



City of
Greater Geraldton
a vibrant future



LAND DEVELOPMENT SPECIFICATIONS



March 2012

Adopted by City of Greater Geraldton Council on 26 June 2012

LAND DEVELOPMENT SPECIFICATIONS

PART A – CITY OF GREATER GERALDTON SPECIFIC ISSUES

Contents

1	ADMINISTRATIVE REQUIREMENTS.....	5
1.1	INTRODUCTION	5
1.2	DEFINITIONS	6
1.3	REFERENCED DOCUMENTATION	6
1.4	RESPONSIBILITIES.....	6
1.5	DOCUMENTATION TO BE SUBMITTED FOR APPROVAL.....	7
1.6	FINANCIAL MATTERS (FEES, BONDS AND CONTRIBUTIONS PAYABLE)	10
1.7	QUALITY CONTROL.....	13
1.8	INSPECTION AND SUPERVISION BY CONSULTANTS	15
1.9	INSPECTION BY THE LOCAL GOVERNMENT OFFICER(S)	15
1.10	CLEARANCES	16
2	SITE PREPARATION AND EARTHWORKS.....	17
2.1	DISPOSAL OF MATERIALS.....	17
2.2	USE OF EXPLOSIVES.....	17
2.3	ACCEPTANCE	17
2.4	DISPOSAL OF SURPLUS SPOIL	17
2.5	POST-DEVELOPMENT ROAD AND LOT LEVELS	18
2.6	COMPACTION EQUIPMENT	18
2.7	COMPACTION	18
2.8	TOLERANCES	19

LAND DEVELOPMENT SPECIFICATIONS

2.9	SOIL STABILISATION.....	20
3	ROAD GUIDELINES.....	24
3.1	GENERAL, POLICIES AND STANDARDS	24
3.2	DESIGN.....	24
3.3	QUALITY ASSURANCE	34
4	STORMWATER DRAINAGE GUIDELINES	35
4.1	GENERAL, POLICIES AND STANDARDS	35
4.2	DESIGN.....	36
5	STREETScape GUIDELINES.....	40
5.1	GENERAL, POLICIES AND STANDARDS	40
5.2	DESIGN.....	40
6	PUBLIC OPEN SPACE GUIDELINES.....	47
6.1	GENERAL, POLICIES AND STANDARDS	47
6.2	DESIGN.....	47
7	STANDARD DETAILS.....	48



City of
Greater Geraldton
a vibrant future



LAND DEVELOPMENT SPECIFICATIONS

PART A

CITY OF GREATER GERALDTON

SPECIFIC ISSUES

LAND DEVELOPMENT SPECIFICATIONS

1 ADMINISTRATIVE REQUIREMENTS

1.1 INTRODUCTION

As a result of continuous change in development associated industries and practices, including amalgamations of local authorities, the City of Greater Geraldton Local Government (CGG) supports pursuing the path of standardising the minimum design requirements for subdivisional and related development in order to improve consistency amongst the diverse compliance obligations required from Consulting Engineers and Developers. It is envisaged that the requirements and governance of these specifications will be acknowledged as an attempt to enhance quality control which will be to the benefit of both the CGG and the Proponent.

The following will serve as the basic guidelines of subdivisional and related development requirements, together with their respective referenced documentation: The City of Greater Geraldton Land development specifications will need to be read in conjunction with the following (but not limited to):

- i) **“Local Government Guidelines for Subdivisional Development Edition 2 – 2011” (LGGSD Ed2-2011)** available from the Institute of **Public Works Engineering Australia (IPWEA)**,
- ii) **“Liveable Neighbourhoods** a West Australian Government sustainable cities initiative” (October 2007) by the (former) **Department for Planning and Infrastructure** (now the Department of Planning [DOP]), **Western Australian Planning Commission (WAPC)** and
- iii) **“Stormwater Management Manual” & “Better Urban Water Management”** by the **Department of Water (DoW)**.
- iv) **AUSTROADS – Road guidelines**

The minimum relevant specifications as prescribed in the appropriate Australian Standards will always serve as the design specification unless otherwise noted. Wherever any subject is covered in this document, the corresponding clauses in the *LGGSD Ed2-2011* should be read in conjunction. The majority of construction related issues are covered sufficiently by the *LGGSD Ed2-2011* and therefore, this document is mainly focused on addressing administrative and quality assurance issues e.g. the submission requirements before and after approval, although, issues on which the CGG prefers to deviate from the *LGGSD Ed2-2011* or where issues requires additional attention, are covered as well.

LAND DEVELOPMENT SPECIFICATIONS

No guidelines and/or specifications from any document whatsoever shall relieve the Consulting Engineer from their professional responsibility for the design of services to higher specification(s) when and where required, e.g. when site specific conditions, test results, or any other conditions require a higher standard. It will remain the Consulting Engineer's responsibility to carry out all design work in accordance with the relevant design specifications and have all tests required for adequate design, performed and endorsed by an accredited "National Association of Testing Authority" (NATA) laboratory.

1.2 DEFINITIONS

Refer to Module 9 of the LGGSD Ed2-2011.

1.3 REFERENCED DOCUMENTATION

References are made to several other documents and associated web sites, which in turn, may reference or imply further references, all of which shall be applicable. Where these documents are in conflict or cause ambiguity, the consultant must notify the CGG and a preferred practice shall be discussed and agreed upon. The references that are applicable to the latest editions, updates and volumes, will be the responsibility of the Consulting Engineer to familiarise themselves with the contents and updates.

For referenced documents, refer to the LGGSD Ed2-2011.

1.4 RESPONSIBILITIES

Developers and their Consultants are encouraged to consult with the CGG at the earliest stage possible when developing a design in order to clarify any ambiguities and prevent delays.

The approval of any drawings, documents, designs, technical reports or similar will not transfer the responsibility from the Consulting Engineer to the CGG. Any visual inspection or the acceptance of any test results will not transfer the responsibility from the Consulting Engineer to the CGG. Similarly, approval through inspection by the CGG of any construction work, only confirms compliance of the visually observed part(s) of the Works as having been constructed, in positions / locations and to approximate dimensions shown on the approved drawings.

LAND DEVELOPMENT SPECIFICATIONS

1.5 DOCUMENTATION TO BE SUBMITTED FOR APPROVAL

The CGG has the following specific requirements.

Prior to commencement of any construction work, the developer or the appointed Consultant(s) must submit the documents listed below to the CGG for approval:

- a) Design or Technical Report – refer to 1.5.1 for format of this report;
- b) Geo-Technical Report (integrated into the Design/Technical Report or as a standalone document); must demonstrate the sumps infiltration rate.
- c) Any other reports, relevant to the specific application, if and when required, (integrated into the Design / Technical Report or as a standalone document); and
- d) Drawings (reduced to A3 size if clarity prevails, integrated into the Design / Technical Report however, two (2) sets of full scale drawings must still be submitted additionally for final written approval).

No construction work shall commence without both the design report and each of the drawings having been stamped, signed and dated, as “approved”, by the CGG.

1.5.1 DESIGN/TECHNICAL REPORT

A comprehensive Design/Technical Report must be submitted together with the drawings. The main purpose of the Design / Technical Report is to provide the CGG with fully documented design information in order to assess the application at the time of submission, but also when future planning, scheme amendments, etc., are applied for. The Design / Technical Report must include, but is not limited to, the following information:

- a) Cover page showing the official locality in which the development is proposed (e.g. Drummond Cove) and the commercial / estate name of the development and stage number if applicable (e.g. “Glenfield Beach” Stage 4);
- b) Description of existing Lot number(s) or other existing property description including adjoining street name(s), easement(s) / right of way(s) and current owner(s);
- c) Locality plan;
- d) Index page(s);
- e) Information page containing full name, contact details of the Developer and all Consultants including Geotechnical Engineer, Surveyor and Contractor;
- f) Proposed development new Lot number(s);
- g) The Consultant must stipulate if the current capacity of all existing drainage services is according to calculations and capable of handling the additional load.

LAND DEVELOPMENT SPECIFICATIONS

- h) The design criteria are to include all sources of assumed information including reference to the design standards and documents. All calculations including checks on existing services downstream due to the proposed development to have calculations determining sump volumes and seepage / infiltration rates and copies of all test results required for the design (testing to be carried out by a NATA approved soils Laboratory);

Soil stabilisation strategy and treatment based on the classification assessment in accordance with “A Guide for the Prevention of Dust and Smoke Pollution from Land Development Sites in Western Australia” by the (DEC) Department of Environmental and Conservation. 2.2.1.5.4 *LGGSD Ed2-2011*.

- a) Cost break down of works for Earthworks, Roads, Drainage, Public Open Space and Streetscape;
- b) Description of the proposed finish to Public Open Space, parks, refuges and verges;
- c) A Stormwater Drainage Management plan based on Urban Water Management Plan (DoW) and Water Sensitive Urban Design guidelines is to be submitted either separately or as part of this Design / Technical Report; and
- d) The final approved report must be submitted to the CGG in electronic format as well as hard copy.

1.5.2 DRAWINGS

The CGG will follow the guidelines as per Module No. 7 of the *LGGSD Ed2-2011*. The Consultant must ensure that all line, text, dimension and hatching types, styles, weights and thicknesses have been checked on the drawings for neatness, clarity and accuracy, before submission.

Landscaping and streetscape planting concept design or detailed design must form part of the submitted drawings to be assessed by the CGG. Refer to section 5 (CGG Land Development Specifications) – Landscaping – 5.2.3, street trees - 5.2.3.1.

If a concept Landscape plan is submitted for approval, the detailed design plan must be submitted within 6 months after the start of the development construction and be implemented before any clearance will be approved or is sufficiently secured by a bond or bank guarantee.

The CGG reserves the right to request any further information.

