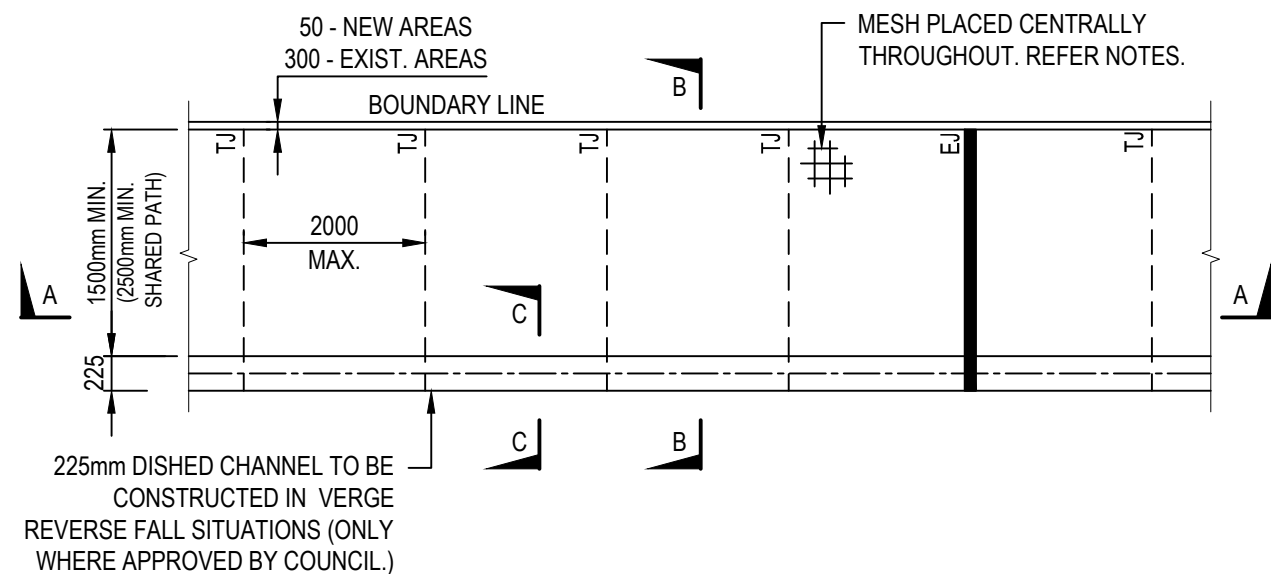
SCALE
AS SHOWN @ A3

DRAWING No.

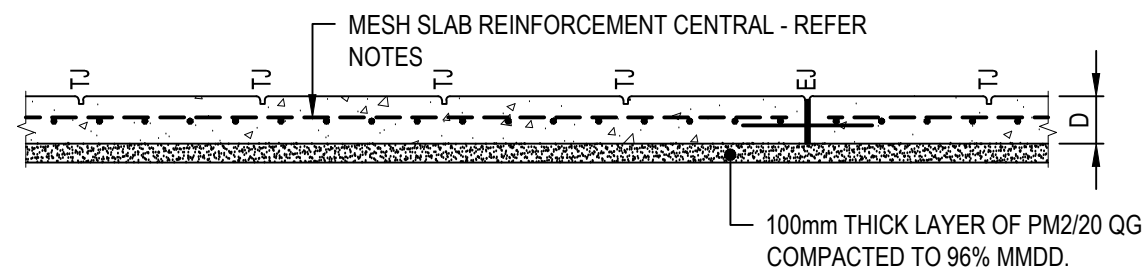
SD 200

REV

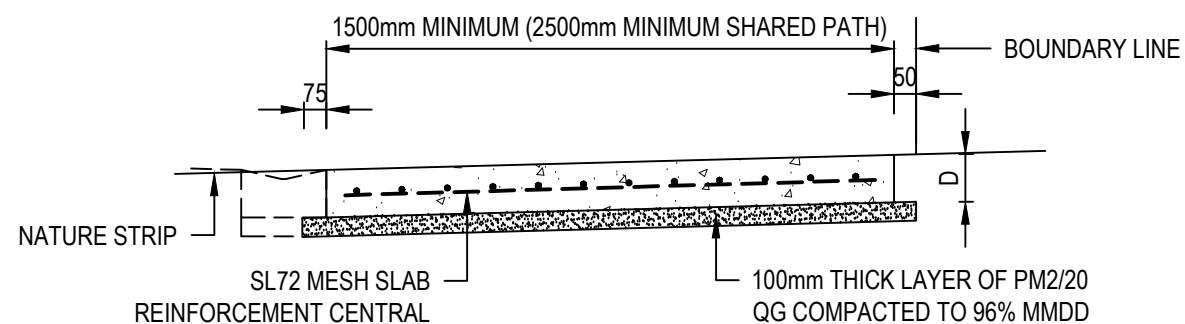
C



PLAN



SECTION A-A
TYPICAL 125mm & 150mm FOOTPATH SECTION



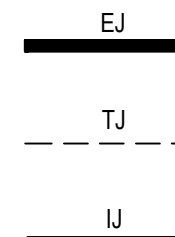
SECTION B-B
TYPICAL 125mm & 150mm FOOTPATH SECTION

LEGEND:

EXPANSION JOINT @ 12m CTS.
MAX.

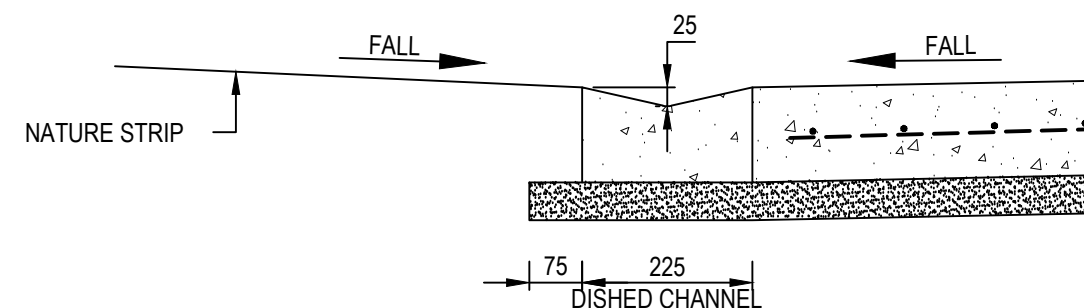
CONTRACTION/TOOLED
JOINTS @ 2000mm CTS. MAX.

ISOLATION JOINT

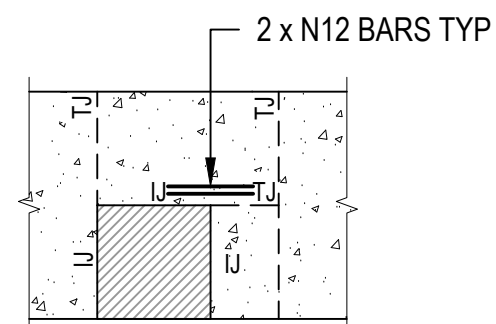


NOTES:

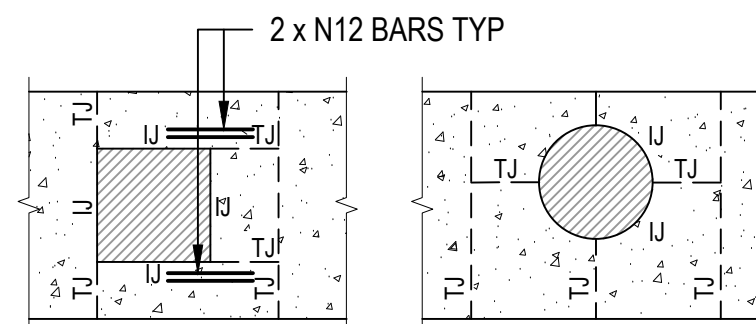
- 'D' = DEPTH OF CONCRETE FOOTPATH
 - EXISTING RESIDENTIAL: D = 100mm 25MPa WITH SL62.
 - NEW RESIDENTIAL: D = 125mm 25MPa WITH SL72.
 - EXPOSED AGGREGATE D = 125mm 32MPa WITH SL72
 - COMMERCIAL/INDUSTRIAL: D = 150mm 32MPa WITH SL82 (TOP) 50 COVER.
- REFER SD 210 FOR DETAILS OF JOINT TYPES.
- ALIGNMENT OF FOOTPATH TO BE SHOWN ON DESIGN PLANS AND APPROVED BY COUNCIL.



SECTION C-C
(ONLY TO BE USED BY COUNCIL APPROVAL)



PIT / ACCESS HOLE AT EDGE (PLAN)



PIT / ACCESS HOLE NOT AT EDGE (PLAN)

ALL MEASUREMENTS IN MILLIMETRES

REV	DESCRIPTION	DATE	DES	DRW	APP
D	MINOR AMENDMENTS	06.11.2018	AF	AF	MDH
C	MINOR AMENDMENTS	18.07.2017	JZ	DL	DSL
B	ISSUED FOR REVIEW	10.05.2016	JZ	DL	DSL
A	ISSUED FOR REVIEW	15.03.2016	JZ	DL	DSL
THIS PROJECT HAS BEEN ASSISTED BY THE LOCAL GOVERNMENT RESEARCH AND DEVELOPMENT SCHEME AND INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA					

INFRASTRUCTURE GUIDELINES (SA)

SHEET TITLE

**TYPICAL CONCRETE FOOTPATH
DETAIL - SHEET 1 OF 2**

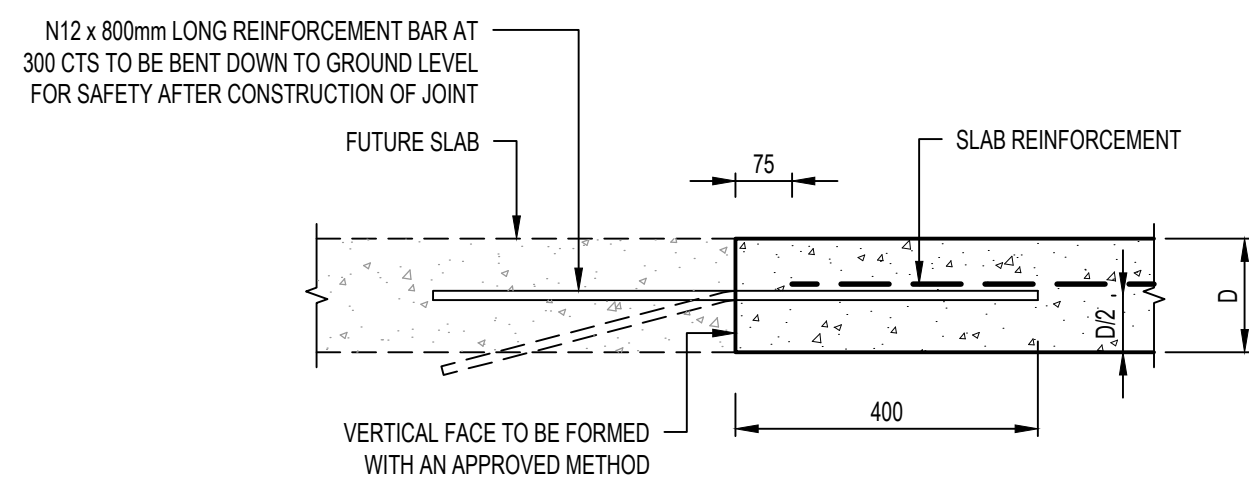
SCALE
NTS @ A3

DRAWING No.

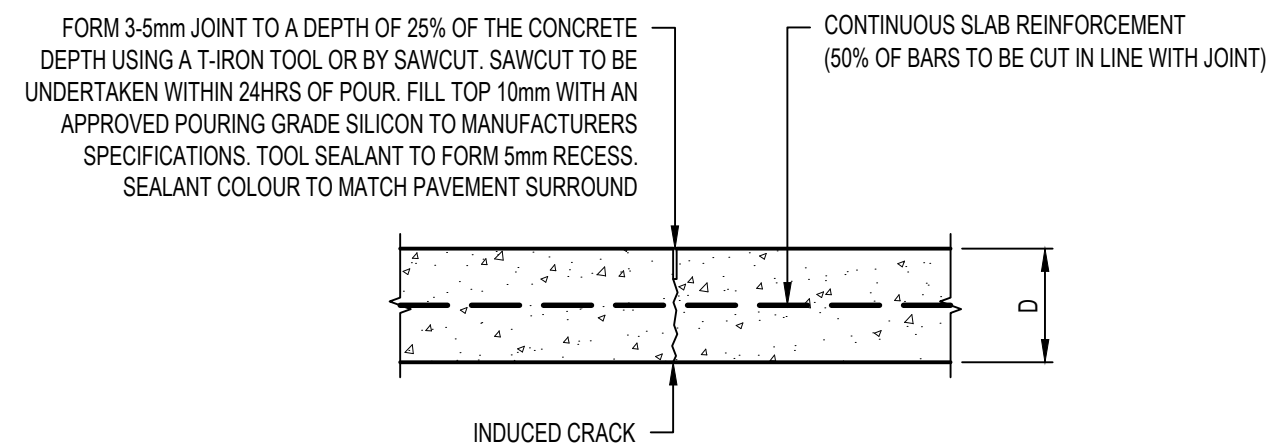
SD 205

REV

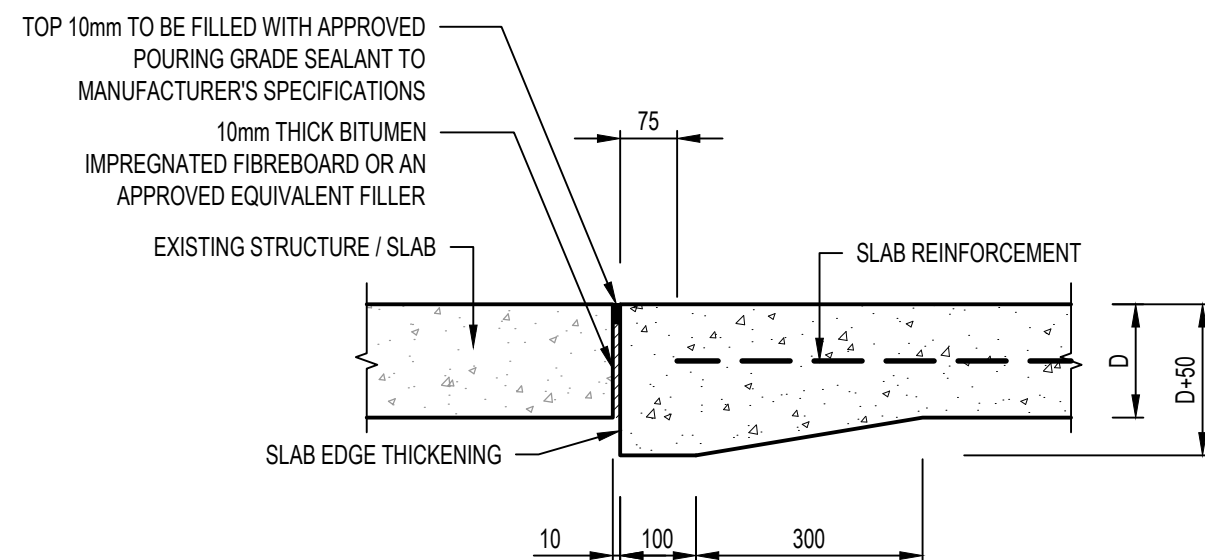
D



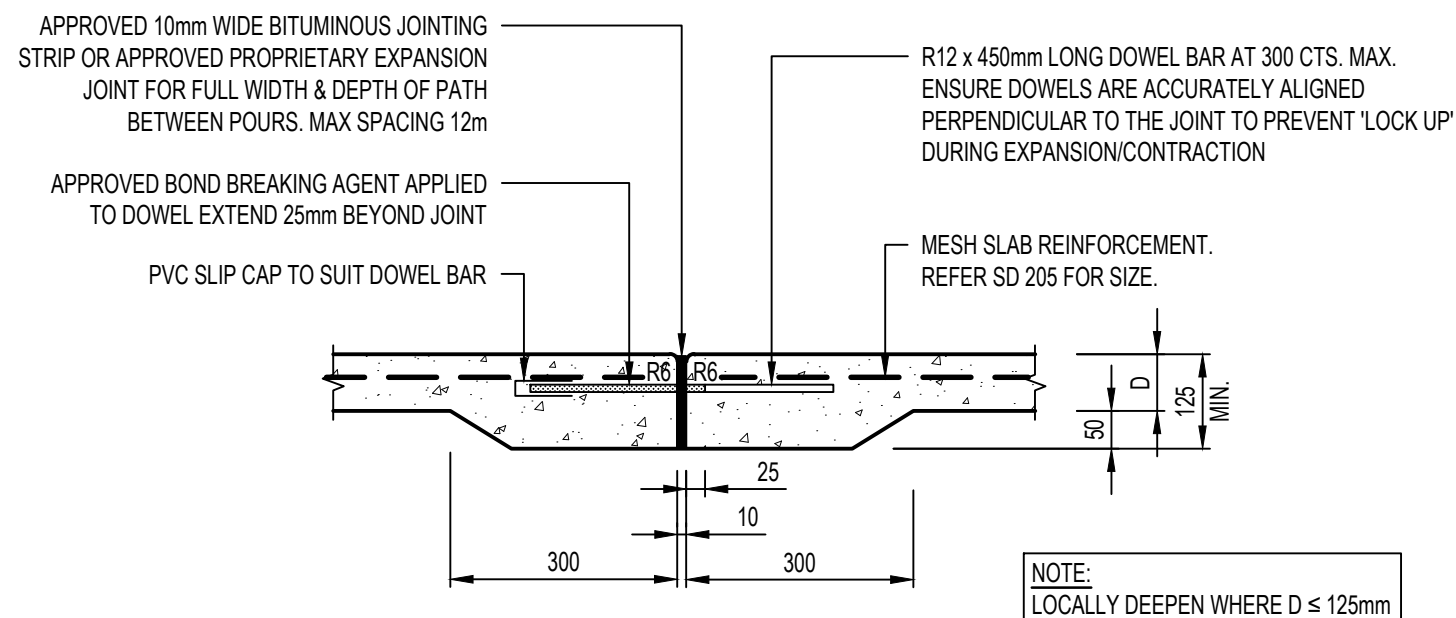
TYPICAL FUTURE CONSTRUCTION JOINT



TYPICAL CONTRACTION / TOOLED JOINT



TYPICAL ISOLATION JOINT SECTION



TYPICAL FOOTPATH EXPANSION JOINT - SECTION

NOTE:

1. PROPRIETARY EXPANSION JOINTS SUCH AS TRIPSTOP CAN BE USED WITH COUNCIL APPROVAL IN REACTIVE SOILS OR WHERE TREE ROOTS MAY AFFECT PATHS.

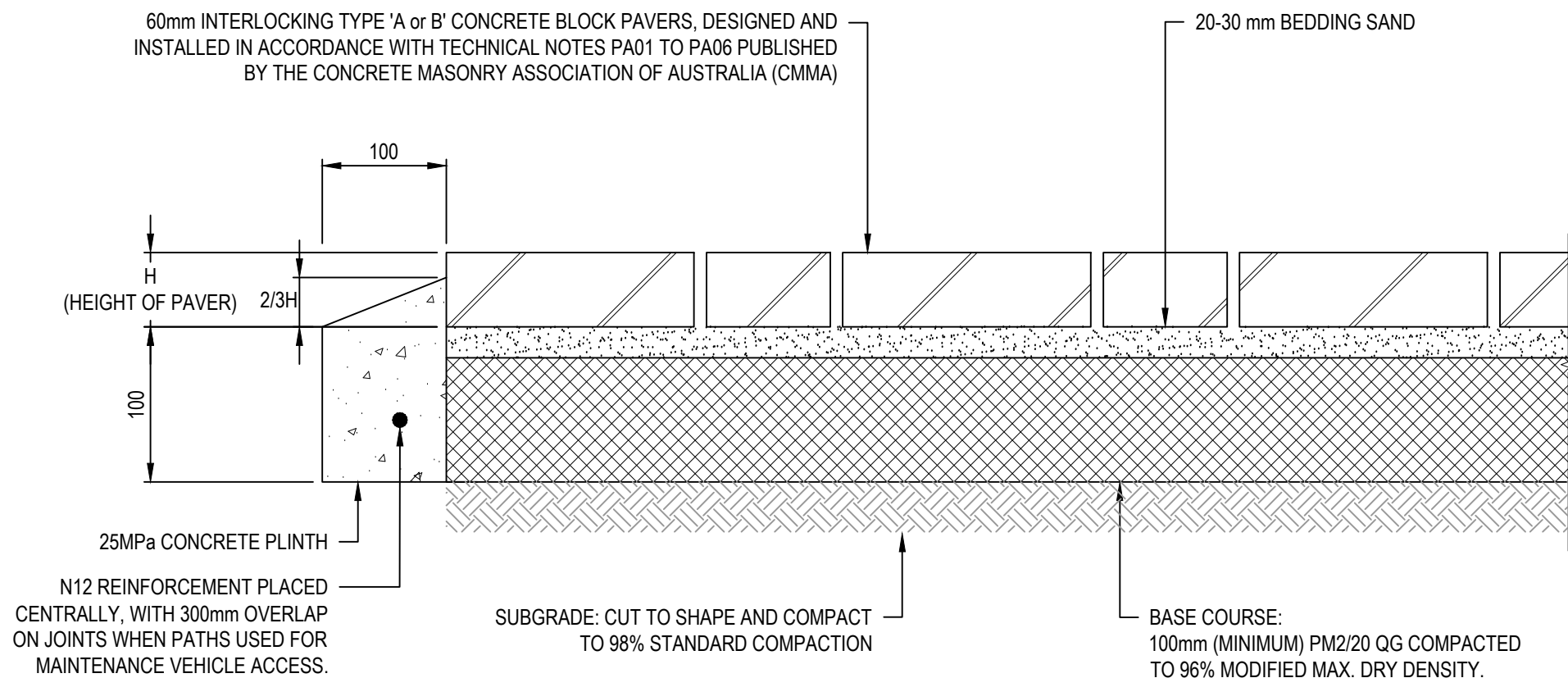
ALL MEASUREMENTS IN MILLIMETRES

						INFRASTRUCTURE GUIDELINES (SA)		SCALE 1:10 @ A3 DRAWING No. SD 210 REV C	
						SHEET TITLE			
C	MINOR AMENDMENTS	18.07.2017	JZ	JC	DSL	TYPICAL CONCRETE FOOTPATH DETAIL			
B	ISSUED FOR REVIEW	10.05.2016	JZ	DL	DSL	SHEET 2 OF 2			
A	ISSUED FOR REVIEW	15.03.2016	JZ	DL	DSL				
REV	DESCRIPTION	DATE	DES	DRW	APP				
THIS PROJECT HAS BEEN ASSISTED BY THE LOCAL GOVERNMENT RESEARCH AND DEVELOPMENT SCHEME AND INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA									



NOTES:

- | | | | | | | | | | |
|--|-------------------|------------|-----|-----|-----|---|--|-------------------|----------|
| | | | | | | INFRASTRUCTURE GUIDELINES (SA) | | | |
| C | MINOR AMENDMENTS | 18.07.2017 | JZ | JC | DSL | SHEET TITLE
TYPICAL HOT MIX ASPHALT FOOTPATH | | | |
| B | ISSUED FOR REVIEW | 10.05.2016 | JZ | DL | DSL | | | SCALE
NTS @ A3 | |
| A | ISSUED FOR REVIEW | 15.03.2016 | JZ | DL | DSL | | | DRAWING No. | |
| REV | DESCRIPTION | DATE | DES | DRW | APP | | | SD 215 | REV
C |
| THIS PROJECT HAS BEEN ASSISTED BY THE LOCAL GOVERNMENT RESEARCH AND DEVELOPMENT SCHEME AND INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA | | | | | | | | | |



SECTION THROUGH EDGE OF FOOTPATH
SCALE 1:5

NOTES:

1. CONCRETE PLINTH TO BE USED WHERE NOT BACK OF KERB, OR BOTH SIDES OF FOOTPATH WHEN NOT BACK OF KERB OR AGAINST FIXED EDGE.
2. MATERIALS AND WORKMANSHIP SHALL BE IN ACCORDANCE WITH THE RELEVANT PUBLICATION OF THE CONCRETE MASONRY ASSOCIATION OF AUSTRALIA AND SHALL BE IN ACCORDANCE WITH BEST TRADE PRACTICE.
3. PAVING BLOCKS TO BE LAID IN 90° HERRINGBONE PATTERN WITH HEADER COURSE UP TO THE CONCRETE PLINTH OR AS SPECIFIED.
4. BLOCKS SHALL BE CONCRETE INTERLOCKING. COLOUR AND STYLE TO BE NOMINATED ON DRAWING APPROVED BY COUNCIL. ALL JOINTS TO BE FILLED WITH SUPERSAND/OR PAVELOCK SAND.
5. ALL CUTTING OF PAVERS TO BE WITH MASONRY SAW ONLY.
6. CLAY PAVERS OR OTHER NON INTERLOCKING PAVERS ARE SUBJECT TO COUNCIL APPROVAL BASED ON PERFORMANCE REQUIREMENTS INCLUDING SLIP RESISTANCE AND STRENGTH.

ALL MEASUREMENTS IN MILLIMETRES

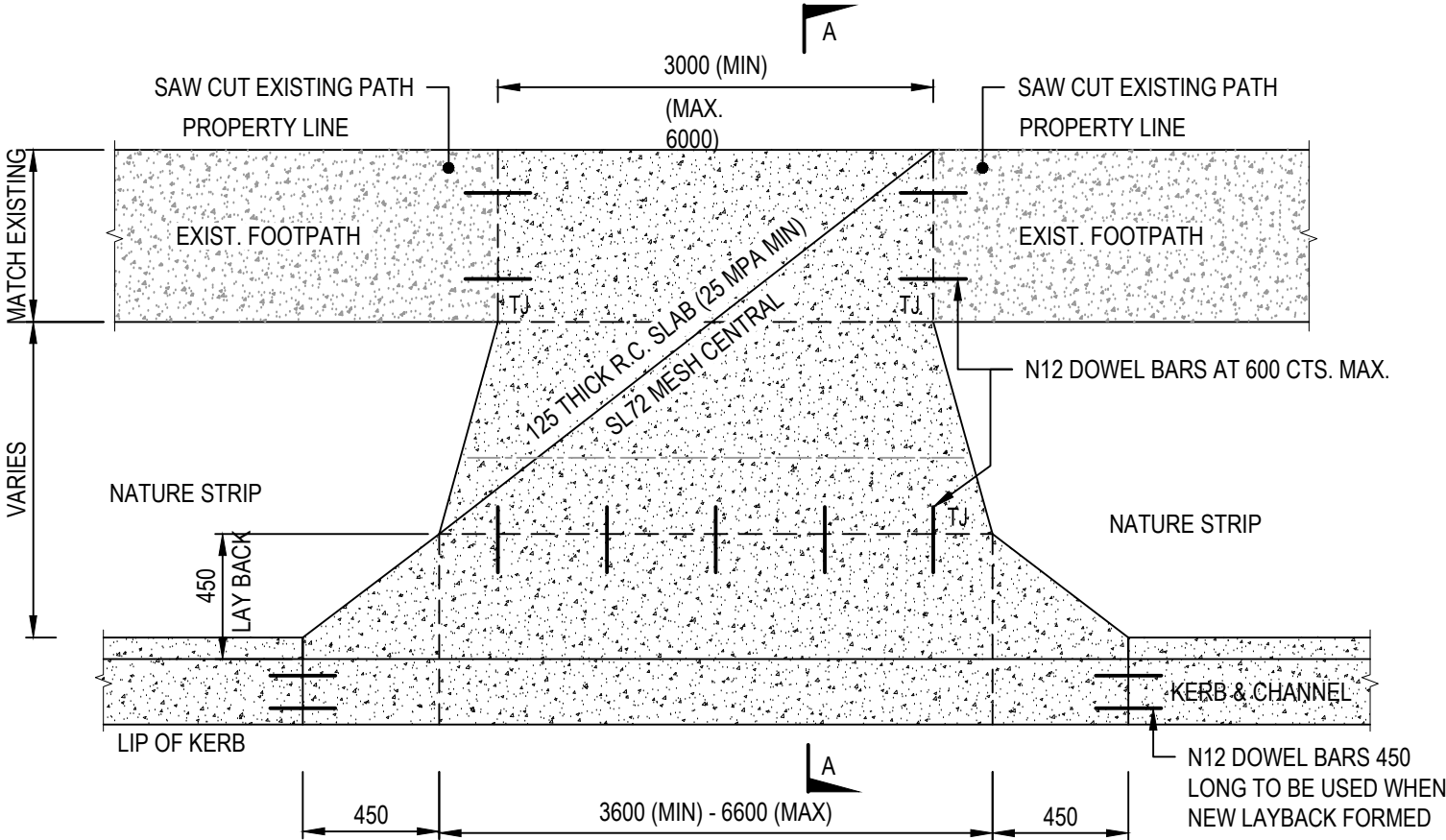
						INFRASTRUCTURE GUIDELINES (SA)			
D	MINOR AMENDMENTS	06.11.2018	AF	AF	MDH	SHEET TITLE			
C	MINOR AMENDMENTS	18.07.2017	JZ	JC	DSL	BLOCK PAVED FOOTPATH			
B	ISSUED FOR REVIEW	10.05.2016	JZ	DL	DSL			SCALE	
A	ISSUED FOR REVIEW	15.03.2016	JZ	DL	DSL			1:5 @ A3	
REV	DESCRIPTION	DATE	DES	DRW	APP			DRAWING No.	REV
THIS PROJECT HAS BEEN ASSISTED BY THE LOCAL GOVERNMENT RESEARCH AND DEVELOPMENT SCHEME AND INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA								SD 220	D

LEGEND:

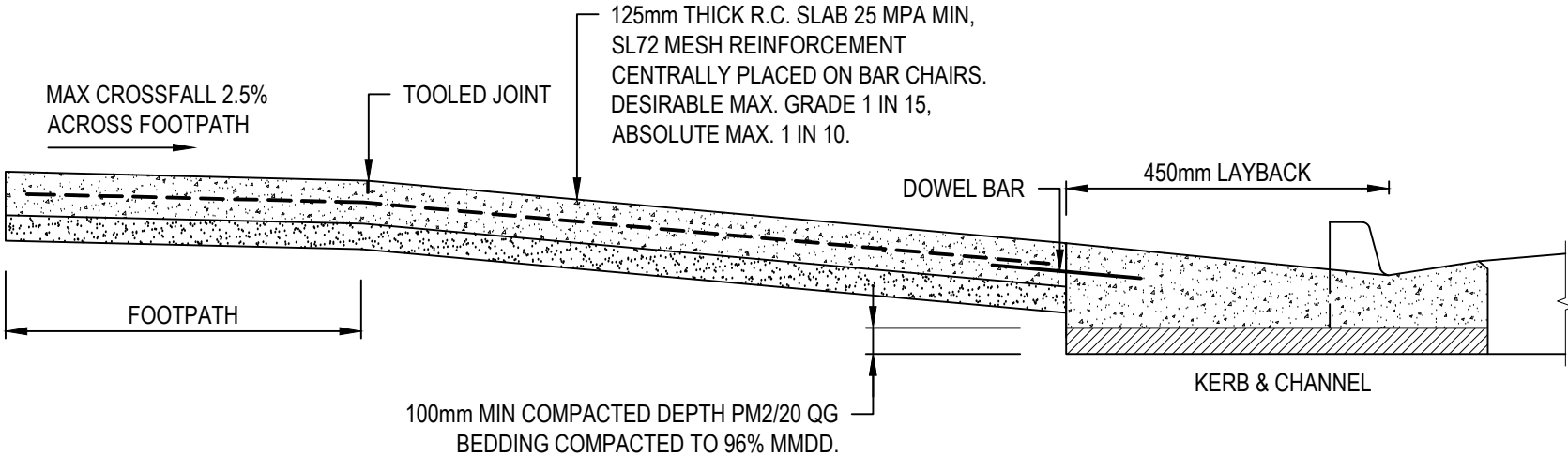
EXPANSION JOINT	EJ
TOOLED JOINTS (REFER TO SD 210)	TJ

NOTES:

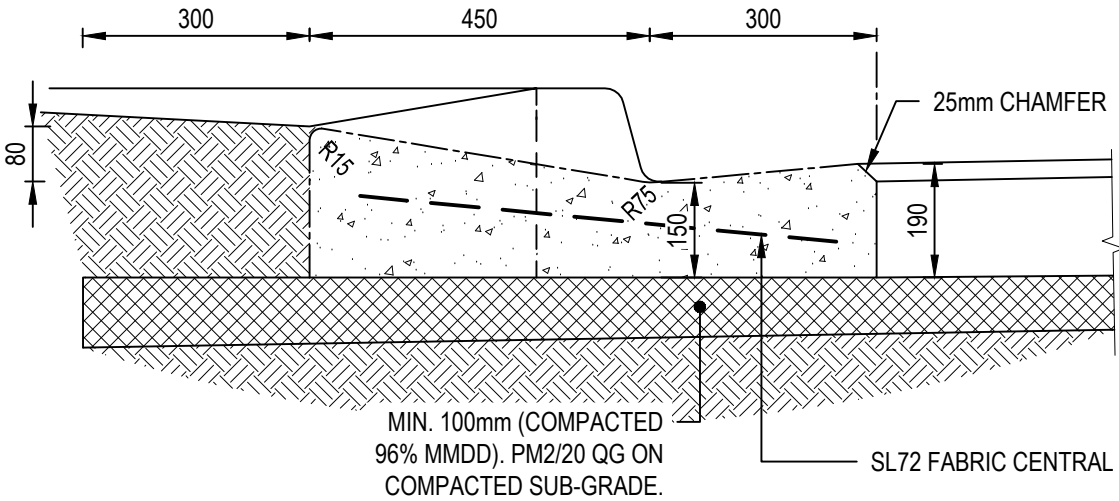
1. THIS DRAWING DETAILS DIMENSIONS FOR STANDARD RESIDENTIAL CROSSINGS ONLY.
2. CROSSING WIDTHS EXCEEDING THE MAXIMUM ALLOWABLE WILL REQUIRE APPLICATION FOR SPECIAL CONSIDERATION.
3. JOINTS AND DOWEL BARS ARE REQUIRED ON EITHER SIDE OF THE CROSSING AT THE INTERFACE WITH THE CONCRETE FOOTPATH. PROVISION SHALL BE MADE IN EXISTING CONCRETE SECTIONS BY DRILLING HOLES TO A MINIMUM DEPTH OF 150mm AND INSERTING R12 X 300mm LONG DOWEL BARS.
4. AN APPROVED JOINT FILLER SHALL BE PLACED ON EITHER SIDE OF THE CROSSING AGAINST FOOTPATH SLABS. DOWEL BARS ARE TO HAVE AN APPROVED BOND BREAKER APPLIED TO THE END OF THE BAR INSERTED INTO THE EXISTING CONCRETE FOOTPATH SECTIONS REFER SD210.
5. ADDITIONAL TOOLED JOINT REQUIRED IF DISTANCE FROM BACK OF KERB TO FOOTPATH IS GREATER THAN 3000 AND SHALL BE PLACED AT THE MIDPOINT OF THE DISTANCE.
6. THE MAXIMUM NUMBER OF CROSSINGS, WHERE ANY CROSSING EXCEEDS 3.6 METRES WIDTH, SHALL BE ONE (1) CROSSING WITH THE MAXIMUM WIDTH OF THAT CROSSING TO BE 6.6 METRES. CROSSINGS TO ADJACENT PROPERTIES SHALL BE EITHER FULLY COMBINED, AND OF MAXIMUM WIDTH OF 6.6 METRES, OR ELSE HAVE A MINIMUM SEPARATION OF 9 METRES..
7. FOOTPATHS OF 100mm THICKNESS ARE ACCEPTABLE ONLY WHERE THE LOTS ARE DEVELOPED ALREADY AND THE RISK OF SITE CONSTRUCTION DAMAGE IS NEGLIGIBLE. WHERE GREENFIELD SITES AND FUTURE HOUSING IS STILL TO BE DONE, THEN THE DEPTH OF THE FOOTPATH SHALL BE 125mm THROUGHOUT.
8. IF REVERSE FALL IS REQUIRED, DESIGN OF VEHICLE CROSSOVER TO BE ON A SITE SPECIFIC BASIS.
9. LOCATION AND DEPTH OF ANY UNDERGROUND SERVICES WITHIN FOOTWAY AREA MUST BE ESTABLISHED BEFORE COMMENCEMENT OF EXCAVATION.
10. UNDERTAKE A 'DIAL BEFORE YOU DIG' SEARCH (PH: 1100) TO LOCATE SERVICES PRIOR TO COMMENCING EXCAVATION.
11. TRANSITION AREA TO CONFORM TO AS2890.1. ANY CHANGES OF GRADE GREATER THAN 12.5% TO BE CHECKED USING THE TEMPLATE IN APPENDIX C AS2890.1
12. A MINIMUM CLEARANCE OF 1m MUST BE ACHIEVED FROM THE DRIVEWAY EDGE TO ANY STREET ASSET. THIS INCLUDES STREET TREES, LIGHT POLES, SIDE ENTRY PITS, PEDESTRIAN RAMPS AND STOBIE POLES.



