SHIRE OF DENMARK

GUIDELINES FOR DEVELOPMENT AND SUBDIVISION OF LAND

INFRASTRUCTURE SERVICES 2008

AS ADOPTED BY COUNCIL ON THE 24TH JUNE 2008
RESOLUTION 260608

Disclaimer: When a fee listed in the Schedule of Fees and Charges is updated by any Act, Regulation, Local Law or Council decision, then the updated fee supersedes the current Schedule. Please refer to Section 4.6 regarding Council Fees and Charges.

Table of Contents

1. 0 INTRODUCTION

This Guideline is to be read in conjunction with the Shire of Denmark's current Development Specifications document and Standard Drawings.

This guideline is an introduction to other documentation prepared by Council and other Authorities to manage Subdivision and Development matters. Other documents include:

- Council's Policies
- Subdivision/Development Design Specifications
- Subdivision/Development Construction Specifications
- Council's Development Application Form
- Council's Building Application Form
- Council's Verge Development Guidelines
- Council's Standard Drawings and Engineering Specifications
- Western Australian Planning Commission (WAPC) Subdivision Application Form
- Town Planning Scheme No. 3 (TPS) and amendments
- WAPC Policies

This document is issued for a fee as determined in Council's Schedule of Fees and Charges, for the guidance of Developers, Consulting Engineers and Contractors. The Schedule of Fees and Charges can be viewed on Council's website at the following link:
http://www.denmark.wa.gov.au/documentsforms/finance/

***(Refer to section 4.6 regarding annual fees and charges)**

Throughout the document there are various references to The Shire, Council, Council's Engineer, Shire Engineer etc. Users of the document should note that the development process is managed by the Shire's officers under delegated authority. As such the Guideline needs to be read with this in mind.

Where officers cannot reach agreement with a Developer and/or are required to refer particular matters to the body of full Council for approval, development applicants or their consultants will be advised of the reporting processes and the likely time lines for response. It must be noted that where issues are of a complex or technical matter Council may defer making a decision until such time as they feel they are in command of all the facts, consequences and community expectations.

This guidelines purpose is to assist subdividers within the Shire of Denmark to uniformly control all development work within the Shire boundaries to ensure quality of work and equal treatment of all development proposals.

This document prescribes the minimum standard applicable to the design and construction of roads, drains, paths, crossovers, development of Public Open Space (POS) and related works.

This document shall apply to the following:

- The design and construction of all civil works within the jurisdiction of this Local Government relating to the subdivision and development of land.

- All Public Road works within the Shire of Denmark.

The West Australian Planning Commission's (WAPC) role is the authority responsible for determining all subdivision applications in WA. The administrative support to the WAPC is provided by a State Government Department, the **Department of Planning (DoP**).

In determining subdivision applications, the WAPC is guided by the requirements and recommendations of the Shire and other government agencies, which are referral agencies, as well as by its own policies. The WAPC is not however bound to determine applications in accordance with the responses received from referral agencies.

Some of the WAPC objectives are:

- To further long term planning goals by the creation of lots in locations and of sizes consistent with those goals.

- To create lots that are capable (including physically capable) of lawful development and simultaneously ensure that existing lots and development on them is not made unlawful by a subdivision.

- To secure public utilities to each new lot having regard to intended development and to ensure constructed vehicular access from the public road system to each created lot.

- To promote design standards based on Liveable Neighbourhoods Community Design Code.

The Shire of Denmark is one of the referral agencies, which has the responsibility to assess subdivision applications from the Shire's perspective. The Shire will advise the WAPC whether or not is supports the subdivision application.

The Shire has the following objectives in providing for the development and subdivision of land:

- To ensure the subdivision is in accordance with local planning objectives and specific Shire technical standards for roads and services.

- To minimise adverse effects on the local environment.

- To provide for the needs of future users of the land in respect to development and building requirements, vehicular and pedestrian access, provision of services and an amenity appropriate to the zoning of the land.

- To minimise the Shire's future maintenance costs for roads, drainage, services and public open space.

- To assist developers by providing for the economic utilisation of the land resource of the area.

- To achieve a balance between the subdivision of land and the amenity of existing residents.

- To provide for an equitable and efficient distribution of public open space and public amenities and services.

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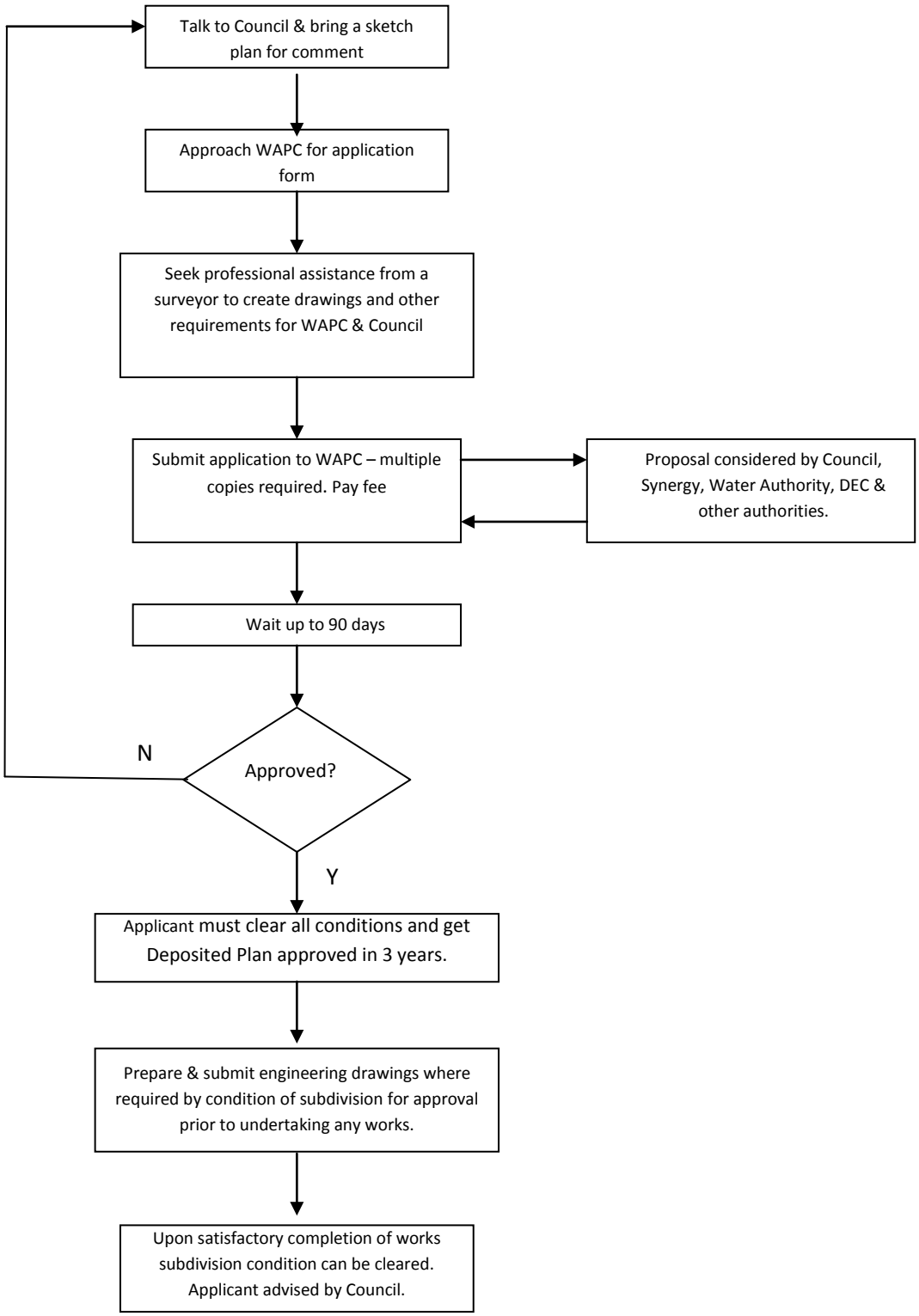
The initial process is:-



Flowchart of initial Subdivision Application

This guideline provides an outline of the procedures to be followed. It is not intended to be comprehensive or totally definitive. The Residential Design Codes of Western Australia, the WAPC's policies and guidelines (including Development Control Policy 1.1 'Subdivision of Land - General Principles') and the Council's Town Planning Scheme No. 3 (TPS), Standard Drawings, Specifications and Policies provide some of the necessary additional information.

Restrictions to the WAPC's ability to approve the subdivision of land are set out in the Planning and Development Act, 2005 (as amended).

The Shire's Town Planning Schemes (TPS) and associated policies must be prepared in accordance with this Act and are not able to restrict or bind the WAPC in determining subdivision applications.

The Town Planning Scheme may, however, restrict the use of the subdivided lots and advice as to what restrictions apply to a property should be initially obtained from the Shire's Planning Department.

2.0 SUBDIVISION AND DEVELOPMENT PROCESSES

A subdivision application is required for all types of subdivision, including amalgamations of lots, boundary adjustments, and strata subdivision proposals.

The Development Application (Planning Consent) and Building Application (Licence) processes are separate and independent from the subdivision approval process. These processes are the responsibility of the Shire, although the WAPC retains development control powers for some types of development, such as those adjoining regional reserves or which can have Regional or State impact.

Therefore whilst approval to subdivide the land rests with the WAPC, approval for the use (or development) of that land generally rests with the Shire. This requires a Development Application to be lodged with the Shire for approval. The WAPC is also likely to have significant regard to the response from the Shire on any subdivision referred to it to ensure that the subdivision, if approved, can be developed in accordance with the Shire's TPS and related policies.

2.1 FORMULATING A SUBDIVISION APPLICATION

Anyone wishing to subdivide land will be required to lodge a subdivision application with the WAPC.
See flowchart 'Flowchart of initial Subdivision Application' on page 6.

Before formally applying to subdivide it is recommended the applicant check with the WAPC on the possibility of subdividing their land. Upon a favourable response being provided, the applicant should then check with the Shire to see what relevant information can be provided to assist in the subdivision process.

It is advantageous to prepare a sketch plan at this early stage indicating the location and size of the proposed lots for perusal by WAPC officers.

The purpose of consultation with sketch plan proposals (which may be accompanied by explanatory reports or background material) is to:

- assess whether any modifications to the proposal are necessary prior to its being formally submitted;
- identify Department of Planning and Shire requirements with regard to the particular subdivision application (and any supporting Development Application);
- identify any problems which may necessitate a review;
- indicate WAPC and Shire requirements (e.g., contribution of public open space)

Consultation with the WAPC, the Shire and any other referral agency is not obligatory.

2.2 MAKING APPLICATION FOR SUBDIVISION

The written consent of the property owner is required in instances where the application is not submitted by the owner.

The following WAPC advice is provided as a guide only and subject to change without notice. It would be prudent to request a Subdivision/Amalgamation form to note the current requirements.

Subdivision applications are to be accompanied by eight (8) copies of the subdivision sketch plan at a scale not smaller than 1:2000.

The sketch plan shall show the following:

- the dimension and area of each lot that it is proposed to subdivide or amalgamate;
- the dimension and area of each lot that is proposed to establish;
- the position, use condition and materials used in the construction of any building on the subject land and its relationship, including measurements, to the existing and proposed boundaries of that land;
- where it is proposed to create a street, road or way, contours at a vertical interval not greater than 0.5 metres, and where it is not proposed to create a street, road or way but the WAPC so requires, contours at specified grid distances or positions;
- flood levels, land liable to inundation, swamps, streams and any land not naturally drained or having a natural outlet on the surface of the land;
- the location names and widths of adjoining streets, and roads and the size and shape of adjoining lots or portion of land.

Additional information about the proposed subdivision may be needed to be provided where that information is essential to the determination of the Subdivision Application. This may include details of any overall development proposal.

2.3 CONSIDERATION OF SUBDIVISION APPLICATIONS

The WAPC is responsible for the control and management of the land subdivision process in WA. In this regard, no land may be subdivided without their approval. Councils and other government agencies are referral agencies and are limited to the provision of advice and recommendations to the WAPC on Subdivision Applications. Referral agencies, including the Council, are required to respond to a Subdivision Application within 42 days from the date of referral.

The DoP will assess the application prior to the WAPC determining the application. The DoP and the WAPC will deal with each application on its merits, however, WAPC policies and Council Town Planning Scheme (TPS) requirements, together with a number of local and state government policies, provide the basis for the assessment of Subdivision Applications. The response of the Council to the Subdivision Application is usually critical to the DoP's assessment and the WAPC's determination of the Application.

The Planning and Development Act 2005, requires all Subdivision Applications to be determined within 90 days of receipt of the application (unless an extension is granted by the applicant).

Where an applicant is dissatisfied with the conditions of approval or the reasons for refusal, a written request for review and re-consideration of the particular condition(s) or the decision may be lodged by the applicant with the WAPC. Such a request must be lodged within 28 days of the applicant being notified of the original decision.

Alternatively or if dissatisfied with the decision on the request for reconsideration, the applicant may lodge a formal appeal with the **State Administrative Tribunal** (SAT). Such an appeal is required to be lodged with the relevant body within 60 days of receipt of the WAPC's determination of the subdivision application (or of the request for reconsideration if such a request is lodged).

2.4 TIME REQUIREMENTS FOR SUBDIVISION WORKS

A subdivision proposal granted conditional approval by the WAPC is valid for three years from the date of the advice. During that time all conditions must be complied with and completed to the satisfaction of the relevant clearance authority (noted at the end of every condition). Any disputes on clearances are arbitrated by the WAPC.

Upon endorsement of the Deposited Plan (DP) by the WAPC, the DP is lodged with the Landgate, who will issue the title for the newly created lot(s).

3.0 ENVIRONMENTAL CONSIDERATIONS

Supporting information required for most subdivision applications. This information normally addresses such matters as:

- suitability and capability of the land;
- access;
- traffic generation;
- risk of flooding;
- fire management and fire risk assessment;
- flora and fauna studies (retention, hygiene);
- local amenity.

Depending on the attributes of the site, specific additional information may be required by the DoP. For example, the proposed plan of subdivision may need to identify vegetation that is significant to the overall landscape of the area and trees to be removed may need to be identified on the plan of subdivision.

Similarly, in responding to the referral of a Subdivision Application, the Council may request that specific conditions be imposed on an approval such as requiring that significant tree/s identified by Council shall be protected at all times during excavation and/or construction. Of interest is retention of flora and fauna. Particular regard is to be made with respect to weed management and control of the spread of dieback. There may also be specific requirements of Council's Town Planning Scheme (TPS) dealing with environmental issues that need to be complied with.

Any sites of Aboriginal significance shall be identified in the application. The Department of Indigenous Affairs (DIA) should be contacted for details and verification of recorded sites and approval is required from the DIA prior to disturbance of any such sites.

All listed heritage items, including natural features of the site and man-made buildings, work and sites are to be identified and retained, wherever possible. The Heritage Council, National Trust and Council should be contacted for details and verification of sites.

3.1 SUBDIVISION DESIGN - Residential Areas

Residential land is defined within areas zoned 'residential' or similar under the Council's **Town Planning Scheme** (TPS).

The statutory requirements with regard to lot sizes, widths and setbacks etc are set out in the Residential Design Codes of Western Australia (R-Codes) based on the residential density coding specified in the TPS. The WAPC's Development Control Policy 1.1 'Subdivision of Land - General Principles' sets out and specific requirements in addition to the R-Codes such as the location of public open space or school sites.

The designer of a subdivision is required to comply with the requirements of the R-Codes, Policy Manual and any other applicable Council Policy or TPS provisions.

Both the WAPC and Council will have requirements on access to a subdivision with the objectives of:-

- providing for flow of through traffic with least disruption;
- establishing a hierarchy of roads in accordance with function, usage and WAPC policy;
- providing a variation in alignment to allow for existing natural features and create interest in the streetscape;
- providing a network of safe pedestrian and cycle paths.

The requirement for providing services to new lots is determined during the 42 day referral period of the Subdivision Application. Applicants will be required to provide fully serviced subdivisions including the provision of a sealed road system with drainage to adequately and safely provide both vehicular and pedestrian access to each allotment. The applicant will be required to meet the full cost of kerbing across all frontages of any subdivision in urban areas.

Required easements or reserves as determined by the WAPC, on the basis of the responses from Referral Agencies (i.e. Council and/or the Water Corporation/DOW), are to be provided over stormwater drains and basins and prepared at the applicants cost. These are to be shown on the Deposited Plan.

Applicants will be required to extend and meet the full cost of water and sewerage reticulations within subdivisions plus the cost of connecting to existing services.

Electricity services are to be extended to the subdivision in accordance with the requirements of Western Power and at no cost to Western Power. Underground power will be required. Underground telephone cables are to be provided by the applicant.

Applicants will be required to provide for Telephone facilities within the design.

Urban stormwater runoff will need to be assessed in terms of satisfactory performance both within the development and external to the development. Where excessive stormwater runoff may is generated, the Applicant may be asked to provide an Urban Water Management Plan to minimise the amount of runoff into the receiving environment.

The land will be required to be assessed for suitability. Modification of the existing land shape and soil properties will be required depending upon the proposed Lot sizes and soil conditions. Modifications will include creating flat blocks where Lot sizes are small and converting soil profiles to a stable classification.

3.2 SUBDIVISION DESIGN - Rural Residential Areas

Rural residential land is generally defined as land zoned special residential (> 1000m² - <1ha) or special rural (minimum lot sizes of 1-2 ha).

The statutory requirements with regard to lot sizes, widths and setbacks etc are set out in the Council's TPS. The WAPC's Development Control Policy 1.1 'Subdivision of Land - General Principles' sets out and specific requirements such as the requirement for land capability assessment to be undertaken as often these lots require on-site effluent disposal.

The requirement for providing services to new lots is determined during the 42 day referral period of the Subdivision Application. Road infrastructure to an urban standard will be required. Generally reticulated water is required for lots up to 1ha in size.

Effluent disposal will normally be by way of appropriate on-site disposal. However, where the development is near to an existing sewer or where in the opinion of the Department of Health or Council's Health and Building Department (and agreed by the WAPC) the land is unsuitable for on-site disposal of effluent, a reticulated sewerage connection will be required.

The configuration of the subdivision is to have consideration for natural features such as rivers, creeks, topography of the land, tree groupings and prominent natural features.

Sites considered environmentally sensitive, such as estuarine wetlands, rainforests, dune areas, steep slopes and flood prone lands may not be approved for subdivision unless the WAPC is satisfied with the data supplied in support of the proposal which addresses the technical and/or environmental issues.

3.3 SUBDIVISION DESIGN - Rural Development Areas

Rural land is defined as that zoned 'Rural' in the Council TPS. Rural land generally comprises larger holdings (i.e. > 20ha).

The WAPC's Development Control Policy 1.1 'Subdivision of Land - General Principles' sets out specific requirements in relation to rural subdivisions. In addition the Applicant will need to demonstrate compliance with the WAPC's Development Control Policy No. 3.4 'Subdivision of Rural Land'.

Applicants will be required to provide an all-weather road system to provide a functional and safe vehicular access to each lot. Sealing of the road system may be required on all new roads and where existing sealed roads will be an extended. The WAPC will not approve the subdivision of lots which do not have frontage to a legal road although battle-axe lots can be approved provided adequate provision is made for fire safety.

Subdivisions in isolated rural areas require a reasonable standard of all-weather access road suitable for all year round access for essential services, i.e. school bus, ambulance, etc. Each proposal will be considered on its merits but should have regard to the following:

- The status of the road;
- Existing road surface condition;
- Cost of upgrading;
- Flooding frequency and hazards of creek or river crossings;
- Potential population catchment.

The extension of electricity mains to the subdivision is required, however, subdivisions in areas remote from electricity mains may be relieved of this requirement, only if special circumstances prevail and details of such circumstances are submitted to Council by the subdivider, together with a written agreement from Western Power.

3.4 SUBDIVISION DESIGN - Industrial/Commercial Areas

The Council's TPS identifies various types of Commercial and Industrial zones. All proposed Commercial and Industrial subdivisions would be anticipated to be located in these zones. It is essential that early consultation with Council officers is sought to determine that the proposed subdivision has the appropriate zoning and would facilitate future development in accordance with Council's TPS and related policies.

The WAPC's Development Control Policy 1.1 'Subdivision of Land - General Principles' sets out specific requirements in relation to commercial and industrial subdivisions. In addition the Applicant will need to demonstrate compliance with the WAPC's Development Control Policy No. 4.1 'Industrial Subdivision'.

The development, where over a large area, should provide for a range of lot sizes. Any lot should be large enough for parking and landscaping as well as specific industrial or commercial uses. Industrial subdivisions would therefore need to be able to facilitate developments which comply with the standards required in Council's TPS

Engineering Road Design and Pavement Design will need to cater for heavy traffic conditions.

Applicants will be required to extend and meet the full cost of water and sewerage reticulations within subdivisions plus the cost of connecting to existing supplies. Electricity services are to be extended to the subdivision in accordance with the requirements of Western Power at full cost to the Applicant. Underground power and telephone services will be required and are to be provided at the cost of the Applicant.

3.5 PROVISION OF OPEN SPACE CONTRIBUTIONS

For residential subdivisions, the WAPC requires the provision of 10% of the subdivided area to be dedicated free of cost as Public Open Space (POS) in a useable form. POS will need to be developed through landscaping and infrastructure however no alteration to POS is to commence prior to the extent of works being agreed. In consultation with Council, the WAPC may accept a cash in lieu payment for POS or a combination of both.

POS will not normally be required in rural subdivision, unless the subdivision contains a significant area of special scenic or public recreational value. Contributions towards Regional Open Space (e.g. river foreshore, significant wetland) may however be required.

In all non-residential subdivisions, contributions of POS is generally not required, however contributions towards upgrading roads, bushfire protection or similar may be required.

3.6 PROVISION OF DEVELOPER CONTRIBUTIONS FOR ROAD INFRASTRUCTURE

Fees and Charges* for developer contributions to road infrastructure are as follows:

Developer Contributions for Road Infrastructure

(per Shire of Denmark Council Resolution 180410)

Development Type			TOTAL
Subdivision (per lot)	1,513.64	151.36	1,665.00
Group or Strata Developments (per dwelling)	1,513.64	151.36	1,665.00
Industrial or Commercial (per 1000m^2 of land or floorspace, whichever is greater)	1,513.64	151.36	1,665.00

***(Refer to section 4.6 regarding annual fees and charges)**

Other Developer Contributions

Applicants may also be required to construct or contribute towards major infrastructure or arterial roadworks where upgrading requirements can be partially or totally attributed to the subdivision.

Neither the WAPC or Council currently have the power or general authority to impose conditions of contributions for other facilities such as community facilities. Requests for “developer contributions” therefore need to be capable of being defended in an appeal situation and be supported by WAPC Policy or TPS provisions.

4.0 ENGINEERING ADMINISTRATIVE REQUIREMENTS

4.1 INSPECTION/SUPERVISION FEE

In accordance with Section 6.16 and 6.17, of the Local Government Act 1995 and Section 158 of the Planning and Development Act 2005 an Inspection/Supervision Fee is payable to Council in relation to the supervision of land subdivision construction work.

4.1.1 Sum

1. Where a subdivider engages a Consulting Engineer or Clerk of Works* to design and supervise the construction of subdivisional works, a sum of one point five percent (1.5%) of the contract value of the construction work is payable to Council.

2. Where a subdivider does not engage a Consulting Engineer or approved Clerk of Works to design and supervise the construction of subdivisional works, a sum of three percent (3.0%) of the contract value of the construction work is payable to Council.

3. A minimum fee shall apply as per Council's Schedule of Fees and Charges.

4. Contract Value is the value of all works inspected by Council:

    - Bulk Earthworks
    - Roadworks, Paths and Signage
    - Drainage Installations
    - Public Open Space Development works
    - Entry Statements
    - Retaining Walls being part of the works, Estate Boundary Walls and Fences.
    - Firefighting Installations & Strategic Firebreaks.

For the purpose of determining the value of works, the following are **excluded**:

- Sewer and Water Supply
- Hydrant Installations

Telecommunication Installations

- Electricity Installations
- Advertising and Site Signs

Council prefers the subdivider engage a Consulting Engineer to design the works and act as superintendent during the construction phase.

If the subdivider does not engage a Consulting Engineer, Council will provide an enhanced inspection service and liaise direct with the contractor. However, responsibility for the quality of materials and workmanship remains with the subdivider until such time that all final clearances are given at the end of the Defects Liability Period.

*Clerk of Works = industry person with several years experience and agreed to by both the Local Government and Consulting Engineer.

4.2 DEFECT LIABILITY BOND

4.2.1 Sum

1. Where the person has not engaged a Consulting Engineer or approved Clerk of Works to design and supervise the construction and drainage, the amount is to be 3% of the cost of the construction and drainage as estimated by the local government;

2. Where the person has engaged a consulting engineer to design and supervise the construction and drainage, the amount is to be 1.5% of the cost of the construction and drainage as estimated by the local government.

3. A minimum bond shall apply as per Council's Schedule of Fees and Charges.

This bond may be given in cash or in form of a Bank Guarantee at the discretion of the subdivider and is to be held in trust by Council until Defect Liability Clearance is granted.

4.2.2 Time of Payment

The Defect Liability Bond is payable on practical completion of works, prior to the issue of clearance of the subdivision's civil works conditions. Where early clearance is sought and approved the defects liability bond is to be paid prior to actual practical completion.

4.2.3 Return of Sum

The Defect Liability Bond shall be returned 12 months from the date of the actual practical completion being granted by Council. The 12 months is not taken from the time any outstanding works bond is paid for early clearance.

During the Defect Liability Period, the subdivider shall make good, at his expense, any defect in the works. Service crossings installed during the maintenance period, street sweeping of excessive material, accumulation and herbicide spraying of weeds in gutters shall be deemed "defects" for the purpose of this clause. Failure to revegetate verges is also regarded as a defect.

Council reserves the right to request that any defects evident during this period be repaired immediately, however, if deemed necessary by the officer and not completed by the subdivider within a time acceptable to the officer, Council will carry out maintenance work and repairs and deduct costs incurred from the Defects Liability Bond.

If upon inspection, defects in the work are apparent, the officer shall inform the subdivider or consulting engineer and arrange for a joint inspection. After such inspection, the officer shall issue a written report of defects which will need to be rectified before the bond shall be released.

At the expiry of the Defect Liability Period, the subdivider shall apply in writing for the release of the Defects Liability Bond. Council's officer will inspect the works, and if satisfied, will confirm in writing the acceptance of the works. The bond shall then be returned to the provider.

4.3 APPROVAL AND INSPECTIONS

4.3.1 Design Drawings and Documentation – Prior to works

Prior to the construction of any subdivisional works, the subdivider shall submit to Council the following detailed documents for approval:

- Earthworks grading plans (cut and fill)
- Roadworks and drainage layout plans
- Roadworks and drainage longitudinal sections
- Roadworks cross section
- Footpath and street lighting plans
- Telephone cable plans
- Typical details sheet
- Stormwater catchment and details plans

- Stormwater drainage calculations including sump volume and seepage calculations
- Specifications of all works relevant to Shire approval
- Site Classification Assessment Chart for Dust Control
- Estimated costs of works
- Project schedule encompassing all works
- Landscaping plans for Public Open Space
- Soil Stabilisation Strategy if applicable

The subdivider shall allow a reasonable time for the examination of all documents. Council's officer will be able to advise the approximate time required.

Plans and documents shall be submitted in duplicate. The Council officer shall return one set of plans either as "approved" or with the required modifications marked upon. If modifications are required, the subdivider shall re-submit the amended documents incorporating the required modifications. Upon acceptance of the documents, a written statement of approval, detailing conditions, shall be issued by the officer.

A Building Permit will not be required for retaining walls if the costs of wall construction are included in the total cost of works.

The datum to be used shall be the Australian height datum (AHD). Temporary bench marks related to AHD shall be clearly indicated on drawings.

4.3.2 Construction Phase

Prior to commencement of construction, the subdivider shall advise in writing of:

- The name of the contractor
- The name of the contractor's representative
- The name of the consultant's representative

The subdivider shall take all reasonable steps to minimise the effects of the works on the amenity of the surrounding residents.

In Council's experience, complaints include dust nuisance, excessive traffic, unsafe loading practice, noise, vibration and after hours operations.

4.3.3 Site Sign & Public Notification

The subdivider is required to erect a sign at the entry to the site indicating the name of the subdivider, Consulting Engineers, Surveyors and the contractor(s).

The sign shall indicate a phone number for the public to call in the event of complaints. While this may be the phone number of the consulting engineer, it is to be shown separately for this purpose.

The sign shall be erected at least seven days prior to commencement of works.

