SUBDIVISION GUIDELINES

CKS-900

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Subdivision Guidelines

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1. SCOPE

This document provides guidelines for consulting engineers, planners, and developers to govern the design construction requirements of subdivisions, including general earthworks. Subdivisions involve dividing larger parcels of land into smaller lots for development.

Standards and specifications for roads and concrete structures are to be read in conjunction with the City's *CKS-200 Road Design & Construction Guidelines.*

1.1 Specification to be Treated as a Whole

Where the specification is separated into titled sections, it is for convenience only and not to dictate or determine the trade or craft involved. Such separations shall not operate to make the City an arbiter for the division of responsibility between the contractor and the sub-contractors, nor shall document separation relieve the contractor of responsibility for the satisfactory completion of the entire work.

1.2 Applicable Standards

The installation, materials and workmanship shall comply with all relevant current Australian Standards, Codes and Regulations and all reference codes and Standards listed in the prefaces to those standards and codes.

Where an Australian Standard is specified, the contractor shall construct and conduct all works in accordance with the provisions of that standard. Where an Australian Standard has not been specified, the contractor shall allow for the construction of the works in compliance with the provisions of the Australian Standard covering the class or type of work being constructed.

If a Standard other than an Australian Standard is specified, the contractor shall allow for complying with the provisions of the specified standard. The standard applying shall be the latest edition at the time of commencement of the contract.

Copies of Australian Standards may be purchased from the Standards Association of Australia. Where Australian Standards and Codes do not exist the appropriate International Standard or Codes shall apply. Request an instruction from the City for amendments to Standards, Codes or Regulations that come into effect during the works and affect the works of the contract.

The following documents are recommended and/or referred to in this guideline:

Document	Title
AS 1012 Suite	Methods of Testing Concrete
AS 1141 Suite	Methods for Sampling and Testing Aggregates
AS 1160	Bitumen Emulsions for Construction and Maintenance of Pavements
AS/NZS 1214	Hot-dip Galvanized Coatings on Threaded Fasteners (ISO metric coarse thread series)

AS 1289 Suite	Methods of Testing Soils for Engineering Purposes
AS 1379	Specification and Supply of Concrete
AS 1597 Suite	Precast Reinforced Concrete Box Culverts
AS 1646	Elastomeric Seals for Water Works Purposes
AS 1742 Suite	Manual of Uniform Traffic Control Devices
AS 1743	Road Signs - Specifications
AS 1744	Forms of Letters and Numerals for Road Signs
AS/NZS 1906 Suite	Retroreflective Materials and Devices for Road Traffic Control
AS 2008	Bitumen for pavements
AS/NZS 2053 Suite	Conduits and Fittings for Electrical Installations
AS 2150	Hot Mix Asphalt
AS 2157	Cutback Bitumen
AS 2341 Suite	Methods of Testing Bitumen and Related Road Making Products
AS/NZS 2648	Underground Marking Tape
AS 2700	Colour Standards for General Purposes
AS 2701	Methods of Sampling and Testing Mortar for Masonry Construction
AS 2758 Suite	Aggregates and Rock for Engineering Purposes
AS 2876	Concrete Kerb and Channel (Gutters)
AS 2890 Suite	Parking Facilities
AS 2891 Suite	Methods of Sampling and Testing Asphalt
AS 3600	Concrete Structures
AS/NZS 3678	Structural steel - hot-rolled plates, floorplates and slabs
AS/NZS 3679 Suite	Structural Steel
AS 3700	Masonry Structures
AS/NZS 3725	Design for Installation of Buried Concrete Pipes
AS 3727.1	Pavements - Residential
AS 3798	Guidelines on Earthwork for Commercial and Residential Developments
AS/NZS 3845 Suite	Road Safety Barrier Systems
AS 3972	Portland and Blended Cements
AS 3996	Access Covers and Grates
AS 4049 Suite	Paints and Related Materials - Pavement Marking Materials
AS/NZS 4058	Precast Concrete Pipes
AS/NZS 4455 Suite	Masonry Units and Segmented Pavers

AS/NZS 4671	Steel Reinforcing Materials
AS 4680	Hot Dip Galvanized Coatings on Fabricated Ferrous Articles
CKS-100	City of Karratha – General Concrete Supply & Installation Specification
CKS-200	City of Karratha – Footpath Design Specification
CKS-300	City of Karratha – Vehicle Crossover Specification
CKS-400	City of Karratha – Road Design & Construction Guidelines
CKS-500	City of Karratha – Stormwater Drainage Design Guidelines
CKS-600	City of Karratha – Parking Guidelines
CKS-700	City of Karratha – Landscape Design Guidelines
CKS-800	City of Karratha – Streetscape Design Guidelines
CKS-910	City of Karratha – Survey & Construction Drawing Guidelines
MRWA Spec 403	Main Roads Western Australia – Sub-soil Drains
MRWA Spec 405	Main Roads Western Australia – Drainage Structures
MRWA Spec 501	Main Roads Western Australia – Pavements
MRWA Spec 503	Main Roads Western Australia – Bituminous Surfacing
MRWA Spec 504	Main Roads Western Australia – Asphalt Wearing Course
MRWA WA 133.2	Main Roads Western Australia – Dry Density/Moisture Content Relationship: Modified Compaction Coarse Grained Soils
MRWA WA 313.2	Main Roads Western Australia – Surface Shape Using a Straightedge
MRWA WA 313.4	Main Roads Western Australia – Surface Profile ARRB TR Walking Profiler
MRWA: TMWR CoP	Main Roads Western Australia - Traffic Management for Work on Roads - Code of Practice
DGSA 2004:2004	WA Government - Dangerous Goods Safety Act 2004
WH&S 2020:2020	WA Government - Work Health and Safety Act 2020
EPA 1996:1996	WA Government - Environmental Protection Act 1986
IPWEA LGGSD:2017	Institute of Public Works Engineering Australia (WA Division) - Local Government Guidelines for Subdivision Development
DWER 1:1993	Department of Water and Environmental Regulation - Land Development Sites and Impacts on Air Quality: A Guideline for the Prevention of Dust and Smoke Pollution from Land Development Sites in Western Australia (November 1996)
DWER 2:2011	Department of Water and Environmental Regulation - A Guideline for Managing the Impacts of Dust and Associated Contaminants from Land Development Sites, Contaminated Sites Remediation and Other Related Activities." (March 2011)

1.3 Definition

Term	Description
Developer	The developer is the owner(s) of, or the company nominated to improve, the land proposed for subdivision and development. The developer is responsible for engaging consultants and contractors responsible for investigating, designing and construction of the subdivision.
City of Karratha (Local Government)	The Local Government representing the interests of the local community, when a Local Government is nominated by the WAPC, to administer and clear certain conditions of subdivision imposed by the WAPC
Consulting Engineer	The consulting engineer is a professional employed by the developer to meet the requirement of the Local Government pursuant to the Local Government Act 1995 and associated legislation.
Superintendent	The superintendent is the person employed by the developer to oversee the progress and standard of construction by the contractor. The consultant engineer frequently undertakes the role of superintendent.
Contractor	The person employed by the developer to construct the subdivision works in accordance with the approved drawings and specifications. The contractor is responsible to the developer and carries out the works overseen by the superintendent. There is no contractual or supervisory relationship between the contractor and the Local Government.

2. SUBDIVISION LEGAL FRAMEWORK & CONTRACT ADMINISTRATION

Works shall comply with IPWEA LGGSD 2017.

The requirements outlined in this document, where applicable, shall take precedence over any reference standards and guidelines. In cases where conflicts arise between the stipulations of this document and established reference standards or guidelines, the provisions of this document shall govern and be followed. The Western Australia Planning Commission (WAPC) determines all green title, built, vacant and survey strata subdivision (except built strata subdivision applications of five lots and under which are determined by Local Government).

Application to the WAPC for subdivision approval is initiated by the landowner/developer. Subdivision applications are lodged with supporting information, including a plan, and are processed by the Department of Planning, Lands and Heritage on behalf of the WAPC. Subdivision applications are registered by the Department of Planning, Lands and Heritage then referred to relevant State government agencies and the Local Government for comment on whether to grant conditional or unconditional approval, or refusal. All applications are referred to the relevant Local Government, Horizon Power, and the Water Corporation. Other possible referral agencies include the Department of Biodiversity, Conservation and Attractions, Department of Water and Environment Regulation, Main Roads Western Australia (MRWA), Fire and Emergency Services, Department of Health, Department of Agriculture and Department of Education.

If conditional approval is recommended, conditions are normally derived from a set of conditions developed and adopted by the WAPC and based on advice from referral authorities; however, non-generic conditions may be imposed. This is the critical point for detailed Local Government engineering involvement and dialogue between the Local Government and the developer should take place as early in the process as possible.