PLAN



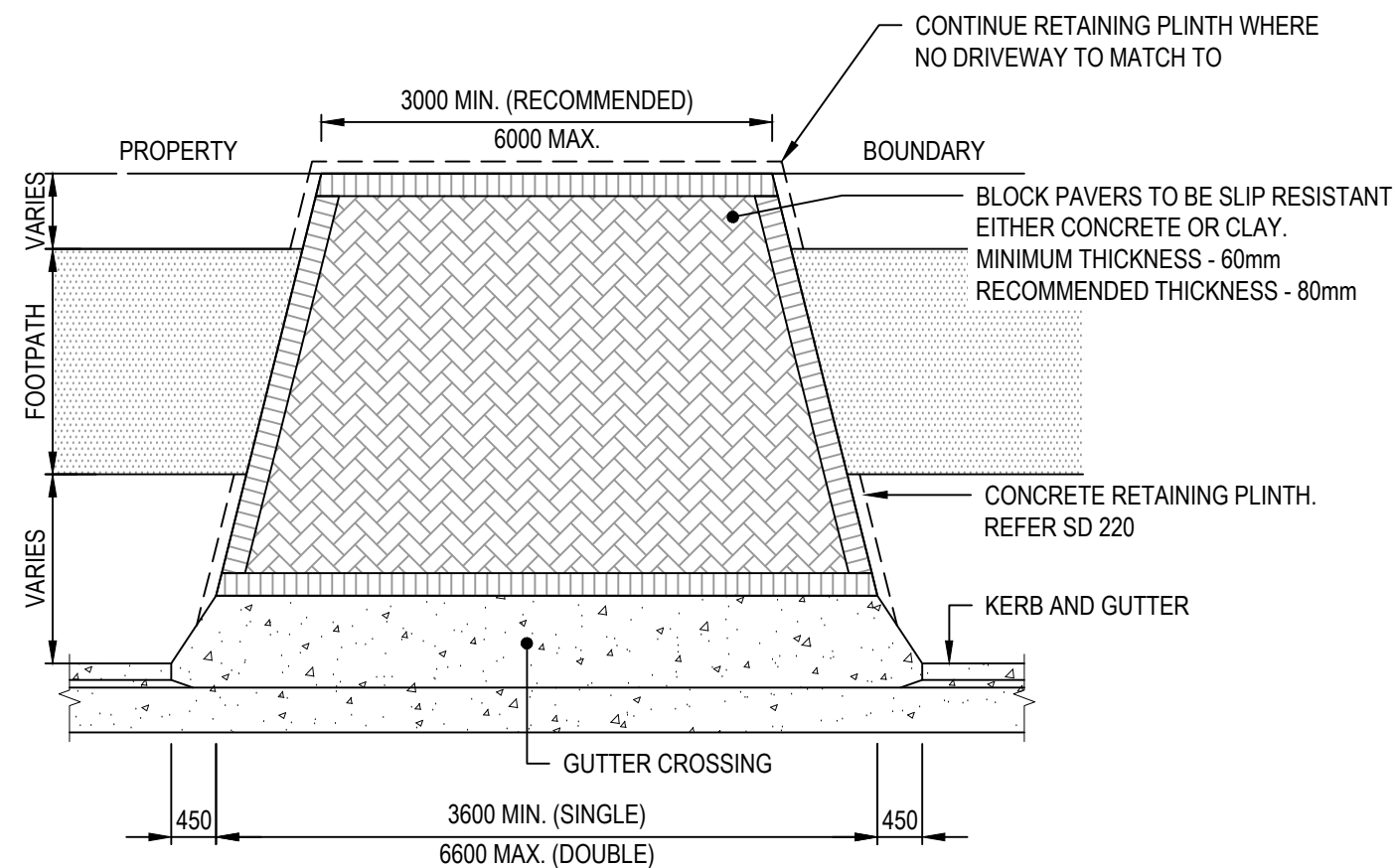
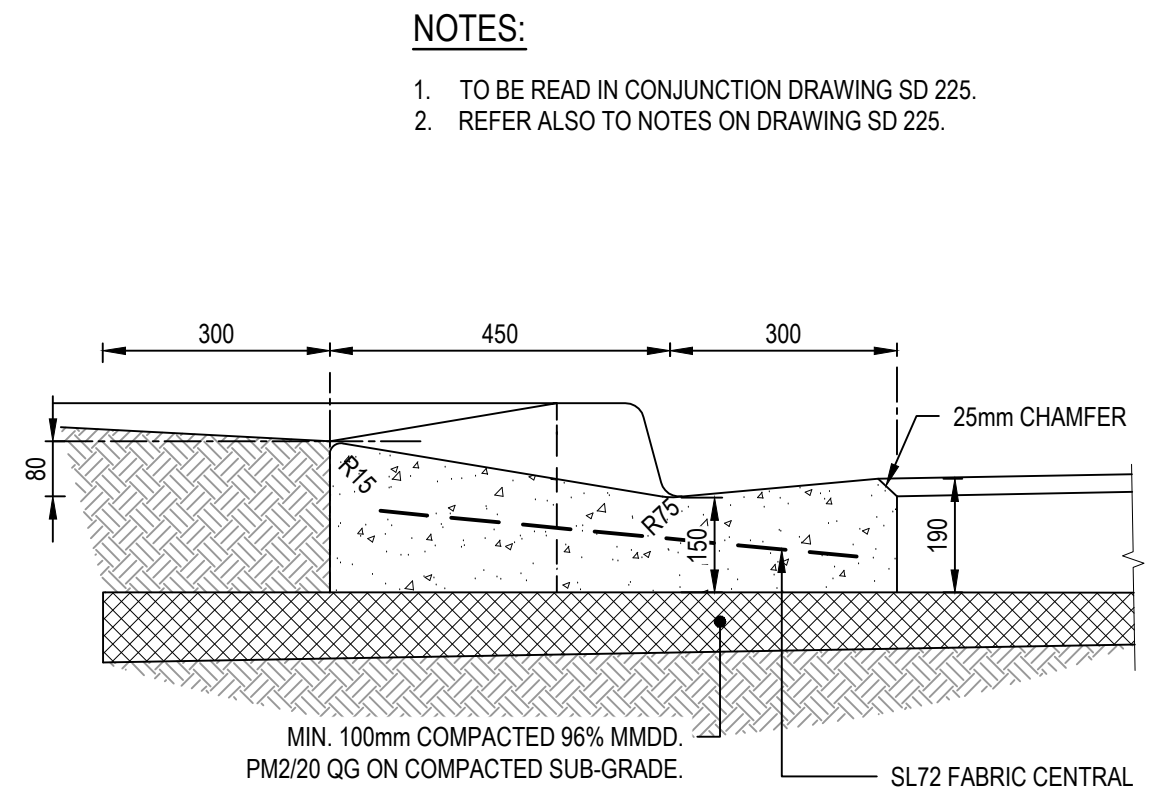
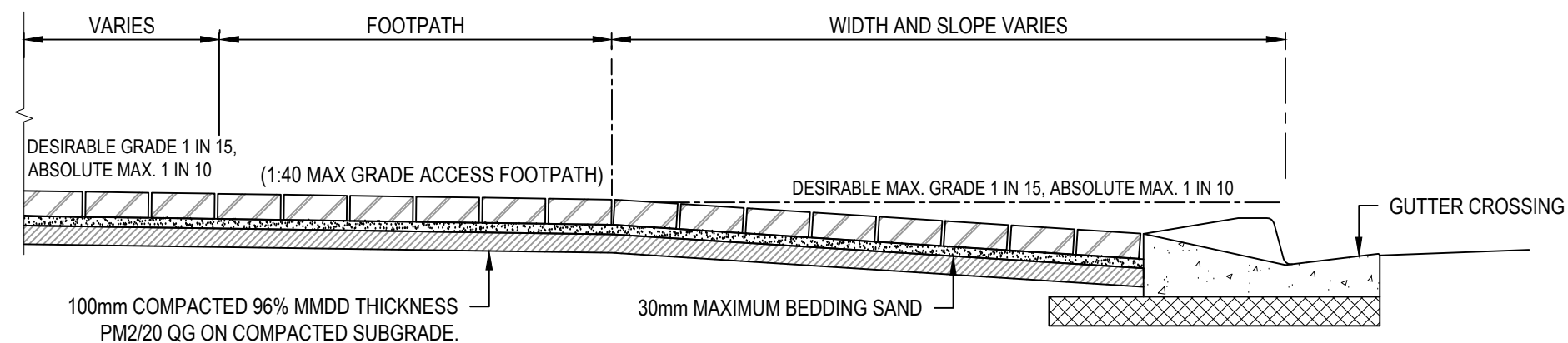
SECTION A-A



SECTIONAL VIEW OF RESIDENTIAL KERB & LAYBACK

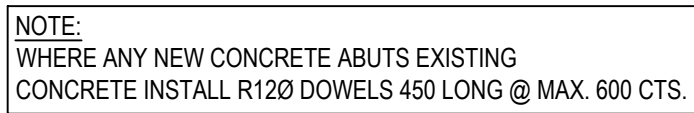
ALL MEASUREMENTS IN MILLIMETRES

						INFRASTRUCTURE GUIDELINES (SA)				
D	MINOR AMENDMENTS	06.11.2018	AF	AF	MDH					
C	MINOR AMENDMENTS	17.07.2017	JZ	JC	DSL					
B	ISSUED FOR REVIEW	10.05.2016	JZ	DL	DSL	SHEET TITLE RETROFIT RESIDENTIAL VEHICLE CROSSING DETAIL		SCALE NTS @ A3		
A	ISSUED FOR REVIEW	15.03.2016	JZ	DL	DSL			DRAWING No. SD 225		REV D
REV	DESCRIPTION	DATE	DES	DRW	APP					
THIS PROJECT HAS BEEN ASSISTED BY THE LOCAL GOVERNMENT RESEARCH AND DEVELOPMENT SCHEME AND INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA										



ALL MEASUREMENTS IN MILLIMETRES

						INFRASTRUCTURE GUIDELINES (SA)		
D	MINOR AMENDMENTS	06.11.2018	AF	AF	MDH	SHEET TITLE VEHICLE BLOCK PAVED CROSSING DETAIL		
C	ISSUED FOR REVIEW	18.07.2017	JZ	JC	DSL			
B	ISSUED FOR REVIEW	10.05.2016	JZ	DL	DSL			
A	ISSUED FOR REVIEW	15.03.2016	JZ	DL	DSL			
REV	DESCRIPTION	DATE	DES	DRW	APP			
THIS PROJECT HAS BEEN ASSISTED BY THE LOCAL GOVERNMENT RESEARCH AND DEVELOPMENT SCHEME AND INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA								
							SCALE AS SHOWN @ A3	
							DRAWING No. SD 235	REV D

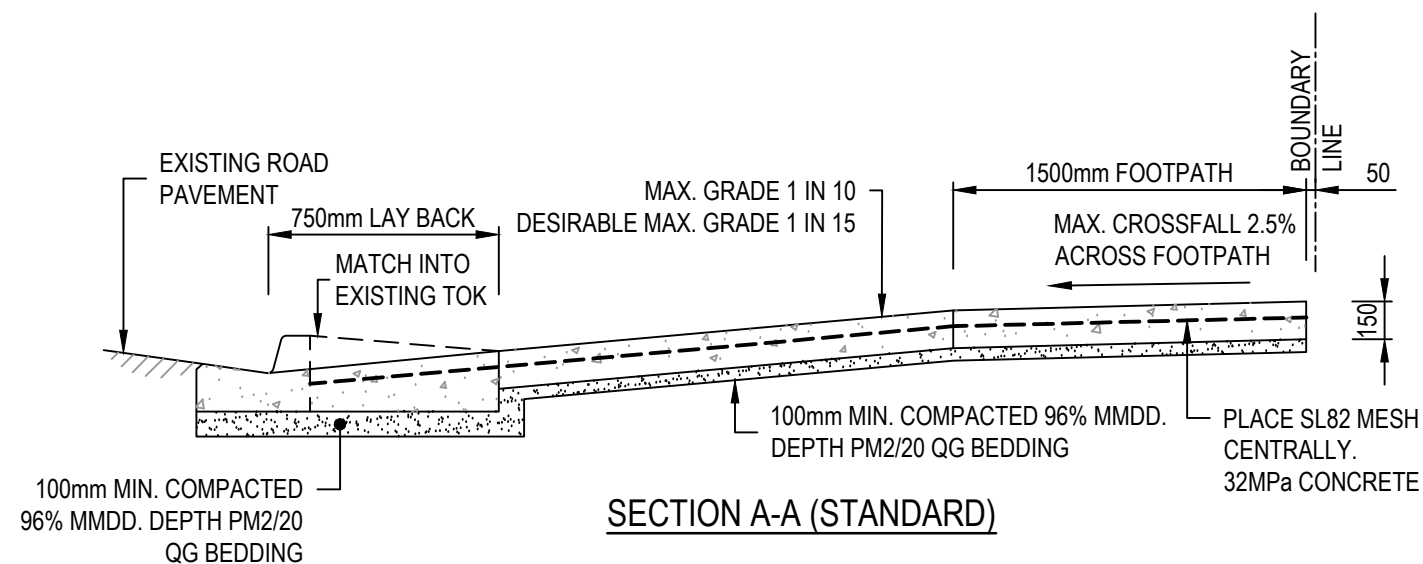
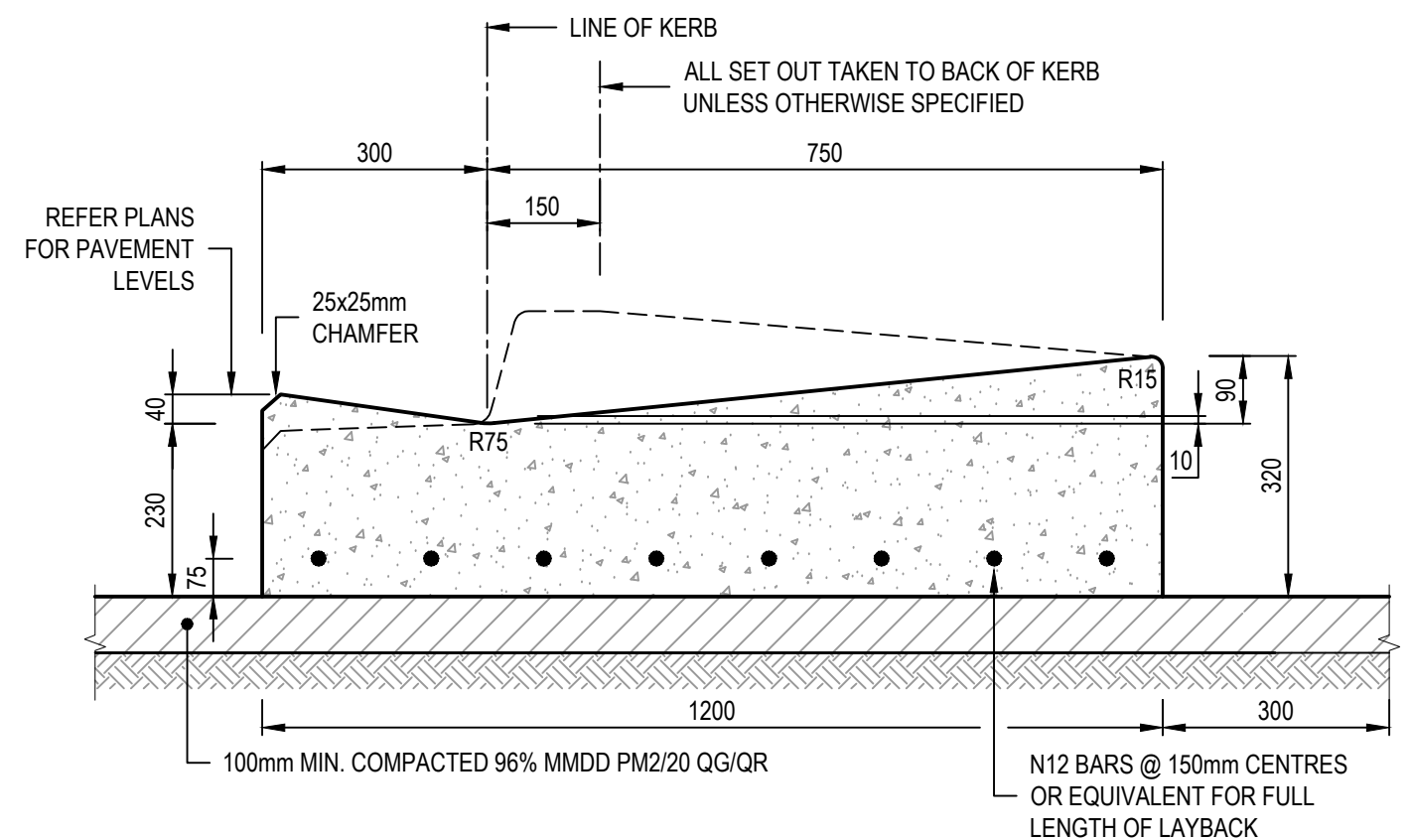


LEGEND:

EXPANSION
JOINT
TOOLED JOINTS
(REFER TO SD 210)

NOTES:

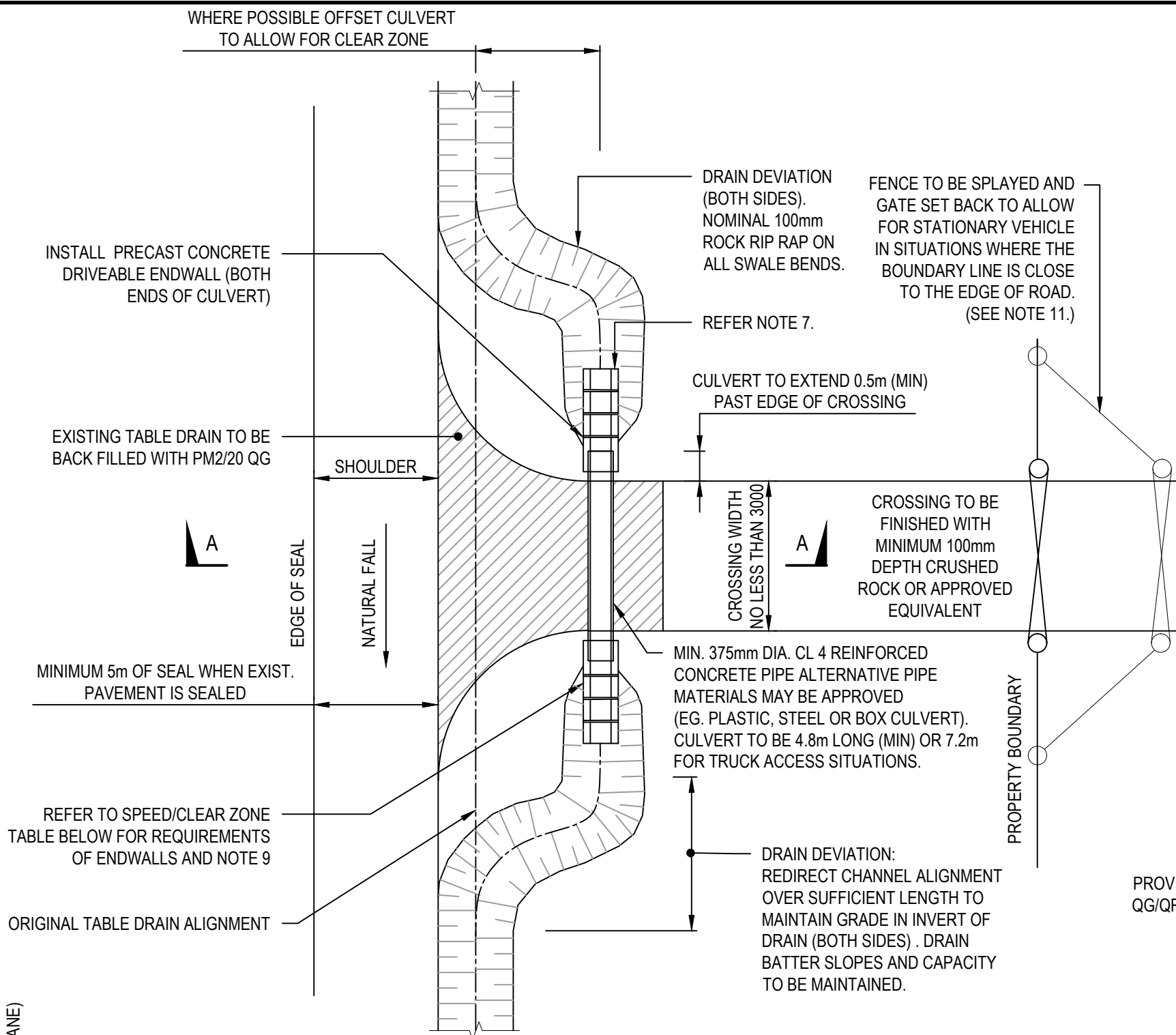
1. T.O.K. DENOTES TOP OF KERB.
2. INDUSTRIAL CROSSOVER WIDTH TO SUIT DESIGN VEHICLE. WIDTH TO BE APPROVED BY COUNCIL.



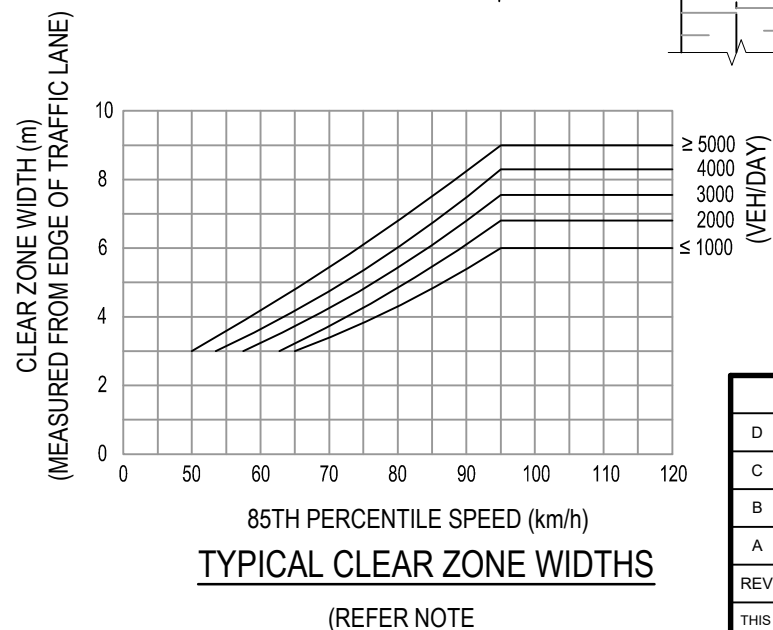
SECTIONAL VIEW OF INDUSTRIAL KERB LAYBACK

ALL MEASUREMENTS IN MILLIMETRES

						INFRASTRUCTURE GUIDELINES (SA)		
D	MINOR AMENDMENTS	06.11.2018	AF	AF	MDH	SHEET TITLE INDUSTRIAL VEHICLE CROSSING DETAIL		
C	ISSUED FOR REVIEW	10.06.2016	JZ	DL	DSL			
B	ISSUED FOR REVIEW	10.05.2016	JZ	DL	DSL			
A	ISSUED FOR REVIEW	15.03.2016	JZ	DL	DSL			
REV	DESCRIPTION	DATE	DES	DRW	APP			
THIS PROJECT HAS BEEN ASSISTED BY THE LOCAL GOVERNMENT RESEARCH AND DEVELOPMENT SCHEME AND INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA							SCALE NTS @ A3	
							DRAWING No.	REV
							SD 240	D



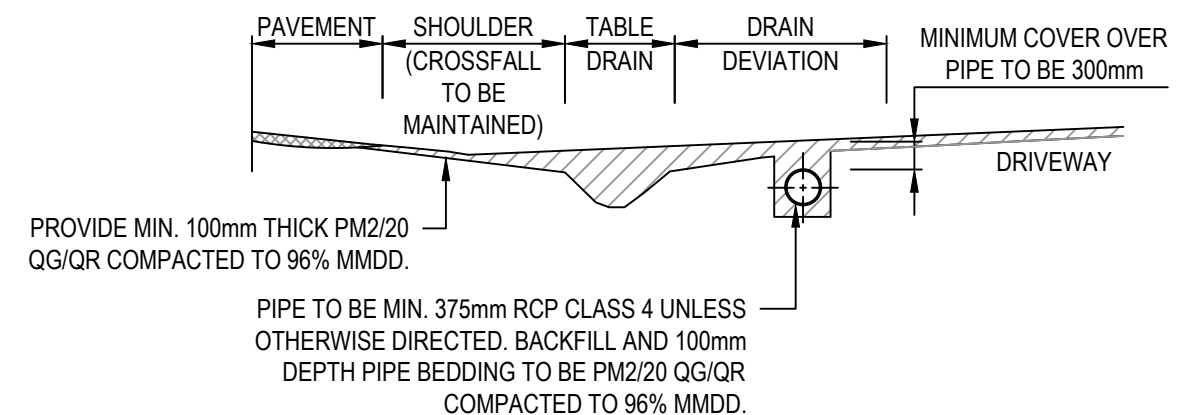
PLAN



NOTES:

1. THIS ARRANGEMENT IS INTENDED FOR RURAL LOW DENSITY RESIDENTIAL & FARMING ACCESS WAYS.
2. COUNCIL RESERVES THE RIGHT TO DIRECT THE USE OF CULVERT END WALL TYPE.
3. THIS IS A TYPICAL CROSSING PLAN. SLIGHT VARIATIONS MAY OCCUR AFTER INSPECTION AND APPROVAL OF LOCATION BY COUNCIL.
4. PRIOR TO THE CONSTRUCTION, THE CROSSING LOCATION SHALL BE APPROVED BY COUNCIL.
5. ALL WORKS TO BE COMPLETED TO THE SATISFACTION OF COUNCIL.
6. MAINTENANCE OF THE CROSSOVER REMAINS THE RESPONSIBILITY OF THE LAND OWNER.
7. INSTALL LOW PROFILE HEAD WALLS OUTSIDE CLEAR ZONE & DRIVEABLE END WALLS WITHIN CLEAR ZONE. NO CULVERT TO BE WITHIN 3m OF EDGE OF SEAL.
8. THE CLEAR ZONE TABLE SHOWN IS A GUIDE ONLY AND FOR FURTHER ACCURATE CLEAR ZONE GUIDELINES REFER TO AUSTRROADS 'GUIDE TO ROAD DESIGN - PART 6: ROADSIDE DESIGN, SAFETY AND BARRIERS' TABLE 4.1: 'CLEAR ZONES DISTANCES FROM EDGE OF THROUGH TRAVELLED WAY'
9. TABLE DRAINS ARE NOT TO BE CLOSER THAN 1.0m FROM FENCE LINES OR SERVICES.
10. COUNCIL MAY REQUIRE THAT CROSSING PAVEMENT BE SEALED DEPENDING ON SITE LOCATION AND SPECIFICS.
11. GATE OFFSET DIMENSIONS:

STANDARD VEHICLE TYPE	MINIMUM GATE OFFSET FROM EDGE OF THROUGH LANE (m)
CAR (5.0m)	8.2
RIGID TRUCK (12.0m)	12.5
SEMI (19.0m)	22
B-DOUBLE (25.0m)	28



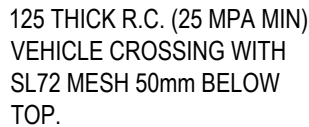
SECTION A-A

ALL MEASUREMENTS IN MILLIMETRES

REV	DESCRIPTION	DATE	DES	DRW	APP
D	MINOR AMENDMENTS	06.11.2018	AF	AF	MDH
C	ISSUED FOR REVIEW	18.07.2016	JZ	DL	DSL
B	ISSUED FOR REVIEW	10.05.2016	JZ	DL	DSL
A	ISSUED FOR REVIEW	15.03.2016	JZ	DL	DSL

THIS PROJECT HAS BEEN ASSISTED BY THE LOCAL GOVERNMENT RESEARCH AND DEVELOPMENT SCHEME AND INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA

INFRASTRUCTURE GUIDELINES (SA)			
SHEET TITLE			
TYPICAL SWALE DRAIN RESIDENTIAL VEHICLE CROSSING (RURAL ENTRANCE)			
SCALE		REV	
NTS @ A3		D	
DRAWING No.		SD 250	



NOTES:

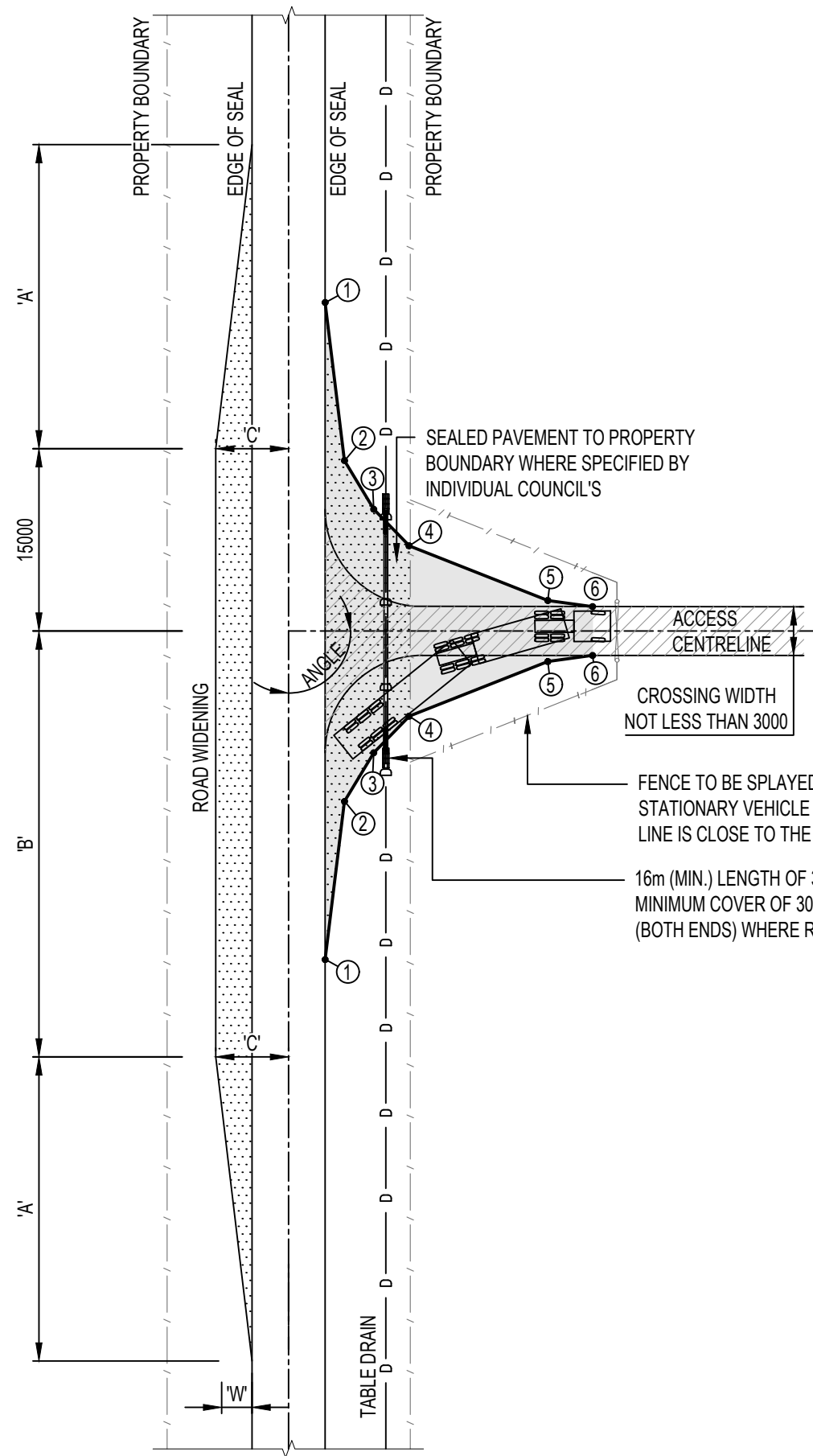
1. THIS ARRANGEMENT IS INTENDED FOR RURAL LOW DENSITY RESIDENTIAL ACCESS WAYS.
2. COUNCIL RESERVES THE RIGHT TO DIRECT THE USE OF CULVERT END WALL TYPE.
3. THIS IS A TYPICAL CROSSING PLAN. SLIGHT VARIATIONS MAY OCCUR AFTER INSPECTION AND APPROVAL OF LOCATION BY COUNCIL.
4. PRIOR TO THE CONSTRUCTION, THE CROSSING LOCATION SHALL BE APPROVED BY COUNCIL.
5. ALL WORKS TO BE COMPLETED TO THE SATISFACTION OF COUNCIL.
6. MAINTENANCE OF THE CROSSOVER REMAINS THE RESPONSIBILITY OF THE LAND OWNER.
7. DRIVEABLE ENDWALLS TO BE USED WITHIN 1.5m OF THE EDGE OF SEAL
8. TABLE DRAINS ARE NOT TO BE CLOSER THAN 1.0m FROM FENCE LINES OR SERVICES.
9. CULVERT TO BE LOCATED AT LEAST 600mm FROM EDGE OF SEAL



C	MINOR AMENDMENTS	06.11.2018	AF	AF	MDH
B	ISSUED FOR REVIEW	10.05.2016	JZ	DL	DSL
A	ISSUED FOR REVIEW	15.03.2016	JZ	DL	DSL
REV	DESCRIPTION	DATE	DES	DRW	APP
THIS PROJECT HAS BEEN ASSISTED BY THE LOCAL GOVERNMENT RESEARCH AND DEVELOPMENT SCHEME AND INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA					

INFRASTRUCTURE GUIDELINES (SA)	
SHEET TITLE	
TYPICAL SWALE DRAIN RESIDENTIAL VEHICLE CROSSING (URBAN ENTRANCE)	

SCALE NTS @ A3	
DRAWING No. SD 255	REV C



LEGEND



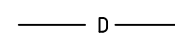
TYPICAL EXISTING ACCESS



RECOMMENDED ACCESS SPLAY



AREA TO BE SEALED



EXISTING DRAIN

SETOUT TABLE

POINT No.	OFFSET DISTANCE FROM EDGE OF SEAL (m)	OFFSET DISTANCE FROM ACCESS CENTRELINE (m)
1	0.0	27.0
2	1.6	14.0
3	4.0	10.0
4	6.9	7.0
5	18.3	2.5
6	22	2.0

ROAD WIDENING

A =	$\frac{0.5 \times \text{SPEED (km/h)} \times W \text{ (m)}}{3.6}$			
B =	ANGLE:	70°	90°	110°
	LENGTH:	40	35	30
C =	ON STRAIGHT: 6.0m (MIN)			
	ON CURVE: 2x (3.0m + CORRESPONDING WIDENING FOR CURVE RADIUS)			
W =	FORMATION WIDENING (IF REQUIRED BY COUNCIL)			

NOTES:

- THIS ARRANGEMENT IS INTENDED FOR RURAL / FARMING ACCESS WAYS THAT REQUIRE SEMI / B DOUBLE ACCESS.
- PAVED AREAS TO BE A MINIMUM OF 150mm DEPTH COMPACTED GRAVEL. PAVEMENT AREAS AND TYPE TO BE APPROVED BY COUNCIL.
- COUNCIL RESERVES THE RIGHT TO DIRECT THE USE OF CULVERT END WALL TYPE.
- THIS IS A TYPICAL CROSSING PLAN. SLIGHT VARIATIONS MAY OCCUR AFTER INSPECTION AND APPROVAL OF LOCATION BY COUNCIL.
- PRIOR TO THE CONSTRUCTION, THE CROSSING LOCATION SHALL BE APPROVED BY COUNCIL.
- ALL WORKS TO BE COMPLETED TO THE SATISFACTION OF COUNCIL.
- MAINTENANCE OF THE CROSSOVER REMAINS THE RESPONSIBILITY OF THE LAND OWNER.
- REFER SD 250 FOR CLEAR ZONE OFFSETS.
- DRIVEABLE ENDWALLS TO BE USED IN CLEARZONE.
- TABLE DRAINS ARE NOT TO BE CLOSER THAN 1.0m FROM FENCE LINES OR SERVICES.
- COUNCIL MAY REQUIRE THAT CROSSING PAVEMENT BE SEALED DEPENDING ON SITE LOCATION AND SPECIFICS.
- GATE OFFSET DIMENSIONS:

STANDARD VEHICLE TYPE	MINIMUM GATE OFFSET FROM EDGE OF THROUGH LANE (m)
SEMI (19.0m)	22
B-DOUBLE (25.0m)	28

ALL MEASUREMENTS IN MILLIMETRES

B	ISSUED FOR REVIEW	10.05.2016	JZ	DL	DSL
A	ISSUED FOR REVIEW	15.03.2016	JZ	DL	DSL
REV	DESCRIPTION	DATE	DES	DRW	APP
THIS PROJECT HAS BEEN ASSISTED BY THE LOCAL GOVERNMENT RESEARCH AND DEVELOPMENT SCHEME AND INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA					

INFRASTRUCTURE GUIDELINES (SA)

SHEET TITLE

TYPICAL SWALE DRAIN HEAVY VEHICLE CROSSING (RURAL ENTRANCE)

SCALE
NTS @ A3

DRAWING No.

