CITY OF
Salisbury

City of Salisbury Infrastructure Guidelines 2019

CITY OF SALISBURY

CITY OF SALISBURY INFRASTRUCTURE GUIDELINES

MARCH 2019

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REFERENCED DOCUMENTS

This Infrastructure Guidelines document is largely based on the Victorian Infrastructure Design Manual originally prepared by the Cities of Greater Bendigo and Greater Shepparton and the Shire of Campaspe. The document has been modified to reflect the development requirements of the City of Salisbury.

Council also acknowledges the Infrastructure Guidelines SA – Standards and Requirements for the Design and Construction of Infrastructure Assets in South Australia released by the LGA in July 2017. Council's Infrastructure Guidelines and standard detail drawings take precedence over the industry document however Council is supportive of moving to an industry standard guideline at some stage in the future.

Consultants and Developers can view and download the Infrastructure Guidelines (SA) from the IPWEA (SA) website http://www.ipwea.org/southaustralia/home

This document is also be read in conjunction with the following documents:

- City of Salisbury Development Plan
- City of Salisbury Landscape Plan
- Austroads Guide to Traffic Engineering Practice
- Relevant Australian Standards as specified
- Relevant Legislation as specified

SUMMARY

These Infrastructure Guidelines have been prepared to be applicable to all infrastructure within the City of Salisbury, be it new or modified and constructed as part of new development or capital works.

All new and modified infrastructure shall be designed and constructed in accordance with the following requirements. Further specification and detail of these requirements can be found in the relevant chapters of these guidelines.

Requirements for master-planned developments may be negotiated and contact should be made with Development Engineering early in the design process.

Where possible, Developers are required to work with adjoining land owners to achieve optimum outcomes.

General Requirements

- Any public infrastructure that is required to be constructed or modified as part of a new development is to be done so by the Developer, with all costs associated with design, approval and construction to be borne by the Developer.
- All site plans are to show existing site features, services, trees and levels. Plans must have a scale, and should be submitted electronically so that they can be reproduced on an A3 sheet size.
- Council's standard details, available from the City of Salisbury website, are to be utilised unless a variation has been sought however they are not to be used in lieu of responsibly engineered and detailed structures.
- Witness points for new public infrastructure that require inspection by Council are as follows:
    - Pre-start for Civil Works
    - Pre-start for Recycled Water Works
    - Pre-start for Landscape Works
    - Prior to pouring concrete for in-situ concrete structures
    - Proof-rolling of subgrade
    - Proof-rolling of subbase
    - Proof-rolling of basecourse
    - Prior to removal of any trees or native vegetation
    - Prior to opening of any traffic control device or new road to the public
    - Prior to Practical Completion of the infrastructure.
- As-constructed details of any new infrastructure are to be provided to Council in .dwg format prior to Practical Completion and handover to Council.
- The Developer shall be responsible for all damage to existing facilities, services and structures sustained as a result of the construction, whether those damaged items are in public or private ownership. All damage is to be promptly reinstated to an equivalent standard acceptable to the asset owner.

- A defects liability period of no less than 12 months shall apply to all new or modified public infrastructure following the achievement of Practical Completion.

Earthworks

- All earthworks must be undertaken in accordance with AS3798 "Guidelines on Earthworks for Commercial and Residential Developments". Where the depth of fill is greater than 300mm, a controlled fill certificate is required.
- Where fill is imported, written records must be provided that indicate the source of the fill and to provide evidence that the soil is not contaminated as per EPA waste fill requirements.
- Earthworks must not adversely impact on floodplain characteristics.
- Dust, mud and debris must be prevented from leaving any site during and after construction.

Roads

- All public roads are to be designed and constructed in accordance with the following publications:
    - Austroads "Guide to Traffic Engineering Practice"
    - DPTI "Manual of Legal Responsibilities and Technical Requirements for Traffic Control Devices"
    - AS 1742 "Manual of Uniform Traffic Control Devices
- Road widths are to be based on the road function and should consider the ultimate traffic volume and design vehicle including commercial vehicles. They should also include allowance for parking, cycle paths, traffic control devices, footpaths, landscaping, street trees, streetlights, services and collection of refuse bins. New roads must have a longitudinal grade no less than 0.35% and no more than 12.5%.
- The wearing course for all public roads is to be designed for the traffic volumes and types, however will not be less than a 35mm layer of AC7 (asphaltic concrete / hotmix) unless specifically approved.
- Traffic control devices are to be utilised where straight lengths of road exceed 200 metres, where four-way intersections are created or as required for traffic management or calming purposes.
- Footpaths are to be a minimum of 1.5 metres wide, be constructed in accordance with AS 1428 – "Design for Access and Mobility" and be constructed from brushed concrete, or an approved concrete paver.
- All carparking areas whether on public or private land, are to be designed and constructed in accordance with AS 2890 "Parking Facilities".

Stormwater

Unless otherwise specified, stormwater infrastructure is to be designed and constructed to meet the following criteria.

- Minor storm network in a residential area.....ARI = 5 years
- Minor storm network in a commercial or industrial area.....ARI = 10 years
- Overland flowpath provision for major storm.....ARI = 100 years

- On-site detention of stormwater discharge to equivalent pre-development peak flows is required for all development unless otherwise approved. The City of Salisbury is focused on stormwater harvesting for community re-use. Developers are encouraged to contact the Manager – Salisbury Water, at the earliest opportunity in the design phase, to discuss stormwater harvesting and recycled water supply options. Jointly funded initiatives can deliver substantial savings for the Developer. Water Sensitive Urban Design methods, suited to the City of Salisbury approach to stormwater harvesting, are to be utilised wherever possible and water quality objectives are to be in line with Salisbury Water requirements. Where detention basins are located in reserves, the reserve and basin must be designed to maximise usable open space.
- The use of stormwater pumps is not generally supported except for uses such as basements and underground carparks. If pumps are specified, the package must include twin pumps with alternating duty, an audible alarm in case of failure and provision of emergency storage in accordance with AS3500.3.8.3.6 must be provided to prevent flooding of neighbouring properties.
- All stormwater pipes located in road reserves are to be reinforced concrete pipes with a minimum diameter of 375mm. Rear of allotment drains within easements may be constructed from uPVC, but must have a minimum diameter of 225mm. Easements with a width of at least 3.0 metres and vested to the City of Salisbury for Drainage Purposes are to be created over all rear of allotment stormwater lines.
- All stormwater pits must be precast units and be designed in accordance with Council's standard details published on the City of Salisbury website. Lids of all stormwater pits located within road reserves are to be Class D unless a higher class is required.

Streetlights & Electrical

- All new streetlights are to be vested to Council unless SAPN distribution poles are utilised. The standard public lighting tariff shall be Energy Only and be designed in accordance with AS1158. The minimum public lighting category for public roads shall be P3. All new public roads must have streetlights energised and operational prior to the roads being opened to the public.

Landscape & Road Furniture

- All landscape elements are to meet the requirements of the City of Salisbury Landscape Plan and be in accordance with CPTED principles and Disability and Discrimination legislation.
- Existing trees and remnant vegetation that are to be retained must be suitably protected prior to commencement of any construction works.
- Landscape design elements require separate approval and inspection to civil infrastructure.

Recycled Water

- Generally, the design of recycled water infrastructure should mimic the requirements for Potable water as detailed in the Water Supply Code of Australia, SA Water Technical Guidelines and relevant Australian Standards and Codes of Practice.
- The Developer should check with Salisbury Water if recycled water is available or planned for their development area. They should also discuss opportunities for co-funded infrastructure, as Salisbury Water will invest in schemes where there is opportunity to secure broader economic and environmental benefit for the City.

THE GUIDELINES

1. DOCUMENTATION

1.1 Design Documentation

The construction plans must show all existing site features, services 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. This will include adjacent roads, above-ground and underground infrastructure, watercourses, trees and vegetation, levels in adjoining properties etc. Boundary pegs, easements and any encroachments must be shown.

1.1.1 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. All plans must comply with the relevant sections of AS/NZS 1100.

1.1.1.1 Sheet Size

- Council prefers plans to be submitted electronically in PDF format such that they can be read and reproduced on an A3 sheet size at a scale which allows sufficient detail and information to be clearly shown. If hard copy plan are provided they must be submitted on A1 or A3 sheets that comply with AS/NZS 1100 Part 101 Section 3.

1.1.1.2 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 from A1 to A3 and retain a standard scale.
- Overall Development Plans / Master Plans should generally be submitted on A1 sheets at a maximum scale of 1:2000.
- Traffic Management Plans, including those showing swept path and turning manoeuvres should be at a scale of 1:200, unless the design vehicle is a commercial vehicle, in which case the scale should be 1:250.

1.1.1.3 Datum

- Survey must be to AHD, GDA 94, MGA Zone 54. Plans involving new public infrastructure 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 PSM's are to be confirmed and used in accordance with the Survey Regulations 2007 and the Cadastral Survey Guidelines issued by the Surveyor General.
- Temporary benchmarks may be used in lieu of AHD for building developments that have adjacent infrastructure capable of being used as a benchmark.
- The origin of all road chainage must be nominated in the plans. Road chainages should commence at clearly designated and identifiable locations.

1.1.1.4 Standard Details

- The Design Engineer should adopt details as shown on the Council's standard drawings where possible. While standard infrastructure is considered highly desirable, the standard drawings are not to be used in lieu of responsibly engineered and detailed structures. Where the standard details are not considered appropriate for the application, variations from the standard details should be fully documented to the satisfaction of Council. Cross-referencing standard details with variations made by note will only be accepted where those variations are considered minor and where directions are clear.
- All standard details are available in pdf format at http://www.salisbury.sa.gov.au/Build/Development_Engineering/Standard_Civil_Details. Copies of the standard details in .dwg format are available from Council's Technical Services division.
- It is the responsibility of the Design Engineer to ensure that the standard drawing used is correct for the application and is the current version.

1.1.1.5 Land Developments

- As a minimum, plans for developments which involve the creation or modification of public infrastructure are to show the following:
  - Overall Site Plan
  - General Construction Plan
  - Stormwater Layout
  - Road Longitudinal Sections
  - Road Cross Sections
  - Typical Cross Sections including Trees, Lights and Footpaths
  - Services Plans including water connections, sewer connections and streetlights
  - Stormwater Longitudinal Sections
  - Stormwater Catchment Plan
  - Q100 Overland Flowpath plan showing depth and spread of flows
  - Details of any outfalls including backfill, water quality and scour protection measures
  - Intersection details including kerb levels
  - Traffic Control Layout
  - Pavement Treatment plan
  - Recycled Water Layout and Details including connections
  - Potable Water Layout and Details including connections
  - Electrical Layout and Details including Streetlights and Transformers
  - Standard Details

- Soil Erosion & Drainage Management Plan (SEDMP)
- Construction Environmental Management Plan (CEMP) – prior to construction.
- When available, copies of the Gas, Communications and As-Constructed Sewer, Water and Electrical plans are to be forwarded to Council.
- 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.

1.1.2 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 Practical Completion.

Specifications must include a Quality section nominating minimum hold points and witness points. The following are to be included as hold points in the documentation:

- Pre-start for Civil Works
- Pre-start for Recycled Water works
- Pre-start for Landscape Works
- Prior to pouring concrete on in situ concrete structures
- Proof-rolling of subgrade
- Proof-rolling of sub-base
- Proof-rolling of basecourse
- Prior to removal of trees or native vegetation
- Prior to opening of any traffic control device to the public

The following are witness points, where Council is to be made aware of the works but works are not held up awaiting inspection:

- Prior to backfill of stormwater pipes
- Prior to placement of asphalt

1.1.3 Design Life

Each asset or item of public infrastructure to be vested to Council should be designed and constructed to the design life as follows. These design lives are based on an accepted service standard and industry standard maintenance during the asset life.

Asset	Design Life
Concrete structures generally including stormwater pipes, pits and pump stations	80 years
Steel or HDPE Pipework	80 years
Bridges (concrete or steel)	100 years
Bridges (timber)	50 years
Minor buildings / structures including retaining walls	50 years
Pumps and associated fittings	25 years
PVC pipes and fittings for water, wastewater and stormwater	50 years
Streetlighting - Post	50 years
Streetlighting - Luminaire	25 years
Landscape Steel Structures	50 years
Landscape Timber Structures	25 years
Other Landscape Elements	40 years

The service level and whole of life cost of infrastructure elements should also be considered in addition to the required design life when specifying infrastructure.

1.2 Documentation Required Prior to Practical Completion

1.2.1 As-constructed Details for Major Works

Council requires an As-Constructed survey of all infrastructure including, but not limited to, stormwater, kerbs, road pavement, line-marking, recycled water, footpaths, signage and street trees. This is to be provided in both .pdf and .dwg format prior to Practical Completion. Practical Completion will not be awarded until this information has been provided and the defects liability period shall only commence once Practical Completion has been awarded.

Any amendments required by Development Engineering shall be completed, with the data resubmitted to the satisfaction of Development Engineering within 28 days of the beginning of the Defects Liability Period. If not received within 28 days, the Defects Liability Period will commence once Council has received the amended information.

Unless otherwise directed, these requirements will not apply to land developments or other building works which do not require construction or modification of roadworks or other public infrastructure vested to Council.

As-constructed information is to be generally shown by amended design drawings, clearly identified as being ‘as-constructed’ and with a revision cloud highlighting any changes between approved and as-constructed elements.

Recycled water as-constructed plans are to be prepared in the same manner as potable water plans for SA Water, and include tie dimensions to fittings and offsets for connections. All dimensions required for 'as-constructed' information of water reticulation shall be obtained by survey.

As-Constructed drawings for Landscape components are required at practical completion, prior to the project being accepted for commencement of the maintenance period. As-constructed drawings shall clearly identify any amendments or changes to the approved landscape working drawings. Hardscape treatments and underground services, in particular, including paving, fences, walls, irrigation, lighting and other structures shall be accurately located for Council records. Any structural elements e.g. retaining walls greater than 1.0m in height will require certification by an appropriately qualified and experienced engineer.

Any plans showing "As Constructed" information shall be certified "As Constructed" by the Superintendent. The accuracy of surveyed "as-constructed" features shall be ±0.10 metres horizontally and ±0.02 metres vertically. Finished surface contours shall accurately represent the surface such that 90% of levels obtained by survey would fall within 0.25 of a metre of the level indicated by the contours. Spot levels over fill areas shall be accurate to ±0.05 metres unless otherwise specified by Council.

A separate certification from a Licensed Surveyor shall be provided to Council that confirms that:

a. Road construction (widths of verges and carriageways) is in accordance with approved engineering plans;

b. All stormwater drainage pipes and associated infrastructure are located within easements, drainage reserves or road reserves and have the correct relationship to property boundaries as required by Council's standard drawings.

Operation and Maintenance manuals for any mechanical or electrical infrastructure shall be provided with the as-constructed details.

1.2.2 As-constructed Details for Minor Works

All plans must include an accurate north arrow, street address and scale and show the following if constructed or altered:

a. Pavement

b. Concrete infrastructure such as kerbs or pram ramps

c. Stormwater

d. Footpath

e. Line Marking / Signs / Bollards

f. Recycled Water

g. Streetlights

1.2.3 Stormwater CCTV

CCTV footage of the underground drainage system for new stormwater construction is to be undertaken prior to sealing to confirm that works have been completed in accordance with the documentation and to the satisfaction of Council. Footage is to be reviewed and certified by the Design Engineer and supplied to Council's Development Engineer for review sufficiently prior to asphalt placement to enable remedial works to be undertaken if necessary.

1.2.4 Other Authorities

As-constructed details for other services including sewer water, gas, electrical and communications is to be provided prior to Practical Completion. These details assist Council with identifying locations of services during future reconstructions and development applications.

The Certificate of Practical Completion for sewer and water, and Certificate of Compliance for electrical must be provided to Council prior to Practical Completion to ensure that no additional remedial works are required prior to handover of roads and other public infrastructure assets.

1.2.5 Inspection & Testing Plans

A geotechnical Inspection & Testing Plan (ITP) is to be forwarded to Council prior to construction. The fully completed ITP is to be provided to Council prior to Practical Completion. Field Density Testing is to be undertaken on all pavement layers and service backfill trenches (including stormwater and common service trench in verge), and all earthworks.