LAND DEVELOPMENT SPECIFICATIONS

1.5.3 AS CONSTRUCTED DRAWINGS

“As Constructed” drawings shall be submitted to the CGG prior to any clearances being signed off by the CGG.

The City is a member of the A-SPEC consortium and requires drawings to be submitted in accordance with the specification.

A-SPEC is the acronym for the program involved in developing specifications for the delivery of newly constructed assets as Digital Data in a GIS ready format to Local Government. The A-Spec management model enables Local Government authorities around Australia to participate in the development and use of the standards developed under this program.

The main objectives of the A-SPEC initiative is to streamline stake holders’ (local government/utilities) processes for receiving, handling and storing of infrastructure related to newly constructed assets either from subdivision developments or internal programs in their GIS and AMIS.

1.5.3.1 USE OF THE SPECIFICATIONS

The specifications are for use by Private Developers, the representatives of Private Developers, engineering consultants and surveyors who undertake Land Development or Capital Works activities for one or more members of the A-SPEC consortium. A key objective of these specifications is to provide information to the Consultants that will be dealing with A-SPEC consortium members. The standards outline the specific requirements for the submission of Survey Enhanced “As-Constructed Measurements” of works as digital data of newly constructed assets.

Therefore it is a requirement of consultants to comply with the relevant specifications upon completion of each project when submitting the as constructed data. This does not release consultants of the requirement to supply all or any other material as specified by council, as the digital data will form part of the council’s GIS and Asset Management Information systems.

A-SPEC training will be available to consultants to ensure compliance with the specification.

LAND DEVELOPMENT SPECIFICATIONS

1.6 FINANCIAL MATTERS (FEES, BONDS AND CONTRIBUTIONS PAYABLE)

CGG may at its discretion accept cash or bank guarantees for bond monies and contributions are payable prior to the signing off of any Clearances. The following fees, bonds and contributions are applicable

- a) Inspection Fee in accordance with the Local Government Act 1995 Section 295(6);
- b) Defects Liability (Maintenance) Bonds;
- c) Contributions as per 1.6.3

1.6.1 INSPECTION FEES

Prior to commencement of any work, an Inspection Fee as calculated below must be paid to CGG. The Planning and Development Act 2005, Part 10, Division 4, Section 158, 3 (b) makes provision for the Developer to pay to the local government an amount equal to 1.5% of the total construction cost of the road works and drainage construction, In the case where a Consulting Engineer is not engaged, this fee will be increased to 3 % of the same total cost.

The Consulting Engineer must submit the relevant amounts of the accepted tender / quotation as part of the Design / Technical Report. The CGG will issue an invoice to the Consultant for payment. **The initial invoiced fee is due for payment prior to the commencement of any work.**

1.6.2 BONDS AND DEFECTS LIABILITIES

Refer to Module 1 Cl 1.20-1.21 of the LGGSD Ed2-2011.

Bonds are required to ensure that the constructed works perform to their intended purpose. The periods required differ depending on the type of bond.

The bond amounts due must therefore be calculated and shown separately for the following services:

- a) Dust Control Bond:
 - i) Soil Stabilisation
- b) Defect Liability Bonds:
 - i) Road works including road earthworks bond (road earthworks can be assumed to constitute 5% of the total earthworks amount);
 - i.) Stormwater Drainage works including associated earthworks bond;

LAND DEVELOPMENT SPECIFICATIONS

- ii) Streetscape maintenance bond;
- iii) Landscape bond including earthworks, where applicable, e.g. POS's, verges, pathway construction etc.

1.6.2.1 Soil Stabilisation Bond and Defects Liability Period

Refer to Module 2 CI 2.2.1.5.5 of the LGGSD Ed2-2011.

The soil stabilisation bond shall cover any soil stabilisation work required on land owned by the developer, including land ceded for public purposes, and for any clean up works that may be necessary on adjacent lands caused by wind erosion emanating from the subdivisional works.

The area to be used for calculations will include the area to be disturbed during development therefore inclusive of road reserves, lots and public open space. The CGG will regard all areas as Site Classification 4 – High Risk and the bond amount will be calculated at AU\$ 3,600.00/ha excl. GST unless the Consultant can provide an acceptable assessment according to the Department of Environment and Conservation (DEC) guidelines.

The bond money will be retained until the Defect Liability Inspection or the stabilisation has been conducted and approved by the CGG. The Defect Liability Period shall be at least 12 months but including one full summer and one full winter period, and is to commence upon the date of certified Practical Completion by the CGG.

1.6.2.2 Road Works Maintenance Bond and Defects Liability Period

All bond amounts for defects liability / maintenance purposes shall be calculated as 5% of the total construction cost of the particular infrastructure as noted below. The Defects Liability Period for roads shall be for duration of twelve (12) months commencing on the date of certified Practical Completion by the CGG.

The Developer will be responsible for any defect, damage caused by vandalism within the development until the date of the final completion inspection and Certification by the CGG.

1.6.2.3 Stormwater Drainage Works Bond and Defects Liability Period

The Defects Liability Period for all drainage and associated work shall also be for the duration no less than twelve (12) months and, shall include at least one full rain season. The date of the commencement shall be the date of the certified Practical Completion by the CGG.

LAND DEVELOPMENT SPECIFICATIONS

1.6.2.4 Streetscape Maintenance Defects Liability Period – (where applicable)

Refer to Module 5 Cl 5.3.8 of the LGGSD Ed2-2011.

The Maintenance and Watering period shall include at least two summer periods. Design performance of any infiltration basin must be demonstrated prior to clearance.

1.6.2.5 Landscape Maintenance – (where applicable)

Refer to Module 6 Cl 6.3.3.4 of the LGGSD Ed2-2011.

All landscaping and grassing shall be supported by a Maintenance and Watering period to include no less than two summer periods to ensure full establishment. The landscape maintenance bond shall be equal to 5% of the contract value for the landscape works (ex GST) as determined by CGG and held in trust until POS handover. Marine Works Bond – (where applicable)

All bond amounts for defects liability/maintenance purposes shall be calculated as 5% of the total construction cost. The Defects Liability Period shall be for the duration of five (5) years commencing on the date of certified Practical Completion by the CGG.

1.6.3 CONTRIBUTIONS

1.6.3.1 Street Tree Contribution – Payment In-Lieu

It is preferred by the CGG that street trees are planted by the developer on both sides of the road and are well staked to assist in the identification of their location. The developer may prefer to contribute to the street tree planting at which the trees will be planted at the convenience of the city in the winter months. This contribution will be calculated at one tree per 20 metres of road length. The amount of the contribution per tree shall be as per the current City of Greater Geraldton Fees and Charges schedule.

1.6.3.2 NOTIFICATIONS AND HOURS OF WORK

The CGG shall be notified in writing no less than 5 working days before the commencement of any works and immediately upon the cessation of work and 1 day before recommencing any works.

LAND DEVELOPMENT SPECIFICATIONS

WORKING HOURS

Working hours on-site shall be as set out in the following table, unless approved otherwise in writing by CGG where extraordinary circumstances exist.

Day	Period
Monday – Friday	7.00am to 6.00pm
Saturday	8.00am to 5.00pm
Sunday	Nil
Public Holidays	9.00am to 5.00pm where prior approval is given by the CGG. (No work shall be permitted on the following days; Christmas Day, Boxing Day, Good Friday and Anzac Day.)

1.6.4 SIGN BOARD AND NOTIFICATIONS

Refer to Module 1 Cl 1.16 of the LGGSD Ed2-2011.

The Developer shall erect a sign board at the entry to the site indicating the name of the Developer, Consulting Engineer(s), Surveyor(s) and Contractor(s). The sign shall indicate a telephone number for the public to call in the event of issues arising from the development works. *The sign shall be erected at least seven (7) days prior to commencing works on site.*

1.7 QUALITY CONTROL

1.7.3 TESTS

Refer to Module 1 Cl 1.17.5 of the LGGSD Ed2-2011.

All relevant testing required for design and / or quality control over materials and construction methods will be arranged for by the Consulting Engineer. All testing will be carried out by an approved NATA registered soils laboratory in accordance with the relevant Australian Standards at the appropriate stages of the project as required.

The Consulting Engineer must notify the CGG in writing immediately after test results become available. Copies of all test results accepted or not, must be attached. A detailed “Plan of Action” for the appropriate remedial work is to be prepared resulting from failed tests must also be included in this correspondence. No Clearance shall be granted by the CGG if all tests results have not been submitted and passed by the CGG.

LAND DEVELOPMENT SPECIFICATIONS

Where testing for construction purposes can be carried out with a Perth Sand Penetrometer (PSP), this will be allowable only if the calibration certificate of the PSP is measured against a nuclear density meter, and the calibration report is supplied to the CGG.

1.7.4 TEST CERTIFICATE REQUIREMENTS:

The CGG reserves the right to, where reasonable, to require any further test results at its sole and absolute discretion, in which case all associated costs shall be borne by the Developer. Test results required but not limited to, are:

- i) Sub-grade: California Bearing ratio (CBR), Particle Size Distribution (PSD), Maximum Modified Dry density (MMDD), Uniclass Soil classification, Plasticity Index (PI) and where applicable soil permeability (1 x CBR for every 1500M³ of pavement construction material, 1 x PSD and PI for every 500M³ pavement construction material, 6 x Random sites selected for MMDD insitue compaction test for every 500 lineal metres of constructed pavement)
- ii) Base course: California Bearing ratio (CBR), Particle Size Distribution (PSD), Maximum Modified Dry density (MMDD), Uniclass Soil classification and Plasticity Index. 1 x CBR for every 1500M³ of pavement construction material, 1 x PSD and PI for every 500M³ pavement material, 9 x Random sites selected for MMDD insitue compaction test for every 500 lineal metres of constructed pavement.
- iii) Sub-grade, Sub-base and Base course compaction test results;
- iv) Primer seal / seal coat application rates;
- v) Bituminous concrete aggregate Particle Size Distribution, bulk density, bitumen content and marshal stability;
- vi) Concrete mixes (copies of delivery dockets);
- vii) Hydro-mulch application rates and consistency;
- viii) Seeding and fertiliser applications rates;
- ix) Footpath sub grade compaction results and
- x) Concrete path construction thickness audit results.