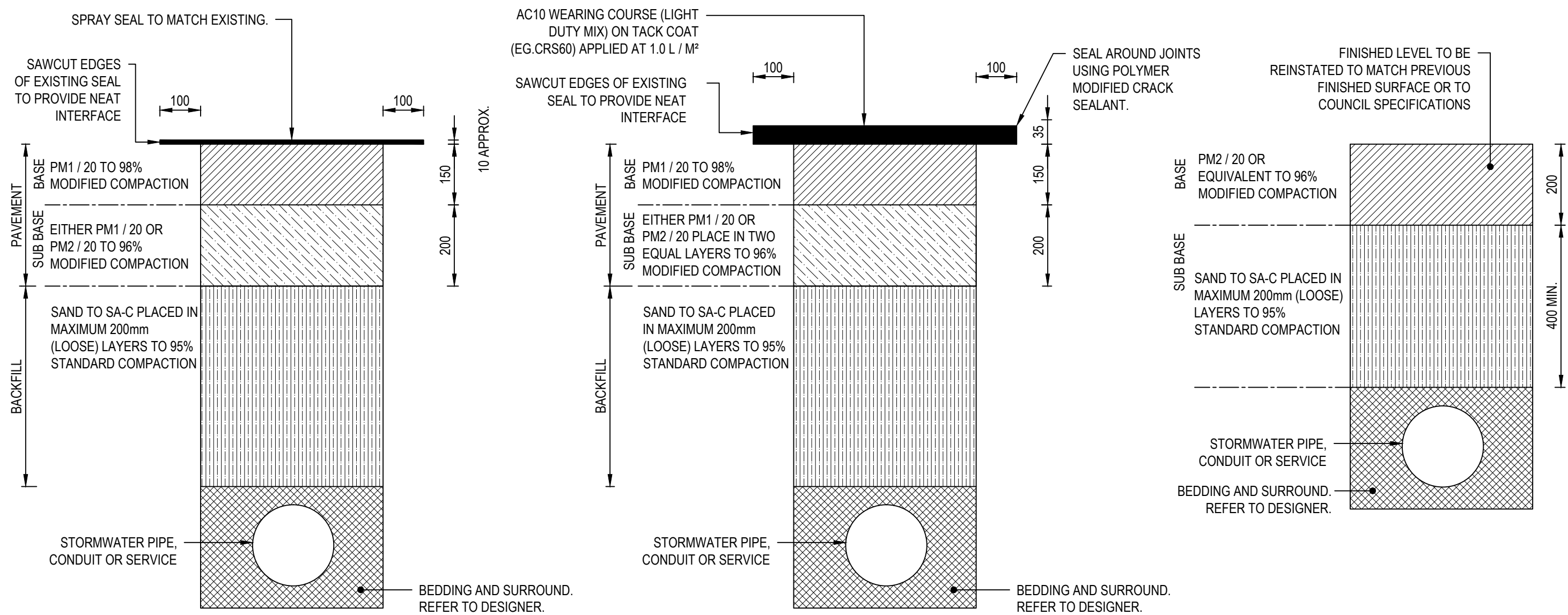
SD 260

REV

B



						INFRASTRUCTURE GUIDELINES (SA)			
C	MINOR AMENDMENTS	06.11.2018	AF	AF	MDH	SHEET TITLE TYPICAL PAVEMENT SUBSOIL DRAINAGE			
B	ISSUED FOR REVIEW	10.05.2016	JZ	DL	DSL			SCALE 1:10 @ A3	
A	ISSUED FOR REVIEW	15.03.2016	JZ	DL	DSL			DRAWING No. SD 265	
REV	DESCRIPTION	DATE	DES	DRW	APP			REV C	
THIS PROJECT HAS BEEN ASSISTED BY THE LOCAL GOVERNMENT RESEARCH AND DEVELOPMENT SCHEME AND INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA									



**LIGHTLY TRAFFICKED ROADS WITH
SPRAYED BITUMINOUS SURFACE**
(< 1000 VPD)
($< 5\%$ CV)

**LIGHTLY TRAFFICKED ROADS WITH
ASPHALT SURFACE**
(< 1000 VPD)
($< 5\%$ CV)

**UNSEALED ROAD PAVEMENTS
AND SHOULDERS**
(< 1000 VPD)
($< 5\%$ CV)

NOTE:

- ROADS WITH TRAFFIC VOLUMES OR CV EXCEEDING ABOVE, REFER TO DPTI PAVEMENT REINSTATEMENT CONFIGURATIONS.

ALL MEASUREMENTS IN MILLIMETRES

						INFRASTRUCTURE GUIDELINES (SA)		SCALE NTS @ A3 DRAWING No. SD 270 REV D	
D	MINOR AMENDMENTS	06.11.2018	AF	AF	MDH	SHEET TITLE			
C	MINOR AMENDMENTS	18.07.2017	JZ	JC	DSL	TYPICAL ROAD CROSSING TRENCH			
B	ISSUED FOR REVIEW	10.05.2016	JZ	DL	DSL	BACKFILL REQUIREMENTS			
A	ISSUED FOR REVIEW	15.03.2016	JZ	DL	DSL				
REV	DESCRIPTION	DATE	DES	DRW	APP				
THIS PROJECT HAS BEEN ASSISTED BY THE LOCAL GOVERNMENT RESEARCH AND DEVELOPMENT SCHEME AND INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA									

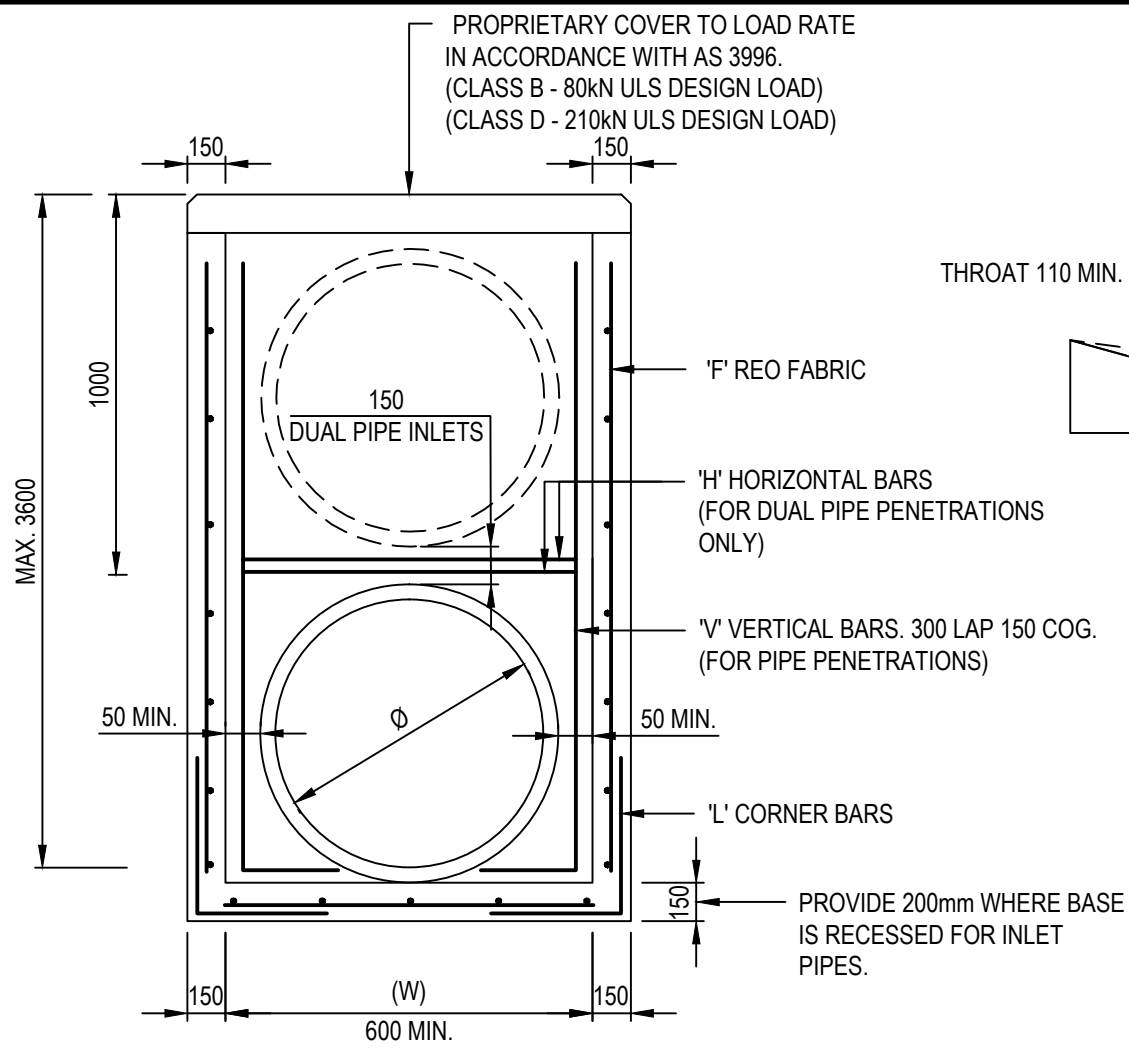
Diagram illustrating the layout and dimensions of a bus stop area, including the property line, kerb face, and various zones and distances.

Dimensions and Distances:

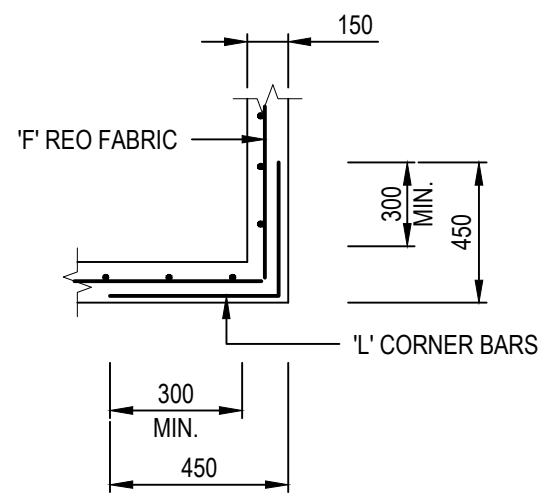
- Overall width: 10000 (NON-SIGNALISED) / 20000 (SIGNALISED)
- Distance from property line to bus stop sign: 9000
- Distance from bus stop sign to kerb face: 2000
- Distance from property line to rear door: 4000
- Distance from property line to middle door: 2500
- Distance from property line to front door: 1500
- Distance from rear door to middle door: 9000
- Distance from middle door to front door: 11000 (MINIMUM FOOTPATH LENGTH)
- Distance from front door to bus stop sign: 4100
- Distance from bus stop sign to shelter location option 2: 4100
- Distance from bus stop sign to kerb face: 750 (SIGN)
- Distance from bus stop sign to shelter location option 1: 600
- Distance from bus stop sign to shelter location option 2: 600
- Distance from bus stop sign to kerb face: 300
- Distance from bus stop sign to shelter location option 1: 300
- Distance from bus stop sign to shelter location option 2: 1000

Key Features and Labels:

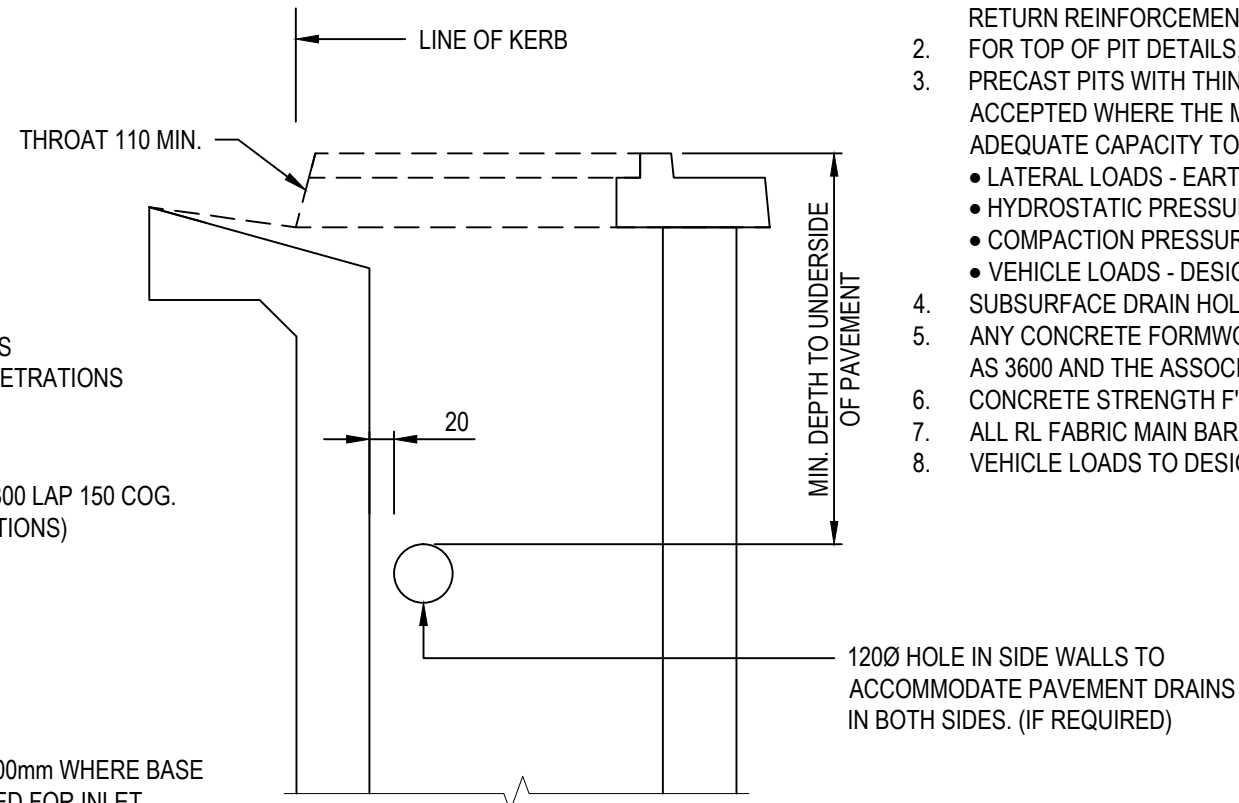
- PROPERTY LINE
- WARNING TSGI's (REQUIRED WHEN BUS SHELTER IS AGAINST PROPERTY BOUNDARY)
- TSGI's (DIRECTIONAL)
- TSGI's WARNING
- BUS STOP SIGN
- R1000 CLEARANCE ZONE TO OBSTACLE
- SHELTER LOCATION OPTION 1
- SHELTER LOCATION OPTION 2
- REAR DOOR
- MIDDLE DOOR
- FRONT DOOR
- 1 IN 6 APPROACH TAPER (MINIMUM)
- 1 IN 2 DEPARTURE TAPER (MINIMUM)
- KERB FACE



TYPICAL PIT DETAIL



150mm CORNER DETAIL



PRECAST PIT

NOTES:

- PIT REINFORCEMENT SHALL HAVE 300mm MIN. LAPS. CLEAR COVER TO BE 50mm MIN. CORNER RETURN REINFORCEMENT MAY BE FABRIC OR EQUIVALENT BARS.
- FOR TOP OF PIT DETAILS, REFER TO RELEVANT STANDARD DRAWINGS.
- PRECAST PITS WITH THINNER WALLS AND LESS STEEL OR FIBRE REINFORCED PITS MAY BE ACCEPTED WHERE THE MANUFACTURER CAN DEMONSTRATE THAT THE PITS HAVE ADEQUATE CAPACITY TO SUPPORT A COMBINATION OF THE FOLLOWING LOADS:
 - LATERAL LOADS - EARTH PRESSURE WITH APPROPRIATE SURCHARGE LIVE LOAD CLASS
 - HYDROSTATIC PRESSURE
 - COMPACTION PRESSURE (25kPa MIN.)
 - VEHICLE LOADS - DESIGN VEHICLE LOAD
- SUBSURFACE DRAIN HOLES TO BE SEALED IF NOT USED.
- ANY CONCRETE FORMWORK, REINFORCEMENT, POURING AND CURING SHALL COMPLY WITH AS 3600 AND THE ASSOCIATED CODES.
- CONCRETE STRENGTH F'C - 32 MPa. (MIN.) AT 28 DAYS. SLUMP TO BE 80mm.
- ALL RL FABRIC MAIN BARS SHOULD BE PLACED HORIZONTALLY.
- VEHICLE LOADS TO DESIGN LOAD CLASS

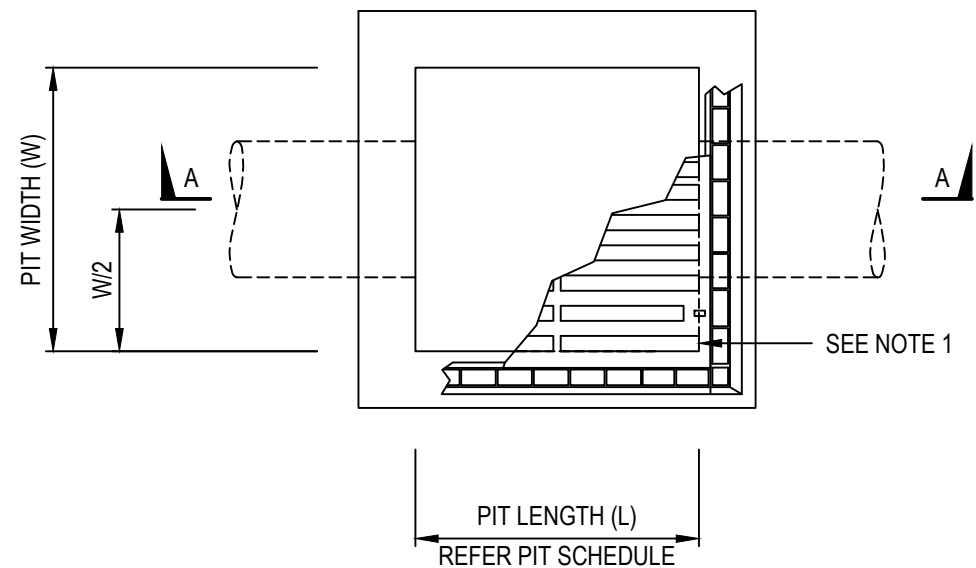
REINFORCEMENT DETAILS					
LOAD CLASS	MAX WIDTH (W) (mm)	'F' FABRIC	'H' HORIZONTAL BARS	'V' VERTICAL BARS	'L' CORNER BARS
B	600	SL82 (c)	2/N10	1/N10	N10 @ 300 (c)
B	900	SL82 (c)	2/N10	1/N10	N10 @ 300 (c)
B	1200	SL92 (c)	2/N12	1/N12	N10 @ 200 (c)
B	1500	SL92 (50 INTERNAL COVER)	2/N12	1/N16	N10 @ 200 (c) (50 INTERNAL COVER)
B	1800	SL92 (50 INTERNAL COVER)	2/N16	1/N16	N12 @ 200 (c) (50 INTERNAL COVER)
D	600	SL82 (c)	2/N10	1/N10	N10 @ 300 (c)
D	900	SL92 (50 INTERNAL COVER)	2/N10	1/N10	N10 @ 200 (c) (50 INTERNAL COVER)
D	1200	RL818 (50 INTERNAL COVER)	2/N12	1/N12	N12 @ 200 (c) (50 INTERNAL COVER)
D	1500	RL118 (50 INTERNAL COVER)	2/N12	1/N16	N12 @ 200 (c) (50 INTERNAL COVER)
D	1800	RL1218 (50 INTERNAL COVER)	2/N16	1/N16	N12 @ 200 (c) (50 INTERNAL COVER)

NOTE:

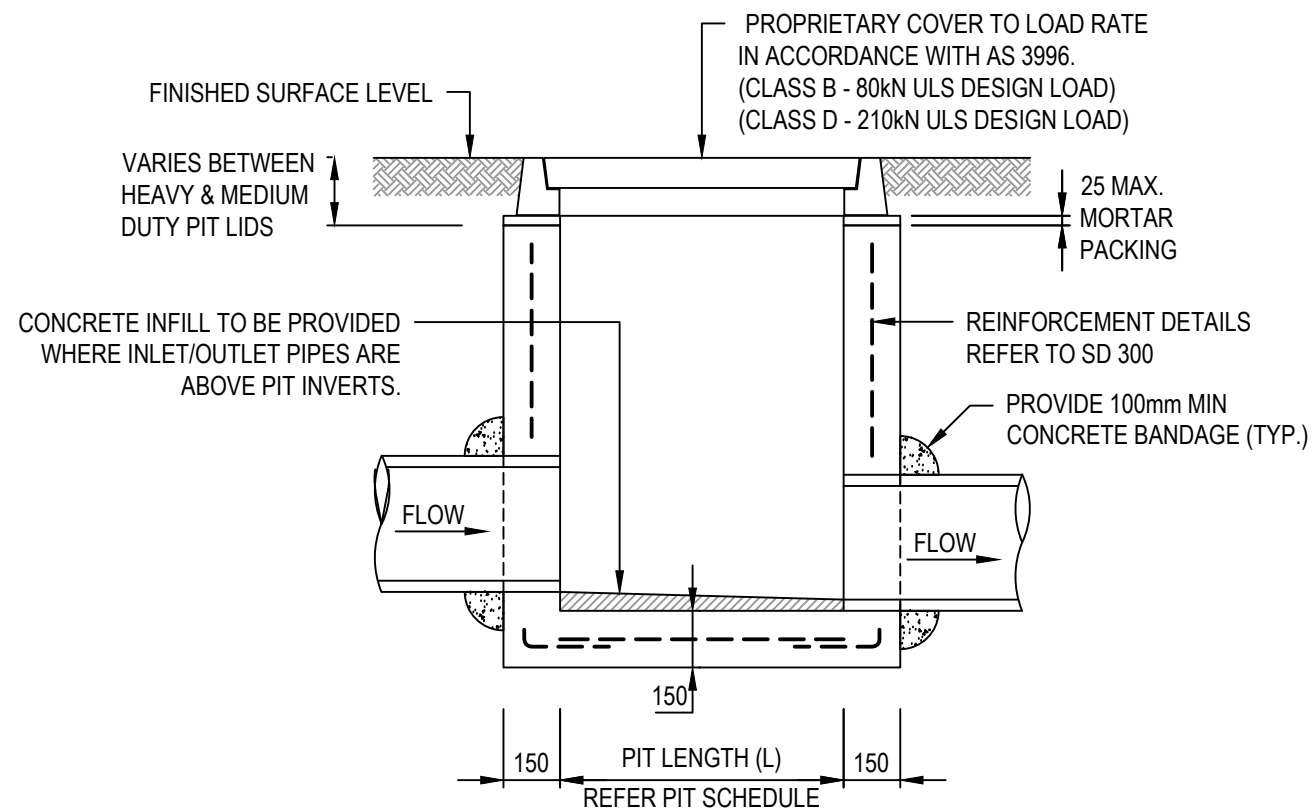
- PROVIDE REINFORCEMENT AS PER TABLE FOR WALL WITH CORRESPONDING WIDTH (W).
- IF ADJACENT WALLS HAVE DIFFERENT WIDTHS, ADOPT 'L' CORNER BARS CORRESPONDING TO HIGHER WIDTH.

ALL MEASUREMENTS IN MILLIMETRES

						INFRASTRUCTURE GUIDELINES (SA)			
D	MINOR AMENDMENTS	06.11.2018	AF	AF	MDH	SHEET TITLE			
C	MINOR AMENDMENTS	18.07.2017	JZ	JC	DSL	STORMWATER PITS REINFORCEMENT			
B	ISSUED FOR REVIEW	10.05.2016	JZ	DL	DSL	DETAILS		SCALE	
A	ISSUED FOR REVIEW	15.03.2016	RJF	DL	DSL			NTS @ A3	
REV	DESCRIPTION	DATE	DES	DRW	APP			DRAWING No.	REV
THIS PROJECT HAS BEEN ASSISTED BY THE LOCAL GOVERNMENT RESEARCH AND DEVELOPMENT SCHEME AND INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA								SD 300	D



PLAN



SECTION A-A

MINIMUM INTERNAL PIT SIZES (AS 3500)	
PIT DEPTH	MINIMUM PIT SIZE
$d \leq 600$	450 x 450
$600 < d \leq 900$	600 x 600
$900 < d \leq 1200$	600 x 900
$d \geq 1200$	900 x 900

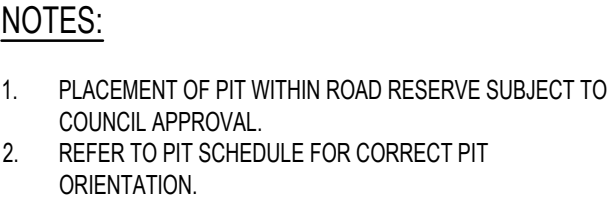
NOTES:

1. HEAVY DUTY COVERS TO BE USED WHEN SUBJECT TO TRAFFICABLE LOADS (AS3996 CLASS D - 210kN) OR APPROVED EQUIVALENT. MEDIUM DUTY COVERS TO BE USED IN OFF ROAD USE (AS3996 CLASS B - 80kN) OR APPROVED EQUIVALENT.
2. CONCRETE PIT STREAMLINING TO BE PROVIDED WHERE SHOWN ON DRAWINGS.
3. INTERNAL PIT DIMENSIONS SHALL ALLOW FOR THE PIPE OUTER DIAMETER AT CUT ANGLE PLUS CONSTRUCTION TOLERANCE PLUS 50mm EACH SIDE.
4. MINIMUM PIT LID OPENING SIZE TO BE 600mm DIAMETER FOR ALL PITS GREATER THAN 600mm DEPTH
5. ALL GRATED COVERS TO BE HOT DIP GALVANISED FOR INSTALLATIONS IN NON-TRAFFICKED AREAS.
6. ROUND PIT LIDS PREFERRED TO REDUCE RISK OF FALL INTO THE PITS.

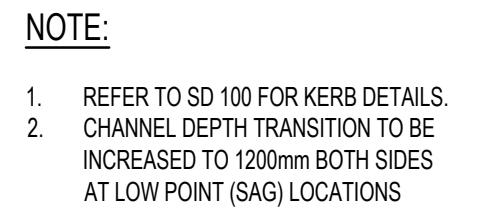
ALL MEASUREMENTS IN MILLIMETRES

						INFRASTRUCTURE GUIDELINES (SA)			
D	MINOR AMENDMENTS	06.11.2018	AF	AF	MDH	SHEET TITLE			
C	MINOR AMENDMENTS	18.07.2017	JZ	JC	DSL	STORMWATER JUNCTION PIT / GRATED INLET PIT			
B	ISSUED FOR REVIEW	10.05.2016	JZ	DL	DSL				
A	ISSUED FOR REVIEW	15.03.2016	RJF	DL	DSL				
REV	DESCRIPTION	DATE	DES	DRW	APP			SCALE NTS @ A3	
THIS PROJECT HAS BEEN ASSISTED BY THE LOCAL GOVERNMENT RESEARCH AND DEVELOPMENT SCHEME AND INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA								DRAWING No. SD 305	REV D

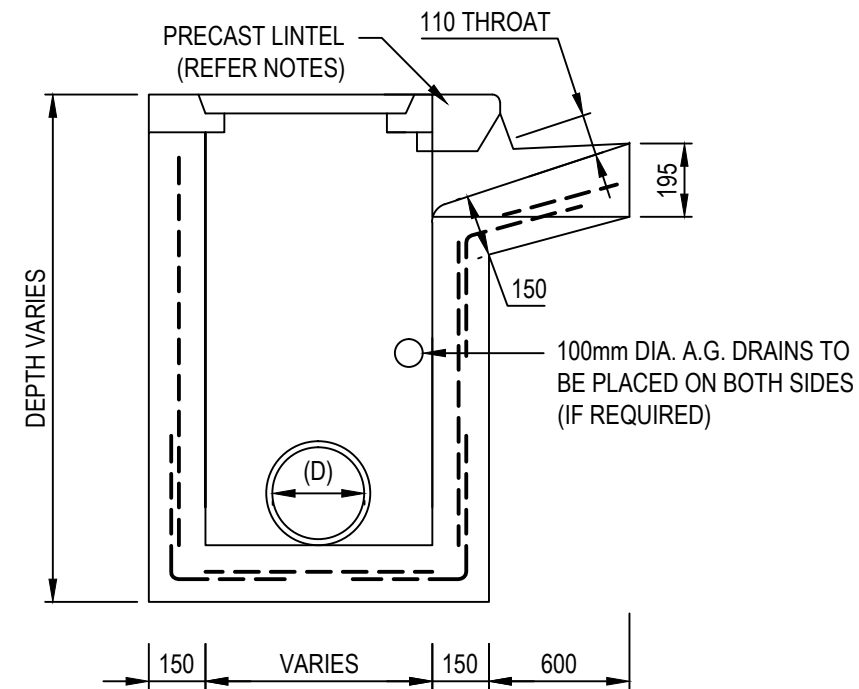
						INFRASTRUCTURE GUIDELINES (SA)	
C	MINOR AMENDMENTS	18.07.2017	JZ	JC	DSL	SHEET TITLE STORMWATER DEPRESSED GRATED PIT	SCALE NTS @ A3
B	ISSUED FOR REVIEW	10.05.2016	JZ	DL	DSL		
A	ISSUED FOR REVIEW	15.03.2016	RJF	DL	DSL		
REV	DESCRIPTION	DATE	DES	DRW	APP		
THIS PROJECT HAS BEEN ASSISTED BY THE LOCAL GOVERNMENT RESEARCH AND DEVELOPMENT SCHEME AND INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA							
						DRAWING No.	REV
						SD 310	C



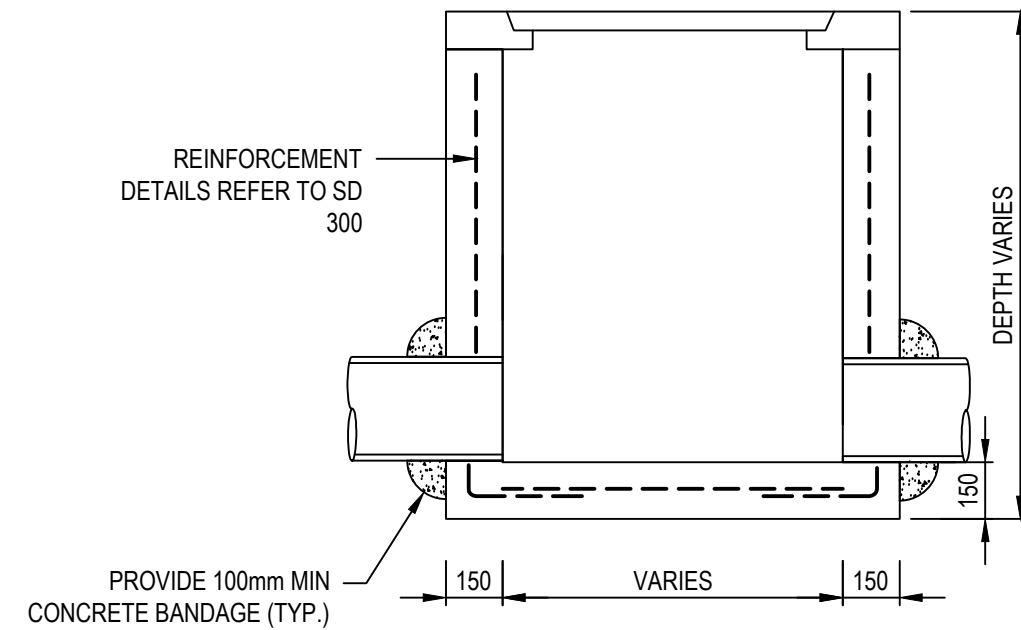
						INFRASTRUCTURE GUIDELINES (SA)				
C	MINOR AMENDMENTS	18.07.2017	JZ	JC	DSL					
B	ISSUED FOR REVIEW	10.05.2016	JZ	DL	DSL					
A	ISSUED FOR REVIEW	15.03.2016	RJF	DL	DSL					
REV	DESCRIPTION	DATE	DES	DRW	APP					
THIS PROJECT HAS BEEN ASSISTED BY THE LOCAL GOVERNMENT RESEARCH AND DEVELOPMENT SCHEME AND INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA							SHEET TITLE		STORMWATER INLET CATCH PIT / FIELD GULLY	
							SCALE NTS @ A3			
							DRAWING No. SD 315	REV C		



						INFRASTRUCTURE GUIDELINES (SA)			
C	MINOR AMENDMENTS	18.07.2017	JZ	JC	DSL	SHEET TITLE STORMWATER SIDE ENTRY PIT 900mm INLET			
B	ISSUED FOR REVIEW	10.05.2016	JZ	DL	DSL			SCALE NTS @ A3	
A	ISSUED FOR REVIEW	15.03.2016	RJF	DL	DSL			DRAWING No. SD 320	
REV	DESCRIPTION	DATE	DES	DRW	APP			REV C	
THIS PROJECT HAS BEEN ASSISTED BY THE LOCAL GOVERNMENT RESEARCH AND DEVELOPMENT SCHEME AND INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA									



SECTION A-A



SECTION B-B

NOTES:

1. PRECAST LINTEL FRAME AND LIDS AS APPROVED BY COUNCIL TO BE INSTALLED TO MANUFACTURERS RECOMMENDATIONS.
2. CONSTRUCT - 100mm DIA. P.V.C. PIPE WITH CONSTRUCTION WORKS TO DRAIN WATER FROM PAVEMENT. AS DIRECTED BY COUNCIL.
3. AT LOW POINT TRANSITION 1200mm BOTH SIDES.
4. PRECAST LINTEL TO MATCH REQUIRED KERB TYPE.