1.2.6 Pavement Survey

To ensure that the minimum thickness of asphalt has been achieved during road pavement construction, Council require certification from a registered surveyor that the road formation levels have been checked prior to and after road surfacing (5 points every 50m). Council may also request asphalt core samples.

1.2.7 Traffic Control Devices

Each traffic control device requires a compliance certificate to be completed by the Design Engineer prior to acceptance of Practical Completion.

The template for this compliance certificate can be found in Appendix A.

2. DEVELOPER RESPONSIBILITIES

2.1 Public Infrastructure

Any public infrastructure that is required to be constructed or modified is to be done so by the Developer with all associated costs of approval and construction to be borne by the Developer.

2.2 Engaging Consultants

The Developer shall engage qualified consultants to design and supervise all works including but not limited to civil and structural engineering, traffic, electrical, landscape, acoustics and environmental management.

All documents such as plans, specifications and supporting design calculations shall be endorsed by a Professional Engineer, as specified by Regulation 55 (3) of the Development Regulations 2008 as being a person who is:

a. A corporate member of Engineers Australia who has appropriate experience and competence in the field of engineering; or

b. A person who is registered on the National Engineers Register administered by Engineers Australia and who has appropriate experience and competence in the field of engineering.

The plans, specifications and management plans for such works shall be submitted to Council for assessment and approved such that requirements have been met prior to commencement of any construction work.

2.3 Liabilities and Insurances

The Developer shall be responsible for all damage to existing facilities, services and structures sustained as a result of the construction of the development, whether those damaged items are in public or private ownership. All damage is to be promptly reinstated to an equivalent standard acceptable to the asset owner.

All Developers and contractors are to hold Public Liability Insurance for a minimum of $20 million dollars and all Consultants are to hold Professional Indemnity insurance for a minimum of $10 million dollars.

Council may require the Developer to take out other necessary insurance policies to indemnify and protect it against any claims that may arise in undertaking the development.

For developments that create infrastructure assets for which maintenance will become the responsibility of Council, Council may require the Developer to enter a bonding agreement for the length of the Defects Liability Period.

2.4 Infrastructure Agreements

Infrastructure Agreements may be required to supplement the conditions of Development Approval where there is likely to be a significant impact on existing infrastructure. Unless otherwise agreed, the Infrastructure Agreement document is prepared by Council, with all associated costs for preparation of this document to be borne by the Developer in accordance with Council's Fees & Charges register.

If an Infrastructure Agreement is required, it is required to be fully executed prior to the issue of Development Plan Consent, Land Division Consent and / or Full Development Approval as required.

2.5 Service Authorities

The Developer shall be responsible for communications with the relevant Service Authorities in relation to the provision of the services within the proposed development.

On-site service location surveys should be undertaken prior to the commencement of construction. Any issues arising from erroneous or omitted services on the approved plans are the responsibility of the Developer.

Where it is necessary to provide mains or connections across existing roads, Council's preferred method of connection is via directional boring where existing soil conditions and service locations permit to minimise disruption to existing road pavements.

Where it is not possible to undertake directional boring and it is necessary to excavate trenches through existing Council road pavements, the Developer shall reinstate such pavements in accordance with the requirements of the current version of SA DPTI "Specification for Works by Other Organisations on Roads Maintained by the Commissioner of Highways (Including Excavation and Reinstatement of Road Pavement)" and the "Pavement Reinstatement Configurations". Verges and reserve areas are to be reinstated to Council's requirements after trenching for underground services.

2.6 Traffic Impact Studies

If required, assessment of the impacts of trip generation in the context of land use and transport planning should be conducted by a suitably qualified and experienced Traffic Engineer. These should include proposals for management of the impacts on road, public transport, cyclist and pedestrian facilities.

2.7 Site History & Environmental Impact Studies

Land that is proposed to be utilised for residential purposes or any other sensitive use may require a site history report to be undertaken as part of the Development Assessment process. The results of this Site History Report will assist Council to determine whether further investigations such as an Environmental Impact Study or an Environmental Audit are required.

2.8 Trees

It is the responsibility of the Developer to ensure that any existing trees are clearly identified on the site plan. Development Approval is required for removal of, or activities that are likely to cause damage to Significant and Regulated trees. In addition, approval is also required for removal of vegetation and trees located on verges and reserves.

Further information on Regulated and Significant trees is available from the Council publication "Regulated and Significant Trees" and "Trees and the Law" published by the Legal Services Commission.

All trees to be retained on site must be protected as per AS 4970.

2.9 Retaining Walls

All retaining walls that are proposed to be constructed as part of the development are to be clearly shown on the site plan along with maximum heights. Details of footings are to be provided by a Professional Engineer.

Construction of retaining walls with a height greater than 1.0m will require a separate Development Approval.

Construction of retaining walls (and fences) over Council easements require additional approval and completion of an indemnity form against damage to Council infrastructure.

2.10 Fences

Any fence greater than 2.1m in height or masonry fence greater than 1.0m in height requires Development Approval.

If a fence is constructed on top of a retaining wall, if the total height of the structure exceeds 2.1m, then Development Approval is required.

Council may require the Developer to erect new boundary fencing where a subdivision abuts large land parcels so as to avoid a neighbouring property owner having to deal with multiple new land owners regarding fencing replacement. Council also requires the Developer to construct boundary fencing on any boundary that abuts a Reserve. The height and type of fence to be constructed on these boundaries is to be negotiated with Council's Landscape Design team.

All fencing that does not require Development Approval is to be negotiated between adjoining landowners. Further information is available from the publication "Fences and the Law" published by the Legal Services Commission.

2.11 Acoustic Reports

Acoustic Reports may be required for developments of a residential or other sensitive nature when the development is adjacent to an arterial road, rail corridor, flight path or shares a boundary with an Industry Zone.

Further information can be obtained from Council's Planning division.

2.12 Health, Well-being and Accessibility Considerations

Our lifelong health and well-being and chronic disease rate are affected by the design of the built environment. The way cities, towns and neighbourhoods are planned and designed impacts on people's opportunity to walk, cycle and use public transport, to access healthy food and to participate in community.

Consideration of the impact on the health and well-being and the accessibility of the community needs to occur in the design and subsequent construction of new or modified developments or capital works. A number of key resources exist to enable developers to achieve these goals. These include:

2.12.1 Healthy by Design South Australia

Healthy by Design SA: guide for planning, designing and developing healthy urban environments in South Australia (2013) aims to assist planners, urban designers and related professionals to design healthy urban environments that enable people to make healthy lifestyle choices, and in particular, to incorporate incidental physical activity – such as walking and cycling for transport and recreation – into their daily routine. The guidelines include key action areas, objectives, design principles and considerations and explanatory statements. It also includes a Matrix of Design Considerations which highlights the synergies between healthy by design and a range of other key design agendas in order to support an integrated approach to urban design and reduce perceptions that the guidelines complete or conflict with other design agendas. This website has additional resources: www.healthybydesignsa.com.au/resources

2.12.2 The Streets for People Compendium for South Australian Practice

This resource provides information and guidance for the development of pedestrian and cycle friendly environments that promote health and strengthen communities. It condenses the knowledge, skills and policy agendas of a broad community of practitioners into one multi-faceted design resource, making the design and approval of innovative streets for people both easier and more desirable.

2.12.3 Age-Friendly Cities and Communities Guidelines

Age-friendly Neighbourhoods: Guidelines and Toolkit for Local Governments are designed to contribute to age-friendly communities – our urban and suburban areas and rural townships where we live, work and recreate. Included in this document is a toolkit providing practical tools to assist local governments in taking the next steps in the implementation of the guidelines including the physical environment.

More information can be found at www.sahealth.sa.gov.au and search Age-friendly Neighbourhoods.

2.12.4 Universal Design

Universal design (also called inclusive design) refers to broad-spectrum ideas meant to produce buildings, products and environments that are inherently accessible to older people, people without disabilities and people with disabilities.

2.12.5 Beyond The Ramp

Council has an infrastructure access strategy in place which goes beyond minimum access standards where appropriate, and details targeted and general upgrades across short, medium and long-term timeframes. More information can be found at www.salisbury.sa.gov.au/beyondtheramp

3. ROADS

3.1 Objectives

The objectives of the Road Design requirements are as follows:

1. To develop a network and alignment that meets the existing and future requirements or makes allowance for future requirements;
2. To provide a serviceable pavement for the specified design life with minimal maintenance;
3. To provide safe and convenient access to all allotments for pedestrians, vehicles and cyclists;
4. To provide for streetscape and amenity improvements;
5. To promote connectivity, legibility and shared space;
6. To ensure that staged construction methods are planned to meet the immediate, medium term and ultimate pavement design requirements;
7. To ensure that the road design meets Austroads guidelines and Australian Standards.

3.2 General

This section sets out the standard design criteria for roadworks, 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 Development Engineering division to assess the merits of that proposal based on the design objectives above.

Aspects not specifically referred to in these Guidelines should be generally in accordance with the following publications:

- Austroads: "Guide to Road Design", incorporating AGRD01 to AGRD07 and all subsections;
- DPTI: "Manual of Legal Responsibilities and Technical Requirements for Traffic Control Devices";
- Streets for People – Compendium for South Australian Practice
- Council's Standard Details

3.3 Urban Roads

The design and construction of roads and allotment accesses should meet or exceed the requirements of Austroads, the Development Act, Development Regulations, these Guidelines and any other relevant Acts, Regulations or Australian Standards.

3.3.1 Road Classification

The classification of residential streets within any Development should be in accordance with Table 3.1 – Deemed to Comply Characteristics for Public Roads.

The road classification referred to within this Guideline relates specifically to the design and construction of new or upgraded roads.

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 the proposed and future development. Estimated traffic volumes for new developments in undeveloped areas must be based upon:

1. Recognised Guidelines;
2. Residential allotments: At least 10 vehicle movements per day per allotment.

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

Where Council holds traffic count data on relevant roads, this information may be made available to the Design Consultant. 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 requested when existing traffic count data is greater than three years old, or where significant Development has occurred since traffic count data was last collected.

3.3.2 Road Characteristics and Road Reserve Widths

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

1. Ultimate traffic volume and type and volume of commercial vehicles;
2. Road carriageway width should include allowance for on-street parking, cycle paths and traffic control devices;
3. Road verges should allow for footpaths and shared paths, landscaping, street trees, streetlights, adequate separation between property and carriageway, aboveground and underground services and stormwater pits;
4. Stormwater generated from the major (100yr ARI) storm event should be contained within the carriageway;
5. Street trees should have a minimum verge width of 2.4m and be located no less than 1.0m behind back of kerb to allow for growth and pruning;
6. Shared paths on higher order roads are typically 3.0m wide;
7. Footpaths are to be a minimum of 1.5m wide;
8. Public lighting is to be located so as to adequately light footpaths and roadways;
9. Provision for refuse bins;
10. Access for Australia Post.

Deemed to comply classification, function and general composition of roads and streets within any Development are detailed in the 'Road Characteristics' in Table 3.1

Road reserve boundaries may be curved around cul-de-sac bulbs, but where they are fenced as chords, these should be no less than 10m in length. Where a number of such chords occur adjacent to each other, they should, as far as possible and practical, be equal in length.

3.3.2.1 Requirements for Local Road Widening

The minimum carriageway and road reserve widths quoted in Table 1 shall be widened locally and/or generally as required to accommodate traffic control devices as well as providing for bicycles, buses and associated public transport infrastructure or where higher traffic volumes occur. A minimum lane width of 5.7m is required from the kerb face at bus stops. The need for such devices and associated road reserve widening will be determined in the Traffic Impact Statement for the development.

The carriageway width of access lanes and local roads shall be widened by 0.8m on all horizontal curves where the centreline radius is less than 50.0m and the total angle of deflection exceeds 20 degrees. The widening shall extend for the full length of the curve plus 8.0m into the straight at either end of the curve, and it shall be applied equally either side of the road centreline. A transition taper of length 8.0m shall be provided at each end of the widened section to transition to the normal road width. The reason for this is to allow for the swept path of larger vehicles negotiating such curves and to enable the provision of a rumble bar median if required.

Road Category	Road Reserve Width (m)	Verge Width (m)	Carriageway Width (m)	AADT Vehicles Per Day	Vehicle Design Speed (max)	Notes
Access Place (Auto Court)	12.0 (access one side) 14.0 (access both sides)	3.4 + 1.4 3.4 + 3.4	7.2	< 50	15km/h	(1)
Access Lane (Rear Loading)	8.0	1.0	6.0	< 300	20km/h	(2)
No Through Local Road (Cul-de-sac)	14.0	3.4	7.2	< 300	20km/h	(3)
Local road (no indented parking)	15.0	3.9	7.2	300 - 1000	30km/h	
Local Road (indented parking)	15.3	3.5	2.3 + 6.0	300 - 1000	30km/h	
Local Road (adjacent reserves)	12.5	3.5 + 1.8	7.2	300 - 1000	30km/h	(4)
Minor Collector (no indented parking)	17.5	4.25	8.0	1000 - 3000	50km/h	(5)
Minor Collector (indented parking)	17.5	4.1	2.3 + 7.0	1000 - 3000	50km/h	(5)
Major Collector (single carriageway)	20.0	5.0	10.0	> 3000	50km/h	(6)
Major Collector (dual carrigeway)	25.0	5.0	5.5 + 5.5 + 4.5 median	> 3000	50km/h	(6)

Table 3.1 Deemed to Comply Characteristics for Public Roads

1. Access function only. Shared vehicular / pedestrian use. Services maximum 3 allotments.
2. Vehicular access only – no pedestrian link. Services maximum 30 allotments.
3. Services maximum 30 allotments. Cul-de-sac bulb to have a radius of no less than 9.0m. Any turnaround provision other than a bulb is to accommodate the 9.4m refuse vehicle.
4. If indented parking is to be provided adjacent the reserve, the road reserve is to be increased to 13.6m.
5. For designated bus routes, increase carriageway width locally at bus stops.
6. No direct frontage for residential allotments except in master planned developments. For designated bus routes, increase carriageway width locally at bus stops.

3.3.3 Reserves for Pedestrian & Cyclist Thoroughfare

The widths and treatments of reserves used for pedestrian and cyclist thoroughfare are to be determined using 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 thoroughfare reserves are incorporated into the Development, the minimum reserve width may need to be increased for reserves deeper than 30m. Removable bollards must be provided in sufficient numbers and at spacings to prevent vehicular access where kerb types do not restrict access.

A landscaping, footpath and lighting plan is to be provided to the satisfaction of Council's Landscape division for all proposed reserves.

3.3.4 Road Geometry

The geometric design of roads must be in accordance with Austroads "Guide to Road Design – Part 3: Geometrical Design" and any DPTI supplements to that publication. 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 are strongly preferred to be of bulb 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 allow for turning areas to be constructed and maintained until such time as the road is extended and/or a permanent turning area is established.

Pedestrian path mapping should be provided to support the proposed road network layout. This will include the path function, construction materials, widths and any proposed furniture such as pram ramps, footbridges, handrails or crossing refuges.

3.3.5 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:

- Austroads "Guide to Road Design – Part 3: Geometric Design"
- Austroads "Guide to Road Design – Part 4a: Signalised and Unsignalised Intersections"
- Austroads "Guide to Road Design – Part 4b: Roundabouts"

Landscaping plans and Building Envelope Plans must be prepared with consideration to sight distance requirements, as must any proposal for 'Estate Entrance Structures' or 'Entry Statements'.

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 kph or the 85th percentile speed.

3.3.6 Design Speed

All roads in new developments should be designed to achieve the target design speeds detailed in Table 1. The target speed is to be achieved through the geometric design of the road and may require the inclusion of traffic control devices to restrict speeds to the target speed.

Posted speeds other than 50 or 100 kph require DPTI approval.

3.3.7 Vertical Alignment and Vertical Curve Requirements

Where possible, road design grading should be extended a minimum of 50m 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 – Part 3: Geometric Design" and any DPTI supplement to that publication.