Note:

1. Prior to placement of pavement material (sub base and base course) the sub-grade shall be proof rolled in the presence of a CGG nominated officer, using a tandem axle vehicle loaded to capacity with no less than 10 tonnes of material or 10,000lts of water. Where deflection in the sub grade occurs and the section is directed to be replaced by the CGG nominated officer, the material to the extent directed shall be removed and replaced with suitable material placed and compacted and a further proof rolling will take place. No pavement material shall be placed until the sub grade passes the proof rolling test.

LAND DEVELOPMENT SPECIFICATIONS

2. The pavement material shall be placed in layers and each layer shall be proof rolled and passed by the CGG nominated officer.
3. Prior to placing any bituminous spray seal or asphalt the final pavement layer shall be proof rolled and passed by the CGG nominated officer.

1.7.5 MATERIAL, INSTALLATION AND CONSTRUCTION

All materials used, as well as installation and construction methods, shall be in accordance with the manufacturer/s / supplier's specifications and all applicable Australian Standards (AS/NZ) document(s). The onus is on the Consulting Engineer and / or the Contractor to be acquainted with the latest and all of the applicable specifications and standards. (Attention is specifically drawn to the laying of stormwater pipe materials). The CGG may at any stage require proof of compliance of materials used to be submitted.

1.8 INSPECTION AND SUPERVISION BY CONSULTANTS

Refer to Module 1 Cl 1.17.3 of the LGGSD Ed2-2011.

It is emphasised that Consultants must ensure the works to be inspected are acceptable, before notifying the CGG to conduct any audit inspection(s).

1.9 INSPECTION BY THE LOCAL GOVERNMENT OFFICER(S)

Refer to Module 1 Cl 1.17.4 of the LGGSD Ed2-2011.

A written notice 48 hours in advance (preferably in "Outlook Appointment Invitation" for acceptance format) will generally be regarded as a reasonable minimum period. The purpose of inspections by the CGG officers is to verify that the relevant work to be inspected, complies with the standards required by the CGG only. Adequacy of design remains the Consulting Engineer's responsibility.

The Contractor must have a full set of approved construction drawings at all times on site during the construction period.

1.9.3 PRACTICAL COMPLETION INSPECTION

Refer to Module 1 Cl 1.18 of the LGGSD Ed2-2011.

The Consulting Engineer must ensure that the works and performance thereof have been inspected and approved prior to arranging for the Practical Completion inspection by the CGG.

LAND DEVELOPMENT SPECIFICATIONS

1.9.4 DEFECTS LIABILITY (MAINTENANCE) – FINAL INSPECTION

Refer to Module 1 Cl 1.21.1 of the LGGSD Ed2-2011.

The Consulting Engineer must request (preferably via an electronic invitation) the CGG officer to conduct a final inspection of the appropriate service after the applicable defects liability period has expired. Defects liability periods can be extended past the twelve month duration particularly in “brown field” developments and this should be negotiated between the developer and the CGG (particularly if performance of engineered assets has not been confirmed during defects liability period). If the performance of all constructed work is found to be acceptable, the Consultant may request the CGG in writing for the release of the relevant bond monies.

Note: The Developer will be responsible for any damage or vandalism within the development up to the date of Certified Final completion by the CGG.

1.10 CLEARANCES

Refer to Module 1 Cl 1.19 of the LGGSD Ed2-2011.

No clearance will be finalised until the “As Constructed” drawings have been submitted in accordance with A SPEC.

LAND DEVELOPMENT SPECIFICATIONS

2 SITE PREPARATION AND EARTHWORKS

Refer to Modules 2 & 8 of the LGGSD Ed2-2011.

2.1 DISPOSAL OF MATERIALS

Refer to Cl 2.2.1.5.6 of the LGGSD Ed2-2011.

The preferred methods of disposal of materials from the site are:

- a) Chipping and mulching for soil stabilisation;
- b) Transplanting appropriate species;
- c) Stacking and cutting of timber for fire wood sale or collection; and
- d) Transferring to the local refuse facility.

Burning of any material or debris will not be permitted.

2.2 USE OF EXPLOSIVES

Refer to Cl 8.3.1.5.4 of the LGGSD Ed2-2011.

Explosives shall not be used without the permission of the CGG's Director of Community Infrastructure as per Regulation 115 of the Explosives and Dangerous Goods Act (Regulations). The Contractor shall obtain all legally required approvals and licences from all the appropriate Authorities. The Shot Firer must submit a "Blast Pattern" diagram to the CGG Director Community Infrastructure prior to operations.

No explosives shall be stored on site.

Note: The use of explosives may only be approved in extreme circumstances.

2.3 ACCEPTANCE

Prior to practical completion of the subdivisional works the entire site of the works including verges and lots, is to be trimmed, graded and compacted in order to achieve a uniformly neat and tidy site. Machine wheel/track ruts are unacceptable.

2.4 DISPOSAL OF SURPLUS SPOIL

Spoil areas must be filled in accordance with requirements for general filling, topsoil must be respread on completion of filling and seeded as specified. All excess material shall be disposed only at a site approved by the CGG nominated officer.

LAND DEVELOPMENT SPECIFICATIONS

2.5 POST-DEVELOPMENT ROAD AND LOT LEVELS

It is the sole responsibility of the Consulting Engineer to design the post-development levels such as to ensure that future driveways to lots will comply with CGG policy and specifications (AS/NZS 2890.1:2004) for the construction of crossovers. Where this is not achievable and ramps are found not to conform to these standards, a civil engineer certified alternate design maybe requested at the time of building licence assessment.

No encroachment of any transitions or driveway ramp structures, including retaining walls, will be allowed inside the verge width.

Refer to CGG Crossover Specifications – www.cgg.wa.gov.au

2.6 COMPACTION EQUIPMENT

Compaction equipment must be suitable for the material being compacted and, unless otherwise permitted, must include at all times during compaction operations at least one roller of each of the following types:

- a) Pneumatic Tyred Rollers: to be of adjustable mass up to at least 4 tonne per wheel. Roller mass shall be uniformly distributed over all wheels. Tyre pressures to be adjustable up to at least 700kPA.
- b) Vibratory Rollers – may be either self-propelled or drawn. The vibrating roller may be of sheep's foot or smooth drum type. The static load intensity is not to be less than 18 kN/m of a vibrating roller width.

The use of other types of rollers, e.g. grid rollers, may be approved subject to the suitability for the material being compacted and achievement of specified densities.

2.7 COMPACTION

The maximum layer thickness must be 150 mm compacted. However, greater thicknesses may be permitted subject to the ability of compaction equipment to achieve specified densities. No layer shall be less than 100 mm deep after compaction. Each layer shall be compacted to the appropriate density prescribed in Table 2.1.

During compaction the optimum moisture content (OMC) is to be within 2% by drying or the addition moisture as appropriate. Water spraying equipment used for this purpose must be capable of distributing water uniformly in controlled quantities over uniform lane widths. The material must be mixed thoroughly to ensure uniform distribution of moisture before rolling commences.

LAND DEVELOPMENT SPECIFICATIONS

NATA approved laboratory test results will be required on all compaction work for moisture content of soil and granular pavement material using the convection oven method. WA 110.1 or AS 1289.2.1.1. Microwave soil moisture testing is acceptable as a preliminary test to allow works to proceed and shorten delays. On request, Proof rolling and other non-destructive test methods must be provided at the time of the audit inspection at the work site by a City officer. These will be used to confirm compliance with the Land development specifications.

Table 2.1

ITEM		COMPACTION REQUIREMENT
1	Backfilling of grub holes	Density of surrounding undisturbed soil
2	Replacement of unsuitable material in cuttings other than sub-grades	Density of surrounding undisturbed soil
3	Replacement of over excavation	95% of modified maximum dry density
4	General fill	95% of modified maximum dry density
5	All embankments	95% of modified maximum dry density
6	Backfill within 2m of structures	95% of modified maximum dry density
7	Replacement of unstable sub-grade material	95% of modified maximum dry density
8	Cut sub-grade in earth	95% of modified maximum dry density
9	Lots	95% of modified maximum dry density
10	Verges	95% of modified maximum dry density

2.8 TOLERANCES

Before placement of covering materials, finished surfaces shall conform to the tolerances in level and shape itemised in Table 2.2.

Table 2.2

ITEM		TOLERANCES
1	Clearing and grubbing (width of design earthworks plus 2m)	0.5m
2	Bulk Earthworks – level	50mm
3	Verge level	10mm
4	Topsoiling thickness	100mm minimum

LAND DEVELOPMENT SPECIFICATIONS

2.9 SOIL STABILISATION

Refer to Module 2 Cl 2.2.1.5.3, 8.3.1.5.5 of the LGGSD Ed2-2011.

It is the Developer's responsibility to adequately control erosion on the site caused by wind and water, both during the construction phase and post-construction, until such time as the land ownership is transferred. The Developer is required to submit:

- a) A Site Classification Assessment Chart from the "A Guideline for the Prevention of Dust and Smoke Pollution from Land Development Sites in Western Australia Department of Environment and Conservation (DEC) November 1996;
- b) A Soil Stabilisation Strategy, i.e. a planned programme of soil stabilisation measures that will be undertaken on-site in accordance with the DEC guidelines and 2.9.1 below;
- c) Soil Stabilisation Bond (refer to 1.6.2.1 above).