ALL MEASUREMENTS IN MILLIMETRES

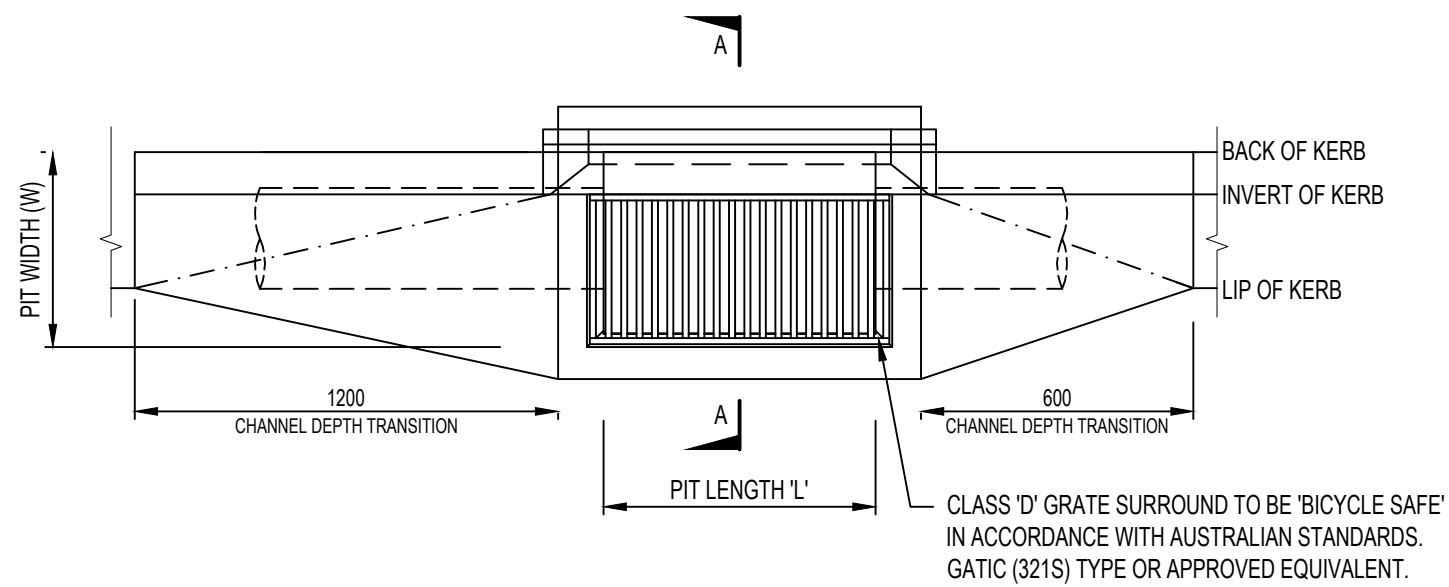
						INFRASTRUCTURE GUIDELINES (SA)			
D	MINOR AMENDMENTS	06.11.2018	AF	AF	MDH	SHEET TITLE			
C	MINOR AMENDMENTS	18.07.2017	JZ	JC	DSL	STORMWATER SIDE ENTRY PIT AND LIDS WITH PRECAST LINTEL			
B	ISSUED FOR REVIEW	10.05.2016	JZ	DL	DSL				
A	ISSUED FOR REVIEW	15.03.2016	RJF	DL	DSL			SCALE NTS @ A3	
REV	DESCRIPTION	DATE	DES	DRW	APP			DRAWING No.	REV
THIS PROJECT HAS BEEN ASSISTED BY THE LOCAL GOVERNMENT RESEARCH AND DEVELOPMENT SCHEME AND INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA								SD 325	D

1. REFER TO SD 100 FOR KERB DETAILS.
2. CHANNEL DEPTH TRANSITION TO BE INCREASED TO 1200mm BOTH SIDES AT LOW POINT (SAG) LOCATIONS

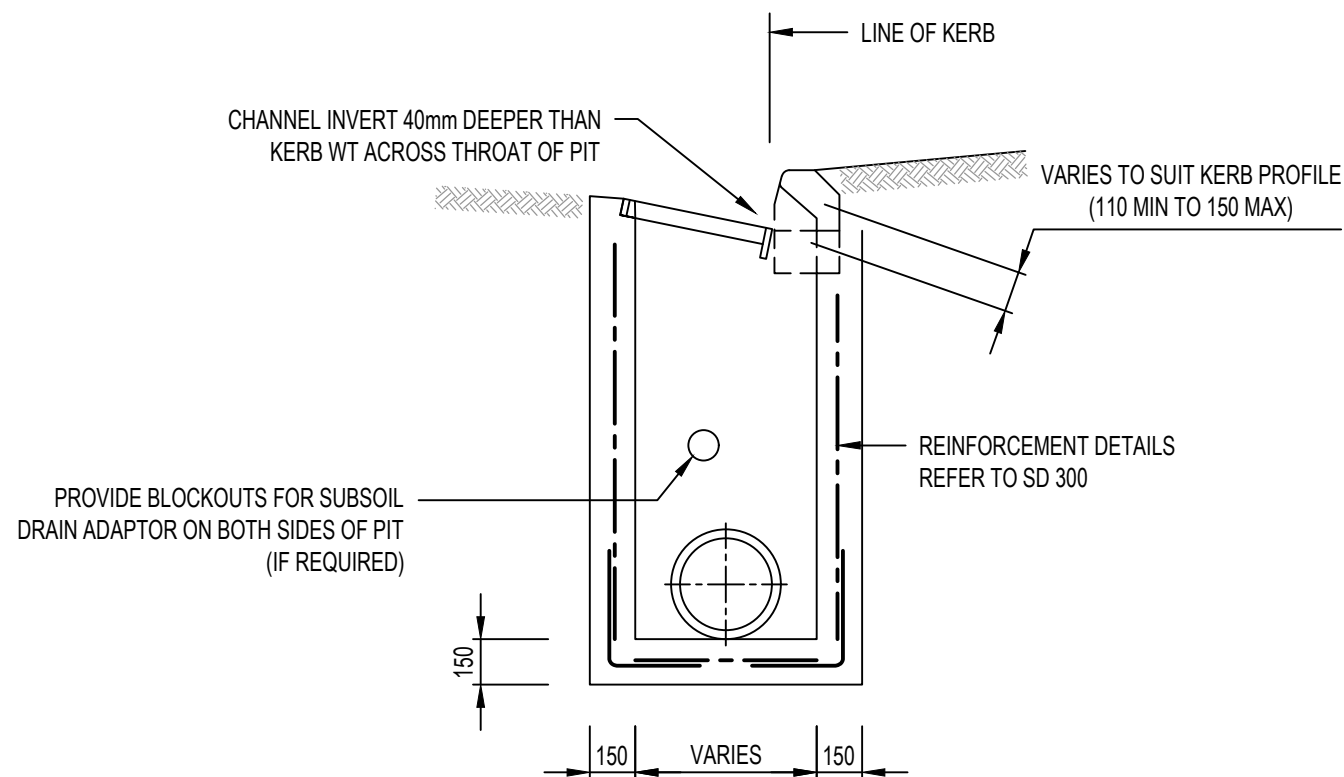


C	MINOR AMENDMENTS	18.07.2017	JZ	JC	DSI
B	ISSUED FOR REVIEW	10.05.2016	JZ	DL	DSI
A	ISSUED FOR REVIEW	15.03.2016	RJF	DL	DSI
REV	DESCRIPTION	DATE	DES	DRW	APP
THIS PROJECT HAS BEEN ASSISTED BY THE LOCAL GOVERNMENT RESEARCH AND DEVELOPMENT SCHEME AND INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA					

REV
C



PLAN



SECTION A-A

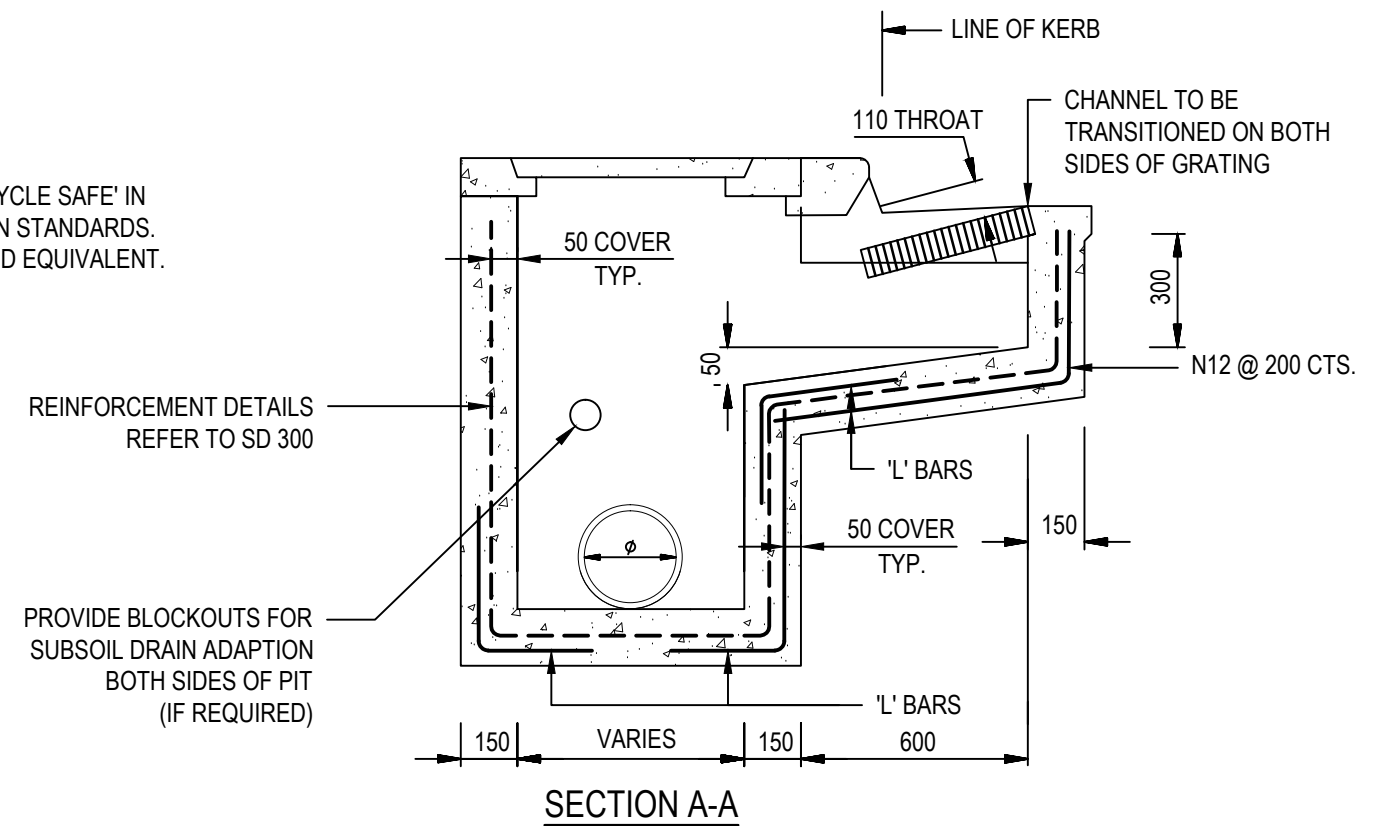
NOTES:

1. REFER TO SD100 FOR KERB DETAILS.
2. CLASS D LOAD RATING REQUIRED.
3. CHANNEL DEPTH TRANSITION TO BE INCREASED TO 1200mm ON BOTH SIDES AT LOW POINT (SAG) LOCATIONS

ALL MEASUREMENTS IN MILLIMETRES

						INFRASTRUCTURE GUIDELINES (SA)	
						SHEET TITLE	
						PRECAST SIDE ENTRY PIT INLET WITH GRATE INLINE	
						SCALE	
						NTS @ A3	
						DRAWING No.	
						SD 335	
						REV	
						C	
REV	DESCRIPTION	DATE	DES	DRW	APP		
C	MINOR AMENDMENTS	18.07.2017	JZ	JC	DSL		
B	ISSUED FOR REVIEW	10.05.2016	JZ	DL	DSL		
A	ISSUED FOR REVIEW	15.03.2016	RJF	DL	DSL		
THIS PROJECT HAS BEEN ASSISTED BY THE LOCAL GOVERNMENT RESEARCH AND DEVELOPMENT SCHEME AND INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA							

1. CLASS D LOAD RATING REQUIRED FOR GRATE. COVERS TO BE CLASS B OR HIGHER IF LIKELY TO BE DRIVEN OVER
2. PRECAST LINTEL AND GRATES APPROVED BY COUNCIL TO BE INSTALLED BY MANUFACTURERS RECOMMENDATIONS.
3. CHANNEL DEPTH TRANSITION TO BE INCREASED TO 1200mm ON BOTH SIDES AT LOW POINT (SAG) LOCATIONS



ALL MEASUREMENTS IN MILLIMETRES

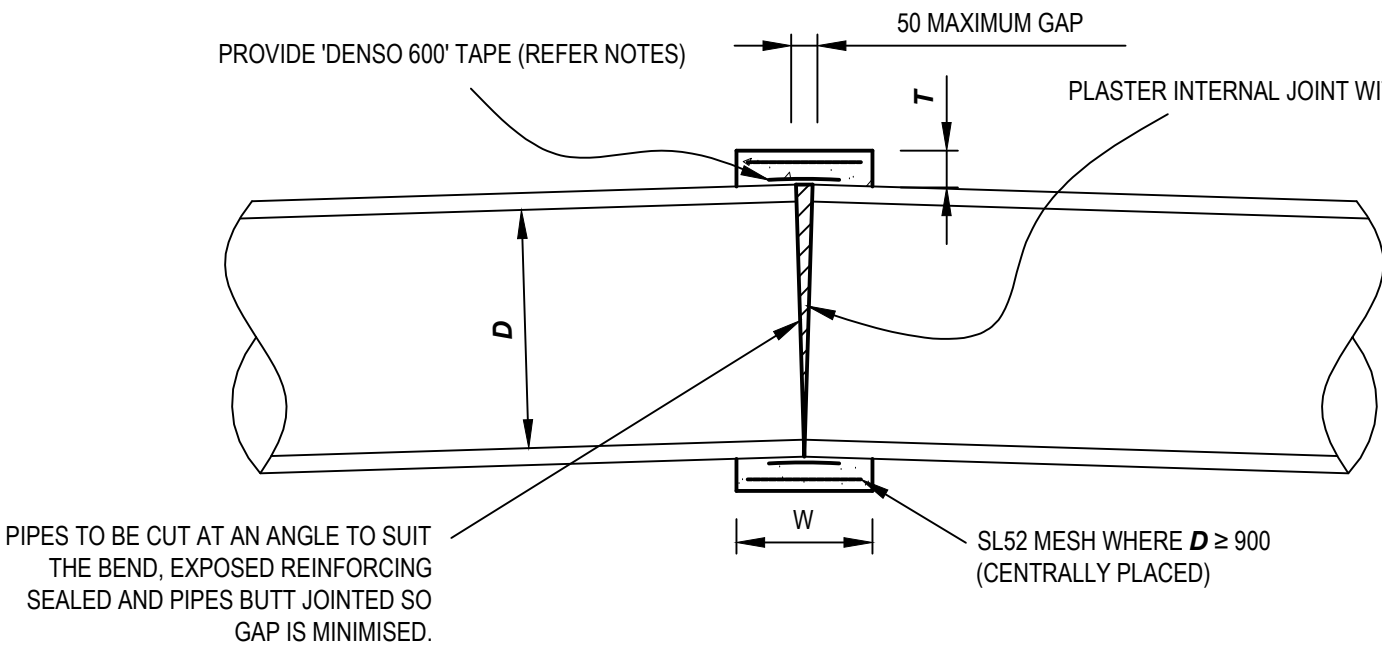
						INFRASTRUCTURE GUIDELINES (SA)		
D	MINOR AMENDMENTS	06.11.2018	AF	AF	MDH	SHEET TITLE OFFSET SIDE ENTRY PIT WITH 900mm INLET GRATE		
C	MINOR AMENDMENTS	18.07.2017	JZ	JC	DSL			
B	ISSUED FOR REVIEW	10.05.2016	JZ	DL	DSL			
A	ISSUED FOR REVIEW	15.03.2016	RJF	DL	DSL			
REV	DESCRIPTION	DATE	DES	DRW	APP			
THIS PROJECT HAS BEEN ASSISTED BY THE LOCAL GOVERNMENT RESEARCH AND DEVELOPMENT SCHEME AND INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA								
							SCALE NTS @ A3	
							DRAWING No. SD 340	REV D

BANDAGE JOINT NOTES:

- 1. ALL CONCRETE WORKS TO BE 32MPa UNLESS NOTED OTHERWISE.
- 2. 'DENSO 600' TAPE OR SIMILAR APPROVED SHALL BE USED. TAPE TO BE 200mm MIN. WIDTH AND LAPPED 100mm MIN. TAPE IS TO BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURER'S SPECIFICATIONS.
- 3. MORTAR MIX TO CONSIST OF 3 PARTS SAND TO 1 PART CEMENT BY VOLUME.
- 4. MAXIMUM DEFLECTION ANGLE

PIPE SIZE	MAXIMUM DEFLECTION ANGLE
• 300Ø	16°
• 600Ø	14°
• 900Ø	12°
• 1800Ø	6°

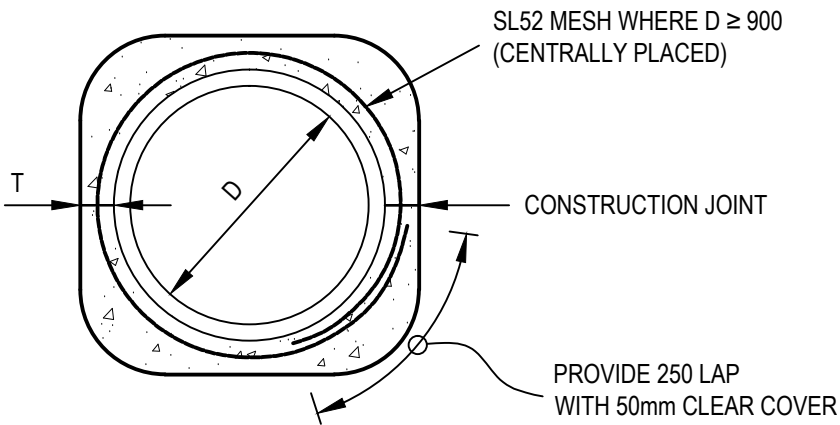
PREFABRICATED SPLAYS SHALL BE USED WHERE DEFLECTION EXCEED ABOVE ANGLES



LONGITUDINAL SECTION

BANDAGE JOINT

FOR CONCRETE PIPES
NOT TO SCALE

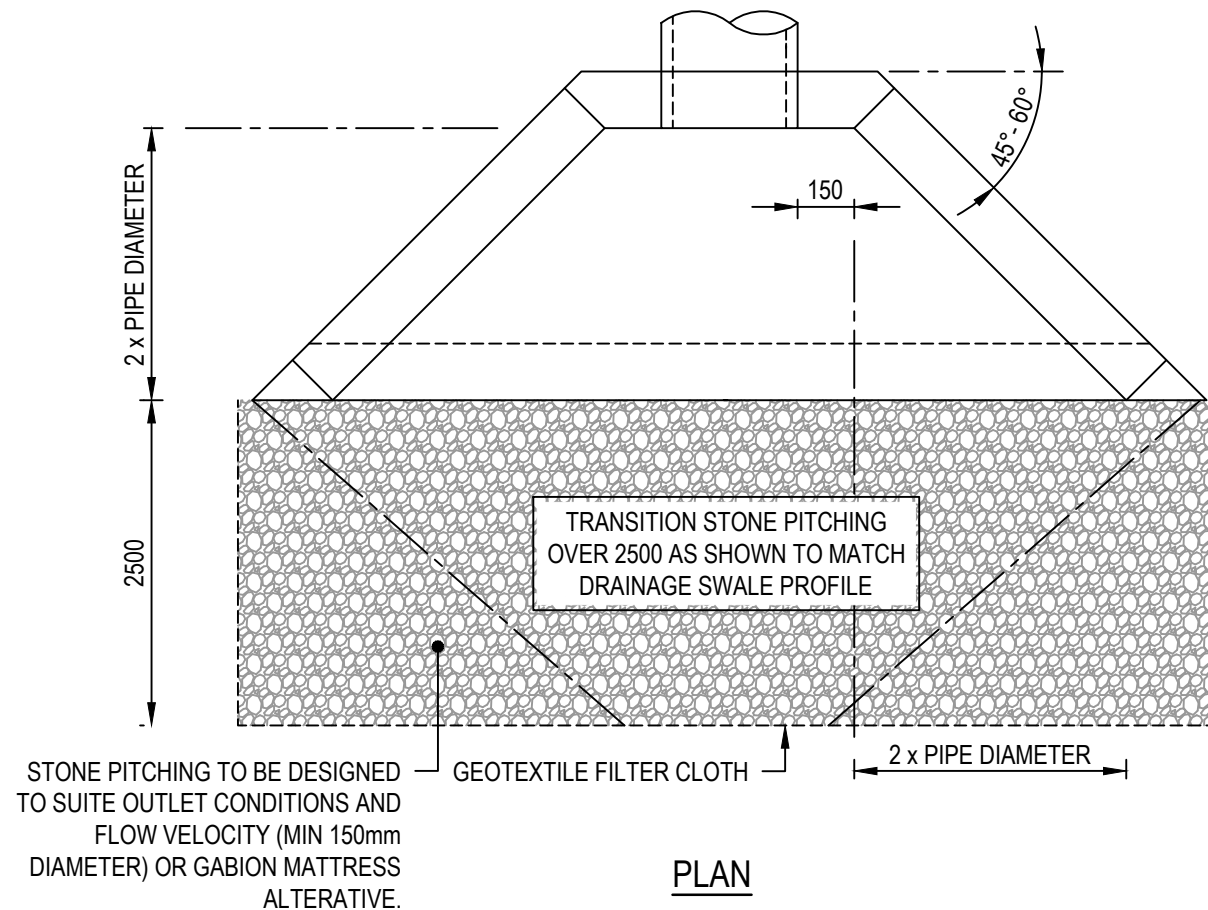
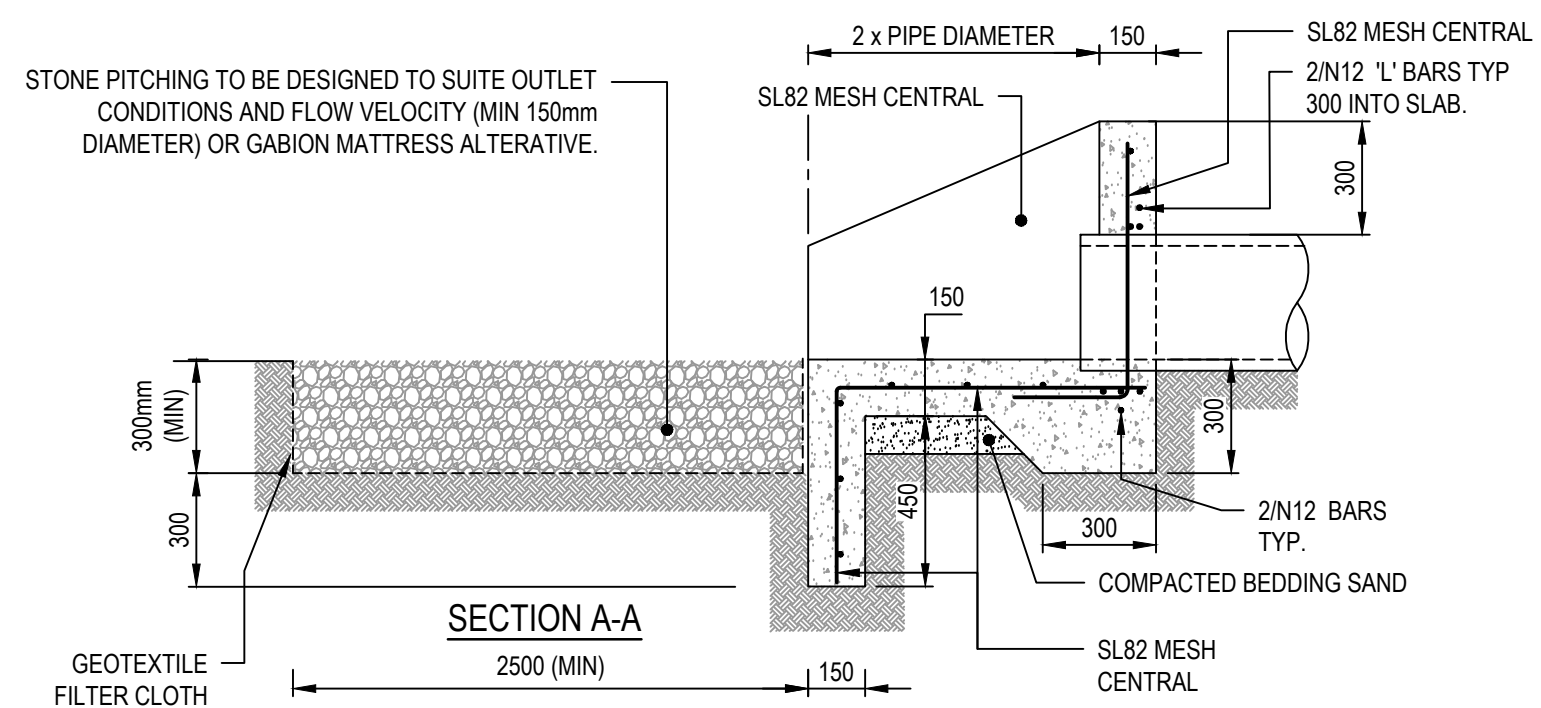


CROSS-SECTION

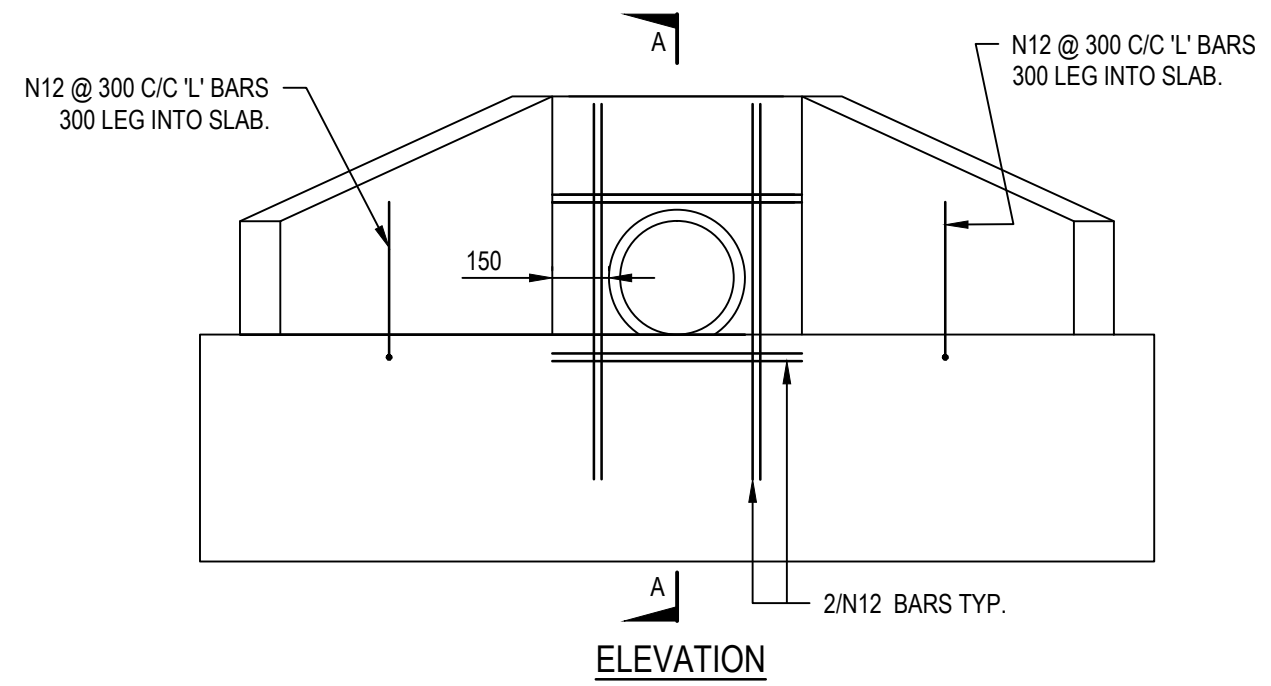
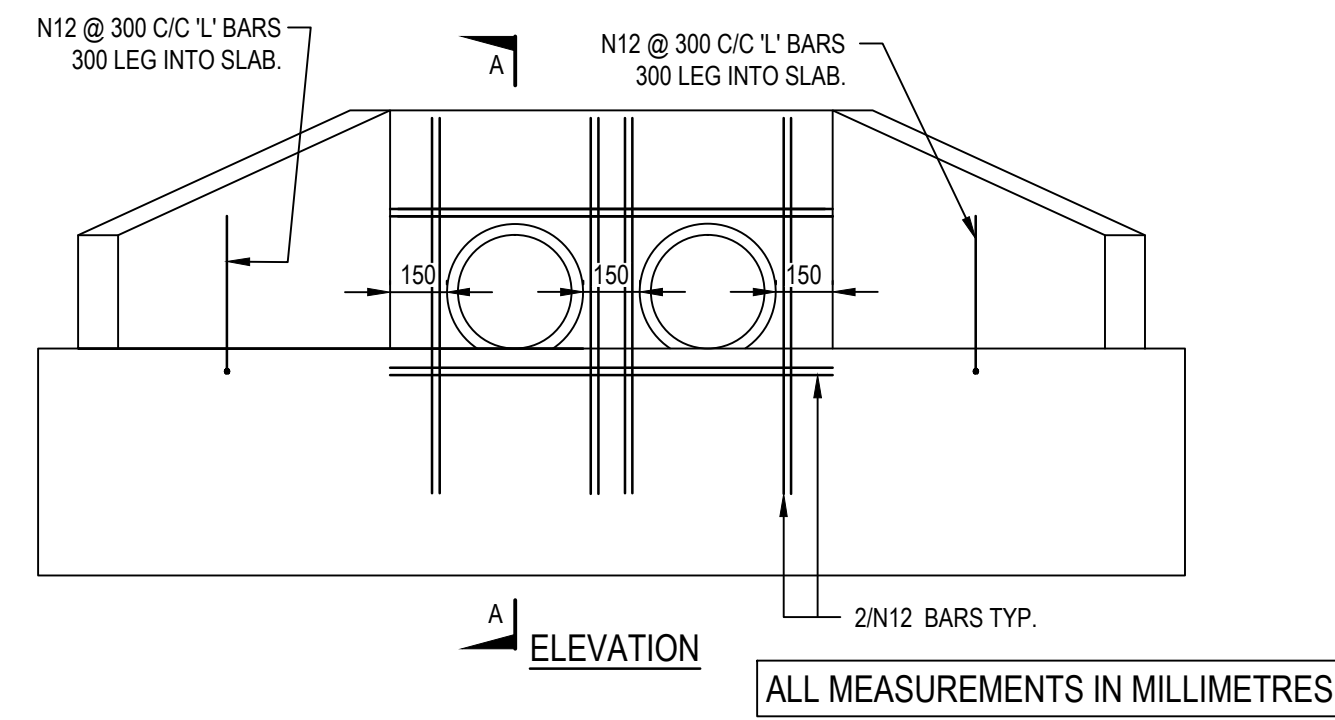
BANDAGE JOINT REQUIREMENTS		
PIPE DIAMETER (D)	THICKNESS (T)	WIDTH (W)
D < 900	100	400
D ≥ 900	150	600

ALL MEASUREMENTS IN MILLIMETRES

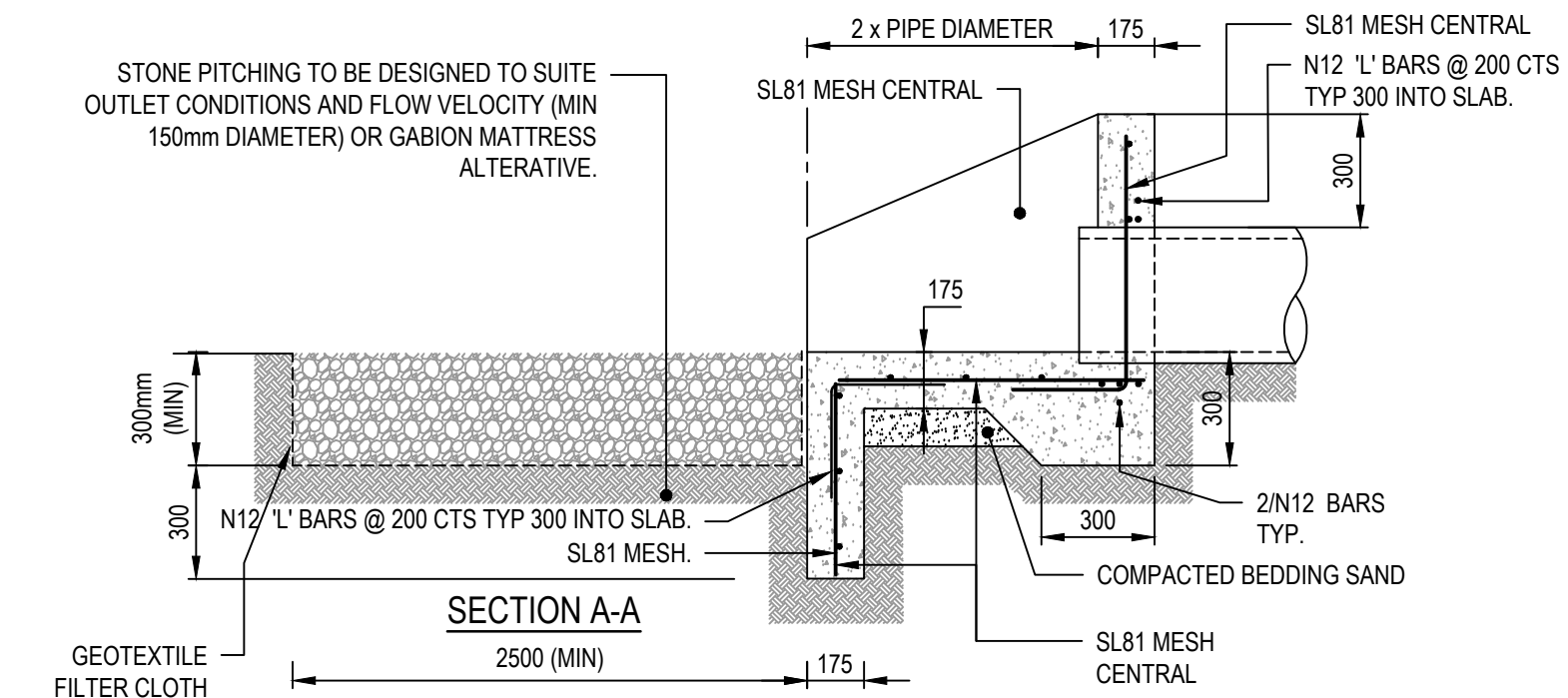
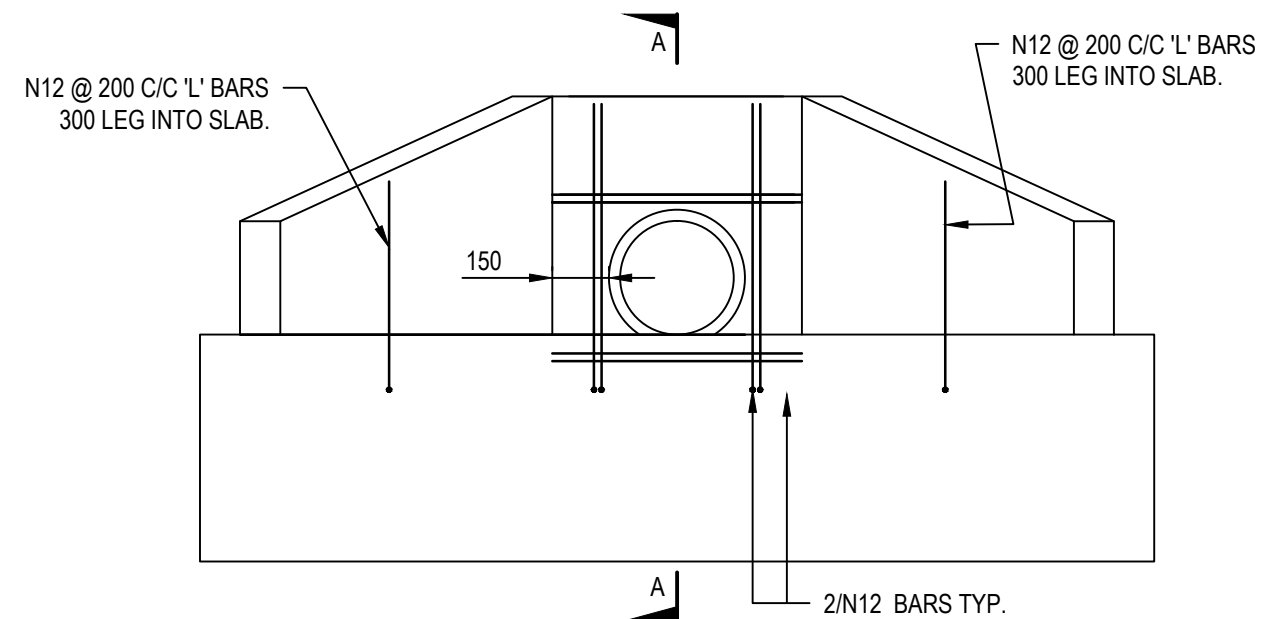
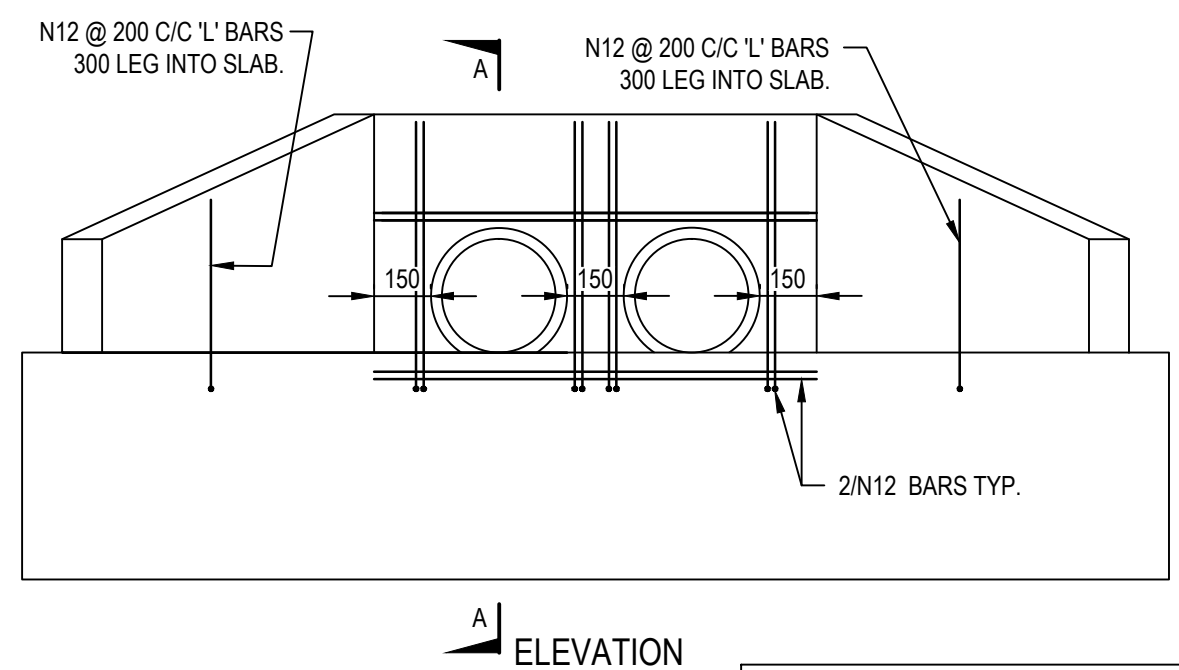
						INFRASTRUCTURE GUIDELINES (SA)		
						SHEET TITLE BANDAGE JOINT		
A	ISSUED FOR REVIEW	06.11.2018	AF	AF	MDH		SCALE NTS @ A3	
REV	DESCRIPTION	DATE	DES	DRW	APP		DRAWING No. SD 341	REV A
THIS PROJECT HAS BEEN ASSISTED BY THE LOCAL GOVERNMENT RESEARCH AND DEVELOPMENT SCHEME AND INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA								



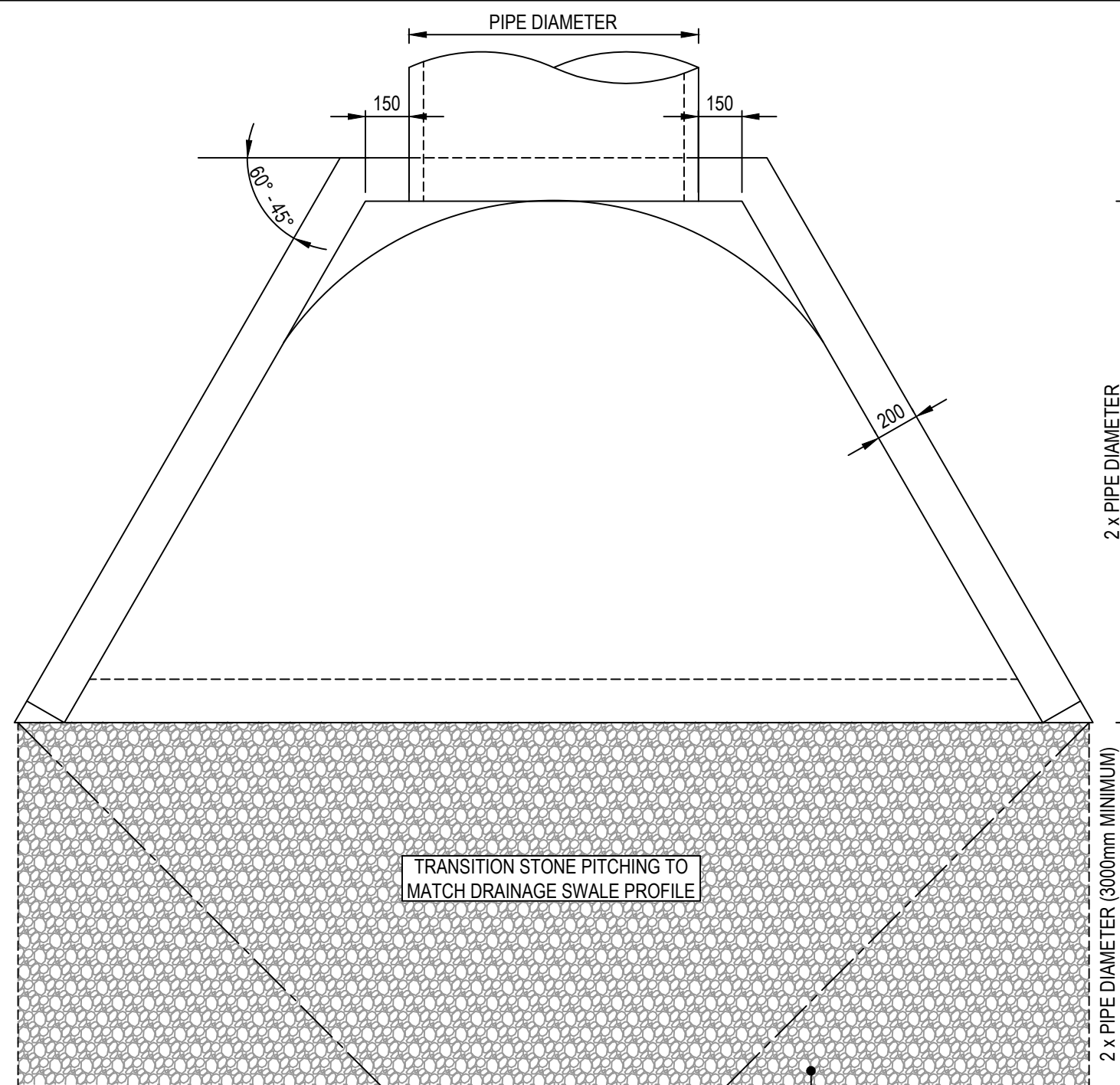
- NOTES:**
1. STREAMLINING AT UPSTREAM END ONLY
 2. SCOUR PROTECTION AT OUTLET AS SHOWN, UNLESS OTHERWISE APPROVED.
 3. APPROVED PRECAST HEADWALLS MAY BE USED AS AN ALTERNATIVE .
 4. MINIMUM COVER TO PIPES TO BE 300mm.
 5. MINIMUM FABRIC LAP 300mm
 6. CONCRETE GRADE TO BE N32, SLUMP 80mm IN ACCORDANCE WITH AS3600.
 7. MAXIMUM BATTER SLOPE ABOVE HEADWALL 1V : 2H
 8. FENCING AT TOP OF HEADWALL MAY BE REQUIRED IN LOCATION WHERE HEIGHT > 1.0m AND SITE ACCESSIBLE TO THE PUBLIC.