A set of ‘model’ conditions, adopted by the WAPC, is used as the basis for condition setting. The decision of the WAPC is forwarded to the applicant with copies to referral agencies. Generic conditions that apply to most major subdivisions include site contouring and provision of power, sewer, potable water, drainage, streets, and open space. In general, more than half of the approval conditions relate to the Local Government requirements.

A responsible State or Local Government agency is identified for each condition to ensure compliance by the developer. These agencies specify the requirements necessary to meet generically worded conditions and they are responsible for confirming that the works or tasks have been completed satisfactorily during the development.

In addition to conditions, approvals often contain advice notes that provide more detailed information on what may be required to satisfy certain conditions. Engineering conditions may be generic and the lack of certainty and specificity on engineering conditions has warranted the Department of Planning, Lands and Heritage's funding of this current review.

An applicant receives either a refusal, or an approval with conditions. If approval with conditions is granted, the applicant may proceed to initiate the clearance process. After construction of the subdivision and certification that relevant standards and conditions have been met, an application is made for final approval and issue of title.

The details for subdivisional process and clearance are provided in the *Local Government Guidelines for Subdivisional Development (LGGSD)*. All applicants and/or applicants' representatives including Civil Engineering Consultants are recommended to review and understand the requirements provided in the Guidelines prior to undertaking any subdivisional works.

The City of Karratha's Technical Services unit's involvement commences when a landowner/developer proceeds to prepare plans for submission to the City of Karratha for review and endorsement.

The City of Karratha subdivision endorsement process is demonstrated in Figure 1.

Figure 1: City of Karratha Subdivision Works Approval Process

2.1 Design Requirements

The design and documentation for all subdivision works and infrastructure must be prepared by qualified Engineers and certified by a Principal Engineer as a minimum. Other design requirements are detailed below:

- The Developer or its representative must ensure all relevant documents outlined under Section 7.4 of the LGGSD are submitted for the City's review and approval.
- The design and drawings shall have the details outlined in the LGGSD section 7.3.
- The information to be shown on drawings shall be in accordance with the details outlined in the LGGSD section 7.5.
- Signage and Pavement Marking plans shall be submitted to Pilbara MRWA for review and approval.
- All design documentation for earthworks, road works and drainage works shall be certified by a Principal Civil Engineer as a minimum.
- All plans for bridge works, retaining walls and/or other structures must be certified by a Principal Structural Engineer as a minimum.

2.2 Permits and Endorsements

- Obtain a Permit to Work and endorsement for Traffic Management from the City of Karratha prior to commencing any construction activities.
- The contractor is required to undertake a Dilapidation Survey before construction commences. A Dilapidation Report must be submitted to the City of Karratha within 30 days of the completion of the survey and must include detailed conditions of the surrounding infrastructure owned by the City of Karratha within 50 metres perimeter.
- The City of Karratha will refer to the Dilapidation Report when undertaking the final asset inspection at completion of construction.

2.3 Construction

Prior to commencing construction, the City of Karratha shall be advised by the developer or consulting engineer in writing of the following:

- Name and address of the contractor
- Name of the contractor's representative
- Name of the consulting engineer's representative or superintendent
- Timetable for construction in the form of a bar chart indicating the starting and finishing dates for each state of the works; and
- Contract prices of the works.

Further to the above, the consulting engineer is required to undertake the following:

- Convene a project start-up meeting with the City of Karratha engineers prior to the commencement of work.
- Submit to the City of Karratha for review and approval, the Inspection & Test Plan (ITP) prepared by the contractor including but not limited to road/pavement and stormwater drainage construction.
- Undertake inspections of hold points for all physical works and approve prior to requesting inspections by the City of Karratha engineers. Refer to Figure 2 for the Hold Points Inspection and Approval Process.
- Review and approve all non-physical works hold points (e.g., review and approval of pavement materials, geotechnical test certificates, etc.) prior to submission to the City for review and approval.

Road Safety Audits should be conducted in accordance with Austroads Guide to *Road Safety Part 6* on all roads of the subdivision at the completion of construction/prior to opening to the public.

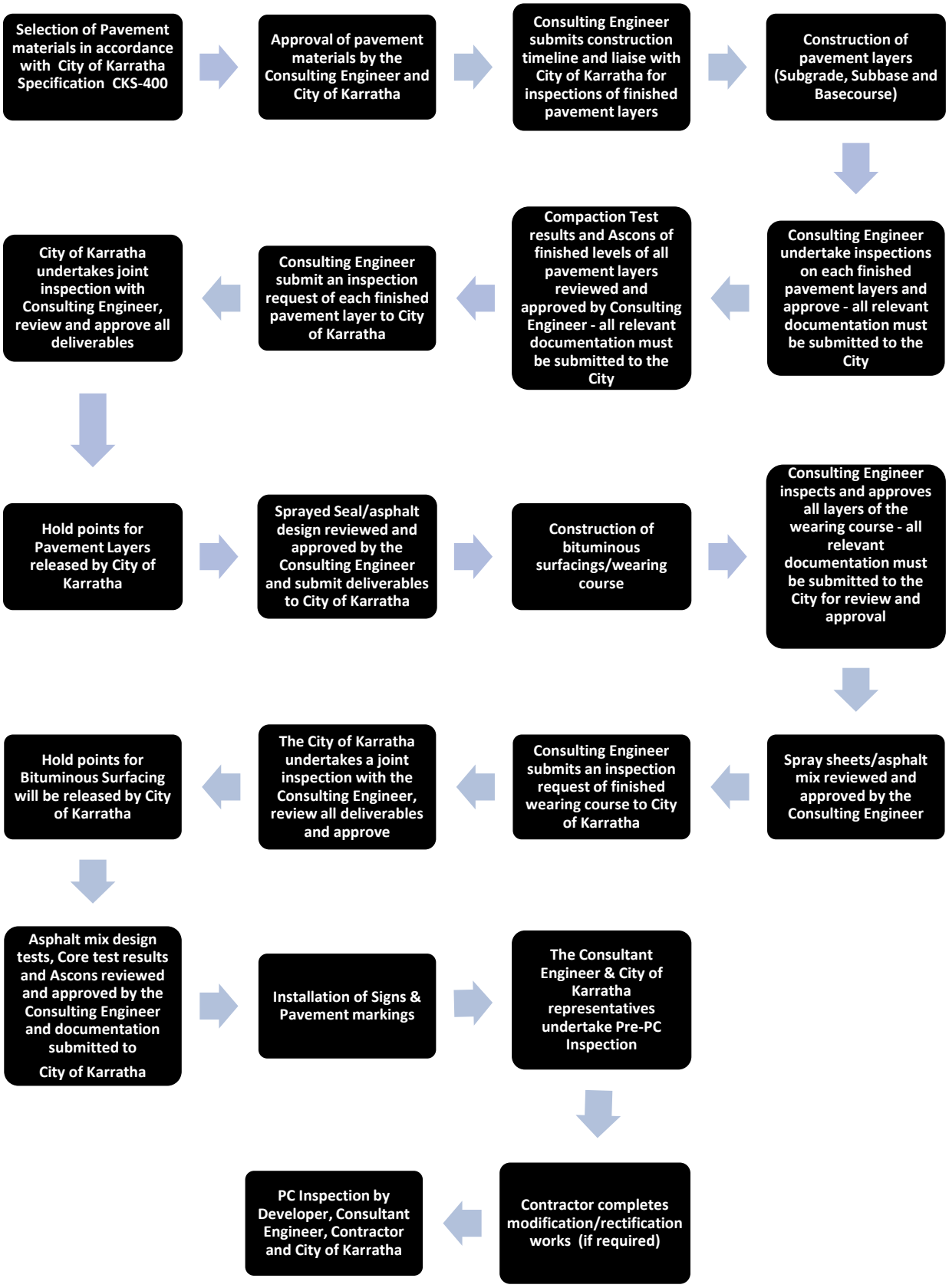

Figure 2 - City of Karratha Road and Pavement Construction Quality Assurance Process

2.4 Practical Completion

Practical Completion is to be granted at the completion of all works, including construction of *bonded items*. *Bonded items* are works bonded to facilitate early clearance. The defects liability period will only commence once PC is awarded by the City of Karratha.

A PC inspection is to be undertaken with all stakeholders involved (i.e., developer's representative, City of Karratha, consulting engineer, and contractor's representative). However, the developer's representative must ensure that the following documentation is submitted for the City of Karratha's review and approval prior to undertaking the PC inspection:

- As-Constructed drawings.
- Submission of certificates and all Quality Assurance (QA) documentation, including but not limited to all signed ITPs, Geotechnical Test Certificates as defined in the Specifications.
- Notification of completion.
- Defects register outlining all defects identified pre-PC inspection with proposed remedial works and timeline of completion.
- Dust control solution (Gluon or similar) to be applied on the lots prior to clearance of conditions.