2.9.3 SOIL STABILISATION STRATEGY

Refer to Module 2 Cl 2.2.1.5.4, 2.2.1.5.5 of the LGGSD Ed2-2011.

To prevent dust nuisance to adjacent properties CGG may direct that no earthworks, including stripping, filling, trenching or placing of topsoil, be carried out when wind, soil and climatic conditions are such as to cause or likely to cause dust or sand drift to affect properties.

There is to be sufficient water carts provided for the area of land cleared in the subdivision to provide dust suppression throughout the site on any one day, including days where works are not carried out or suspended for whatever reason.

2.9.4 ENVIRONMENTAL MANAGEMENT PLAN

A number of emissions are generated by development; these include noise and air emissions. It is necessary for individual industrial developers to take all reasonable and practicable measures to prevent or minimise emissions. It is generally expected that through appropriate implementation of engineering and process controls, emissions from a development can be prevented from causing an adverse environmental impact beyond the boundaries of a particular site.

LAND DEVELOPMENT SPECIFICATIONS

The CGG will require the preparation and approval of an Environmental Management Plan setting out in detail the management commitments applicable to emissions minimisation relevant to all activities and processes. The Management Plan shall demonstrate that emissions will achieve compliance with the relevant requirements of the Environmental Protection Act/Regulations and should address issues such as noise, vibration, dilapidation reports and dust.

2.9.5 OPERATIONAL PERIOD (SEASONS) AND EARTWORKS TIME LIMITS

The rain season is regarded to be from the 1st of March until the 1st of October. As a result of dust related issues in the Midwest region, no bulk earthworks will normally be allowed to commence before the 1st of March and continue past the 1st of October. Although, the CGG may allow earthworks within the road reserve to continue following a written request with an approved valid reason and dust management plan from the Consulting Engineer. Where circumstances necessitate bulk earthworks to be carried out before or after the time limit specified above, the Developer and Consulting Engineer may approach the CGG to apply for conditional approval in writing. Such cases will be dealt with on individual basis, where the CGG is under no obligation to allow work to proceed outside the seasonal period.

2.9.6 METHODS

Stabilisation of the soil shall be carried out in accordance with the Soil Stabilisation Strategy approved by the CGG at the commencement of the land development. All materials and soils used for stabilisation are to be approved by the CGG. The following three (3) methods are generally approved but other innovative methods will be considered after submission to the CGG for approval and prior to the application thereof.

The Developer shall allow for reseeding in all areas where seed failed to germinate, within one (1) month from the date of original seeding. *Where germination has not taken place satisfactorily, reseeding may be required by the CGG at the expense of the Developer, whereby the Defects Liability period for Soil Stabilisation will be extended accordingly.*

2.9.6.2 Hydro-mulching and Seeding

Stabilisation must be carried out by an experienced and reputable soil stabilisation company employing supervisory personnel. The application rate in soft soils shall be three (3) $\text{l/m}^2 = 30\,000\ \text{l/ha}$. The seed and fertilizer shall only be applied before the first winter rain usually starting in March and finishing in August. The following hydro-mulch mix has been designed for the CGG and will be required, together with a tackifier, unless a more efficient mix can be proven.

LAND DEVELOPMENT SPECIFICATIONS

Tackifier could be used on its own, applied out of any water cart at 800 – 1 000 l/ha. Seed and fertiliser cannot be placed in this mix as it requires paper to carry to seed and fertiliser. Seed and fertiliser could be “drilled in”, or “spun out” followed by cover over with cover harrows and then have tackifier applied over the top to stop sand blasting of new shoots and stabilise soil.

Cannoning hydro-mulch quickens the process but does not give the best result as the product floats on the surface and is not mixed in. The Developer shall provide proof of the seed and fertiliser applications.

Green dye is required in Hydromulching to show the effective coverage area. Dye should last 6 – 12 months.

Table 2.3

SUBSTANCE		APPLICATION RATE
1	Paper	1 000 kg/ha
2	Cereal Rye	80 kg/ha
3	Wimmera Rye	20 kg/ha
4	Fertiliser	80 kg/ha
a.	Sulphur [S]	16.8 %
b.	Nitrogen [N]	12.3 %
c.	Potassium [K]	6,2 %
d.	Phosphorous [P]	1.8 %
e.	Iron [F]	0.5 %
f.	Manganese [Mn]	0.4 %
g.	Copper [Cu]	0.1 %
h.	Zinc [Zn]	0.1 %
5	Tackifier	800 l/ha
a.	Gluon 240	100 %

LAND DEVELOPMENT SPECIFICATIONS

2.9.6.3 Stabilisation by Topsoil and Seeding

Surface stabilisation shall be carried out with a minimum 75mm layer of top soil, seeded and fertilised. Where topsoil available is insufficient to achieve the minimum thickness, the Contractor must obtain the Consulting Engineer's direction and CGG's approval before proceeding further. Note: Two row barley has been found to be very effective at stabilising all types of soil if planted early in the winter growing period in Geraldton.

2.9.6.4 Loam Sheeting

Loam sheeting can be used for stabilisation of sand dune environments as follows:

Clayey loam / sandy loam material shall be placed in areas as specified in the approved Soil Stabilisation Strategy to a depth of 70mm. The Loam shall be placed in a pre-wetted state and the surface finished to a non-smooth texture. Seeding must follow after placement of loam sheeting.

2.9.7 MAINTENANCE

Seeding shall be kept moist by the Developer until full soil stabilisation is achieved. This may include irrigation at required intervals to achieve satisfactory results.

The Developer shall protect the newly sown areas against trespass by pedestrian and / or vehicular traffic until full and complete soil stabilisation is achieved through complete establishment of the vegetation.

LAND DEVELOPMENT SPECIFICATIONS

3 ROAD GUIDELINES

Refer to Module 3 of the LGGSD Ed2-2011.

3.1 GENERAL, POLICIES AND STANDARDS

Refer to Cl 3.1 of the LGGSD Ed2-2011.

The following policies should be referenced as design guidance and assessment criteria:

- Liveable Neighbourhoods (WAPC);
- WAPC Policy DC 1.5 – Bicycle Planning (February, 1990);
- WAPC Policy DC 2.6 – Residential road planning (December, 1992);
- WAPC Policy DC 4.1 – Industrial subdivisions; and
- Australian National Cycling strategy 2005-2010 (Austroads 2005).

Additionally, road designs should conform to the relevant Austroads standards and have regard to Australian Road Research Board (ARRB) and other publications, which include:

- Guide to Traffic Engineering Practice – Parts 1 to 15 (Austroads)
- Turning Path Templates (Austroads, 1995)
- All latest Austroad Publications
- Street (Road) Lighting Code AS 1158
- All ARRB Publications
- AS 2150: Hot Mix Asphalt
- AS 2008: Residual Bitumen for Pavements
- Technical Specifications, Tender Form and Schedule for Supply and Laying of Hot Asphalt Road Surfacing (AAPA/IPWEA)

3.2 DESIGN

3.2.3 GENERAL

Refer to Cl 3.3 of the LGGSD Ed2-2011.

Where road upgrading is required the standard of the upgrading shall be in accordance with the standard associated with the current zoning of the area, irrespective of whether the proposed level of subdivision is less than the maximum permitted. See Table 3.1 for the minimum standards applicable.

LAND DEVELOPMENT SPECIFICATIONS

Table 3.1

RANKING	MIN. STANDARD
<p>1 Residential = R5 – 2 000m² and Higher R Codes.</p>	<ul style="list-style-type: none"> • 25mm thick. Asphalt wearing course on 7mm Primer Seal on engineered pavement layers; • Concrete kerbing; • Drainage – Water Sensitive Urban Design (WSUD) practice where possible otherwise underground pipe work, pits, or approved informal drainage, or a combination of above depending on streetscape aspects etc; • Multi-purpose pathways
<p>2 Low Density residential =R2.5 – 4 000m² to R2 – 5 000m²</p>	<ul style="list-style-type: none"> • Primer + 2 Coat Seal (14/10 aggregate) / Bitumen 50/50 on engineered pavement layers; • Unsealed shoulders – kerbing at intersections only; • Informal drainage i.e. Flat bottom shaped drains, soakage drains, swales, etc.
<p>3 Rural Residential = 1ha to 4ha</p>	
<p>4 Rural Small Holdings and Rural = 4ha to 40ha</p>	<ul style="list-style-type: none"> • Primer + 2 Coat Seal (14/10 aggregate) / Bitumen 50/50 on engineered pavement layers; • on engineered pavement layer(s); • Informal drainage i.e. Flat base shaped drains, soakage drains, swales, etc.
<p>5 Industrial / Commercial</p>	<ul style="list-style-type: none"> • 40mm thick. Bituminous Concrete wearing course on 7mm Primer Seal on engineered pavement layers; • Concrete kerbing; • Formal or approved informal drainage (depending on street scaping aspects), etc; • Multi-purpose pathways

LAND DEVELOPMENT SPECIFICATIONS

Note: Battle axe legs:

- a) Ranking 1-2 Seal whole access.
- b) Ranking 3-5 Seal the first 5-6 metres from the edge of the sealed road only.
- c) Gravel road sealed access optional.

3.2.4 BATTLEAXE ACCESS LEGS

Refer to Module 3 Cl 3.3.17 of the LGGSD Ed2-2011.

Battleaxe leg widths are determined by the WAPC.

Under WAPC Policy DC 4.1, it is noted that shared battleaxe legs are not permitted in industrial subdivisions.