Where kerb and watertable is provided, road grades must fall within the limits shown below:

TYPE OF GRADE	ROAD LONGITUDINAL GRADE
DESIRABLE **MINIMUM** GRADE	0.5%
ABSOLUTE **MINIMUM** GRADE	0.35%
DESIRABLE **MAXIMUM** GRADE	10%
ABSOLUTE **MAXIMUM** GRADE	12.5%

Table 3.2 – Longitudinal Gradients

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 road and to follow as closely as possible the vertical curve produced on the pavement by designing to match the through road.

The desirable minimum grade for kerb returns is 0.75% and the absolute minimum is 0.35%.

3.3.8 Vehicle Turning Movements

Vehicle turning movements are to be examined for design vehicles and check vehicles using current Austroads or Australian Standard Design Vehicle and Turning Path templates. The design is to ensure that the design vehicle is able to negotiate a left turn from the left lane without entering any other lane or median. The identified 'Checking Vehicle' may impinge upon opposite lanes except where a median is present.

All intersection designs must be such that a minimum of 600mm clearance is provided in addition to the swept path (not wheel path) to allow for above-ground structures. Vehicle access points and driveways are NOT to be used for turning movements.

Turning movement plans for the following Design Vehicles must be provided to Council where requested.

Intersecting Road Types	Design Vehicle	Checking Vehicle
Access Place, Access Lane, Local Road (Residential)	Single Unit Refuse Vehicle (9.4m) Radius 10.8m	Articulated Vehicle (19m) Radius 12.5m
Minor Collector / Local Road (Residential)	Single Unit Refuse Vehicle (9.4m) Radius 10.8m	Articulated Vehicle (19m) Radius 12.5m
Major Collector / Local Road (Residential)	Heavy Rigid Vehicle (12.5m) Radius 12.5m	Articulated Vehicle (19m) Radius 12.5m
Major Collector / Minor Collector (Residential)	Articulated Vehicle (19m) Radius 12.5m	Extended Vehicle (25m) Radius 12.5m
Commercial and Industrial	Articulated Vehicle (19m) Radius 12.5m	Extended Vehicle (25m) Radius 12.5m

Table 3.3 – Design and Checking Vehicle Turn Radius

1 *If an Industrial precinct is designated for use by B-Doubles or larger vehicles, then intersections should be designed accordingly.*

3.3.9 Cross Section Profiles

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

a. Type of kerb and channel;

b. Pavement construction including material type and depth;

c. Surface Details;

d. Subsoil stormwater drainage, if required;

e. Typical footpath offsets;

f. Typical streetlight offsets;

g. Typical service corridors;

h. Typical landscape corridors;

i. Crossfall grade.

The crossfall on bituminous pavements should be 3%. Should design speeds require super-elevation of horizontal curves, design of crossfall should be based on the Austroads "Guide to Road Design Part 3: Geometric Design".

Central spoondrains in the road pavement without kerbs (such as for Access Lanes) will only be permitted where there are to be no direct property drainage outlets.

Verge crossfalls on either side of footpaths should be 1:20 desirable maximum and 1:10 absolute maximum (permitted only where local topography prevents compliance with the desirable maximum). Should steeper verges be proposed, the Designer is to demonstrate that vehicle access can be provided to affected allotments.

For properties which fall away from the road reserve, the verge shall have a minimum fall from the property boundary to the kerb in accordance with Council's Standard Detail drawing SD-13.

Any resulting differences between the finished surface and natural surface at the property alignment shall be handled by 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:

a. they can be reasonably maintained, and

b. they will have long term stability having regard to the topographical form and geotechnical properties of the site.

3.3.10 Footpaths

Footpaths must conform with *AS 1428.1: 2009 "Design for Access and Mobility" and AS 1428.4 "Design for Access and Mobility – Means to Assist the Orientation of People with Vision Impairment – Tactile Ground Surface Indicators"* for TGSI details and surface finish.

Footpath are to be constructed in accordance with Council's standard detail drawings SD19, SD-37 and SD38. Footpath alignment is to consider property access requirements and topography and should be on the same side of the road as the public lighting. The alignment should consider safe and convenient access for the visually impaired, be a minimum of 1.5m in width and constructed of broomed concrete or Council's nominated interlocking concrete pavers.

Alternative footpath alignment proposals are to be discussed with and will require the approval of Council's Development Engineer.

Location of services within the footpath or pedestrian areas should be avoided where possible.

Patterned finishes to footpaths or pedestrian accesses are unlikely to be approved due to future maintenance considerations.

The minimum width for shared paths is to be 2.5m and designed and constructed in accordance with the AUSTROADS publication "Guide to Road Design Part 6A: Pedestrian and Cyclist Paths, 2017" and any DPTI supplement to those guidelines. Where a shared path crosses a pedestrian bridge a minimum lateral clearance of 0.5m on both sides of the shared path must be provided where the speed of cyclists is less than 20km/hr. Where higher bicycle speeds are likely a minimum lateral clearance of 1.0m on each side of the shared path must be provided.

3.3.11 Kerbs

All roads must be constructed with kerb and watertable and a sealed pavement unless alternative treatment is integral to a WSUD application.

Kerbs 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 types are to be constructed in accordance with Council's Standard Details.

Semi-mountable or 'rollover' kerb is strongly preferred within residential areas, with upright kerbing being utilised adjacent reserves and other locations where vehicular access is to be restricted. Upright kerbing with driveway inverts is to be utilised in Industrial and Commercial areas.

The transition between different types of kerb should be either:

a. Immediately after a kerb crossing; or

b. Over a 3 metre length after a Side Entry Pit (SEP).

Kerb crossings and driveway requirements are detailed in Section 3.7.

3.4 Intersection Design

3.4.1 General

Intersections are to be designed and constructed such that they function in a safe, convenient and appropriate manner for the type of 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", DPTI's "Manual of Legal Responsibilities and Technical Requirements for Traffic Control Devices" and any other DPTI supplement to those Guidelines.

Intersections with roads that are under the control of DPTI are to be designed, approved and constructed in accordance with DPTI requirements and approval process.

Three-way intersections (T-junctions) should be adopted in preference to Four-Way intersections. Where Four-way, or cross intersections are to be constructed, traffic control treatments such as roundabouts will be required.

Where existing or future intersections are in a configuration that is deemed likely to have a negative impact on traffic, the Developer may be required to construct traffic control devices to provide control and safety. Centrelines of roads must intersect at an angle between 70 and 110 degrees.

3.4.2 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, the roundabout must be designed in accordance with the current edition of Austroads publication "Guide to Road Design Part 4B: Roundabouts", the DPTI publication "Manual of Legal Responsibilities and Technical Requirements for Traffic Control Devices" and any other DPTI supplement to those guidelines.

3.4.3 Intersection Spacing

The spacing of intersections should generally not be any less than 30 metres, centreline to centreline, unless otherwise agreed with Council.

Intersection spacing on DPTI controlled roads is in accordance with any DPTI Access Management Policies that may apply. Developers are encouraged to discuss access to DPTI controlled roads with DPTI early in the Planning Application process.

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

3.4.4 Corner Cut Off

Corner cut offs or truncations of suitable dimensions to allow adequate sight distance must be provided at all corners of new or upgraded intersections in accordance with the following:

- Vehicle Design Speeds of less than 50km/h – 3 x 3 metre truncation;
- Vehicle Design Speeds of 50km/h or greater – 5 x 5 metre truncation;

3.4.5 Kerb Returns

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

- Residential areas 8.0m
- Collector Road 12.5m
- Arterial Road 15.0m

Further to this, kerb radii must be designed upon turning movement requirements as detailed in Section 3.3.8 “Vehicle Turning Movements”.

3.4.6 Traffic Calming

Traffic calming devices may be required where the road layout does not or will not naturally create a low speed safe environment. Generally, any straight road with a length greater than 200 metres will require traffic calming.

The Design Engineer must determine any necessary traffic calming devices (slow points, raised ‘speed bumps’, roundabouts, chicanes, splitter islands etc.) in accordance with Austroads “Guide to Traffic Management Part 8: Local Area Traffic Management”, DPTI “Manual of Legal Responsibilities and Technical Requirements for Traffic Control Devices” and any DPTI supplement to those guidelines. The design and construction of traffic control devices must comply with AS 1742 “Manual of Uniform Traffic Control Devices”. The layout of the development should be the primary means of limiting vehicle speeds.

The following features must be addressed as a minimum:

a. Streetscape

- Reduce the linearity of the street by segmentation;
- Avoid continuous long straight lines (eg. kerb lines)

- Enhance existing landscape character;
- Maximise continuity between existing and new landscape areas.

b. Location of Devices / Changes

- Devices other than at intersections should be located to be consistent with streetscape requirements.
- Existing streetlighting, stormwater drainage pits, driveways and services may decide the exact location of devices.

c. Design Vehicles

- Emergency vehicles must be able to reach all residences and properties.
- The design vehicle and checking vehicle specified in Section 3.3.8 should be able to manoeuvre through the devices at low speed without damaging the device or any landscaping.
- Where bus routes are involved, buses should be able to pass without mounting kerbs and with minimised discomfort to passengers.

d. Vehicle Speeds

- Maximum vehicle speeds can only be reduced by deviation to the travelled path. Pavement narrowing only has 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, platforms etc).
- 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 200m) using appropriate devices, streetscapes or street alignment to create short sight lines.

e. Sight Distance & Visibility

- 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 in particular must be located near existing street lighting where practicable and all street features / furniture should be delineated for night time operation. Additional street lighting must be provided for all new speed control and calming devices for which existing lighting is inadequate.

It should be noted that some traffic calming devices require special approval and it is the responsibility of the Designer to obtain those approvals. Designers should refer to the DPTI "Manual of Legal Responsibilities and Technical Requirements for Traffic Control Devices".

3.5 Pavement Design

Table 3.4 includes reference pavements which provides guidance on the design expected as a minimum for each road classification unless site specific road design is undertaken.

Access Lane with a single traffic lane: 4 x 10^3 ESAs	35mm AC7 Medium Prime @ 1.0 l/m^2 150mm PM1/20QG 98% MMDD, 60% OMC dry back 150mm PM2/20QG 96% MMDD, 70% OMC dry back Prepared subgrade 98% SMDD or Type A Select fill
Access Place or Cul-de-sac with two traffic lanes: 6 x 10^3 ESAs	35mm AC7 Medium Prime @ 1.0 l/m^2 160mm PM1/20QG 98% MMDD, 60% OMC dry back 160mm PM2/20QG 96% MMDD, 70% OMC dry back Prepared subgrade 98% SMDD or Type A Select fill
Local Access Road with no buses: 6 x 10^4 ESAs	40mm AC10 Medium Prime @ 1.0 l/m^2 160mm PM1/20QG 98% MMDD, 60% OMC dry back 180mm PM2/20QG 96% MMDD, 70% OMC dry back Prepared subgrade 98% SMDD or Type A Select fill
Local Access Road with buses: 1 x 10^5 ESAs	40mm AC10 Medium Prime @ 1.0 l/m^2 180mm PM1/20QG 98% MMDD, 60% OMC dry back 180mm PM2/20QG 96% MMDD, 70% OMC dry back Prepared subgrade 98% SMDD or Type A Select fill

Local Road in Industrial Area: 3 x 10^5 ESAs	50mm AC10 Medium Prime @ 1.0 l/m^2 150mm PM1/20QG 98% MMDD, 60% OMC dry back 150mm PM2/20QG 96% MMDD, 70% OMC dry back 150mm PM2/20QG 96% MMDD, 70% OMC dry back Prepared subgrade 98% SMDD or Type A Select fill OR 40mm AC10M 50mm AC14M 60mm AC14M 150mm PM2/20QG 96% MMDD, 70% OMC dry back Prepared subgrade 98% SMDD or Type A Select fill
Collector Road with no buses: 6 x 10^5 ESAs	40mm AC10M 50mm AC14M 65mm AC14M 150mm PM2/20QG 96% MMDD, 70% OMC dry back Prepared subgrade 98% SMDD or Type A Select fill
Collector Road with buses: 1 x 10^6 ESAs	40mm AC10M 50mm AC14M 50mm AC14M 50mm AC14HB 150mm PM2/20QG 96% MMDD, 70% OMC dry back Prepared subgrade 98% SMDD or Type A Select fill

Table 3.4 – Pavement Design

All designs based upon subgrade strength CBR 3%

Onsite testing may find higher CBR values exist. Site specific pavement design may demonstrate that pavement thicknesses can be reduced. In such instances a suitably qualified engineer may submit an alternative pavement design to council for consideration. With exception of access lanes, an absolute minimum pavement thickness of 350mm applies to local roads regardless of higher CBR. Geotechnical analysis of the subgrade material and any non-standard pavement materials must be provided with the design.

3.5.1 Sub-grade Analysis

Pavement design must be based on the results of the sub-grade analysis, including testing for soaked Californian Bearing Ratio (CBR), carried out by a NATA registered testing laboratory. Sub-grade soil samples must be taken at maximum intervals of 200 metres, in the bowls of all cul-de-sacs, at all intersections and at all location where there is an obvious change of subgrade material. Core samples must be bored to a minimum depth of 1.0m below the final road subgrade level. The soil sample used for laboratory testing must be taken from the core at subgrade level. Full details of the subgrade test results and core samples must be submitted to Council with the detailed design plans.

3.5.2 Flexible Road Pavements

Flexible road pavement designs must be undertaken in accordance with the current Austroads "Guide to Pavement Technology, Part 2". Pavement design must be carried out using Traffic Load Distributions appropriate for each road classification and equivalent standard axle loadings based on the ultimate design traffic and a 25-year minimum design life for residential and commercial roads. Pavement design for industrial roads must be based on a 40-year minimum design life.

To take into account heavy vehicle traffic generated by construction during Development works, 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 Place	4%
Access Street	3%

Use of polymer modified binders in Asphalt, where appropriate, is encouraged. The DPTI Local Government asphalt mix is encouraged for low volume residential roads.

3.5.3 Interlocking Pavers

For safety, operational, noise and maintenance issues, interlocking concrete block street pavement will not be generally approved. In situations where approval is given, or at threshold treatments, the pavers must be designed in accordance with the CMAA Segmental Paving Technical Manuals to a minimum 25 year design life.

Interlocking paving shall be shape type A, or constructed in a herringbone pattern. The longitudinal grade of the road shall not exceed 10%, and on grades exceeding 5%, suitable drainage shall be installed to minimise sand and water migration.

Concrete paving units shall comply with MA 20 "Specification for Concrete Segmental Paving Units" published by the Concrete Institute of Australia. They shall be 80mm thick for both trafficable and non-trafficable areas, Strength Grade N45, have a minimum abrasion resistance of 1.2 at 28 days, interlocking in design and are of the colour and shape as nominated by 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 matter or deleterious 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 – Type A (PM61) as per Part 215 of the DPTI Master Specification, named Supply of Pavement Materials for quarry and recycled materials.

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 ± 3mm 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 5mm and 10mm 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.

3.5.4 Minimum Pavement Thickness

Notwithstanding any of the above requirements, the pavement thickness must not be less than those shown in Table 3.5. for each road classification, unless engineered calculations are provided to support alternative designs. Local Access Road pavements are not to have pavement thickness less than 350mm regardless of CBR.

The sub-base layer must extend a minimum of 300mm past the rear face of any kerb and / or guttering.

3.5.5 Compaction Requirements

Depending on traffic volumes and actual pavement design, compaction will be in accordance with the DPTI Master Specification. Compaction testing of all pavement levels must be undertaken by a NATA approved laboratory, or by calibrated densometer test to the relevant Australian Standard. Tests should be taken at 2/3 depth of pavement layer where possible. An Inspection & Testing Plan (ITP) is to be prepared and completed by the Design Engineer and submitted to Council prior to Practical Completion.

3.5.6 Road Material

Roads shall be constructed using materials conforming to the requirements of Part R15 of DPTI Master Specification, named Supply of Pavement Materials for quarry and recycled materials. Base shall comply with PM1/20QG. Sub-base shall comply with PM2/20QG, PM2/40QG or PM2/20CR. The pavement design is to be approved by Council prior to construction. The construction of the rubble pavement shall be in conformance with Part R21 of DPTI Master Specification, Construction of Un-stabilised Granular Pavement.

3.5.7 Subgrade

The subgrade must be compacted to 98% standard compaction or in accordance with the Construction Specification and/or AS 3798.