2.5 Clearance Requirements

The developer must meet the following requirements prior to clearance:

- Practical Completion has been achieved
- Infrastructure Asset Details
- Certificate of compliance
- Bonding of outstanding works as per LGGSD
- Diagram of survey
- Payment of clearance fees and bonds as per LGGSD
- Clearance of conditions
- Legal agreements

3. PRELIMINARIES

3.1 Site Investigations

The contractor shall allow for all pre-site inspections and investigations required to inform themselves of the works. It shall be assumed that the contractor is fully conversant with the ground conditions within and adjacent to the site and all geotechnical investigation results and data to enable construction works. The geotechnical report, test results and data would have been made available by the consulting engineer.

The contractor is also required to review the feature, topographical and utility surveys supplied by the developer or the consulting engineer to identify, locate and set out all above and underground features, structures, services/utilities. Refer to City of Karratha's *CKS-910 Survey and Construction Drawing Guidelines* and *CKS-400 Road Design and Construction Guidelines* for details on land survey works. Generally, a Class B survey is completed to enable a design in accordance with City of Karratha and MRWA's *Underground Utility Survey Class B*. Hence, the contractor shall undertake a *Class A* underground utility survey prior to commencing construction works.

3.1 Land Survey Accuracy

The contractor shall check the values and locations of any benchmarks and property pegs to be used for construction and be responsible for all further setting out necessary for the construction of the works to the levels and positions shown on the drawings or described in the specification.

The contractor shall be responsible for the protection of all benchmarks, cadastral and property pegs.

The Contractor must refer to the City's *CKS-910 Survey and Construction Drawing Guidelines Drawings Guidelines* as part of this specification.

3.2 Safety

The contractor shall prepare and implement a Project Safety Management Plan which complies with the Work Health and Safety Act 2020 and Worksafe WA requirements.

The contractor shall notify Worksafe Western Australia of all Notifiable Works.

The contractor shall conduct the construction of the works in accordance with all current statutory requirements, Local Government By-laws, and the provisions of Australian Standard AS1470, together with any other Code relating specifically to type of machine, process, handling procedures or materials. The contractor shall provide employees with all necessary equipment and protective clothing to allow the safe construction of the works and shall ensure maintenance to all plant and machinery allows for their safe operation.

3.3 Drawing Accuracy

Dimensions are shown on the construction drawings, but it shall be the contractor's responsibility to check all pertinent dimensions and existing conditions on or about the site before commencement of work. Any work component shown on the drawings but not included in this specification or included in this specification but not shown on the drawings, shall be deemed part of the Contract.

3.4 Timing

The contractor shall submit a timing schedule or Gantt chart of the works, stating mobilisation, demobilisation, and key milestone dates.

Unless with prior approval in writing from the City, the contractor shall not conduct works on Sundays, Public Holidays or between the hours of 7 pm on any day and 7 am on the following day except those works required in respect to safety or maintenance of site conditions, such as dewatering activities.

3.5 Dilapidation Survey

A dilapidation survey documents the existing condition of a building before any nearby construction work begins. Where existing buildings are located within 50m of any work area or where buildings may be affected by the works, the contractor shall have a dilapidation survey of each building undertaken by the contractor's insurers prior to commencement of work. A copy of the survey report shall be provided to the City within seven (7) days of its completion.

4. CONSTRUCTION WORKS

4.1 Safety

If the City identifies work as unsafe (including operation of machinery, activity, or any structures), the contractor must stop the works and immediately address the safety issue. Where no remedial action can ensure continued safe works, the contractor shall, in the case of an operation, cease such operation, and, in the case of a machine or structure, shall dismantle and remove such machine or structure from the site.

Where the general safety of the public is concerned and time of notification of the contractor further jeopardises this safety, the City may order immediate remedial works to be conducted at the contractor's expense.

The contractor shall report all accidents and near misses to the City within 24 hours in the form of an incident report noting any corrective action undertaken or to be undertaken.

The contractor shall supply, equip, and maintain adequate First Aid facilities and equipment on the site and shall have an experienced First Aid Officer, available at all times when work is in progress.

4.2 Communication

In the construction of the works, the parties shall act in a spirit of mutual trust and co-operation.

Any party shall promptly notify the other(s) as soon as it becomes aware of any matter which could increase the total price, delay completion, or impair the performance of the works in use.

Any party may call a joint meeting of parties to determine action as to how to manage the effect of the notified

matter.

4.3 Construction Supervisor

The contractor shall provide a Supervisor, experienced in the type of works to be constructed, to always be in charge and who is authorised to receive and act upon instructions from the City.

Where the works are to be inspected by stages, the contractor shall notify the Consulting Engineer as well as the City's representatives at least forty-eight (48) hours prior to the time the inspection is required.

4.4 Contractor Facilities

The contractor shall allow for the erection of all sheds, offices, storage compounds, stockpiles and other necessary facilities in areas approved by the City. All sheds, offices, storage compounds, stockpiles and other necessary facilities shall, for the duration of the contract, conform in all respects to the provisions of the Local Government Act, Local Authority By-Laws, all other Acts and By-Laws, Regulations and Codes of Practices, including the National Construction Code, relevant to such structures and works.

The contractor shall provide, for the duration of the Contract, adequate toilet facilities in a clean and sanitary condition to the satisfaction of the Local Authority Health Inspector. On completion of the Contract, the contractor shall dismantle and remove from the Site all temporary toilet facilities and thoroughly disinfect the area in accordance with the Local Authority Health By-Laws.

4.5 Hold Points & Inspections

Inspections and/or reviews will be required by the City at the following Hold Points following inspections and/or reviews and approvals by the consulting engineer:

No	Stage	Details / Principal's Requirements
1	Selection of Pavement Materials	a) Review and approval of material specifications including test certificates. b) Material Test Certificates must clearly outline the following: • Type of Road base (whether it is MRWA Type A or Type B). • Outlines the following information as a minimum: – AS Sieve Size (mm), percent passing and specification limits. – PSD Graph – Liquid Limit (%) – Plastic Limit (%) – Plasticity Index (%) – Linear Shrinkage (%) – CBR Soaked (%) c) Comply with the City's pavement materials specification as outlined below: • Basecourse MRWA Road Base Type A only. • Subbase MRWA Road Base Type B only.
2	Completion of earthworks	a) Completion of set-out and prior to clearing. b) Completion of earthworks prior to respreading of topsoil.
3 – a	Completion of drainage infrastructure	a) Visual inspection of the subgrade level and proof-roll post compaction (95% MMDD min.). b) Review and approval of compaction test certificates. c) Visual inspection of the bedding layer and proof-roll post compaction (95% MMDD min.). d) Review and approval of compaction test certificates. e) Photographs documented for the following: • Dewatering (if required) • Trenching • Installation of culverts • Restoration and adjacent work f) Visual inspection of the road base fill material above box culverts (95% MMDD min.) g) Review and approval of compaction test certificates.

		h) Approval of compaction results and approval of string line / as constructed levels.
3 – b	**If no drainage**	a) Visual inspection of the subgrade level and proof-roll post compaction (95% MMDD min.). b) Review and approval of compaction test certificates. c) Approval of as constructed levels, compaction results, and satisfactory subgrade surface condition.
5	Completion of subbase	a) Visual inspection of the subbase level and proof-roll post compaction (96% MMDD min.). b) Review and approval of compaction test certificates. c) Approval of as constructed levels, compaction results, and satisfactory subbase surface condition.
6	Completion of basecourse	a) Visual inspection of the basecourse level and proof-roll post compaction (99% MMDD min. for Crushed Rock Base Basecourse and 98% for other Basecourse materials). b) Review and approval of compaction test certificates. c) Approval of as constructed levels, compaction results, and satisfactory basecourse levels. d) Visual inspection, approval of surveyed string line and departure from 3.0m straight edge.
7	Completion of seal	a) Review of seal design/mix or test certificate and approval. b) Visual inspection of finished seal surface, levels and approval. Photographic records including: • Preparation of surface • Application of seals/asphalt • Application of tack coat (if sprayed seal and if required) • Placing of material, including joints • Compaction • Protection of work c) Approval of as constructed levels, compaction results, and satisfactory basecourse levels. d) Visual inspection, approval of surveyed string line and departure from 3.0m straight edge.
8	Completion of line marking and signage	a) Certificate of Compliance that the paint complies with the relevant Australian Standards or APAS specification. b) Visual inspection.
9	Completion of landscaping (where required)	a) Review and approval of design and drawings. b) Inspection of subsoil drainage (if any) as per drainage construction requirements above. c) Inspection and approval post planting (before acceptance).
10	Pre-Practical Completion Inspection	Site walk through no later than four (4) weeks prior to the intended Practical completion date to identify defects for repair.
11	Practical Completion	Site walk through prior to reopening, identification of defects for repair.

Works shall not progress to the next stage of construction until inspected and approved by both the Consulting Engineer and City of Karratha. The City of Karratha representative shall be contacted by the contractor before works can proceed.

The contractor shall, upon request, provide the City with the location and reduced levels of all temporary benchmarks on or near the Site.