The contractor shall inform in writing all residents within 200 metres from any part of the work of the project details and schedule, together with a contact phone number for any queries.

A copy of the above information sheet is to be submitted to Council within 5 working days of its distribution.

4.3.4 Hours of Work

Working hours on site shall be:

Monday	Friday 7.00 am to 6.00 pm
Saturdays	8.00 am to 4.00 pm
Sundays	NIL
Public Holidays	NIL

4.3.5 Supervision

The contractor shall be represented on site by a competent and experienced person at all times.

The Consulting Engineer or approved Clerk of Works, if appointed by the subdivider, shall be deemed to be the superintendent for the performance of the works.

4.3.6 Inspections by Council

The Superintendent shall give the Council officer twenty four hours notice for any inspections to be carried out at each of the following stages:

- Completion of Bulk Earthworks
- After laying, but prior to backfilling of drainage pipes
- Completion of subgrade preparation and compaction
- Completion of basecourse pavement prior to primer sealing
- Completion of primer seal prior to installation of kerbing
- Completion of kerbing prior to final seal

No stage of works shall proceed until the preceding stages have been inspected and written approval given to proceed.

The Council officer may, at any time, enter the site for the purpose of inspection of any part of the works.

The Council officer is authorised to issue a **STOP WORK ORDER** to site personnel for technical and safety reasons. This order may be given verbally but shall be confirmed in writing as soon as practical thereafter. Details of the instruction shall be conveyed to the superintendent as soon as possible.

4.3.7 Testing

Testing shall be carried out in accordance with the detailed specifications of this document. Testing shall be carried out by a NATA registered laboratory in accordance with the relevant Australian Standards. Copies of all test results shall be submitted to Council on practical completion.

The following test certificates are required:

1. Base Course grading analysis and Atterberg limits
2. Sub grade and base course compaction of roads and paths
3. Primer seal and seal application rates and composition
4. Bituminous concrete aggregate particle size distribution, bulk density, bitumen content and marshall stability
5. Concrete mix
6. Seed and fertiliser mix and application rates if applicable

7. Hydromulch mix and application rates if applicable

8. Standpipe flow rate if applicable

4.3.8 Final Inspection

On practical completion of works, a final inspection shall be held by the Council officer in company with the superintendent and the contractor. The contractor shall arrange for all manhole covers to be opened for inspection.

On completion of the final inspection, the Council officer shall provide in writing:

1. A list of all items requiring completion or repair before subdivision clearance as relating to works will be issued.

2. A list of all items which shall be completed or repaired during the Defect Liability Period but will not delay issue of subdivision clearance as relating to works.

On satisfactory completion of item 1 above, a statement giving clearance as relating to works shall be issued by Council.

4.4 STABILISATION/DEFECTS LIABILITY BOND

4.4.1 Purpose

The purpose of the Stabilisation Bond is to provide a source of funds to cover the cost of adequate erosion control and for clean-up operations in subdivisional developments should the subdivider fail to install or maintain adequate erosion control measures. This applies to wind erosion (dust nuisance) and water erosion.

4.4.2 Application

A Stabilisation Bond applies to all development work in all areas of the Shire of Denmark.

This bond covers any soil stabilisation work required on land owned, disturbed or impacted upon by the developer for the duration of the construction phase and the Defect Liability Period. It also covers all land the subdivider has ceded for any public purpose (POS, Road Reserves, PAW).

On notification of an erosion concern, Council shall inform and set a time for the subdivider, as per the Department of Environmental Protection's Dust Control Guidelines, for the remedy of the problem.

Should the subdivider fail to carry out the remedial action within the set time or to Council's satisfaction, then Council may carry out all work deemed necessary by the Shire Engineer to rectify the problem and reimburse all costs from the Stabilisation Bond.

The Stabilisation Bond may be used by Council to fund repairs to any stabilisation measures, including fencing, seeding, hydromulching, earthworks and reinstatement of erosion damage as well as removal of material from areas outside the development if this material originated from the development or its movement was caused by the development in the opinion of Council's officer.

4.4.3 Sum

This bond may be given in cash or in form of a Bank Guarantee at the discretion of the subdivider.

The amount to be lodged as Stabilisation Bond is based on the Dust Control Guidelines of the Department of Environmental Protection.

Site Classification 1 - Negligible Risk	=	$	Nil
Site Classification 2 - Low Risk	=	$	600.00 per ha

Site Classification 3 - Medium Risk	=	$ 1,800.00 per ha
Site Classification 4 - High Risk	=	$ 3,600.00 per ha

4.4.4 Duration

The Stabilisation Bond shall be lodged with Council before commencement of any work on site.

For the purpose of this clause, survey and mobilisation of plant to the site shall not be deemed as work on site.

The Stabilisation Bond shall apply during the duration of the Defect Liability Period in accordance with section 4.2 of this document.

This bond shall be returned in conjunction with, and under the same conditions as, the Defect Liability Bond, being 12 months after the final inspection is approved.

4.5 CLEARANCE

The subdivider shall satisfy Council that he has complied with all relevant conditions as imposed by the Western Australian Planning Commission prior to clearances being issued.

Clearance will not be granted until all of the following issues have been addressed to the satisfaction of Council:

- Construction of all roads and drainage (or payments in-lieu)
- Construction of footpaths, dual use paths, pedestrian access ways and landscaping (or payment in-lieu)
- Construction of strategic firebreaks, tanks and standpipes, if applicable
- Creation of all easements
- Creation and vesting of all reserves
- Soil Stabilisation Measures and Bond
- Payment of Inspection Fee and Defects Liability Bond

Refer also to Section 6.0 page 24 for additional information on Subdivisional Clearances.

4.6 SUMMARY OF FEES AND BONDS

Fees and bonds applicable to developments are listed in Councils annual budget and are subject to annual review by the Shire of Denmark. Fees and bonds cover such things as cash-in-lieu, headworks charges, etc. The fees and charges listed in this document are current as at 20th May 2011. Please refer to the following link to view Council's annual fees and charges on the website. http://www.denmark.wa.gov.au/documentsforms/finance/.

Disclaimer: When a fee listed in the Schedule of Fees and Charges is updated by any Act, Regulation, Local Law or Council decision, then the updated fee supersedes the current Schedule.

5.0 ENGINEERING DOCUMENTATION STANDARDS

5.1 GENERAL

All drawings submitted shall be drafted in accordance with Australian Standards AS-1100 Part 101-1984 and Part 401-1984.

Drawings may be microfilmed by Council and lettering sizes and linework shall take account of this fact.

In particular, line weights shall conform with the metric standard with a minimum of 0.25 mm line thickness and a minimum letter height of 2.5 mm.

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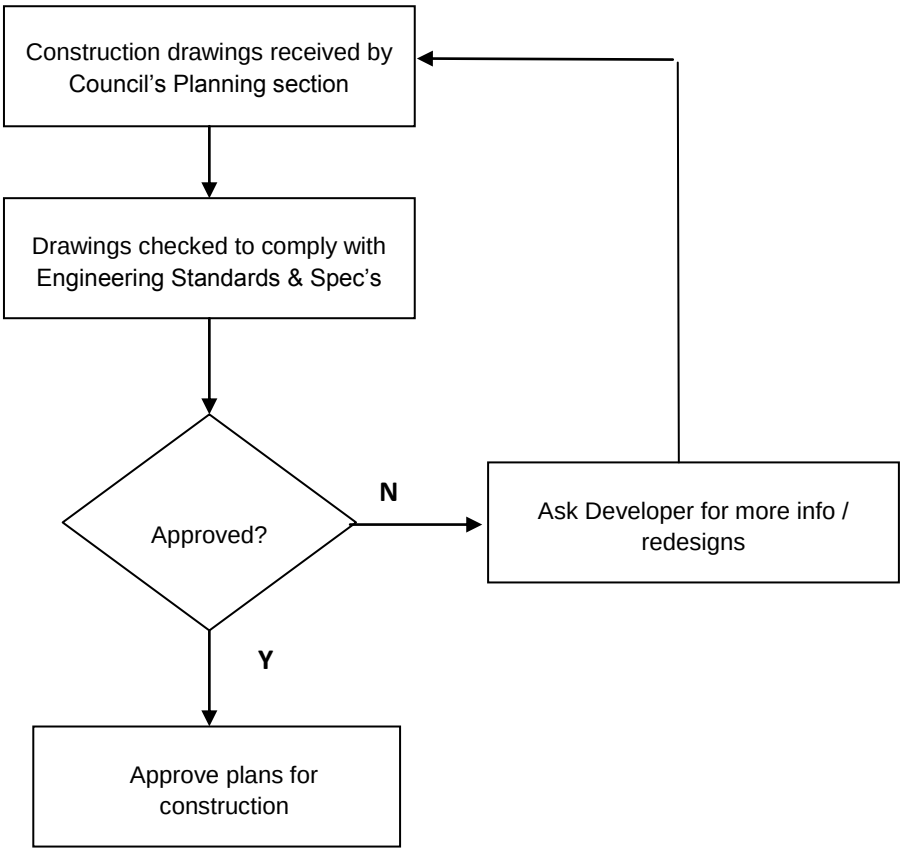


FLOW DIAGRAM - ENGINEERING REQUIREMENT

5.1.1 Planning

All plans for earthworks (site regrading), road works, drainage works, water supply, sewerage works, and foreshore works are to be certified by a Civil Engineer. All plans for bridgeworks, retaining walls, other major structures and pumping stations are to be certified by a Civil Engineer.

Some Standard Drawings, Design Specifications and Construction Specifications have been prepared by Council for use in Subdivisions/ Developments. Specifications other than those supplied by Council are required to be prepared by a Civil Engineer and will need to be submitted to Council for approval with each set of engineering designs.

In summary the requirements for design plans, drafted to Australian Standards and suitably scaled, are as follows:

a) Cover Sheet
b) Locality Plan and General Arrangement showing existing structures/ features
c) Earthworks (site regrading, adjacent property levels etc)
d) All Structural Details for Buildings
e) Road works (General arrangement and Details)
f) Road Pavement
g) Stormwater Drainage and Calculations (inc overland flood path for 1:100yr storm)
h) Road furnishings
i) Foreshore Works

j) Water Supply Works (For information only)
k) Sewerage Works (For information only)
l) Landscaping Works
m) Erosion and/or Environmental Control Works
n) Street and external Lighting
o) Footpath and Kerbing Details
p) Plan of Trafficable Areas
q) Traffic Management Device Details
r) Traffic Management Plans
s) Vehicle Crossover Details
t) Telephone Services
u) Verge Details
v) Line marking and signs drawings
w) Applicable Specifications

5.2 COMMENCEMENT OF WORKS

Notwithstanding approval to the subdivision application, no engineering works are to be undertaken until the **detailed** design plans (min 2 sets req'd), calculations and specifications are formally approved by Council's Infrastructure Services Directorate. The Plans submitted for WAPC approval do not always contain enough information for Engineering Approval. Whilst all the above plans may be required, the absolute minimum required, to be approved before commencing works are a), b), c), d), e) f), g), m), o), q), r), s), t), and v) from the above.

The submitted drawings will be signed and either be marked "Approved" (subject to any mark-ups), or "Revised Plans Required" with advice on further details required. **No Engineering Works are to commence without first being stamped and signed "Approved" on the drawings.**

The Contractor(s), and their quality testing organisation will be nominated and will also require approval by the Shire's Engineer.

The Shire of Denmark has yet to develop a set of formal requirements relating to Quality Assurance,however Inspection and Test documentation is to be forwarded to the Shire prior to clearances being issued. The Shire supports the principles of quality assurance and failure to comply with the following will not prevent approval for works to commence.

Approval to the subdivision will stipulate whether the subdivision is to be constructed as a "Quality Assured Contract" in which case a Quality Plan will need to be submitted to cover all construction works. Acceptance of the submitted Quality Plan will be required prior to commencement of works.

Where a Quality Assurance contract is not a requirement and a Quality Plan is not therefore provided, it will be necessary as a minimum requirement that:

The Principal's Superintendent or Superintendent's Representative under the Contract be nominated and approved as suitably qualified and experienced.

A project plan detailing control, inspection and testing requirements to ensure that the works are constructed in accordance with the approved drawings and specifications

Council Officers are given a minimum of 24 hours notice of required inspections

5.3 INSPECTION AND TESTING

Whether the subdivision proceeds under Quality Assurance Contract or not, the full cost of all testing is to be met by the Subdivider. Test results will be required to ensure that the material supplied and the work carried out conforms to the approved specification.

Similarly joint inspections at key stages of construction will be required to be carried out by representatives of both Council and the Developer/ Builder.

Key stages include:

- Site regrading and clearing
- Installation of erosion, or environmental control measures
- Preservation measures installed for trees, vegetation or heritage sites as determined
- Drainage line installation prior to backfilling
- Water and sewer line installation prior to backfilling
- Traffic Control
- Subgrade preparation
- Backfilling of Retaining Walls, footings and other structural components
- Establishment of line and level for kerb and gutter placement
- Road Pavement construction
- Road Pavement surfacing
- Footpath and Crossover preparation work prior to placement
- Practical Completion

Council will insist on uninterrupted access at all times for its Officers so as to enable audit inspections or testing. Records of all test results required by Council will be made available to Council promptly and tests will be undertaken strictly to prescribed test procedures by appropriate testing organisations.

5.4 LAYOUT DRAWING DETAILS

Unless otherwise approved in advance, roadworks and drainage layout plans shall be drawn to a minimum scale of 1:500.

The following information shall be shown:

1. All existing roads and proposed roads
2. Road reserve widths and road widths between faces of kerb
3. Lot boundaries and lot numbers
4. Easements - description and widths
5. Horizontal curve data for roads: Radius, Tangent length, curve length, deflection angle and chainage of tangent points.
6. Drains - Pipe sizes and classes, upstream and downstream invert levels, distance between centres of manholes and pits, grade
7. Drainage Structures - Type of structure and chainage measured along road centreline
8. Existing and proposed contours at 0.5 m intervals
9. Bench and Survey marks
10. Footpaths, Dual Use Paths and Pedestrian Access Ways
11. Retaining and Estate Boundary Walls and Fences

12. Public Open Space landscaping and development

13. Strategic Firebreak, Tanks & Standpipes where applicable

14. Soil stability strategy if applicable.

5.5 LONGITUDINAL SECTIONS

Longitudinal sections shall be drawn at a scale of 1: 1000 (or 1:500) horizontally and 1:100 vertically, or larger.

The following information shall be shown:

1. Road centreline chainages

2. Natural surface or existing centreline levels

3. Design centreline levels at even 10 metre chainages and at change points on vertical curves

4. Vertical curve data, including the chainage and elevation of vertical intersection points and length of curve

5. Horizontal curve data and crossfall data

6. Drainage: Pipe sizes, upstream and downstream invert levels, chainage at centres of manholes and pits

5.6 CROSS SECTIONS

Cross sections shall be drawn at a scale of 1:200 or 1:250 and shall show the offset from the centreline and levels of the following points:

1. Road centreline

2. Toe and top of kerb

3. Any change in crossfall

4. Road reserve boundaries

5.7 GRADING PLANS

Where the earthworks extend over an area larger than 25 % of the site, a separate grading plan shall be provided. This plan shall show existing and proposed contours at 0.5 m (max) contours.

This plan shall be at the same scale as the Layout Drawing in accordance with clause 5.4 of this document.

5.8 STANDARD DETAILS

The consulting engineer shall include in his drawings the following standard details:

1. Typical Road cross section

2. Drainage structures including Side Entry and Grated Pits, Junction Pits, Headwalls and Outfall Structures

3. Dual Use Paths ramps and rails

4. Street Signs and furniture

5.9 AS CONSTRUCTED - Survey and Drawing

The subdivider shall supply "As Constructed" drawings of the development within 4 weeks of the Final Inspection.

While the "As Constructed" drawing will need to appear very similar to the original design plans, it is not acceptable to utilise design plans with variations marked up.

As constructed drawings must show actual measurements only.

Plans shall be based on actual survey and be:

1. On transparent plastic film

2. To the same scale as the design plans

3. Show road surface levels at a maximum spacing of 20 metres at centre, left and right face of kerb or edge of seal.

4. Show invert levels, length, grade and size of all pipes and drainage installations.

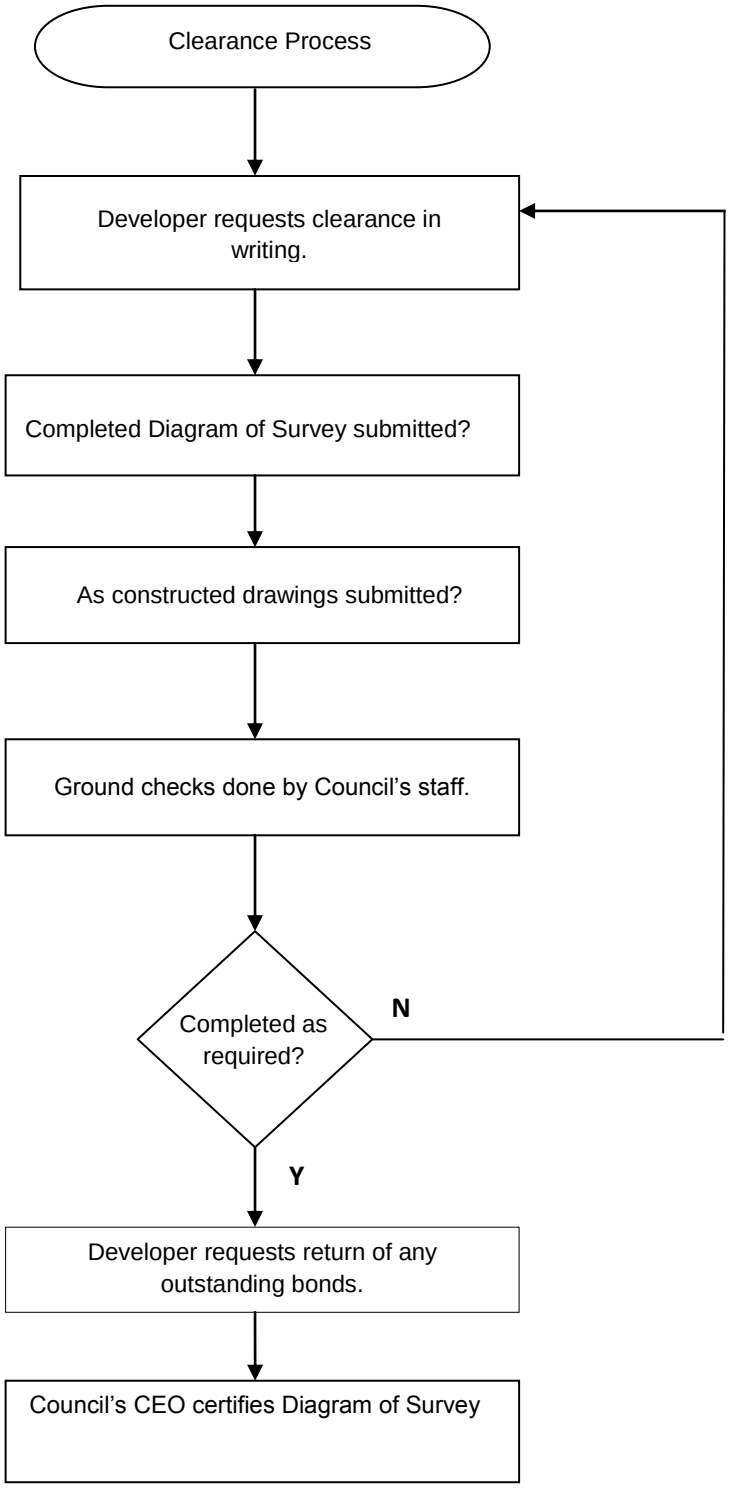
5. One full set of electronic ‘as built’ plans is to be submitted in CAD (Autocad preferred) editable format and retained by Council.

All ‘as constructed’ drawings shall bear the Consulting Engineer’s or Consulting Surveyor’s certification stating that all information shown on the plans is accurate.

5.10 INSURANCES

The Supervising Consultant shall take out professional indemnity insurance indemnifying himself and Council. The Supervising Consultant will also provide Council with evidence that all contractors have obtained appropriate third party and public risk insurance satisfactory to Council's requirements prior to commencing works.

6.0 CLEARANCES



FLOW DIAGRAM – ENGINEERING CLEARANCE PROCESS

6.1 COMPLETION OF WORKS AND CERTIFICATION

On practical completion of construction works the Supervising Consultant is to advise the Shire's Engineer to that effect in writing and certify that the whole of the works have been carried out in accordance with the approved plans and specification. If the whole of the works are considered satisfactory the Engineer will agree to a date (the date of practical completion) on which the whole of the works are considered to have entered into the maintenance period.

At this stage the Subdivider's Surveyor completes the final property survey and prepares the final plan of subdivision which is known as the "linen" plan. The final plan of subdivision plan shall be submitted for endorsement by Council as an original transparency and eight (8) copies. Detailed requirements for these plans are set out in Council's Subdivision Code. This plan will later be lodged by the Developer with the Registrar General who will prepare title deeds and advise Council of a deposited plan (DP) number so that sale of allotments of land may proceed.

The maintenance period will commence for all components at the date of practical completion and not beforehand. Some components such as pumping stations may commence a maintenance period only after satisfactory commissioning and completion of pump performance tests.

6.2 EARLY CLEARANCES BY APPLICATION OF ENGINEERING BONDS

Council may give consideration to the acceptance of a bond for the performance of engineering works to enable the early release of linen plans of subdivision. However, before Council will consider accepting a bond providing an irrevocable work guarantee, the construction of engineering works within the subdivision the following must apply:

The engineering works are at least 25% complete.

Full details of the extent, nature & location of work to be bonded, and a programme for completion of the works, being provided to Council.

All major engineering problems have been overcome to the satisfaction of the Shire Engineer.

All works that involve the safety of the public (e.g. road junctions, flood control structures) are completed.

All works on private accessways or private property, required for title release, must be completed and will not form any part of the bond

Any geotechnical reports regarding the suitability of land for development as required by the Shire Engineer are to be submitted.

Payment of all fees and contributions required as conditions of development consent are complete.

Bonds for engineering works required as a condition of subdivision approval will generally be for a maximum period of one (1) year. Extended periods (up to 5 years) may be required for non-complying works.

Bank guarantees and interest bearing deposits in the name of Council only will be accepted for works with a value in excess of $1,000.00. No "sunset" date will be accepted.

A bond fee is payable where a bond has been lodged to guarantee the completion of engineering works. (The bond fee is set out in Council's Schedule of Fees.)

The bond amount may be progressively reduced as the work covered by the bond is carried out, but at no time will the bond amount fall below 150% of the estimated outstanding works, or 10% of the total contract amount, whichever is greater. The Supervising Consultant will be required to lodge a schedule of quantities of all outstanding works to enable the bond amount to be determined.

The application for bond must be in writing and include the following information:

- Name and address of person responsible for payment

- WAPC No., Building Licence Number, or Engineering Reference number as applicable
- A timetable for the future completion of the works
- An itemised estimate of the bonded works
- Reasons for requesting the Bonding of incomplete works
- Any other relevant information which would assist Council to assess the request.

7. DEVELOPMENT DESIGN GUIDELINE

7.1 EARTHWORKS

7.1.1 OBJECTIVES

The objective of this guideline is to provide designers with information in respect to current parameters used by the Shire when considering land shape associated with subdivisional design.

7.1.2 REFERENCE DOCUMENTS

(a) Council Specifications

Construction Specifications
- Control of Erosion and Sedimentation
- Clearing and Grubbing
- Earthworks

Design Specifications
- Austroads -Geometric Road Design
- ARR87, Stormwater Drainage Design
- Erosion Control and Stormwater Management
- Site Regrading

(b) Drawing Standards
- Driveway Gradings
- Retaining Walls, typical details

(c) Other

IPWEA (WA) - Guidelines for Subdivisional Development 2009

7.1.3 SPECIAL TREATMENT OF PARTICULAR AREAS

1. Where the development requires re-contouring and earthworks of the existing land designers shall ensure that works are compatible with road, stormwater and POS design requirements and that the resultant land form is aesthetically comparable with adjacent and surrounding land and or developments.

2. Where earthworks impact on adjacent land the developer shall ensure that approvals from the adjacent land owners are obtained prior to submitting designs for approval.

3. Earthworks for Public Access Ways and Battleaxe Entries shall have a general level cross section boundary to boundary. General maximum grades to be 1 in 14.

4. Re-contouring of land adjacent to roads shall match the boundary levels for that road except where the existing road or verge require adjustment.

5. Re-contouring and earthworks on Public Open Space (POS) where approved shall be to a maximum grade of 1 in 6. All works within POS areas are to be approved before any changes are made.

6. Where residents are required to wheel Waste containers to deposit areas or bin pads, the maximum grade over the maximum permissible distance of 40 metres is 1:14.

7.1.4 GENERAL STANDARD OF LOT PREPARATION

1. The whole area of approved earthworks including roads, blocks, POS, PAW's and Battleaxe's, etc, shall be cleared of trees, shrubs and vegetation and grubbed out to clear roots and stone.

2. Topsoil shall be removed, stockpiled and respread on batters, embankments, POS and other earth-worked areas to encourage vegetation re-growth. Clearing is restricted to those areas that require earth working. Where rock is encountered during re-contouring, the top 400mm is to be ripped and raked to remove all stone over 150mm in size.

3. Where it is necessary to fill in areas where existing natural specimen trees may be affected by the fill, the designer shall outline a management strategy to the Council that will ensure the long term impact of the fill operations is minimised on the vegetation. The management plan must meet the satisfaction of Council. All tree stumps must be removed as part of the re-contouring operation.

4. Selected trees shall be preserved by approved means to prevent destruction normally caused by placement of conventional filling or other action within the tree drip zone. The Council's Representative shall be consulted for advice and all specific requirements noted on the design plans.

7.1.5 STANDARD OF EARTHWORKS FOR URBAN LOTS

1. Site constraints relating to lot size coupled with excessive slope either natural or otherwise will be required to be identified as a burden on the developed property. It is recommended that the designer take this into account when preparing the design. The property may be affected by a "restriction as to use", which will be controlled by a covenant placed on title to the land advising prospective purchasers of any restrictions affecting the land.

2. The maximum grade across blocks will depend upon the potential size of the block. Blocks 500m2 may have a maximum grade of 1 in 20. Blocks over 1000m² and may have an average maximum of 1 in 5. Blocks over 2000m² and under 4000m² may have an average maximum of 1 in 4. Block sizes in between these general limits can have pro-rata slopes to the next increment (eg a 750m² block will be a minimum 50% flat and a maximum 50% at 1 in 5 or a combination not exceeding the pro-rata limit). Side-to-side boundary slopes on blocks less than 500m² is to be a maximum of 0.5m.

3. For residential Lots where overall re-contouring is not required the maximum block grading from the design verge level at the property boundary shall be not greater than 1 in 5 extending 6.0 metres into the property. The Council may approve a variation to this requirement under special circumstances.

4. Overland drainage will only be permitted through a maximum of 2 Lots before discharge into a Council road, park or drainage reserve. Fences, open drains within lots and other mechanisms forcing water against the design contours are not sufficient for achieving this.

5. Where drainage through an adjoining property is required to discharge overland flow or connect the upstream property to a formal drainage system a minimum 3m easement shall be provided in favour of the upstream property.

6. Where designers intend to utilise retaining walls across a subdivision as part of the re-contouring plan, the proposal shall be subject to a building licence and specific negotiation with Council regarding materials and where walls exceed 2m in height.

7. All disturbed areas shall be topsoiled to a minimum depth of 100mm and suitably stabilised.

8. Verges are to be finished in accordance with Councils verge development guidelines. Topsoil is to be treated so it is weed free and used in the areas from which it was removed. Where there is insufficient top soil available on site imported topsoil from an approved source must be used. Alternatively designers, subject to acceptance, may indicate areas that will not be topsoiled and demonstrate how those areas will be managed to provide desired outcomes.

7.1.6 TEMPORARY PROTECTION WORKS

All earthworks shall have temporary protection put in place prior to commencing earthworks to ensure that no silt or debris leave the site. Temporary works are to remain in place until the development is stabilised. When approved temporary works are to be removed and all affected areas reinstated. Protection plans are to be included with earthworks drawings for approval.

7.1.7 AS CONSTRUCTED PLANS

The Consultant shall annotate on the site regrading plan, the site specific detail to be shown on the AS CONSTRUCTED plans. Such detail shall include certifications, testing and survey data, as required in the specification and these standards. Where nominated by Council, a geotechnical report certifying the works to be suitable for the intended purpose shall also be provided by the Consultant.