GEOMETRY

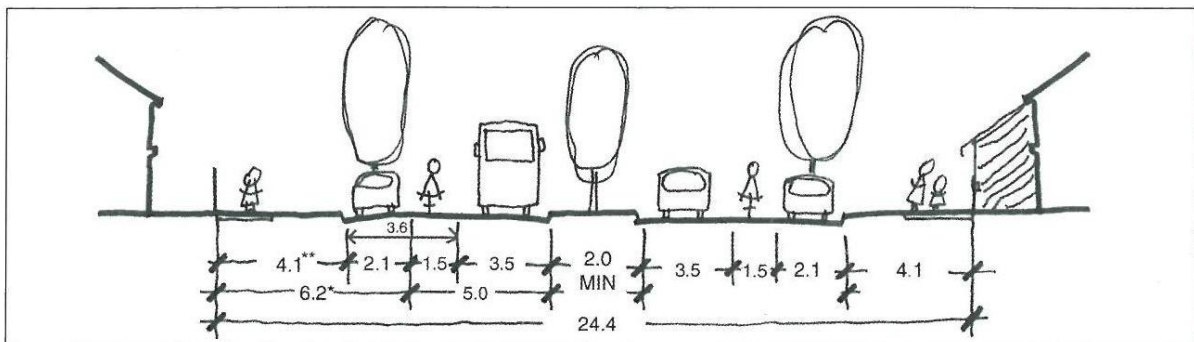
LAND DEVELOPMENT SPECIFICATIONS

Refer to Module 3 (all applicable Clauses) with specific reference to Table 3.4 and following notes in the LGGSD Ed2-2011. In all instances, the guidelines as in Element 2 – Movement network of the Liveable Neighbourhood document must also be consulted. Where new roads abut existing and there is a change in carriage way width, the transition shall be even and smooth. Where subdivisional roads intersect Main Roads, the Consulting Engineer must also obtain approval from Main Roads WA. In residential areas and where possible and practical, the choice of narrower single carriage ways in each direction above that of wide dual carriage ways will be supported by the CGG as per the extraction from the Liveable Neighbourhoods document below.

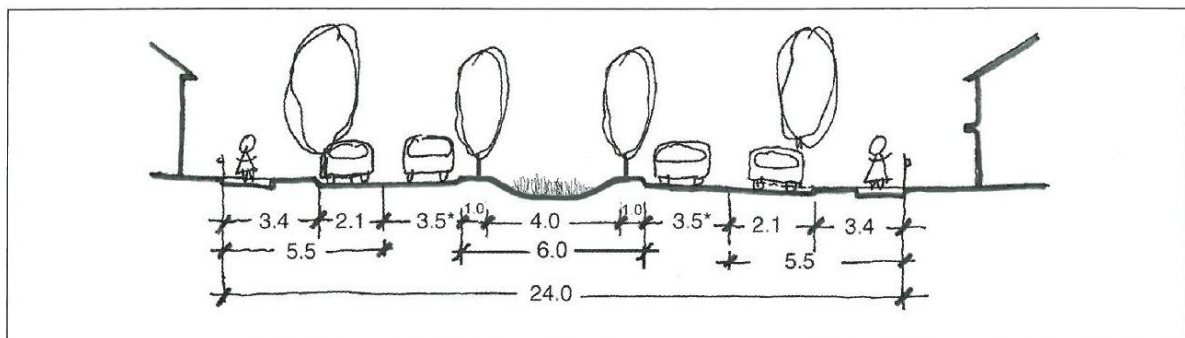
Note:

The CGG requires road reserve widths for single carriage way access roads based on a 5m distance from the back of the kerb to the property boundary line (verge width). The Liveable Neighbourhoods document currently indicates this distance as 4.1m though the WAPC is in the process of adopting a 5.0m width to allow sufficient space for all amenities in particular the increased pathway widths.

Neighbourhood connector streets



Access streets



LAND DEVELOPMENT SPECIFICATIONS

3.2.5 VERGE AND PROPERTY GRADE

Refer to Module 3 CI 3.3.4 & 3.3.16 of the LGGSD Ed2-2011.

Verge widths to be 5.0m minimum in industrial areas.

3.2.6 KERBING

Refer to Module 3 CI 3.3.5 & 8.3.1.14 of the LGGSD Ed2-2011.

Table 3.6 of the *LGGSD Ed2-2011* will generally form the basis of the profile to be used but the CGG will look at this issue in the context of each area and could request otherwise. Generally, the CGG will require semi-mountable kerbing at all intersections on residential and rural roads and mountable kerbing on all other sections on residential street frontages, where applicable – refer to Table 3.6 of the *LGGSD Ed2-2011*. Where the radius of curvature is less than 40 metres, keyed kerbing must be provided.

3.2.7 CUL-DE-SAC TURNING CIRCLES

Refer to Module 3 CI 3.3.6 of the LGGSD Ed2-2011.

3.2.8 ROUNDABOUT

Refer to Guide to Traffic Management - Part 4B

3.2.9 EYEBROW TREATMENT

Refer to Module 3 CI 3.3.15 of the LGGSD Ed2-2011.

3.2.10 PAVEMENT LAYERS

Refer to Module 3 CI 3.3.7 to 3.3.12 & 8.3.1.6 to 8.3.1.13 of the LGGSD Ed2-2011.

Where required, either by soil conditions, tests or other influencing factors, the Consulting Engineer shall be responsible for the adequate design of all pavement layers including the sub-grade and treatment of the in-situ soil where applicable. The Consulting Engineer shall confirm in writing to the CGG that the sub-grade strength and conditions have been tested and are sufficient for the pavement design.

LAND DEVELOPMENT SPECIFICATIONS

IMPORTANT NOTE: – the CGG will not approve any pavement layer thicknesses based on the minimum guideline as per *Cl 3.3.9 of the LGGSD Ed2-2011* only, nor any other ‘nominal’ pavement design. Designs shall include subgrade CBR, Design period, Traffic growth rate, Heavy vehicle percentage and design ESAs. Geraldton has areas of high plasticity soils so adequate treatment of the subgrade including stabilisation may be required.

The pavement design shall be based on Geotechnical report field testing where the majority of the test sites within the subdivision are within the proposed road reserve areas. The Consulting Engineer must provide calculations in the Design / Technical Report indicating how depth of the various layers were derived for each road.

The Consultant’s attention is also drawn to MRWA “Engineering Road Note 9 April 2009” and the Procedure for the design of flexible pavements, January 2010.

Austroads “Guide to Pavement Technology Parts 1 & 2” with specific reference to Chapter 12 and Cl 12.5 - Part 2. Refer to Module 3 Cl 3.3.12 & 8.3.1.9 to 8.3.1.13 of the LGGSD Ed2-2011.

Note: All services (water, power, gas, communication, sewer, and drainage) shall be installed before the final sealing of any roads are accepted by the CGG. Designs shall include subgrade CBR, Design Period, growth traffic rate, Heavy vehicle percentage, and Design ESA’s. Geraldton has areas of high plasticity soils so adequate treatment of subgrade, including stabilisation, may be required.

Design of pavements is to be based on the provisions of the Austroads – “a guide to the design of new pavements for light traffic” (APRG No 21) and the Department of Main Roads Pavement Design Manual using the CGG Traffic loading identified in Table 3.1.2 – Design Traffic Loading/Pavement Thickness.

3.2.11 MATERIALS

Refer to Module 3 Cl 3.4 of the LGGSD Ed2-2011 and MRWA pavement specification 501.

Also refer to Table 3.4 and 3.5 below.

NATA laboratory test certificates shall be included in the Design / Technical Report or separately supplied, confirming compliance of all material to be used within the development area.

LAND DEVELOPMENT SPECIFICATIONS

3.2.11.2 GENERAL

A gravel base course shall consist of a combination of soil binder, sand and laterite gravel and shall conform to this specification. It shall be free of vegetable matter and lumps or balls of clay and shall not contain excessive quantities of pyrites or other foreign substances.

3.2.11.3 PROPERTIES

Coarse aggregate retained on a 2.36mm sieve shall consist of hard, durable particles or fragments of gravel. Materials that break up when alternatively frozen and thawed or wetted and dried shall not be used.

Coarse aggregate shall have a percentage wear by the Los Angeles Test or not more than 45%.

Fine aggregate passing a 2.36mm sieve shall consist of natural or crushed sand and fine mineral particles passing the 0.065mm sieve.

The portion of the sample which passes the 0.425mm sieve (soil mortar) shall conform to the following requirements when tested in accordance with *AS 1289: Methods of Testing Soils for Engineering Purposes*:

Table 3.2 Gravel Base course

Soil Testing	
Property	Value
Plastic limit shall not exceed	20
Liquid limit shall not exceed	25
Plasticity Index shall not exceed	5
Linear Shrinkage shall not exceed	1%
Dry Compressive Strength shall not be less than	1.75MPa
Dust ratio shall not exceed	0.67

3.2.11.4 GRADING

The grading of the gravel shall conform to the following requirements:

Table 3.3

Gravel Grading	
Sieve Size	Percentage by Weight Passing
(Square opening AS Sieve)	
19mm	100%

LAND DEVELOPMENT SPECIFICATIONS

4.75mm	45 – 65%
2.36mm	30 – 50%
0.425mm	12 – 30%
0.075mm	3 – 12%

The ratio of the portion passing 0.075m sieve to the portion passing 0.425mm sieve shall fall within the range of 40-60%. The portion of the total sample retained on the 19mm sieve shall not exceed 5% of the total sample.