The contractor shall allow for provision of all facilities reasonably required to conduct such inspections.

The contractor shall instruct employees to display a co-operative and courteous manner towards the City engineers and/or other representatives, inspecting authorities and in all contacts with the public in respect of

works carried out under the contract. No works subject to inspection or approval shall be backfilled or rendered inaccessible until such inspection has been undertaken or approval has been given.

- Any hold points for all physical works must first be inspected and approved by the Consulting Engineer prior to inspections by the City Representative. This applies to all roadworks; stormwater drainage and other infrastructure and service being built as part of the development.
- Any hold points for all nonphysical works (e.g., review and approval of Pavement Materials, sealing materials etc.) must first be reviewed and approved by the Consulting Engineer prior to handing over to the City.
- The Consulting Engineer must be present at all inspections carried out by the City personnel.
- The hold points will only be released once approval is granted from both parties:
  - Developer's Consulting Engineer/Superintendent
  - City of Karratha Engineers

4.6 Noise

The contractor shall take all reasonable measures to limit nuisance to the Public arising from operations regardless of the source of such nuisance. The Contractor shall, at all times, take adequate measures to control noise on the site in accordance with City of Karratha's Construction Noise Environmental Health Service Information Sheet HS-0008 which is available to be obtained from the City's website (Construction Noise Environmental Health Information Sheet).

Construction noise management shall be carried out in accordance with the City's Residential Noise Environmental Health Information Sheet as follows:

Work that creates noise on a construction site may be carried out between 7am and 7pm on Monday to Saturday (excluding Sundays and public holidays) provided:

- The equipment is the quietest available, and
- Work is undertaken in accordance with noise controls AS 2436 Clause 2, 4 and Appendix C.

The Contractor shall comply with all statutory requirements relating to minimise nuisance from noise. Refer to Environmental Protection (Noise) Regulations 1997. The Contractor may be required to complete a Noise Management Plan if construction is required outside the ordinary hours outlined in the City's HS-0008 information sheet.

Construction personnel carrying out work on a Sunday or public holiday will need to complete a Noise Management Plan (City of Karratha Noise Management Plan Application) which includes noise controls and response to noise complaints should they arise.

The contractor shall ensure the level of noise, when measured in accordance with the Local Authority By-laws and regulations, shall not exceed the maximum permissible level permitted by such By-Laws and Regulations. Where any machine or any operation cannot be conducted within the prescribed limits the contractor shall cease such operation or remove such machine from site. The cost of all noise attenuation measures shall be borne by the contractor.

The contractor shall allow for all reasonable measures, to limit nuisance caused by construction traffic, dust, sand, smoke, vibration, light spill, or other intrusion arising from the contract operations.

4.7 Fire Prevention

The contractor shall provide and maintain adequate, approved firefighting equipment on site. The contractor shall observe the provisions of the WA Bushfires Act, Local Authority regulations, WA Fire Brigades Board regulations and any other regulation in respect to fire prevention.

Burning shall not take place.

The contractor shall ensure that all flammable materials are used and stored in accordance with the Explosives and Dangerous Goods Act and any other statute or regulation governing storage and use of such materials and shall obtain such permits and licenses and pay all relevant fees and charges.

4.8 Dust and Smoke Control

The contractor shall take all necessary measures to prevent dust and windborne material from being carried onto land outside the Site of the Works.

The contractor shall comply with the Land Development Sites and Impacts on Air Quality: A Guideline for the Prevention of Dust and Smoke Pollution from Land Development Sites in Western Australia (November 1996) and A Guideline for Managing the Impacts of Dust and Associated Contaminants from Land Development Sites, Contaminated Sites Remediation and Other Related Activities." (March 2011) both published by the Department of Water and Environmental Regulation.

The contractor shall be responsible for preventing movement of sand, dust or soil from within the Site of the works and shall indemnify the Principal against any claims which may arise as a result of movement of sand, dust or soil from within the Site of the works however valid those claims may be.

The contractor shall, if any claims are made, deal fairly with the person making such claims and shall request that person to deal directly with the contractor and not with the Principal.

The contractor shall arrange operations so that existing vegetation and topsoil are preserved in all areas except those on which fill is to be placed on or in which excavation is to take place or those areas which are defined in this specification as areas for occupation or access.

All access tracks and other disturbed areas shall be regularly watered to prevent wind erosion.

The contractor shall on request, within 48 hours, remove from public roads and other land outside the Site, sand or dust where the City considers the sand or dust originated from the Site of the works.

4.9 Unauthorised Site Access

The contractor shall take all reasonable precautions to limit access and entry to the Site to all unauthorised persons and shall allow for the provision of all necessary warning signs, signposting, and any other measures required in this regard.

The contractor shall allow for all reasonable measures to protect the Works and the operations therein from acts of vandalism. The contractor shall allow for any remedial action required because of such acts. Vandalism shall not be an excluded risk.

4.10 Traffic Management and Alternative Routes

The contractor shall allow for restrictions to the use of the Site to that minimum reasonably necessary for the construction of the Works and shall, in any case, limit activities to those constraints set out in Preliminaries Clause "Limitation of Damage" of this Specification without prior approval of the City.

The contractor shall prepare a Traffic Management Plan for all works that abut or are on existing public roads in accordance with Main Roads Western Australia Traffic Management for Works on Roads Code of Practice and shall obtain approval of the Traffic Management Plan from the controlling Road Authority.

The contractor shall follow the approved Traffic Management Plan during the conduct of the work.

The contractor shall at all times maintain access to the Site for the City to inspect works. The contractor shall not clear, construct or use any route or way for purposes of access without prior written approval of the City.

4.11 Water for Construction

The contractor shall be responsible for the provision of a suitable water supply for the construction of the Works and shall comply in all respects with any restrictions with respect to water use in force during the period of the Contract.

Upon approval by the City, the contractor may draw water for the Works from suitable lakes, streams, bores or other approved natural sources. However, water used for the purpose of mixing concrete shall comply with *City of Karratha Concrete Specification CKS-100*.

4.12 Battery Limits

Generally, the contractor shall, without prior written approval of the City, conduct the following works within the specified limits

4.12.1 Stormwater Drains

Works and clearing for stormwater drain within properties and new road reserves shall be limited to an area of three (3) metres on either side of the centre line of the proposed stormwater alignment.

4.12.2 Roads within New Road Reserves

Roads within new road reserves shall be constructed on the alignments shown on the drawings, and clearing, stripping, and earthworks shall be limited to within the road reserve boundaries except where otherwise stated.

4.12.3 Site Works and Earthworks

Earthworks and associated clearing and stripping operations shall only extend to those limits shown on the Drawings together with the batters for such earthworks or as otherwise described in Site Preparation and Earthworks Clause "Clearing".

Notwithstanding the above, the contractor shall allow for all restrictions to operations caused by likely damage to existing structures, fences, retaining walls, pavements, services, or other improvements either within or outside the Site. Where, in the opinion of the City, the removal of any trench shoring, formwork, falsework, or other similar temporary works may cause damage to any existing structure, fence, service, retaining wall, pavement or other improvement, the City may direct that such trench shoring, formwork, falsework, or temporary works be left in place.

Such direction by the City shall in no way relieve the contractor of responsibility for the repair and reinstatement of any further damage arising from the contractor's activities.

Where, in the opinion of the City, the contractor's activities in clearing, access or stripping have caused unnecessary damage to vegetation, the contractor shall replant, seed, or stabilise in a manner approved by the City all such unnecessary damage.

4.13 Existing Services / Utilities

The contractor shall be entirely responsible for the location and protection of all Public Utilities and services before any works are commenced, regardless of the utility being shown or not shown on the drawings. Repair and reinstatement costs arising from damage to any Public Utility due to the contractor's activities shall be borne by the contractor together with all costs arising from delays caused by such damage.

The contractor shall arrange for any supervision and approval required by any Public Utility in connection with any works on or adjacent to existing services.

5. EARTHWORKS

5.1 General Requirements

This section describes requirements Earthworks for construction activities not covered by existing City of Karratha guidelines and standards.

The contractor shall allow for clearing, excavation, backfilling, compaction, and dewatering in any material that may be encountered on site. The contractor shall deposit all materials that cannot be used in the works at an approved refuse disposal site. The contractor shall allow for all costs and charges in connection with the removal and disposal of such materials.

Earthworks shall include all cut and fill required within the Site to achieve the required levels and shapes as shown on the drawings and specified herein.

Dust control solution (Rainstorm Gluon or approved equivalent) shall be applied to the lots prior to land clearing.

5.2 Clearing

The clearing shall consist of removal for the entire width of the formation area and those cut and fill areas

designated in the drawings of all trees, stumps and other vegetation, boulders and rubbish. All such material shall be removed to a depth of 600mm from the finished surface.

Any holes left shall be filled and compacted to the same density as that of the surrounding undisturbed soil.