3.5.8 Sub-base

The typical flexible pavement sub-base which is generally PM2/20QG must be compacted to the relative modified maximum dry density (MMDD) of 96%. Frequency of Testing is to be in accordance with AS 3798 and AS 1289 Geotechnical Testing. Test locations shall be selected on a random stratified basis in accordance with AS1289. Frequency of testing is to be one test per 400m2 with a minimum of 4 tests.

3.5.9 Basecourse

The typical flexible pavement base, which is generally fine crushed rock (PM1/20QG) must be compacted to the relative modified maximum dry density (MMDD) of 98% with test locations to be selected on a random stratified basis in accordance with AS1289 and measured to a minimum of 2/3 of the depth of layer. Frequency of testing is to be one test per 400m2 with a minimum of 4 tests.

3.5.10 Proof Rolls

Proof rolls of the subgrade, sub-base and basecourse are hold points and must be undertaken at the expense of the contractor, in accordance with AS 3798 and in accordance with the requirements of the DPTI Master Specification R10 Construction of Earthworks. The subgrade must not show signs of deep seated deflection vertically under the test roller (fully-laden tandem truck or watercart with not less than 10kL capacity or multi-tyre roller). Localised areas should be remediated. If deep seated 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 proof roll. Areas that fail a proof roll test are the responsibility of the contractor to rectify. Proof rolls are to be undertaken in the presence of the Site Supervisor, Consulting Engineer / Superintendent and Council representative.

3.5.11 Pavement Defects

Where unsuitable material exists or develops during construction, it must be rectified to the satisfaction of the Council. Possible treatment methods include cement 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 same required levels of compaction as specified above.

3.5.12 Wearing Course

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

The wearing course that is to be constructed on all residential roads is to be a minimum of 30mm of AC7 asphalt on minor access roads and a minimum of 40mm of AC10 asphalt on access roads, collector roads and distributor roads with more than 400 vehicles per day. The surface of the wearing course shall be 5mm proud of the concrete watertable, however it is to be flush with the lip of the kerb and channel at all footpath kerb crossings to eliminate trip hazards.

All AC10 Asphalt placed on low traffic local roads shall conform to the Hot Mix Asphalt Mixes of the DPTI Specification R27 – Supply of Asphalt, and R28 – Construction of Asphalt Pavements.

All new and upgraded roads, including widened roads located in commercial or industrial zones, or which are identified as collector roads, must be sealed with AC10 14 Asphalt of suitable thickness for the expected traffic loading, with the minimum thickness to be as shown in Table 3.4 or as supported by the engineered design.

Production testing and field density results must be provided for each asphalt mix and layer. Density test locations should be selected on a random stratified basis in accordance with AS1289. Frequency of density testing is to be a minimum of 1 test per 100m length of road with a minimum of 4 tests.

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

3.6 Traffic Control Devices

The Design Engineer must determine any necessary traffic control devices 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". The supply and installation of traffic control devices must comply with AS 1742 "Manual of Uniform Traffic Control Devices".

It should be noted that Major traffic control items require special approval from DPTI. It is the Designer's responsibility to obtain the necessary approvals.

3.6.1 Signposting and Pavement Marking

Signposting and pavement marking should generally be provided to roads, intersections, traffic control devices, bicycle lanes and carparks in accordance with AS 1742 Parts 1-15 and the DPTI "Standard Specifications" Parts R45 and R46". All street name plates are to be to the City of Salisbury standard and be in accordance with AS 1742.5 – Manual of uniform traffic control devices – Street name and community facility name signs.

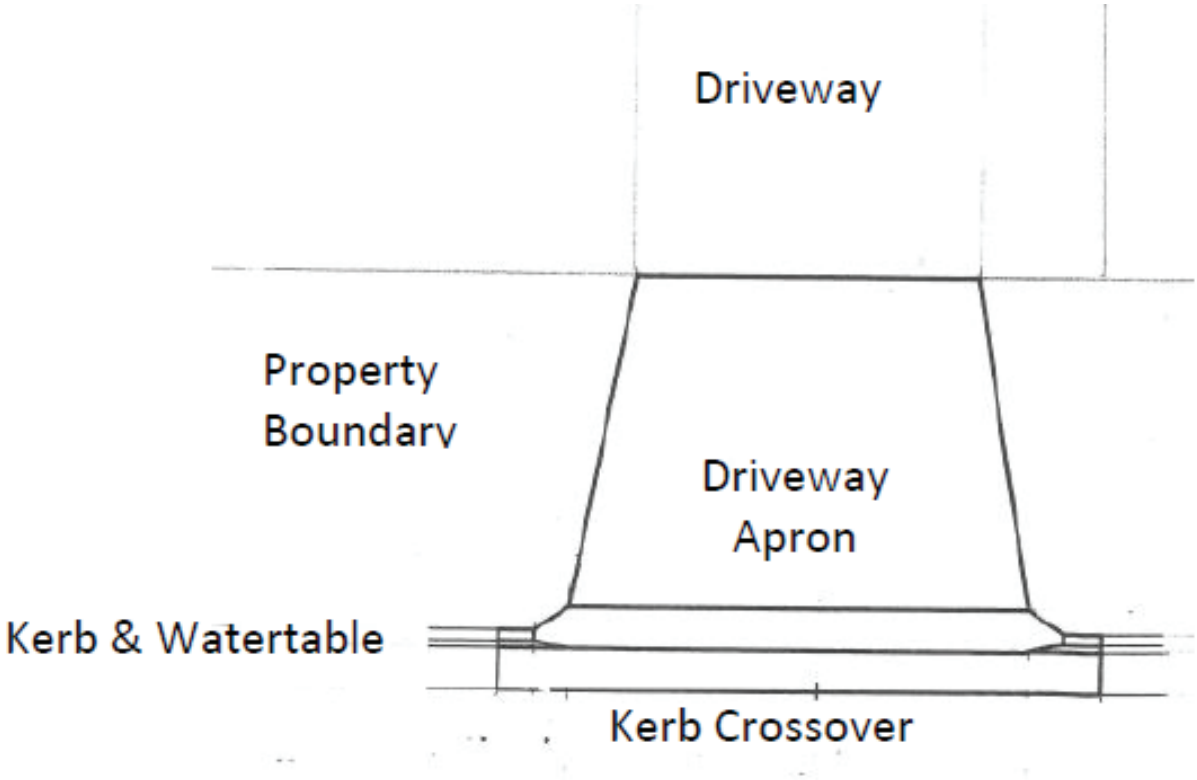
3.6.2 Road Names

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

3.7 Vehicular Access Driveways

Vehicular access to each and every allotment within a land division development must be nominated at the time of Development. Concrete crossovers are not required to be constructed at the time of construction where mountable or semi-mountable kerb is used as these may be constructed during later building works when the final location is known.

Where a new or upgraded road includes construction of barrier or upright kerb, a kerb crossover invert and driveway apron must be provided to each allotment frontage.



The horizontal design and layout of all driveways shall be in accordance with AS 2890.1 – Off-street Car Parking, AS1428.1 – Design for Access and Mobility, and the B85 (8.0m radius) swept path template with a minimum of 300mm clearance on each side.

Where the surface level of a garage, car park or allotment will vary significantly to the road level, Council requires the Designer or Developer to demonstrate how vehicular access will be achieved in accordance with AS 2890.1. This will be required to be provided for each occurrence within the development. This will need to be demonstrated on a longitudinal section which identifies the individual transitions. If a proposed finished floor level for a future dwelling resulting from a land division is to be restricted due to access requirements, this is to be done via a Land Management Agreement or Encumbrance.

All access must be safe and convenient 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 of vehicle crossover inverts and aprons and the reinstatement of existing crossovers not required by the Development shall be carried out by the Developer to the satisfaction of Council. All vehicle crossings must be constructed in accordance with Standard Details SD-12 to SD-16.

All single battle-axe allotments shall be provided with a sealed driveway with width in accordance with AS2890.1:2004 extending the full length of the access leg of the allotment designed to Council satisfaction.

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

Driveways and other vehicle access locations entering trunk collector or DPTI managed roads shall be designed to allow both entry and exit from properties to occur in a forward motion. The maximum width of a vehicle crossing in a residential area is 7.0m at the kerb (plus transitions).

Crossings to adjacent properties should either be fully combined, or have a minimum separation of 6.0m to allow on-street park between driveways. Kerb crossings must be constructed at approved locations and must comply with Council's standard details. Kerb crossings near intersections must be located at least 6.0m from the kerb tangent in accordance with AS2890.1:2004. Additional minimum clearances are noted in Table 3.5. In some instances where there is low traffic volume, a reduced set back may be permitted at the discretion of the Council's Development Engineering or Traffic teams.

INFRASTRUCTURE	MINIMUM DRIVEWAY OFFSET
Street Tree	2.5M
Street light, Stobie Pole, SAPN Service pillar	1.0M
Stormwater side entry pit	0.5M
Kerb ramp	0.5M
Water meters (potable and recycled)	0.5M

Table 3.5 - Clearance from Infrastructure

All crossings must be constructed with a sealed surface and the portion of the crossing that passes through the footpath zone must conform to the requirements of AS 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 on compliance with relevant Standards and Policies.

3.8 Verges

All verges shall grade from the property boundary to the top of kerb. The maximum grade shall be 5% and the minimum grade shall be 2%. For properties that fall away from the road reserve, the verge shall have a minimum fall to the kerb from the property boundary of 2%. (Note: Dwellings with Finished Floor levels which are lower than the top of kerb require a 150mm rise between kerb and property boundary to provide additional freeboard against flooding and this may result in the need for developers to modify the verge level and provide longitudinal footpath transitions).

Any resulting differences between the finished surface and natural surface at the property alignment shall be battered up or down to the natural surface level as required and within the proposed allotments or reserves where agreed (external to road reserve). Such batters shall not exceed a grade of 1 in 5 (20%) to allow stability and maintenance.

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

Backfill material should be able to be classified as a General Purpose Soil or On-site soil as per AS 4419-2003 Soils for landscaping and garden use, being suitable for the growth of plants usually grown in residential gardens and public landscaped areas.

Where backfill is unable to be supplied from on-site soil, substitute soil shall be selected with consideration of Appendix L of AS 4419-2003. Material bought to site shall be accompanied by material information sheet or invoice, as per section 8 of AS 4419-2003. Material bought to site without suitable documentation will be refused and need to be reinstated with approved material.

Following filling, spreading and levelling of topsoil, all exposed batter slopes, excavated and filled areas that will not be subject to specific landscape works will be reseeded.

3.9 Car-parking

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. 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 203 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.

3.9.1 Car parking Requirements

The following parking requirements apply to all projects:

a. The parking requirements for normal levels of activity associated with any land use should be accommodated on-site and should be located and sized to allow convenient and safe access and usage.

b. 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 from Council's Development Engineering or Traffic teams.

c. The layout and access arrangements for all on-street and off-street parking areas should conform to AS2890.1 – Off Street Parking, AS2890.2 – Off Street Commercial Parking, AS2890.3 – Bicycle Parking Facilities, AS2890.5 – On Street Parking and AS2890.6 – Off Street Parking for People with Disabilities.

d. Loading / unloading requirements should consider potential conflicts between commercial vehicles, forklifts and pedestrians on the site as well as any other potential movements.

e. Carparks should be designed to include medians and landscaped areas to avoid large expanses of paved areas.

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

f. On-street parking areas should be sited to minimise any restriction to driveway access created by vehicles parked on the opposite side of the road.

g. Where a particular development may generate a high demand for parking, the Developer may provide adequate additional parking in the road reserve for visitors, service vehicles and any excess resident parking. Such parking is to be convenient to dwellings.

h. All verge spaces and indented parking must be constructed of concrete, interlocking pavers, bitumen or asphalt with crushed rock pavement base and designed to withstand the loads and manoeuvring stresses of vehicles expected to use those spaces.

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

i. 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.

j. All loading / unloading zones should be constructed of concrete pavement to resist damage from diesel and fuel spills.

k. Disabled parking spaces must be provided in accordance with AS2890.6.

l. The level and standard of lighting shall be determined according to Standards Association of Australia codes and AS1158 series to reflect Council's policy of pursuing lighting standards that are energy efficient and environmentally sustainable.

m. The carpark design is to include landscaping, drainage, pavement design and material selections

4. EARTHWORKS

4.1 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, overland flow paths and vegetation removal.

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

a. To ensure that the earthworks, lot filling or Development does not cause or aggravate the flooding other properties and that, in particular, existing runoff storage areas and/or flow paths are not filled unless necessary permits have been obtained

b. To ensure buildings are located on natural surface or on approved filled ground above the 100 year ARI flood level to comply with Council's Development Plan.

c. To ensure compliance with the recommendations of the Catchment Management Authorities or other relevant agencies or organisations.

d. To ensure that earthworks and lot filling work does not result in erosion, dust, mud or debris to be released from site.

e. To maintain privacy and security of adjacent land owners.

4.2 General

Approval of engineering plans by Council's Development Engineering team relates only to the capacity of earthworks required to accommodate road and stormwater drainage systems to the satisfaction of Council and does not negate the need for Development Plan consent of such works. 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 Development Engineering team.

The horizontal design or layout of all driveways shall be in accordance with AS2890.1, AS1428.1 and the B85 Swept Path template with 300mm 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 special treatments such as retaining walls and appropriate erosion control measures are applied.

4.3 Requirements

The following relate to all earthworks and filling:

a. All work must be undertaken in accordance with AS 3798 – "Guidelines on Earthworks for Commercial and Residential Developments".

b. 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 is obtained.

c. Any earthworks or filling within a floodway should ensure that there is no impact on the Major Storm flood level.

d. All new allotments must be graded, cut or filled, such that a minimum grade of 1:200 is achieved along the low side of the allotment towards the stormwater drainage outlet.

e. The finished floor level of buildings is to be a minimum of 300mm above the Major Storm flood level.

f. The finished surface of any lot filling must be equal to or above the Major Storm flood level unless otherwise approved by Council.

g. The extent and depth of all proposed lot filling must be denoted on the construction plans. Where depths of fill on allotments exceed 300mm, those areas are to be clearly differentiated from fill of depth less than 300mm.

h. Full records must be kept of all areas filled and the information must be recorded on the 'as constructed plans'.

i. Where the depth of fill is greater than 300mm, allotment fill must be compacted to the requirements of AS3798 – 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 required for all allotments and highly desirable for filling of public roads.

j. Allotment Fill testing must be included in the Contractors Inspection and Testing Plans that are submitted for Council's consideration.

k. Where earthworks abut structures, the Design Engineer must demonstrate the continued safety and integrity of those structures to the satisfaction of Council.

l. The maximum depth of fill allowable against fencing is 200mm and requires a concrete plinth at the bottom of the fence.

m. Retaining walls must be provided when the depth of fill exceeds 200mm or maximum batter slopes are exceeded.

n. No water is to be directed to flow into adjoining properties.

o. Where fill is imported onto any Development site, 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.

p. All reasonable precautions should be taken to prevent the spread of noxious weeds from or to the development site. Special requirements may apply in certain areas.

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

r. All areas that are to involve earthworks are to have the topsoil stripped, stockpiled and reinstated. Before completion of the site works, the depth of topsoil replicating predevelopment depths must be placed and rehabilitated over all areas where there have been earthworks.

s. Special consideration must be given to sites that may have been subject to biological or chemical contamination. The Council, EPA or other relevant authority may require a full analysis of any potentially affected sites and may require an Environmental Impact Statement.

5. STORMWATER

5.1 Stormwater Drainage Strategy Plans

5.1.1 General

The design and management of stormwater runoff must be consistent with any relevant Council Flood Management Strategy (FMS).

Where the stormwater drainage system has not been previously defined in the Development Plan, Developers may be required to provide a Stormwater Drainage Strategy Plan. This plan must address all runoff generated within the project area or transmitted from upstream catchments through the project area and must be prepared by an experienced and qualified Engineer on behalf of the Developer. The Stormwater Drainage Strategy Plan submission must reference the relevant Council FMS and include catchment and sub-catchment plans, conceptual stormwater drainage systems including treatment, detention, retention, mitigation and proposed location and method of stormwater discharge from the system. The plan should also consider water quality, water sensitive urban design, erosion management and flood management. The impact on the overarching Council FMS must be clearly stated.