LAND DEVELOPMENT SPECIFICATIONS

Table 3.4

PROPERTIES:	SUB-GRADE	SUB-BASE	BASE
Material		Crushed Limestone or similar approved as per Table 3.5	Laterite Gravel, Crushed Rock or similar approved as per Table 3.5
California Bearing Ratio (CBR)	* = > 7 %	= > 30 %	= > 80 %
Plasticity Limit		= < 20	= < 20
Liquid Limit		= < 25	= < 25
Plasticity Index (PI)	= < 15	= < 5	= < 5
Linear Shrinkage		= < 1 %	= < 1 %
Dry Compression Strength		= > 1.75MPa	= > 1.75MPa
Dust Ratio	–	= < 0.67	= < 0.67
** Compaction –Maximum Dry Density (MDD)	95 %	95 %	98 %
Tolerances – width	100 mm		
level	+5 ; -30 mm	+5 ; -10 mm	+10 ; -0 mm

All CBR values shall be obtained through the 4 day soaked CBR test method.

Compaction shall be tested / confirmed using a Nuclear Density Meter. The density to which a sub-grade material is compacted can have a significant effect upon its strength. Variability in density is also a matter of concern, as it will result in differential deformation due to traffic compaction. Consideration should be given to the depth to which effective compaction can be achieved. In some circumstances the strength of the material below the sub-grade layer may be a critical consideration in the design of the total pavement system.

LAND DEVELOPMENT SPECIFICATIONS

Table 3.5

SIEVE SIZE:	% PASSING BY WEIGHT		
	Sub-Base	Base Course	
	Crushed Limestone or similar approved	Lateritic Gravel	Crushed Rock
75 mm	100 %	–	
19 mm	50 – 75 %	100 %	100 %
9.5 mm	–	–	70 – 80 %
4.75 mm	–	45 – 65 %	40 – 65 %
2.36 mm	30 – 50 %	30 – 50 %	30 – 50 %
0.425 mm	–	12 – 30 %	12 – 30 %
0.075 mm	0 – 15 %	0 – 12 %	3 – 12 %

LAND DEVELOPMENT SPECIFICATIONS

3.3 QUALITY ASSURANCE

Acceptance:

Refer to Module 8 of the LGGSD Ed2-2011.

Dry Back

For most materials, the strength at a moisture content of 100% OMC is inadequate. This is not of serious concern provided adequate strength at the generally lower design moisture content is available. However the basecourse material is required to have sufficient strength from the first day of open traffic. It is therefore necessary to dry back the compacted basecourse prior to application of the primerseal. Dryback testing must be preformed 2-3 days before the primer seal is applied and further testing preformed if the base course or sub grade material has been affected by heavy moisture in the 2-3 day period prior to sealing.

Care should be taken that the subbase and basecourse have been dried back so not to provide a source of moisture to move into the basecourse. As Per Main Roads WA specifications dry back to less than 85% of OMC.

LAND DEVELOPMENT SPECIFICATIONS

4 STORMWATER DRAINAGE GUIDELINES

Refer to Module 4 of the LGGSD Ed2-2011.

4.1 GENERAL, POLICIES AND STANDARDS

Refer to Cl 4.1 of the LGGSD Ed2-2011.

The following CGG information is to be taken into account. Geraldton consists of a vast variety of soil and underground soil types, ranging from sand to almost totally impervious soil types. In addition, it has been experienced that permeable soil types are often bordered by impervious layers at varying depths which are normally difficult to predict. The result of this is that permeability tests on the upper layers are often misleading in calculations related to detention / soakage structures. Consulting Engineers are to carry out in depth investigations in this regard. All test results and results from onsite investigations shall be submitted to CGG with design calculations and plans.

Site investigations should be carried out by qualified hydro geologist, geotechnical engineer, groundwater geologists or other suitably qualified person to determine the depth to groundwater and the hydraulic properties of the soil.

- 1 The compensation basins rely on the capacity of the sandy subgrade material to allow infiltration of captured stormwater into the ground water below. Permeability calculations are to be taken from >1 metre below the floor level of the proposed compensation basin / storm water storage area.
- 2 The rate of infiltration 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 storm water storage.
- 3 If the floor of the compensation basins is closer than 4m to the ground water table, additional areas may be required and detailed calculations shall be submitted to Council.

Infiltration rates shall be calculated after conducting tests on the capacity of the soil at a suitable depth below the storm water storage level and taking into account the ground water table level for the design period.

It is through the monitoring of constructed basins during storm events that the predicted infiltration modelling can be verified and whether the basin is performing as per design. The Developer will be required to undertake a monitoring program over a minimum two (2) full winter periods.

Policies and Standards – *Refer to Cl 4.2 of the LGGSD Ed2-2011.*

LAND DEVELOPMENT SPECIFICATIONS

4.2 DESIGN

GENERAL PRINCIPLES

Refer to Cl 4.3.2.4 of the LGGSD Ed2-2011.(Design event for underground drainage system)

It is a requirement throughout the state for stormwater to be retained on site. The CGG is aware that in severe events or in problematic soil types this is not always possible. Therefore the CGG will, in line with the DoW requirement, require from any development to retain all of the stormwater runoff resulting from a frequent event (1 year return period for a duration of 1 hour maximum) to be retained on site, whether by means of soakage or storage facilities (see Table 4.2 below). It should be noted that sumps are not a permitted solution. Runoff resulting from events exceeding this magnitude will be allowed to flow overland to the lower lying road to enter into the drainage system through the catch pits. No direct connection will be allowed unless otherwise approved by the CGG in writing.

The Consulting Engineer is expected to prepare and submit an urban water management plan in accordance with the guidelines from the “Better Urban Water Management” and “Stormwater Management Manual” documents available from the DoW.

The Consulting Engineer must also prepare and submit a drainage catchment plan with calculations as part of the Technical Report indicating the following:

- a) Boundaries of each catchment / sub-catchment area;
- b) Area in hectare (ha) of each catchment / sub-catchment area;
- c) Coefficient for runoff for each catchment / sub-catchment area;
- d) Time of concentration (tc) for runoff for each catchment / sub-catchment area;
- e) Average Return Intervals (ARI) and storm durations used in analysis for the conduit and the storage / detention facilities respectively.

Runoff Calculation – Runoff can be calculated according to the “rational method” as detailed in “Australian Rainfall and Runoff 2001” (herein after AR&R).

Note:

Physical observations and experience has shown that runoff from lots does occur and must be taken into account. Table 4.1 below provides the generalised impervious area per lot size to be taken into account for all stormwater runoff calculations:

LAND DEVELOPMENT SPECIFICATIONS

Table 4.1

LOT AREA (m ²)	300	400	500	600	700	800	900	1000 TO 1100	*
Impervious Area (%)	90	85	80	70	65	60	55	50	*

* % impervious area per lot size in excess of 1100m² will be assessed by the Consulting Engineer and shown in the calculations.

For commercial and industrial sites, car parks etc., the impervious area shall be assumed to be 90%. It is the responsibility of the designer to assess the appropriate coefficient for the whole or any part of a development.

Entry and Junction Pits – (Refer to Cl 4.3.3.2 and 4.3.3.3 of the LGGSD Ed2-2011).

The CGG will require grated gulley pits to be installed on all roads where access to private property is required. Where the Consulting Engineer wishes to deviate from this requirement, substantial motivation will be required for consideration. Pits shall be located at midpoint adjacent to property boundaries. The maximum distance between pits shall be 65m to accommodate CGG cleaning equipment. Pit covers / lids, designed to accommodate the appropriate traffic, load shall be used in all locations.

Open Access Flood Storage/Detention Facilities – (Refer to Cl 4.3.3.6 and 4.3.4 of the LGGSD Ed2-2011). In new subdivisional developments the Developer shall provide for the retention / detention of runoff by means of one or more or a combination of the following:

- a) Unfenced landscaped shallow basin(s) within Public Open Space (POS) land (without reducing the active / passive recreational amenity of the Public Open Space land) with sand filter(s) and sub-soil drainage pipes to bore hole(s) down pipe discharging into underground water table where possible;
- b) Underground storage (approval of products to be used shall be obtained from the CGG at an early stage of design).

Note: – (Refer to Cl 4.3.3.6 and 4.3.3.7 of the LGGSD Ed2-2011). The side slopes of any embankment used in this case shall be 1:6 maximum unless otherwise required by the CGG and the maximum water depth shall not exceed 900mm for a¹⁰ARI event and 1200mm in the case of a ¹⁰⁰ARI. Unless safe overland flow routes from the facility to a natural water body, approved by the CGG, is available, without any chance of causing a threat to life or property due to flooding, the facility shall be sized to contain the full ¹⁰⁰ARI₍₇₂₎. In all cases, basins shall be seen as flood prevention facilities and shall be sized to store all of the relevant runoff volume, without taking infiltration rates into account of the soil in which it is to be situated. . Sufficient infiltration rates will be required to ensure water soaks away in an acceptable time limit as described below.

LAND DEVELOPMENT SPECIFICATIONS

The facilities shall be located, designed, unfenced and landscaped, so that the public is able to use the open space for passive and / or active recreation and amenity is not impaired.

A freeboard of 300mm to the adjacent carriageway and a minimum of 1 metre freeboard to Western Power pad mount sites within the overall development are to be achieved by the design.

All discharge pipes into such basins shall be equipped with an approved purpose made grated safety/security barrier at the outlet or any other openings to prevent human entry but shall allow for easy cleaning.

Disease Vector and Nuisance insect Management – (Refer 4.3.1.3 LGGSD 2011)

In the interests of public health and for the prevention of Mosquito breeding the soakage basins shall not retain water for more than a 96 hour (4 days) period from November to May. Should the performance of the basin not meet this requirement, additional filter and borehole arrangements must be provided at the cost of the Developer for the required soakage rate to be met. Other Better Management Practices for guidance on how to reduce mosquito breeding risks can be found in the storm water management manual for Western Australia.

A detailed landscaping plan of the facility area shall be submitted to the CGG for approval together with the construction drawings.

All related assumptions, formulae and calculations shall be shown in the Technical / Design Report.