Before any excavation or filling to any part of the Works is commenced, the contractor shall remove from that part of the Site all vegetation with a diameter of more than 30mm and length of more than 300mm and shall dispose of all such vegetation from the site.

Minor vegetation matter may be re-distributed with the topsoil with the prior approval of the City.

Any surplus cut material shall be removed from site and disposed of at a location approved by the local authority.

5.3 Compaction

Prior to placement of any fill, the site shall be proof compacted, proof rolled and inspected by the contractors Geotechnical Engineer. All proof compactions must be carried out with modern, efficient, heavy-duty vibrating compaction plant which conforms with Table 2.

Table 1: Minimum compactor specifications (AS 3798 Clause 5.5)

Compaction specification	Smooth drum roller	Plate Compactor
Minimum compactor size	2.0m wide	0.68 x 1.08m
Minimum static weight at drum	60 kN/m width of drum	0.76t
Minimum exciter frequency	20Hz	30.5 Hz

Any areas of unsuitable material exposed shall be excavated, removed, and replaced with suitable material. Prior to placement of the fill the contractor's Geotechnical Engineer shall provide written certification that the site has been prepared in accordance with the Geotechnical Report.

Table 2: Compaction requirements

Location	Minimum Depth (mm)	Minimum degree of compaction (% MMDD)	Moisture content (%)
Areas that are to support fill and subsequently support a structure or trafficable area	200	95	+/-2% OMC
Under all building foundations, floor slabs or structures	300	95	+/-2% OMC
At trench bottoms under pipe bedding	200	92	+/-2% OMC

All fill, backfill, subgrade or other areas required by the Specification or Drawings to be compacted shall be compacted using mechanical or other approved means to attain a minimum dry density ratio of 95% when tested in accordance with AS1289 E2.1 unless otherwise specified for the extent of the fill or 0.6m minimum depth.

The contractor shall avoid excessive use of vibratory compaction equipment. The vibrators shall not be started or stopped near a building.

The type of vibratory equipment and the wave velocity generated shall be selected to minimise ground vibrations beyond the Site.

The wave velocity at buildings and structures shall not exceed a maximum velocity of 5mm/s at the foundations.

5.4 Fill

General fill (for non-structural areas not requiring precision) within the Site shall be placed in layers not exceeding

300mm thickness and compacted to achieve a minimum dry density ratio of 95% when tested in accordance with AS 1289 E2.1 unless otherwise specified.

Select fill shall be as per MRWA Spec 302.09.

Where the subgrade soils are cohesive materials and poorly draining, they shall be shaped to avoid water ponding areas prior to the placement of fill.

All fill material above the prepared subgrade shall be clean, free draining, suitable materials as determined by an appropriate geotechnical investigation, free from foreign and organic matter.

All fill shall be clean non plastic material imported to the Site or obtained from general or roadwork excavation and shall not be contaminated with large stones, vegetation, rubbish or other deleterious material.

The contractor shall allow for any means necessary for adjusting the moisture content of the fill to achieve the required compaction.

Earthworks shall be trimmed to a neat finish within the tolerance specified. The surface shall be even and conform to the intent of the drawings.

5.5 Cement Stabilised Fill

A geotechnical engineer shall determine if cement stabilised select fill is required underneath structural foundations and culverts. The geotechnical engineer shall specify the performance criteria of the cement stabilised fill when the additional stabilisation is required to improve the strength of the material.

5.6 Batters and Embankments

Imported material for embankment shall be in accordance with MRWA Spec 302.08.

5.6.1 Cut Batter

Cut batters shall:

- Not undercut material above the batter
- Achieve an even finished surface
- Be free of loose stones, boulders, roots, stump and any unstable materials
- Not concentrate and or impede flow of water down the batter face

5.6.2 Fill Batter

Fill batters shall:

- Have the batter face trimmed and compacted
- Have the slope not steeper than the specified design line
- Have the toe of the batter achieving the tolerances specified in Table 4

5.7 Tolerances

The following tolerances apply to all earthworks.

Table 3: Tolerances

ITEM	TOLERANCE
Clearing and Grubbing (Width of Design Earthworks above 2.0m)	+/- 0.5m
Earthworks - overall level	+ 50mm / -0mm
Earthworks - top and toe of cut and fill batters	+/- 100mm

Earthworks - drainage basins	+ 0mm / -100mm
Final finish level	+/- 25mm
Flatness – maximum deviation when measured with a 3m straightedge	15mm
Top Soiling (minimum thickness)	+ 50mm - 20mm
Batter / Embankment Slope toe	+/- 30mm
Fill batter – horizontal location of top of batter/shoulder	+/- 300mm
Foundation earthworks width	+300mm / -0mm
Foundation centreline / set-out lines	+/- 50mm
Drain / Levee – deviation from design line	+/- 50mm
Drain / Levee – drain base depth	+/- 50mm

Surfaces that do not comply with the above tolerances must be reworked to a minimum depth of 100mm, by adding or removing material, reshaping, adapting moisture content and re-compacting with appropriate equipment.

5.8 Topsoil

Topsoil shall consist of the upper layer of material which includes vegetation, roots and grass.

Topsoil shall be removed from all areas on which excavation or fill operations are to be conducted. Topsoil so removed shall be stockpiled in areas so selected as to avoid interference with other construction or causing likely contamination of trench backfill. Topsoil stockpiles to be a maximum of 1.5m high and should be hydro mulched to prevent wind blow and supress weed growth.

Clean topsoil free of debris shall be re-distributed to a depth of 100mm to all areas in which cutting, filling and excavation operations have occurred. After the cutting and filling operations have been approved, the contractor shall, within 72 hours of such approval, re-distribute topsoil to a maximum depth of 100mm over these areas.

Any surplus topsoil and shall be removed from the site and disposed of at a location approved by the local authority.

5.9 Water in Excavations

The contractor shall at all times maintain excavations free from water regardless of source or method of entry to the excavation. The contractor shall allow for cut-off drains, well points, bores, drain diversions, pumps and any other means necessary to keep excavations dry and in a safe condition and shall repair or reinstate to the satisfaction of the City any damage caused by failure to keep the excavation free from water.

5.10 Excavation in Rock

"Rock" is defined as material that is required to be excavated to achieve the earthworks levels in the project construction drawings, in accordance with MRWA Spec 302.23 Clause 2:

- Rock is material that cannot be excavated or ripped by a hydraulic single shank ripper of combined mass not less than 52 tonnes (e.g., Caterpillar D10R or its equivalent) at a rate in excess of 90m³ (solid) per hour.
- Isolated boulders, each greater than 0.8m³ in volume, shall also be defined as rock excavation.

A survey to determine the quantity of rock to be removed must be completed and agreed upon by the City. The rock's surface must be exposed and practically clear of all loose material before the survey is undertaken. The survey shall measure to the lines and levels shown on the design drawings – no allowance for over-break or overcutting shall be included in the quantity.

Where excavation in rock occurs, the contractor shall be responsible for any overcut beyond that specified and

all necessary backfill to allow the correct line and level to be maintained.

The method of rock excavation, removal, reuse or disposal shall be agreed upon with the City. Any additional equipment, materials or consumables used by the contractor in performing rock excavation must be reflected in the agreed unit rate.

Failure to complete these requirements forfeits the contractor's right to claim excavation as rock.

5.11 Excavation in Existing Road Reserves

Excavation shall be kept to a minimum in existing roadways, footpaths, other paved areas and developed verges. Lawn is to be cut in sods or rolls, removed, and stacked prior to excavation. Lawn is to be reinstalled and level immediately after backfilling of the trenches.

Any irrigation lines which are damaged during the works shall be reinstated immediately upon backfill of the excavations. Pipes shall be cut and capped to allow use of the system during works.

The contractor shall ensure minimal damage to all vegetation and any damage shall be reinstated to the satisfaction of the City.

5.12 Stabilisation

The disturbed soil on the Site other than the road formation shall be stabilised by either dry seeding and covering with shredded vegetation or hydromulch as soon as practicable after the topsoil has been satisfactorily replaced and regraded.

It is the responsibility of the design consultants to assess and select appropriate soil stabilisation methods and materials in accordance with the project's requirements. This responsibility encompasses:

- Conducting a comprehensive geotechnical analysis to understand the soil conditions and bearing capacity
- Evaluating the project's design specifications and load-bearing requirements.
- Recommending suitable soil stabilization techniques and materials, considering factors such as environmental impact, durability, and cost-effectiveness, ensuring that the chosen soil stabilization strategies are compatible with surrounding soils and promote long-term stability.
- Collaborating with relevant experts, including geotechnical engineers and environmental specialists, to ensure the selected methods align with best practices.
- Overseeing the implementation of the selected stabilization methods during construction to ensure they are applied correctly and meet the project's performance criteria.

5.12.1 Dry Seeding

A mixture of endemic local groundcovers and shrubs, as specified by the local authority, shall be sown using an approved seed drill attached to a tractor.

The mixture shall be applied at the rate of not less than 120 kg/ha.