E	MINOR AMENDMENTS	06.11.2018	AF	AF	MDH	INFRASTRUCTURE GUIDELINES (SA)	SHEET TITLE STANDARD HEADWALL FOR PIPES 300-375 DIAMETER		
D	ISSUED FOR REVIEW	17.07.2017	JZ	SGP	SH				
C	ISSUED FOR REVIEW	10.06.2016	JZ	DL	DSL				
B	ISSUED FOR REVIEW	10.05.2016	JZ	DL	DSL			SCALE NTS @ A3	
A	ISSUED FOR REVIEW	15.03.2016	JZ	DL	DSL			DRAWING No. SD 345	
REV	DESCRIPTION	DATE	DES	DRW	APP	REV E			
THIS PROJECT HAS BEEN ASSISTED BY THE LOCAL GOVERNMENT RESEARCH AND DEVELOPMENT SCHEME AND INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA									



D	MINOR AMENDMENTS	06.11.2018	AF	AF	MDH
C	ISSUED FOR REVIEW	17.07.2017	JZ	SGP	SH
B	ISSUED FOR REVIEW	10.05.2016	JZ	DL	DSL
A	ISSUED FOR REVIEW	15.03.2016	JZ	DL	DSL
REV	DESCRIPTION	DATE	DES	DRW	APP
THIS PROJECT HAS BEEN ASSISTED BY THE LOCAL GOVERNMENT RESEARCH AND DEVELOPMENT SCHEME AND INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA					

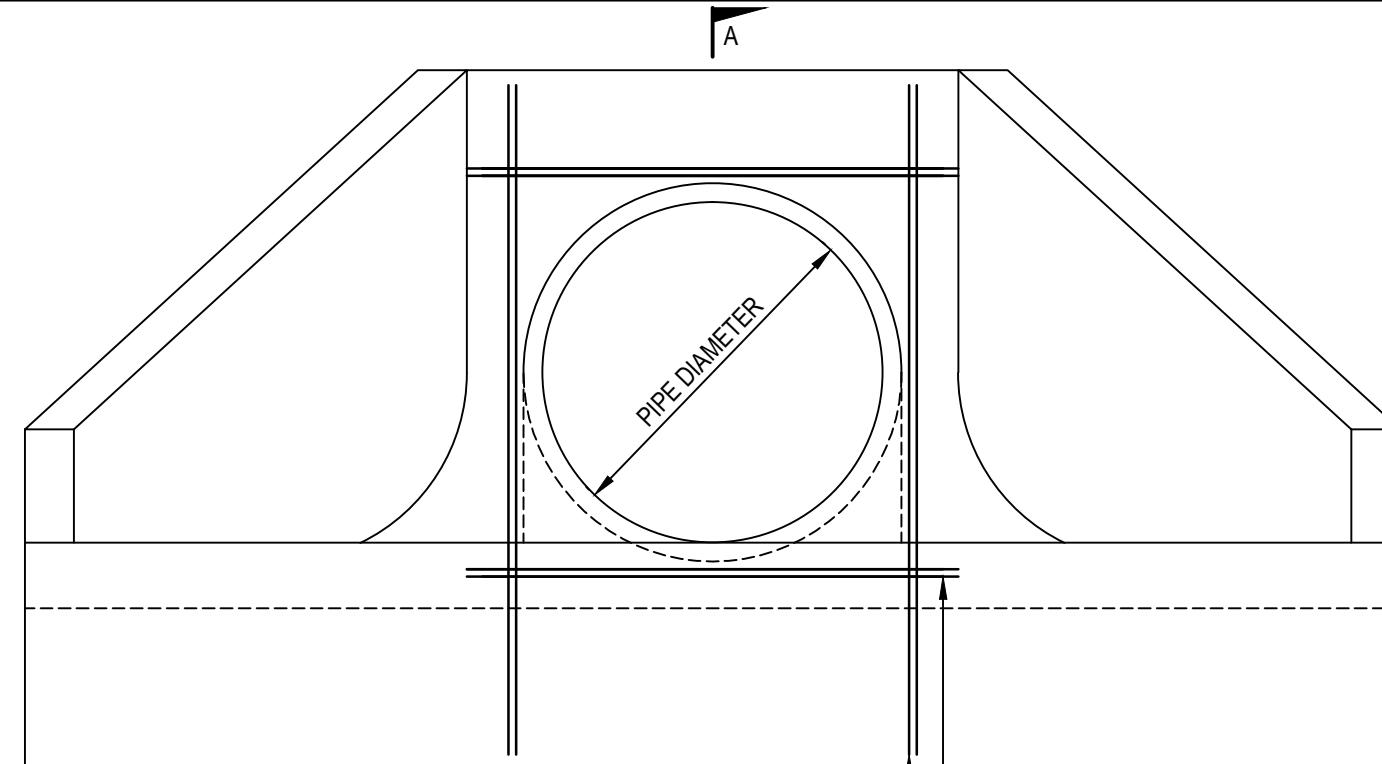


PLAN

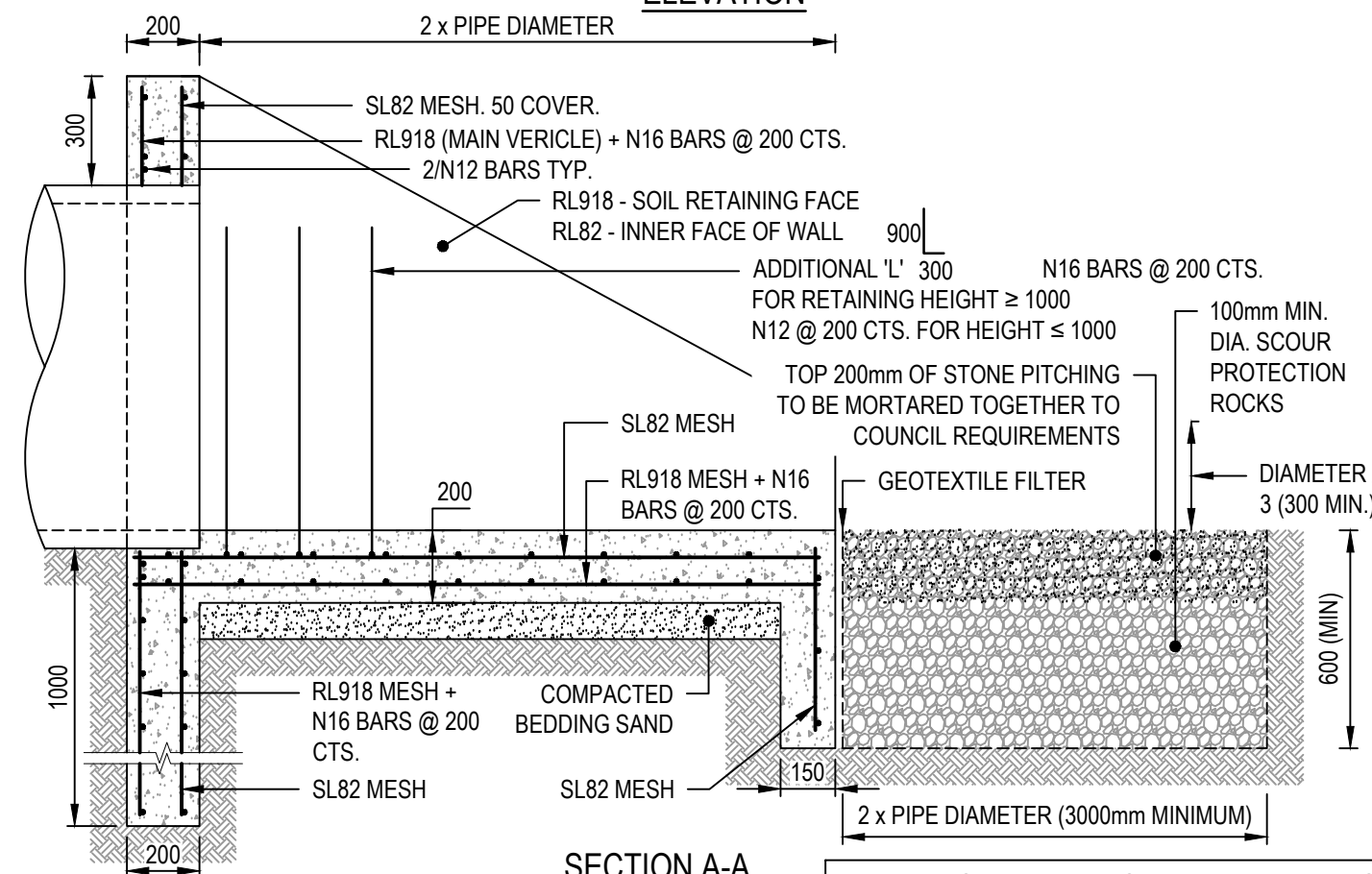
NOTES:

1. STREAMLINING AT UPSTREAM END ONLY
2. SCOUR PROTECTION AT OUTLET AS SHOWN, UNLESS OTHERWISE APPROVED.
3. APPROVED PRECAST HEADWALLS MAY BE USED AS AN ALTERNATIVE WITH CAST IN SITU LEGS.
4. MINIMUM COVER TO PIPES TO BE 300mm
5. MINIMUM FABRIC LAP 300mm
6. CONCRETE GRADE TO BE N32, SLUMP 80mm IN ACCORDANCE WITH AS3600.
7. FENCING AT TOP OF HEADWALL MAY BE REQUIRED IN LOCATION WHERE HEIGHT > 1.0m AND SITE ACCESSIBLE TO THE PUBLIC.
8. ALTERNATE SCOUR PROTECTION INCLUDING MATTRESSES AT OUTLET OF HEADWALL ACCEPTABLE SUBJECT TO DESIGN BASED ON FLOW RATE AND VELOCITY.
9. MAXIMUM BATTER SLOPE 1V : 2H

STONE PITCHING TO BE DESIGNED TO SUITE OUTLET CONDITIONS AND FLOW VELOCITY (MIN 150mm DIAMETER)



ELEVATION



SECTION A-A

ALL MEASUREMENTS IN MILLIMETRES

REV	DESCRIPTION	DATE	DES	DRW	APP
D	MINOR AMENDMENTS	06.11.2018	AF	AF	MDH
C	ISSUED FOR REVIEW	10.06.2016	JZ	DL	DSL
B	ISSUED FOR REVIEW	10.05.2016	JZ	DL	DSL
A	ISSUED FOR REVIEW	15.03.2016	JZ	DL	DSL
THIS PROJECT HAS BEEN ASSISTED BY THE LOCAL GOVERNMENT RESEARCH AND DEVELOPMENT SCHEME AND INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA					

INFRASTRUCTURE GUIDELINES (SA)

SHEET TITLE

STANDARD HEADWALL FOR SINGLE PIPE 675-1800 DIAMETER

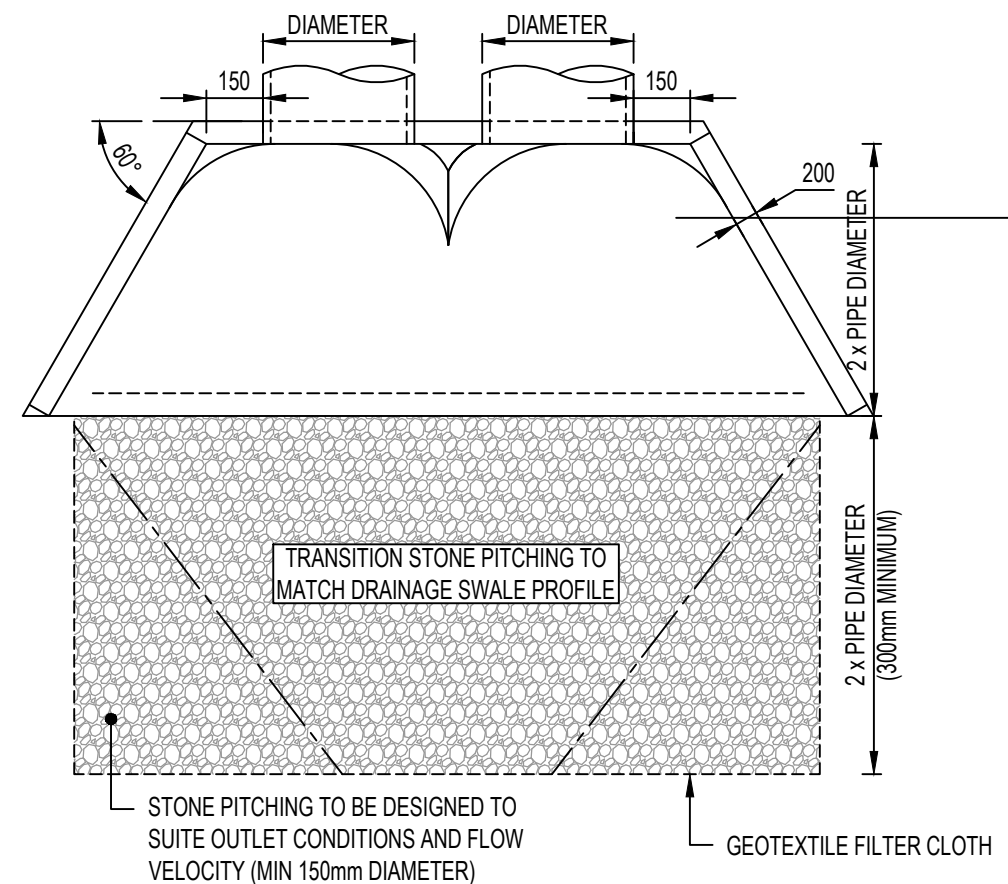
SCALE
NTS @ A3

DRAWING No.

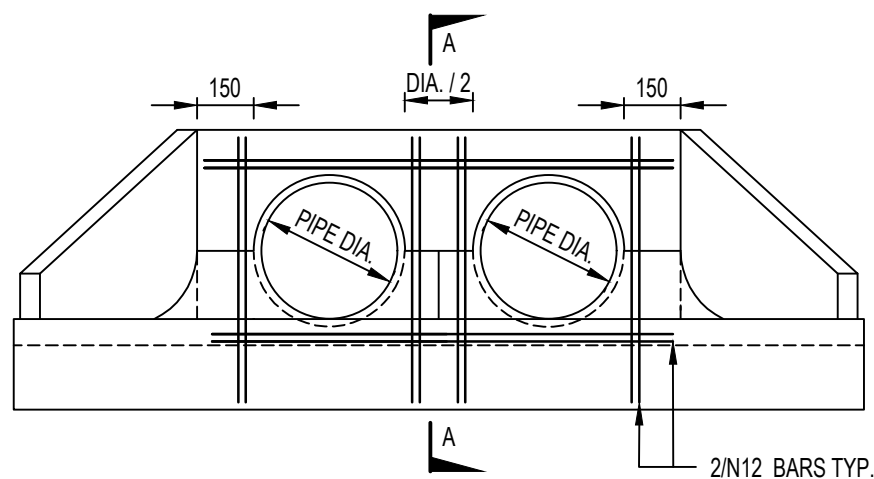
SD 351

REV

D



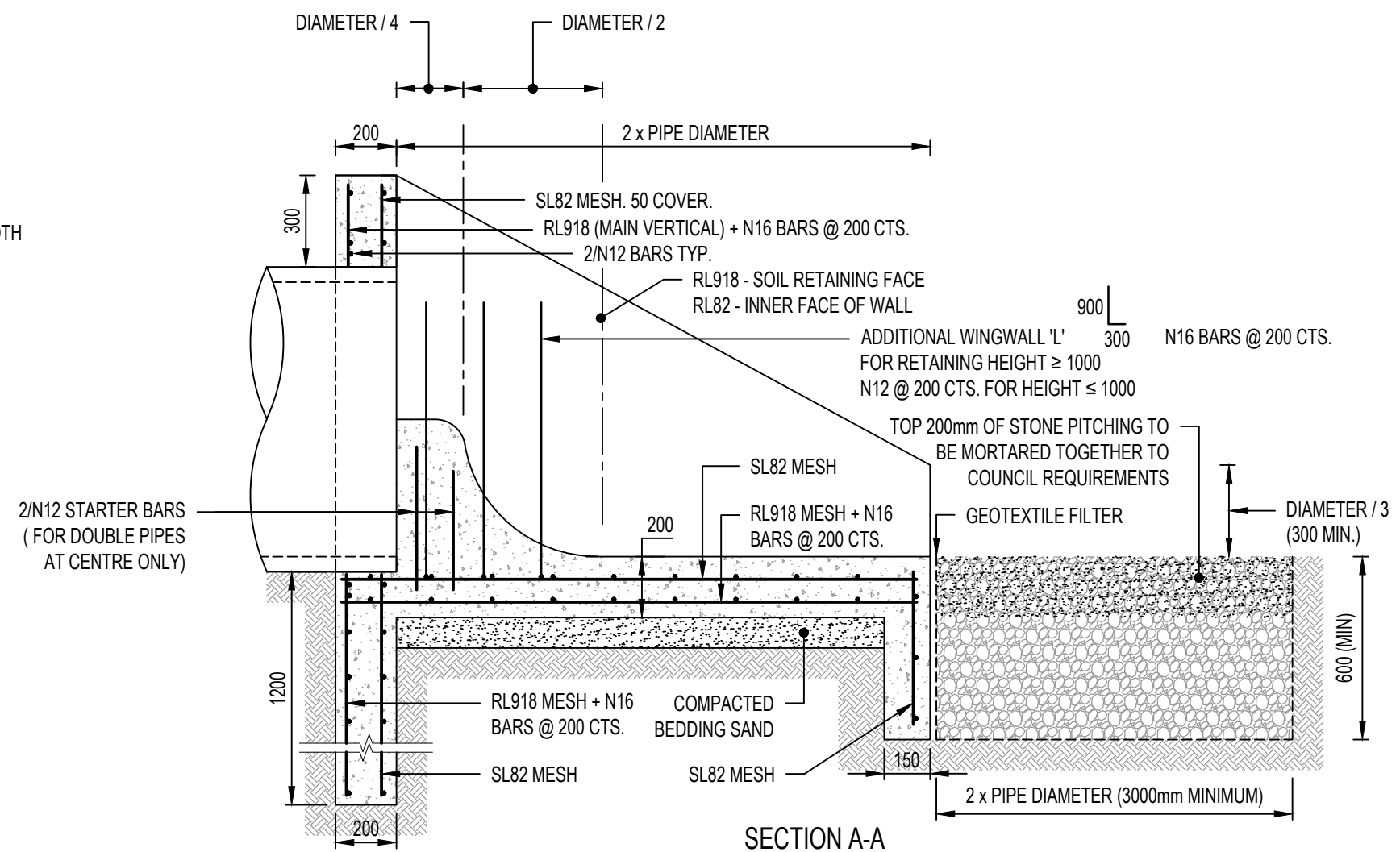
PLAN
SCALE 1:50



ELEVATION
SCALE 1:50

NOTES:

1. STREAMLINING AT UPSTREAM END ONLY
2. SCOUR PROTECTION AT OUTLET AS SHOWN, UNLESS OTHERWISE APPROVED.
3. APPROVED PRECAST HEADWALLS MAY BE USED AS AN ALTERNATIVE.
4. MINIMUM COVER TO PIPES TO BE 300mm
5. MINIMUM FABRIC LAP 300mm
6. CONCRETE GRADE TO BE N32, SLUMP 80mm IN ACCORDANCE WITH AS3600.
7. FENCING AT TOP OF HEADWALL MAY BE REQUIRED IN LOCATION WHERE HEIGHT > 1.0m AND SITE ACCESSIBLE TO THE PUBLIC.
8. ALTERNATE SCOUR PROTECTION INCLUDING MATTRESSES AT OUTLET OF HEADWALL ACCEPTABLE SUBJECT TO DESIGN BASED ON FLOW RATE AND VELOCITY.
9. MAXIMUM BATTER SLOPE 1V : 2H



SECTION A-A

ALL MEASUREMENTS IN MILLIMETRES

REV	DESCRIPTION	DATE	DES	DRW	APP
D	ISSUED FOR REVIEW	17.07.2017	JZ	SGP	SH
C	ISSUED FOR REVIEW	10.06.2016	JZ	DL	DSL
B	ISSUED FOR REVIEW	10.05.2016	JZ	DL	DSL
A	ISSUED FOR REVIEW	15.03.2016	JZ	DL	DSL
THIS PROJECT HAS BEEN ASSISTED BY THE LOCAL GOVERNMENT RESEARCH AND DEVELOPMENT SCHEME AND INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA					

INFRASTRUCTURE GUIDELINES (SA)

SHEET TITLE

STANDARD HEADWALL FOR TWIN PIPES
825-1800 DIAMETER

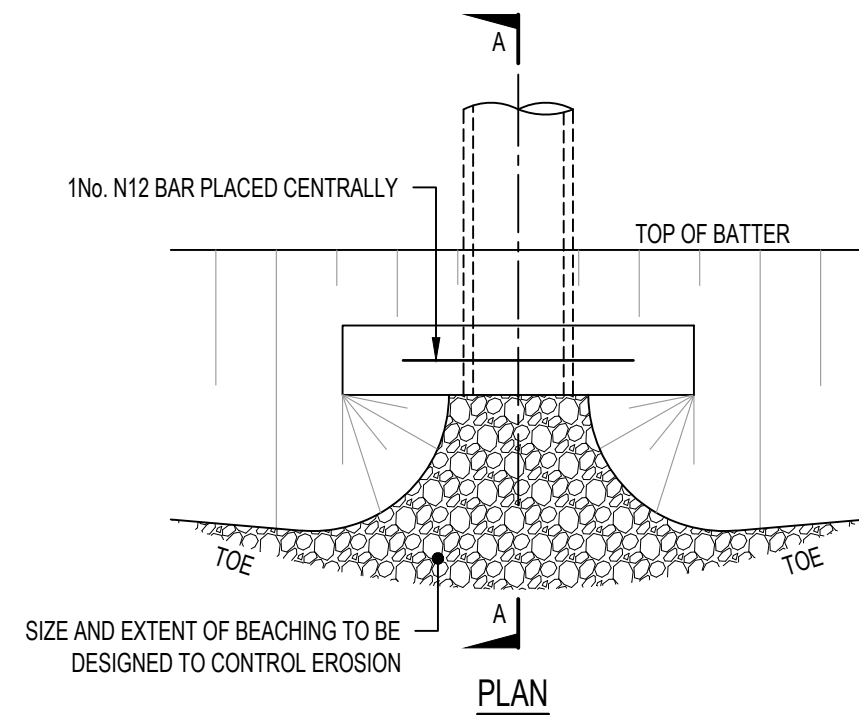
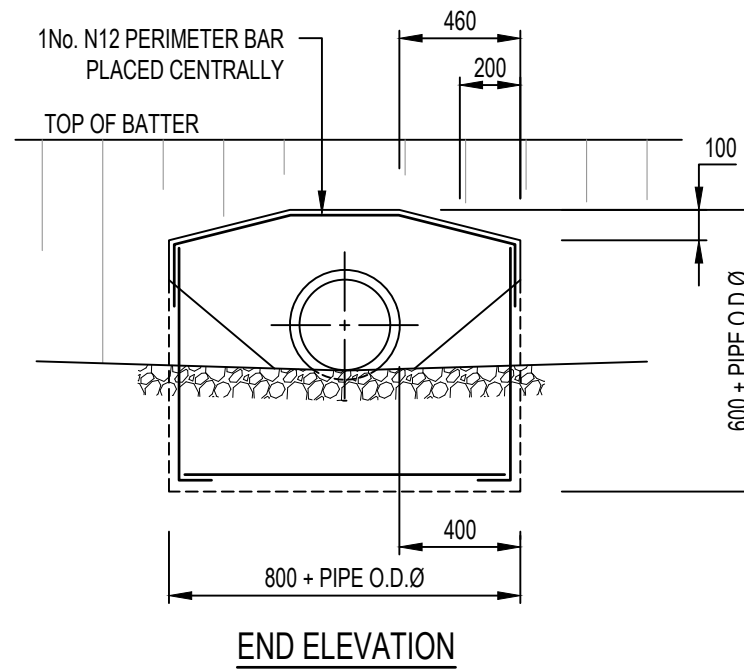
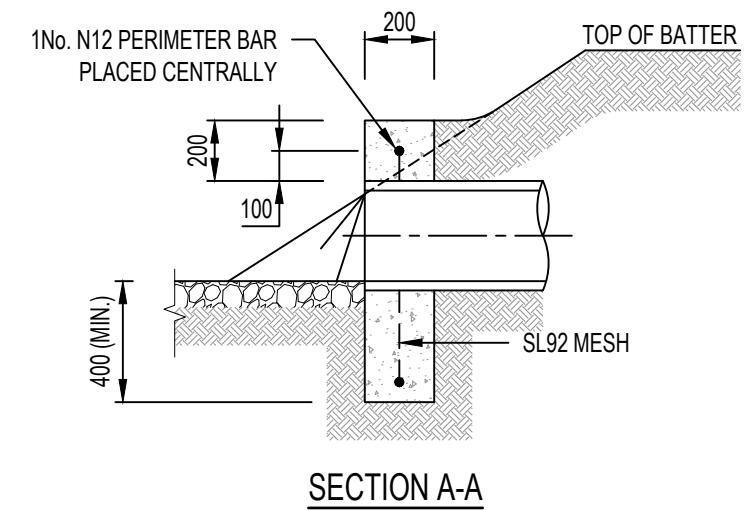
SCALE
AS SHOWN @ A3

DRAWING No.

SD 355

REV

D

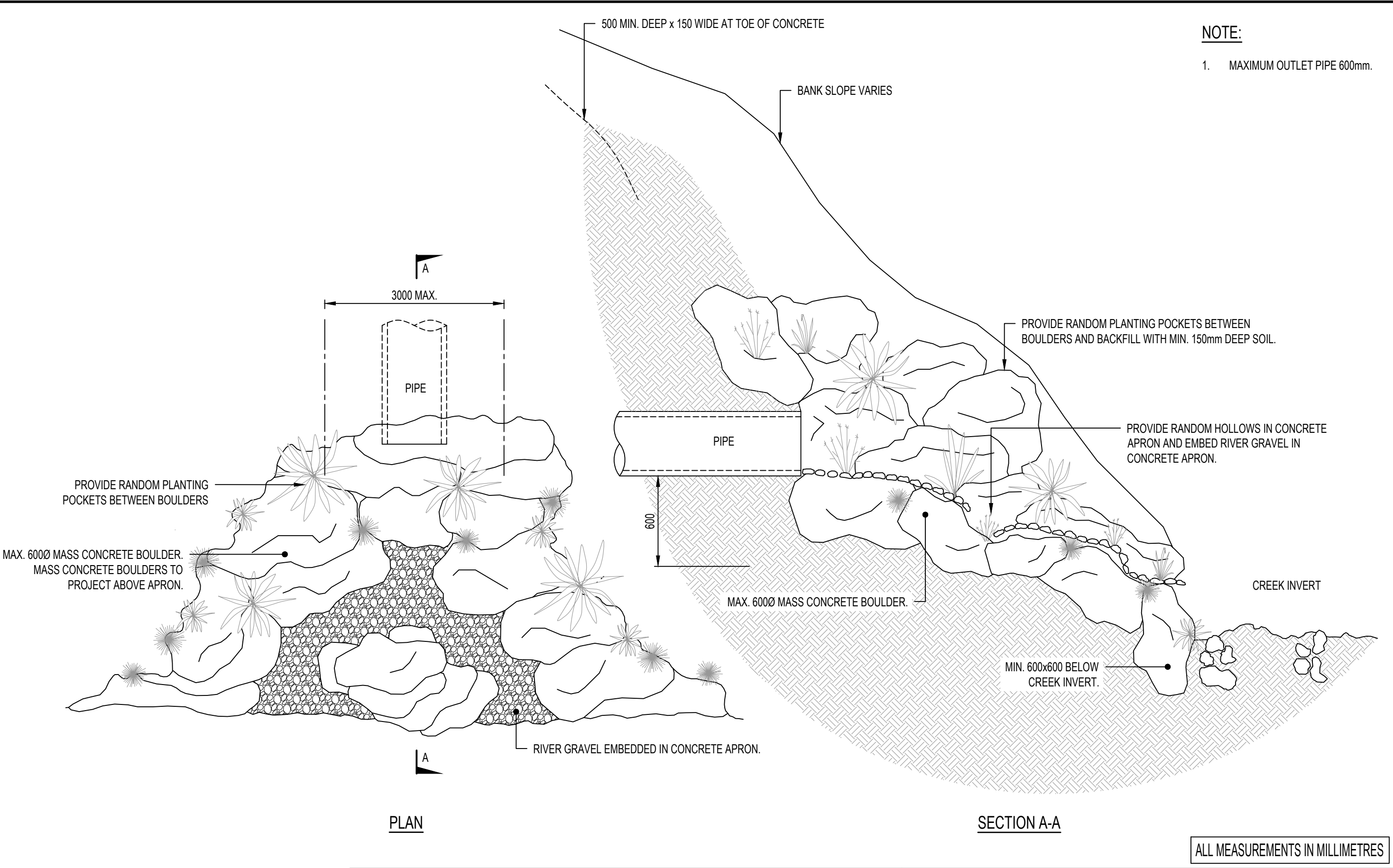


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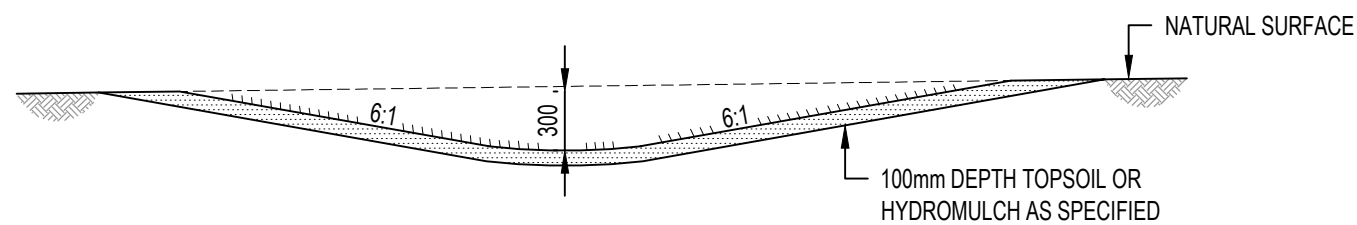
1. COMPACTION PRESSURE BEHIND ENDWALLS IS NOT TO EXCEED 12.5kPa. REFER (1.5 TONNE VIBRATORY ROLLER).
2. A MAXIMUM PIPE SIZE OF 300Ø FOR THIS ENDWALL ARRANGEMENT.
3. NOT TO BE USED WHERE GENERAL VEHICULAR TRAFFIC IS PRESENT (MAINTENANCE OR EMERGENCY VEHICLES EXCEPTED).
4. ALTERNATIVELY PRECAST ENDWALL MAY BE USED WHERE APPROVED BY COUNCIL.
5. CONCRETE STRENGTH F'C = 25 MPa (MIN.) AT 28 DAYS.
6. MAXIMUM BATTER SLOPE 1V : 2H

ALL MEASUREMENTS IN MILLIMETRES

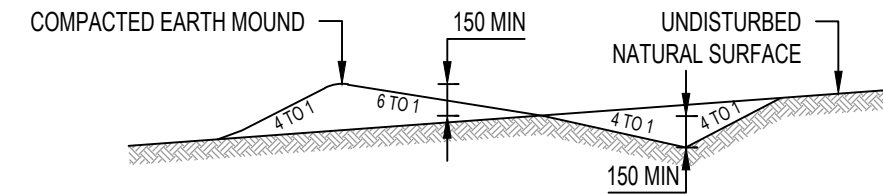
						INFRASTRUCTURE GUIDELINES (SA)		SCALE NTS @ A3 DRAWING No. SD 365 REV C	
						SHEET TITLE			
C	ISSUED FOR REVIEW	10.06.2016	JZ	DL	DSL	CONCRETE ENDWALL FOR PIPES UP TO 300mmØ (WALKWAYS,PATHS AND TRACKS)			
B	ISSUED FOR REVIEW	10.05.2016	JZ	DL	DSL				
A	ISSUED FOR REVIEW	15.03.2016	JZ	DL	DSL				
REV	DESCRIPTION	DATE	DES	DRW	APP				
THIS PROJECT HAS BEEN ASSISTED BY THE LOCAL GOVERNMENT RESEARCH AND DEVELOPMENT SCHEME AND INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA									