LAND DEVELOPMENT SPECIFICATIONS

The following Intensity-Frequency-Duration (IFD) data shall be used for calculations:

Intensity-Frequency-Duration Table

Location: 28.800S 114.700E NEAR.. GERALDTON AIRPORT Issued: 12/8/2009

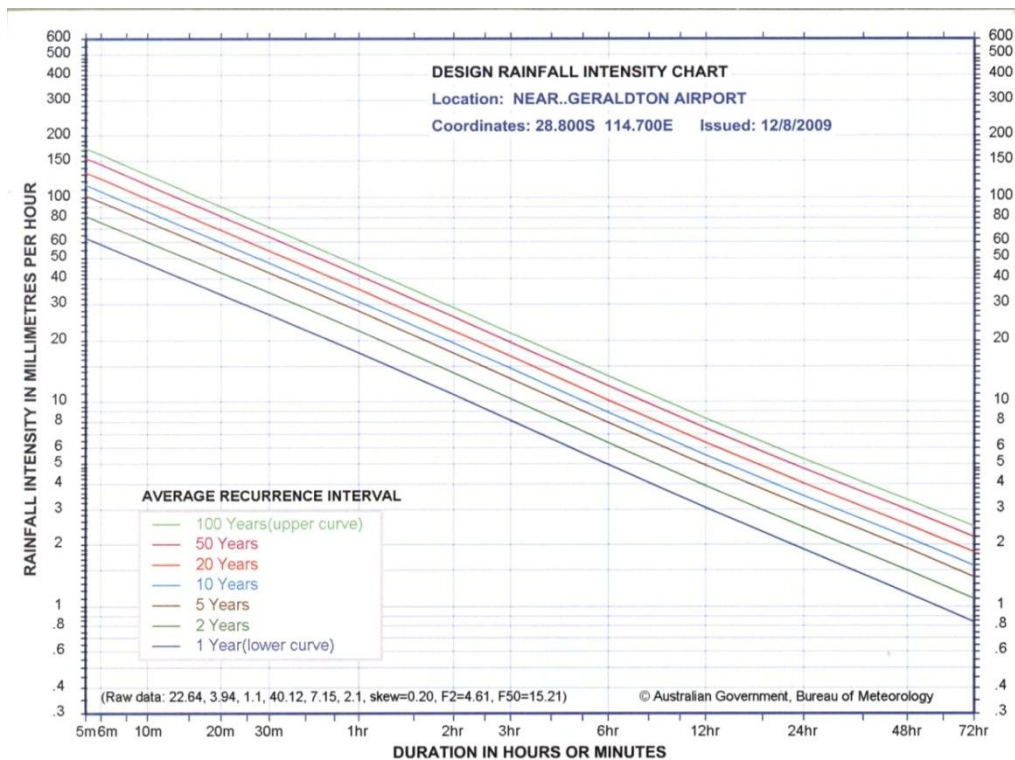
Rainfall intensity in mm/h for various durations and Average Recurrence Interval

Average Recurrence Interval

Duration	1 YEAR	2 YEARS	5 YEARS	10 YEARS	20 YEARS	50 YEARS	100 YEARS
5Mins	63.2	81.1	102	115	132	155	174
6Mins	58.8	75.4	95.1	107	123	145	162
10Mins	47.2	60.5	76.1	85.4	98.2	115	129
20Mins	33.5	42.9	53.7	60.1	69.0	80.8	90.0
30Mins	26.7	34.2	42.7	47.7	54.7	64.0	71.3
1Hr	17.4	22.3	27.8	31.0	35.5	41.5	46.2
2Hrs	10.9	13.9	17.3	19.4	22.2	26.0	28.9
3Hrs	8.15	10.4	13.0	14.6	16.7	19.5	21.7
6Hrs	4.95	6.34	7.94	8.91	10.2	12.0	13.4
12Hrs	3.04	3.90	4.91	5.52	6.35	7.46	8.32
24Hrs	1.90	2.43	3.09	3.48	4.01	4.73	5.28
48Hrs	1.16	1.50	1.92	2.17	2.51	2.97	3.33
72Hrs	.839	1.09	1.39	1.58	1.84	2.18	2.46

(Raw data: 22.64, 3.94, 1.1, 40.12, 7.15, 2.1, skew=0.20, F2=4.61, F50=15.21)

© Australian Government, Bureau of Meteorology



LAND DEVELOPMENT SPECIFICATIONS

5 STREETScape GUIDELINES

Refer to Module 5 of the LGGSD Ed2-2011.

Developers must participate in enhancing the environment through streetscape improvements. Where streetscaping is to be carried out, a suitably qualified landscape designer or landscape architect shall be appointed and all intended work shall be presented to the CGG on drawings and / or other forms of presentation.

Water Sensitive Urban Design (WSUD) will be applied as far as practically possible and a minimum of a 90% strike rate for planting will be required before final clearance is given by the CGG. The drawings will form part of the set of construction drawings submitted to the CGG for approval.

The City of Greater Geraldton's intent for the Landscape plans to be a part of the design drawing approval is to assess the development of the POS and the extent of the proposed development within the POS area as the City will be ultimately responsible for the ongoing maintenance. The assessment allows the City to manage the development of centralised major parks and the link to minor parks within the development of the cities suburbs.

The City would be satisfied with either a fully detailed plan or a concept plan for the proposed landscaping. A concept plan would be sufficient to make comment and add drawing approval conditions, the details and implementation of the Landscape plan can be formalised at a later date to satisfy the WAPC condition and Local Government requirements.

Note: Species and types of trees need to meet local government requirements that take into account existing plants and trees and local government policy.

5.1 GENERAL, POLICIES AND STANDARDS

Refer to Cl 5.1 & 5.2 of the LGGSD Ed2-2011.

Policies and Standards – *Refer to Cl 5.2 of the LGGSD Ed2-2011.*

5.2 DESIGN

5.2.1 PATHWAYS

All pathways and associated pram ramps must be constructed at the time of the development to the CGG pathway specifications, no bond or bank guarantee will be accepted in lieu of the pathway construction and no clearance will be given until the pathway construction has been completed.

Refer to Cl 5.3.1, 5.4.1 & 8.3.1.15 of the LGGSD Ed2-2011.

LAND DEVELOPMENT SPECIFICATIONS

Refer 5.3.1.2 LGGSD Ed2 - 2009, - CGG requires developers to provide facilities for pedestrians and cyclists in all new subdivisional developments in accordance with an overall network plan.

Refer Liveable neighbourhoods Element 2 page 9 & 10 Movement network for guidance.

Refer to the shared Pathway specifications CGG CONCRETE PATHWAY LAYOUT.

5.2.2 CYCLISTS

Refer to Cl 5.3.1.1, 5.3.1.2 of the LGGSD Ed2-2011.

Refer Liveable neighbourhoods Element 2 page 9 & 10 Movement network for guidance.

All pathways shall be shared pathways unless otherwise approved by the CGG. Pathway widths shall be as per the CGG specifications but the CGG reserves the right to insist on wider paths, paths on both sides of the road and where the need is justifiable e.g. in the vicinity of Public Open Space (POS), schools and other areas expected to carry a high density of pedestrians and / or cyclists. The CGG will only approve concrete pathways. Joints shall be provided as per the CGG specifications for pathways – (refer to 1.6.3.1 above for cost calculations).

All roads in developments will have pathways unless otherwise approved by the CGG. Pathways must generally be located according to the hierarchy of the road along which it is to be constructed as follows, unless otherwise approved by the CGG:

- a) *Local Distributor roads and higher (may have residential lot frontage but will serve community, recreational and commercial sites and connect access roads and arterials) – usually to be located up against the property boundary line;
- b) *Access streets and lower (residential lot frontage) – usually to be located directly against the back of the kerb line.

* Existing conditions could determine logical / practical relocation and will be dealt with a case by case basis.

LAND DEVELOPMENT SPECIFICATIONS

5.2.3 LANDSCAPING

5.2.3.1 Street Trees

Refer to Cl 5.3.6, 5.3.8 and 5.4.2, of the LGGSD Ed2-2011.

In the interest of the future plans for the City to enhance the appearance of street verges, roundabout centres and other public open spaces, developers will be required to contribute to street tree planting and establishment contribution for the provision of street trees – (refer to 1.6.3.1 above for cost calculations).

In accordance with the requirement for the WAPC- Liveable Neighbourhoods Guidelines. R47: Street trees that provide a generous canopy at maturity should be planted in most streets (except rear laneways) for pedestrian shade and shelter, streetscape amenity, and traffic management. Street trees contribute to a pleasant walking environment, provide shade and accommodate fauna.

In the event that a developer makes a contribution to street tree planting, the CGG reserves the right to plant the trees of its choice in the road reserves, when and where it sees fit. Maintenance of street trees planted by the CGG is therefore not the responsibility of the Developer.

5.2.3.2 Compensation basins

A landscaping and management plan is to be provided and implemented to the specification of the CGG. This is to reinforce clause R37 Element 4 of Liveable Neighbourhoods. “The landscaping and management plan should address the care, maintenance and ongoing management of the public open space shown on the subdivision plan. All planting shall be supported by a maintenance and watering period of a least two summer periods to ensure full establishment”.

5.2.4 PUBLIC LIGHTING

Refer to Cl 5.3.4 & 5.4.3 of the LGGSD Ed2-2011.

All requirements and specifications as per AS 1158. Approval in all instances must also be obtained from the Western Power authority.

The CGG is in favour of decorative street lighting provided the Western Power product range is used. The CGG will generally require Metal Halide luminaires or Compact Fluorescent. This is subject to practical considerations that affect heavy traffic areas and should be confirmed with the CGG at an appropriate early stage.

LAND DEVELOPMENT SPECIFICATIONS

5.2.4.1 Specification Measures

Existing residential Areas

Street lights should be provided to CGG and Western Power standards where the permanent occupancy rate in any particular street is 50%. Lighting should also be installed to provide lighting at each end of a Pedestrian Access Way which may exist in the area.