The rows of seeds shall, wherever practicable, run parallel to the contours of the ground surface.

The whole area shall, upon completion of the seeding, be lightly raked to remove wheel tracks etc., and present a smooth even surface.

5.12.2 Hydromulching and Seeding

Hydromulch shall consist of water, seed, wetting soil agent, fertiliser, binding agent and a biodegradable filler, and a stabiliser applied by mechanical spray.

Stabiliser shall be applied at 250 L/ha.

Mulch shall comply with AS 4454 and the City's Landscaping Specification.

Prior to Hydromulching all areas to be treated shall be graded to present an even surface on completion of the hydromulch application.

5.12.3 Temporary Stabilisation

Temporary stabilisation shall be undertaken as required by the City by the application of an organic stabiliser, protect coat K61 or similar and water mix. The mix may be sprayed onto the Site by water cart.

5.12.4 Spreading Shredded Vegetation

Shredded vegetation shall be evenly spread over disturbed ground, other than building sites, as directed by the City.

5.13 Site Presentation

All verges shall be back bladed and graded to present an even surface. This shall be completed prior to stabilization works.

6. ROAD SPECIFICATIONS

6.1 General

Roads shall comply with the *City of Karratha Road Design and Construction Guidelines CKS-400.*

Roads shall be constructed to the project drawings – any deviations or unclear information shall be referred to the consulting engineer.

Road Safety Audits should be conducted in accordance with Austroads Guide to road Safety Part 6 on all roads of the subdivision at the design stage and at the completion of construction / prior to opening to the public.

6.2 Tolerances

Pavement construction shall comply with the following tolerances and the surface shape shall be such that water cannot pond at any point.

Table 4: Road Specifications

COMPONENT	TOLERANCE			
	THICKNESS	LEVEL	SHAPE (DEPARTURE FROM 3M STRAIGHT EDGE)	WIDTH
Subgrade	-	+ 10mm - 30mm	-	+ 200mm - 0mm
Subbase	+ 15mm - 0mm	+ 10mm - 20mm	-	+ 200mm - 0mm
Basecourse	+ 10mm - 0mm	+ 5mm - 10mm	5mm	+ 100mm - 0mm
Wearing Course Option 1: Seal Surface	-	+ 5mm -10mm	5mm	+ 100mm - 0mm
Wearing Course Option 2: Asphalt Surface	+ 5mm - 0mm	+ 5mm - 10mm	5mm	+ 100mm - 0mm

6.3 Sub-Grade

The formation shall be excavated to the required pavement width and to the longitudinal and cross sectional

gradings shown on the drawings.

Heavy clay, gilgai or other unsuitable material shall be removed completely or to a depth recommended by a suitably qualified and experienced geotechnical engineer. Excavations shall be filed with clean sand or filling material. Fill material shall be compacted in layers of 250mm or less and shall be compacted to a minimum dry density ratio of not less than 95%.

The sub-grade shall be compacted to a minimum dry density ratio of not less than 95% when tested in accordance with AS1289 E2 to a minimum depth of 150m below the sub grade surface.

The completed sub-grade shall be:

- In a homogenous uniformly bonded condition with no evidence of layering or disintegration
- Have a surface maintained in its conforming condition until pavement construction commences, and shall be watered as necessary to prevent shrinkage, cracking, dusting, or loosening of its surface
- Approved by the Superintendent prior to placing the sub-base material.

6.4 Subbase

The sub-base shall be constructed of crushed rocks or gravel complying with *City of Karratha Road Design and Construction Specification CKS-400.*

The material shall be placed within the formed box and spread, without unduly disturbing the sub-grade, to the required profiles working from the centre towards the edges.

The material shall be water-bound, spread, and compacted to a minimum dry density ratio of 96% when tested in accordance with AS1289 E2.1.

The completed sub-base shall be approved by the Superintendent prior to the placing of the base course.

6.5 Basecourse

The base course shall be constructed of crushed rock base complying with MRWA Spec 501.11 to the width shown on the drawings.

The base material shall be spread from an approved tipping truck in an even and continuous layer.

Base course shall be compacted in layers with thicknesses between 150mm and 200mm, inclusive.

The base material shall be watered to the optimum moisture content, graded to the required profile with a minimum of cut and uniformly compacted to a minimum dry density ratio of 99% when tested in accordance with AS1289 E2.1.

Any part of the base course which is below the required level after consolidation shall be scarified to a depth of 75mm, made up with fresh base material and re-compacted.

The final base course shall have a minimum thickness of 200mm and be free from bony areas and thin layers of finer material.

The completed base course shall be approved by the Superintendent prior to the application of the primer/binder for the surface wearing course.

Road base shall be hard crushed aggregate of various gradings, including "fines", derived from naturally occurring igneous rock and free from sand, vegetable matter and any other deleterious material.

Grading:

The particle size distribution for the crushed rock base basecourse shall comply with MRWA Spec 501.11 and Table 501.09.

Notwithstanding this specification, any sample which in the opinion of the Superintendent, is composed of unsuitable material, or is composed of material which would break down with aging or weathering to such an extent that it would then fall outside the limits of this Specification, shall be rejected.

- Compacted Pavement layers shall be in a homogeneous, uniformly bonded condition with no evidence of layering, cracking, disintegration, or surface tearing.
- The finish surface should appear as a stone mosaic interlocked with fine material and shall be dense, even textured and tightly bonded. Slurring of fines to the surface shall be avoided.
- Basecourse must retain the above characteristics after rotary brooming and be suitable to receive bituminous surfacing.
- Prior to the application of a bituminous surfacing the surface of the Basecourse shall be uniformly dry.

6.6 Proof-rolls

Proof-rolls of the subgrade, subbase and basecourse are hold points and must be undertaken at the expense of the contractor, in accordance with AS 3798.

The subgrade must not show signs of deep-seated deflection vertically under the test roller (fully-laden tandem truck or watercart with not less than 10kL capacity or multi-tyre roller).

Localised areas should be remediated. If deep seated deflection of the subgrade is found in more than 20% of the project area, then the total area must be reworked.

There must be no visible deformation or cracking of the pavement during a proof roll. Areas that fail a proof roll test are the responsibility of the contractor to rectify.

Proof rolls are to be undertaken in the presence of the Site Supervisor, Consulting Engineer / Superintendent and Council representative.

- Prior to the construction of any pavement Layer, the contractor shall certify to the Consulting Engineer that the pavement material supplied by the contractor complies in all aspects with the specified requirement.
- Prior to the construction of any pavement layer, the contractor shall certify to the Consulting Engineer that the underlaying layer has been constructed as specified.

6.7 Wearing Course – General Requirements

The contractor shall notify the Superintendent at least 48 hours in advance of the intended sealing or surfacing works and shall submit the proposed seal design for approval. However, any *sprayed seal or asphalt mix design must be certified by Developer's Engineer/Superintendent and submitted for the City of Karratha's review and approval prior to construction.

Sealing shall proceed a minimum of 24 hours after application of the prime coat.

The pavement shall be protected from all traffic for a minimum of 48 hours following the completion of sealing.

The surface course of roads shall be either:

- Option 1 – Bituminous Sprayed Seal - Double/Double Seal
  - Apply Cutback Bitumen Prime to the prepared basecourse
  - Allow Cutback Bitumen Prime to cure as specified in MRWA Specification 503
  - Apply double/double seal (bitumen class and aggregate size to be designed by the engineering consultant's pavement engineer).
- Option 2 – Asphalt - Dense graded Asphalt (Hot-mixed) laid to a minimum thickness of 30mm unless otherwise specified in the drawings.

***NOTE: the City's preference for wearing course at subdivisions is asphalt to minimise the need for regular maintenance. Sprayed seal design will only be considered in rare cases where asphalting is not suitable.**

Intersections shall have a wearing course of dense graded 10mm size asphalt (Hot-mixed) intersection mix laid to a minimum thickness of 40mm unless otherwise specified on the drawings.

6.8 Wearing Course – Option 1 - Bituminous Sprayed Seal

6.8.1 Materials

Materials used for a Bituminous Spray Sealed Surface Wearing Course shall comply with the following relevant standards:

- AS 1160 Bitumen Emulsions for Construction and Maintenance of Pavements
- AS 2008 Residual Bitumen for Pavements
- AS 2157 Cut Back Bitumen
- AS 2758.2 Aggregates and rock for engineering purposes, Part 2: Specification for sealing aggregate

6.8.2 Aggregates

Aggregates shall consist of clean hard, durable pieces of crushed stone or crushed gravel, free from deleterious material or excessive amounts of flat or elongated pieces.

Aggregates shall comply with AS 2758.2.