7.1.8 RURAL SUBDIVISIONS

1. Designers shall undertake earthworks generally as outlined for urban development's taking into account any special aesthetic appeal of the rural landscape. Clearing, however, should be restricted generally to those areas requiring earthworking.

2. Where re-contouring and earthworks abut roads or future roads, then the relevant clauses Urban Areas shall apply.

3. The maximum batter on roads and properties shall be 1 in 3 in cut and 1 in 6 in fill, extending from the table drain in cut or the edge of formation in fill. Table drains, run-off drains and drainage disposal areas shall be provided.

7.1.9 INDUSTRIAL SUBDIVISIONS

1. Industrial areas shall be re-contoured and earthworked to provide suitable grades for sewerage disposal and large diameter stormwater drainage pipes, accommodate large structures and storage areas requiring level pads and meet the grade requirements for large and overlength and overwidth commercial vehicles.

2. The whole area requiring re-contouring and earthworks shall be treated as generally outlined for an urban area.

3. The maximum grade across blocks shall be 1 in 15, rear property boundary to front property boundary. In areas not requiring overall re-contouring or earthworks, Council may approve a grading up to a maximum of 1 in 10 from the +2% verge to natural surface inside the property extending no further than 6 metres back into the property.

4. Where re-contouring and earthworks abut roads or future roads then the relevant clauses for Urban Areas shall apply.

7.1.10 RETAINING WALLS

1. Retaining walls that are constructed as part of the subdivision development are to be designed and certified by a Practising Structural Engineer. Retaining walls over 1.2 metres height require submission to the Council for special approval. Designers should liaise with Council officers to determine the meeting time lines for presentation to Council.

2. Plans showing location, elevations and structural details are to be submitted. All retaining walls shall be subject to a separate application for a Building Licence. The plans are also to be included in the set of detailed engineering subdivision drawings

3. All lot boundary retaining walls are to be designed to withstand the foundation loading of either a single storey house on standard setbacks as defined by the Residential Planning Code or as otherwise defined by Council, or the loading of a standard residential driveway, whichever is the worst case. Notwithstanding this, all walls are to be designed to accommodate loadings associated with standard 1.8m high subdivisional fencing.

4. Retaining walls constructed in small lot subdivisions will be subject to constraints imposed by the impact of amenity on adjoining lots and designers shall clearly demonstrate how amenity and safety will be maintained by their design.

5. Retaining walls located alongside road reserves, pedestrian accessways and public open space are to be a maximum height of 2.0 metres. Retaining walls in all other locations are to be a maximum height of 1.5 metres. Retaining walls for Lots are to be wholly contained within the Lot boundaries.

8. SUB-SURFACE DRAINAGE

8.1 SCOPE

1. The work to be executed under this Specification consists of the design of the subsurface drainage system for the road pavement and/or subgrade.

2. This specification contains procedures for the design of subsurface drainage, including:

   (a) Subsoil and Foundation Drains

   (b) Sub-Pavement Drains

   (c) Drainage Mats, including Type A and Type B Mats. (See 8.2.7 for type definitions).

3. Reference guidelines for the application and design of subsurface drainage include ARRB Special Reports 35 and 41, and the ARRB publication - Guide to the Control of Moisture in Pavements During Construction. The full titles of these guidelines are given below.

8.1.1 OBJECTIVES

1. The objective in the design of the subsurface drainage system is to control moisture content fluctuations in the pavement and/or subgrade to within the limits assumed in the pavement design.

8.1.2 TERMINOLOGY

1. Subsoil drains are intended for the drainage of ground water or seepage from the subgrade and/or the subbase in cuttings.

2. Foundation drains are intended for the drainage of seepage, springs and wet areas within and adjacent to the foundations of the road formation.

3. Sub-pavement drains are intended for the drainage of the base and sub-base pavement layers in flexible pavements. They may also function to drain seepage or groundwater from the subgrade.

4. Type A drainage mats are intended to ensure continuity of a sheet flow of water under fills, to collect seepage from a wet seepage area, or for protection of vegetation or habitat downstream of the road reserve where a fill would otherwise cut the flow of water.

5. Type B drainage mats are constructed to intercept water which would otherwise enter pavements by capillary action or by other means on fills and to intercept and control seepage water and springs in the floors of cuttings.

8.1.3 REFERENCE AND SOURCE DOCUMENTS

Australian Standards

AS2439.1 - Perforated drainage pipe and associated fittings

Other

AUSTROADS - Guide to Pavement Technology, Part 10: Subsurface Drainage

ARRB-TN13 - Control of Moisture in Pavements During Construction, 2003

ARRB-SR35 - Australian Road Research Board, Special Report No. 35 - Subsurface Drainage of Road Structures, Gerke R.J. 1987.

ARRB-SR41 - Australian Road Research Board, Special Report No. 41 – A Structural Design Guide for Flexible Residential Street Pavements, Mulholland P.J., 1989.

8.2 SUBSOIL AND SUB-PAVEMENT DRAINS

8.2.1 JUSTIFICATION

1. Subsoil drains are designed to drain groundwater or seepage from the subgrade and/or subbase in cuttings.

2. Sub-pavement drains are designed to drain water from base and subbase pavement layers in flexible pavements, and to drain seepage or groundwater from the subgrade.

3. Subsoil or sub-pavement drains shall be provided on both sides of the formation in the following locations, unless the geotechnical report indicates the absence of subsurface moisture at the time of investigation and the likelihood that changes in the subsurface moisture environment will not occur within the design life of the pavement and/or the pavement has been specifically designed to allow for likely variations in subgrade and pavement moisture contents:

    (a) Cut formations where the depth to finished subgrade level is equal to or greater than 300mm below the natural surface level.

    (b) Locations of known hillside seepage, high water table or isolated springs.

    (c) Irrigated, flood-prone or other poorly drained areas.

    (d) Highly moisture susceptible subgrades, ie. commonly displaying high plasticity or low soaked CBRs.

(e) Use of moisture susceptible pavement materials.

(f) Existing pavements with similar subgrade conditions displaying distress due to excess subsurface moisture.

(g) At cut to fill transitions.

Where only one side of the formation is in cut, and the other side in fill, it may be sufficient to provide subsoil or sub-pavement drains only along the edge of the formation in cut.

4. The need for subsoil and sub-pavement drains may otherwise become apparent during the construction process, due to changes in site moisture conditions or to areas of poorer subgrade being uncovered that were not identified in the geotechnical investigation. The Design Drawings shall be suitably annotated to the potential need for subsoil or sub-pavement drains in addition to those shown on the Drawings.

8.2.2 LAYOUT, ALIGNMENT AND GRADE

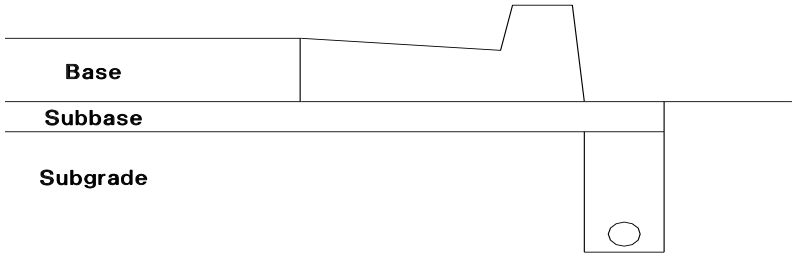


Figure D4.1 - Typical Subsoil Drain

1. In kerbed roads, the two acceptable alternative locations for the line of the trench are directly behind the kerbline. Pavement layers must extend to at least the line of the rear of the trench.

2. In unkerbed roads, subsoil and sub-pavement drains shall be located within the shoulder, preferably at the edge of the pavement layers.

3. The minimum desirable longitudinal design grade shall be 1.0-1.5%. For non corrugated pipes, an absolute minimum grade of 0.7% is acceptable.

4. Trench widths shall be a minimum of 300mm, with a minimum depth below finished subgrade level of 600mm in earth and 450mm in rock, and below the invert level of any service crossings.

5. Outlets shall be spaced at maximum intervals of 150 metres. Where possible, subsoil and sub-pavement drainage pipes shall discharge into gully pits or other stormwater drainage structures. Where not possible, outlets shall be provided through fill batters.

6. Cleanouts are to be provided at the commencement of each run of drain, and at intervals not exceeding 80 metres. Cleanouts shall generally be located directly at the rear of kerb or at the edge of shoulder, as applicable.

8.2.3 FOUNDATION DRAINS

1. The need to provide foundation drains may be apparent from the results of the geotechnical survey along the proposed road formation alignment, and in this case the location shall be shown on the plans. However, more commonly, the need to provide

foundation drains is determined during construction, and hence in this situation requirements and locations cannot be ascertained at the design stage.

2. Where the road formation traverses known swampy, flood-prone, or watercharged strata, the design Drawings shall be suitable annotated to the potential need for foundation drains at various locations, in addition to those shown on the Drawings.

8.2.4 LAYOUT, ALIGNMENT AND GRADE

1. Typical cross-sections of foundation drains are shown below in Figure D4.2.

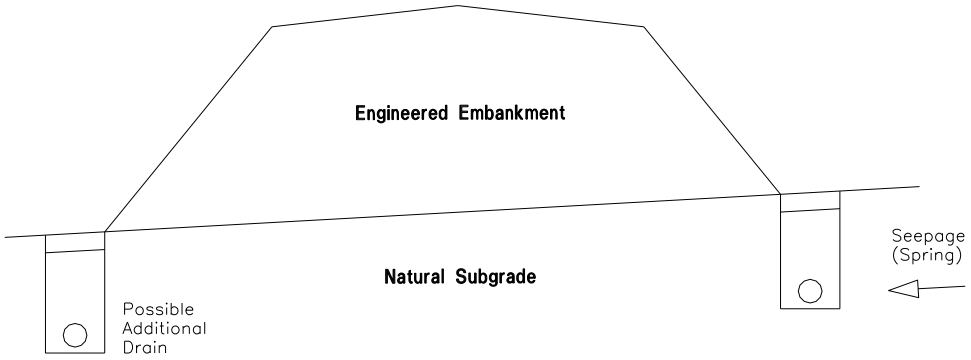


Figure D4.2 - Foundation Drains

2. The minimum desirable design grade shall be 1.0-1.5%. For non corrugated pipes an absolute minimum grade of 0.7% is acceptable.

3. Foundation drains shall be a minimum trench width of 300mm, with a variable trench depth to suit the application, pipe gradient and ground conditions on site.

4. Outlets shall be spaced at maximum intervals of 150 metres.

5. Where practicable, cleanouts are to be provided at the commencement of each run of foundation drain and at intervals not exceeding 80 metres. Where not practicable to provide intermediate cleanouts, outlets shall be spaced at maximum intervals of 100 metres.

8.2.5 DRAINAGE MAT OR GEOTEXTILE

1. Type A drainage mats are designed where there is a need to ensure continuity of a sheet flow of water under fills, to collect surface seepage from a wet seepage area, or for protection of vegetation or habitat downstream of the road reserve where a fill would otherwise cut the flow of water. Type A drainage mats are constructed after the site has been cleared and grubbed and before commencement of embankment construction.

2. Type B drainage mats are designed where there is a need to intercept water which would otherwise enter pavements by capillary action or by other means on fills and to intercept and control seepage water and springs in the floors of cuttings. Type B drainage mats shall be constructed after completion of the subgrade construction and before construction of the pavement.

3. The need to design for the provision of drainage mats should be apparent from the result of the geotechnical survey along the proposed road formation alignment.

8.2.6 SUBSOIL AND SUB-PAVEMENT DRAIN PIPE MATERIALS

1. Pipes designated for subsoil, foundation and sub-pavement drains shall be 100mm diameter slotted pipe.

2. Corrugated plastic pipe shall conform with the requirements of AS2439.1. The appropriate class of pipe shall be selected on the basis of expected live loading at the surface. Joints, couplings, elbows, tees and caps shall also comply with AS2439.1.

3. Slotted rigid UPVC pipe shall be of a type and class approved by Council.

4. All slotted pipe shall be fitted with a suitable geo-textile filter tube, except for cleanouts and outlets through fill batters which shall be un-slotted pipe.

5. Butt jointed pipes are not acceptable.

8.2.7 FILTER MATERIAL

1. The types of filter material covered by this Specification shall include:

   (a) Type A filter material for use in subsoil, foundation, and sub-pavement (trench) drains and for Type B drainage mats.

   (b) Type B filter material for use in subsoil, foundation and sub-pavement (trench) drains.

2. Material requirements and gradings for each type of filter material are included in AUSTROADS 'Guide to Pavement Technology, Part 10: Subsurface Drainage, 2009.

3. The type of filter material specified to backfill the sub-surface drainage trenches (subsoil, foundation and sub-pavement drains) shall depend on the permeability of the pavement layers and/or subgrade and the expected flow rate. Generally, Type A filter material is used for the drainage of highly permeable subgrade or pavement layers such as crushed rock or coarse sands, while Type B filter material is used for the drainage of subgrade and pavement layers of lower permeability such as clays, silts or dense graded gravels. Alternatively, using the IPWEA guidelines, equal parts of 14mm, 10mm + 5mm granulas stone (granite) can be used as the filter, surrounded in a geotextile blanket.

8.2.8 GEOTEXTILE

1. Where necessary to provide separation (ie. prevent infiltration of fines) between the filter material in the trench and the subgrade or pavement material, geotextile shall be designated to encapsulate the filter material. The geo-textile shall comply with the requirements included in AUSTROADS 'Guide to Pavement Technology, Part 10: Subsurface Drainage, 2009.

2. Geotextile shall also be designated for both Type A and Type B Drainage Mats.

8.2.9 DESIGN DRAWINGS AND CALCULATIONS

1. The proposed location of all subsurface drains shall be clearly indicated on the Design Drawings, including the nominal depth and width of the trench, and the location with respect to the line of the kerb or edge of pavement. Where practicable, the location of outlets and cleanouts shall also be indicated on the Drawings.

2. Assumptions and/or calculations made in the determination of the need or otherwise for subsurface drainage in special circumstances or as a variation to the requirements of this specification shall be submitted to Council for approval with the Design Drawings.

9. DEVELOPMENT DESIGN SPECIFICATION - STORMWATER DRAINAGE DESIGN

9.1 GENERAL

9.1.1 SCOPE

This Guideline assists with the design of stormwater drainage systems for urban and rural areas. This is to be read in conjunction with the Australian Rainfall and Runoff manual and associated technical reports.

Should designers wish to submit designs with alternative criteria, they should be able to clearly demonstrate that it meets performance criteria acceptable to the Shire for,

- Long and Short term Flood Management
- Technical compliance (Minor Systems)
- Safety
- Maintenance
- Economy
- Longevity (75yr design life)

9.1.2 OBJECTIVES

1. The objectives of stormwater drainage design are as follows:

   (a) To ensure that inundation of private property only happens rarely and that, in such events, surface flow routes convey floodwaters below the prescribed velocity/depth limits.

2. The Shire supports the following principles:

   (a) New Developments are to provide a stormwater drainage system in accordance with the "major/minor" system concept set out in the Australian Rainfall & Runoff manual, ie, the "major" system shall provide safe, well-defined overland flow paths for rare and extreme storm runoff events while the "minor" system shall be capable of carrying and controlling flows from frequent runoff events.

   (b) Redevelopment - Where the proposed development replaces an existing development, the on-site drainage system is to be designed in such a way that the estimated peak flow rate from the site for the design average recurrence interval (ARI) of the receiving minor system is no greater than that which would be expected from the existing development.

   (c) Where appropriate, the environmental and amenity objectives of water sensitive urban design principle should be taken into account.

9.2 REFERENCE AND SOURCE DOCUMENTS

9.2.1 Australian Standards

AS 1254	-	Unplasticised PVC (uPVC) pipes and fittings for stormwater or surface water applications.
AS 2032	-	Code of practice for installation of uPVC pipe systems.
AS 3725	-	Loads on buried concrete pipes.
AS 4058	-	Precast concrete pipes.
AS 4139	-	Fibre reinforced concrete pipes and fittings.

9.3 HYDROLOGY

9.3.1 DESIGN RAINFALL DATA

1. Designers can develop their own IFD tables as outlined in the Australian Rainfall and Run-off. Typical IFD rainfalls for the Perth station are typically used throughout the Shire (see below). Please refer to the Bureau of Meteorology website: www.bom.gov.au/water/designRainfalls/index.shtml.

LOCATION: 34.975 S 117.350 E * **NEAR:** Denmark **ISSUED:** 25th October 2010

***ENSURE THE COORDINATES ARE THOSE REQUIRED SINCE DATA IS BASED ON THESE AND NOT LOCATION NAME**

PREPARED BY –HYDROMETEOROLOGICAL ADVISORY SERVICE – MELBOURNE

LIST OF COEFFICIENTS TO EQUATIONS OF THE FORM

$$\log_e(I) = A + B * (\log_e(T)) + C * (\log_e(T))^2 + D * (\log_e(T))^3 + E * (\log_e(T)^4 + F * (\log_e(T))^5 + G * (\log_e(T))^6$$

T = TIME IN HOURS AND I = INTENSITY IN MILLIMETRES PER HOUR

RETURN PERIOD (YEARS)	a	b	C	d	e	f	g
1	2.6625	-.6139	-.0056	.00840	-.002311	-.0002391	.0000591
2	2.9171	-.6242	-.0011	.00778	-.002493	-.0001057	.0000449
5	3.1395	-.6490	.0100	.00639	-.002937	.0002079	.0000065
10	3.2645	-.6626	.0159	.00490	-.002983	.0004675	-.0000357
20	3.4181	-.6750	.0213	.00383	-.003132	.0006619	-.0000628
50	3.6024	-.6903	.0281	.00298	-.003367	.0008532	-.0000875
100	3.7321	-.7010	.0328	.00210	-.003495	.0010203	-.0001111

RAINFALL INTENSITY IN MM/HR FOR DURATIONS AND RETURN PERIODS

RETURN PERIOD

DURATION (HOURS)	MINUTES	1 YEAR	2 YEARS	5 YEARS	10 YEARS	20 YEARS	50 YEARS	100 YEARS
.083	5	53.2	71.3	98.1	118.	144.	184.	219.
.100	6	49.6	66.5	91.3	109.	134.	171.	203.
.167	10	39.6	52.7	71.1	84.3	102.	129.	152.
.333	20	27.6	36.2	47.1	54.6	65.0	80.2	92.9
.500	30	21.8	28.4	36.3	41.6	49.1	59.9	68.9
1.000	60	14.3	18.5	23.1	26.2	30.5	36.7	41.8
2.000	120	9.36	12.0	14.8	16.7	19.3	23.1	26.1
3.000	180	7.31	9.36	11.5	12.9	14.9	17.8	20.1
6.000	360	4.79	6.13	7.53	8.44	9.75	11.6	13.1
12.000	720	3.11	3.99	4.93	5.55	6.42	7.67	8.69
24.000	1440	1.96	2.53	3.18	3.62	4.23	5.11	5.83
48.000	2880	1.18	1.54	2.00	2.31	2.74	3.37	3.90
72.000	4320	.851	1.13	1.49	1.75	2.09	2.60	3.03

2. Design Average Recurrence Interval (ARI) - For design under the "major/minor" concept, the design ARIs to be used are given below:-

   - 150 years for major system overflow paths
   - 10 years for commercial/industrial area "minor" systems
   - 10 years for urban/residential area "minor" systems
   - 5 years for rural residential area "minor" systems
   - 1 year for parks and recreation area "minor" systems.

3. Where a development is designed so that the major system flows involve surcharge across private property, then the underground system (both pipes and inlets) shall be designed to permit flows into and contain flows having an ARI of 100 years from the upstream catchment which would otherwise flow across the property. A surcharge path shall be defined for systems even where 100 year ARI flows can be maintained within the system. Easements are to be provided in private property over pipe systems and surcharge paths.

4. Ensure that stormwater runoff is contained on-site, where possible, for a one in one year (one hour)ARI storm event.

9.3.2 CATCHMENT AREA

1. Sub-dividers whose land shares a common catchment area have a shared responsibility to ensure that the whole catchment area (including arterial roads) will be effectively drained.

2. The total catchment area shall include all public land such as road reserves, public car parks, public building etc. and an impervious 500m2 per lot in residential areas.

3. Stormwater drainage from commercial properties in suburban areas is to be incorporated in the drainage system.

4. Where development is to be staged, an overall drainage plan for the whole of the catchment is required before approval will be given for any individual stage. Drainage construction of each individual stage shall be in accordance with the approved overall plan. Sub-dividers are responsible for arranging their own cost sharing arrangements.

5. Where a new development occupies the upper part of a catchment common with existing developed land for which there is no overall plan, the following shall apply:

6. The subdivider shall submit an overall drainage catchment plan indicating the boundaries of the total catchment and the estimated runoff from the total catchment and each sub-catchment.

7. The subdivider shall submit calculations to prove that the existing drainage system is capable of transmitting and disposal of the total runoff.

8. The new development shall be provided with a drainage system capable of transmitting and disposal of all runoff in a manner acceptable to Council Officers.

9.3.3 RATIONAL METHOD

1. Peak flow calculations are to be carried out using the Rational Method in accordance with Book 8, AR&R and the requirements of this Guideline.

2. All calculations shall be carried out by a qualified person experienced in hydrologic and hydraulic design.

3. Coefficients of Run-off shall be calculated in accordance with the Australian Rainfall and Run-off manual and full details of coefficients utilised shall be provided. The designer is to assess the run off coefficients for each catchment with all calculations shown.

4. The maximum time of concentration in an urban area shall be 20 minutes unless sufficient evidence is provided to justify a greater time. The minimum time of concentration shall be 6 minutes. Designer should note that the time of concentration parameters may be increased to account for Water Sensitive design however the designer must justify the value used.

5. Surface roughness coefficients "n" shall be derived from Book 8, AR&R (1997). Values applicable to specific zoning types and overland flow path types are given below:

Flow across Parks	0.35
Flow across Rural Residential land	0.30
Flow across Residential (1000-2000m2)	0.21
Flow across Residential (<1000m2)	0.11
Flow across Industrial	0.06
Flow across Commercial	0.04
Flow across Paved Areas	0.01

Flow across Asphalt Roads	0.011
Flow across Gravel Areas	0.02

9.3.4 HYDRAULIC GRADE LINE

Hydraulic calculations shall generally be carried out in accordance with Australian Rainfall and Runoff 1997 and shall be undertaken by a qualified person experienced in hydrologic and hydraulic design. The calculations shall substantiate the hydraulic grade line adopted for design of the system and shown on the drawings. Summaries of calculations are added to the plan and details of all calculations are given including listings of all programme input and output.

The "major" system shall provide safe, well-defined overland flow paths for rare and extreme storm runoff events while the "minor" system shall be capable of carrying and controlling flows from frequent runoff events.

Downstream water surface level requirements are given below:-

Known hydraulic grade line level from downstream calculations including pit losses at the starting pit in the design event.

Where the downstream starting point is a pit and the hydraulic grade line is unknown, a level of 0.15m below the invert of the pit inlet in the downstream pit is to be adopted

Where the outlet is an open channel and the design storm is the minor event the top of the outlet pipe shall be the downstream control

Where the outlet is an open channel, the design storm is the major event and downstream flood levels are not known, the top of the outlet pipe shall be the downstream control.

Where the outlet is an open channel, the design storm is the major event and downstream flood levels are known, the downstream control shall be the 1% probability flood level.

The water surface in drainage pits shall be limited to 0.150m, below the gutter invert for inlet pits and 0.150m below the underside of the lid for junction pits.

9.3.5 MINOR SYSTEM CRITERIA

1. Designers shall generally meet the requirements as outlined in the IPWEA (WA) Guidelines for Subdivisional Development 2009. Flow widths from the kerb line at intersections are to be less than 1.0m. A maximum width of 2 metres is permitted elsewhere.

2. Minimum pipe size shall be 300mm diameter. Minimum box culverts to be 600mm wide x 300mm high.

3. Minimum velocity of flow in stormwater pipelines shall be 1m/sec. This minimum velocity should be checked for a 1in 1 year storm (i.e. partial flow) with coefficient of 0.4 road reserve (maintenance check). Maximum velocity shall be 6.0 m/sec.

4. All trapped low points are to be designed for a 100 year short duration storm. Low points adjacent to private properties that could be inundated are not permitted.

5. The minimum grade for 300mm pipes shall be 1:200 (0.5%).

9.3.6 PITS

1. Inlet Pits shall be spaced so that the gutter flow width is limited in accordance with this guideline. As a guide general spacing 40-50m. Maximum spacing to be 100m.

2. The use of side entry pits (SEP's) is preferred where the drainage system discharges into a sump site. The entry throat depth is to be no greater than 95mm+/- 15mm. Pits are to consist

of pre-cast concrete well liners, an integral conversion slab/apron with appropriate deflectors and a pre-cast cover slab with galvanised angle iron support.

3. The following applies to gullies and SEP:

   3.1. The locations are to be designed so that minimum interference is likely to future crossovers, pedestrian/cyclist ramps and at intersections.

   3.2. All inlet pits to be connected to the main line via manholes.

   3.3. The minimum connection pipe diameter to be 300mm.

   3.4. Maximum depth of inlet pits to be 1.2m.

   3.5. All covers and grates to be secure against unauthorised access consist of pre-cast concrete well liners, an integral conversion slab/apron with appropriate deflectors/grates and a pre-cast cover slab with galvanised angle iron support.

4. Where designers cannot meet the above maximum depth requirements eg existing land restraints and must incorporate inlet pits on line, then connection shall be to pipes no greater than 600mm (absolute maximum) diameter and preferably less than 450mm diameter.

5. Entry structures design capacities on grades shall be:

   - Side Entry Pits - 20 l/sec
   - Grated Gully Pits - 15 l/sec.
   - Combination SEP & gullies - 25 l/sec.
   - Junction Pits shall be of pre-cast concrete construction with trafficable covers in roads and verges and concrete lids in non-trafficable areas.

6. Drainage structures shall generally meet the requirements as shown in Councils Standard Drawings

9.3.7 OTHER

1. All sources of coefficients used in calculations shall be provided to Council with design summary schedules as shown on the 'stormwater drainage analysis sheet'. A sample calculation sheet is also shown. (9.3.7b)

2. Computer programs using the Colebrook-White equation is considered the most appropriate method of calculating pipelines The coefficient 'Ke' shall not be acceptable unless they are consistent with those from the charts in ARRB special report No 34 or equivalent source.

3. The chart used and relevant friction coefficients for determining 'Ke' value from that chart shall be noted on the hydraulic summary calculation sheet provided for plan checking and included on the final design drawings.

4. Due to the generally impervious nature of the natural ground or the occurrence of a high water table, it is generally considered impractical to dispose of private storm water on site. Each Lot shall be provided with a minimum 600mm diameter connection pit which is connected to Councils stormwater system.

5. The requirements for private pipes entering Council's system are given below:-

   a. All pipe inlets, including roof and subsoil pipes, shall where possible, enter the main pipe system via a single 150mm pipe at manholes. The connection point shall be finished off flush with and be grouted into the pit wall.
   b. If a junction has to be added which is larger than 150mm then a junction pit shall be built at this location in accordance with this Specification.

6. Specific approval is required for construction of a junction without a manhole. Where such an arrangement is approved the adopted pressure change co-efficients Ku, for the upstream pipe and Kl, for the lateral pipe, must be justified.

9.4 MAJOR SYSTEM CRITERIA

Freeboard requirements for finished floor levels and tops of levee bank levels from flood levels in open channels, roadways and stormwater surcharge paths are given below:

Generally:-

(a) Surcharging of a drainage system is generally not permitted. However surcharging of the drainage system for storm frequencies greater than 1:20 year or 5% probability may be permitted across the road centreline providing the road pavement is below the natural surface of the adjoining private property.

(b) A minimum freeboard of 300mm shall be provided between the 100 year flood level and finished floor levels on structures and entrances to underground car parks. A higher freeboard may be required in certain circumstances.

(c) Where the road is in fill or overtopping of kerbs and flow through properties may occur a 100mm freeboard shall be provided between the ponding level of water in the road and the high point in the verge. Driveway construction in these instances needs to consider this requirement.

(d) A minimum freeboard of 1.0m shall be provided between the 100 year flood level and finished floor levels on all special facilities. These shall include but not be limited to Western Power installations, emergency services facilities and schools

(e) The velocity x depth product of flow across the footpath and within the road reserve shall be such that safety of children and vehicles is considered. The maximum allowable depth of water is 200mm and a maximum velocity x depth product of $0.4m^2/s$ is permitted. Where the safety of only vehicles can be affected, a maximum velocity x depth product of $0.6m^2/s$ is permitted. In open channels the above velocity x depth product criteria will be followed where possible or the design shall address the requirements for safety in relation to children by providing safe egress points from the channel or other appropriate methods.