The need for the Stormwater Drainage Management Plan may be triggered by any of the following:

- Amendment to the Development Plan
- Request for Rezoning
- Significant increase in runoff as a result of proposed development
- If in the opinion of Council, the additional stormwater may exceed the capacity of the downstream network
- Where developments include the construction of any of the following:
- A new detention basin
- A new treatment facility
- A new stormwater drainage outfall
- There is potential for significant further Development within the catchment

- The catchment involves multiple Developers within a specific locality.

Where a Stormwater Drainage Strategy Plan is required to be prepared prior to the issue of Development Plan Consent, the submitted plans will not receive endorsement until the plan is approved in Principle by Council's Development Engineering section.

5.1.2 Requirements

Where Stormwater Drainage Strategy Plans are required to be prepared for submission the following applies:

- The catchment area is to be carefully analysed and determined and the resultant defined area submitted to Development Engineering 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 flows for the 100 year ARI event. A blockage factor of 20% should be considered for the minor system generally, however a blockage factor of 50% should be considered for sag inlets.
- 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 flood ways, floodplains and/or flow paths are present, no Development will be approved without hydraulic modelling and analysis of these systems. 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 managed.
- 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 floodwaters and preserve the inherent values of wetlands.
- Proposed outfall conditions including quality objectives are to be clearly documented for approval by Development Engineering and other authorities if applicable.
- The Designer should ensure that the number of retarding basins and pump stations are minimised to reduce Council's ongoing operating and maintenance costs. Gravity systems are strongly preferred. If a pump station is proposed, it should be justified with a whole of life cost assessment and include measures to accommodate pump failure such as overland secondary pumps, alarms, overland flow paths and emergency peak flow storage.

5.2 Stormwater Drainage Systems

5.2.1 Objectives

The general objectives of urban stormwater drainage are:

- To collect, control and manage all stormwater generated from the development or project;
- To collect stormwater from a catchment and convey it to its receiving waters with minimal nuisance, danger or damage to the environment;

- To prevent flooding of public and private property both within the catchment, upstream and downstream;
- To provide safety for traffic and pedestrians by controlling flows from minor and major events;
- To provide an effective outlet for all collected stormwater to a natural watercourse or approved outfall with outlet erosion control;
- To optimise water quality and facilitate opportunities for stormwater harvesting and reuse; and
- To achieve these objectives without detrimentally affecting the environment generally, surface and subsurface water quality, the adjoining landowners and other landowners in the vicinity of the stormwater drainage outlet and watercourses either upstream or downstream of the development.

5.2.2 General

Stormwater drainage design must be in accordance with the current provisions of "Australian Rainfall and Runoff" with consideration to WSUD principles.

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 full Development potential 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. Staged upgrading of the system can only be undertaken with the approval of Development Engineering or Technical Services.

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 pavements. 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, including associated costs, are the responsibility of the Developer.

Prior to commencing detailed design, the Design Engineer must determine the ultimate zoning of all external catchment areas contributing to the stormwater drainage system. This may require consultation with Council's Development Engineering and Planning officers in the first instance and will likely require engagement and advice from Council's Technical Services Division and Salisbury Water.

5.2.3 Major and Minor Stormwater Drainage Systems

The Design Engineer must adopt the 'major / minor' approach to 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 Section 5.2.6. 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, Australian Runoff Quality, a guide to Water Sensitive Urban Design and all stormwater conveyance should be in accordance with the National Plumbing and Drainage Code and AS 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 Section 5.2.6). 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.

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 the major storms, 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. A road if the catchment area is small; and / or

b. A stormwater drainage reserve if it is impractical or unsafe for a road to carry the excess flows.

5.2.3.1 Finished Floor Levels

Finished Floor Levels are to be as follows:

a. A minimum of 300mm above the top of kerb level for residential properties that grade towards the road unless otherwise advised.

b. Properties that grade away from the road should have the Finished Floor Level built up wherever possible, however if not practical, the level of the driveway and front boundary is to be raised at least 150mm above the top of the kerb level directly adjacent to provide freeboard.

c. Finished Floor Levels for industrial and commercial properties are to be a minimum of 150mm above the level of the post-development major storm flood level adjacent to the building – this is usually calculated within the adjacent carpark or hardstand area.

d. Finished Floor Levels for developments of a sensitive nature (ie. emergency services, schools, adjacent water courses etc) are to be assessed using the merits of the site.

5.2.4 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 an electronic drainage model (such as DRAINS or equivalent). The catchment plan should incorporate clear, defined contours.

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 a relatively long 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.

The Design Engineer must determine the most appropriate methodology when assessing the major stormwater drainage. Regardless of the method used, detailed documentation and electronic files must be submitted for detailed design approval.

5.2.5 Rainfall Data

Intensity / Frequency / Duration (IFD) charts are available from the Bureau of Meteorology website. Charts for any Australian location can be created on this website using latitude and longitude of the location.

5.2.6 Average Recurrence Interval (ARI)

The design the stormwater drainage system must be based on the ARI documented in Table 5.1.

Stormwater Drainage System	Capacity (Minor Event)	Capacity (Major Event)
Residential areas	5 year ARI	100 year ARI
Commercial areas	10 year ARI	100 year ARI
Industrial areas	10 year ARI	100 year ARI
Sensitive use (emergency facilities, schools)	20 year ARI	200 year ARI
Areas prone to local flooding	100 year ARI	100 year ARI

Table 5.1 – Average Recurrence Intervals for City of Salisbury

The capacity of the road carriageway, inclusive of the underground system, must comply with the major events as detailed above.

5.2.7 Coefficients of Run-Off

A range of typical coefficients of runoff to be used in the design of stormwater drainage systems are shown below. The coefficient of runoff is to be assessed by the Design Engineer based on the locality. Site with steeper slopes, clay or rock surfaces, less vegetation or higher rainfall intensities will all have higher coefficients of runoff.

Catchment Type	Coefficient of Runoff
Predevelopment Conditions	0.25
Low Density Residential Areas (Allotments 2000m2 and above)	0.3 - 0.35
Residential Areas Allotments 1000m2 to 2000m2)	0.5
Residential Areas (Allotments 600m2 to 1000m2)	0.6
Residential Areas (Allotments 450m2 to 600m2)	0.75
Residential Areas (Allotments 300m2 to 450m2)	0.8

Residential Areas (Allotments < 300m2)	0.9
Residential Areas Medium Density	0.9
Commercial Zones	0.9
Industrial Zones	0.9
Landscaped Areas	0.35
Paved Areas	0.9
Pools, Stormwater Basins, Lakes & Wetlands	1.0

5.2.8 Hydraulic Design

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

- The HGL must be at least 150mm below the invert of the kerb for minor flows;
- The HGL must be contained within the road carriageway for major flows;
- The HGL 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 below.

Pipe Material	N	K
Spun Precast Concrete	0.013	0.6
UPVC	0.009	0.06

Table 5.3 – Pipe Roughness Values

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

a. Where the pipe(s) of the primary stormwater drainage system adjacent to the relevant allotment have a diameter equal to or greater than 525mm and surcharge due to a 20% blockage (50% blockage for sag) of the pipe could flood the allotment; or

b. Where the pipe(s) of the primary stormwater drainage system adjacent to the relevant allotment have a diameter less than 525mm and surcharge due to 50% blockage of the pipe could flood the allotment; or

c. Where surcharge from a blockage of 50% of the adjacent stormwater pits could flood the allotment.

5.2.8.1 Pipe Velocities

The design pipe velocities are as follows:

- Minimum – pipe running ½ full or greater 0.75 m/s
- Minimum – pipe less than ½ full 1.00 m/s
- Maximum 5.00 m/s

5.2.8.2 Minimum Pipe Grades

In general the absolute minimum grade of a stormwater pipe is to be 0.5% to ensure that water velocities are sufficient for self-cleansing.

5.2.8.3 Minimum Pipe Cover

- The minimum cover will be the greater of:
  - Manufacturers Recommendation
  - Australian Standards
  - 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 as required by the service provider.
- Pipe classes must be determined having regard to the proposed cover and loading to be encountered during construction. All road crossings shall have Class 4 pipes and pipes within the existing or future carriageway shall be not less than Class 3.
- Wherever an external area contributes to the system, the drainage system must be designed to serve the total upstream area.
- Any exceptions to the minimum cover requirements are to be discussed with Council's Development Engineering team.

5.2.8.4 Splays

A pit is to be constructed wherever there is a change in horizontal or vertical alignment of stormwater pipes. Splays are not permitted.

5.2.8.5 Pipe Alignments at Pits

- 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.

5.2.8.6 Pit Losses

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

5.2.8.7 Pit Locations

- Generally side entry pits are to be spaced so that the length of flow in water tables does not exceed 100 metres, or the "depth x velocity" does not exceed safe levels (typically 0.4m/s2), or depth of flow is more than 2/3 of the kerb height, whichever is less distance.
- Side entry pits should be sufficiently set back from intersections and road corners to minimise damage by vehicle traffic (including construction traffic) or where this is not possible, shall be of heavy duty construction in accordance with Council's standard detail for side entry pits.
- 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. Junction boxes should preferably be located outside of road carriageways to allow safe access.
- 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 kerb returns, kerb crossings and 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 Design Engineer demonstrates that a single side entry pit provides sufficient inlet capacity for the pipes to operate at their required capacity. Side Entry Pits must be located at least one metre from the tangent point.
- Deflectors are to be used where the grade of the watertable exceeds 12.5%.
- In all cases, design consideration must be given to pit location and pit inlet capacities. Pits should be installed upstream of kerb crossings and pedestrian crossings.

5.2.9 Trunk Drains

Pipes with a diameter of 750mm or more are to be designed as trunk drains, and as such, large direction changes through standard pits are undesirable. Consideration should be given to use of special manholes, additional pits and streamlining / benching at all changes of direction.

Design criteria for the outfalls of trunk drains must be determined after discussion with Council's Development Engineering team.

5.2.10 Pipes

5.2.10.1 Pipe Materials

1. Reinforced Concrete Pipes & Culverts

   Reinforced concrete pipes are to have a spigot-and-socket profile and be manufactured to meet the requirements of AS 4058, AS 1597, AS 2041 and AS 5100. Pipes with a diameter of 750mm or less are to have rubber ring joints. Larger pipes and culverts are to be flush jointed with external bands installed in accordance with the manufacturers recommendations

2. Other Pipe Profiles and/or Materials

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

5.2.10.2 Pipe Diameters

- The minimum pipe diameter is generally 90mm UPVC for outlets servicing a single property. The minimum pipe size for rear of allotment drains should be determined on merit, with a minimum diameter of 225mm and be of DWV class or better. Additional outlets may be required where discharge from the property 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 225mm. Pipes that are or will become Council assets and do convey runoff from a road or street must have a minimum diameter of 375mm to reduce the risk of blockage.

5.2.10.3 Standards for Design & Installation of Pipes

1. General

   All pipes must be designed and installed according to the relevant Australian Standards for that type of pipe. When selecting the type and class of pipe to be used, due regard must be given to the external loading (including during construction), the pipe characteristics and the construction technique 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.

2. Reinforced Concrete Pipes

   Reinforced concrete pipes must be designed and installed in accordance with AS 3725 and

with the guidelines published by the Concrete Pipe Association of Australia.

5.2.11 Structures

5.2.11.1 Stormwater Drainage Structures

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

5.2.11.2 Step-downs at Pits

- Minimum step-downs 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 20mm. In all circumstances where changes in direction occur, a number of pipes enter the one pit, larger inlet and outlet velocity differences exist or grated or side entry pits are used, losses must be considered and provided for.

5.2.11.3 Side Entry 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 which are found on the City of Salisbury website.
- Pre-fabricated pits are to be used unless otherwise approved. Council may require that a certificate be provided by a Qualified Engineer to confirm the structural integrity of any pits approved to be cast in situ.
- All pits shall be designed for the road class and include some redundancy to allow for minor site modifications typical to construction.

5.2.11.4 Pit Covers

- Pit covers are to be in accordance with Council's standard details and a minimum of Class D within road reserves. Trafficable load bearing covers are to be provided on all pits located in exposed kerb areas, and on all pits located in industrial areas. The stormwater drainage network shall be designed to locate pits away from exposed kerb areas wherever possible.

5.2.12 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 a stormwater drainage basin. The GPT must be located such that safe and convenient access by maintenance vehicles is achieved with an all-weather access track and hardstand that allows the maintenance vehicle to be clear of the road carriageway.

Gross pollutant traps should be designed to treat a 3-month ARI event, to be cleaned by Eductor Truck and have a suitable overflow mechanism.

5.2.13 Outfall Structures and Energy Dissipaters

Outfall structures or discharge points must be designed and constructed to meet the following requirements:

a. Scour protection components are to be designed for the design discharge volume and velocity of the outlet structure.

b. A hardstand must be provided above the headwall to allow a maintenance vehicle or machine to be clear of the road carriageway during maintenance. An all-weather access track to this hardstand is to be provided.

c. Slopes behind wing walls are to be backfilled with cement treated rubble, an approved geotextile or treated with an application of lean mix concrete to improve stability and prevent erosion.

5.2.14 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.

5.2.15 Property Drains

A stormwater connection point shall be provided for each and every allotment.

Where residential properties grade towards the street, a galvanised steel kerb adaptor shall be provided and cast into the kerb on the lower side of the allotment. See Council Standard Detail SD-08.

Where an allotment grades to the rear and there is no rear of allotment stormwater drainage provided, if not filled to grade towards the road, a stormwater drainage easement will need to be obtained for the outfall pipe through neighbouring property for connection to the street water table at the Developer's expense. Such drains shall be designed to accommodate stormwater from the entirety of the respective developed allotments in the occurrence of a 5 year ARI storm event. The minimum diameter of the pipe shall be 225mm and each allotment shall be provided with a 300 x 300mm grated inlet pit / junction box, located at the lowest corner of each respective allotment. Rear of allotment stormwater drainage shall also be provided where allotments back onto reserves. Easements are to be in favour of Council for all rear of allotment drains other than one single allotment.

Stormwater discharge from industrial and commercial properties (including car parking areas) must pass through an appropriately designed treatment chain to ensure water quality targets set by the EPA to remove grit and contaminants prior to entering the stormwater system are met. Typically all treatment is to occur within the property and discharge is directly connected to the existing underground drainage network. Roof water may be discharged to the drainage network without any requirement for water quality treatment. Also refer to Section 5.4 – Stormwater Treatment.

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 Council's Development Engineering team.

5.2.16 Major Storm Drainage Requirements

The major storm 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, limits flooding of private and public property and minimises the inflow of pollutants to receiving waters.

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

a. Design of major storm drainage systems must be based on the critical major storm, with some consideration given to the impact of a rarer storm event (1 in 200yr ARI). The critical storm must be determined by routing storms of varying duration until major peak flows are identified.

b. Hydraulic Grade Line analysis must be used for design of floodways, low flow pipes and detention / retention basins. The width of major floodways must be governed by the greater of the hydraulic requirements or the width for suitable maintenance (including mowing of grassed swales and drains).

c. 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 must be kept below a flow "depth x velocity" limit of 0.4m2/s and maximum allowed ponding of 0.15m corresponding to the kerb heights parallel to the flow.

5.2.17 Floodway Design

A major floodway generally comprises engineered open waterways, and often makes use of roadways, swales and sometimes sheet flow through open spaces. Major floodways area generally located within road reserves, stormwater drainage reserves or public open spaces. Council will not accept major floodways through easements on private land and major flows must be contained entirely within reserves and road reserves.

When overland floodways or storage is to be altered or changed as part of a Development, compensatory works must be assessed and implemented.

Where active floodways are present, hydraulic modelling and analysis will be required. The Designer may also be requested to submit a risk assessment report including details of the 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 work 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 flows on the Development.

The alteration or change to any existing wetland must only be considered after all other alternatives have been considered.