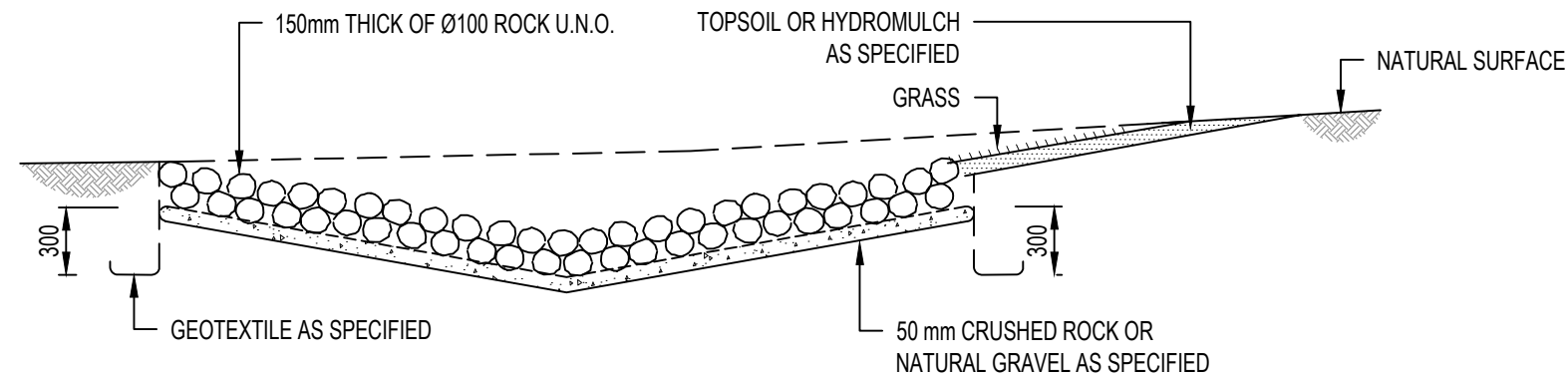
						INFRASTRUCTURE GUIDELINES (SA)		SCALE NTS @ A3	
						SHEET TITLE			
C	ISSUED FOR REVIEW	10.06.2016	JZ	DL	DSL	NATURAL LOOK CONCRETE AND BOULDER HEADWALL			
B	ISSUED FOR REVIEW	10.05.2016	JZ	DL	DSL				
A	ISSUED FOR REVIEW	15.03.2016	JZ	DL	DSL				
REV	DESCRIPTION	DATE	DES	DRW	APP			DRAWING No.	REV
THIS PROJECT HAS BEEN ASSISTED BY THE LOCAL GOVERNMENT RESEARCH AND DEVELOPMENT SCHEME AND INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA								SD 370	C



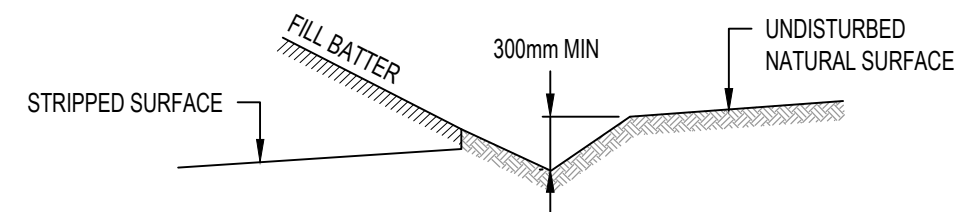
TYPICAL GRASS CATCH DRAIN SECTIONS



**TYPICAL MOUNDED CATCH DRAIN
(ERODABLE TERRAIN)**



TYPICAL ROCK LINED CATCH DRAIN



TYPICAL CATCH DRAIN AT TOE OF BATTER

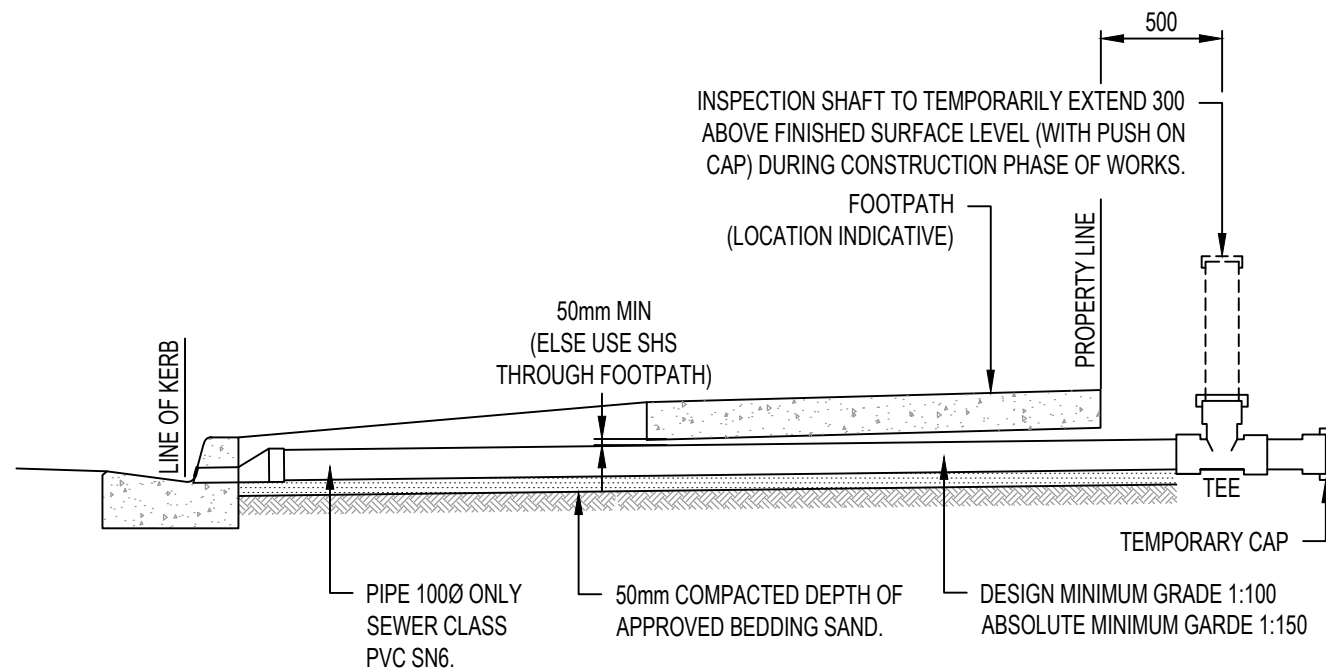
NOTES:

1. CATCH DRAINS SHALL BE CONSTRUCTED WHERE INDICATED ON ALIGNMENT PLANS.
2. CATCH DRAINS LOCATION RELATIVE TO THE BATTER SHALL BE DETERMINED BY THE COUNCIL REPRESENTATIVE.
3. CATCH DRAINS SHALL BE GRADED TO CULVERTS OR EXISTING LOW POINTS.
4. CATCH DRAINS SHALL BE SPECIFIED BY THE DESIGNING AND THE LINING DETAILS BASED ON DESIGN FLOW VELOCITY, SCOUR POTENTIAL AND SOIL TYPE.
5. REFER SD 315 FOR INLET CATCH PIT DETAILS.

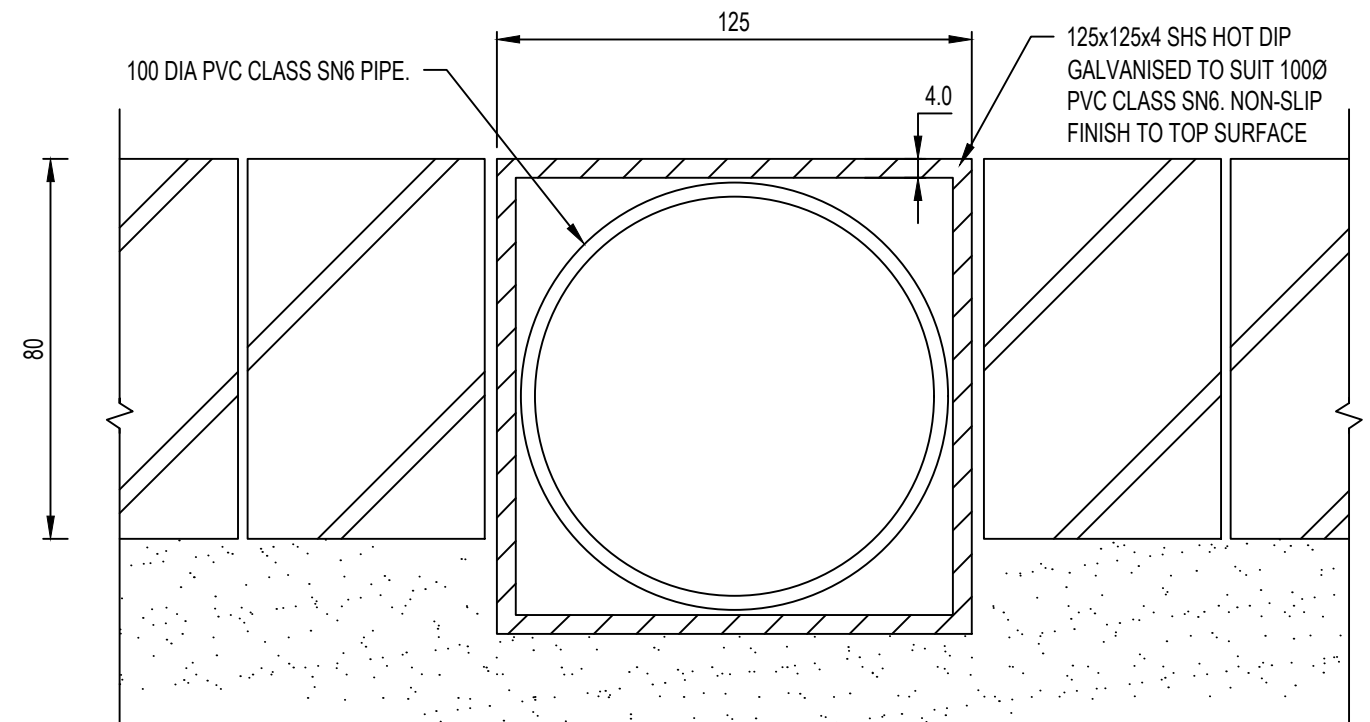
ALL MEASUREMENTS IN MILLIMETRES

REV	DESCRIPTION	DATE	DES	DRW	APP
C	MINOR AMENDMENTS	18.07.217	JZ	JC	DSL
B	ISSUED FOR REVIEW	10.05.2016	JZ	DL	DSL
A	ISSUED FOR REVIEW	15.03.2016	JZ	DL	DSL
THIS PROJECT HAS BEEN ASSISTED BY THE LOCAL GOVERNMENT RESEARCH AND DEVELOPMENT SCHEME AND INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA					

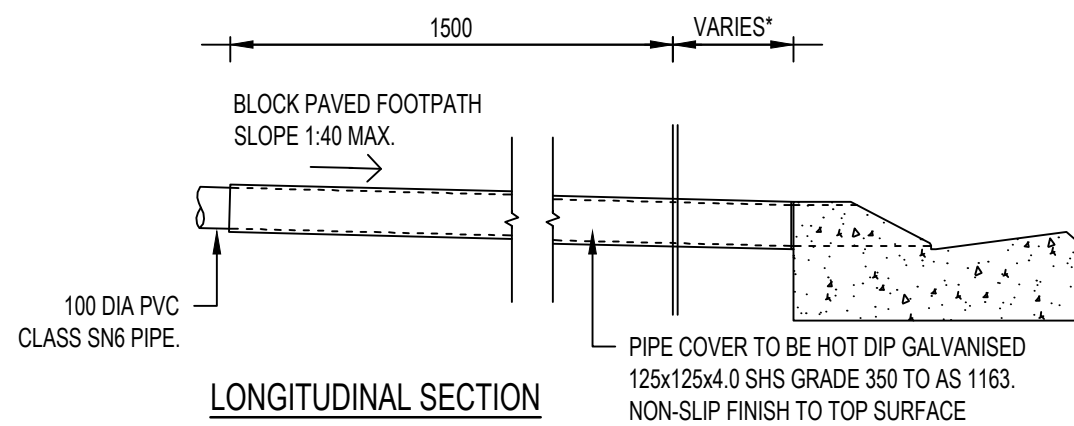
INFRASTRUCTURE GUIDELINES (SA)	
SHEET TITLE	
STORMWATER CATCH DRAIN DETAILS	
SCALE	
NTS @ A3	
DRAWING No.	REV
SD 375	C



TYPICAL CROSS SECTION

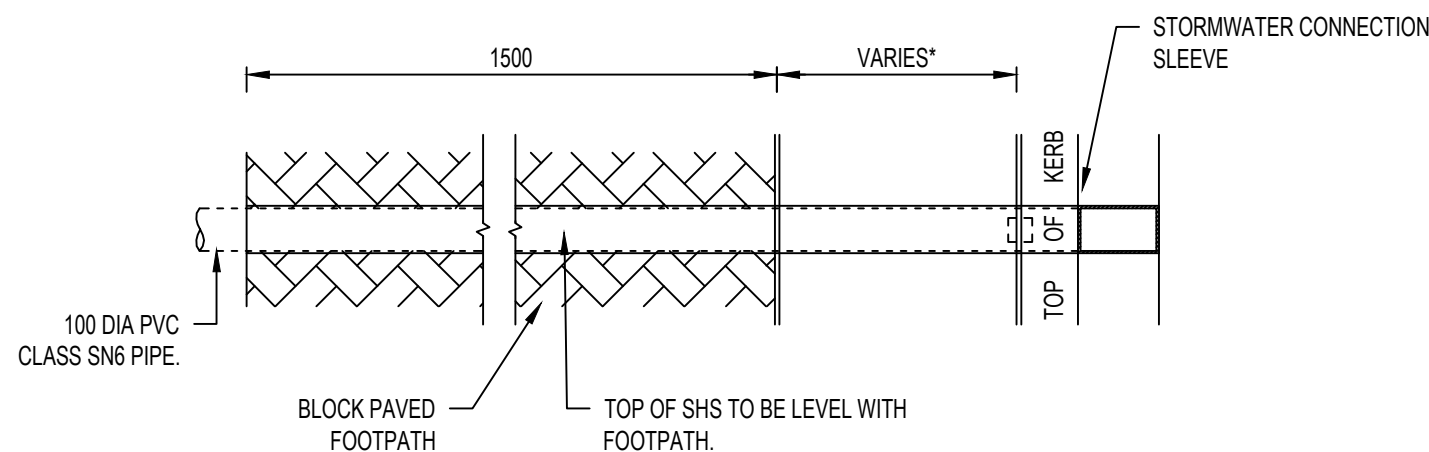


TYPICAL SHS CROSS SECTION

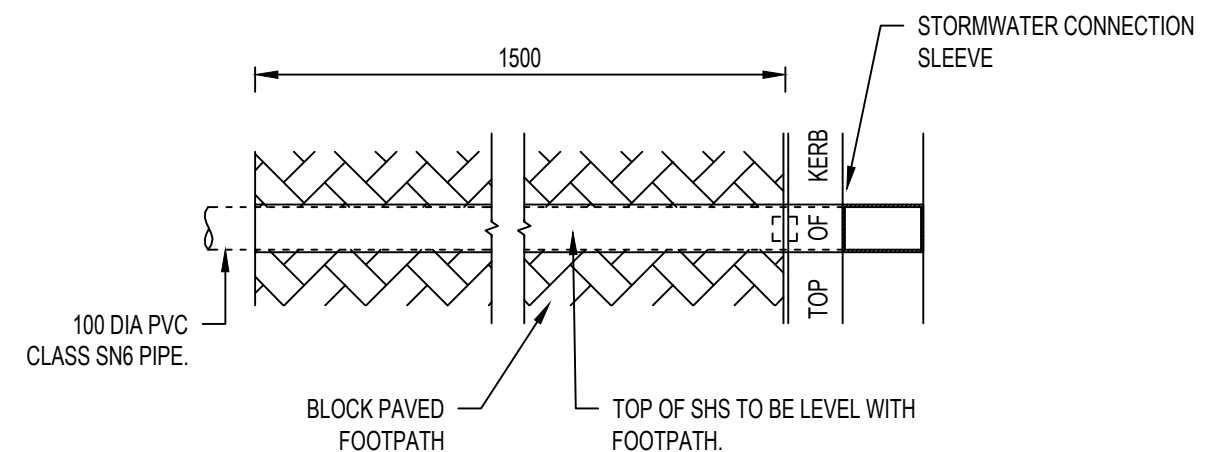


LONGITUDINAL SECTION

(BLOCK PAVED FOOTPATH NOT SHOWN)



PLAN VIEW



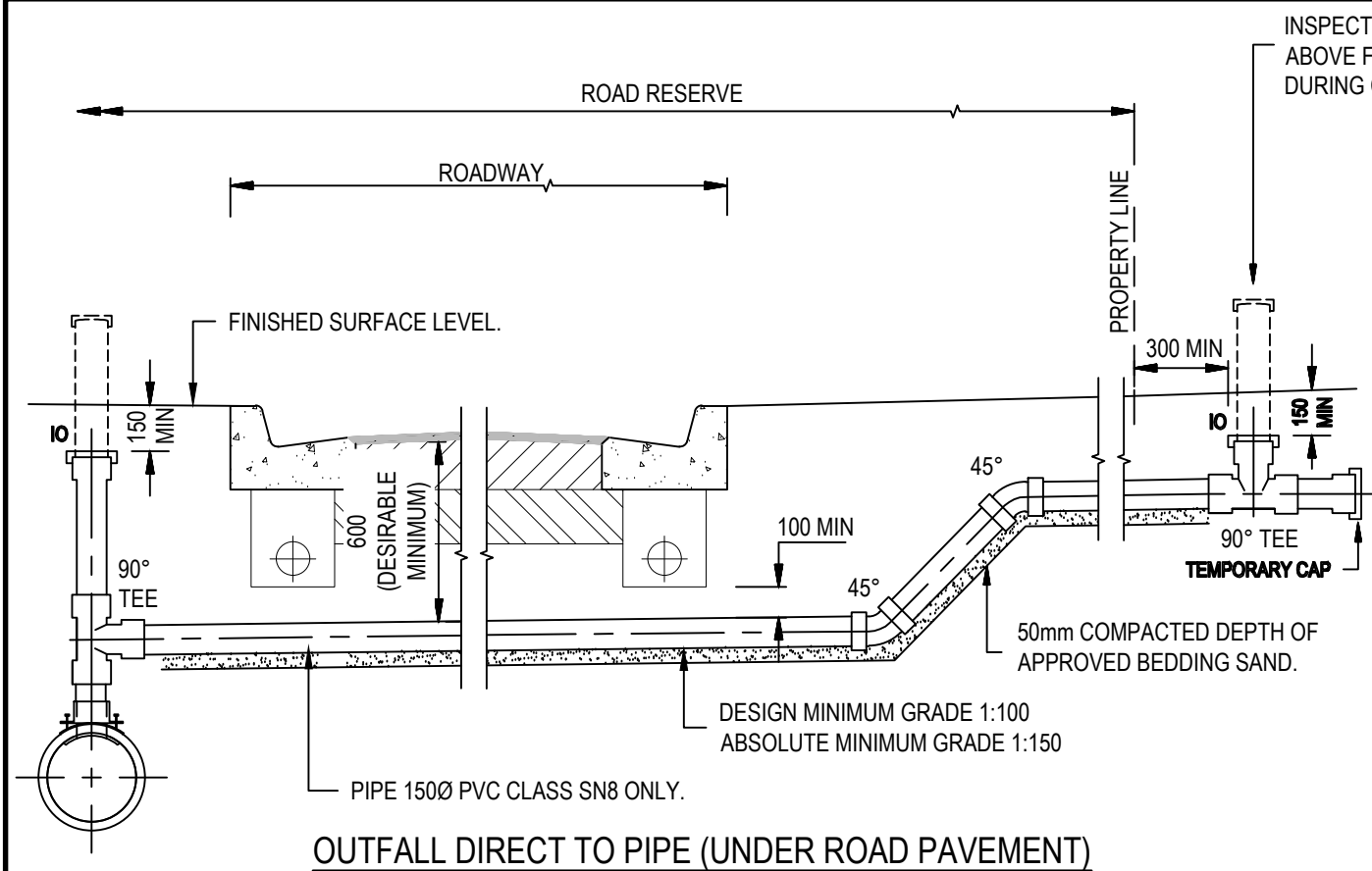
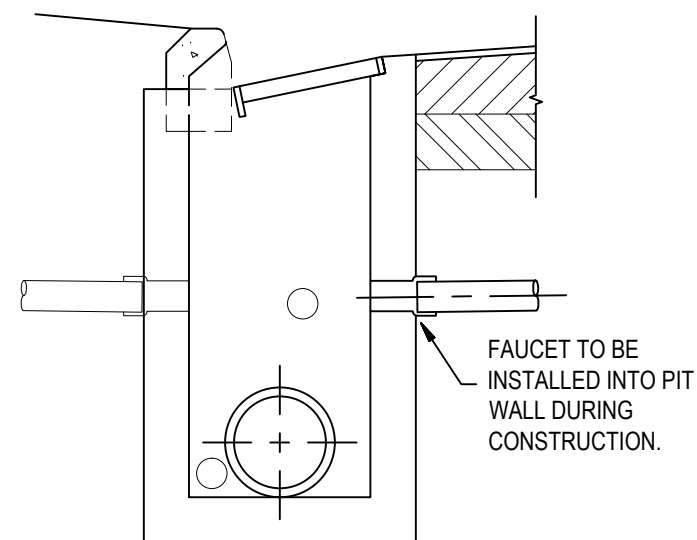
ALTERNATE PLAN VIEW

* DISTANCE TO KERB MAY VARY, REFER TO TYPICAL LAYOUT DRAWINGS.

ALL MEASUREMENTS IN MILLIMETRES

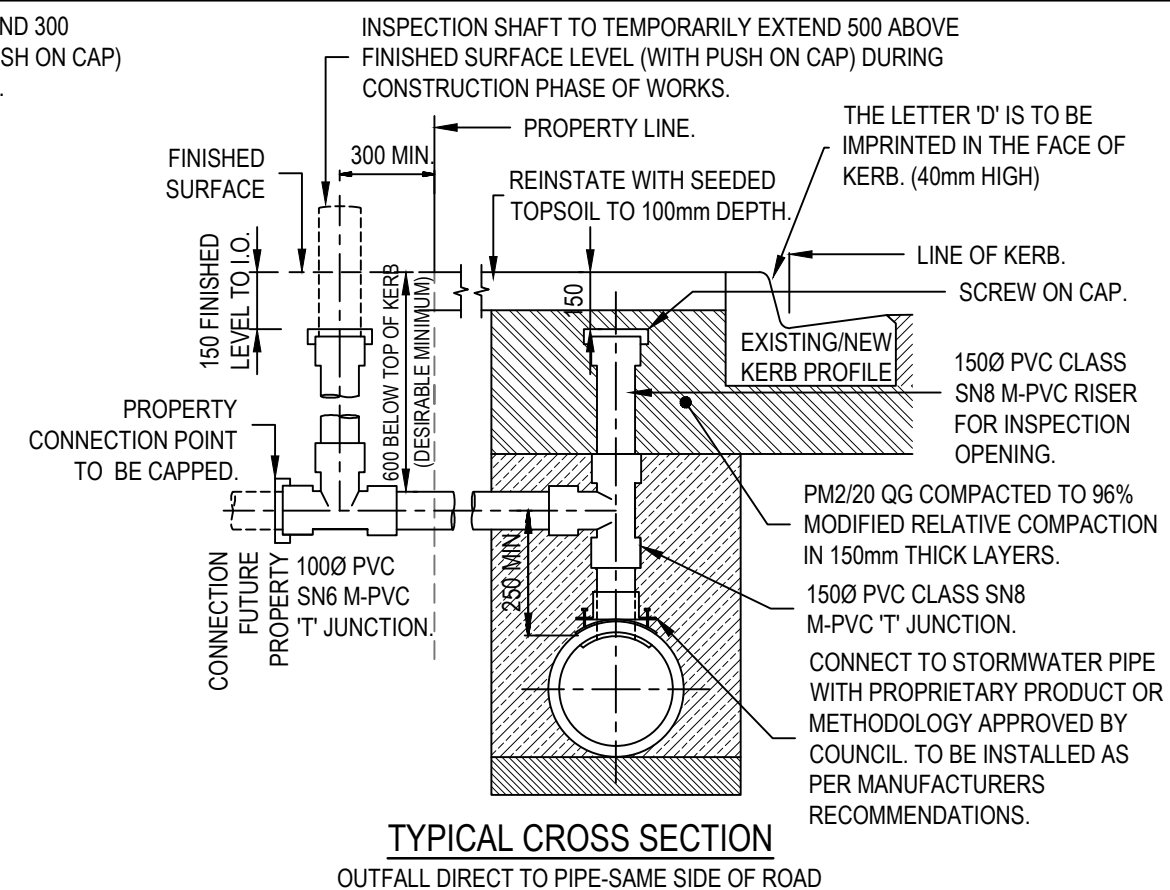
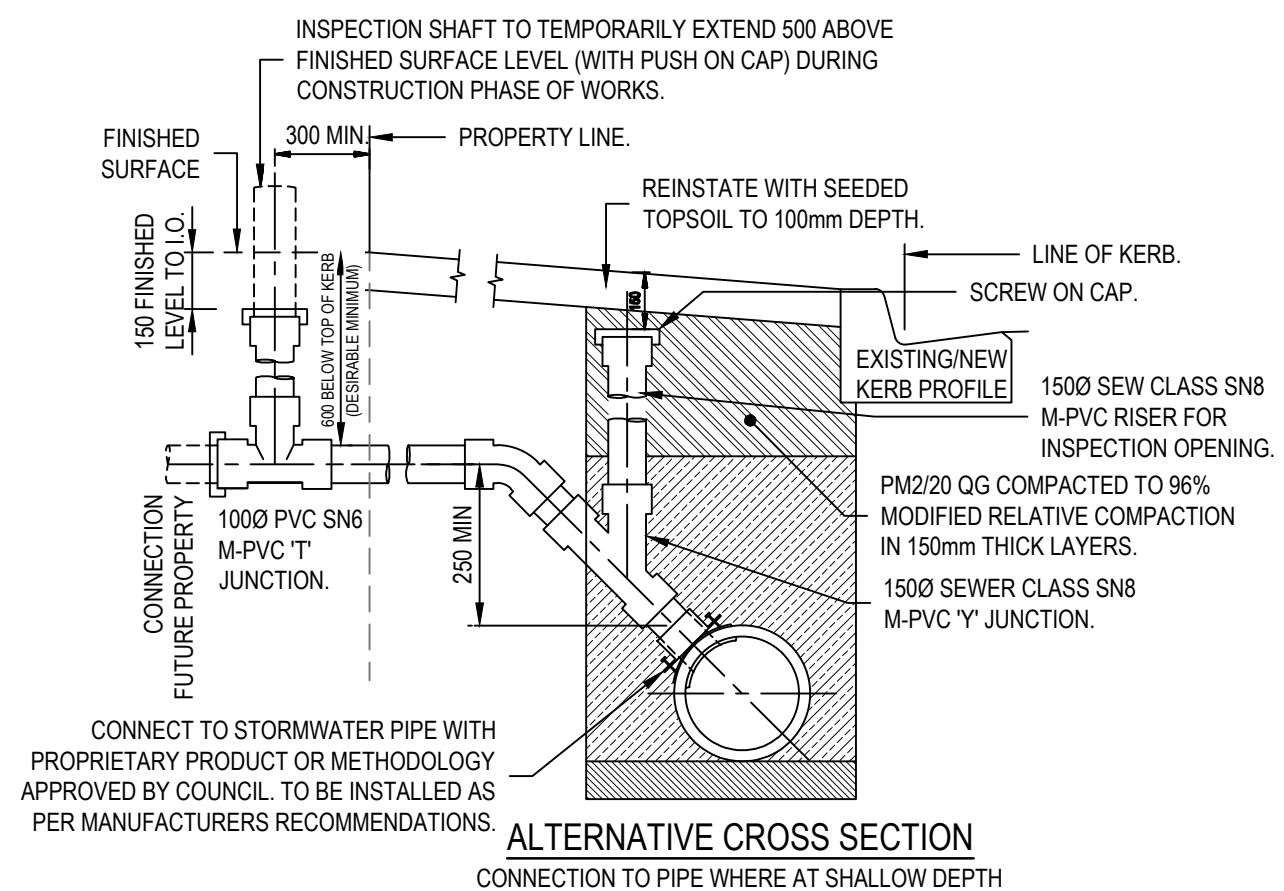
REV	DESCRIPTION	DATE	DES	DRW	APP
C	MINOR AMENDMENTS	18.07.2017	JZ	JC	DSL
B	ISSUED FOR REVIEW	10.05.2016	JZ	DL	DSL
A	ISSUED FOR REVIEW	15.03.2016	JZ	DL	DSL
THIS PROJECT HAS BEEN ASSISTED BY THE LOCAL GOVERNMENT RESEARCH AND DEVELOPMENT SCHEME AND INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA					

INFRASTRUCTURE GUIDELINES (SA)			
SHEET TITLE			
DRAIN STORMWATER ALLOTMENT TO KERB AND CHANNEL CONNECTION		SCALE NTS @ A3	
		DRAWING No. SD 380	REV C



- NOTES:**
1. PM2/20 QG BACKFILL TO BE USED UNDER ROAD PAVEMENT.
 2. CONCRETE KERB TO BE STAMPED WHEN CURING WITH THE LETTER 'D' ADJACENT THE HOUSE DRAIN CONNECTION POINT.

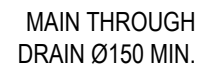
ALL MEASUREMENTS IN MILLIMETRES



						INFRASTRUCTURE GUIDELINES (SA)		
D	MINOR AMENDMENTS	06.11.2018	AF	AF	MDH	SHEET TITLE STORMWATER ALLOTMENT DRAIN CONNECTION TO AUTHORITY PIPELINE		
C	MINOR AMENDMENTS	18.07.2017	JZ	JC	DSL			
B	ISSUED FOR REVIEW	10.05.2016	JZ	DL	DSL			
A	ISSUED FOR REVIEW	15.03.2016	JZ	DL	DSL			
REV	DESCRIPTION	DATE	DES	DRW	APP			
THIS PROJECT HAS BEEN ASSISTED BY THE LOCAL GOVERNMENT RESEARCH AND DEVELOPMENT SCHEME AND INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA								
							SCALE NTS @ A3	
							DRAWING No. SD 385	REV D



SIDE ELEVATION



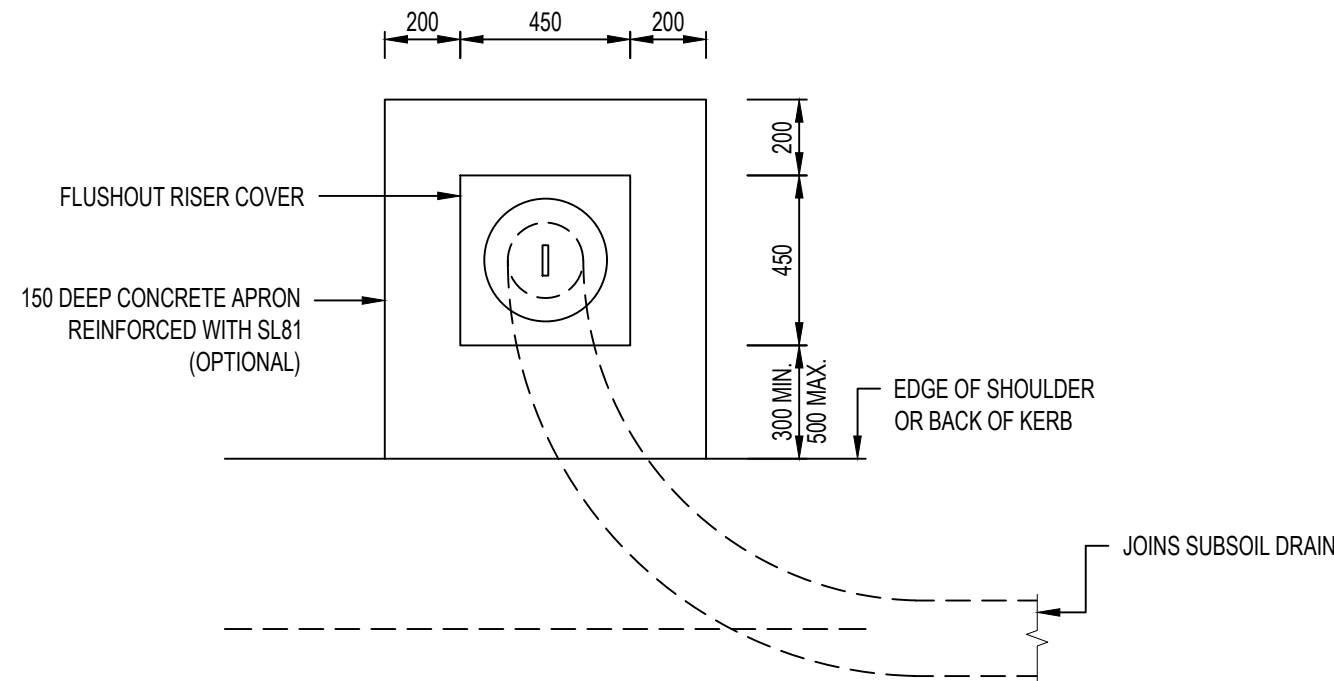
SECTION A - A

NOTES:

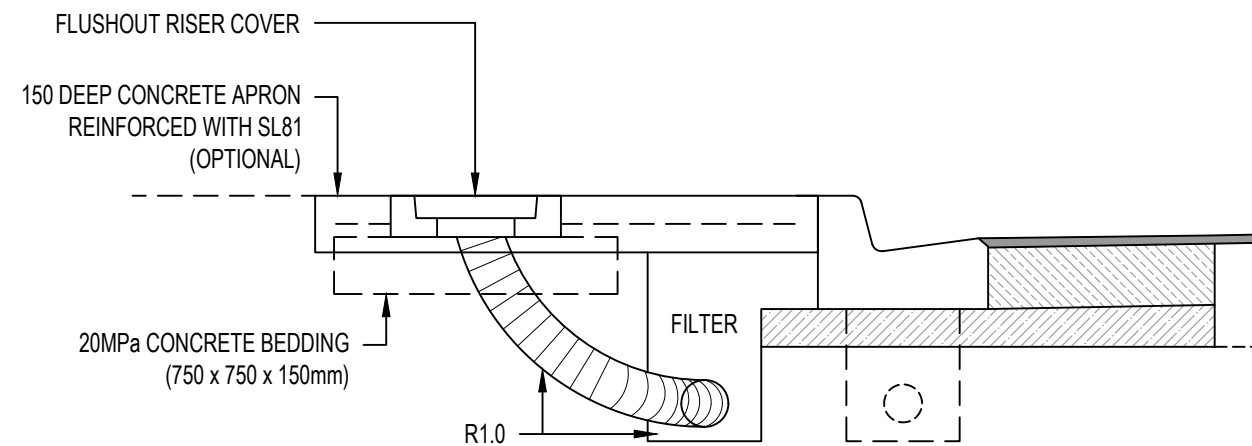
1. MINIMUM COVER TO PIPES TO BE 300mm.
2. ALL STORMWATER PIPES TO BE PVC SN8 (150Ø)
SN6 (100Ø)