(f) Flow capacities of roads should be calculated using Technical Note 4 in Chapter 14 of AR&R.

9.5 OPEN CHANNELS

1. Generally open channels are not permitted, whereas bio-retention systems with overflow outlets are desired.

2. Maximum side slopes on grassed lined, unfenced open channels shall be 1 in 5, with a preference given to 1 in 6 side slopes, channel inverts shall generally have minimum cross slopes of 1 in 20.

3. Transition in channel slopes to be designed to avoid or accommodate any hydraulic jumps.

9.6 MAJOR STRUCTURES

All major structures shall be designed for the 100 year ARI storm event without afflux in urban areas. Some afflux and upstream inundation may be permitted in certain rural and urban areas provided the increased upstream flooding is minimal and does not inundate private property.

A minimum clearance of 300mm between the 100 year ARI flood level and the underside of any major structure superstructure is required to allow for passage of debris without blockage.

All bridges shall be designed for 1% probability flood intensity without afflux in urban areas.

Certified structural design shall be required on bridges and other major culvert structures and may be required on some specialised structures. Structural design shall be carried out in accordance with AUSTROADS Bridge Design Code.

All culverts shall be designed for 1% probability flood intensity without afflux in urban areas.

9.7 SUMPS AND DETENTION BASINS

Sumps, Basins and other water retaining structures built in fill or close to embankments must be certified by a practising structural engineer.

9.8 STORMWATER DETENTION

The Shire has a lot of clay sites where traditional on-site soakage methods or sumps are unsuitable. Where designers cannot adequately dispose of storm water on-site they shall consult with Council officers in the early stages of the development process to determine the conditions of disposal into the Council's drainage system network. In any event systems are to be designed to detain post development flows past peak flow times.

Pipe systems shall contain the minor flow through the Retarding Basin wall. Outlet pipes shall be rubber ring jointed with lifting holes securely sealed. Pipe and culvert bedding shall be specified to minimise its permeability, and cut off walls and seepage collars installed where appropriate. Pipe inlet shall be protected from blockage.

Side slopes are to be a maximum of 1 in 6 to allow easy egress.

Water depths shall, where possible, be less than 1.2m in the 20 year ARI storm event. .

The depth indicators are to be provided indicating maximum depth in the basin.

Protection of the low flow intake pipe shall be undertaken to reduce hazards for people trapped in the basin.

Signage of the spillway is necessary to indicate the additional hazard.

No basin spillway is to be located directly upstream of private property.

Where any of these guidelines are not met a safety audit is to be prepared for presentation to Council prior to acceptance.

9.9 INTERALLOTMENT DRAINAGE

Inter-allotment Drainage shall be provided for every allotment which cannot be drained on its own allotment into the natural ground.

The inter-allotment system shall be designed to accept concentrated drainage from buildings and paved areas on each allotment for flow rates having a design ARI the same as the "minor" street drainage system

Pits shall be 600mm diameter and pipes shall have a minimum grade of 0.5% designed to flow full without surcharge at the pit.

In lieu of more detailed analysis, the following areas of impervious surface are assumed to be contributing runoff to the inter-allotment drain:-

Developer Type	**- % of Lot Area**
Residential (1000-2000m2)	40
Residential (<1000m2)	70

Industrial	95
Commercial	100

9.10 DETAILED DESIGN - DRAINAGE PIPES

1. Conduit and Material Standards shall meet Australian Standards for concrete pipes and Fibre Reinforced pipes. Where designers wish to use PVC pipes or alternative materials they shall provide sufficient evidence to the Council to support the use of such material.

2. Storm water pipes in road reserves shall be aligned in accordance with the Utility Providers Code of Practice for Western Australia (October 1997) and generally 1.5 m behind the back of kerb . Approval of Council is required for alignments other than those specified in the Code.

9.10.1 PIT DESIGN

1. Pits shall be designed with benching to improve hydraulic efficiency and reduce water ponding. Typical pit designs and other pit design requirements are included in Council's Standard Drawings ES-DR-03/1 to ES-DR-03/12.

2. Pits and junctions shall be generally located in accordance with the requirements of the Guidelines for Subdivisional Development (IPWEA WA 2009). Junction manholes shall be placed on the drainage line generally located 1.5 m behind the kerb line.

3. Pit floor levels should allow for an absolute minimum slope of 0.01m/m (desirable that drop is 30mm over pit)

9.10.2 STORMWATER DISCHARGE

1. Scour protection at culvert or pipe system outlets shall be constructed in accordance with Council Standard Drawing No ES 03-12-0 unless outlet conditions dictate the use of more substantial energy dissipation arrangements.

2. Where outlet velocity is greater than 2.5m per second or where the kerb discharge causes scour, then protection shall be provided to prevent scour and dissipate the flow.

(See AusSpec D5.21)

9.11 DOCUMENTATION

9.11.1 PLANS

1. Catchment Area Plans should be drawn at an appropriate scale. Catchment Area Plansshall show contours, direction of grading of kerb and gutter, general layout of the drainage system with pit locations, catchment limits and any other information necessary for the design of the drainage system. They shall not be limited to the development area where consideration of a greater catchment is required.

2. The Drainage System Layout Plan shall be incorporated on the road layout. The Plan shall show drainage pipeline location, grade, drainage pit location and number and road centre-line chainage, size of opening and any other information necessary for the design and construction of the drainage system.

3. The plan shall also show all drainage easements, reserves and natural water courses. The plan may be combined with the road layout plan.

4. The Drainage System Longitudinal Section shall be drawn at a scale ratio of 10 horizontally and 1 vertically and shall show pipe size, class and type, pipe support type in accordance with AS 3725 or AS 2032 as appropriate.

9.11.2 EASEMENTS AND AGREEMENTS

1. Evidence of any Deed of Agreement necessary to be entered into as part of the drainage system will need to be submitted prior to any approval of the engineering plans. Easements will need to be shown on the subdivision plans and lot clearance plans.

2. Where an agreement is reached with adjacent landowners to increase flood levels on their property or otherwise adversely affect their property, a letter signed by all the landowners outlining what they have agreed to and witnessed by an independent person shall be submitted prior to any approval of the engineering plans.

9.11.3 SUMMARY SHEETS

An example of a Hydrological Design Sheet can be found on the Shire website.

- A copy of a Hydrological Summary Sheet providing the minimum information set out in the AR&R 1987 or Appendix B ARRB Special Report No 34 is required.

- A completed copy of our 'Stormwater Drainage Analysis Sheet' providing the minimum information set out in the AR&R 1987 or Appendix B ARRB Special Report No 34 is required.

- Computer program output may be provided as long as summary sheets for Hydrological and Hydraulic calculations in accordance with this Specification are provided with plans submitted for checking and with final drawings.

- Copies of final computer data files, for both hydrological and hydraulic models shall be provided for Council's data base of flooding and drainage information in formats agreed with Council.

- Summary sheets are to be dated and signed by the relevant competent designer.

9.12 RETENTION SUMPS

1. Retention sumps are not in common use throughout the Shire. Where sumps are used they rely on the capacity of the sandy subgrade material to allow filtration of captured stormwater into the ground water below.

2. The rate of filtration of the subgrade is critical to their effectiveness and as such the depth of the water table should be carefully considered when calculating the size of the sump.

3. If the floor of the sump is closer than 4m to the ground water table, additional area will be required and detailed calculations shall be submitted to Council.

4. The Shire's research and experience on the filtration characteristics of subgrades at various has not permitted any clear conclusions to be drawn as to desired filtration rates that may be applied to sump design calculations for the various locations. The sump design characteristics outlined below have assumed a conservative filtration rate.

5. Infiltration rates shall be calculated after conducting tests on the capacity of the soil and taking into account the ground water table level for the design period.

6. All test results and results from onsite investigations shall be submitted to Council with design calculations and plans.

9.13 DESIGN DETAILS

1. In sandy areas sumps are required to be designed for the longer duration storm as follows. Whichever is the critical design factor must be satisfied

   The surface area of the storm water disposal drainage basin shall be measured at a top water level (TWL) corresponding to the discharge hydraulic grade line at the basin when available or the lowest level of the incoming pipes.

   The surface area requirement at TWL may be nominally calculated at a minimum rate of $1m^2$ for each $40m^2$ of Equivalent Impervious Area draining into the sump. The sump shall have sufficient volume below TWL to contain equivalent to the 10 hour duration,1 in 10 storm event ($600m^3$ for 1 ha effective)

   Provide overall storage at the catchment low point equivalent to the 24 hour duration 1in 100 year storm event (1330 m^3 for 1ha effective).

2. Designers must ensure free board requirements outlined in this guideline are met.

3. Alternative disposal designs will be considered, when supported by field investigations and calculations. Alternative storage designs will be subject to the proponent undertaking monitoring program over a minimum two (2) full winter periods.

   As part of the alternative design proposal, subdividers will be required to provide an easement for a drainage reserve area and bonding for the drainage sump requirements calculated in accordance with the design criteria.

   Alternative designs will be required to satisfy the minimum criteria for the 100 year storm event. That the kerb side depth and channel flow average velocity is limited so that discharge velocity is not greater than 0.4m/sec

4. In applying the criteria outlined above the, Council will take into account the critical nature of the location of the sump site and where there are overland flow paths and secondary storage areas located adjacent to sump sites, design requirements may be eased. These alternatives should be discussed with Council at the preliminary design stages.

9.14 SUMP SITES

1. All Industrial and commercial development shall be drained to a secure fenced sump site only.

2. Catchments consisting of only residential areas may be drained to a secure fenced sump site, an open basin, or the combination of the two. The nature of the basin type will depend on the risks associated with the site location, the amenity of the surrounding area and the impact of the sump design on the site.

9.15 FENCED SITES

Fenced sump sites shall be completely enclosed by a secure fence of suitable materials to suit the amenity of the area. Lockable outward opening gates (min total 4m wide) and access ramp at maximum grade 1 in 4 to the sump base shall be provided. Gates to have bolts with locating dowels built into sealed access. Maximum gap under fence and gates 50mm.

The interior of the fenced sump may be landscaped between the top of the sump batters and the fence line with suitable plants that require minimal maintenance. Landscape designs shall be discussed with the Shire and be provided as part of the sump design details.

9.16 OPEN BASINS

Generally open basins shall be unfenced and designed to accommodate pedestrian traffic. Open basins shall be dry for the majority of time and will generally be landscaped and or grassed. The maximum slope of an open basin shall be 1in 8 and the maximum depth of water in the basin during a major storm shall not exceed 900mm.

It is usually not permitted (overland flow routes excepted) to incorporate stormwater detention/disposal into POS. Where subdividers are seeking to include stormwater areas as part of their POS contribution, they will be required to develop the POS in such a manner so the stormwater storage is a formal feature area including such infrastructure as paths, furniture, lighting etc. The developer shall consult with council officers regarding this. Whether supported by officers or not, specific Council approval is required before incorporating stormwater into POS.

9.17 ROAD CROSSINGS

1. The following conditions apply to development works that necessitate the opening up of existing roads as part of the subdivision. These conditions shall be read in conjunction with the Utility Providers Code of Practice for Western Australia.

2. A written application indicating the exact location and dimensions of the road crossing shall be submitted to the Council.

3. All pipes shall be thrust bored across roads unless otherwise authorised in writing by Council. All requests for open trenching across roads shall include data justifying the need for special approval to open trench.
4. Reinstatement of the surface of roads, vehicle crossings and footpaths shall be undertaken to Council standards or by Council at the contractor's expense.

5. A bond for reinstatement works shall be lodged with Council prior to the commencement of the works. This bond relates to an estimate of costs only and where Council undertakes the work actual expenditure incurred will be charged.

6. Competent contractors may undertake works, subject to the prior approval. The work is to be covered in the maintenance period of the sub-divisional release.

7. Notification shall be given in writing to the Council at least forty-eight (48) hours prior to the commencement of work or re-commencement of work after any prolonged cessation of the works.

8. Affected Residents shall be advised of intended works at least forty-eight (48) hours prior to the commencement of the works.

9.18 TRAFFIC CONTROL

Roads without approved alternative access such as cul-de-sacs shall be kept open to traffic at all times.

Applications for permission to close roads shall be in accordance with the Local Government Act. Notwithstanding this requirement a further notification is to be forwarded to Council for prior approval, at least forty-eight (48) hours prior to the closing of any road to traffic. Such notification shall also be forwarded to the relevant police, public transport and emergency service authorities.

Road closures shall be kept to a minimum and every cut shall be backfilled and made trafficable immediately pipe laying has been completed.

The contractor shall make adequate provision for all traffic using the road or footpath and shall erect such barriers, warning signs, etc, as is required under the Australian Standard 1742.3 and undertake traffic control in accordance with the traffic Code of Practice.

9.19 EXCAVATION

The road surface shall be cut to provide a clean straight joint prior to the commencement of excavation works. Stockpiling of any excavated materials other than immediately adjacent to the excavation shall be on approved sites only

Cultivated lawns shall be removed for the full top width of the excavation by cutting with a sodding machine and the sods neatly stacked in a manner to ensure the maximum possible preservation of the lawn. After completion, such lawns shall be reinstated as near as practicable to their original condition.

9.20 EMERGENCIES

In the event of any irregularities or emergencies occurring, the Council must be notified immediately of the problem(s) occurring and the intended remedial action.
Any damages which may occur to Council facilities or private property during the course of the road cutting operations either directly or indirectly, or which may subsequently be evident from the operations thereof, shall be the sole responsibility of the applicant.

The applicant shall be responsible for the repair, replacement, legal claim liability or result that may arise from the road cutting or associated activities.

9.21 BACKFILL OF TRENCHES

9.21.1 MATERIALS

Backfill material for road crossings shall be entirely similar material or other road pavement material approved by Council to within 300mm of the underside of the pavement. The material shall be free of clay material, vegetable matter, building debris and disused road paving material.

The upper 300mm below the road pavement shall consist of crushed limestone or cement /bitumen stabilised gravel, evenly graded, with a maximum spall size of 100mm. The pavement shall be reinstated using similar basecourse material and the surface shall be sealed with material matching the existing road pavement to the nominated thickness (50mm minimum where asphalt is used).

9.21.2 COMPACTION

Before the general backfill of the trench is commenced, all manholes and spaces around the utility installed shall be carefully cement stabilised and compacted with hand rammers. The minimum depth of initial hand compaction above the crown of the pipe shall be no less than 150mm.

Compaction of the remaining backfill shall be in 150mm layers. Compaction shall be achieved by mechanical means at optimum moisture to a density of not less than 95% of the maximum dry density when tested in accordance with AS 1289 - 1977 (Part E2-1) or at least equal to that of the surrounding undisturbed road.

The base course shall be compacted to 98% of the maximum dry density when tested in accordance with AS 1289 - 1977 (Part E2-1).

9.21.3 VEHICLE CROSSOVERS

Please note that all Council drawings referenced in this document are available on the Shire website, www.denmark.wa.gov.au

Materials for backfilling trenches across driveways shall be as for road crossings, with the minimum depth of limestone or gravel being 175mm.

The compaction standard for driveways shall not be less than 95% of the maximum dry density when tested in accordance with AS 1289 - 1977 (Part E2-1).

Council's Crossover Policy is as follows:

DEFINITION

A vehicular crossover, is defined as a crossing area for vehicular access between the road and private property boundary within Council's road reserve.

Council wants to achieve consistent, transparent, equitable guidelines for the entire community in consideration of the environment, streetscape and visual amenity of a crossover.

The Main Roads WA has the care and responsibility of South Coast Highway and The Denmark-Mt Barker Road and accordingly applications for crossovers along these highways must be made though them. You can call a local MRWA representative on 9892 0555. You may still be subsidised by Council on completion of the crossover to MRWA requirements, but only on presentation of the contractors receipt to Council.

PERMIT SUPERVISION FEE

All other crossovers require a construction permit, obtainable from Council's Administration Office or downloaded from our website. Once completed it must be sent to Council and accompanied with the permit/supervision fee of $25*. Construction must not commence until the fee is paid and at least 3 days notice is given. During this time someone will ring to discuss the location you propose with your contractor.

Gravel crossovers will not attract a subsidy but will still require the permit fee to be paid. Permits are only valid for 12 months from the date of receipt of payment. Failure to construct the crossover during this period will require a new application and fee to be paid. Building and Planning License approvals do not constitute approval for the construction of a crossover or exempt from payment of a permit fee.

***(Refer to section 4.6 regarding annual fees and charges)**

Inspection

In general, you must contact Council at least 4 times

- Make application and pay the permit fee.
- Advise when formwork is in place for inspection.
- Request inspection when the work is fully completed.
- Send a copy of contractor's crossover receipt for subsidy calculation a payment.

Of course you may contact us whenever you require advice, but in order to comply with our requirements and maintain a consistent standard the minimum number of times to contact us are shown above.

Redundant vehicular crossovers are to be removed and re-vegetated in keeping with the existing surrounds. Redundant crossover openings in streets that are kerbed, are to be reinstated with new concrete kerbing having the same profile as that which exists, by your contractor, under our supervision.

Council has the discretion to remove or modify any vehicular crossover that is not constructed or maintained to Council's satisfaction, and if not rectified within 21 days of due notice being issued, commence to remove or modify the crossover at your expense.

The public shall be protected from injury during construction with the use warning signs, barriers and flashing signals overnight.

Subsidy Payment

The subsidy shall be paid only if the work complies with all specifications as listed. Subsidies are listed in Council's current Fees & Charges Schedule* at the following link:
http://www.denmark.wa.gov.au/documentsforms/finance/

***(Refer to section 4.6 regarding annual fees and charges)**

Crossovers are to be designed and constructed in accordance with the Shire's standard drawings ES-CR-01 to ES-CR-05. These drawings are available for download from the Shire of Denmark Website:
www.denmark.wa.gov.au/councilservices/engineering/standarddrawings/crossovers/

The crossover subsidy is a maximum amount only and will be reduced to 50% of the cost of construction as estimated by Council. For instance, Council has estimated the cost of construction on a verge width of 6.3m. If your verge is only 3m wide, then the subsidy will be adjusted downwards for the lesser area. However, the subsidy will not be increased if for longer widths above the 6.3m standard.

MATERIALS

Crossovers can only be constructed in Gravel, Bitumen Seal, Concrete or Brick Paving.

Refer to drawing ES-CR-01 for Bitumen Crossovers.

Crossovers constructed in gravel must still comply with the general shape and specification as that for a bitumen sealed crossover. A permit is still required and timber edging to define and contain the gravel is required. A subsidy is not payable until it is sealed to the satisfaction of Council.

Concrete crossovers cannot be coloured, without the approval of Council's Infrastructure Services Section. They should have a smooth brushed surface.

Council's standard crossover is a minimum 3m wide at the boundary and up to 6m wide maximum.

Bitumen Seal

Refer to drawing ES-CR-01.

A base course of 200mm compacted gravel over a sound sub-grade. If sub-grade soggy or spongy, then it must be replaced with at least 200mm of limestone.

For commercial crossovers, a base course of 300mm compacted gravel is required. Similarly, if the sub-grade is poor, then 200mm of limestone is required. Refer to the drawing for layout dimensions.

The minimum standard is a 2 coat seal (to Australian Standard) with a sand finish. Washed pea gravel is not permitted as a finished surface.

Concrete

Refer to drawing ES-CR-01.

For residential crossovers the minimum thickness of 20mpa concrete is 100mm, with a minimum thickness of 150mm at the bund or toe at the kerbline. If the sub-grade is poor, then a minimum of 150mm of compacted limestone is required.

For commercial crossovers the minimum thickness of 25mpa concrete is 150mm, reinforced with F62 mesh. Similarly, if the sub-grade is poor, then a minimum of 150mm of compacted limestone is required.

The minimum standard is a non-slip brushed surface (lateral) in the direction of the road travel.

Brick Paving

Refer to drawing ES-CR-01.

The brick paver colours must be approved by council and be 60mm thick trafficable types. They must be laid in an interlocking herring-bone manner with the edge pavers constrained by a concrete base & lip. All other pavers are to sit on a 20-30mm compacted sand or dust sub-base. If the sub-grade is poor, then it must be replaced with a 150mm limestone base. Brick paving is not usually suitable on very steep slopes > 10%.

The minimum standard is the use of 2 colours only.

Pipe Crossings

If you have an open drain or water course to cross, Council will determine the pipe size required once the site has been inspected following payment of the fee.

Stormwater pipes for crossovers are not supplied free of charge but can be purchased from local businesses, like hardware stores or earthmoving companies. Odd lengths may incur an additional cutting charge. The usual minimum rural standard is 375mm dia PVC (Black Max).

GENERAL

Formwork

Bitumen crossovers are to have jarrah edging positioned flush with the top of the finished surface level. The jarrah edging is to be 150 * 25mm with stakes every 1.2m apart. The tops of the stakes are to be secured to the boards and 25mm below the top of the edging.

The crossover is to be inspected once the timber edging/formwork is in place for both bitumen and concrete crossover. Once approved on-site, the crossover can then be completed.

One Crossover per property

There will be no more than 1 crossover to each property unless approval is granted by the Director of Infrastructure Services. The width of the second crossover shall only be 3m wide and will not be subsidised.

Adjoining Properties

Where two adjoining properties have/will have crossovers abutting, they shall not exceed 5m each in width.

Council Assets

Where Council's assets such as manhole covers, grates, road edge markers, etc have to be relocated for a crossover, then approval must be granted by Councils Director of Infrastructure Services. If relocation is possible, then the full cost is fully recoverable from the applicant or property owner. A bond may be requested prior to construction to ensure the work can be done.

Where a footpath exists, it would normally be replaced with a crossover that would normally blend into the footpath, without leaving any level difference or step to be tripped over. However, clarification would be required in each situation.

Tree Removal

The removal of trees is generally prohibited, unless special circumstances apply. Trees removal requires the approval from Council's Infrastructure section and Planning/NRM sections and will probably require a replacement tree to be established somewhere else on the verge.

Intersecting Roads

A crossover cannot be constructed within 6 metres of the corner boundary of an intersecting road.

Future maintenance

Future maintenance of the crossover is the responsibility of the owner.

9.21.4 FOOTPATHS

Materials for backfilling trenches across concrete footpaths shall be clean sand or other material approved by Council to be brought up to the full depth of the trench. No limestone need be used.

The compaction standard for footpaths shall not be less than 95% of the maximum dry density when tested in accordance with AS 1289 - 1977 (Part E2-1), (measurement using a properly calibrated standard Perth penetrometer would be acceptable)

Where flexible paths are reinstated the requirement shall be as per road crossings.

9.21.5 VERGES

Verges shall be backfilled to their original level and compacted equivalent to surrounding virgin ground or as required by Council. Verges are to be left in a clean and tidy condition free from debris.

Verges are to be stabilised to prevent sand blow, scour or silt runoff. Reinstatement of verge treatment to be as required by Council after a final inspection at the conclusion of works.

10. DEVELOPMENT DESIGN SPECIFICATION DESIGN (Urban and Rural)

10.1 GENERAL

The road system within a subdivision is to be designed so as to provide:

- convenient and safe access to all Lots for pedestrians, vehicles and cyclists.
- safe, logical and hierarchical transport linkages with regard to existing street systems.
- appropriate access for buses, emergency and service vehicles.
- for a quality product that minimises maintenance costs.
- a convenient way for public utilities.
- an opportunity for street landscaping.
- convenient parking for visitors.
- adequate drainage
- longevity of asset and
- general road safety and traffic measures
- appropriate regard for the climate, geology, flora, fauna and topography of the area

The requirements outlined in this document represent standards accepted within the Shire for the design of roads. Should designers wish to present alternative design standards they should support

their design with objective evidence as to how they will meet desirable outcomes in the key elements of;

- Technical Compliance with recognised industry standards
- Safety
- Environmental Compatibility
- Amenity
- Accessibility and Convenience

10.2 ECONOMY (EFFICIENT CAPITAL DEVELOPMENT AND EFFECTIVE LONG TERM ASSET MANAGEMENT)

A fundamental requirement of the design process is for designers to determine the vehicle speed which is deemed acceptable for a particular subdivision or section of road. The concept of designing to regulatory street speeds is contrary to the current principles of subdivision road design.

Notwithstanding the current design practice in respect to the determination of the vehicle speed for a particular subdivision or section of road, the Shire reminds designers that they need to be mindful of the Regulatory speed zones that will be applied to the various roads within the subdivision when making design assumptions.

For example a designer may assert the appropriate speed is 40km/hr where the regulatory speed is 60km/hr. Conversely a designer may assert the regulatory speed to be 50km/hr where the 85th percentile may be 70km/hr due to the physical characteristics. Designers must liaise with council officers before adopting speed criteria.

10.3 REFERENCE AND SOURCE DOCUMENTS

All Specifications for Design and Construction.

(a) Australian Standards

AS 2890.1 Parking facilities: Off-street car parking.
AS 1742 .1 Traffic Control Devices
AS1742.13 Traffic Management Devices

(b) State Authorities

Policy for Installation by Public Utility Authorities within the Road Reserve

Liveable Neighbourhoods; Community Design Codes (Draft Dec 1997)

(c) Other

AUSTROADS - Guide to the Geometric Design of Rural Roads.
Guide Policy for the Geometric Design of Major Urban Roads.
Guide to Traffic Engineering Practice:
PART 5, Intersections at Grade
PART 6, Roundabouts
PART 10, Local Area Traffic Management
PART 13, Pedestrians
PART 14, Bicycles

The Institute of Municipal Engineering Australia, W.A Division - 1998: Design Guidelines for Subdivisional Development

(d) Standard Drawings

ES-BU-01	-	Bus Embayment Details
ES-CR-01	-	Residential crossover – typical plans and sections
ES-CR-02	-	Crossover layouts and approved brick paving patterns
ES-CR-03	-	Crossover gradients
ES-CR-04	-	Rural crossover – typical plan and sections
ES-CR-05	-	Commercial & development crossover details
ES-DR-01	-	Pipe bedding details
ES-DR-02	-	Culvert headwalls and construction details
ES-DR-03	-	Drainage – manhole construction details
ES-DR-04	-	Drainage – side entry pit & deflector slab details
ES-DR-05	-	Drainage – combination side entry pit - special approval required
ES-DR-06	-	Drainage – property stormwater connection details
ES-DR-07	-	Drainage – at grade/table drain – inlet/outlet structure
ED-DR-08	-	Drainage – sump details
ED-DR-09	-	Drainage – outlet structure details
ES-FE-01	-	Sump fencing options
ES-FE-02	-	Infrastructure security fencing – specific approval required
ES-FE-03	-	Post and wire fencing
ES-LS-01	-	Road reserve landscaping – setbacks and sightlines
ES-LS-02	-	Verge bollards
ES-PA-01	-	Footpath, shared path and public access way details
ES-PA-02	-	Pedestrian ramps and grab rail details
ES-RO-01	-	Local distributor – typical cross section and pavement details
ES-RO-02	-	Brick paving in road details
ES-RO-03	-	Roundabout details
ES-RO-04	-	T-intersection treatments – district to local distributor
ES-RO-05	-	Island and lane setouts
ES-RO-06	-	Right of way details
ES-RO-07	-	Rural road – typical cross sections
ES-RO-08	-	Rural road – guide post details
ES-RO-09	-	Extruded kerb details
ES-RT-01	-	Typical retaining wall details
ES-SI-01	-	Street sign and works information sign

10.3.1 CONSULTATION

The consultation process shall be minuted and a copy forwarded to the designer.

10.3.2 PLANNING CONCEPTS

Readers should note that any urban design concepts outlined in this document reflect the Shires accepted practice at the time of the preparation of the document. The information in respect to planning concepts and road hierarchy is intended to provide general concepts only.

Developers will be required to refer to current planning practices and policy as provided by the Council's Planning Department and the Western Australian Planning Commission.

For all matters relating to subdivisional layout developers should refer to current WAPC Policy and draft guidelines Liveable Neighbourhoods Community Design Code and Design and Traffic Management Guidelines.

Notwithstanding design code suggestions, Council has determined minimum road reserve widths. There are functional contradictions between some design guidelines and for example utility requirements, future subdivision needs, traffic control and maintenance requirements.

Councils Guidelines are to take precedence where other documents suggest a narrower road reserve width.

11. URBAN DESIGN CRITERIA

11.1 ROAD HIERARCHY

The function of the road hierarchy and its sub-components are documented in the **Western Australians Planning Commission's Policies and Community Design Code (Liveable Neighbourhoods).** Designers are encouraged to ensure that the recommendations of the WAPC's policies, and Codes and Guidelines are incorporated into their street designs.