The minimum requirements that apply to the design and treatment of floodways and open unlined drains and swales are as follows:

a. Depth of floodways should be kept to a minimum (generally less than 1.2m).

b. Desirable maximum batter slope is 1:8; absolute maximum batter slope is 1:5. Desirable minimum cross fall for inverts is 1:40. Minimum bed width is to be 2.5 metres.

c. Permissible scour velocities and minimum permissible velocities for public safety must govern maximum longitudinal grades for major floodways.

d. Desirable maximum longitudinal grade for major floodways is 1:500 in order to minimise the likelihood of ponding and siltation Absolute minimum grade is 1:1000.

e. 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.

f. Floodway Design utilising a low flow pipe must be sized for the entire major ARI design flow 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 450mm and absolute minimum cover is 350mm. 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 three (3) month ARI flow as an absolute minimum.
- Minimum grade of low flow pipes must be sufficient to generate self-cleansing velocities.
- Minimum diameter of low flow pipes is 375mm with orifice to reduce the potential for blockage.
- Low flow pipelines, including pits and other structures should be aligned to minimise hydraulic losses. In some cases however, pits / structures may be specifically design to dissipate energy.

g. Major floodways 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.

h. Pipes discharging into major floodways must be connected to the low flow pipe with surcharge pits provided as necessary.

5.2.18 Stormwater Drainage Reserves

Where stormwater drainage reserves are incorporated into Developments, the minimum reserve width should be 10 metres. Reserve widths must accommodate a drain with sufficient capacity to cater for a major storm event. A 3 metre wide all-weather access track is required on both sides of the drain with batter slopes of maximum 1:5. Any pump stations, electrical equipment, water-quality treatment infrastructure or any other service must be sited with sufficient clearance for construction and maintenance vehicle turning at an appropriate location.

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 when the open space is usable and with the agreement of Council. Consideration should be given to increasing reserve width for conservation and landscaping purposes.

5.2.19 Stormwater Drainage Easements

Easements shall only be constructed where discharge to the road reserve or existing drainage reserve is not feasible. Approval of new easements is at the discretion of Council. 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 be provided over all drains in any allotments not being a road reserve. Unless otherwise required by Council such easements shall be three (3) metres wide when the easement contains only a single drain or pipe and at least four (4) metres wide when the easement contains more than one drain or pipe; where they shall be separated by a minimum of 1 metre.

Where practicable, 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.

Stormwater pipes and easements to be constructed over only one property are to be in favour of the source property.

5.2.20 Building over Easements vested to Council for Drainage Purposes

Consent from Council's Infrastructure Asset Owner is required to construct a permanent building or structure over an easement vested to Council for drainage purposes.

Building over an easement will generally only be considered where other options have been exhausted and the design considers the ongoing maintenance and upkeep of both assets.

5.3 Retention/Detention Basins

5.3.1 Objectives

a. To ensure that the capacity of existing stormwater infrastructure is not 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.

b. To ensure that the likely cumulative impact of similar projects or Development will not exceed the capacity of the existing stormwater drainage system.

c. To reduce runoff and peak flows from catchments into receiving waters.

d. To limit, as much as possible, the number of Council owned retention / detention basins servicing an area in order to reduce Council's future maintenance expenditure.

e. 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 such as car parks as determined by Council.

f. To minimise costs of stormwater drainage infrastructure by reducing peak flows.

g. 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.

h. To incorporate stormwater treatment, sedimentation traps and litter traps into the retention / detention basin design where practical and required by Council.

i. To ensure that retention / detention basins are so designed and constructed as to:

- Be aesthetically pleasing
- Have regard to the area in which they will be located
- Form part of the open space
- Avoid any adverse impact on amenity in the surrounding areas such as odour and mosquitos.

5.3.2 General

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

For Development it must be demonstrated that any required stormwater retention or detention systems can be integrated into the existing stormwater drainage system. Any design must be consistent with the requirements of Council and other authorities such as NRM Boards, with discharge limits to be equivalent to pre-development flows.

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

In circumstances where retention / detention basins will not be maintained by Council and are located within private or common property, Council is unlikely to be a member of the Body Corporate. In such cases, a Land Management Agreement must be placed on each benefitting allotment to ensure that stormwater drainage of Council's roads or reserves is not compromised by any act or failure to act by any property owner or body corporate.

When a retention / detention basin is required for any Development, the basin and any overland flow paths should be constructed as part of the first stage of works. 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, calculations and approvals from relevant authorities to Council, demonstrating that satisfactory alternate provisions can be made for storage and outfall.

5.3.3 Retention / Detention Basin Design Requirements

5.3.3.1 Location and Siting

- Retention / Detention basins should not be sited in areas identified as being affected by overland flooding.
- 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 as active floodways. Works must be carried out to minimise erosion and maintenance resulting from overland flows entering and leaving the basin.
- Siting of retention / detention basins must have regard to:

a. The physical dimensions required for storage volume including the flattest possible batters, access to the basin bed and maintenance of batters and edges;

b. Predevelopment catchments;

c. Existing developed catchments;

d. Existing stormwater drainage including pipes, open drains and flowpaths;

e. Existing and proposed stormwater drainage easements;

f. Ground water depth and seasonal fluctuations;

g. Subsoil characteristics;

h. Location and point of discharge;

i. Soil type and seepage rate;

j. Land uses and zoning;

k. Effect of overland flows external to the catchment;

l. Potential risk or effect on people, fauna and flora;

m. Amenity of the area;

n. Benefiting landholder issues;

o. 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 pumped outfall.

p. Availability of mains electricity for pumping and/or future telemetry;

q. Safe all-weather access for maintenance;

r. Water quality;

s. Whether or not the basin is proposed to be used or included in the calculation for Public Open Space for development;

t. The location of overland flows into the basin and the treatments to minimise erosion;

u. Inlet / outlet velocities and the need to install energy dissipation structures;

v. Q100 flood level;

5.3.3.2 Design Criteria

Retention / Detention basins must be designed for the critical major storm. Basins with downstream established areas and no clear and safe overland flow paths must be designed for the critical major storm with consideration given to a rarer storm event (Q500).

The minimum freeboard must be 300mm for earth structures and 200mm for hard structures, noting that allowance for wind action will be required for retention basins and permanent water bodies. Basins are required to have a minimum freeboard to top basin water level 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 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, ie. 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.

Where on-site detention is required prior to discharge into Council's existing stormwater drainage network, the Design Engineer must provide calculations to the satisfaction of Development Engineering which show how the permissible rate of discharge and volume of on-site detention have been determined. The Design Engineer must also demonstrate that Council's existing stormwater drainage system will not be adversely impacted by the project.

5.3.3.3 Inlet Structures

Any inlet to a basin must have an approved inlet stormwater drainage structures including a headwall and approved post and rail barrier to prevent falls and to identify the location of headwalls and wing walls.

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

5.3.3.4 Low Flow Pipes

Retention / Detention basins discharging into, or located adjacent a natural waterway must incorporate a low flow pipe system having a minimum pipe diameter of 375mm. The low flow pipe system must be designed to match the outflow capacity where this is less than a 5 year ARI storm event.

5.3.3.5 Overflow Systems

A suitable overflow system (ie weir, spillway) must be provided to cater for rarer storm events than what the system has been designed for 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 to cater for a major storm event.

The maximum depth of overland flow must be designed so that it is no higher than 300mm below the lowest floor level of any dwelling impacted by the overflow.

5.3.3.6 Depth of 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 Development Engineering to prevent the ingress of groundwater.

The maximum depth of all basins in public areas will be determined having regard to the safety of the public.

5.3.3.7 Batter Slopes in Earthen Basins

Where public access is to be provided the desirable maximum batter slope for retention / detention basins is 1:8 for both cut and fill situations, with the absolute maximum batter slope being 1:5 for both cut and fill situations. The use of any slope greater than the absolute maximum slope of 1:5 requires specific permission to be sought from the Council after provision of methodology in regards to access, maintenance and stability. The desirable minimum cross fall for the floor is 1:400 graded to the outlet point.

5.3.3.8 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 the maintenance vehicle is clear of the road carriageway.

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

5.3.3.9 Risk Analysis

A risk assessment report is to be prepared by the Design Engineer for all retention / detention structures including basins and associated infrastructure. The risk assessment should be undertaken in accordance with the principles of AS31000 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's Development Engineering team 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.

5.3.3.10 Fencing & Security

Unless prior written approval has been obtained from Council, all basins which are not to be accessible to the public must be fenced and secured against casual access.

Where batters are steeper than 1:8, a full risk assessment must be submitted to Council's Development Engineering team for consideration. Where the risk assessment determines that the above ground storage system or basin should be fenced due to public risk, a 1.8 metre high chainmesh security fence must be installed for the entire perimeter. Suitable access via lockable gates must be provided for maintenance purposes.

5.3.3.11 Landscaping

A detailed landscape plan for all basins and drainage reserves must be provided to Council for approval with the design documentation. The Developer will be responsible for the maintenance of landscape elements for a period of 12 months after Practical Completion unless otherwise agreed in writing by Council's Landscape Design team.

5.3.3.12 Maintenance

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

For on-site detention systems to remain effective it is important that Council can inspect these systems to ensure that the landowner is properly maintaining their system in accordance with Council requirements.

For private property Council may therefore require a Land Management Agreement binding the landowner to regularly maintain their on-site detention systems and to pay Council an annual inspection fee as set by Council from time to time. Council will arrange for preparation and registration of the Land Management Agreements at the cost of the Developer.

5.4 Stormwater Treatment

5.4.1 Objectives

a. To ensure that all stormwater discharged to natural watercourses and other Council infrastructure meets the requirements of the Natural Resources Management Act 2004, Environment Protection Act 1993 and Council's water quality requirements.

b. To implement the design requirements of Council's Stormwater Management Plans.

c. To ensure all designs incorporate consistent best practice WSUD measures and principles, consistent with the Salisbury Water approach to WSUD which focuses on maximising the beneficial reuse of stormwater.

d. 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.

e. To protect and enhance natural water systems within urban environments

f. To integrate stormwater treatment into the landscape, maximising the visual and recreational amenity

g. To improve the quality of water draining from urban catchments into receiving environments.

5.4.2 General

All Designers must make provision for the improvement of water quality for runoff 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 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 the Environment Protection Authority's "Water Quality Policy", and should meet the "Water Sensitive Urban Design in Greater Adelaide Technical Manual" prepared for Local Government in South Australia.

The following stormwater treatment methods may be considered, subject to Development Engineering approval, to enable compliance with the Codes and Guidelines. These are listed in order of priority:

- Grassed swales
- Gross Pollutant Traps
- Sedimentation Basins
- Constructed Wetlands
- Water Tanks, preferably with fixed retention / detention ratio's
- Waterway rehabilitation including revegetation
- Lined Bio-retention swales
- Lined Bio-retention basins
- Soakage solutions are a last resort, to be adopted only if no viable alternative can be found.

Further to this, Council may require drainage reserves for the specific purpose of stormwater treatment to ensure appropriate water quality of discharge.

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.

5.4.3 Requirements

5.4.3.1 General Requirements

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

a. Developments and Council projects should comply with principles and recommendations of Water Sensitive Urban Design in Greater Adelaide Technical Manual and Council's Flood Management Strategy.

   For external development, early design discussions with Council may facilitate integration with Council's extensive network of constructed wetlands and Managed Aquifer Recharge (MAR) facilities allowing the water quality objectives outlined below to be achieved in the most economical manner.

   The following water quality targets apply:

   - 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).
   - 60% retention of the typical urban annual load for Total Nitrogen (TN) ##
   - 100% retention of the typical urban annual load for Gross Pollutants (litter).
   - No visible oil flows up to the 3month ARI peak flow

Target is for large scale projects. Commercial development with less than 60L/sec discharge, group residential greater than 1200m2 total area or more than 6 dwellings have the reduced performance target 45% Total Nitrogen.

Where a development is in close proximity to existing wetlands or the stormwater discharge rate can be shown to be very low (ie commercial <10L/sec) Council's Development Engineer, in consultation with Infrastructure Management Team may permit reduced water quality targets.

The use of WSUD techniques to achieve the specified water quality targets is strongly encouraged. MUSIC modelling is to be provided for all commercial developments 60>L/sec discharge to verify water quality improvements can be achieved.

b. Discharge stormwater quality is to be maintained at predevelopment water quality levels during an average 2-year ARI storm event.

c. Treatment types are determined by the Designer subject to approval by Council's Development Engineers and must satisfy Council wide standards for maintenance, ongoing costs and stormwater quality.

   Developers of industrial estates will be required to contribute to treatment offsite 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 will be required to provide separate treatment for their Developments.

d. Staging and construction of developments is to be considered as part of the water quality planning.

e. 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 able to be undertaken without need for access of confined spaces.

f. 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.

g. Operational documentation and manuals are to be provided to Council prior to the issue of Practical Completion.

h. All water quality infrastructure must be able to be maintained year round.

5.4.3.2 Gross Pollutant Traps

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

a. For sizing GPT units the design flow to be used is the Q(3 months) with a high flow bypass provided for up to the minor design storm event detailed in Table 5.1.

b. The Designer will provide all weather access to all treatment sites to the satisfaction of Council and should allow for truck access to GPT's.

c. Discharge water quality standards must meet Council's requirements.

d. For design purposes, the cleaning frequency of GPT's is 6 months.

5.4.3.3 Bio Retention Swales

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

a. Typically, bio-retention swales are best suited to slopes of 1% to 4% or where velocities during major storm events do not exceed 2m/s. Where excessive grades are identified as a constraint, check basins may be required to reduce velocities.

b. Water should not pond at entry points to the swale for longer than 1 hour after cessation of rainfall.

c. For maintenance requirements, grass swales requiring mowing must not have side slopes greater than 1:5.

d. Swales should be in accordance with the guidelines set out in Water Sensitive Urban Design in Greater Adelaide Technical Manual.

5.4.3.4 Vegetated Swales / Grass Swales / Buffer Strips

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

a. 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.

b. Swale side slopes are typically 1:8, however grassed swales requiring mowing must not have side slopes steeper than 1:5.

c. Swale Design should be in accordance with the guidelines set out in Water Sensitive Urban Design in Greater Adelaide Technical Manual.

5.4.3.5 Sedimentation Basins

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

a. The design operating discharge for the basin should be a minimum of 1 year ARI peak discharge.

b. A bypass structure should provide for flow bypass of downstream macrophyte zones and wetlands for events up to the major storm event.

c. The sedimentation basin is to be designed to remove 95% of the particles less than 125µm in a 1 year ARI storm event.

d. Approach batter slopes should be no steeper than 1:5 with all edges having safety benches of at least 1.5m to 3.0m wide from the edge of the normal top water level.

e. Safety benches should have a maximum grade of 1:8 for the first 1.5m – 3.0m before changing to 1:5 grade.

f. Safety considerations should be addressed in every design. An independent safety audit must be conducted for each design that has elements that differ from the above requirements.

g. Basins shall be provided with a hard stand should be at least 3m wide which is designed and constructed to be capable of supporting 20 tonne excavation plant. Multiple areas should be considered where the pond is greater than 7m 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.

h. Where sedimentation basins double as a landscape element, a weir is recommended as an appropriate discharge control structure.

i. 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.

j. For sedimentation basins less than 14m wide, access is to be provided along both edges for maintenance vehicles.

k. For sedimentation basins greater than 14m wide, drawdown of the basin is required with vehicular access available in the base of the facility.

l. Sedimentation basins should be in accordance with the guidelines set out in Water Sensitive Urban Design for Greater Adelaide Technical Manual.