Aggregates shall be even graded from coarse to fine and comply with the following limits:

Table 5: Bituminous Spray Seal Aggregate Requirements (Extract from AS 2758.2 Table 7.1)

AGGREGATE GRADING SPECIFICATION			
NOMINAL SIZE (mm)	PERCENTAGE (BY MASS) PASSING FOR THE FOLLOWING NOMINAL SIZE AS SIEVE		
	14mm	10mm	7mm
19.0	100		
13.2	85 - 100	100	
9.5	0 - 30	85 - 100	100
6.7	0 - 10	0 - 40	85 – 100
4.75	-	0 - 15	0 – 35
2.36	0 - 2	0 - 3	-
1.18			-
0.600			0 – 3
0.075	0 - 1	0 - 1	0 - 1
Maximum Flakiness Index	Maximum 35%		
Minimum average least dimension (mm)	7.0	5.0	3.5

When tested in accordance with the Los Angeles abrasion test, aggregate shall have a percentage of wear not greater than 40%, and when tested in accordance with the Aggregate Crushing Strength Test, shall have a loss not greater than 30%.

Notwithstanding this Specification, any sample, which in the opinion of the Superintendent, is composed of unsuitable material, or is composed of material which would break down with ageing or weathering to such an extent that it would then fall outside the limits of this specification, shall be rejected.

6.8.3 Hot Bitumen

Hot bitumen shall be straight run class 170 residual bitumen suitable for road sealing purposes.

Additives for various conditions may be specified by the Superintendent.

For spray work the temperature of the bitumen shall be not greater than 180°C and not less than 16°C.

6.8.4 Bitumen Emulsions

The emulsions shall be prepared from class 50 residual bitumen and an approved emulsifier.

The type and grade of emulsion may be specified by the Superintendent. The bitumen content shall be a minimum of 60%.

6.8.5 Cut-back Bitumen

The cut-back bitumen shall consist of straight run class 170 residual bitumen mixed with medium curing cutter and slow curing cutter.

The grade and proportions of each cutter may be specified by the Superintendent.

For spray work, the temperature of the cut-back shall be in accordance with the relevant range recommended in Austroads “Guide to Pavement Technology Part 4K: Selection and Design of Sprayed Seals”, 2019.

6.8.6 Adhesion Agents

Adhesion Agents shall be compatible with the Sealing Aggregate being used.

6.8.7 Precoating

Precoating for aggregates shall be a slow curing cutter. The application rate shall be 2L / loose m^3.

6.8.8 Sprayed Seal - Primer

The grade and application rate of the binder shall be in accordance with the appropriate seal design and confirmed by the contractor after the inspection of the completed base course. Generally, the binder will be bitumen emulsion but maybe cut back hot bitumen.

Generally, the application rate will be 1.4 L/m^2.

After the completed base course has been approved and any deficiencies corrected, it shall be broomed clean of all loose materials and dust without damaging the surface. Priming shall not proceed until the basecourse surface has dried back to a moisture content not exceeding 3%.

Immediately before the application of a bitumen emulsion binder, the basecourse shall be slightly dampened to ensure proper penetration and coverage.

6.8.9 Sprayed Seal – Final Seal

The grade and application rate of the binder shall be in accordance with the appropriate seal design and confirmed by the contractor after inspection of the completed primer seal.

Generally, the binder will be hot bitumen fluxed with 1% diesel fuel and contain 0.1% adhesion agent.

Generally, the application rate will be 1.50 L/m^2.

The cover aggregate shall be spread at a rate approved by the Superintendent. Generally, for 14mm nominate aggregate the application rate will be $800m^2/m^3$.

Prior to sealing, the primer seal shall be broomed clean of all loose materials and any defects or irregularities corrected to the satisfaction of the Superintendent. Sealing shall not proceed until a minimum of 24 hours after application of the prime.

Each seal coat shall extend at least 400mm behind each proposed kerb line or where there is no kerb to the proposed edge of seal as shown on the design drawings.

The pavement shall be protected from all traffic for a minimum of 48 hours following completion of the second seal coat.

6.8.10 Spraying

The binder shall be sprayed directly from a spraying unit having a current test certificate issued by Main Roads Western Australia.

Before and after each spray run, the contents of the spraying unit shall be dipped on level ground, and the application rate checked. This shall be within 5% of the specified rate.

The aggregate spreading trucks and rolling and brooming equipment shall be ready to follow the spraying unit prior to the commencement of each spray run.

The width and length of each spray run shall not be greater than that which can be adequately covered by the material and equipment on hand immediately prior to the commencement of the spray run.

The laps of each run shall be free of loose aggregate prior to the commencement of an adjoining run. Stop/start trays or cut-off sheets shall be available for use if required by the Superintendent.

Spraying of hot bituminous binders shall not be carried out when the pavement temperature is below 20ºC and spraying in general shall be not carried out in inclement weather or if the Superintendent has advised that conditions are unsuitable.

6.8.11 Spraying Equipment

The spraying unit shall have a current test certificate issued by Main Roads Western Australia and shall comply with the requirements specified in Austroads “Performance Requirements for Bitumen Sprayers”, 2019.

Unless otherwise permitted, the sprayer shall have a minimum tank capacity of 2000 litres.

6.8.12 Aggregate Spreading

Trucks used for aggregate spreading shall be in good mechanical condition and fitted with bodies and aggregate spreaders from which the material cannot spill.

The aggregate spreader shall be operated only by persons competent and experienced in similar types of work.

At the completion of each spreading run the quantities used shall be recorded and the application rate checked.

The aggregate shall be spread immediately following the commencement of each spray run and continue as close as practicable behind the spraying unit.

6.8.13 Rolling and Brooming

Prior to rolling, any areas under covered shall be corrected and any spillage heaps shall be removed or uniformly distributed over the work.

If the aggregate is wet the rolling operation shall be delayed until it is almost dry.

Initial rolling shall be affected by a 6/8t smooth steel wheeled roller completing two passes over the total sealed area.

After the initial rolling the seal shall be broomed with a drag broom to ensure uniform distribution of the aggregate and final rolled with a 6/8t smooth steel wheeled roller or 8/10t pneumatic rubber tyred multi-wheeled roller.

The rolling shall continue in conjunction with the brooming to achieve 1 hour of rolling per 500m^2 of seal. The wheels of the roller shall be kept clean.

If there is any evidence of aggregate crushing, the steel roller shall be removed from the work and the rolling continued with a rubber tyred roller.

6.8.14 Finish

The completed seal shall produce a well bonded uniform surface free from over-sprayed, under-sprayed or under-covered areas and an excessive quantity of loose aggregate.

The completed seal may be inspected by the Superintendent and no sealing plant shall be removed from the site until the work has been approved.

6.9 Wearing Course – Option 2 - Asphalt (Hot Mix) Surface

Wearing Courses using Asphaltic Concrete, or simply Asphalt shall comply with Table 7, *City of Karratha Road Design and Construction Specification CKS-400* and MRWA Spec 504.

Table 6: Asphalt Specification

Standard Mix	AC14 Intersections	AC10	AC7
Nominal Mix Size	14mm	10mm	7mm
Bitumen Binder	Class 320	Class 170	Class 170
Binder Content	4.4% to 5.0%	5.1% to 5.7%	5.1% to 5.7%
Grade	Dense		
Aggregate Type	Igneous Rock		
Marshall Blows	75		
Minimum Marshall Stability of Compacted Mix	8kN		
Marshall Flow	2 to 4mm		
Air Voids (WA 733.1)	4.0% to 7.0%		

Asphaltic Concrete Aggregate sieve sizes shall comply with Table 8.

Table 7: Asphalt Aggregate Sieve Sizes - extract from MRWA Table 504.B2

SIEVE SIZE	RANGE PERCENTAGE OF MINERAL AGGREGATE PASSING SIEVE (BY MASS)	
	AC 10	AC 14 INTERSECTIONS
19.0mm	-	100
13.2mm	100	93 - 100
9.50mm	90 - 100	79 - 89
6.70mm	-	63 - 73
4.75mm	30 - 40	49 - 59
2.36mm	10 - 16	33 - 41
1.18mm	8 - 14	22 - 32
0.600mm	-	15 - 23
0.300mm	4 - 10	10 - 18
0.150mm	-	6 - 11
0.075mm	2 - 4	2 - 5

6.9.1 Delivery

All delivery vehicles shall be in good mechanical condition. Vehicle bodies shall be such that the asphalt cannot leak or spill and shall be fitted with covers of such size, thickness and material as to protect the load from the weather.

When directed by the Superintendent, or where the lead exceeds 110km, or where the ambient temperature is below 10ºC and the lead exceeds 50km, the vehicle body and the cover shall be suitably insulated.

The interior of each vehicle body shall be cleaned of all foreign materials and lightly lubricated as necessary with a slightly detergent solution or other approved material. All foreign material and excess lubrication shall be removed prior to loading the vehicle.

Delivery dockets showing the following written information shall be available to the Superintendent.

- Quantity of material.
- The date and time of loading.
- The name of the supplier.
- The identification number of the vehicle.
- The size of the asphalt and the location reference of the plant at which the asphalt was manufactured.