Where designers utilise guidelines care must be taken not to select aspects that lessen the intent of the guideline. For example Liveable Neighbourhoods may suggest narrow road reserves, but it also suggests footpaths on both sides of the road and specific distances to services.

Council has set minimum urban road reserve widths as follows:

Access Way/ Place/ Road = 16m

Local Distributor = 20m

Special Rural (preferred) = 20m with underground drainage

Special Rural = 25m with table drains

District Distributor = 25m

The Residential street serves a number of functions such as,

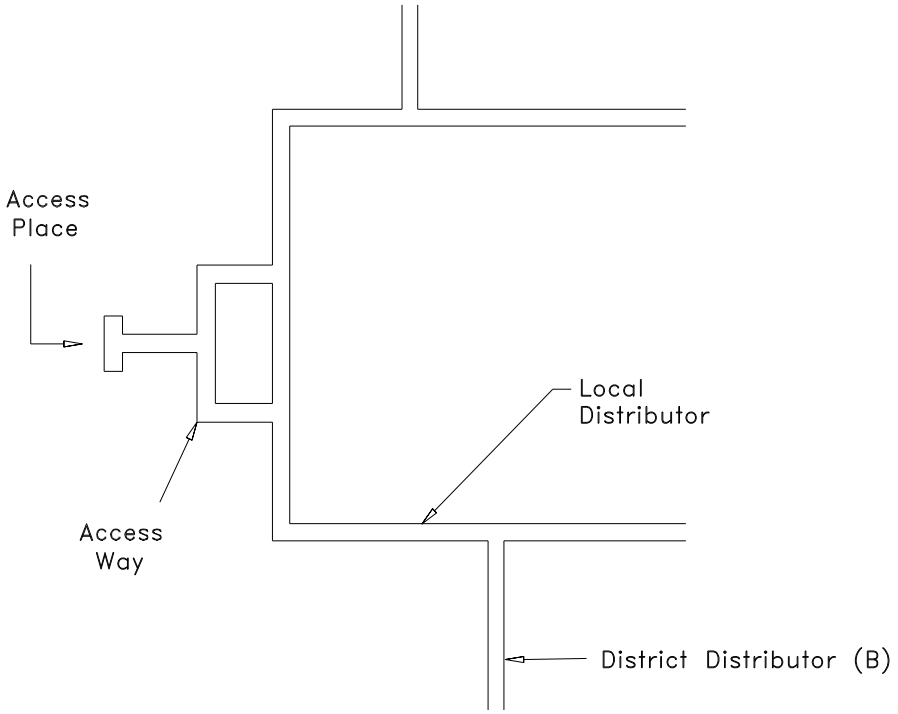
- Access to Residences :- Motor Vehicles, Pedestrian, Cyclists, Visitors, Services
- Parking
- Social and Activities
- Amenity and Aesthetics
- Storm Water
- Public Utility Service

Designers need to ensure that each of these functions are suitably assimilated into the street design and layout with due consideration for the critical performance elements previously mentioned. i.e.

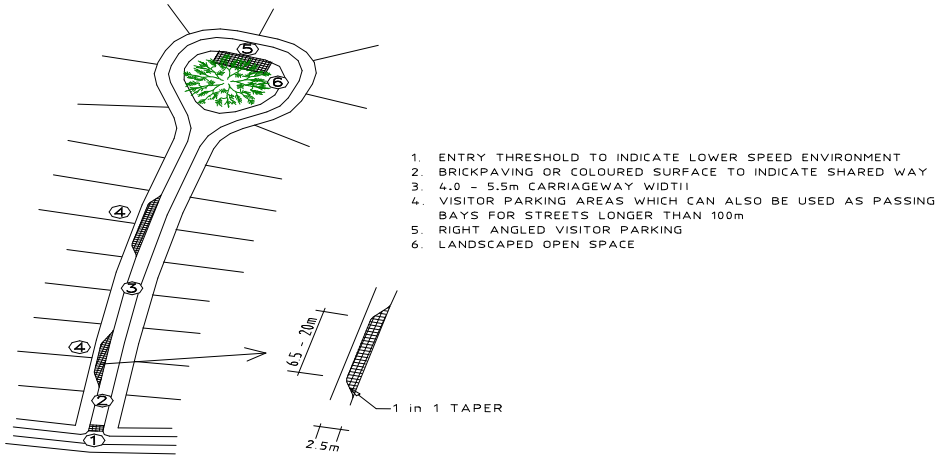
- Technical Compliance
- Safety
- Environmental Compatibility
- Amenity
- Accessibility and Convenience
- Economy

A pictorial representation of the inter-road relationships shown indicatively below. The pictorial representations do not represent the level of detail required or indicate Shire support for any particular layout.

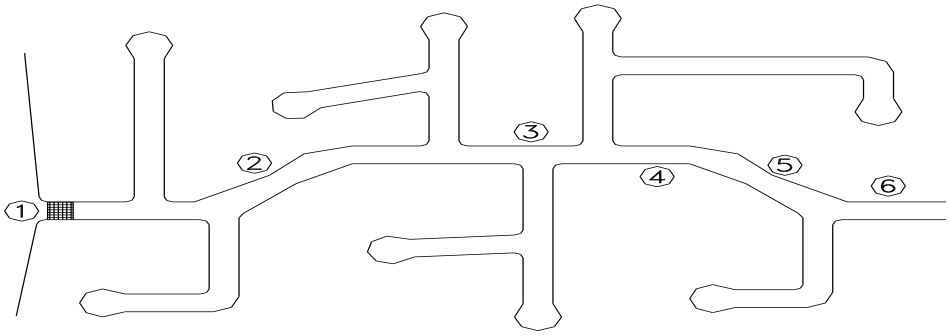
Where designers seek to use alternative designs, they shall demonstrate that their proposed design meets acceptable standards in terms of vehicular access, pedestrians and cyclists and people with disabilities



The lowest order road (access place) having as its primary function, residential space - amenity features which facilitate pedestrian and cycle movements, and where vehicular traffic is subservient in terms of speed and volume, to those elements of space, amenity, pedestrians and cyclists. The features of a typical access place are shown below



The next level road (access way) as a local residential street should provide a balance between the status of that street in terms of its access and residential amenity functions. Resident safety and amenity are dominant but to a lesser degree than access places. A typical access way is illustrated below.



1. BRICK-PAVED ENTRY THRESHOLD SIGNIFIES ENTRY TO LOWER SPEED ENVIRONMENT
2. BENDS IN CARRIAGEWAY CONTROL SPEED
3. SHORT SECTIONS OF STRAIGHT CARRIAGEWAY CONTROL SPEED
4. CARRIAGEWAY WIDTH 5.5 - 6.0m
5. 1.2m FOOTPATH ON ONE SIDE
6. SEMI MOUNTABLE / MOUNTABLE / FLUSH KERBING

The second highest order road (local distributor) has a residential function but also carries higher volumes of traffic collected from lower order streets. A reasonable level of residential amenity and safety is maintained by restricting traffic volumes and speeds, however, amenity and resident safety do not have the same priority as access place and access way.

Traffic volumes and speeds on any road should be compatible with the residential functions of that road as outlined in the WAPC's Community Design Code (Liveable Neighbourhoods). Designers should also refer to the summary of planning criteria outlined in the IPWEA (WA) Guideline for Subdivisional Development 2009.

Minimum surfacing to be a primer seal and 30mm min asphalt for urban and special rural subdivisions. Brick paving and other materials will be considered.

In urban environments footpaths are to be clearly delineated in colour from the roadway. Dark roads and lighter footpaths are the preferred blend.

11.2 DESIGN SPEED

While the design speeds outlined in D1.09, item 3 of the Aus Spec document represent current design practice, designers should also be aware of the current zoned speeds that would be applied to the subdivisional road network. Designers should also refer to the WAPC Policies, Codes and Guidelines when determining the appropriate design speed for the development.

Adoption of a low design speed discourages speeding, however, where vertical or horizontal curves of low design speed are located in foreseeably higher speed sections the result is a dangerous section of road. It should be recognised that in low standard roads, operating speeds will tend to be in excess of arbitrary speed standards. Attention should be given to ensuring that potentially hazardous features are visible to the driver and adopting traffic engineering measures which will help a driver avoid errors of judgement.

Absolute minimum design criteria will only be accepted where it is not possible to achieve any other result. "Desirable" is the benchmark criteria for new subdivisions.

Generally the following design speeds should be adopted:

Access Place	40 km/h
Access Way	50 km/h
Local Distributor	60 km/h
District Distributor (B)	70 km/h

11.3 LONGITUDINAL GRADIENT

A minimum longitudinal gradient of 0.7% will be accepted. Variable crossfall may be necessary to produce the required grade in the gutter.

Maximum Recommended Longitudinal Grades

	Access Place/Way	Local Distributor	District Distributor (B)	Rural
Desirable maximum percentage*	10	10	8	10
Absolute maximum percentage*	15	12	10	15

* maximum length 150 m on straight alignment. Where absolute maximum is proposed –it must be demonstrated that alternatives are not viable.

Longitudinal grade through intersections (TP to opposite TP) should not exceed 4 per cent, the actual gradient being dependent on the type of terrain. Design of the road alignment and the grades used are interrelated. A steep grade on a side street is undesirable if vehicles have to stand waiting for traffic in the priority road. Turning circles in cul-de-sacs on steep grades must have grades less than 5 per cent.

11.4 HORIZONTAL CURVES AND TANGENT LENGTHS

Horizontal design to generally comply with Austroads.

Curves that progressively tighten and sudden reverse curves are not supported.

Minimum desirable horizontal radius 100m. For roads 70-90km/hr design speed minimum desirable radius 300-400m.

Traffic management devices will be required where curve configurations lend themselves to motorists cutting corners.

11.5 VERTICAL CURVES

Simple parabolas are to be used on all changes of grade greater than 1%.

Crest and Sag vertical curves are to comply with Austroads

Crest vertical curves are to be designed using a reaction time of 2.5 seconds.

Sag curves will be limited by drainage considerations.

11.6 SUPERELEVATION

Refer to AusSpec D1.13.

Superelevation to comply with Austroads

Maximum superelevation for 70km/hr is roads 6%.

Desirable that all curves be superelevated. Exceptions may be short cul-de-sac roads.

In general curves larger than the desirable minimum and superelevation less than the maximum should be used.

Maximum side friction factor for all roads 0.15

11.7 CARRIAGEWAY WIDTH

Summary Characteristics of Roads

Designers should refer to the Western Australian Planning Commission's document "**Liveable Neighbourhoods',** Utility Code of practice and the IPWEA (W.A) Guideline for Subdivisional Development 2009, when determining the reserve and carriageway characteristics,

1. Verge areas are required to provide a suitable buffer area between the road carriageway and the abutting lots. Verges provide opportunities for pedestrian movements, landscaping for the managing authority and residents, parking, noise reduction, public utility services and crossover facilities for lots.

2. Designers need to ensure that verge widths can accommodate the desired level of infrastructure while maintaining adequate safety standards for all road users. Verge widths should also allow for the economic construction and maintenance of verge facilities.

3. Verges shall be provided and have sufficient width for the provision of trunk and reticulation services to properly service the adjoining properties.

4. Verges should be graded at a slope of 2% upwards to the property boundary from the top of the kerb. Verges on roads with a pavement width of 7.4 metres or less, may have a verge grading of 2% upwards from the top of kerb for the first 3 metres, then ranging up to a maximum 10% to the property boundary where the verge would be in a cut at the boundary if a 2% slope was used for the full width.

5. The verge should in general terms be parallel to the slope of the road.

6. The maximum slope across a median island to be 10% (1 in 10).

7. Traffic generation rate to be 10 vehicles per day per Lot.

8. The safety of pedestrians and cyclists is to be catered for in terms of road width where it is intended they use the carriageway.

9. Carriageway and road reserve widths are to be wide enough to allow maintenance and works crews to operate in accordance with the Traffic Code of Practice.

10. Road widths are to cater for motorists entering and reversing out of Lots with vehicles parked on roadway opposite crossovers.

11. General maximum length of access way 100m and access road 250m. Where access roads exceed this length of have a configuration that allows higher speeds a traffic blister islands may be required.

Table D.1.5 Characteristics of Roads in Residential Subdivision Road Networks

Road Type	Max Veh Vol per day	Max Vel (kph)	Road width (m)	Parking Within Road Reserve (3)	Kerb	Path Req'd	Cycle-path Requirement
Access Place	200 (20 Lots)	50	6.0	2.0 widened parking strips	Mountable	No	No
Access Road	800 (80 Lots)	50	6.0	On Carriage way/ off road in parking bay	As Above	One side Min 1.5m wide	No
Local Distrib	3,000 with access to lots, else 6,000	60 with access to lots, else 70	7.4-9.2	As above	Semi-Mount Mountable	At least one side Min 2.5m wide	Most likely
District Distrib	8,000	70	8.0-10	As above	Semi-Mount	Both sides	Yes

11.8 CROSSFALLS

Roads are to be crowned with a 3% crossfall for spray sealed roads and 2.5% crossfall for asphalt roads

Maximum crossfall anywhere on any road to be 5% (unless superelevated).

11.9 FOOTPATHS

All footpaths must meet the Disabled Access requirements as outlined in AS 1428.1

See Council standard drawings for layouts.

The following criteria is to be applied to footpaths throughout the Shire;

Cross-fall in footway paving should generally be 2% upward draining towards the road. Footpath design should also be consistent with the requirements of the Austroad Guidelines

Longitudinal grade usually parallels that of the road and this may be steeper than 5 per cent.

Footpath minimum widths are 1.5 m, Dual use path 2.5m and Recreational path 3.5m

Footpaths: 100mm deep concrete, where asphalt is approved paths to be constructed to trafficable road standard.

Joint Spacing - Preferred is “Lockjoint” with expansion joints at 15 times path width. Otherwise Contraction Joint 2m, Expansion Joint 10m. Note that this will vary on wider paths and the designer is to consult with the Shire.

Surface Irregularities - <2mm

Level of Path in verge - +2% verge level
Vertical Alignment - <10mm in 3m

11.10 INTERSECTIONS AND CUL-DE-SAC

Cul-de-sacs should have a minimum head radius of 9 metres with 15 metre radius tapers.

Cul-de-sac head design not to use driveways as part of the turning manoeuvre.

The cul-de-sac head must be able to accommodate turning manoeuvres from those trucks undertaking the Rubbish collection service “Hammerhead” terminus are not supported.

Cul-de-sacs are generally not supported in rural and industrial subdivisions. However should they be approved they should generally have a minimum head radius of 15 metres with 20 metre transitions.

The streets intersect preferably at right-angles and not less than 80°. Minimum straight length of road before intersection to be 30m. Roads not intersecting at 90° may require traffic islands.

If intersections occur on curves the minor street is to be on convex side of the major street. Intersections on the concave side are not supported. Traffic islands on side road and intersected road are required where intersections are on curves.

Minimum 40m stagger between intersections on access places and roads. A minimum 200m between distributor roads.

Intersections must accommodate the 5-15km/hr static MRWA service vehicle turning template without overhang to central islands.

Intersection kerbing to be semi- mountable from TP to TP.

District distributor to Local distributor roads as per Council Standard Drawings.

Street signs to be located opposite intersections

No Utility manholes, valves or junction boxes are to be located within the lesser area of either the radius arm sweeps from radius centre to both TP’s or from corner truncation points to adjacent kerb TP. This is to allow for future intersection widening without the need to relocate expensive utility services.

11.11 ROUNDABOUTS

Refer to AusSpec D1.18.

Roundabouts to generally comply with AUSTROADS.

Deflection through roundabout to be 90-100m radius based upon a 2m wide vehicle.

Entry throat to single roundabout 3.5m min to 4.5m max.

Typical minimum trafficable roundabout dimensions for a local roundabout to be 12m internal radius and 18m outside radius. Centre paved annulus adjacent to roadway to be minimum 2 metres wide.

Traffic islands to have crossings through them at grade, precluding the need for pram ramps, with minimum crossing dimensions of 2m wide by 2 metres long. Pram ramps will be required on large islands.

Minimum traffic island radius to be 0.6m

Main Road Western Australia approval is required for line marking and signage.

Advance warning signs required.

Approach legs of roundabouts and roundabouts to be lit to Australian standards

Structures in roundabouts and objects that can cause injury to motorcyclists are generally not permitted.

11.12 TRAFFIC CALMING

11.12.1 Critical Dimensions

Refer to AusSpec D1.19.

Designers should refer to Austroad standards, Australian Standards and Guidelines to determine acceptable dimensions for traffic calming devices.

Horizontal shift devices, particularly blister islands are the preferred on-road traffic calming device. Vertical displacement devices may be used where they incorporate a pedestrian function and have a minimum 2m wide traversable area.

Deflection criteria through a blister island to be 100m radius maximum 90m minimum.

11.12.1.1 PARKING

Parking requirements for development and cash-in-lieu of parking should be obtained from Council's Planning & Sustainability Directorate.

Generally parking is to comply with Austroads.

Bay widths to be 2.5m minimum with disabled bays 4.0m wide minimum and 0.5m longer.

11.12.1.2 BATTLEAXE ENTRY ROADS AND R.O.W

1. Maximum length of Battleaxe Legs and R.O.W to be 40m. Numbered concrete bin pads are to be provided adjacent accessway where multiple properties use access leg. Bin pads are to be constructed on the edge of the road. Battleaxe entry roads provide private access to battleaxe lots. The access ways are to be designed to provide safe and convenient access and of suitable material to ensure future maintenance for residents is minimised. Designers should incorporate standards similar to those proposed for lanes.

2. Battleaxe entry roads should be a minimum width of 3.0 metres (single Lot) and 5.5m multiple Lots and be paved and drained in accordance with normal road pavements within this specification.

3. Battleaxe accessways may be constructed of insitu concrete, brick or block paving or flexible granular pavements with an asphaltic sealed surface. The access way may be kerbed or have flush kerbing with a central draining configuration.

4. A minimum of 0.5 metre wide verge should be provided on each side of the battleaxe entry or R.O.W pavement for clearance of vehicles to fences and for utilities. Designers must make allowance for the provision of future services by providing suitable individual service ducts (3 off) or making arrangements for the placement of services along the full length of the access leg.

5. The battleaxe road should have a vertical alignment, horizontal alignment and constructed to an urban road standard.

12. RURAL DESIGN CRITERIA

12.1 GENERAL

The Rural Road Hierarchy has been divided into the following categories

(a) **Arterial Roads**; which carry or will potentially carry the major traffic flows between centres usually with high volume, high speed traffic. The ultimate road standard may be of dual carriageway standard and all design should be undertaken to account for the ultimate configuration of the road
(b) **Collector Roads**; transfer traffic from the local road network to the Arterial roads. Collector roads are usually single carriageway construction and may allow direct lot access.
(c) **Local Roads**; have a primary access function and incorporate low traffic link roads.

Rural road reserves shall be of suitable width to provide for the required carriageways, verges, stormwater, public utilities and earthworks associated with the safe design requirements in accordance with the Austroads Design Guidelines.

The following road reserve widths apply throughout the Shire

Arterial Roads	To suit the Ultimate Carriageway (min 45m)
Collector Roads	Min 30m
Local Roads	Min 25m

Rural roads generally have higher traffic speed than urban roads, therefore, the requirements on design speed selection and matching the geometric elements of the road to the design speed are critical, especially for higher speed values.

Minimum seal requirements are a primer seal followed by a 2 coat 14/10mm hot spray seal.

12.2 SIGHT DISTANCES

(See Austroads)

Reaction time 2.5 seconds

12.3 HORIZONTAL AND VERTICAL ALIGNMENT

(See Austroads)

12.4 INTERSECTIONS

(See Austroads Part 5)

Adequate sight distance should be provided at intersections both horizontally and vertically. Each intersection location shall be examined for conformance with the criteria for Approach Sight Distance (ASD), Entering Sight Distance (ESD) and Safe Intersection Sight Distance (SISD).

Staggered “T” intersections for rural cross roads should be “right to left” configurations. Rural intersections to be sealed for 100m on each leg (min) using a 2 coat 14/10mm where gravel rural roads are approved to be otherwise constructed as an unsealed gravel road.

12.5 PLAN TRANSITIONS

(See Austroads)

13. PAVEMENT DESIGN

13.1 GENERAL

1. The work to be executed under this Specification consists of the design of the road pavement to meet the required design life, based on the subgrade strength, traffic loading and environmental factors, and including the selection of appropriate materials for select subgrade, subbase, base and wearing surface.

2. This guideline contains procedures for the design of the following forms of surfaced road pavement construction:

   (a) flexible pavements consisting of unbound granular materials;
   (b) flexible pavements that contain one or more bound layers, including pavements containing asphalt layers other than thin asphalt wearing surfaces;
   (c) rigid pavements (ie. cement concrete pavements);
   (d) concrete or clay segmental pavements.

3. Consideration to the design of unsealed (gravel) pavements will only be given for minor (one or two Lot) rural subdivisions/developments in isolated rural areas where the access to the subdivision is via an existing unsealed road and upgrading the existing road would be prohibitive. A cash contribution for the upgrading of the existing road may be required.

13.1.2 OBJECTIVES

1. The objective in the design of the road pavement is to select appropriate pavement and surfacing materials, types, layer thicknesses and configurations to ensure that the pavement performs adequately and requires minimal maintenance under the anticipated traffic loading for the design life adopted.

13.1.3 REFERENCE AND SOURCE DOCUMENTS

AUSTROADS — Pavement Design, A Guide to the Structural Design of Road Pavements, 1992.

AUSTROADS - Guide to Control of Moisture in Roads.

AUSTROADS - Design of Sprayed Seals (1990).

ARRB-SR41 — Australian Road Research Board, Special Report No. 41 - A Structural Design Guide for Flexible Residential Street Pavements, 1989.

Cement and Concrete Association of Australia.

CACA - T51 — Concrete Pavement Design for Residential Streets, 1997.

Concrete Masonry Association of Australia.

CMAA - T44 — Concrete Segmental Pavements - Guide to Specifying, 1997

CMAA - T45 Concrete Segmental Pavements - Design Guide for Residential Access Ways and Roads, 1997.

CMAA - T46 Concrete Segmental Pavements - Detailing Guide, 1997.

Clay Brick and Paver Institute

Design Manual 1 - Clay Segmental Pavements, A Design and Construction Guide for Sites Subjected to Vehicular and Pedestrian Traffic, 1989.

13.2 PAVEMENT DESIGN CRITERIA

13.2.1 DESIGN VARIABLES

1. Regardless of the type of road pavement proposed, the design of the pavement shall involve consideration of the following five input variables:

   (a) Design Traffic (a 20% surcharge on current axle loads is required)
   (b) Subgrade Evaluation (in situ and laboratory testing required)
   (c) Environment
   (d) Pavement and Surfacing Materials
   (e) Construction and Maintenance Considerations

13.3 DESIGN TRAFFIC

1. The design traffic shall be calculated based on the following minimum design lives of pavement:-

   (a) Flexible, Unbound Granular - 30 years

   (b) Flexible, Containing one or more bound layers - 30 years

   (d) Segmental - 30 years

2. Design traffic shall be calculated in equivalent standard axles (ESAs) for the applicable design life of the pavement, taking into account present and predicted commercial traffic volumes, axle loadings and configurations, commercial traffic growth and street capacity.

   For new subdivisions, the design traffic shall take account of both the construction traffic associated with the subdivision development and the in-service traffic. For interlocking concrete segmental pavements, the simplification of replacing ESA's with the number of commercial vehicles exceeding 3 tonne gross contained in CMAA-T45 is acceptable up to a design traffic of 10^6. Beyond this, ESAs should be calculated.

3. The pavement design shall include all traffic data and/or assumptions made in the calculation of the design traffic.

4. In general, reference should be made to ARRB-SR41 for the calculation of design traffic volumes up to 10^6 ESAs and AUSTROADS Pavement Design for design traffic volumes approaching or exceeding 10^6 ESAs.

5. In the absence of other traffic data, the following traffic values (in ESAs) may be taken as a guide to the design traffic, but shall be subject to variation depending on the circumstances for the particular development.

Street Type:		**Design ESA's - 25 year design life**
Urban Residential	- Cul-de-sac	2×10^4
	- Minor	6×10^4
	- Local Access	3×10^5

	- Collector	1×10^6
	- Distributor	2×10^6
Rural Residential	- Cul-de-sac	2×10^4
	- Other	3×10^5
Commercial and Industrial		5×10^6

13.4 SUBGRADE EVALUATION

1. Except where a mechanistic design approach is employed using AUSTROADS Pavement Design, the measure of subgrade support shall be the California Bearing Ratio (CBR).

   Where a mechanistic design approach using linear elastic theory is employed for flexible pavements, the measure of subgrade support shall be in terms of the elastic parameters (modulus, Poisson's ratio).

2. The following factors must be considered in determining the design strength/stiffness of the subgrade:

   (a) Sequence of earthworks construction

   (b) The compaction moisture content and field density specified for construction

   (c) Moisture changes during service life

   (d) Subgrade variability

   (e) The presence or otherwise of weak layers below the design subgrade level.

3. The subgrade Design CBR adopted for the pavement design must consider the effect of moisture changes in the pavement and subgrade during the service life, and hence consideration must be given to the provision of subsurface drainage in the estimation of equilibrium in-situ CBRs, and hence in the design of the pavement structure.

   Requirements for subsurface drainage are given elsewhere in this guideline. If subsurface drainage is not provided, then the Design CBR adopted must allow for a greater variability in subgrade moisture content during the service life of the pavement, and hence a Design Moisture Content above the Optimum Moisture Content.

4. The calculation of the Design CBR shall be based on a minimum of three 4 day soaked CBR laboratory samples for each subgrade area, compacted to the relative density specified for construction, and corrected to allow for the effects of subsurface drainage (or lack of), climatic zone, and soil type if appropriate (as per the guidelines in ARRB SR41) to give an estimated equilibrium in-situ CBR. The Design CBR for each subgrade area is computed by using the appropriate formulae as follows:

   Design CBR = Least of estimated CBRs, for less than five results

   Design CBR = 10th percentile of all estimated CBRs, for five or more results

   = C - 1.3S

   Where C is the mean of all estimated CBRs, and S is the standard deviation of all values.

5. Where practicable, the Design CBR obtained from laboratory testing should be confirmed by testing performed on existing road pavements near to the job site under equivalent conditions and displaying similar subgrades.

6. The pavement design shall include a summary of all laboratory and field test results and assumptions and/or calculations made in the assessment of Design CBR.

13.5 ENVIRONMENT

1. The environmental factors which significantly affect pavement performance are moisture and temperature. Both of these factors must be considered at the design stage of the pavement. Reference should be made to AUSTROADS Pavement Design, ARRB-SR41, and to NAASRA (Now AUSTROADS) - Guide to Control of Moisture in Roads.

2. The following factors relating to moisture environment must be considered in determining the design subgrade strength/stiffness and in the choice of pavement and surfacing materials:

   (a) Rainfall/evaporation pattern

   (b) Permeability of wearing surface

   (c) Depth of water table

   (d) Relative permeability of pavement layers

   (e) Whether shoulders are sealed or not

   (f) Pavement type (boxed or full width)

3. The effect of changes in moisture content on the strength/stiffness of the subgrade shall be taken into account by evaluating the design subgrade strength parameters (ie. CBR or modulus) at the highest moisture content likely to occur during the design life, ie the Design Moisture Content. The provision of subsurface drainage may, under certain circumstances, allow a lower Design Moisture Content, and hence generally higher Design CBR.

4. The effect of changes in temperature environment must be considered in the design of pavements with asphalt wearing surfaces, particularly if traffic loading occurs at night when temperatures are low, thus causing a potential reduction in the fatigue life of thin asphalt surfacing. The effect of changes in temperature environment should also be considered for bound or concrete layers.

5. The pavement design shall include all considerations for environmental factors, and any assumptions made that would reduce or increase design subgrade strength, or affect the choice of pavement and surfacing materials.

13.6 PAVEMENT AND SURFACING MATERIALS

1. Pavement materials can be classified into essentially three categories according to their fundamental behaviour under the effects of applied loadings:

   (a) Unbound granular materials, including modified granular materials

   (b) Bound (cemented) granular materials

   (c) Asphaltic Concrete

2. Surfacing materials can also be classified into essentially four categories or types:-

   (a) Sprayed bituminous seals

   (b) Asphaltic concrete and bituminous micro-surfacing (cold overlay)

(c) Concrete Segmental Pavers

(d) Clay Segmental Pavers

13.7 CONSTRUCTION AND MAINTENANCE CONSIDERATIONS

1. The type of pavement, choice of base and subbase materials, and the type of surfacing adopted should involve consideration of various construction and maintenance factors as follows:

   (a) Extent and type of drainage

   (b) Use of boxed or full width construction

   (c) Available equipment of the Contractor

   (d) Use of stabilisation

   (e) Aesthetic, environmental and safety requirements

   (f) Social considerations

   (g) Construction under traffic

   (h) Use of staged construction

   (i) Ongoing and long-term maintenance costs

   These factors are further discussed in AUSTROADS Pavement Design.