ALL MEASUREMENTS IN MILLIMETRES

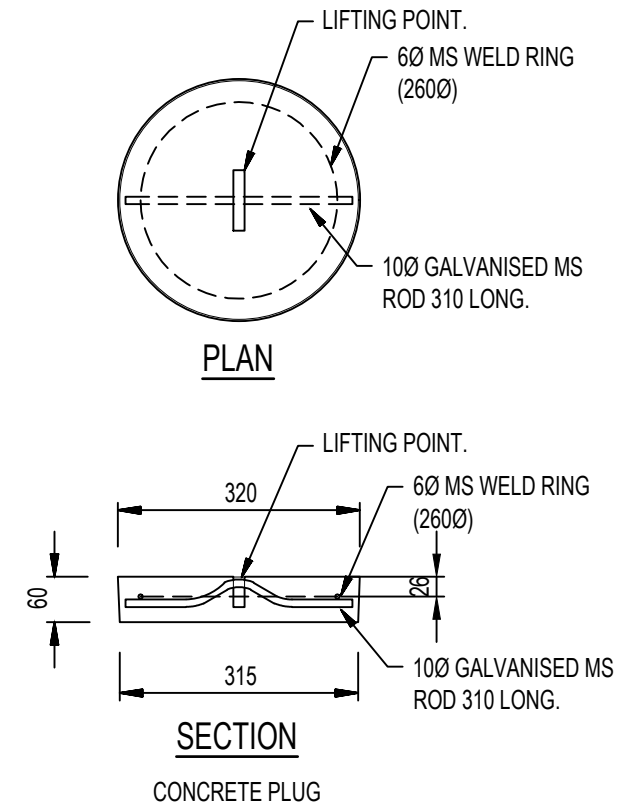
						INFRASTRUCTURE GUIDELINES (SA)	
D	MINOR AMENDMENTS	06.11.2018	AF	AF	MDH	SHEET TITLE STORMWATER ALLOTMENT CONNECTION IN EASEMENT DETAIL	SCALE NTS @ A3
C	MINOR AMENDMENTS	18.07.2017	JZ	JC	DSL		
B	ISSUED FOR REVIEW	10.05.2016	JZ	DL	DSL		
A	ISSUED FOR REVIEW	15.03.2016	JZ	DL	DSL		
REV	DESCRIPTION	DATE	DES	DRW	APP		
THIS PROJECT HAS BEEN ASSISTED BY THE LOCAL GOVERNMENT RESEARCH AND DEVELOPMENT SCHEME AND INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA						DRAWING No.	REV
						SD 390	D



TYPICAL FLUSHOUT RISER PLAN



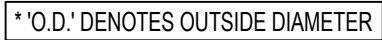
TYPICAL FLUSHOUT RISER SECTION



FLUSHOUT RISER COVER DETAIL

ALL MEASUREMENTS IN MILLIMETRES

						INFRASTRUCTURE GUIDELINES (SA)			
						SHEET TITLE			
						SUBSOIL DRAINAGE FLUSHOUT RISER DETAIL			
B	ISSUED FOR REVIEW	10.05.2016	JZ	DL	DSL			SCALE NTS @ A3	
A	ISSUED FOR REVIEW	15.03.2016	JZ	DL	DSL			DRAWING No.	
REV	DESCRIPTION	DATE	DES	DRW	APP			SD 395	REV B
THIS PROJECT HAS BEEN ASSISTED BY THE LOCAL GOVERNMENT RESEARCH AND DEVELOPMENT SCHEME AND INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA									



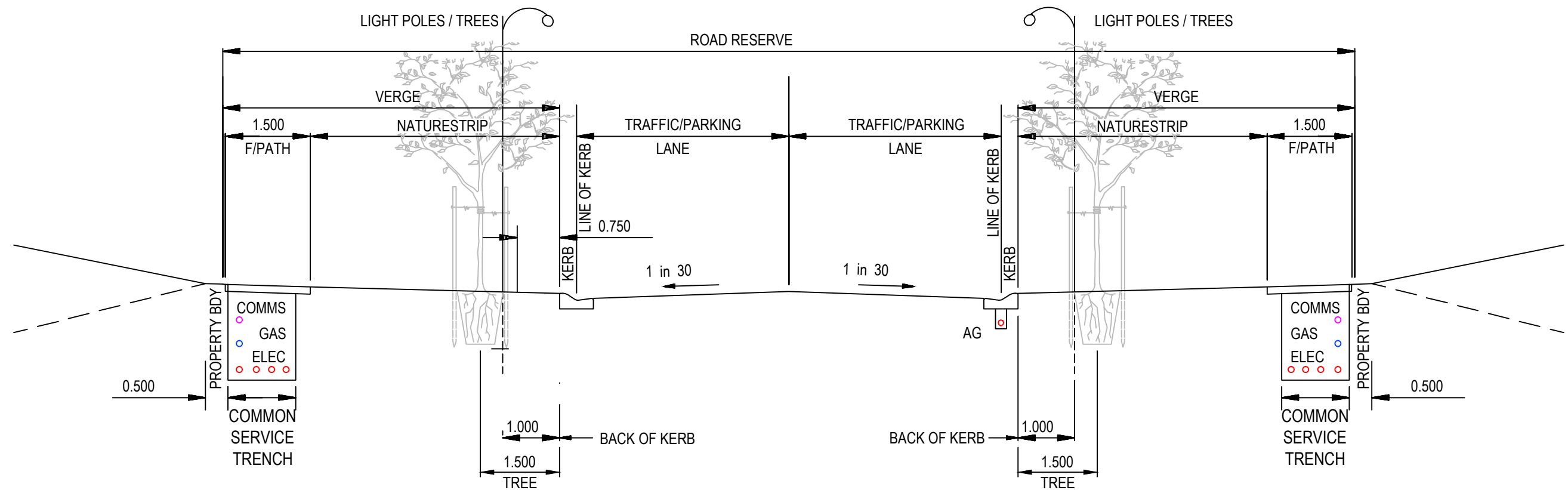
						INFRASTRUCTURE GUIDELINES (SA)		
								SHEET TITLE STORMWATER DRAINAGE PIPE ANCHOR BLOCK
B	ISSUED FOR REVIEW	10.05.2016	JZ	DL	DSL			
A	ISSUED FOR REVIEW	15.03.2016	JZ	DL	DSL			
REV	DESCRIPTION	DATE	DES	DRW	APP			
THIS PROJECT HAS BEEN ASSISTED BY THE LOCAL GOVERNMENT RESEARCH AND DEVELOPMENT SCHEME AND INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA								
						SCALE NTS @ A3		
						DRAWING No. SD 400	REV B	

1. PAVEMENT TO BE DETERMINED BASED ON TRAFFIC LOADING, PAVEMENT MATERIALS AND SUBGRADE STRENGTH.



D	MINOR AMENDMENTS	6.11.2018	AF	AF	MDH
C	MINOR AMENDMENTS	18.07.2017	JZ	JC	DSL
B	ISSUED FOR REVIEW	10.05.2016	JZ	DL	DSL
A	ISSUED FOR REVIEW	15.03.2016	JZ	DL	DSL
REV	DESCRIPTION	DATE	DES	DRW	APP
THIS PROJECT HAS BEEN ASSISTED BY THE LOCAL GOVERNMENT RESEARCH AND DEVELOPMENT SCHEME AND INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA					

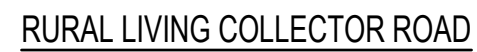
INFRASTRUCTURE GUIDELINES (SA)			
SHEET TITLE TYPICAL ROAD SECTIONS (UNKERBED)			
		SCALE NTS @ A3	
		DRAWING No. SD 500	REV D



TYPICAL CROSS SECTION

ALL MEASUREMENTS IN MILLIMETRES

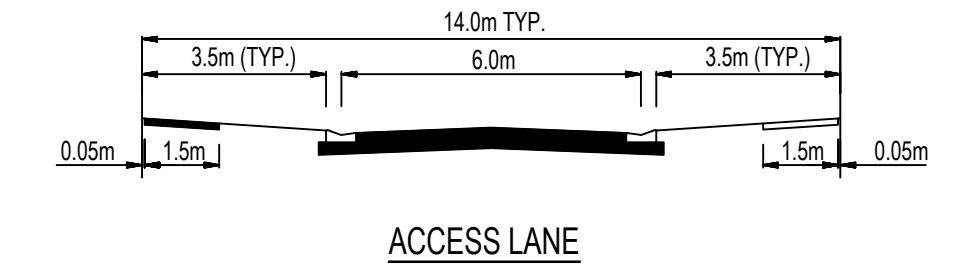
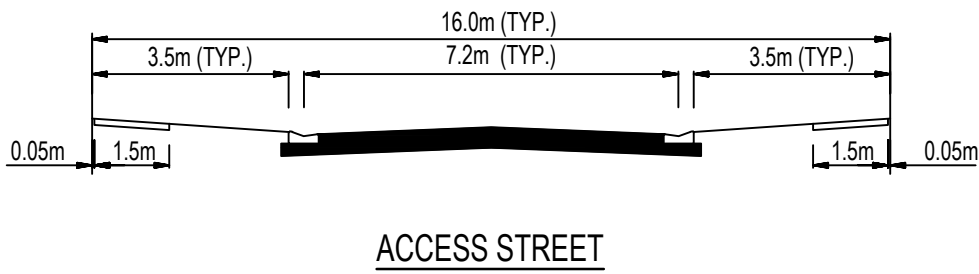
						INFRASTRUCTURE GUIDELINES (SA)			
D	ISSUED FOR REVIEW	06.11.2018	AF	AF	MDH	SHEET TITLE			
C	MINOR AMENDMENTS	18.07.2017	JZ	JC	DSL	TYPICAL ROAD SECTION LAYOUT (KERBED RESIDENTIAL STREET)		SCALE	
B	ISSUED FOR REVIEW	10.05.2016	JZ	DL	DSL			NTS @ A3	
A	ISSUED FOR REVIEW	15.03.2016	JZ	DL	DSL			DRAWING No.	
REV	DESCRIPTION	DATE	DES	DRW	APP			REV	
THIS PROJECT HAS BEEN ASSISTED BY THE LOCAL GOVERNMENT RESEARCH AND DEVELOPMENT SCHEME AND INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA								SD 505	
								D	



						INFRASTRUCTURE GUIDELINES (SA)	
						SHEET TITLE TYPICAL ROAD PROFILES RURAL LIVING & LOW DENSITY RESIDENTIAL AREAS	
B	ISSUED FOR REVIEW	10.05.2016	JZ	DL	DSL		
A	ISSUED FOR REVIEW	15.03.2016	JZ	DL	DSL		
REV	DESCRIPTION	DATE	DES	DRW	APP		
THIS PROJECT HAS BEEN ASSISTED BY THE LOCAL GOVERNMENT RESEARCH AND DEVELOPMENT SCHEME AND INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA							
						SCALE NTS @ A3	
						DRAWING No. SD 510	REV B

NOTES:

1.
- COLLECTOR ROADS AND HIGHER ORDER ROADS TO BE DESIGNED BASED ON TRAFFIC REQUIREMENTS INCLUDING BUS, TRAM, PEDESTRIANS AND CYCLISTS.
2.
- DIMENSIONS NOTED ARE TYPICAL, REFER GUIDELINE DOCUMENT FOR DEEMED TO COMPLY MINIMUM ROAD CARRIAGE WAY AND MINIMUM ROAD RESERVE WIDTHS.



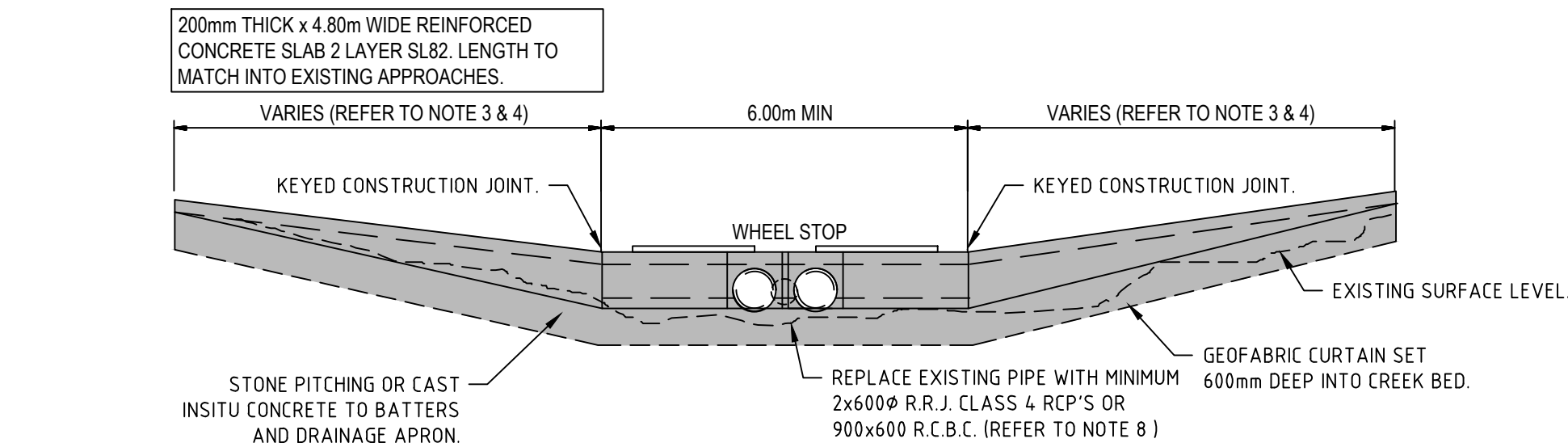
ALL MEASUREMENTS IN MILLIMETRES

						INFRASTRUCTURE GUIDELINES (SA)			
C	MINOR AMENDMENTS	18.07.2017	JZ	JC	DSL	SHEET TITLE TYPICAL ROAD SECTIONS URBAN AREAS			
B	ISSUED FOR REVIEW	10.05.2016	JZ	DL	DSL				
A	ISSUED FOR REVIEW	15.03.2016	JZ	DL	DSL				
REV	DESCRIPTION	DATE	DES	DRW	APP			SCALE NTS @ A3	
THIS PROJECT HAS BEEN ASSISTED BY THE LOCAL GOVERNMENT RESEARCH AND DEVELOPMENT SCHEME AND INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA								DRAWING No. SD 515	REV C

1. COLLECTOR ROADS AND HIGHER ORDER ROADS TO BE DESIGNED BASED ON TRAFFIC REQUIREMENTS INCLUDING BUS, TRAM, PEDESTRIANS AND CYCLISTS.
2. DIMENSIONS NOTED ARE TYPICAL, REFER GUIDELINE DOCUMENT FOR DEEMED TO COMPLY MINIMUM ROAD CARRIAGE WAY AND MINIMUM ROAD RESERVE WIDTHS.

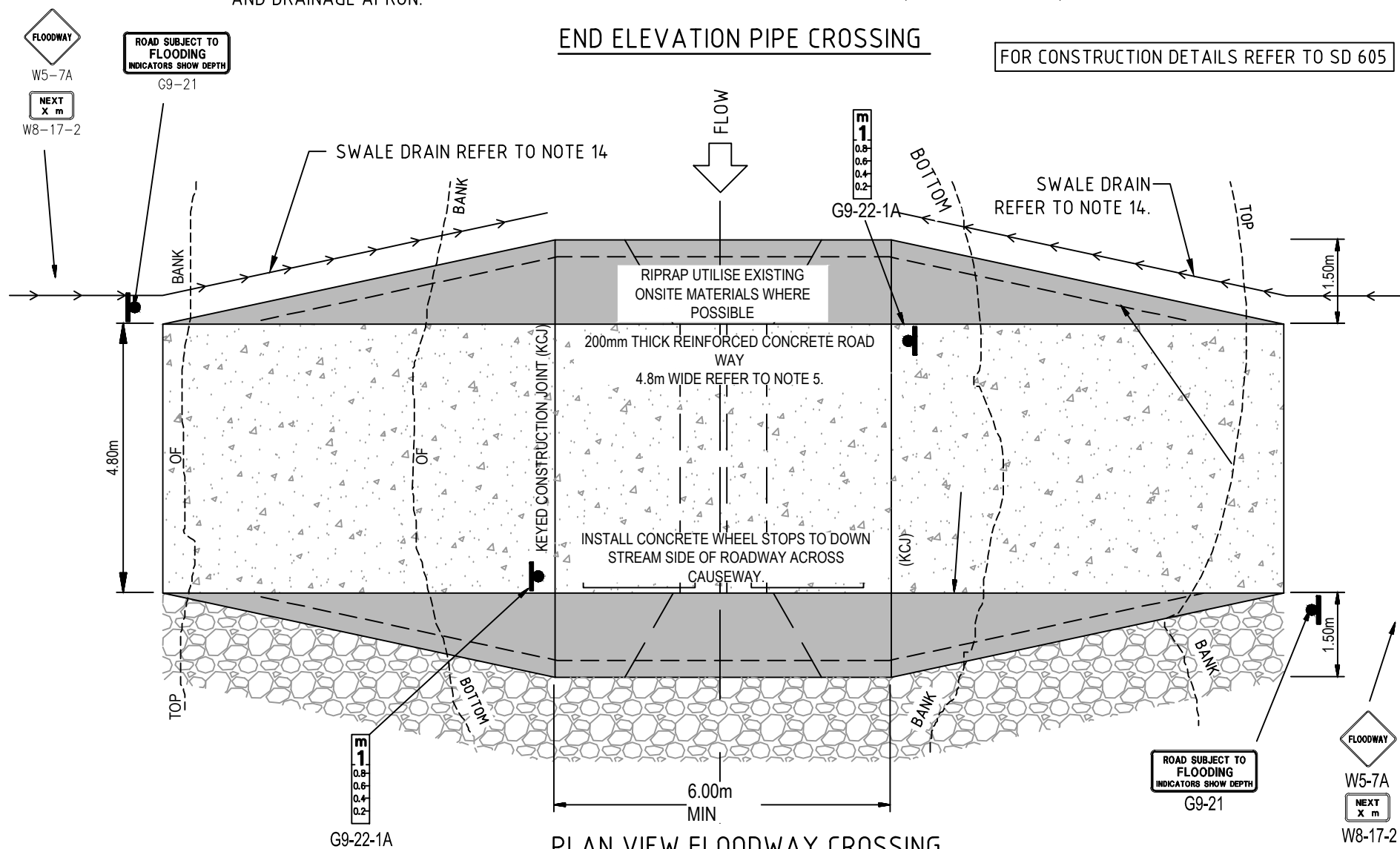


						INFRASTRUCTURE GUIDELINES (SA)			
C	MINOR AMENDMENTS	18.07.2017	JZ	JC	DSL	SHEET TITLE TYPICAL ROAD PROFILES COMMERCIAL STREET / INDUSTRIAL STREET		SCALE NTS @ A3	
B	ISSUED FOR REVIEW	10.05.2016	JZ	DL	DSL				
A	ISSUED FOR REVIEW	15.03.2016	JZ	DL	DSL				
REV	DESCRIPTION	DATE	DES	DRW	APP			DRAWING No.	REV
THIS PROJECT HAS BEEN ASSISTED BY THE LOCAL GOVERNMENT RESEARCH AND DEVELOPMENT SCHEME AND INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA								SD 520	C



END ELEVATION PIPE CROSSING

FOR CONSTRUCTION DETAILS REFER TO SD 605



PLAN VIEW FLOODWAY CROSSING

NOTES

- DETAILS ARE FOR THE UPGRADING/RECONSTRUCTION OF AN EXISTING FLOODWAY ON A ONE LANE RURAL ROAD ONLY. DETAILS ARE NOT TO BE USED FOR NEW CONSTRUCTION UNLESS APPROVED BY COUNCILS ENGINEER.
- THESE FLOODWAY DETAILS PERTAIN TO A 90° ROAD CROSSING. WHERE AT SKEWED CROSSING IS REQUIRED THE GENERAL ARRANGEMENTS MAY BE MODIFIED TO SUIT.
- FLOODWAY IS DESIGNED TO CATER FOR Q10 FLOWS < 5m³/s. WITH AN ASSUMED DOWN STREAM STANDING WATER LEVEL OF 150mm ABOVE INVERT LEVEL AND MAY NOT SUIT ALL SITES. SITE APPROVAL IS TO BE OBTAINED FROM THE MANAGER PROJECT MANAGEMENT AND CONSTRUCTION PRIOR TO COMMENCING CONSTRUCTION.
- ROADWAY APPROACHES FLOODWAY:-
 - DESIGN AND CONSTRUCT IN ACCORDANCE WITH AUSTRROADS 'GUIDE TO ROAD DESIGN' PART 3 - GEOMETRIC DESIGN AND TO THE SATISFACTION OF THE SITE SUPERVISOR/CONTRACT MANAGER.
 - CAUSEWAY AND APPROACHES ARE TO BE 200mm THICK REINFORCED CONCRETE WITH SL82 MESH TOP & BOTTOM (75mm BOTTOM COVER) WITH CONSTRUCTION JOINTS AT 5m CENTRES (MAX) OR OTHERWISE SHOWN. CONCRETE TO BE N32 CURED FOR 7 DAYS WHERE A SIDE ROAD IS CONSTRUCTED OR N50 CURED FOR 12 HOURS WHERE A SIDE TRACK IS NOT CONSTRUCTED.
 - APPROACH GRADES ARE TO BE 1:20 MAX. MATCHING INTO EXISTING ROAD LEVELS. LENGTH OF CAUSE WAY APPROACHES ARE TO BE DETERMINED ON SITE BY THE SITE SUPERINTENDENT AND TO MATCH INTO EXISTING ROAD LEVELS AT THE TOP OF THE BANKS.
- SIGN POSTING:-
 - FLOODWAY
 - NEXT... km (W8-17-2)
 - ROAD SUBJECT TO FLOODING - INDICATORS SHOWN DEPTH (G9-21)
 - DEPTH INDICATOR - (G9-22)
 - GUIDE POSTS, WARNING SIGNS AND DEPTH INDICATORS ARE TO BE INSTALLED AS PER THE MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES.
- TEMPORARY CONSTRUCTION OF SIDE ROADS ARE TO BE DETERMINED ON SITE BY THE SITE SUPERINTENDENT.
- CULVERT CROSSING IS TO BE RECONSTRUCTED TO MATCH INTO EXISTING LEVELS. CLEAR AND RESHAPE CREEK BED WHERE REQUIRED.
- BOX CULVERT PREFERRED FOR PERMANENT STREAM WHERE FISH PASSAGE IS REQUIRED
- RIPRAP AND ROCK PITCH TO UTILISE EXISTING MATERIAL ON SITE WHERE POSSIBLE. RIPRAP TO BE SELECTED ANGULAR ROCKS WELL GRADE D50 300mm ROCKS PLACED 450mm DEEP. AREA, SIZE AND LOCATION TO BE DETERMINED ON SITE BY THE SITE SUPERINTENDENT.
- BATTER TREATMENT, CULVERT HEADWALL AND APRON TO BE KEYED 600mm INTO CREEK BED. BATTERS TO BE SHAPED TO MATCH INTO EXISTING CREEK CHANNEL
- ROCK PITCHING TO BATTERS AND PIPE SURROUND SHAPE PITCHING TO MATCH INTO CREEK FLOOR CHANNEL CAPACITY. PRECAST HEADWALLS OR CONCRETE CAST INSITU 150mm THICK (NOM.) MAY ALSO BE USED.
- ROCK PITCHING ORDER OF WORKS:-
 - PLACE GEOFABRIC AND INSERT APRON ENDS 600mm MIN. INTO NATURAL MATERIAL.
 - PLACE ROCK/STONE ON GEOFABRIC.
 - APPLY CONCRETE TO ROCK SURFACES AND CREVICES
 - WASH LATENT FROM ROCK SURFACES.
- GEOFABRIC TO BE NON WOVEN BIDIM A24 OR EQUIVALENT MEETING STRENGTH AND PERMEABILITY REQUIREMENTS REQUIREMENTS.
- ADJOINING ROAD SWALE DRAINS ARE TO BE CLEANED AND RESHAPED TO SUIT.

SWALE DRAIN TREATMENT

SWALE DRAIN	TREATMENT
0.4%-2%	CONCRETE LINED
2%-5%	GRASS LINED
5%-10%	ROCK LINED
10% OR GREAT	CONCRETE LINED

- SELECT FILL TO BE PM2/20 OG/QR COMPACTED TO 96% MODIFIED (ONE (1) TEST EACH SIDE OF CULVERT).
- INSTALL 150mm HIGH WHEEL STOPS TO DOWN STREAM SIDE OF ROADWAY ONLY ACROSS CAUSEWAY AT 1.0m SPACING.

E	MINOR AMENDMENTS	6.11.2018	AF	AF	MDH
D	MINOR AMENDMENTS	18.07.2017	JZ	JC	DSL
C	ISSUED FOR REVIEW	10.06.2016	JZ	DL	DSL
B	ISSUED FOR REVIEW	10.05.2016	JZ	DL	DSL
A	ISSUED FOR REVIEW	15.03.2016	JZ	DL	DSL
REV	DESCRIPTION	DATE	DES	DRW	APP
THIS PROJECT HAS BEEN ASSISTED BY THE LOCAL GOVERNMENT RESEARCH AND DEVELOPMENT SCHEME AND INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA					

INFRASTRUCTURE GUIDELINES (SA)

SHEET TITLE

FLOODWAY - GENERAL ARRANGEMENT LOW VOLUME RURAL ROADS

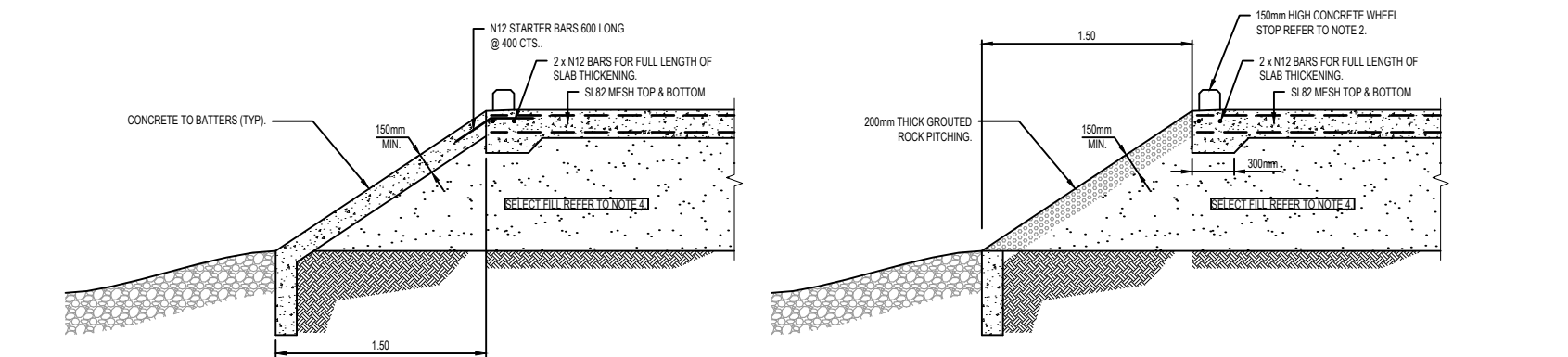
SCALE
NTS @ A3

DRAWING No.

SD 600

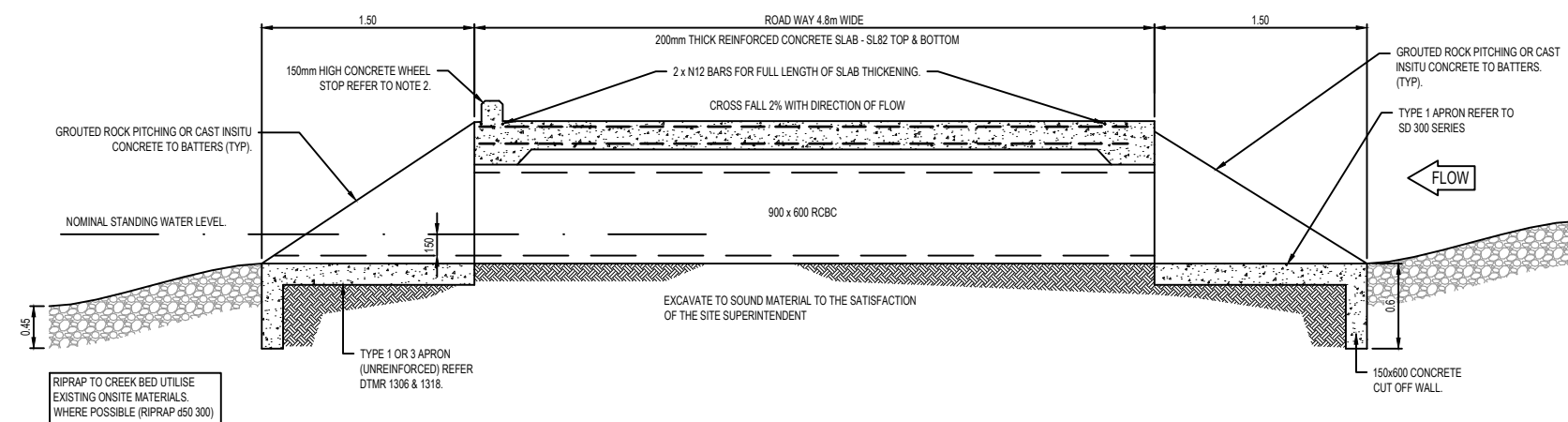
REV

E

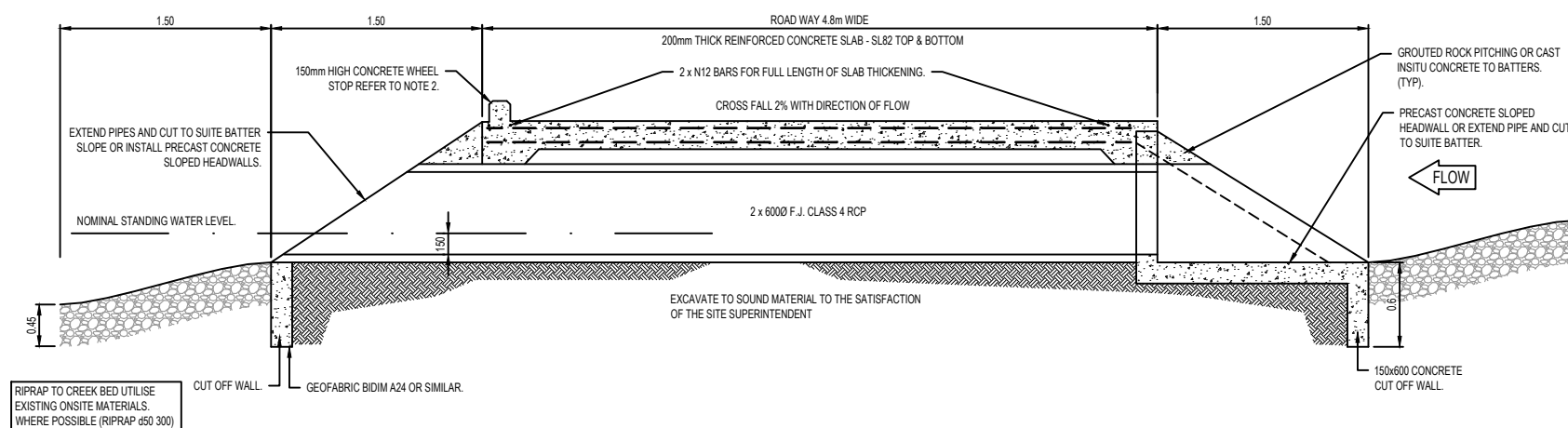


CONCRETE BATTER TREATMENT

CONCRETE BATTER TREATMENT



TYPICAL RCBC CROSS SECTION



TYPICAL PIPED CROSS SECTION

NOTES

- FOR GENERAL ARRANGEMENT OF FLOODWAY AND STANDARD NOTES REFER TO SD 600
- INSTALL 150mm HIGH WHEEL STOPS TO DOWN STREAM SIDE OF ROADWAY ONLY, ACROSS CAUSEWAY AT 1.0m SPACING.
- END TREATMENT OPTIONS:- i) ROCK PITCHING. ii) REINFORCED CONCRETE 150mm THICK SL82. iii) SLOPED 600Ø HEADWALLS. iv) EXTEND PIPES AND CUT AT ANGLE TO MATCH EXISTING BATTER SLOPE.
- SELECT FILL TO BE PM2/20 OG/QR COMPACTED TO 96% MODIFIED (ONE (1) TEST EACH SIDE OF FLOODWAY)

ALL MEASUREMENTS IN MILLIMETRES

B	ISSUED FOR REVIEW	10.05.2016	JZ	DL	DSL
A	ISSUED FOR REVIEW	15.03.2016	JZ	DL	DSL
REV	DESCRIPTION	DATE	DES	DRW	APP
THIS PROJECT HAS BEEN ASSISTED BY THE LOCAL GOVERNMENT RESEARCH AND DEVELOPMENT SCHEME AND INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA					

INFRASTRUCTURE GUIDELINES (SA)

SHEET TITLE

FLOODWAY - DETAILS

LOW VOLUME RURAL ROADS

SCALE

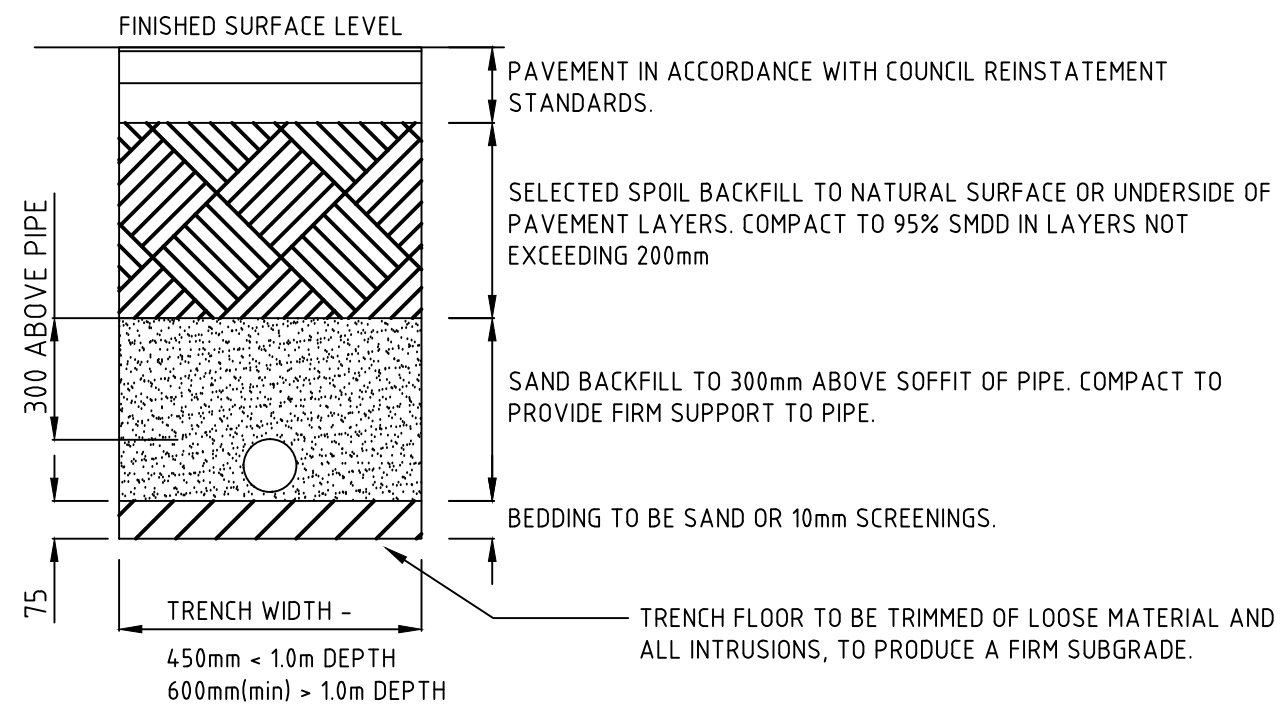
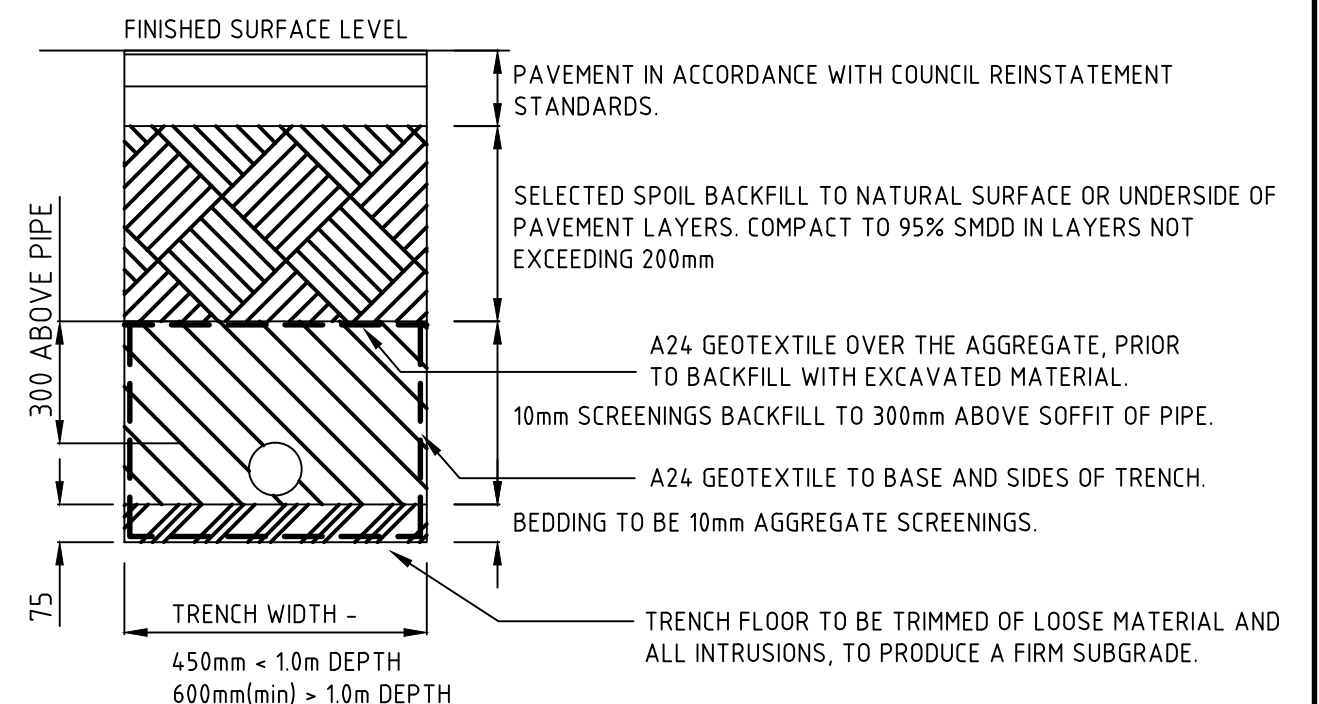
NTS @ A3

DRAWING No.