5.4.3.6 Constructed Wetlands

The design requirements for constructed wetlands are as follows:

a. 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.

b. A high flow bypass should be provided capable of taking flows in excess of design flows (typically a 1 year ARI event).

c. The wetland design must meet safety requirements and implement reasonable safety measures; this may include fencing, safety barriers, signage and benching.

d. Safety considerations should be addressed in every design. An independent safety audit must be conducted for each design that has elements that differ from the above requirements

e. Approach batter slopes should be no steeper than 1:5 with all edges having safety benches of at least 1.5m to 3.0m wide from the edge of the normal top water level.

f. Safety benches should have a maximum grade of 1:8 for the first 1.5m – 3.0m before changing to a grade of 1:5.

g. Hardstand areas should be provided adjacent to the inlet zone to allow for the maintenance and clean out of this zone with an all-weather access track.

h. The riser outlet pipe should be sized to act as an emergency overflow equivalent to the one year ARI peak discharge.

i. A minimum of 0.3m freeboard on the embankment is required.

j. Wetlands should always be constructed following a detention / sedimentation basin or with a sedimentation basin incorporated in the inlet zone. Offline wetlands are preferred for stormwater harvesting, however if space is limited, the wetland may be incorporated within a detention basin.

k. When considering macrophyte layout it is important to optimise hydraulic efficiency (ie. reduce dead zones and short circuiting of water). The optimal hydraulic efficiency value for constructed wetlands should be not less than 0.5 or greater than 0.7 where possible.

l. 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.

m. 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. In general, basins and wetlands should always be clay lined. Suitable topsoil with high organic matter should be re-introduced to wetland reed-bed zones to ensure healthy aquatic vegetation can be established as quickly as possible.

5.4.3.7 Rainwater Tanks

The design for rainwater tanks are as follows:

a. 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.

b. Rainwater tanks should be sized using the appropriate reference curves for the region.

c. Rainwater tanks should be in accordance with the guidelines set out in Water Sensitive Urban Design in Greater Adelaide Technical Manual.

5.4.3.8 Rain Gardens

Rain Gardens are generally more suited to higher density urban environments with hard surfaces than low-medium density developments where the filtration systems are likely to become ‘clogged’ with soils and other biological matter. The proposed use of rain gardens should be discussed with Council at the earliest opportunity to ensure that these matters can be addressed during the design process.

5.5 Stormwater Discharge Points

5.5.1 Objectives

Stormwater discharge points will be determined having regard to the following objectives:

a. To avoid the capacity of existing stormwater infrastructure being exceeded beyond the levels for which the infrastructure was originally designed as a result of development

b. To limit the percentage increase of the stormwater flow being generated when compared to the whole catchment

c. 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

d. 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.

e. To ensure that stormwater is effectively treated and that either the resultant discharge or the treatment processes themselves have an adverse impact on the environment and surrounding properties.

5.5.2 General

The impacts of new Developments and Council Projects on the existing stormwater drainage network must be assessed prior to discharge into the network. It is imperative that more frequent flooding episodes do not occur and that any existing drainage deficiencies are not exacerbated as a result of additional runoff and volume.

5.5.3 Requirements

Stormwater Drainage Strategy Plans should include the following information:

a. Site plan showing the extent of works, including proposed pervious and impervious areas and drawn to scale with clear contours.

b. Provide design details of any stormwater pump systems including backflow prevention

c. Existing and proposed surface levels at an interval not exceeding 10 metres

d. Description of the proposed project

e. Locality plan showing the site location in regards to catchment boundaries

f. Location and size of existing drains and easements and reserves within and adjacent to the project site

6. ENVIRONMENTAL MANAGEMENT

6.1 Objectives

The general objectives of environmental management are to ensure that:

a. 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 in writing by Council.

b. Construction sites are to be managed in a manner to minimise the impact of construction works on the environment.

c. The relevant provisions of Council's Flood Management Strategy are complied with during construction.

d. Existing vegetation which is not to be removed is adequately protected during construction.

e. Stormwater discharge during construction does not contaminate or degrade the quality of the receiving waters.

f. WSUD and vegetated assets are protected from siltation.

g. The impact of crushed rock, rubble or debris being carried onto public roads or footpaths is minimised and to ensure no mud is removed from the site.

h. 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.

i. Appropriate measures are taken to avoid damaging Aboriginal sites, objects and remains.

j. 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 traffic.

k. Landowners and residents within the vicinity of construction are not adversely impacted in accordance with the requirements of any regulation or guideline or Code of Practice from the Environment Protection Agency.

6.2 General

The Superintendent and Contractors engaged must ensure that during the construction of works all appropriate steps are taken to minimise any detrimental impact on the environment and compliance with the requirements of all applicable Environmental Legislation.

All earthworks must be undertaken in accordance with the provisions of AS3798 "Guidelines on Earthworks for Commercial and Residential Developments".

6.3 Erosion Control and Sediment Discharge

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

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.

During construction, erosion control and sediment discharge controls should include the following:

a. Cut-off drains installed to intercept surface water before it reaches the areas of disturbed earth.

b. Approved silt control measures must be installed prior to the entrance of all drains to ensure that all silt is retained within the site. Typical measures may include one or more of the following:

- Settlement Ponds
- Silt Fences
- Pit Socks, gravel sausages, straw bales (open drains only)
- Temporary sumps in selected and approved stormwater drainage pits
- Landscaping or promotion of vegetation downstream of the works but still within the site.

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 of mud drag out.

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 areas 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 75mm of weed-free topsoil where appropriate topped with weed mat, mulch or hydro-mulch to establish vegetation such as suitable grass species to ensure that erosion is minimised.

All boundaries with public land are to be suitably protected and maintained with adequate sediment control measures (ie. silt fence) as soon as practicable upon completion of earthworks.

6.4 Site Control

The Superintendent and contractors shall observe all rules and regulations in force on the site and shall comply with all notices and instructions issued by Council in relation to such rules and regulations.

Except where otherwise provided for in the contract, space for the storage of materials and for construction amenities will be allowed only as arranged between the Superintendent and Council.

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

Under no circumstances whatsoever shall fire be lit without the prior written approval of the Metropolitan Fire Service and the Council.

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

6.5 Water Conservation

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

6.6 Environmental Control

The 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, prior to the commencement of work on the site, submit to the Council a Construction Environmental Management Plan (CEMP) which details their proposals for traffic movements, temporary structures, cleaning up, waste management, erosion control and the like. After the CEMP has been approved by Council, the Superintendent shall be responsible for ensuring that the approved proposals are implemented and maintained. Any changes to the approved methodology must be approved by Council.

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 Construction Engineer shall prepare a Soil Erosion and Drainage Management Plan (SEDMP) showing how Environmental Controls are to be achieved. The plan shall include a site layout together with a written procedure and implementation plan, and be submitted to Council's Development Engineering team for approval prior to the commencement of work on site. The SEDMP shall include all aspects of site management including:

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

The 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 the CEMP with Council approval being obtained prior to the commencement of works.

- Limit site access to nominated and controlled locations and ensure that sediment is not transported off the site on vehicles or by vehicle was 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;
- 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 planning progressively as earthworks are completed.
- Batter slopes should be kept at a grade of not more than 1:5 and finished as soon as possible with a minimum thickness of 75mm of 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 subdivision public land boundaries are to be suitably protected and maintained with adequate sediment control measures as soon as is practical upon completion of earthworks.
- Effectively maintain the erosion control and sediment collection devices; and
- Decommission sediment traps and basins only after completion of final works and as approved by the Council.

6.7 Soil, Liquid and Gaseous Contaminants

The Contractor shall be responsible for the proper disposal of all solid, liquid and gaseous contaminants in accordance with all statutory and contractual requirements including the provisions of this section.

Gaseous contaminants shall be discharged in such a manner that they will be sufficiently diluted with fresh air that the toxicity will be reduced to a recognised acceptable level.

Subject to statutory and local requirements, liquid contaminants may be diluted with water to a level of quality acceptable in the wastewater system or shall be contained in approved vessels for disposal at an approved site.

Solid contaminants shall be disposed of by removal from the site to approved locations or as otherwise directed by Council.

Construction plans and equipment shall be maintained and operated in a manner that minimises smoke emissions and fumes to the atmosphere.

The Contractor shall keep the site in a clean and tidy condition. Refuse from construction operations, including food scraps and the like, shall be removed from the site. All hoppers, chutes or buckets for refuse shall be covered or be of such design as to fully confine the material and prevent dissemination of dust and waste and attraction of pest animals.

6.8 Preservation of Flora

The Contractor shall refrain from destroying, removing or clearing trees and vegetation to an extent greater than that shown on the approved plans.

Areas to be cleared that are not clearly depicted on the plans shall be inspected by the Superintendent, and approval from Council's Tree Services team sought before any trees or vegetation are removed, cleared or destroyed.

All construction activities, including storage of materials, vehicles, equipment and rubbish are to be kept clear of existing trees which are to be retained. Vehicles are not be driven or parked within tree protection zones. Tree protection zones are to be determined and protection installed prior to any works being undertaken on the site in accordance with AS4970.

Where there are existing trees to be retained on the site, the tree protection measures advised by a qualified arborist are to be established prior to commencement of any demolition, construction, building or civil works. The tree protection zone should be adequately fenced to prevent access and accidental construction works.

The Superintendent shall ensure that the provisions of any Land Management Agreement (LMA) or Infrastructure Agreement (IA) in respect to trees are complied with.

Council may direct the Contractor to repair any damage or injury to a tree that is to remain. This work shall be undertaken by an arborist engaged by the Contractor and approved by Council. Should the tree not be able to be saved, monies to fund replacement advanced trees to be planted on the same footprint of the damaged tree will be forfeited by the Contractor.

6.9 Working Hours

Construction activities on the site shall generally be carried out between the following hours:

- Monday to Saturday – 7am 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 advanced notification may be required.

6.10 Site Access

Designers / Contractors are to obtain Council's written consent for the location of working access points to the site.

6.11 Dust During Construction

The Contractor must ensure that dust suppression is undertaken in the form of constant water spraying or other natural based proprietary dust suppressant to ensure that dust caused by vehicles moving along roads to the site and within the site do not cause a nuisance to surrounding properties to the satisfaction of Council.

6.12 Pollution

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

6.13 Noise

The Contractor must ensure that all noise emitted from the site is within the specified limits, set by the EPA for the relevant activity at all times.

If the Council receives a complaint from the public relating to noise generated from the site, the Contractor must undertake the appropriate noise testing to justify continued operation.

6.14 Weed Importation and Transportation

The Contractor 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 offences relating to precautions that must be taken when moving soil, sand, gravel or stone which may be infested with noxious weeds. Accordingly appropriate measures in accordance with the requirements of the approved construction plan must be undertaken to ensure that weed species are not transported on earthworks equipment or in soil or material leaving or entering the worksite.

6.15 Contamination

Removal of surplus fill from the site, or the 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 the 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 of contaminated material on site is generally not acceptable without an environmental management plan prepared by an approved environmental consultant approved by Council.

If contaminated material is found on a residential allotment it must be removed or treated to the satisfaction of an environmental auditor and in accordance with the National Environment Protection Measures.

6.16 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.

7. LANDSCAPE

7.1 Objectives

The general objectives for landscaping requirements are as follows:

a. All landscaping to meet the requirements of the City of Salisbury Landscape Plan.

b. Define high profile sites and vehicular corridors that require a higher profile landscape treatment.

c. Utilise plant lists based around increasing biodiversity and sustainability as well as development of standard features, shade and screening vegetation that complies with CPTED principles.

d. The landscaping is able to be effectively and economically maintained.

e. Consideration of historical and Aboriginal cultural and heritage issues.

f. Consideration of current and future environmental factors or issues that may affect landscapes.

g. The standard of infrastructure to be provided for landscape works is clearly specified.

h. The risk to the public from any landscaping on public land is eliminated or minimised.

i. All landscaping complies with the requirements of Disability and Discrimination legislation.

7.2 Introduction

The City's key strategies in relation to new developments are to:

a. Enhance individual and community well-being by following a path of economic development that safeguards the welfare of future generations;

b. Provide for inter-generational equality;

c. Protect ecological biodiversity and maintain essential ecological processes and life support systems.

Landscape and Streetscape are important elements of any new road or development and should be addressed early in the design process. The purpose of this section is to assist Developers in the preparation of suitable landscape plans and documents which will help them in meeting the City of Salisbury's requirements when preparing development applications.

The City's key objectives are as follows:

a. Provide a high standard of landscape design, preferably by employing a suitably accredited Landscape Architect or Landscape Designer.

b. Consider landscape design in liaison with building and land division design at an early stage in any development. This approach will help to avoid hard and soft infrastructure conflicts.

c. Incorporate environmentally sustainable practices within the design.

d. Provide a landscape that requires appropriate levels of maintenance dependent on the hierarchy of the space. i.e. natural and low usage areas are generally low maintenance. High use areas such as civic squares will require greater maintenance.

e. Protect existing natural systems such as waterways and remnant vegetation.

f. Reduce delays in the development approval process.

7.3 Design Guidelines

7.3.1 Residential Land Division

Landscape Plans are a requirement of the development approval process. Plans must be submitted for approval for residential land division applications.

The aim of the landscape design for residential land division shall be to:

a. Consider the unique built and environmental context of the site and surrounding areas;

b. Harness site specific environmental opportunities;

c. Provide a consistent landscape character and 'sense of place' within the development;

d. Improve the visual amenity and legibility, and ameliorate specific site conditions that may exist;

e. Enhance public safety and reduce anti-social behaviour.

7.3.1.1 Design Considerations

- Provide planting that is in scale with the built form.
- Consider the mature sizes of trees and shrubs in relation to buildings and other infrastructure.
- Maintain important vehicular sightlines and view corridors, both for safety and amenity.
- Provide screen or buffer planting to define and create spaces, and mitigate noise and visual disturbances.
- Create safe environments through the use of Crime Prevention Through Environmental Design (CPTED) principles.
- Protect biodiversity and maintain essential ecological processes.
- Utilise landscapes and planting that are suitable to the site's environmental conditions such as local soil conditions, hydrology and climate.
- Plant species selection that is suitable for the region and on the approved street tree list.
- Responsible management of water use through Water Sensitive Urban Design (WSUD) and efficient irrigation systems. Sites are only to be irrigated where Council's irrigation decision support tool criteria is met.
- Create low maintenance and self-regenerating landscapes.

- Use landscape materials that are renewable or recyclable and landscape practices that have a low environmental impact.
- Provide 100mm depth of organic mulch throughout planted areas.
- Provide subsurface drip irrigation to garden beds. Only to be irrigated where the Council's irrigation decision support tool criteria is met.
- Public Open space use and classification.
- Trees should be between 1.0 and 1.5 metres tall at the time of planting.

7.3.2 Industrial & Commercial Developments

7.3.2.1 Design Considerations

- Consider the impact of the landscape on adjoining properties such as overshadowing, structural issues and negation of views through careful selection of trees and shrubs.
- Screen loading docks, service areas, waste collection areas, or any other visually unattractive views with appropriate planting or noise attenuation walls if required.
- Provide raised planting areas edged with solid concrete kerbs to delineate gardens from storage or parking areas.
- Integrate proposed landscape design with existing streetscape themes to establish a consistent landscape character.
- Provide suitable edging between turf, gardens and paved areas.
- Provide 100 mm depth of organic mulch throughout planted areas.
- Provide subsurface drip irrigation to garden beds, only to be irrigated where the Council's irrigation decision support tool criteria is met.
- Trees should be between 1.0 and 1.5 metres tall at the time of planting.
- Car park areas shall have one tree per every eight car bays for the provision of shade and amenity.
- Public Open Space use and classification.
- Responsible management of water use through Water Sensitive Urban Design (WSUD) and efficient irrigation systems. Sites are only to be irrigated where the council's irrigation decision support tool criteria is met.

7.4 Information to be provided to Council

For the successful establishment of future developments, the City of Salisbury has provided a list of items that must be provided by developers in order to obtain the necessary approvals prior to construction commencing. In all cases, the submitted plans must include the following:

a. Applicant/consultant name, address, email and phone number.

b. Site address and location map.

c. Scale of plan.

d. Date of drawing.

e. North point.

f. Plan reference number.

g. Site boundaries.

7.4.1 Vegetation Survey

A vegetation survey will be required for all vegetation and significant trees present on the site. The survey must be carried out by a qualified person, such as a horticulturist or arborist. The detail required shall include the following:

a. List and location of species present on site.

b. List and location of noxious weeds.

c. Condition of vegetation.

d. Tree species

- Record of significant trees' height and width, girth at 1 metre above ground level
- Health
- Structure
- Height
- Crown spread
- Presence of nesting avi-fauna.

7.4.2 Site Analysis

A site analysis may be required by the City of Salisbury for specific complex developments. This may include sites that have very steep topography or may have other difficult constraints.