13.8 PAVEMENT THICKNESS DESIGN

13.8.1 PAVEMENT STRUCTURE – GENERAL

1. The pavement thickness, excluding the thickness of surfacings, shall not be less than 250mm of non-plastic gravel for any roads.

2. Notwithstanding the minimum thickness all proposed road subgrades shall be tested. The Shire has a full range of subgrade materials ranging from sand to heavy clays. Limited testing in the Shire has shown typical CBR values for sand to be 10% and for clays as low as 2%.

3. Low subgrade strengths can result in pavements consisting, for example, of a UV protected geofabric and up to 600mm sand and 250mm gravel or a 300mm limestone layer.

4. Proposed subgrade improvement methods are to be submitted for approval, with supporting test results and calculations.

5. The subbase layer shall extend a minimum of 300mm behind the rear face of any kerbing.

6. The base and surfacing shall extend to the face of any kerbing. Where the top surface of the subbase layer is below the level of the underside of the kerbing, the base layer shall also extend a minimum of 300mm behind the rear face of the kerbing.

7. For unkerbed roads, the subbase and base layers shall extend at least to the nominated width of shoulder, ie 500mm from edge of seal.

13.9 UNBOUND GRANULAR FLEXIBLE PAVEMENTS (BITUMINOUS SURFACED)1.

1. Unbound granular flexible pavements with thin bituminous surfacings, including those with cement or lime modified granular materials, with design traffic up to 10^6 ESAs shall be designed in accordance with ARRB-SR41.

2. For design traffic above 10^6 ESAs, the design shall be in accordance with AUSTROADS Pavement Design.

13.10 FLEXIBLE PAVEMENTS CONTAINING BOUND LAYERS (BITUMINOUS SURFACED)

1. Flexible pavements containing one or more bound layers, including cement stabilised layers or asphaltic concrete layers other than thin asphalt surfacings, shall be designed in accordance with AUSTROADS Pavement Design.

2. As an alternative to AUSTROADS Pavement Design for design traffic up to 10^6 ESAs, bound layers may be assumed to be equivalent to unbound layers of the same thickness, and the pavement designed in accordance with ARRB-SR41, using Figure 7 (95% confidence limit curves).

13.11 CONCRETE SEGMENTAL PAVEMENTS

1. Concrete segmental pavements with design traffic up to 10^6 estimated commercial vehicles exceeding 3T gross shall be designed in accordance with CMAA -T45

2. For design traffic above 10^6 estimated commercial vehicles exceeding 3T gross the design shall be in accordance with AUSTROADS Pavement Design, with the calculation of design traffic in terms of ESAs.

13.12 CLAY SEGMENTAL PAVEMENTS

1. Clay segmental pavements with design traffic up to 10^6 ESAs shall be designed in accordance with Design Manual 1 - Clay Segmental Pavements.

2. For design traffic above 10^6 ESAs and up to 10^7 ESAs the design shall involve consideration of both Design Manual 1 - Clay Segmental Pavements and AUSTROADS Pavement Design, with the thicker and more conservative design of each of the two methods adopted.

3. For design traffic above 10^7 ESAs, the pavement shall be designed in accordance with AUSTROADS Pavement Design.

13.13 SURFACING DESIGN

13.13.1 CHOICE OF SURFACE TYPE

1. Except where the pavement is designed for concrete or segmental block surfacing, the wearing surface shall be a bituminous wearing surface as follows and in compliance with Councils specification:-

   (a) Urban Residential streets - Cul-de-sac, Access Places and Ways, Local Distributor and Rural Residential streets: - primer seal, plus 30mm minimum asphalt.

   (c) Commercial and Industrial streets: - primer seal, minimum 40mm AC10 or greater,

   (d) Sub-arterial and Arterial and Rural roads:

   - primer seal, plus asphalt in urban areas

   - primer seal, plus a 2 coat hot spray 14mm and 10mm in rural areas

2. At intersections, traffic management devices and any turning circles or 90 degree bends on rural streets with spray seals, asphalt surfacing shall be provided within the vehicle braking and turning zones.

3. Variations to these requirements may be approved by Council in special circumstances.

4. The design of hot sprayed seals, including primer seals, shall be in accordance with the AUSTROADS - Design of Sprayed Seals.

5. 7mm primer seals shall be indicated on the Drawings below all hot spray seals and asphalt surfacings. Where a 7mm primer seal is impractical, a 10mm primer seal shall be indicated in lieu.

6. Two-coat hot spray seals shall comprise a minimum of two coats binder and two coats of aggregate. The preferred seal types are:

   1st coat 14mm

   2nd coat 10mm

13.13.2 ASPHALTIC CONCRETE

1. In light to medium trafficked residential, rural or commercial streets (design traffic up to approximately 3 x 10^5 ESAs), the asphalt mix design shall be either a 'high-bitumen content' mix or the ARRB Gap-graded mix in accordance with ARRB- 2.in medium to heavily trafficked residential, rural or commercial roads and in all industrial and classified roads, the asphalt mix design shall be a dense graded mix.

3. Asphaltic concrete surfacings shall be designed to provide a minimum compacted layer thickness of not less than 25mm on light to medium trafficked residential, rural and commercial streets, and 40mm on medium to heavily trafficked residential, rural or commercial roads and on all industrial and classified roads.

4. As a minimum, a 7mm or 10mm primer seal shall be indicated on the Drawings below the asphalt surfacing.

13.13.3 SEGMENTAL PAVERS

1. Concrete segmental pavers shall be heavy duty 80mm thick, interlocking shape Type A, and designed to be paved in a herringbone pattern.

2. Clay segmental pavers shall be heavy duty 65mm thick, Class 4, and designed to be paved in a herringbone pattern.

3. The edges of all paving shall be designed to be constrained by either kerbing or by concrete edge strips.

13.14 DOCUMENTATION

13.14.1 DESIGN CRITERIA AND CALCULATIONS

1. All considerations, assumptions, subgrade test results, and calculations shall be submitted with the pavement design for approval by Council.

2. The Drawings shall clearly indicate the structure, material types and layer thicknesses of the proposed pavement and surfacing.

14. DEVELOPMENT DESIGN SPECIFICATION RESERVE AND PUBLIC OPEN SPACE DESIGN

14.1 GENERAL

1. This specification sets out requirements to be used in the design of Reserves and Public Open Space and the associated infrastructure for the Shire of Denmark.

2. This specification outlines general requirements in respect to landscaping however detailed landscaping and reticulation design requirements for all reserves including roads, road verges and entry statements are outlined elsewhere.

14.1.1 OBJECTIVES

1. This specification aims to set standards and document requirements related to the provision of reserves and associated facilities which can be managed in a cost effective manner and meet community expectations in respect to amenity aesthetics and safety.

14.1.2 REFERENCE AND SOURCE DOCUMENTS

Standard Drawings

ES RT-01 - Typical Retaining Wall Details

ES FE-01 - Post and Wire Fencing

ES RO-09 - Extruded Kerb Details

Other

AUSTROADS - Traffic Engineering Practice Part 11 - Parking

AS 1428.1 (1993) - Design for Access and Mobility

14.2 CONSULTATION

The Shire of Denmark encourages designers to enter into a consultative partnership with the Shire at the earliest stages of the planning and design process.

It would be expected that Council Officers would have input to the preliminary design of landscapes and be present at meetings associated with design and construction matters of the overall reserve area.

14.3 PLANNING CONCEPTS

1. As soon as practicable after the approval of the subdivision plan by the Western Australian Planning Commission the designer should contact the Council to discuss general issues and concepts. In line with the consultative process outlined above, Council will forward the Information Kit relevant to the subdivision to the designer.

2. Along with the preliminary concept plans, designers shall supply an overall development Plan that clearly outlines the objectives for the reserve area and the strategies that need to be implemented to meet those objectives.

3. For landscape areas the designer shall support the design objectives with visual goals and maintenance regimes for the ongoing development of the site.

15. GENERAL DEVELOPMENT CRITERIA

15.1 PUBLIC OPEN SPACE

Please also refer to Town Planning Policy No. 39 (see following link) for further information regarding Public Open Space.

http://www.denmark.wa.gov.au/councilservices/planning/documents/documents/policy39publicopenspace

While the Western Australian Planning Commission determines minimum areas of POS, location and POS contributions allocated to compensating basins, the following outlines the Shires general position on these matters.

1. The location of Public Open Space (POS) within any subdivision should be determined through consultation with Council and the Ministry of Planning.

2. The minimum size acceptable for Public Open Space area should generally be approximately four thousand (4000) square metres.

3. Purpose allocated buffer and screen areas, dedicated enclosed recreation areas and swales/compensation basins have not generally been accepted as part of the ten percent (10%) public open space allocation required in the subdivision.

4. POS should not generally be in the vicinity of high voltage overhead power lines.

5. Entry statements and landscaping to road reserves will not be accepted as POS.

6. Where public open space abuts a road, adequate screening and security access barriers shall be installed to ensure security and safety of the reserve area for all users and in particular children without adversely impacting on the amenity or aesthetic design of the reserve.

7. The total estimated maintenance cost (excluding buildings and roadways) for the public open space and landscape areas within a subdivision, other than major and regional reserves, shall not exceed twenty percent (20%) of the estimated total Council rate revenue collected from the properties within the subdivision.

8. There is a general presumption against the placement of drainage sumps in POS. Council will support the detention of stormwater through the use of swales and depressions or other suitable measures which contributes to the amenity value and aesthetics of the POS and shall be designed and located to maximise the use thereof during low rainfall periods.

15.2 EXISTING SITES

1. Before the commencement of any work on the Reserve the location of all existing underground and overhead services, cadastral boundary pegs, survey and bench marks, fences, vegetation and trees, buildings and structures shall be noted or picked up by the surveyor, plotted on a plan and used as a record to design, draw and construct the works and avoid disruptions or damage to the services, pegs, marks, fences, vegetation and trees and structures.

2. All power cables and utilities on Reserves shall be relocated (preferred) or undergrounded unless otherwise approved by Council.

15.3 EARTHWORKS

1. Earthworks on Reserves shall be undertaken in accordance with Design ‘Site Regrading’ to provide for the re-contouring of the existing surface to new levels matching the location of facilities in accordance with the Approved Development Plan.

2. No earthworks, clearing, or changes to POS areas, is to be undertaken until approved drawings are issued.

3. Earthworks on reserves shall provide for ovals, pitches, playing areas, spectator mounds, roads, carparks, building pads, tennis courts and netball courts.

4. Particular attention shall be given in the design of earthworks and re-contouring on reserves to suit the development objectives submitted with the concept designs.

5. Continued consultation shall be made with the Council to ensure that slopes and grades can be properly maintained after development and that ovals, pitches and playing areas are of an adequate size and area for the nominated sport. Allowance shall be made for pitch, oval and playing area rotation and offsetting to ensure proper turf management

6. Design, earthworks, grades and slopes for ovals, pitches and playing fields shall be in accordance with Table 1.0 Design Grades (Vegetated Areas).

7. Design, earthworks and grades for roads shall be in accordance with design standard 'Geometric Road Design' with the exception that the maximum longitudinal grade of a road on POS be 7% or 1:14. Carparks, tennis courts and netball courts shall be in accordance with the requirements of those facilities as outlined in this specification.

TABLE 1.0 - DESIGN GRADES (VEGETATED AREAS)

Area	Finished Treatment	Use	Grade
Existing (Non-earthworked)	Partial clearing, natural vegetation and drought resistant grass. Non reticulated.	Passive	Natural Surface
Batter (Earthworked)	Native trees and shrubs and drought resistant grass. Non reticulated	Passive	Maximum 1:3
Batter (Earthworked)	Grassed and reticulated	Active & Passive	Standard 1:6 Maximum1:4 -only with Shire Approval
Ovals & Pitches	Grassed and reticulated	Active & Passive	Maximum 1:100

15.4 ROADS

1. The location and layout of all roads on the Reserve shall be in accordance with the Approved Development Plan

2. Design standards for roads, including earthworks, grades, drainage, pavement thickness and surface type, shall be in accordance with the standards detailed within the Design Specifications ' Geometric Road Design', 'Pavement Design' and 'Stormwater Drainage Design'.

3. Designers must design carriageway widths to take into account peak flow rates during the normal use of the reserve facilities and generally the minimum carriageway width should be 6.0 metres with maximum longitudinal grade of 8% or 1:14.

4. The location and connection of reserve access roads with existing or proposed subdivisional roads, shall generally be opposite the side boundary of adjoining properties or the side boundary of a corner lot on the other side of the road. In all instances, traffic and pedestrian safety shall be the prime consideration

5. Un-kerbed roads may be permitted on Reserves.

6. Roads shall be located no closer than 3 metres to a building or structure unless otherwise approved by Council.

7. Service conduits shall have 450mm clearance under the sub-base of the road pavement.

15.5 CARPARKS

1. The location, number and layout of carparks and parking bays shall be provided in accordance with the Approved Development Plan.

2. Parking layout design shall generally in accordance with AUSROADS Guidelines Traffic Engineering Practice Part 11 – Parking. Provision for people with disabilities shall be made in accordance with Australian Standard AS 1428.1-1993.

3. The standards outlined below have traditionally been used within the Shire.

   The size of bays shall be:

end bays	2.50m wide x 6m long
mid bay	2.5m wide x 5.5m long
disabled bays (90°)	4.0min m wide x 5.5m long

4. In special circumstances and with Council approval, bays may be reduced in length to 5.0m provided 1.0m of clear area is available for vehicle overhang.

5. A 2 metre wide backup area shall be provided in the roadway next to the last bay in a carpark to allow for easier backup and exit.

6. The width of road adjacent to the bays shall be a minimum of 6m. All radii on kerbs to be a minimum of 1m on bays and 2m on islands and noses.

7. Kerbing shall be extruded concrete semi-mountable and/or flush kerbing depending upon locations and stormwater disposal. Flush kerbing shall be laid adjacent to disabled bays for easy entry and exit for wheelchairs.

8. Service conduits shall have 450mm clear cover under the sub-base of the carpark pavement

9. The maximum longitudinal grade shall be not greater than 6% unless otherwise approved by Council.

10. Fencing shall be installed not closer than 1m to the kerb of a carpark. A kerb line shall not be closer than 1m to a property boundary, fence or swale and 3m to a structure or building unless otherwise approved by Council.

11. The pavement depth and surface finish shall be similar to those standards for a 6.0m wide road as detailed in the Specification for Geometric Road Design.

12. Alternative pavement types and stormwater disposal methods may be used with Council approval.

15.6 TENNIS COURTS

15.6.1 Court layout

1. Tennis courts shall be located and laid out on the Reserve in accordance with the Approved Development Plan.

2. The dimensions of tennis courts shall be 23.77 metres long by 10.97 metres wide measured to the outside of the 50mm wide base lines and doubles side line respectively. All other dimensions shall be in accordance with the standard court layout.

3. Clearances to adjoining courts and fences, measured from the outside of the external white line, shall be:

side clearance to fence, kerb or light pole	-	3.05m
side clearance to adjoining court	-	3.05m
end clearance to fence, kerb or light pole	-	5.5m

4. The pavement shall be composed of the materials and to the thickness as detailed below:

Subgrade	-	compacted, well drained sandy soil
Base Course	-	150mm compacted rock base
Seal Course	-	25mm compacted asphaltic concrete Mix 2 size 7 Granite
Playing Surface	-	synthetic acrylic applied to manufacturer's specification.

5. Playing surface gradient shall be a maximum of 1:100 and a minimum of 1:200, either as a side or lengthways slope, the whole court area forming a flat plane, side to side and corner to corner.

6. Courts shall not be sloped away from the centreline or net line. The courts shall be oriented in the north-south direction with a maximum rotation of 30 degrees either way if site conditions restrict.

7. A playing complex comprising of 4 courts or less, shall have a perimeter of concrete kerbing to maintain an edge and support the pavement. The kerbing shall have interlocking ends and be installed flush with the finished playing surface of the courts. The kerbing and court surface shall stand 50mm proud of the trimmed finished ground or natural surface level surrounding the court.

8. A playing complex comprising more than four courts and constructed as a one-off or staged facility may also have drainage control by using extruded concrete kerbing to direct water to gullies and a stormwater system. Where extruded concrete kerbing is used, flush kerbing is not required.

9. Stormwater drainage run-off shall be accommodated by soakage into the surrounding ground or by spoon drain and soak well if directed off court by an extruded concrete kerb. Soak wells shall be no closer than 1 metre to the courts.

10. Criteria for stormwater run-off shall be to the requirements of the Design Specification in section 10.0 of this document.

11. The synthetic acrylic playing surface and line marking shall have a 3 year unconditional warranty on materials, colour, surface texture and workmanship and be approved by the WA Lawn Tennis Association for B & C grade competition play.

15.6.2 COURT FURNITURE

Court furniture shall be provided to conform to the dimensions shown on Figure 1. The net shall be black polyethylene UV stabilised fabric.

15.6.3 COURT FENCING

1. Perimeter fencing shall be black PVC coated chain link fabric mesh of the nominal dimensions 3050mm x 95mm x 2.5mm. The fencing shall have a finished height of 3.1m with a single strand of barbed wire on the top edge.

2. Intermediate fencing between courts on complexes with more than 4 courts shall be 2.4 metres high using black PVC coated chain link fabric mesh to match the external fence.

3. Fencing should be designed to accommodate windbreak material that may be required at high standard competition play venues.

4. Pedestrian access gates 1.5m wide shall be provided at the locations shown on the drawings.

5. Two adjacent 1.5m wide full height gates shall be provided for vehicle access at the location shown on drawings.

15.6.4 COURT LIGHTING

1. The Shire has adopted two standards for illumination of tennis courts. Recreation Standard for smaller 2 & 4 court facilities which provides for recreational and occasional users. The illumination standard is suitable for locations requiring more light control closer to residences. Association Standard is for larger tennis court facilities where occupying clubs participate in night time competitions organised by District and Tennis West associations.

2. The following lighting standards shall be applied to tennis courts whose primary function is to provide for recreation standard tennis.

    a. The minimum average service illuminance within the total playing area shall be 100 lux, with a minimum illuminance of 80 lux at any point.

    b. The minimum average service illuminance within the principal playing area shall be 125 lux with a minimum of 100 lux at any point.

    c. The uniformity ratios shall be in accordance with Table 5.

3. The following lighting standards shall be applied to tennis courts whose primary function is to provide for association standard tennis.

    a. The minimum average service illuminance within the total playing area shall be 180 lux, with a minimum illuminance of 150 lux at any point.

    b. The minimum average service illuminance within the principal playing area shall be 200 lux with a minimum of 180 lux at any point.

    c. The uniformity ratios shall be in accordance with Table 5.

4. The principal playing area (PPA) shall extend to 200mm beyond the marked court area. The total playing area (TPA) shall extend to 6 metres beyond the baselines and 3.5 metres beyond the double lines.

5. TABLE 5 – TENNIS COURT ILLUMINATION STANDARDS

STANDARD	ILLUMIONANCE LEVEL lux						UNIFORMITY RATIOS			
	PPA			TPA			PPA		TPA	
	Init	Maint	Abs Min	Init	Maint	Abs Min	Emin/ Eav	Emin/ Emax	Emin/ Eav	Emin/ Emax
Association	250*	200	180	220*	180	150	0.6	0.4	0.5	0.3
Recreation		125	100		100	80	0.6	0.4	0.5	0.3

** - minimum values only – not to be used in design calculations*

6. The design of the court lighting should be based on the recommendations of AS 2560 Pt 1 & Pt 2.1 (1982).

7. Luminaires shall have metal halide high pressure discharge lamps and generally have sealed aluminium or corrosion resistant low maintenance housings. Luminaires to be of the environmental type which emit no light above the horizontal plane.

8. Poles shall be hot dipped galvanised and base plate mounted. Poles and footings shall be designed and constructed in accordance with Australian Standard AS 1250 as amended. Pole design shall include provision for luminaire sail area.

9. Cabinets shall be provided to contain the main supply meter and main fuses, court switches and luminaire fuses at each pole.

10. Cables, conduits and all appurtenance necessary to connect the lighting system to the electricity supply shall be designed in accordance with Australian Standard AS 3000 (1981) (SAA Wiring Rules) as amended and the requirements of Western Power. All conduits shall have 300mm clear cover under the subgrade of the tennis court pavement.

15.7 NETBALL COURTS

15.7.1 COURT LAYOUT

1. Netball courts shall be located and laid out in accordance with the Approved Development Plan.

2. The standard dimension of the netball courts shall be 30.5 metres long by 15.25 metres wide, measured to the outside of a 50mm wide white line. Dimensions of the court and internal line marking shall be in accordance with Australian Standards

3. Clearances to adjoining courts and edge of court surrounds, measured from and to the outside edge of the white line shall be:

Side clearance to edge of court - 3.05m

Side clearance to adjoining court - 3.7m

End clearance to edge of court - 3.05m

End clearance to adjoining court - 3.05m

4. The pavement shall be composed of the materials and to the thicknesses as detailed:

Subgrade - compacted well drained sandy soil

Sub-base Course - 150mm compacted limestone rubble

Base Course	-	50mm compacted fine crushed rock
Seal and Playing Surface	-	20mm compacted asphaltic concrete, Mix 2 Size 7, Diorite

5. The playing surface and surrounds shall be at a gradient of a maximum of 1:100 and a minimum of 1:200. The surface shall be sloped to minimise rainfall run-off to the outside courts in a multi-court complex and if a two way grading is used, at least one grade shall be 1:100. All other dimensions shall be in accordance with the recommended guidelines

6. The courts shall be oriented to match existing courts and facilities on the reserve.

7. The court shall have a perimeter kerbing of extruded concrete flush kerbing to support and contain the pavement. The surrounding ground shall be trimmed off level with the flush kerbing.

8. Rainfall run-off shall be accommodated by soakage into the surrounding ground or, where the court is surrounded by other than flush kerbing, a stormwater drainage system designed and constructed in accordance with Council's specifications for the Design and Construction of Roads and Stormwater Drainage.

15.7.2 COURT FURNITURE

The goal posts, brackets, sleeves, rings and other fittings shall be provided in accordance with accepted standards for netball.

15.7.3 LINE MARKING

Line marking shall be provided using an approved road marking paint. Line width shall be 50mm.

16. RETAINING WALLS

The location and layout of retaining wall shall be in accordance with the Approved Development Plan.

16.1 MASS RETAINING WALL

1. All retaining walls that are constructed as part of the subdivisional development shall be designed by a practicing Structural Engineer and be certified as such.

2. All retaining walls shall be subject to application for Building Licence. Where retaining walls exceed 3.0 metres, approval will be subject to consideration by full Council.

3. The wall shall be located so that it is not surcharged by other loads such as vehicles or structures and shall have a clearance from roads or buildings equal to its total height. As well the retaining wall shall not surcharge other retaining walls or structures unless designed to do so.

4. Fences on top of retaining walls are permissible, however the type and location must suit site specific requirements which need to be confirmed with Council in the early stages of design.

5. Retaining walls shall not be constructed over service lines without prior approval.

16.2 DRAWING STANDARDS

16.2.1 General

1. Drawings shall be provided to detail the design, location and construction of facilities in accordance with the Approved Development Plan.

2. Drawings detailing the design shall show all existing contours or spot levels, services, survey pegs and marks, fences, trees and vegetation and structures and buildings and all new or proposed contours or spot levels, earthwork embankments, playing surfaces, landscaping features, roads, carparks, tennis courts and netball courts.

3. Drawings shall in general be prepared in accordance with Australian Standard AS 1100 Pt 101 (1992) and Pt 401 (1984).

4. Drawings will be microfilmed following the practical completion of a project therefore line thickness and density shall be to micrographics standards. The minimum line thickness shall be 0.25mm. Bar scales shall be provided on all drawings for all scales on those drawings.

5. The datum used shall be the Australian Height Datum.

6. Upon the completion of electrical installation and lighting of reserve facilities, as constructed cable details, conduit alignments and cabinet locations (if different from design) shall be provided to the Council.

16.2.2 DRAWINGS SPECIFIC

Drawings for earthworks and re-contouring, roads, carparks, tennis courts and netball courts shall be provided to the scales and required details below.

Drawing	Scales	Detail (Minimum Requirement)
Locality Plan	Minimum 1:5000 Horizontally	Existing roads, lots, reserves and locality areas, new construction and details. Index of drawings.
Overall Plan	Minimum 1:1000 Horizontally	Cadastral boundaries, existing level contours, fences, vegetation, structures, services and reticulation. New works, all dimensions, widths and construction details. Cross sections, pavement depths, court layouts and lighting details.
Longitudinal Plan and Profiles	Minimum 1:1000 horizontally and 1:100 vertically	All existing natural surface levels and existing detail. New profiles, grades, crossfalls, kerbs and intersection and junction details.
Cross Sections	Minimum 1:200 horizontally & 1:100 vertically	All existing natural surface levels and detail. New works, widths, depths and construction details.
Intersections and Junctions	Minimum 1:250 horizontally	Cadastral boundaries, footpath, footways, cycleways, new and existing kerb and channelisation and drainage details.
Contour Plans	Minimum 1:1000 horizontally	All existing cadastral boundaries, pegs, marks and fences and existing levels and contours. New contours and regrading levels, oval and pitch areas, pad levels, carparks and roads.
Details	To standard Engineering Drawing Scales	As required by Council
Courts	Minimum 1:250 horizontally	All dimensions of court layout, line marking

		and side clearances.
Electrical and Lighting	Minimum 1:250 horizontally	All dimensions of court areas, fencing, conduits, cabinets and pole locations.
Retaining Walls	Minimum 1:250 horizontally	All dimensions and heights of walls including fencing, typical cross sections and construction details.

17. DEVELOPMENT DESIGN SPECIFICATION - LANDSCAPE DESIGN

17.1 GENERAL

1. This guideline sets out requirements to be used in the design of Landscapes for reserves and Public Open Space.

2. This specification outlines requirements in respect to landscape design for subdivisional areas including road reserves and swales. The specification also outlines the requirements for ongoing maintenance that apply to landscaped areas, both in the short and long term.

17.2 OBJECTIVES

This specification aims to set standards and document requirements related to the provision of landscape areas in reserves and public open space. The specification aims to provide designers with the flexibility to develop innovative landscapes while ensuring that the long term maintenance of landscapes can be managed in a cost effective manner and meet community expectations in respect to amenity, aesthetics and safety.

17.3 REFERENCE AND SOURCE DOCUMENTS

(a) Council Specifications

ES-FE-01	-	Sump fencing options
ES-FE-02	-	Infrastructure security fencing – specific approval required
ES-FE-03	-	Post and wire fencing
ES-LS-01	-	Road reserve landscaping – setbacks and sightlines
ES-LS-02	-	Verge bollards

(b) Other

Shire of Denmark Subdivisional Landscape Policies and Procedures

17.3 CONSULTATION

The Shire of Denmark encourages designers to enter into a consultative partnership with the Shire at the earliest stages of the planning and design process.

In support of this commitment the Shire will allocate an officer who will advise on policies, limitations and objectives associated with the design, construction and ongoing maintenance of landscaped areas.

It would be expected that Council's officer would have input to the landscape brief for the subdivision and be present at meetings associated with design and construction matters of the overall reserve area.

17.4 PLANNING CONCEPTS

1. As soon as practicable after the approval of the subdivision plan by the Western Australian Planning Commission the designer should contact the Council to discuss general issues and concepts.

2. Council has as an objective the consolidation of recreational nodes and formal equipment areas.

3. The location, configuration and complexity of the landscape and amenities areas design and construction shall achieve long term aesthetic and use objectives and also minimise maintenance

4. For landscape areas the designer shall support the design objectives with visual goals at maturity of the planted sites together with the strategies required to reach those goals and any maintenance regimes necessary for the ongoing development of the site.

17.5 LANDSCAPE DESIGN MANUAL

1. The visual goals and objectives shall be contained within a Design Manual prepared by the designer. This manual shall portray the intent of the design by defining the image required for the various elements as they mature.

   For example:

   - Where plants are used for screening purposes it should be stated whether the planting element is for visual screening etc. and therefore significant foliage development should be retained to a specific height.

   - Where planting is deliberately crowded, the manual should state whether each species group shall be isolated by pruning as necessary or left to intermingle with one species becoming dominant.