SD 605

REV

B



- NOTES:
1. PIPES TO BE LOCATED CENTRALLY IN TRENCH
 2. TRENCH BASE TO BE FIRM AND TO HAVE CONSTANT GRADE.
 3. UNEVEN TRENCHES ARE NOT ACCEPTABLE.
 4. DEWATER TRENCH DURING CONSTRUCTION.

ALL MEASUREMENTS IN MILLIMETRES

						INFRASTRUCTURE GUIDELINES (SA)		
								SHEET TITLE TRENCH AND BACKFILL DETAILS CWMS
B	MINOR AMENDMENTS	06.11.2018	AF	AF	MDH			
A	MINOR AMENDMENTS	18.07.2017	JZ	JC	DSL			
REV	DESCRIPTION	DATE	DES	DRW	APP	SCALE NTS @ A3	DRAWING No. SD 700	
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I.P. INSPECTION POINT

F.P. FLUSHING POINT



1. REFER CWMS DESIGN DRAWINGS FOR I.P. LOCATIONS OTHER THAN SHOWN ABOVE.

						INFRASTRUCTURE GUIDELINES (SA)	SHEET TITLE		
B	MINOR AMENDMENTS	06.11.2018	AF	AF	MDH			DRAWING No.	REV
A	MINOR AMENDMENTS	18.07.2017	JZ	JC	DSL				
REV	DESCRIPTION	DATE	DES	DRW	APP				
THIS PROJECT HAS BEEN ASSISTED BY THE LOCAL GOVERNMENT RESEARCH AND DEVELOPMENT SCHEME AND INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA									

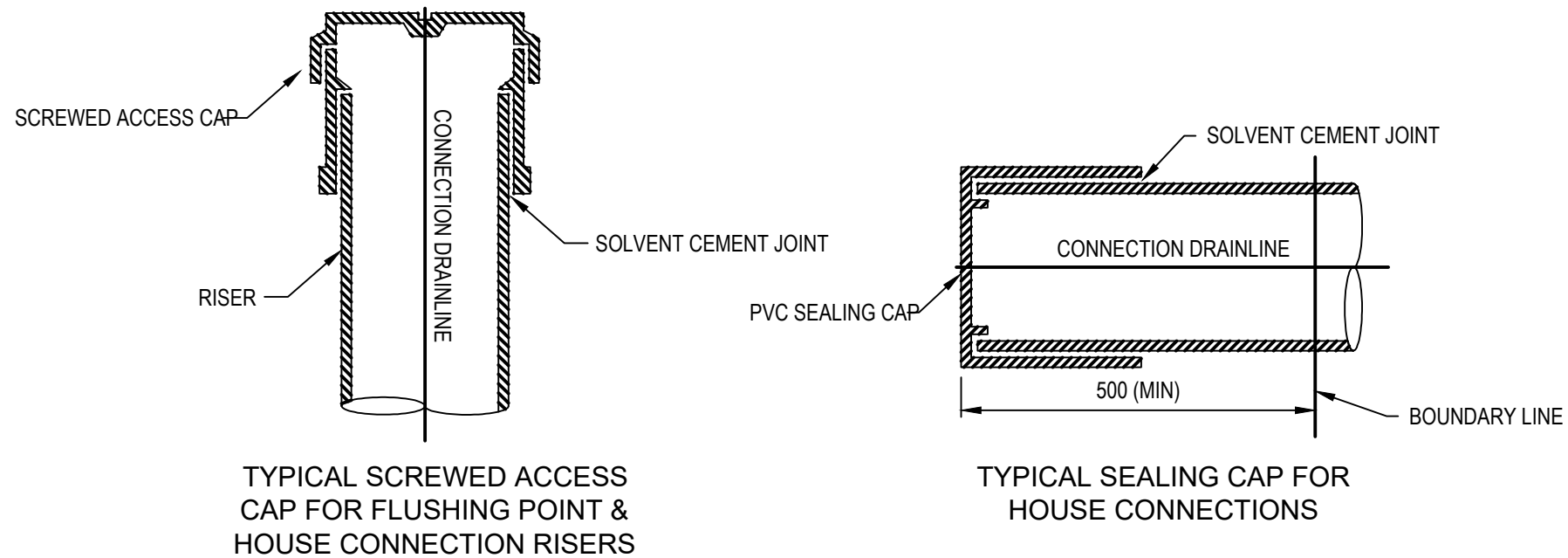


I.P. INSPECTION POINT

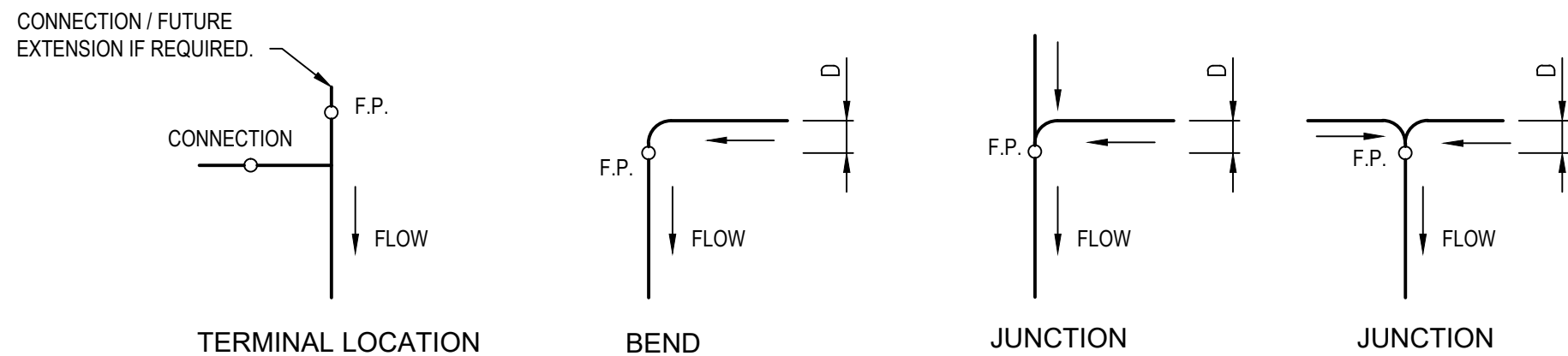
F.P. FLUSHING POINT

1. CHECK INVERT OF NEW CONNECTION IS SUFFICIENTLY DEEP TO SERVICE THE ALLOTMENT.
IF TOO SHALLOW A NEW CONNECTION TO THE MAIN DRAIN WILL BE REQUIRED
2. WHERE CONNECTION EXCEEDS 10m A NEW CONNECTION TO THE MAIN IS REQUIRED.

						INFRASTRUCTURE GUIDELINES (SA) SHEET TITLE 'Y' CONNECTION OFF AN EXISTING CONNECTION - CWMS		
B	MINOR AMENDMENTS	06.11.2018	AF	AF	MDH		SCALE NTS @ A3	
A	MINOR AMENDMENTS	18.07.2017	JZ	JC	DSL		DRAWING No. SD 715	
REV	DESCRIPTION	DATE	DES	DRW	APP		REV A	
THIS PROJECT HAS BEEN ASSISTED BY THE LOCAL GOVERNMENT RESEARCH AND DEVELOPMENT SCHEME AND INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA								



UPVC SEALING CAP DETAILS

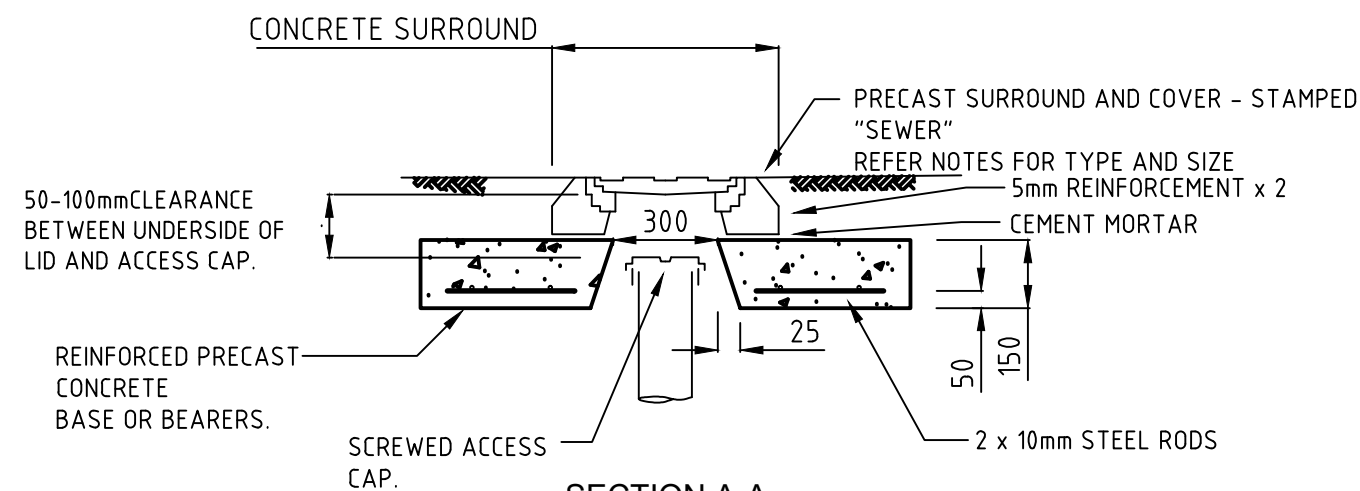
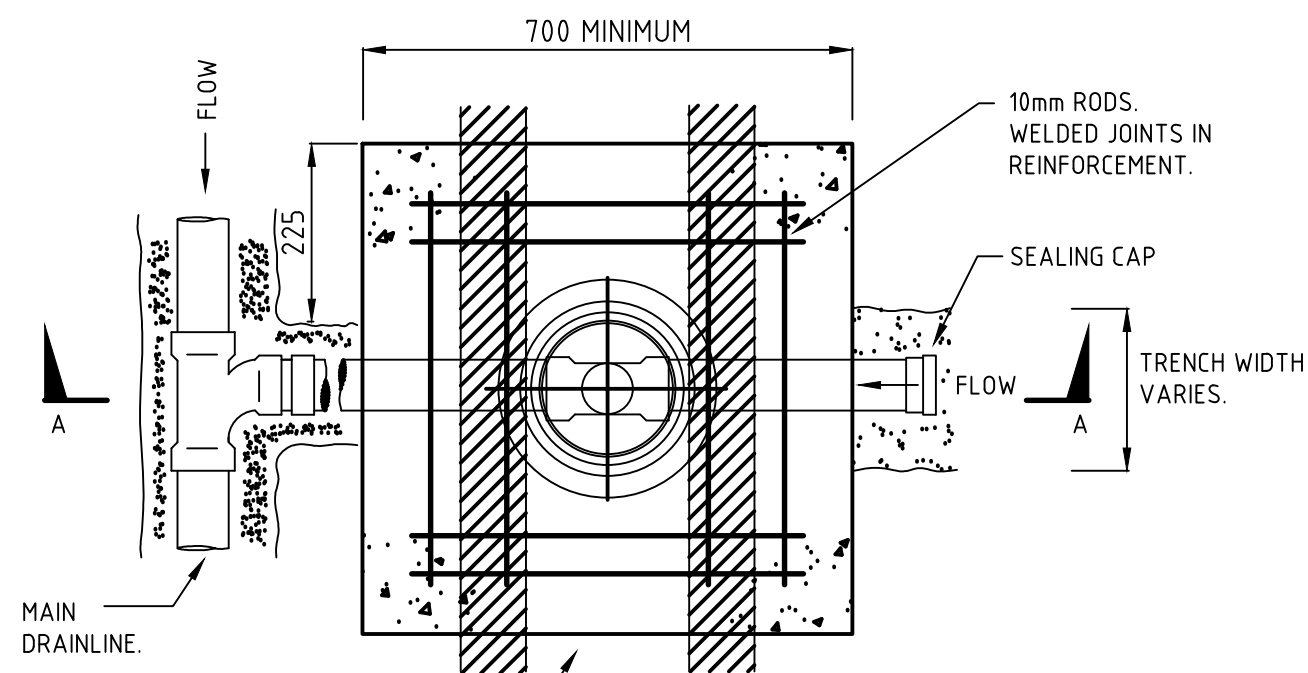


IN LINE FLUSHING POINT LOCATIONS

PIPE DIAMETER	OFFSET 'D'
Ø100mm	500mm
Ø150mm	600mm
Ø225mm	800mm

ALL MEASUREMENTS IN MILLIMETRES

						INFRASTRUCTURE GUIDELINES (SA)			
						SHEET TITLE			
						SEALING CAP DETAILS AND IN LINE FLUSHING POINT LOCATIONS CWMS			
B	MINOR AMENDMENTS	6.11.2018	AF	AF	MDH			SCALE NTS @ A3	
A	MINOR AMENDMENTS	18.07.2017	JZ	JC	DSL				
REV	DESCRIPTION	DATE	DES	DRW	APP			DRAWING No.	REV
THIS PROJECT HAS BEEN ASSISTED BY THE LOCAL GOVERNMENT RESEARCH AND DEVELOPMENT SCHEME AND INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA								SD 720	B



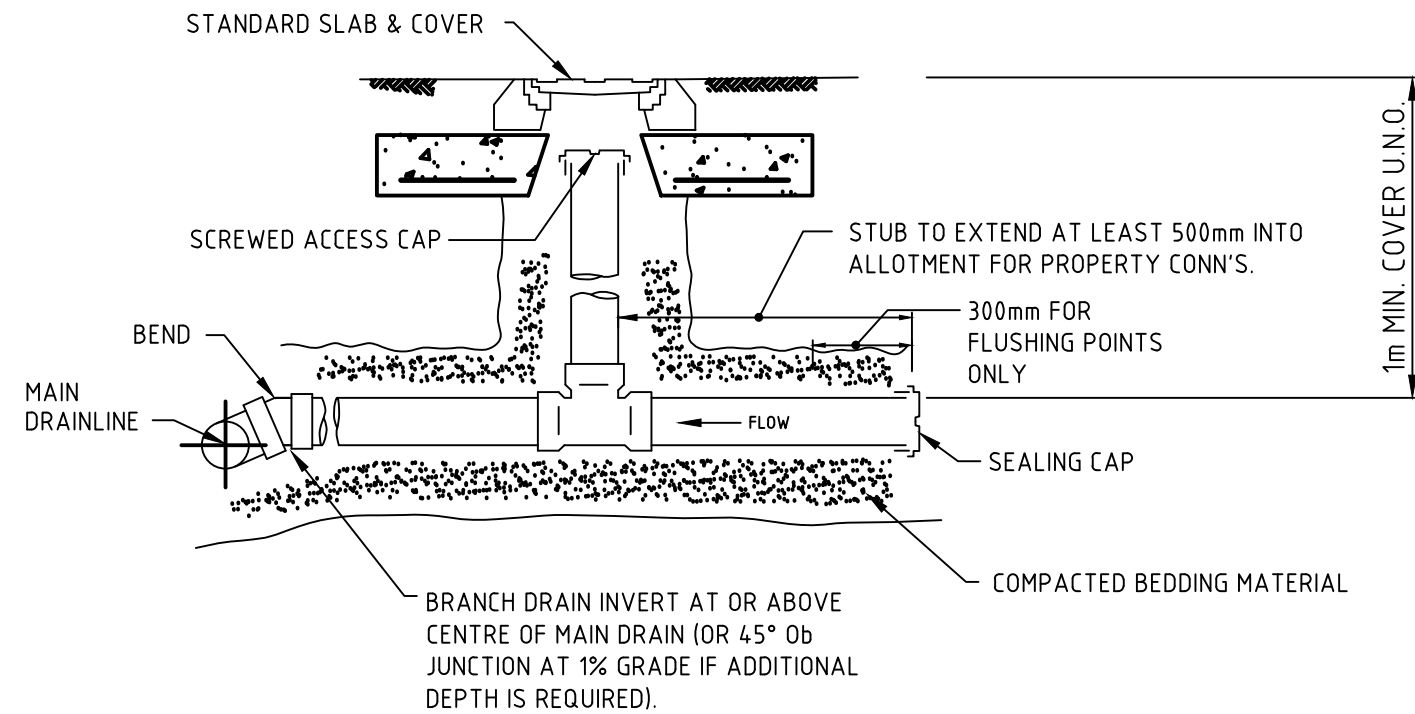
REINFORCED PRECAST CONCRETE BASE.
WHERE THE F.P. BASE IS INSTALLED IN THE
ADJOINING ALLOTMENT, ROADWAY OR
FOOTPATH, THE CONNECTION SHALL BE
EXTENDED AT LEAST 500mm INTO THE
ALLOTMENT BEING PROVIDED WITH THE
CONNECTION.

NOTES:

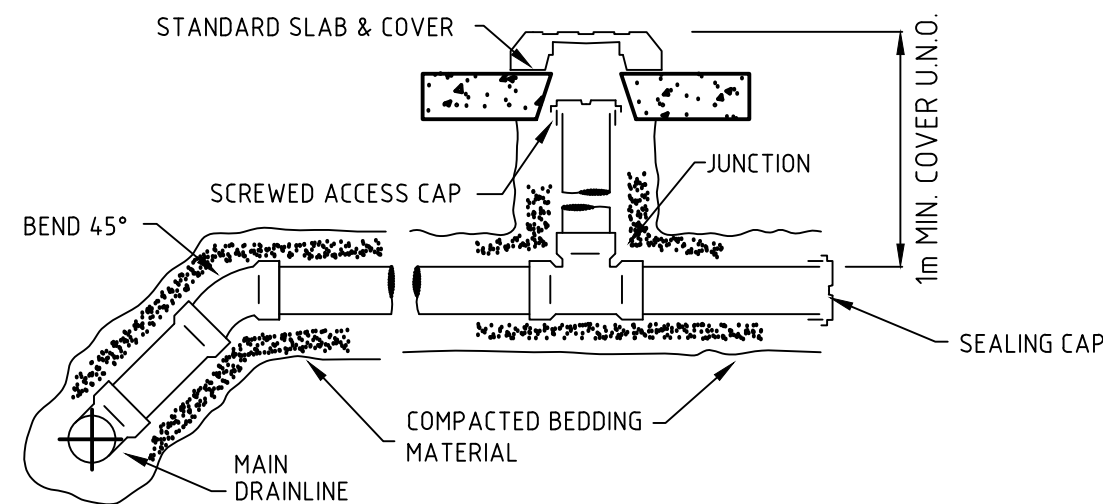
1. "TYPE 1" SLAB AND COVER TO BE USED IN ROADS, ROAD RESERVES AND ALL TRAFFICABLE AREAS.
2. "TYPE 2" SLAB AND COVER TO BE USED IN REAR OF ALLOTMENT ONLY - NON TRAFFICABLE AREAS.
3. ALL ON LINE FLUSHING POINTS & ALLOTMENT CONNECTION I.P.s "TYPE 1" TO HAVE PRECAST CONCRETE BASE.
4. USE 100X100X1000 LONG PERMAPINE OR EQUIVALENT BEARERS IN LIEU OF CONCRETE BASE FOR ALLOTMENT CONNECTION I.P.s "TYPE 2". BEARERS TO SPAN PERPENDICULAR TO TRENCH AND BE FOUNDED MIN. 200mm ONTO FIRM SOIL.
5. CAST IRON COVER SIZE TO BE 150mm FOR $\phi 100$ mm RISER AND 230mm FOR $\phi 150$ mm RISER

ALL MEASUREMENTS IN MILLIMETRES

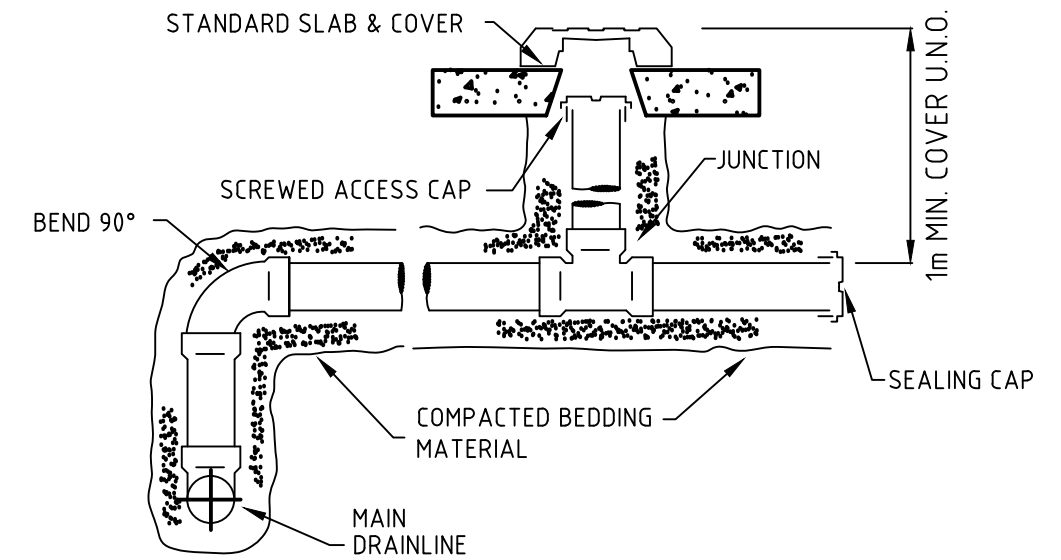
						INFRASTRUCTURE GUIDELINES (SA)			
						SHEET TITLE			
						TYPICAL CONNECTION AND FLUSHING POINT COVER DETAILS CWMS			
B	MINOR AMENDMENTS	6.11.2018	AF	AF	MDH			SCALE	
A	MINOR AMENDMENTS	18.07.2017	JZ	JC	DSL			NTS @ A3	
REV	DESCRIPTION	DATE	DES	DRW	APP			DRAWING No.	REV
THIS PROJECT HAS BEEN ASSISTED BY THE LOCAL GOVERNMENT RESEARCH AND DEVELOPMENT SCHEME AND INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA								SD 725	B



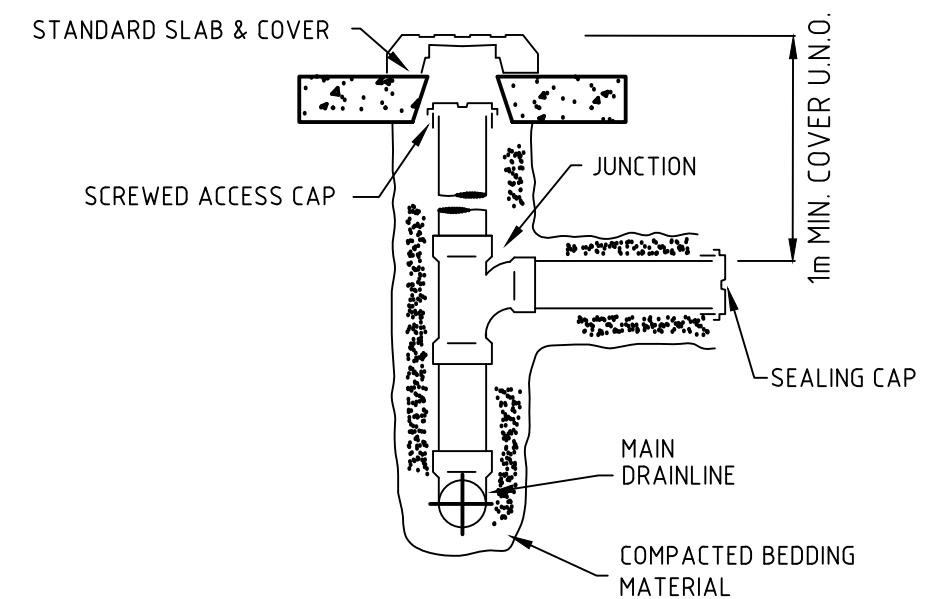
ELEVATION



[A] (CONNECTION ONLY)



[B] (CONNECTION ONLY)

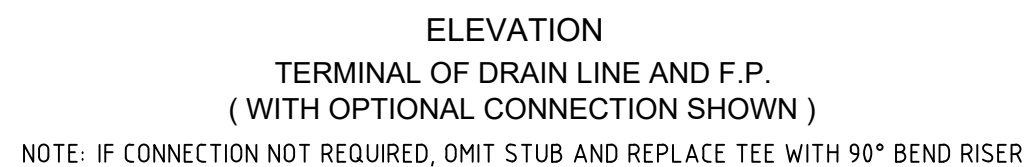


[C] (FP OR CONNECTION)

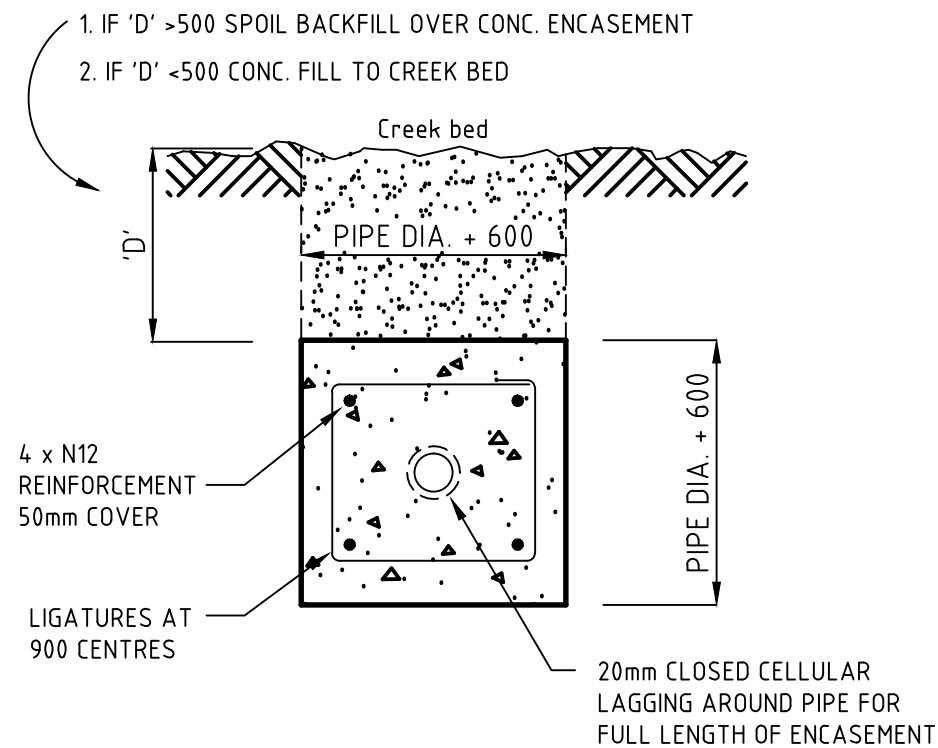
ALL MEASUREMENTS IN MILLIMETRES

REV	DESCRIPTION	DATE	DES	DRW	APP
B	MINOR AMENDMENTS	06.11.2018	AF	AF	MDH
A	MINOR AMENDMENTS	18.07.2017	JZ	JC	DSL
THIS PROJECT HAS BEEN ASSISTED BY THE LOCAL GOVERNMENT RESEARCH AND DEVELOPMENT SCHEME AND INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA					

INFRASTRUCTURE GUIDELINES (SA)			
SHEET TITLE FLUSHING POINT OR MAXIMUM DEPTH CONNECTIONS - CWMS			
		SCALE NTS @ A3	
		DRAWING No. SD 730	REV B



						INFRASTRUCTURE GUIDELINES (SA)	SHEET TITLE TERMINAL OF DRAIN LINE & FLUSHING POINT - CWMS		
B	MINOR AMENDMENTS	06.11.2018	AF	AF	MDH			SCALE NTS @ A3	
A	MINOR AMENDMENTS	18.07.2017	JZ	JC	DSL			DRAWING No. SD 735	
REV	DESCRIPTION	DATE	DES	DRW	APP			REV B	
THIS PROJECT HAS BEEN ASSISTED BY THE LOCAL GOVERNMENT RESEARCH AND DEVELOPMENT SCHEME AND INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA									



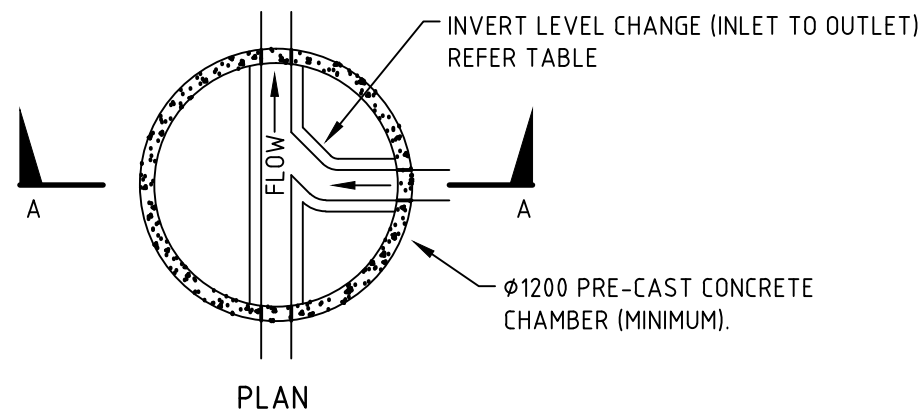
TYPICAL CONCRETE ENCASEMENT OF DRAIN
OR RISING MAIN THROUGH CREEKS

NOTES:

1. CONCRETE ENCASEMENT TO EXTEND 1m EACH SIDE OF INVERT OF CREEK.
2. SUPPORT PIPE DURING CONSTRUCTION TO MAINTAIN GRADE.

ALL MEASUREMENTS IN MILLIMETRES

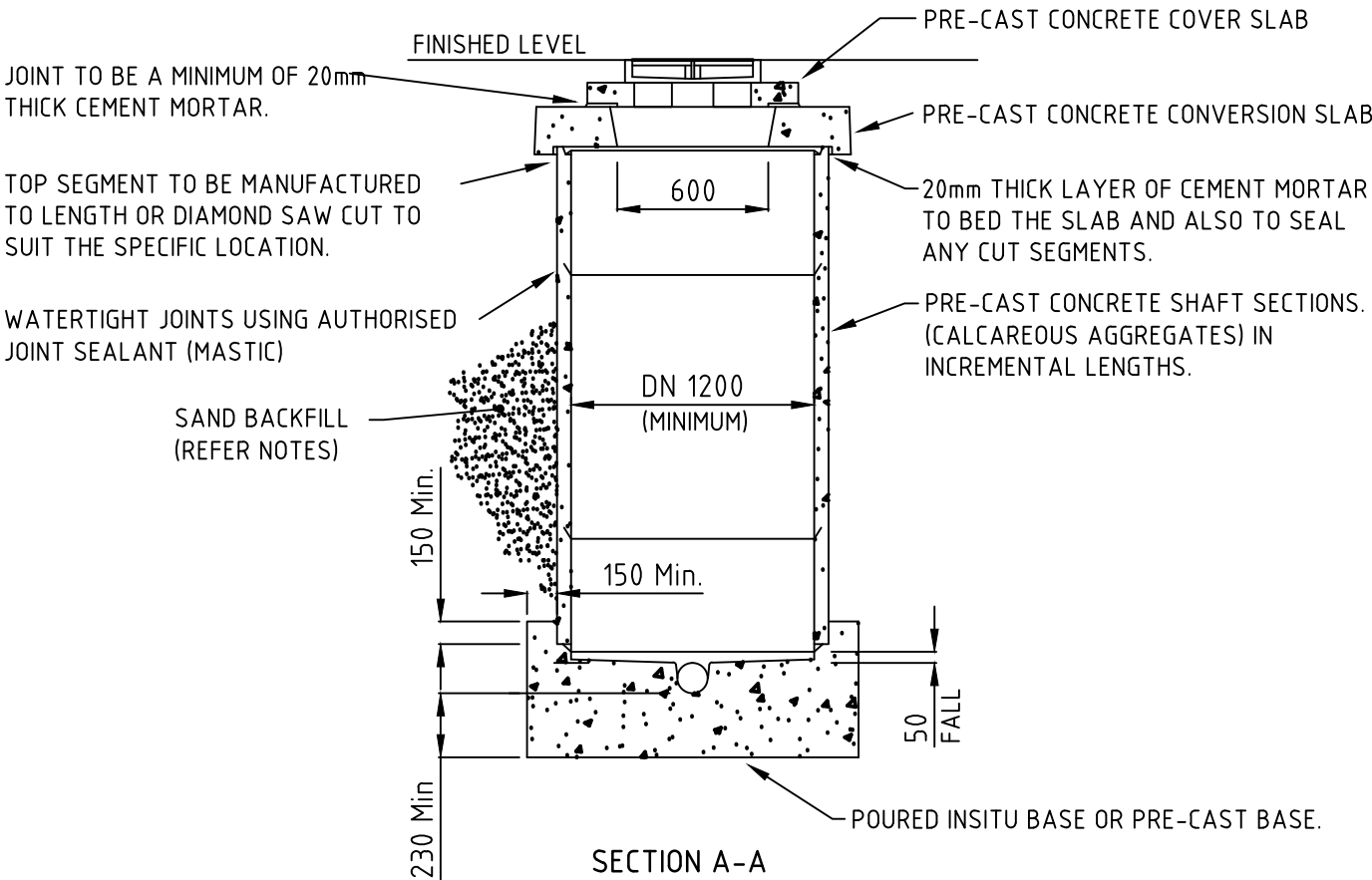
						INFRASTRUCTURE GUIDELINES (SA)	SCALE NTS @ A3 DRAWING No. SD 740 REV B	
						SHEET TITLE		
						TYPICAL CONCRETE ENCASEMENT OF DRAIN OR RISING MAIN THROUGH CREEKS - CWMS		
B	MINOR AMENDMENTS	6.11.2018	AF	AF	MDH			
A	MINOR AMENDMENTS	18.07.2017	JZ	JC	DSL			
REV	DESCRIPTION	DATE	DES	DRW	APP			
THIS PROJECT HAS BEEN ASSISTED BY THE LOCAL GOVERNMENT RESEARCH AND DEVELOPMENT SCHEME AND INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA								



INVERT LEVEL CHANGE ACROSS MANHOLES	
CHANGE IN FLOW DIRECTION	MINIMUM FALL ACROSS PIT
STRAIGHT THROUGH OR FOR BENDS <45°	MAINTAIN PIPE GRADE
FOR BENDS 45° TO 90°	30mm
FOR BENDS > 90°	60mm

NOTES: WHERE PIPE DIAMETER CHANGES ACROSS MANHOLE - MATCH OBVERT LEVEL OF PIPES

- NOTE:
- CAST IRON LID & FRAME WITH "GATIC" TYPE LIFTING LUGS. OR SIMILAR APPROVED - CLASS 'D'.
 - C.I. COVER AND FRAME TO BE A MATCHING SET WITH PRE-CAST CONCRETE COVER SLAB.
 - LID TO BE STAMPED "SEWER".



- NOTES:
1. CONCRETE TO BE 32Mpa SULPHATE RESISTANT.
 2. LIFTING HOLES AND OTHER PERFORATIONS IN CHAMBER WALL TO BE FILLED WITH EPOXY GROUT.
 3. SAND SHALL BE APPROVED CLEAN PIT SAND. FREE FROM CLAY, ROCKS, LOAM & VEGETABLE MATTER AND SHALL BE COMPACTED TO 95% STANDARD COMPACTION.
 4. SCREENINGS TO BE USED WHERE GROUNDWATER IS EVIDENT.
 5. M.H./A.C. TO BE DESIGNED FOR UPLIFT IF REQUIRED.
 6. UNLESS VARIED BY THE ABOVE NOTES, REFER TO S.A.WATER REQUIREMENTS.

ALL MEASUREMENTS IN MILLIMETRES

						INFRASTRUCTURE GUIDELINES (SA)	
B	MINOR AMENDMENTS	6.11.2018	AF	AF	MDH	SHEET TITLE MAINTENANCE HOLE / ACCESS CHAMBER (MH / AC) - CWMS	SCALE NTS @ A3
A	MINOR AMENDMENTS	18.07.2017	JZ	JC	DSL		
REV	DESCRIPTION	DATE	DES	DRW	APP		
THIS PROJECT HAS BEEN ASSISTED BY THE LOCAL GOVERNMENT RESEARCH AND DEVELOPMENT SCHEME AND INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA							
						DRAWING No. SD 745	REV B