The site analysis shall show the following details:

a. Height of existing buildings on the site.

b. Topography, slope and aspect.

c. Views from and into site.

d. Street character.

e. Prevailing winds.

f. Surface stormwater run-off.

g. Spot levels, contours and location of services.

h. Location of heritage or cultural items.

i. Location of contaminated soils or fill.

j. Vegetation survey.

7.4.3 Environmental Management Plans

Environmental management plans may be required for developments within environmentally sensitive areas. The City of Salisbury will inform the Developer with the scope of information that is required. This may include the following:

a. Environmental management plan.

b. Conservation report and/or heritage status.

c. Soil analysis.

d. Survey of endangered or vulnerable species or endangered ecological communities.

e. Arborist's report.

7.4.4 Landscape Concept Plans

A concept plan is required when seeking Development Approval. The following details are required:

a. Location and classification of existing and proposed buildings.

b. Location of all existing trees showing species, canopy spread, and height.

c. Location of existing and proposed hard surfaces such as paths and roads, showing proposed materials and finishes.

d. Existing and proposed ground levels, i.e. spot levels and/or contours.

e. Location and height of retaining walls.

f. Schematic planting plan showing proposed species and locations.

g. Maintenance Plan

h. Other supporting information as necessary.

7.4.5 Final Design Documentation

Fully documented landscape plans and specifications will be required for Construction Approval. The following details will be required:

a. Location of all services.

b. Location of existing and proposed buildings.

c. Location of all existing trees showing species, canopy spread and height.

d. Location of existing and proposed hard surfaces such as paths and roads, showing proposed materials and finishes.

e. Existing and proposed ground levels i.e. spot levels and/or contours.

f. Location and height of retaining walls.

g. Irrigation plans and details.

h. Planting plans showing plant location and size when mature.

i. Plant schedule including plant symbol used on plans, botanical and common names, proposed spacing for mass planting, proposed pot sizes and total numbers of each plant.

j. Landscape and irrigation specification.

k. Details describing site preparation, soil cultivation methods, fertilisation schedule, imported topsoil, mulches, edge treatments.

l. Tree protection plans.

m. Construction details certified by a qualified Structural Engineer.

n. Proposed maintenance schedule

7.5 Street Trees

Street trees shall be provided by the developer wherever existing street trees have been removed or new road infrastructure has been built. Street tree planting will be carried out as follows:

a. Trees shall be selected from the City of Salisbury Approved plant lists.

b. Street trees shall be installed at a minimum size of 1.0 – 1.5 metres tall or a pot size of 25 - 45 litres volume.

c. Soil used for backfill will include 200 grams 'Terracottem' incorporated as per manufacturer's recommendations.

d. Trees are to be located as specified in the City of Salisbury Street Tree Planting guidelines.

7.6 Existing Trees and Remnant Vegetation

Existing trees and remnant vegetation that is to be retained must be protected pursuant to AS 4970 before the commencement of any construction works. To ensure protection of trees to be retained, the following measures must be undertaken:

a. A tree protection zone must be established and should be the width of the tree canopy or half the tree height, whichever is greater.

b. The Tree Protection Zone is to be fenced and clearly marked at all times in accordance with the following specifications.

c. The fence should be a minimum of 1.5-1.8 metres of chain mesh fence with 1.8 metre star pickets every 3-4 metres and a top line of high visibility plastic hazard tape. The area inside this Tree Protection Zone should be mulched with a covering of approximately 100 mm of woodchip mulch or like material. If temporary access is required through a Tree Protection Zone, this may be carried out using sheets of structural plywood but should not be considered for long term requirements.

d. No people, vehicles or machinery are to enter the Tree Protection Zone. No fuel, oil dumps, chemicals, materials, equipment or temporary buildings shall be allowed in or stored on the Tree Protection Zone. The servicing and refuelling of equipment and vehicles should be carried out away from the root zones. Under no circumstances should anything be attached to a tree including temporary services wires or any other fixings.

e. Supplementary watering should be provided to all trees through any dry periods during and after the construction process.

f. If pruning is required, it must be carried out by a qualified arborist. Pruning is to comply with the Australian Standard – AS 4373 – 1996 Pruning of Amenity Trees.

g. If root excavation is required, it must be carried out by hand digging or by 'Air-Excavation' techniques. Root cutting must be undertaken by saw cutting, not with a backhoe or blunt instrument.

h. If underground services must traverse the tree protection zone, they shall be installed through directional boring that passes beneath the tree's root plate.

7.7 Crime Prevention Through Environmental Design (CPTED)

The South Australian Development Act (1993) provides for local Development Plans that form the basis for the preparation and assessment of specific development proposals. They cover a range of land use, transport, infrastructure and environmental matters related to the intended future development of the area. Development Plans are statutory documents and therefore legally enforceable.

The Development Plan can contribute towards achieving the community's CPTED objectives by seeking best practice outcomes from the development process. Development Plans now address a wide range of contemporary development or related issues, for example the incorporation of bushfire, stormwater, energy efficiency principles, in response to community demands that these issues should be considered and addressed as part of responsible new development.

7.8 Plant Selection

The City of Salisbury is committed to strengthening the existing landscape with a diverse range of species that will develop resilience and character. Species should be generally hardy plants from arid climates similar to the northern Adelaide Plains.

Species selection and planting patterns should follow local growing conditions relating to soil conditions and other environmental factors. Selected plants must also relate to the scale and proportion of the built environment such as roads and buildings.

Street Tree species are to be selected from the City of Salisbury Approved plant lists.

7.9 Public Urban Elements

Hard landscape elements that are installed by a developer in public land must comply with the City of Salisbury Standards for Public Urban Elements.

Refer to the City of Salisbury Public Urban Elements Standards for further information.

7.10 Irrigation

The landscape within the City of Salisbury should be designed with low water use principles, - use the City of Salisbury irrigation decision support tool to assist in determining the appropriate level and type of irrigation for any development.

All irrigated public open space must have irrigation systems designed to the City of Salisbury Irrigation Standard.

7.11 Landscape Establishment and Maintenance

7.11.1 Maintenance Standards

A suggested guide for the standard of open space is provided in Section 7.8 of the City of Salisbury Landscape Plan: Public Open Space Maintenance. These standards show the specific requirements for maintenance including the selection of areas for high, moderate and low maintenance levels. Other information regarding maintenance can also be found in the City of Salisbury Landscape Plan : Section 10.0 – Maintenance.

7.11.2 Establishment and Maintenance Period

Public open space is often developed by private companies to increase the visual amenity of the local environs. Reserves that are developed in this manner must be established and maintained for a minimum of two summers prior to handover to the City of Salisbury.

7.11.3 Practical Completion and Final Completion Inspections

The City of Salisbury landscape and irrigation staff must be involved in the Practical Completion inspection at the conclusion of construction works, and at the Final Completion inspection at the completion of the maintenance period. The City of Salisbury must receive notification two weeks prior to any inspections. Any defects that are apparent must be rectified and inspected again prior to handover being accepted.

7.11.4 Landscape Handover

Once defects have been rectified and the City of Salisbury has accepted the handover of public open space, the developer shall provide the City of Salisbury with “as built” construction plans and details for both landscape and irrigation works within one month of handover. These shall be in an approved format.

8. STREETLIGHTS AND ELECTRICAL

8.1 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.

8.2 Provision of Public Lighting

All new roads created through the land division 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 also be given as part of any Council road upgrade / renewal project for the upgrade and replacement of public lighting to conform to current 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.

Lighting in public reserves is considered on a case by case basis. Preliminary advice regarding lighting in reserves can be provided by Council's Energy and Lighting team. Please contact Council on 8406 8222 and request to speak with a team member.

All public lighting must incorporate the use of unmetered LED Luminaires that are certified to be compliant with AS1158.6 and are listed on the AEMO load table.

8.3 Future Ownership of Lights

Within the City of Salisbury, streetlights are of the following types:

a. SLUoS Vested in SA Power Networks

b. CLER

c. Energy Only

d. Metered (private ownership)

Developers of new land divisions are required to provide a system of streetlights in conjunction with the underground electrical system. All lighting in new land division is to be vested to Council unless SAPN distribution poles are utilised. The standard public lighting tariff shall be Energy Only and electrical designs shall comply with AS3000. Lighting design is to comply with AS1158.

All costs associated with provision, installation and energisation of lighting is the responsibility of the Developer.

8.4 Design Requirements

Street lighting in new land divisions shall be designed in accordance with AS1158. Special attention needs to be given to the lighting of:

- Traffic control devices (roundabouts, traffic islands etc).

- Cul-de-sacs (with a light at the 'head' or turnaround of such roads being mandatory).
- Walkways, which must be illuminated in accordance with the above standard and avoid being shaded by street trees.

The Designer shall be responsible for liaison with SAPN in respect to both public lighting and for the provision of an underground electrical network to service all new allotments. Allowance for light pole locations must be provided within all road reserves, and offsets must be shown on Road Construction plan cross-sections.

A minimum 800mm offset must be provided from back of kerb to face of light pole for all roads with P category lighting, including laneways and shared zones.

A minimum 1000mm clearance is required from face of light pole to the edge of pram crossings and driveway crossovers within the road verge.

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.

The below table illustrates the minimum public lighting classification in reference to the road layout.

Road Classification	Public Lighting Level of Serviceability
Access Place / Street	P3
Local Street	P3
Minor Collector	P3
Major Collector	V5

Table 6.1

8.5 Approved Fittings & Poles

8.5.1 SAPN Ownership

In situations where SAPN utility poles must be utilised, the Luminaires and wiring are to be standard SAPN items or SAPN approved. LED luminaires available on the PLC tariff are to be utilised and this tariff nominated.

8.5.2 Council Ownership

The default for P category roads shall be 6.5m Galvanised INGAL EPS Avenue Octagonal columns and Sylvania StreetLED 25W LED luminaires. The default V Category columns are Ingal 9.0m & 10.5m Impact Absorbing Columns and Sylvania RoadLED luminaires. Where the Developer seeks to introduce an alternative item of lighting, Council must be satisfied through adequate means, independent test documentation, etc. that the alternative systems and equipment proposed will be appropriate. Acceptance of the alternative will be at Council's discretion.

8.6 Construction Requirements

8.6.1 SAPN Ownership

Where the new street lighting facilities will become assets of SA Power Networks, the poles, luminaires and wiring shall be installed wholly in accordance with the standard drawings, standard specifications and requirements of that Authority.

8.6.2 Council Ownership

Where the new street lighting facilities will become assets of Council, the whole of the new lighting installation is to be constructed in accordance with AS3000 and be suitable for the Energy Only tariff.

9. RECYCLED WATER

9.1 Objectives

The general objectives for recycled water are as follows:

a. To ensure that all recycled water infrastructure that is to be vested to Council for maintenance meets Council's requirements and standards.

b. To ensure that the design and construction of recycled water infrastructure meets Australian Standards, Codes of Practice and Guidelines.

c. To develop a recycled water network that meets the existing and future requirements, or makes allowance for future requirements.

d. To promote sustainability.

9.2 General

The design, documentation and installation of all recycled water infrastructure must be in accordance with the requirements of Council, and of relevant Codes, Guidelines and Australian Standards.

It is the Designers responsibility to liaise and coordinate the design and integration of all associated infrastructure with Council.

9.3 Design Guidelines

Generally, the design of recycled water infrastructure is to mimic the requirements for Potable Water as detailed in the Water Supply Code of Australia, SA Water Technical Guidelines and relevant Australian Standards and Codes of Practice.

Documents to be referenced include, but are not limited to:

WSAA Codes

- WSA 01 Polyethylene Code of Australia
- WSA 03 Water Supply Code of Australia

Australian Standards

- AS 1477 PVC(-U) pipes and fittings for pressure applications
- AS 4130 Polyethylene (PE) pipes for pressure applications
- AS 4131 Polyethylene (PE) compounds for pressure pipes and fittings
- AS 4441 Oriented PVC (PVC-O) pipes for pressure applications
- AS 4765 Modified PVC (PVC-M) pipes for pressure applications

SA Water Technical Standards

- TG 105 Allowable Pipe Size, Class and Materials for Water Mains
- NIS Authorised Items for Dual Water Supply Systems – Recycled Water for Mains up to DN 375
- SA Water Supplementary Documentation to WSA 03-2011

9.4 Information to be provided to Council

Items that shall be shown on recycled water design plans are:

- Site Address
- Street Names
- Allotment Numbers to the Real Property Act
- New Recycled Water Mains
- Existing Recycled Water Mains
- Easements
- Size & Type of Pipes
- Hydrants / Fire Plugs including alternate usage e.g. scour
- Fire Plug Connectors (with Thrust Block)
- Stop Valves and Reflux Valves
- Tapers

- Bends and Tees
- Existing Meters, Pressure Reducing Valves or any other special fitting
- New Connections
- Existing Connections
- Dogleg Details around Obstructions
- North Point
- Bar Scale
- Revision Details
- Details and Certification of Design Engineer

Once the infrastructure has been constructed, the design plans shall be amended and re-issued to Council as 'As-Constructed' plans. Practical Completion will not be awarded until such time that these plans have been received and deemed acceptable by Council.

9.5 Testing

The Constructor shall be responsible for carrying out hydraulic testing on the water reticulation system including the water connections. This test procedure may be used as an alternate to the procedure detailed in the WSAA Code. It is not applicable for testing of PE pipe (see WSA 01-2004). Once the selected test procedure has been commenced it is not permissible to swap to the alternate test procedure.

All pumping and test equipment for hydraulic testing shall be supplied by the Constructor. Pressure gauges shall each have a certificate of calibration issued within the last 12 months by an approved NATA registered laboratory.

Testing of the mains including water connection and fire services shall:

- Be carried out in the presence of the Superintendent's Representative.
- Not be carried out until at least 7 days after pouring of concrete anchor/thrust blocks or suitable temporary restraint mechanisms have been installed.
- Be carried out after the embedment and trench fill has been completed including the road sub base and base courses, but excluding the wearing course (bitumen surface) or at an earlier stage if directed by the Superintendent's Representative.
- Be to a hydrostatic test pressure of 160 metres head of water. This test pressure shall be maintained for a minimum of 30 minutes or for as long as the Superintendent's Representative considers necessary.

Where the water reticulation system is to be tested in parts the Constructor shall supply and install any necessary temporary plugs, caps or stops to the section of main to be tested and shall ensure that the main is adequately temporarily anchored prior to applying the test pressure. The Constructor shall be responsible for the design and installation of any additional/temporary anchors/thrust blocks necessary to restrain the pipe.

The water reticulation system will be accepted as being satisfactory by the Superintendent's Representative if there are no leaks after the full test pressure has been held for the minimum time as specified above.

All leaks shall be repaired by the Constructor and following the repairs, the testing shall be repeated until approved as satisfactory by the Superintendent's Representative.

All repairs carried out by the Constructor shall be inspected and passed by the Superintendent's Representative before backfilling is continued.

9.6 Issue of Practical Completion

The Superintendent's Representative will issue the Certificate of Practical Completion when all of the following requirements have been met:

a. All of the Works have been completed by the Constructor in accordance with the Drawings and this Code of Practice, including the checking of all stop valves and fire plugs for correct operation, to the satisfaction of the Superintendent's Representative.

b. All testing has been successfully completed by the Constructor and all certificates of compliance for trench compaction have been provided to the Superintendent's Representative.

c. All As-Constructed information has been provided and certified correct by the Surveyor to the satisfaction of the Superintendent's Representative.

d. All the 'common trenching' including installation of electrical, gas and telecommunication apparatus in that trenching has been completed and any damage to those installations caused by the Constructor's works, or damage to the sewers, connections or pumping mains, water supply mains or water connections, or any other services, caused by the common services work, has been made good to the satisfaction of the Superintendent's Representative and other Authorities.

e. The roads in which any water supply mains or water connections etc are laid have been fully constructed or repaired.

f. All tools, debris and foreign matter have been removed from the mains and connections.

g. All surplus spoil has been removed from the site and the site cleared and restored.

h. All equipment Guarantees and Operating Manuals have been provided to the Superintendent's Representative.

i. The defects liability security has been lodged.

CITY OF SALISBURY

CITY OF SALISBURY INFRASTRUCTURE GUIDELINES

MARCH 2019 CITY OF SALISBURY, 12 JAMES STREET, SALISBURY SA 5108