   - Where trees are planted in parkland, should they be pruned to allow clear vision underneath or is it intended that they form a partial screen for a changing scene as people move through the area.

   - The visual appreciation of any grassland quality (e.g. high quality turf, meadow grass, medium quality parkland etc) should be nominated in the manual so that maintenance levels can be determined.

2. Designers shall ensure that landscape development plans for any stage of an overall development are consistent and compatible with all other stages of the development.

17.6 GENERAL DESIGN GUIDELINES

The following general guidelines shall apply to the design of landscape areas within a subdivision. It is not intended that these Guidelines prescribe minimum standards but merely highlight Councils general expectations as a starting point for early conceptual development of landscape proposals that will be crystallised following detailed consultation and discussion between Council and the designer.

1. The designer shall submit a comprehensive landscape management plan and ancillary construction drawings (set on the engineering base plans) displaying all aspects of the work necessary for Council to understand the issues of design and the construction standards for the development.

2. Documents are to include but not limited to plant layout details of all landscape areas, hard landscaping, furniture, lighting, plant species details including expected growth patterns and final dimension details, water requirements and reticulation layout, any drainage requirements, nutrient management plans and maintenance management plans.

3. All areas treated with planted grass, trees or shrubs and are of a surface area greater than 800m^2 shall be reticulated with an appropriate automatic watering system from underground water supply.

4. Planted area less than 800m^2 shall not have water reticulation permanently provided. However, if there is convenient access to the system connected to an underground water

supply, water reticulation may be provided for trees and shrubs during the first two summers to facilitate early development.

5. During summer the capacity of the water extraction system shall provide grassed areas with a minimum of 40mm over five applications per week, and shrubs and trees with a minimum of 10 litres and 20 litres respectively over three applications per week.

6. The minimum planting distance between a plant and any architectural or engineering structure, including footpaths, road pavements and associated storm water drainage is required to be 750mm or 75% of the anticipated mature diameter of the plant foliage growth, whichever is the greater distance.

7. Designers are to be cognisant of the variation in cultivation requirements of each plant species and group those requiring similar watering and food requirements together and contain them within a particular watering control station.

8. Should the design options preclude the opportunity for grouping, it would be necessary to install a water reticulation design that could be managed in such a way as to ensure that the variations required by the different species were able to be applied.

9. Other than in road reserves no tree shall be planted in such a location that the mature trunk is at a distance of less than 2.0 metres from a pedestrian access way or dual use path.

10. The skyline of a residential area is fundamentally dependent on the provision of large trees in Public Open Space Areas. Accordingly Council is favourably disposed to the inclusion of large trees, both as specimens and in groups, in these areas.

11. Council has for many years concentrated on the inclusion of native trees and shrubs in the landscape to create an image and also reduce maintenance costs. Deciduous trees and shrubs are therefore not a preferred option for landscape resolutions.

12. Temporary landscaping may be applied to locations within any subdivision to highlight certain areas or functions. Such areas shall be identified on the landscape plans for approval. These areas are to be converted to a permanent landscape component of the subdivision prior to acceptance of the maintenance responsibility by Council.

13. The landscape plan should identify how these temporary areas will be modified to compare them with other areas of the subdivision.

14. A suitable bond, as determined by Council officers shall be lodged with the Council to ensure such works are converted to the modified landscape design which shall be completed at least three months prior to the handover time.

15. The developer must advise all property purchasers of the requirement to modify the landscaping of temporary areas and the anticipated installation time.

16. Where special feature such as lakes, marsh lands or fountains etc. require approval of Statutory Authorities, such approvals shall be obtained prior to the submission of the detailed plans for approval.

17.7 PLANT SPECIES

Theme species plantings and majority of other plant species used throughout any subdivision shall be Australian native species or cultivated varieties of these. A list of preferred plants is available from Council. It should be noted that where proposed POS is adjacent to existing bush the approved plant species will be endemic to that specific locality in the Shire.

Should the species nominated in the submitted plan not be acceptable, for whatever reason, the designer shall nominate an alternative that is acceptable to Council for the purpose and location.

Should an acceptable alternative not be available, the developer may use a nominated species under conditions as provided by the Shire.

Designers should give preference to the use of plants that have lower maintenance requirements, particularly in relation to pruning, water application and feeding. While emphasis should be given to endemic native species that meet these criteria, designers who wish to use exotic species with similar characteristics may be permitted to incorporate such where it is considered necessary to develop a particular landscape character.

17.8 LIMITATIONS

Higher maintenance plant species, particularly those that have a short life span, require a high manual labour effort or necessitate high applications of food and water, are not considered acceptable in the landscape planning schemes.

17.9 GRASSED AREAS

17.9.1 PLANT SPECIES

1. Grass treatments or plant species with husbandry requirements that necessitate supplementary water applications after an initial 2 year development period, shall not be used in areas that are isolated from other reserves and cannot be watered.

2. All grassed areas and other vegetation treatments shall be separated from each other by a concrete kerb to a depth of 100mm below the soil surface.

3. All areas to be grassed shall be planted with a 'Kikuyu Grass.'

17.9.2 Trees

Where trees are plated within grassed areas, the spacing shall be such as to allow access by the appropriate sized ride-on mowers.

18. ROAD RESERVES

18.1 DESIGN SITE LINES

1. Regardless of any other guideline or landscape requirements, trees planted within any road reserve will be under-pruned at an appropriate stage of formative development to a level of 2 metres above the ground unless over the hardstand of a road or crossover.

2. The height of any plant used in a road reserve, other than a tree, shall not exceed 600mm at maturity. Design sight distance envelopes for safe movement of vehicles, cyclists and pedestrians shall be maintained at all times.

3. A tree overhanging the hardstand of a road or crossover shall be pruned to have a ground surface clearance of not less than 4.2 metres as required by the Road Traffic Act

4. Any street tree must be planted in a location that conforms to the requirements of the Utility Providers 'Code of Practice' and the Road Traffic Act.

5. Any tree planted in a road reserve shall be of a species that shall attain a mature height of not less than 4 metres.

18.2 VERGE TREATMENTS

1. Entry statement treatments should primarily comprise of reticulated grass with more intense horticultural and/or architectural features in the vicinity of the main signage.

2. Road verge areas abutting the frontage or side of private properties are generally not maintained by Council subsequent to handover, and therefore shall not contain landscape planting other than street trees plant on the alignment and in accordance with the requirements of the Council.

3. The extensive use of verge hardstanding throughout the Shire is not encouraged, however where it is considered necessary, approval will be granted subject to the area, layout and design being in accordance with the requirements of Council's Verge Development Guidelines.

4. Council will maintain the road verges abutting the rear of private properties for Distributor type roads, where landscape treatments comprise of simple screening effects and street tree plantings. These areas shall not contain landscape treatments that necessitate broad area watering.

5. For plantings in a road reserve, no plant species, density of planting or method of husbandry shall be used that would cause growth in excess of 600mm, other than in the instance of street trees conforming to the requirements of this specification.

18.3 MEDIAN ISLANDS

All trees planted within median islands shall be of suitable species so as to maintain desired sight lines and clearances previously outlined. Designers shall consult with Council as to which species will be accepted for placement within medians.

Where trees are to be located in brick paved medians, they shall be placed in tree well liners.

18.4 LIMITATIONS TO DESIGN

1. Planting in road verge areas abutting the frontage of residential properties shall be limited to street trees that conform to Council's policy.

2. Only those road verge areas abutting a watered public open space shall be watered after a 24 month establishment period providing the POS is reticulated.

3. Landscape areas abutting the rear or side of residential property shall be limited to treatments that will not be watered after an initial twenty four month establishment period.

4. Watered landscaped entry statements, which contain an identified name of the estate, shall not exceed a dimension of 40 metres to any street frontage i.e. a total maximum length of 80 meters.

5. Entry statement treatments shall be limited to treatments that will not be watered after a 24 month establishment period from the time of practical completion of the landscaping works.

18.5 BUSHLAND

18.5.1 GENERAL PHILOSOPHY

Council's landscape philosophy strongly supports the retention of remnant bushland areas where practicable. To ensure the long term aesthetic impact and protection of these areas, the following design criteria should be incorporated into landscape design proposals where possible

18.5.2 DESIGN CRITERIA

The Minimum area of remnant bush to be retained shall be 1000m^2. No remnant bushland area shall have a distance between one side and that opposite of less than 40 metres.

All bushland areas retained shall have at least the under-storey reinforced by supplementary planting with one or more of the dominant endemic species or a robust species of a similar type and appearance to the endemic species. The supplementary planting shall be in an informal pattern and generally fill those areas sparsely vegetated or where weeds dominate.

All supplementary planting areas, where practicable, shall have an automatic, individual plant, water reticulation system installed and supplied from a scheme or ground water extraction system. The reticulation shall be on one or more intense horticultural areas such as grassed areas, gardens or shrubbery. The detail of the design for the reticulation shall depend on the situation.

The system shall be designed in such a way as to minimise disturbance to the existing bushland.

The design should be on the basis that watering would only be applied until the supplementary planting is established.

18.6 MAINTENANCE

18.6.1 MAINTENANCE MANAGEMENT PLAN

In order to assist Council in their development of a Maintenance Management Plan the developer shall provide information on the following;

- Special features within the design requiring specific maintenance requirements. Of particular note are water features such as lakes, marsh areas and fountains etc.

- Detailed as-constructed plans for each water supply and water reticulation system installed within the subdivision.

- All as-constructed plans associated with the landscaping of the subdivision together with any specifications or warranties associated with equipment and other assets incorporated into the design

18.7 NUTRIENT AND IRRIGATION MANAGEMENT PLAN

1. The developer shall undertake a Nutrient and Irrigation Management Plan (NIMP) in accordance with the Guidelines set down by the Department of Environment Protection

2. Developers shall be provided with assistance by Council in the preparation of the NIMP in so far as it will affect maintenance when Council assumes control.

3. The Developer shall submit the NIMP to the Department of Environment Protection and the Water & Rivers Commission for endorsement as a suitable management plan for the cultivation of turf and plant areas.

4. The approved endorsed plan shall be submitted to Council as part of the approval process.

18.8 HANDOVER

1. The developer shall advise the Council of the satisfactory completion of the landscaping plan, including the associated infrastructure for all stages within the subdivision.

2. Council shall arrange for an inspection of the area/areas and subject to the satisfactory acceptance of the work, the developer shall advise the Council in writing of the satisfactory completion and inspection and Council shall acknowledge the commencement of the 24 month maintenance period.

3. At the completion of the maintenance period the Council shall undertake a comprehensive inspection of the relevant areas with the subdivider. The developer is required to supply the following prior to the acceptance and take-over of the areas;

    - Comprehensive As-Constructed Plans

    - Instruction manuals

    - Training of Council personnel on any special features or equipment required for the maintenance of the areas

    - Warranty and Guarantee documents

    - Copies of all tender documents and specifications related to the works undertaken

    - Other items considered to be necessary for Council to effectively manage the areas

19. DEVELOPMENT DESIGN SPECIFICATION ROAD FURNITURE AND LIGHTING DESIGN

19.1 GENERAL

1. This specification sets out requirements to be used in the design of various types of roadside furniture and street lighting.

2. All relevant design principles contained in the Australian Standard AS1158 "The Lighting of Urban Roads" referenced below must be integrated in the design of street lighting and associated infrastructure.

19.2 OBJECTIVES

This specification aims to set standards and document requirements related to the provision of a variety of roadside furniture including

- Signs
- Bus Facilities
- Bollards and

Street Lights

Roadside furniture and street lighting facilities must support desired amenity, safety and aesthetic levels for all road reserve users and residents.

19.3 REFERENCE AND SOURCE DOCUMENTS

Council Specifications and Standard Drawings

ES-BU-01	-	Bus Embayment Details
ES-LS-02	-	Verge Bollards
ES-SI-01	-	Street sign and works information sign
ES-PA-02	-	Pedestrian ramps and grab rail details
ES-PA-01	-	Footpath, shared path and public access way details
ES RO-08	-	Rural Road Guide Post Details

Australian Standards

AS 1158 - The Lighting of Urban Roads and Other Public Thoroughfares

AS 1742 - Street Signage

Other

AUSTROADS – Guide to Traffic Engineering Practice Part 12 – Roadway Lighting

19.4 CONSULTATION

The Designer is encouraged to consult with Council, the Developer's Landscape Architects/Designers and relevant authorities prior to and during the preparation of street signage, bollards and street lighting design.

20. STREET NAME PLATES

20.1 LOCATION

Street name plates shall be erected at all road junctions and intersections as indicated on approved drawings and in accordance with Councils Standard Drawings.

20.2 DIMENSIONS & COLOUR

Street Name plates shall be reflective extruded sections constructed from non-corrosive aluminium not less than 3mm thick.

Plates shall have a minimum depth of 150mm and shall be black on white in colour.

20.3 TOURIST SIGNS

Tourist Signs shall be designed in accordance with Australian Standard 1743.

20.4 MOUNTING & FIXING

1. Mounting brackets shall be adjustable clamps, fixed to both top and bottom of the plates extruded section.

2. Brackets shall be suitable for attachment to timber power and light poles or galvanised steel power and light poles or to nominal 57mm OD galvanised steel street name plate poles, whichever may be applicable.

3. Plates shall not be drilled for mounting in any way.

4. The post shall be set vertically and located on the 2.75m street alignment (boundary offset distance).

5. The lowest part of the street name plate shall be a minimum of 2.5m and a maximum of 3m above verge ground level.

6. The post shall be set into a concrete footing of sufficient dimension and in such a manner as to ensure rigidity of the post and to prevent rotation. Footing dimensions in accordance with Council's Standard Drawings may be used as a guide.

STREET TYPE DESIGNATION

The street type designation shall be selected from the following:

Al	Alley	Cs	Circus	Lp	Loop	Row	Row
Ar	Arcade	Ct	Court	Me	Mews	Sq	Square
Ave	Avenue	Cyd	Courtyard	Pde	Parade	St	Street
Bvd	Boulevarde	Dr	Drive	Pl	Place	Tc	Terrace
Cct	Circuit	Es	Esplanade	Prm	Promenade	Trl	Trail
Ch	Chase	Gdn	Gardens	Pwy	Parkway	Vale	Vale
Ci	Circle, Circlet	Gr	Grove	Pz	Plaza	Wk	Walk
Cl	Close	Hwy	Highway	Quay	Quay	Way	Way
Cnr	Corner	Jn	Junction	Ra	Ramble		
Cr	Crescent	Key	Key	Ri	Rise		
Cro	Cross	La	Lane	Rd	Road		

21. BOLLARDS AND POST & RAIL FENCING

21.1 VERGE BOLLARDS & POSTS AND RAILS

All bollards and post and rail fencing shall be provided and installed in accordance with Councils Standard Drawings.

Guide posts shall be located in accordance with the requirements of Australian Standard 1742.

21.2 DECORATIVE FURNITURE

1. Developers who want use non-standard street furniture must submit their designs for approval.

2. Designers are encouraged to bring these issues to the attention of the Council officers in the earliest stages of the consultation process.

3. Designers must consider the costs associated with the ongoing maintenance and replacement (availability) of the furniture. The designer also needs to demonstrate that all legal obligations in respect to safety, both public and workers have been considered and been complied with.

4. Where decorative/ custom furniture is proposed Council may support the proposal based upon a stock of replacement items being made available.

21.3 PEDESTRIAN HANDRAILS & BOLLARDS

1. Barrier rails placed along dual use path facilities to control access and speed on the approach to road intersections shall be of such design and dimension as outlined in Councils Standard Drawings. Barrier rails shall be 40 mm NB galvanised pipe and shall be placed in a concrete footing, trowelled off flush with the pathway.

2. Bollards used in conjunction with footpaths or dual use facilities shall be designed in accordance with Councils Standard Drawings.

3. Ramp and Grab rails shall be constructed in accordance with the Main Roads Western Australia Standard Drawing Number 9831-5649.

21.4 BUS SHELTERS

Bus shelters will be considered on their merit. Concept designs must be submitted as part of the consultative process in the early stages of the design process.

22. STANDARD STREET LIGHTING

22.1 GENERAL

1. Standard Street Lighting refers to the use of standard light poles, lamps, luminaires and fittings as generally prescribed and erected by Western Power on the road network throughout Western Australia.

2. Developers who wish to use non-standard or decorative lighting need to submit details as part of the consultative process in the early stages of the design. Spare poles may be required by Council if alternative poles are approved.

3. All lighting designs submitted for approval shall be undertaken by a suitably qualified lighting designer or Illumination Engineer.

22.2 OBJECTIVES

1. All designs shall take due account of lighting design principles including aesthetics, economy of installation and operation, suitability of location, co-ordination with other features and services and fitness for purpose.

2. Effective Street Lighting Designs should;

   - Provide good levels of illumination for vehicular use
   - Provide even levels of illumination for pedestrian use
   - Highlight hazards
   - Minimise nuisance lighting for residents
   - Encourage a feeling of safety for pedestrians

3. All street lighting for public roadways shall comply with the requirements of Australian Standard 1158 " The Lighting of Urban Roads and Other Public Thoroughfares"

4. The following details shall be included with design documents submitted for approval.

   - The drawing plans showing roadway layout, street names, lighting types and location conduit/cabling locations and routes, connection points to Western Power's network grid, switch/meter board positions, wiring schematic and other associated information as applicable to the proposed installation.

   - Detail plans and specifications shall be provided for all proposed lighting hardware including poles, luminaires, lamp, control gear, foundations, earthing arrangement and mounting details. This information shall clearly show material types, sizes, fixings, luminaire/pole identification number, etc.

   - Operating costs shall be provided with the design proposal (dusk to dawn operation) and are to include all calculations step by step.

   - Documents shall include lighting design details that demonstrate and certify compliance with Australian Standard AS1158.1 and other authority requirements as appropriate.

   - Design details are to be provided for each area of road or pathway to be illuminated ie. typical straight road sections, intersection, T-junction, roundabouts, etc.

23. SOIL STABILISATION

23.1 GENERAL

It is the responsibility of the subdivider to adequately control wind and water erosion on the site. This applies during the construction phase and post construction in accordance with the Stabilisation Strategy. Works are to be carried out in such way as to minimise the effect on the amenity of the existing surrounding developments.

The subdivider shall submit for approval:

1. A completed Site Classification Assessment Chart of the Dust Control Guidelines as attached.

2. A Soil Stabilisation Strategy in accordance with clause 6.5.3 of this document.

3. A Soil Stabilisation Bond in accordance with clause 4.4 of this document.

23.2 CLEARING RESTRICTIONS

It is desired by Council that clearing for survey purposes be kept at a minimum and be undertaken in an environmentally sensitive way.

Clearing on land under control of Council requires authorisation by the Shire's CEO.

Council will impose clearing restrictions on land zoned residential which is subject to subdivision, if warranted.

Council may require building envelopes to be utilised.

Clearing outside building envelopes shall be limited to parkland clearing and/or the installation of boundary fences as approved by Council.

No green waste created by clearing of local vegetation shall be removed from development site unless authorised by the Shire Engineer.

All green waste created shall be mulched on site and be utilised on site for stabilisation and/or landscaping.

Material of a size that does not allow on-site mulching will be accepted by the Shire of Denmark on the following conditions:

(a) Timber that is accepted for milling or the making of fence posts by the Shire can be deposited free of cost at the Shire Depot, Zimmermann Street.
(b) Timber that is unsuitable for the above is to be cut to a maximum length of 2 metres and is to be deposited at the Shire landfill site on McIntosh Road. Standard dumping fees will apply.

Contractors should refer to Environmental Protection Authority Clearing Regulations 2004 prior to undertaking any clearing.

23.3 STRATEGY

A Soil Stabilisation Strategy shall be submitted for approval if the development has a site classification of class 3 or 4.

This strategy is a planned program of soil stabilisation measures that will be undertaken on site in order to minimise erosion if and when required in accordance with the approval.

This strategy shall incorporate all or any of the following:

- Minimisation of clearing and top soil stripping
- Programming of works for periods of mild (wet) weather
- Wind break fencing
- Brushing
- Hydro-mulching
- Loam sheeting
- Seeding
- Use of dust suppressants
- Watering
- Fencing and signs to restrict access
- Sweeping
- Compensation payments to affected residents
- Replacement of soil

Loam sheeting shall not be applied until after August to avoid excess stormwater runoff. Direct seeding without follow up watering during warmer weather is not considered sufficient as soil stabilisation.

Appropriate action is to be taken post construction to deter unnecessary vehicle and pedestrian access to areas under revegetation measures.

Purchasers and builders are to be informed by the developer of the need to preserve the stabilisation measures until actual commencement of building activity.

Council will forward any erosion (dust) complaints to the subdivider for action. Should the subdivider not take appropriate action within the time specified by Council Staff, the Stabilisation Bond may be used by Council without further reference to the subdivider.

23.3.1 Hydromulching

Hydromulch shall consist of the application of a mix of water, seed, fertiliser, binding agent and biodegradable filler.

Hydromulching shall be applied by an experienced contractor only. Specifications of the proposed mix and subsequent test results are to be submitted to Council.

23.3.2 Seeding

The seed mix proposed on the site is to be submitted for Council's information only.

Where germination is not to the satisfaction of the Shire Engineer, re-seeding and additional watering will be required prior to the release of the Defect Liability Bond in accordance with clause 4.4.4 of this document.

23.3.3 Loam Sheeting

Loam sheeting shall be applied to a depth of 70 mm and be supplied in a moist state. The loam shall be spread to a non-smooth surface and be watered.

The surface shall include contour banks and other appropriate measures to retain stormwater runoff.

All loam intended for use as a stabilisation measure requires approval from the Shire engineer prior to application on site.

23.3.4 Tree Planting

Pursuant to clause 5.26 of Town Planning Scheme No 3, Council may impose a condition of tree planting where deemed appropriate in the opinion of Council.

Any plant species to be seeded or planted on existing and newly created public land (road reserves and Public Open Spaces) shall be indigenous to the Shire of Denmark.

Any planting on existing road reserves and other public land requires approval from the Shire of Denmark.

The subdivider shall plant said trees on road verges or in other areas of the subdivision as determined by Council as a condition of subdivision and/or development application.

If a condition of tree planting is imposed, the following shall be submitted:

1. Drawings at an appropriate scale depicting the density and species of plants to be provided.

2. The maximum spacing between plants shall be 4 metres.

3. Program providing details of site preparation, timing of planting and timing and method of maintenance.

4. A bond of a value equal to the cost of the total planting work shall be given separate from the Defect Liability or Stabilisation Bonds.

   This bond shall be held by Council for a minimum period of two (2) years or until such time that the tree planting area is fully established and does not require further maintenance in the opinion of the Shire Engineer.

5. Council will require the submission of the bond as outlined above if tree planting is a development condition in order to clear this condition.

23.3.5 Weed Control

In order to prevent the introduction and spread of undesirable plant species during execution of civil works, the following procedure shall be followed:

1. Areas where spoil is to be used in rehabilitation projects are to be inspected prior to disturbance and any undesirable plant is to be identified.

2. Written inspection records are to be submitted for Council's records.

3. Where possible, undesirable plants are to be removed prior to any disturbance of the area.

4. After spoil has been used for rehabilitation, the area shall be treated in the most appropriate manner to remove any undesirable plant species that was identified during the initial site inspection.

23.3.6 Seed Collection

Where it is intended to execute clearing of native vegetation in excess of 0.4 hectare (1 acre), the subdivider shall give the Shire of Denmark two weeks notice before commencement of such clearing.

The Shire shall have the right to collect seed from any plant due to be removed within that period.

The Shire shall authorise knowledgeable persons to carry out the seed collection for Council's Revegetation Nursery on behalf of Council.

The seed collecting personnel may allow the subdivider to commence selective clearing during this time as this may be necessary to access seed bearing parts of plants (trees).

The subdivider shall support seed collecting personnel by providing the means to carry out the seed collection.

Shire personnel shall endeavour to keep the time required for seed collection to a minimum.

If so desired by the subdivider, seed collected from areas cleared within the development shall be kept specifically for revegetation within same development until such time that all civil works are completed and it is desired to have revegetation works carried out.

23.3.7 Rehabilitation

Council does encourage subdividers to revegetate any areas that may have been cleared in excess of the actual works, e.g. access tracks, gravel pits, pipe trenches etc.

On request of the subdivider, Council shall offer to carry out revegetation measures, utilising previously collected seeds, to rehabilitate any disturbed section of the development and/or areas disturbed by the works as approved by the Shire Engineer.

Where seed had been collected from the site, Council shall offer said work at cost price to the developer.

Where seed was not collected on site, Council shall offer the revegetation work at a competitive price. Revegetation work may be carried out by a contractor at the discretion of the subdivider in this case only.

24. FIRE FIGHTING REQUIREMENTS

24.1 ADMINISTRATION

24.1.1. APPLICATION

Strategic Firebreaks (SFBs) and other Fire Control Measures are to be designed and constructed for all subdivisions and developments zoned Residential, Special Residential, Special Rural, Rural and Tourist.

All Strategic Firebreaks shall connect to form a network throughout the Shire of Denmark. Any new development shall contribute and connect to this network.

24.1.2 AUTHORITY

a. In accordance with Conditions of Subdivision imposed by the Western Australian Planning Commission, the Fire and Emergency Services Authority (FESA) and the Shire of Denmark as the Local Authority (LA) shall be the approving Authorities.

b. The Shire of Denmark hall be the local inspector, and liaise with the Chief Bushfire Control Officer and FESA in relation to all works.

24.1.3 APPROVAL

a. In reference to the document Planning for Bush Fire Protection published by the WA Planning Commission and FESA (as amended), the developer shall submit a Fire Management Plan (FMP) as required, for the proposed subdivision showing all SFBs and other Fire Control Measures. The plan shall be submitted in duplicate to the Shire of Denmark. The Community Emergency Services Manager, in cooperation with the Director of Planning and Sustainability of the Shire of Denmark shall assess the proposed SFBs and other Fire Control installations.

b. The Director of Planning and Sustainability shall advise the developer of requirements as part of the approval of design plans and specifications.

24.1.4 CONTROL

a. Technical Specifications are governed by this Standard and shall be controlled by the Local Authority.

b. The Shire of Denmark shall assess and approve all technical aspects and conduct all site inspections in cooperation with relevant Bushfire Personnel. On satisfactory completion of all works, the Shire of Denmark shall issue its clearance as applicable and recommend clearance of relevant conditions to FESA.

24.1.5 IMPLEMENTATION

All work required shall be carried out. Payments in Lieu shall not be acceptable.

24.1.6 INSPECTION FEE

The developer is to provide the cost of construction of all works relating to Fire control. An Inspection Fee of 1.5 % of the value of all works as relating to Fire Control shall apply in accordance with this Development Standard and shall be paid to the Shire of Denmark prior to construction.

24.1.7 DEFECTS LIABILITY BOND

1. Where the person has <u>not</u> engaged a Consulting Engineer or approved Clerk of Works to design and supervise the construction and drainage, the amount is to be 3% of the cost of the construction and drainage <u>as estimated</u> by the local government;

2. Where the person has engaged a consulting engineer to design and supervise the construction and drainage, the amount is to be 1.5% of the cost of the construction and drainage as estimated by the local government.

3. On or within three weeks after the expiry of the 12 months Defects Liability Period, the Director of Infrastructure Services and the Community Emergency Services Manager shall inspect all installations. A written report of this inspection shall be submitted to the Developer, FESA and the Shire of Denmark (LA).

The Defects Liability Bond shall be returned if the work is found to be without defects. Interest shall not be payable on this bond.

Any repairs required in the opinion of the Director of Infrastructure Services and the Community Emergency Services Manager shall be made good prior to the return of the Defects Liability Bond.

24.1.8 BONDS FOR WORK

a. Bonds in lieu of works shall be acceptable only for a time prior to the construction of any building and only between 1 April and 15 November. On commencement of any building activity, all Fire Control Measures are to be implemented immediately by the developer or the holder of the bond, to be in place by 1 December/Fire Regulations Notice.

b. Where a bond for Fire Control Measures was lodged and work needs to be commenced in the opinion of the Director of Infrastructure Services, the LA shall inform the provider of such bond that the bond will be drawn upon prior to commencement of expenditure.

c. The developer shall notify the LA within 48 hours after such notice has been given of his intentions regarding the completion of the work. Should the developer wish to carry out the work by his own means, work shall commence no later than five (5) working days after the developer was notified by the LA of the requirement of implementation.

d. Should the developer not wish to have the work carried out, the Director of Infrastructure Services is authorised to utilise the bond for this purpose immediately.

e. If work undertaken by the developer does not progress to the satisfaction of the Local Authority, the bond shall be utilised to expedite progress without further notification.