Proposed Residential and Low Density Residential/Rural Residential

In the case of Greenfield subdivisional development, street lighting is to be designed as follows:

- Provide lighting at each end of each Pedestrian Access Way.
- Residential areas with blocks less than 4100 sq/m - to draft policy (AS/NZS 1158)
- Residential and Special Rural areas with blocks of 4100 sq/m and above:- flag lighting (150W high pressure sodium) at tee intersections; AS/NZS 1158 Category P lighting at roundabouts; and AS/NZS 1158 Category P lighting at 4 way cross roads.
- Where no road lighting exists on existing roads, road lighting will only be provided on the basis of night time vehicle accident reports or night time crime reports, where there is a positive net present value in providing road lighting.

Existing Low Density Residential/Rural Residential

Street lighting will only be provided at intersections where substantial traffic/pedestrian movements are found to occur; otherwise lighting will not be provided.

Other Areas

Street lighting on existing roads will be installed where based on accident history; there is positive net present value of installing street lights.

Where ever possible, new street light technologies, which result in less energy usage (including the energy used in manufacture and disposal) and less greenhouse gas emission, should be used.

Public lighting shall be installed in accordance with the current AS/NZS 1158 using the following table for guidance:



LAND DEVELOPMENT SPECIFICATIONS

ROAD/AREA	AS/NZS1158 Category	Typical Equipment & Geometry (lamp/height/spacing/width)
Primary and District Distributor A Roads (>15 000vpd) -2	V3	250 W HPS /10.5m /55m /2 lanes-4
		250 W HPS /9m /40m /2 lanes-5
District Distributor B Roads, (6 000-15 000vpd)	V5 -6	150 W HPS/10.5 m/55 m/2 lanes-4
		150 W HPS/9 m/40 m/2 lanes-5
Local Distributor Roads (3 000 – 6 000 V.P.D.)	P3	70 W MH/6.5 m/60 m/20 m road reserve-4
		70 W MH /7.86m /40m /20m road reserve-5
Local Access Roads (<3 000 V.P.D)	P4	70 W MH /6.5m /60m /20m road reserve-4
		70 W MH /7.86m /80.5m /20m road reserve-5
PAW's, Laneways (<300 V.P.D.) - 3	P4	70 W MH /5.2 m /40m /3-5 m laneway
	P5	42 W CF /5.2 m /40m /3-5 m laneway
Intersections: Distributor Road Access Road Isolated intersections & bends	V3/V5	250 W HPS /10.5 m-4
	P3	70 W MH /6.5 m-4
	P4	70 W MH /6.5 m-4
Local Area Traffic Management Devices	Cat P -3.5 Lux Minimum	See Clause 3.2.6.2 of AS 1158.3.1 Area includes 3m of entry and exit
Car Parks low use/risk	P11c	42 W CF or 70 W MH /6 m.
Car Parks medium use/risk	P11b white light	70 W MH /6 m /15 m X 17 m.
Car Parks high use/risk	P11a white light	150 W MH /6 m /15 m X 17 m.
Car Parks (disabled bays)	P12 white light	150 W MH /6m.
Pathways in Passive Open Spaces	P4	70 W MH /6.5m /60m, 42 W CFL /4.5m /30m,

LAND DEVELOPMENT SPECIFICATIONS

Notes:

1. HPS = high pressure sodium, MH = metal halide, MV = mercury vapour, CF = compact fluorescent. (MV=mercury vapour; these street lights are not accepted by AS1158.6 after 1-1-2011; the lamps will be phased out by the EU in 2015; and were banned in the USA in 2008).
2. Pedestrian/vehicle conflict and presence of heavy vehicles also influences selection of V3/V5.
3. Busy PAW's P4, quiet PAW's P5.
4. Underground power
5. Overhead power
6. Category V design requires computer calculation according to AS/NZS 1158. Intersections require special attention to satisfy illuminance criteria.

For footpaths, light poles are typically setback 500 mm from the edge of the footpath.

For category P minor roads, Light poles shall be setback at least 1 metre from the kerb or edge of carriageway.

For Category P roads, in addition to achieving the light technical parameters, it is necessary to locate a street light within 10 m of a bend and an intersection. At a tee intersection it is also necessary to locate a street light at half spacing on the tee.

For Category V major roads:

- Frangible poles can be located 0.7 m back from the kerb or lane edge.
- Under 70 km/h rigid poles need to be 3 m back from kerb or lane edge
- Over 70 km/h rigid poles need to be 6 m back from kerb or lane edge.
- There are two types of frangible pole: impact absorbing for lower speeds and pedestrian areas; and slip base for high speeds away from pedestrian areas. Reference needs to be made to AS/NZS 1158.1.3 Appendix B (pages 66 to 81).

Road lighting equipment shall be selected from the Western Power standard or decorative range.

In Passive Open Spaces:

- The minimum pole height shall be 4.5 m
- Bollard lighting will not be allowed
- Any uplighting shall use stainless steel in ground uprights complying with IEC 60598-2 Category C and with 75°C maximum surface temperature (at 40°C ambient)
- Electricity supply shall be from an unmetered supply pit or, from any pump control panel
- Lighting shall be controlled by a seven day programmable time switch.

LAND DEVELOPMENT SPECIFICATIONS

Energy efficient lighting is required.

- Major road lighting shall comply with “Minimum Energy Performance Standards, Design Energy Limits for Main Road Lighting”.
- Minor road lighting shall use 42 W compact fluorescent luminaires instead of 80 W mercury vapour luminaires; and 70W metal halide luminaires instead of 125W mercury vapour luminaires.

For subdivisions: lighting proposals shall be submitted to the City for review and be subject to City approval; and lighting equipment shall be consistent throughout the subdivision.

NB: When considering AS 1158 street lighting, particular emphasis should be placed on facilities for pedestrians and cyclists.

5.2.5 RETAINING WALLS

Refer to the Local Planning Policy

FENCING

Refer to Cl 6.4.6 of the LGGSD Ed2-2011.

5.2.5.1 Fencing - Soil stabilisation

The Soil stabilisation shall incorporate wind break fencing appropriate to the site to prevent both soil and sediment erosion.

5.2.5.2 Fencing retaining walls - Public safety

A sufficient fence is to be installed along any retaining wall above 1 metre in height to act as a visible warning and barrier to protect anyone or anything from falling from the walls. The fence should be, but not limited to, a cyclone ring lock style, with shade cloth attached if added wind break protection is needed.

5.2.6 ENTRY STATEMENTS

Entry statements and landscape works proposed within a subdivision will need to be approved by the CGG council and be subject to a separate development approval with locality names to be included.

LAND DEVELOPMENT SPECIFICATIONS

6 PUBLIC OPEN SPACE GUIDELINES

Refer to Module 6 of the LGGSD Ed2-2011 and Liveable Neighbourhoods element 4 – Public parkland.

6.1 GENERAL, POLICIES AND STANDARDS

Refer to Cl 6.1 and 6.2 of the LGGSD Ed2-2011.

Landscaping and approved infrastructure for City Parks and Public Open Space (POS) will be guided by the intended function of the space and any other policies the CGG has in place.

Liveable Neighbourhoods element 4 – Public parkland.

The WAPC will generally require public open space to be developed by a subdivider to a minimum standard that may include full earthworks, basic reticulation, grassing of key areas, pathways that form part of the overall pedestrian and/or cycle network, and maintenance for two summers.

Development of public open space should be carried out in accordance with a landscape plan first approved by the local government.

P.O.S areas must comply with Livable Neighbourhoods Guidelines, in particular the pedshed requirements. CGG reserves the right to refuse any POS proposal that presents any adverse ongoing maintenance issues, or does not provide useable recreation space for the community.

The WAPC may not require development of public open space where land is in fragmented ownership, where it is restricted use public open space, and where climatic variations do not require such development.

6.2 DESIGN

Refer to Cl 6.3, 6.4 & 7.5.8 of the LGGSD Ed2-2011.

An overall Public Open Space Concept Development Plan should be submitted to CGG for approval in principal prior to submitting detail working drawings.

LAND DEVELOPMENT SPECIFICATIONS

7 STANDARD DETAILS

Refer to Cl 4.3.2.4 of the LGGSD Ed2-2011.

The following is a list of the standard details available from the CGG internet web site:

DRAWING NUMBER	DRAWING TITLE
LDS - 001	PROJECT SIGN BOARD
LDS - 002	STANDARD INTERSECTION DETAILS
LDS - 003	ROAD PAVEMENT AND CROSS-SECTION DETAILS
LDS - 004	TYPICAL SECTION FOR ENTRY STATEMENTS AND CORNER APRONS
LDS - 005	STANDARD DRAINAGE DETAILS
LDS - 006	DRAINAGE DETAILS- Residential Property Drainage Pits, Stepiro, Sump Outfall
LDS - 007	RECONSTITUTED LIMESTONE BLOCK RETAINING WALLS
LDS - 008	CGG CONCRETE PATHWAY LAYOUT
LDS - 009	BRIDAL PATH LAYOUT
LDS - 010	KERB DETAILS
LDS - 011	ASPHALT PATHWAY & STREET FURNITURE DETAILS
LDS - 012	TREE PLANTING & ROOT BARRIERS

PART B

IPWEA LOCAL GOVERNMENT GUIDELINES for SUBDIVISIONAL DEVELOPMENT Edition 2 – 2009

(LGGSD Ed2-2011)

<http://www.ipweawa.org.au/>

PART C

LIVEABLE NEIGHBOURHOODS a Western Australian Government Sustainable Cities Initiative

October 2007

<http://www.planning.wa.gov.au/Publications/1594.aspx>