24.1.9 PAYMENT IN LIEU OF WORK

Where a development is of a lesser size that listed under clauses 1.1 to 1.5 of the Technical Specification, the developer may, at his discretion, provide all fire fighting installations as required by the zoning or make payment to the LA.

24.2 TECHNICAL SPECIFICATIONS

24.2.1 STRATEGIC FIREBREAKS

a. The design of SFBs shall be flexible to allow protection of areas considered as being of high conservation value under consideration of the need for Fire Protection by the population. The final decision on such matters shall be made by the Council of the Shire of Denmark (LA) in consultation with the Community Emergency Services Manager and FESA.

b. Roads with a cleared profile as prescribed in this document may be deemed to form part of the SFB Network if approved by Council.

24.2.2 RESIDENTIAL ZONES

Sections of the SFB network shall be provided to separate areas zoned Residential to a maximum of 15 hectares from adjoining land where such development is located adjacent to land with the potential of being or becoming a seasonal fire hazard.

24.2.3 SPECIAL RESIDENTIAL ZONES

Sections of the SFB network shall be provided to surround areas zoned Special Residential to a maximum of 15 ha.

24.2.4 SPECIAL RURAL ZONES

Sections of the SFB network shall be provided to surround areas zoned Special Rural to a maximum of 40 ha.

24.2.5 RURAL ZONES

Sections of the SFB network shall be provided to surround areas zoned Rural to a maximum of 150 ha.

24 2.6 TOURISM ZONES

Sections of the SFB network shall be provided to surround each area zoned Tourism to a maximum of 10 ha.

24.2.7 NETWORK REQUIREMENT

Strategic Firebreaks may be required in subdivisions of a lesser size if the SFB Network requires a connecting link through or around the land under consideration. SFBs shall connect to constructed Public Roads and shall not be designed as a cul-de-sac.

24.2.8 LOCATION

Strategic Firebreaks shall connect areas of reduced Fuel Loading. SFBs are to be installed along boundaries between reduced Fuel Loading and high Fuel Loading.

24.3 HORIZONTAL DESIGN:

24.3.1 WIDTH

Strategic Firebreaks shall have a minimum cleared width of 6.0 metres at ground level to allow for two way traffic during emergencies.

24.3.2 CLEARING

Strategic Firebreaks shall have a minimum cleared height of 5.0 metres to allow safe usage by heavy Fire Fighting Vehicles during emergencies.

24.3.3 CURVATURE

A minimum inside curve radius of 10 metres shall apply to all curves.

24.3.4 WATERCOURSES

Crossings of watercourses shall be constructed to allow usage by heavy 4x4 Fire Fighting vehicles of up to 15 t. This may be achieved by the installation of appropriately sized culverts or rock paved floodways.

Crossings shall not restrict the flow of the watercourse.

24.3.5 CULVERTS

Culverts may be chosen at the discretion of the developer.

Where culverts are selected, the developer shall provide calculations proving sufficient dimensions for a 1:100 year flood event.

24.3.6 FLOODWAYS

Floodways are to be constructed as flush rock crossings. All floodways are to be practically tested by a vehicle of no less than 15 t actual weight. Ten (10) vehicle test crossings are to be carried out in the presence of the Director of Infrastructure Services and Community Emergency Services Manager. Maximum permissible dislocation of materials shall be 100 mm vertically and 100 mm horizontally.

Any dislocation of materials shall be made good and the crossing shall be re-tested before acceptance.

24.4 VERTICAL DESIGN

24.4.1 MAXIMUM GRADES

The desirable maximum grade is 10% (1:10).

The maximum allowable longitudinal grade shall be 1:6 (16.6 %) over a maximum distance of 50 metres.

24.4.2 CROSSFALL

The desirable crossfall or camber shall be 3 %.

The maximum allowable crossfall shall be 5 % (1:20) on sections of straight alignment only.

All curves shall be level or have superelevation of 3 % Reverse crossfalls to a maximum grade of 1 % shall be allowed at curves with a radius in excess of 50 metres.

24.4.3 SURFACE

An acceptable surface may consist of natural occurring soil if such soil does provide a safe non-slip surface during damp conditions under consideration of the horizontal and vertical alignment.

24.4.4 PURPOSE

This construction standard is to ensure that SFBs provide access to all 4x4 fire fighting vehicles in dry and damp conditions (e.g. Thunderstorms).

24.4.5 PAVEMENT

Should natural occurring soil not allow compliance with clause 7.1, a gravel or crushed rock surface to a compacted thickness of 100 mm and a width as specified under clause 5.1 shall be constructed.

24.4.6 BOUNDARY GATES

1. SFB's shall not be restricted by lot boundaries. Five (5) metre wide boundary gates shall be installed wherever a SFB traverses a cadastral boundary. Such gates shall consist of a galvanised steel frame with minimum tube diameter of 25mm with galvanised mesh or sheet metal infill.

2. Where such gates adjoin a public thoroughfare such gates shall be equipped with one sign per side depicting "Strategic Firebreak - No Public Access". Such signs shall be made of aluminium, have a white background with weatherproof red lettering of a minimum height of 100 mm. The signs shall be securely fitted to the top rail.

3. Where such gates adjoin a public thoroughfare such gates shall be equipped with a Shire security lock.

24.5 MAINTENANCE

24.5.1 DEVELOPER

The developer shall maintain SFBs until the End of the Defect Liability Period in accordance with clauses 7a and b.

24.5.2 LANDOWNERS

It shall be the responsibility of all landowners to maintain all Strategic Firebreaks (or sections thereof) including gates located within their individual property at all times.

24.5.3 LOCAL AUTHORITY

The Local Authority shall maintain SFBs on all land under its control and all floodways and culverts on the alignment of SFBs is these serve the sole purpose of fire fighting access.

The LA shall enforce all maintenance requirements in accordance with its authority by law.

24.5.4 ANNUAL INSPECTION

The L.A in cooperation with Local Bushfire Control Officers shall inspect all SFB's annually and submit a detailed inspection report to the L.A for enforcement.

24.6 TECHNICAL SPECIFICATIONS - WATER SUPPLY

24.6.1 RESIDENTIAL ZONES

Water supply for fire fighting purposes for areas zoned Residential shall be provided by the installation of hydrants at intervals of no more than 200m.

24.6.2 SPECIAL RESIDENTIAL ZONES

Water supply for fire fighting purposes for areas zoned Special Residential shall be provided by the installation of hydrants at intervals of no more than 200m where reticulated mains water is supplied.

Where reticulated mains water is not supplied, one free standing rainwater tank and one standpipe shall be installed per 25 lots.

24.6.3 SPECIAL RURAL ZONES

In areas zoned Special Rural, one free standing tank and one standpipe shall be installed per 25 lots.

Where a developer is able to provide unrestricted legal access to a suitable dam by provision of a caveat on the relevant title, and connects same to the fire fighting tank, the area deemed serviced by this tank shall be increased to 50 lots.

24.6.4 RURAL ZONES

In areas zoned Rural, one free standing tank and one standpipe shall be installed per 150 ha.

Where a developer is able to provide unrestricted legal access to a suitable dam by provision of a caveat on the relevant title, and connects same to the fire fighting tank, the area deemed serviced by this tank shall be increased to 300 ha.

24.6.5 TOURISM ZONES

Water supply for fire fighting purposes for areas zoned Tourism shall be provided by the installation of hydrants as specified by FESA and Water Corporation and the supply of one (1) hydrant-connecting fitting to the local Bushfire Brigade where reticulated mains water is supplied.

Where reticulated mains water is not supplied, one free standing rainwater tank and one standpipe shall be installed per development site to a maximum of 10 ha.

24.6.6 INDUSTRIAL

Water supply for fire fighting purposes for areas zoned Industrial shall be provided by the installation of hydrants at intervals of no more than 100m.

24.7 TANKS

24.7.1 LOCATION

Tanks shall be installed on or adjacent to public road reserves to the satisfaction of the Director of Infrastructure Services. Where a safe installation on a road reserve is not possible in the opinion of the Director of Infrastructure Services, the developer shall provide a suitable tank site of no less than 90 m^2 adjacent to the road reserve and shall arrange that such land be vested as part of the adjoining road reserve with the Local Authority.

24.7.2 CONSTRUCTION

Tanks shall be stable and durable with a minimum expected lifespan of 20 years. Such lifespan shall be proven by the developer by submission of a guarantee from the manufacturer to the Local Authority. Tanks shall be constructed of steel reinforced concrete with a self-filling lid.

24.7.3 CAPACITY

Tanks required for fire fighting purposes shall have a minimum capacity of 25,000 litres. Free standing tanks that are not connected to an external water supply (dam) shall have a self-draining roof.

Tanks shall be filled once only by the developer at completion of construction.

Tanks are to be located at such levels above the connected standpipes that total drainage via the standpipe is achievable at the appropriate discharge rate of 450 l/min minimum.

Where such discharge flows are not achievable by differences in natural levels of the development site, the tank is to be raised above natural ground level by placement of fill at a maximum batter grade of 1:3. Additional land required for such elevated installation shall be provided by the developer as prescribed in clause 2.1 above. The surface of such fill is to be stabilised to the satisfaction of the Director of Infrastructure Services.

Tanks are to be fitted with discharge pipes of a minimum diameter of 75 mm having one Stop Valve near the tank outlet. Where a tank is connected to an external water supply (dam), one additional Stop Valve is to be installed at the fill side.

24.7.4 ACCESS

A paved vehicle access bay shall be constructed between the edge of the carriageway and the tank to a minimum length of 10 metres at a minimum clear width of 3.5 metres. Such vehicle bays shall not restrict other drainage installations (open drains, culverts etc).

The gravel pavement shall have a minimum compacted thickness of 200 mm at a compaction rate of 95 % MDD. The surface of such vehicle bays adjacent to tanks shall be to the same standard as the adjoining road. The pavement shall be formed to allow surface drainage.

24.8 STANDPIPES

24.8.1 LOCATION

Standpipes shall be located on public road reserves allowing any vehicle using such standpipe to leave the carriageway completely and not restrict traffic flow and visibility.

24.8.2 CONSTRUCTION

Standpipes shall be of sound construction, made from galvanised steel and shall withstand a load of 150 kg at the pipe outlet without visible deformation of the structure.

Standpipes shall be equipped with a Metal Stop Valve at 1.5 metres above ground level. The minimum height of the discharge pipe outlet shall be 4.0 metres above surrounding surface level. 2.0 metre of flexible hose of appropriate diameter shall be fitted to the discharge pipe outlet.

Valves shall be capable of being padlocked, with a Shire security lock.

24.8.3 CAPACITY

The minimum discharge shall be 450 litres per minute.

The minimum discharge pipe diameter shall be 75 mm.

24.8.4 ACCESS

A paved vehicle access bay shall be constructed between the edge of carriageway and the standpipe to a minimum length of 25 metres. Such vehicle bays shall not restrict other drainage installations (open drains, culverts etc).

The gravel pavement shall have a minimum compacted thickness of 200 mm at a compaction rate of 95 % MDD.

The surface of such vehicle bays adjacent to standpipes shall be to the same standard as the adjoining road.

The pavement shall be formed to allow surface drainage.

24.8.5 PIPELINES

P.V.C. pipeline shall be permitted only where such pipe is installed at a depth in access of 600mm from the final ground surface. Any pipe at a lesser depth shall be metal.

25. VERGE TREATMENT GUIDELINES

25.1 VERGE TREATMENT GUIDELINES URBAN AREA

Council encourages and supports the development of road verges in urban areas, either a maintained grass style or a dry garden style or a mixture of both. These are the preferred treatments.

This guideline interprets various existing laws, policies, specifications and does offers general guidance only. Property owners, occupiers and Contractors are obliged to seek advice from Council's Engineering Services

It is accepted by the Shire of Denmark that road reserves form a significant portion of public open space and this area is available to residents for improving their outdoor lifestyle. A well planned and maintained garden greatly enhances the appearance of the neighbourhood. It is the Shire's responsibility to ensure verge areas are maintained to a safe standard and this guideline has been formulated to assist residents in undertaking beautification works, which are kept free of hazards to ensure safe movement for pedestrians.

Property owners may install the following verge treatments:

- Lawns (Refer points I & VI)
- Reticulation (Refer points II & VI)
- Acceptable Hardstand Materials (Refer point III)

- Gardens/Landscaping (Refer points III & VI)
- Street Trees and alignment (Refer points IV)
- Partial hardstand (Refer points V & VI)
- Compacted Material (Refer points V & VI)

25.1.1 LAWNS

Un-reticulated lawned verges do not require Council's approval.

Lawn (Verge Registration)

The registering of verges is no longer applicable within the district and has been superseded by Clause 3.8 of the Shire's Parking Local Law. This law prevents motorists from parking on a road verge without the adjoining property occupier's consent. For further information, please contact Ranger Services at the Shire of Denmark.

25.1.2 RETICULATION

When reticulating verges the following points must be noted:

1. Water pipes must be laid beneath the verge at a depth between 150mm and 300mm. No fitting connected to the pipes can protrude above the surface of the lawn or garden.

2. The pipes and connections must be at least 250mm away from the footpath.

3. The system must contain approved valves, located within the property. These are connected to your supply and fitted so as to give complete control of the flow of water from that point.
4. Where reticulation extends to the kerb line, half sprinklers must be used. These will direct the flow of water away from the paved road surface.

5. Reticulation sprinklers are not to spray water on a footpath or road and watering is to be restricted to times where inconvenience to pedestrians, cyclists and motorists is at a minimum.

6. Should damage to any utility services (water, telecom, power etc) occur, the damage will be made good by the authority having the control of that particular plant, and such expense incurred in reinstating the plant, will be to the property owner.

25.1.3 ACCEPTABLE HARDSTAND MATERIALS

Acceptable verge hardstand materials permitted over no more than one third of the verge (excluding vehicle crossover) are:

A. Bound materials
   - Pavers
   - Concrete
   - Asphalt
   - Spray Bitumen

B. Unbound materials
   - Quarried aggregates
   - Gravel
   - Limestone

25.1.4 GARDENS/LANDSCAPING

Many residents are becoming water conscious when planning their landscaping. This does not mean that vegetation has to be eliminated. Parks and Gardens Services can provide advice on the species of plants best suited to verge areas.

Before commencement, the following conditions of approval should be considered:

1. That an area measured 2.0 metres from the back of kerb and running parallel to the kerb, is kept clear of garden landscaping to allow pedestrians a safe point of refuge on the verge in emergency situations.

2. The applicant accepts responsibility for removal or relocating the plants if required by Council or any public utility.
3. The matured plants are to be kept 300mm clear of any footpath where applicable.

4. The landscape scheme is to be of such a nature as not to create any undue hazard to road users or pedestrians.

5. That no plant be permitted to exceed 750mm in height on the verge to ensure sight lines from crossovers are clear (excludes street trees).

6. The minimum clear understorey height of mature street trees is to be greater than 2.0 metres to ensure sight lines.

25.1.5 STREET TREES ON VERGES AND THEIR ALIGNMENT

In the interests of vehicular and pedestrian safety, as well as keeping services clear, street trees on verges shall be of a specific species planted within a particular alignment.

The resident is entitled to one or two street trees according to the following Table 1. Council will supply and plant the trees however, once planted it is the responsibility of the resident to water the street trees. Any other maintenance required should be referred to the Shire's Parks and Gardens Services.

Table 1: Street Tree Alignment and Quantity

Lot Type	Number of Trees
Standard Lot	1
Corner Lot	1 on short side 2 on long side

The standard alignment for a verge tree is:

1. Central on a standard block.

2. 5 metres from any crossovers.

3. At least 2 metres from the road and front property boundary

4. 10 metres from the road truncation.

For any further information on alignment, please contact Infrastructure Services.

There will be exceptions due to configurations of Lots and existing infrastructure. Please do not be afraid to ask.

The Shire's Parks and Gardens Services has an Officer on staff who supervises native revegetation. It is this officer's position to determine the best trees to plant in each area. Appropriate street trees are chosen not only for their hardiness, but also to provide a consistent theme throughout each neighbourhood.

When requesting street tree(s) please state whether:

1. Overhead powerlines are present.

2. Footpaths are present

3. There is any existing verge planting.

Although all residents are entitled to apply for a street tree, you may decide to select and plant a street tree yourself. Please consult with Engineering Services on 9848 0300 regarding your proposed selection to ensure it is not an inappropriate or hazardous species. Incorrectly chosen or planted street trees will be removed at Council's discretion so please choose wisely.

The following typical tree species are not approved as street trees:

1. Ficus Species (root structure).

2. Salix Species (root structure).

3. *Cupressus Arizonica* (sight line obstruction)

4. All plants listed under Council's "Pest Plants" Local Law.

This is a list of approved species suitable for use in various applications within the road reserve

Approved Groundcovers			
Botanic name	**Common name**	**Flowers**	**Size**
Chorizema ilicifolium	holly flame pea	Jul - Oct	0.1 - 0.3
Dampiera linearis	common dampiera	Jul - Dec	0.15 - 0.6m
Gompholobium knightianum	handsome wedge pea	Jul - Dec	0.1 - 0.5m
Gompholobium polymorphum	showy pea	Sep - Jan	to 1.2m
Hakea prostrata	harsh hakea	Aug - Oct	0.3 - 2m
Hardenbergia comptoniana	native wisteria	Jul - Oct	climber
Kennedia coccinea	coral vine	Aug - Nov	climber
Kennedia prostrata	scarlet runner - running postman	Apr - Nov	to 1.5m
Scaevola globulifera	n/a	Aug - Dec	0.1 - 0.5m
Scaevola microphylla	n/a	Sep - Mar	0.5 - 0.5m
Scaevola nitida	n/a	Aug - Dec	0.03 - 3m
Scaevola striata	n/a	Aug - Dec	0.03 - 0.3m
Xanthosia rotundifolia	southern cross	Jun - Feb	0.35 - 0.8m

Approved Shrubs to 1m			
Botanic name	**Common name**	**Flowers**	**Size**
Acacia drummondii subsp drummondii	drummonds wattle	Ju - Oct	0.3 - 1.0

Actinodium cunnighammii	albany daisy	Sep - Jun	0.15 - 1.0
Brachysema melanopetalum	n/a	Sep - Jan	to 3m
Brachysema praemorsum	n/a	Sep - Feb	0.5 - 1.5
Brachysema sericeum	n/a	Jun - Nov	to 1.2m
Conospermum caeruleum	bluesmoke bush	Jun - Nov	0.1 - 1m
Dampiera hederacea	karri dampiera	Jun - Jan	0.2 - 1m
Grevillea depauperata	n/a	Mar - Dec	0.1 to 0.8m
Grevillea quercifolia	oak-leaved grevillea	Jul - Dec	0.3 - 0.7m
Grevillea trifida	n/a	Jul - Feb	0.3 - 1.7m
Hemiandra pungens	snake bush	Jan - Dec	.05 - 1m
Hypocalymma angustifolium *Pimelea ferrugninea*	white myrtle pink rice flower	Jun - Oct Aug - Feb	to 1.5m to 1.8m
Pimelea rosea	rose banjine	Jul - Dec	0.3 - 1m
Tetratheca hirsuta	black-eyed susan	Jul - Dec	0.1 - 0.9m
Thysanotus multiflorus	many-flowered fringe lily	Aug - Jan	0.1 - 0.5
Ficinia nodosa	knotted club rush	Aug - Apr	0.4 - 1m
Patersonia occidentalis	purple flag	Apr - Jan	0.25 - 0.75
Patersonia umbrosa	yellow flag	Aug - Dec	to 0.9m
Johnsonia lupulina	hooded lily	Sep - Dec	0.3 - 0.8m

Approved Shrubs 1 to 3m			
Botanic name	**Common name**	**Flowers**	**Size (H&W)**
Acacia pentadenia	karri wattle	Aug - Nov	2m
Adenanthos obovatus	basket flower	Sep - Nov	0.5 - 2m
Anigothanzus flavidus	tall kangaroo paw	Nov - Jan	to 2m
Beaufortia decussata	gravel bottlebrush	Sep - Jun	to 3m
Beaufortia sparsa	swamp bottlebrush	Jun - Feb	to 2m
Boronia crenulata	aniseed boronia	May - Feb	1 - 1.2m
Boronia heterophylla	red boronia	Sep - Nov	1 - 3m

Boronia megastigma	scented boronia	Jul - Oct	0.2 - 2m
Bossiaea linophylla	narrow-leaved bossiaea	Jul - Dec	0.7 - 2.2m
Calothamnus quadrifidul	common net bush	Jun - Dec	0.9 - 3m
Darwinia citriodora	lemon scented myrtle	May - Dec	0.2 - 1.5m
Gompholobium scabrum	painted lady	Aug - Nov	to 1.5m
Grevillea diversifolia	variable leaved grevillea	Apr - Jan	1 - 6m
Grevillea occidentalis	n/a	May - Feb	0.4 - 1.8m
Grevillea pulchella	beautiful grevillea	Jun - Mar	0.2 - 1.5m
Hakea ruscifolia	candle hakea	Dec - Jun	to 3m
Hibbertia cuneiformis	cutleaf hibbertia	Jul - Dec	2.5m
Hovea elliptica	tree hovea	Aug - Dec	0.6 - 3m
Hovea pungens	devil's pins	May - Nov	0.2 - 1.8m
Hypocalymma angustifolium	white myrtle	Jun - Nov	0.2 - 1.8m
Isopogon formosus	rose cornflower	Jun - Dec	0.2 - 2m
Lavandula dentata	French lavender	Jul - Nov	to 1m
Leucopogon verticillatus	tassel flower	Aug - Nov	0.8 - 1.5m
Melaleuca incana	grey honey myrtle	Jul - Nov	0.7 - 3m
Melaleuca lateritia	robin redbreast bush	Sep - Jun	0.4 - 2m
Olearia axillaris	salt bush	Jan - Jul	0.5 - 3m
Rosmarinus officinalis	rosemary		
Templetonia retusa	cockies tongue	Apr - Nov	0.3 - 4m
Westringia dampieri	n/a	Jun - Jan	0.2 - 1.5m
Approved Small trees to 10m			
Botanic name	**Common name**	**Flowers**	**Size**
Agonis flexuosa	peppermint (Mt Hallowell)	Jul - Dec	to 10m
Banksia attenuata	coast banksia	Oct - Feb	0.4 - 10m
Banksia grandis	bull banksia	Sep - Jan	1.5 - 10m
Corymbia ficifolia	red flowering gum	Dec - May	2 - 10m
Corymbia ficifolia	red flowering gum	Dec - May	2 - 10 m
Dryandra formosa	showy dryandra	May - Dec	to 4m

Hakea oliefolia	olive leafed hakea	Aug - Oct	2 - 10m
Homalospermum firmum	n/a	Aug - Dec	0.3 - 8m
Kunzea ericifolia	granite kunzea	Jul - Dec	1 - 3m
Kunzea sulphurea	n/a	Sep - Nov	1 - 3.5m
Melaleuca rhaphiophylla	swamp paperbark	Aug - Nov	to 10m
Persoonia longifolia	snottygobble	Nov - Feb	1 - 5m
Taxandria parviceps	n/a	Jul - Oct	to 4m
Templetonia retusa	cockies tongues	Apr - Nov	0.5 - 4m
Trymalium floribundum	karri hazel	Jul - Dec	to 9m

Trees 10m plus			
Botanic name	**Common name**	**Flowers**	**Size**
Allocasuarina decussata	drooping sheoak		to 15 m
Allocasuarina fraseriana	sheok	May - Oct	5 - 15m
Corymbia calophylla	marri	Dec - May	to 40m
Eucalyptus cornuta	yate	Jan - Nov	2 - 25m
Eucalyptus megacarpa	bullich	Ap - Nov	to 30m
Fraxinus 'Raywoodii'	claret ash		
Jacaranda mimosaefolia	jacaranda		
Liquidamber styraciflua	liquidamber		

25.1.6 HARDSTAND VERGE TREATMENTS

Council permits no more than one third of the verge area (excluding any vehicle crossing) to be sealed with brickpaving, concrete or bitumen. The remaining area is to be treated by sealing is 3.0 metres wide, measured from the back of the kerb and running parallel to the kerb in the verge abutting the property, or alternatively an area of equal size.

If a footpath exists in front of the property, the portion of the verge between the kerb and the footpath is permitted to be sealed. Refer to Engineering's Standard Drawings for options available.

Brick Paving

Schedule of requirements

1. Pavers — Minimum 70mm heavy-duty rectangular or square.
2. Brick Paving Pattern — Refer to Standard Drawing ES07-8-0.

3.	Sand bed	20mm - 40mm thick.
4.	Sub-base	100mm gravel or rock base.
5.	Edge restraints	250mm wide and a minimum of 80mm deep concrete edge restraint robust enough to withstand vehicle impact and prevent any lateral movement of the bricks. Visible edge restraints shall be installed flush to the level of the pavers.
6.	Verge gradient	A positive 2% slope from the top of the kerb towards the property boundary.

PLEASE NOTE:

Council will not accept liability for replacing any paving bricks, concrete or asphalt located on verges as part of verge treatments, which are subsequently damaged through works undertaken.

Concrete

Schedule of requirements

1.	Depth	100mm Minimum
2.	Contraction Joints	Minimum depth of 20mm at 2.5m centres. The joints shall be placed at right angles to the kerb.
3.	Expansion Joints	Bitumen impregnated joints are not permitted.
4.	Strength	Concrete high early strength to 20 Mpa at 28 days
5.	Surface Finish	Broomed non -slip.
6.	Verge gradient	A positive 2% slope from the top of the kerb towards the property boundary.
7.	Delineation	Verge infill is to be delineated from existing paths.

Asphalt

Schedule of requirements

1.	Base Course	Minimum 150mm thick crushed rock free from sand, loam, capstone, roots or other organic matter. The rock must be compacted and water bound to a smooth finish.
2.	Pavement	A 30mm thick pavement of 7mm nominal aggregate bituminous concrete.
3.	Edge Restraints	A 100mm wide by 150mm deep concrete edge restraint shall be constructed to the outside edges of asphalt. The surface of the edge restraint shall be non-slip broomed finish and shall be flush with the surface of the asphalt pavement.
4.	Verge Gradient	A positive 2% slope from the top of the kerb towards the property boundary.

25.1.7 COMPACTED UNBOUND HARDSTAND AREAS

Compacted unbound material is an acceptable treatment on verges adjoining residential properties provided that the material is less than 19mm nominal size, well graded, waterbound and compacted, or stabilised, to a hard, smooth finish. The depth of such material must be an absolute minimum of 150mm.

This treatment is not permitted on verges, which adjoin properties housing non-residential activities, for example childcare centres, businesses.

Poorly graded materials such as river stone, crushed brick and other decorative treatments are not permitted unless incorporated into a defined and approved landscaping plan.

Crossovers and Driveways

ALL Crossovers and Driveways up to the property boundary must be sealed and maintained to Council Standards. Approved Treatments are Concrete, Heavy Duty Interlocking Brick Paving, Road base and Bitumen. Please obtain Council's specification for Crossovers prior to commencing Works.

IMPORTANT NOTE: You may be eligible for a Council provided subsidy when up-grading or carrying out new works.

25.1.7 CONDITIONS APPLICABLE TO ALL VERGE TREATMENTS

1. The owner agrees to maintain the area so as not to cause a hazard. Failure to comply may result in removal of the treatment by the Shire's workforce at the owner's expense.

2. All verge treatments are to be kept in a safe and tidy condition.

3. Approval must be obtained through Engineering Services for any alternative treatments, or treatments that do not comply because of verge size, distances etc.

4. The verge must be generally maintained at a positive 2% gradient from the top of the back of the kerb (real or imagined) to the front property boundary. Any alteration to this gradient must be approved by the Manager Engineering Services.

5. No uncompacted gravels, crushed bricks or loose stones are permitted on verges unless specifically approved as part of landscaped treatment. These are easily displaced collecting on the road, footpath and adjoining properties thus posing a hazard to pedestrians and other road users.

6. The placement of obstructions on verge areas is not permitted. Obstructions are objects that could be dangerous to, or restrict access of pedestrians, motor vehicles and cyclists e.g. rocks, stakes and string, fencing, bricks etc.

7. No sporting equipment (i.e.: basketball hoop/stand, cricket wickets etc) may be positioned temporarily or permanently within the verge area**.** When basketball hoops are located on private property please be mindful of the direction the hoop faces so as to prevent balls entering the road and neighbouring properties.

8. Council reserves the right to remove or disturb any verge treatment for the purpose of carrying out public works, without being liable to compensate any person for such loss and without having to reinstate any treatment including grass or reticulation.

9. No assistance shall be provided by Council for development, ongoing operation, or maintenance costs.

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