6.9.2 Asphalt Construction Plant

Sprayers

Sprayers shall be capable of spraying the tack coat uniformly through jets in a spray bar at the desired rate of application up to a width of 2.5m. The spray bar shall be fitted with end shields.

Pressure type sprayers issued for spraying bitumen emulsion shall be capable of operating at a continuous pressure of 175kPa.

Pavers

Pavers shall be self-propelled and shall be equipped with hoppers and distributing screws of the counter rotation type to place the asphalt evenly in front of the screed. Means shall be provided to heat the screed uniformly over its full width.

Pavers shall be equipped with a quick and efficient steering device and shall be capable of forward and reverse travelling speeds of 30m/min. They shall be capable of spreading the asphalt without segregation in a paver compacted thickness between 15mm and 150mm and to widths between 1.8m and 4.3m except in the case of wide or twin pavers which shall be capable of spreading widths up to 8.0m.

Compaction Plant

The contractor shall provide at least one steel wheeled tandem roller fitted with a suitable cutting wheel and one pneumatic tyred multi-wheeled roller.

The rollers shall be in good mechanical conditions and capable of reversing without back lash.

All rollers shall be fitted with approved devices to enable the whole of the surface of the wheels to be kept damp with a minimum amount of water. The taps controlling the rate of flow shall be readily accessible to the driver. In no circumstances shall the water be allowed to run directly from taps onto the asphalt being compacted.

For the compaction of asphalt, the contractor shall provide self-propelled reversible rollers complying with the following requirements:

- Steel wheeled rollers shall have a mass not less than 9 tonne (non-vibratory) and 6 tonnes vibratory and shall have a static load intensity not less than 4.5 tonne per metre width of drive roll.
- Self-propelled, pneumatic tyred, multi-wheeled rollers shall be equipped with tyres of equal size and diameter, having smooth treads. Tyres on the rear wheel shall be offset relative to the front tyres to give overlapping wheelpaths and complete coverage for the effective width of the roller. The tyres shall be capable of being inflated to 700kPa. The total operating mass and tyre pressures may be varied as directed by the Superintendent.
- Rollers used for layers of compacted thickness less than 100mm thickness shall be so constructed that the total mass of the roller can be varied to produce an operating load per tyre up to 1 tonne.
- Rollers used for layers of compacted thickness of 100mm or more shall be so constructed that the total mass of the rollers can be varied to produce an operating load per tyre of between 1.3 tonnes and 2.3 tonnes.
- Self-propelled, pneumatic tyred, multi-wheeled rollers for use in initial rolling on layers of compacted thickness

of 100mm or more shall have tyres not less than 220mm wide, on rims not less than 500mm diameter.

- All rollers shall have approved brushes or similar devices so that each roll of tyre is kept clean of foreign material and can be kept uniformly damp.
- For compacting confined areas, the contractor shall provide a small roller and/or a mechanical impact type or vibrating type hand-operated compactor.

6.9.3 Asphalt Preliminary Work

Before commencing each day's work, the contractor shall clean the area.

Cleaning shall consist of the removal of all deleterious material and sweeping the area clean.

Surface preparation, which shall include sweeping and hand chipping shall be done before applying the tack coat. When any area contains an excess of binder in such a quantity that there is any possibility of the excess binder coming to the surface of the new work, no asphalt shall be placed upon such area until all such excess binder has been removed to the satisfaction of the Superintendent.

The contractor shall take all necessary action and precautions to prevent and divert traffic from damaging the works. The contractor shall at all times supply, use and place all necessary traffic control devices to control the traffic movement along the street when work is in progress. All such devices shall be selected and placed in accordance with the Main Roads Western Australia Traffic Management for Roadworks Code of Practice, AS 1742.3, Manual of Uniform Traffic Control Devices Part 3 Traffic Control Devices for Works on Roads, and SAA HB81, Field Guide for Traffic Control at Works on Roads.

6.9.4 Tack Coat

Tack coat shall consist of Class 50 rapid setting bitumen emulsion which may be diluted by the addition of up to 50% of clean water with the consent of the Superintendent. It shall be applied only to a clean, dry surface.

The tack coat shall be applied a minimum of 30 minutes and a maximum of 2 hours before asphalt is laid.

Tack coat shall be applied by a sprayer through jets in the spray bar at a rate of 0.5 L/m^2.

Tack coat sprayers shall at all times be in a clean condition internally and externally. The interior of all pipework, spray bars and spraying jets shall be clean and free from any tack coat materials before spraying commences.

Tack coating and spreading of asphalt shall cease if the sprayer does not spray uniformly at the desired rate of application.

The contractor shall arrange the work so that the minimum length of tack coat is sprayed in any one operation. A sufficient period of time shall be provided in order to allow the tack coat to set up and become tacky before the asphalt is placed.

The use of hand lance or squeegee will be strictly limited to those areas inaccessible to the use of a sprayer or where a variable application rate is required.

When spraying the tack coat shields shall be used and all necessary precautions taken to protect kerbs and adjoining structures from damage.

The Superintendent may require the contractor to dispense with the tack coat when spreading asphalt over clean freshly laid asphalt, or over a clean dry and cured primed surface, or where the depth of the layer equals or exceeds 50mm.

6.9.5 Spreading

Asphalt shall be laid after the kerbing has achieved adequate strength.

The asphalt shall be laid on a foundation which is essentially dry and free from puddles.

No asphalt shall be placed in layers less than 25mm compacted thickness when the ambient temperature is less than 10ºC unless rolling is done immediately after spreading.

No asphalt shall be placed in layers less than 100mm compacted thickness when the ambient temperature is less than 10ºC or when cold winds chill the asphalt to an extent that spreading, and compacting are adversely affected. In an emergency, approval may be given by the Superintendent to spread the asphalt when the ambient

temperature is below 10ºC but only under such conditions as may be directed.

Under no circumstances shall asphalt be spread when the ambient temperature is less than 5ºC.

The asphalt shall be spread in accordance with the lines and levels shown on the contract drawings for each pavement course.

The speed of the paver shall be as uniform as possible and the lowest consistent with the rate of delivery of asphalt. The occasions on which the paver needs to be stopped shall be kept to a minimum.

Asphalt paving operations shall not commence until sufficient asphalt is on-site to permit continuous spreading operations.

The asphalt shall be spread without tearing, gouging, or displacement to produce an even surface. Where necessary, the surface shall be corrected by methods approved by the Superintendent.

The spreading of asphalt by hand behind the paver is not permitted except where it is impractical to spread and finish asphalt by machine methods; hand methods may be used with the approval of the Superintendent.

Asphalt shall be spread in such a manner as to minimise the number of joints in the carriageway. The layout of joints shall conform to the following requirements.

In any individual layer, transverse joints in adjoining paver runs shall be displaced longitudinally by not less than 2m.

All longitudinal joints shall be offset from layer to layer by not less than 150mm. Where proposed lane line positions are provided, longitudinal joints in the wearing course shall be made to coincide with these by the use of spreading widths corresponding with the lane widths.

The screed of the paver shall overlap the previously spread lane by 25mm to 50mm. At cold joints, the overlapped asphalt shall be removed to waste or crowded back at the joint. No asphalt shall be thrown onto the mat being spread.

Unless otherwise directed by the Superintendent, the day's work shall be organised so that each layer spread covers the full width of the carriageway.

Immediately after any layer is spread and before compaction is started, the surface shall be checked, any unevenness adjusted, and all sandy, segregated, hungry, or dusty areas removed and replaced with fresh hot asphalt. Irregularities in alignment and grade along the outside edge shall be corrected by the addition or removal of asphalt before the edge is rolled.

Competent workmen capable of correcting all pavement irregularities shall be employed. The correction of irregularities shall be checked for shape and level with a straight edge immediately following the initial rolling.

Permission to proceed with paving operations may be withdrawn by the Superintendent until remedial work is complete.

When laying of asphalt by hand is approved, it shall be distributed into place without segregation in a loose layer of uniform density and to the correct level. It shall be spread without tearing, gouging or displacement to produce a smooth, even surface true to line, level and camber. Raking shall be done in a careful and skilful manner. Asphalt shall not be deposited any faster than can be properly handled.

Workmen shall not stand or walk on the hot-spread asphalt except for the purposes referred to above.

6.9.6 Joints and Junctions

All longitudinal and transverse joints shall be well-bonded and sealed. Hot longitudinal joints are preferred.

Junctions between old and new pavements and joints between successive days' work shall be carefully made in such a manner as to ensure a thorough and continuous bond between the old and new surfaces and to provide a smooth riding connection across the junction or joint.

The exposed edges of each paver run shall be formed while hot with a dense face which may be between vertical and 45º to the vertical for the full depth of the layer. Rollers shall not be permitted to damage this face. Any segregated or open textured asphalt in such face shall be removed by cutting back the edge in a straight line to

expose fresh, dense asphalt. The cut edge shall be between vertical and 45º to the vertical.

All longitudinal joints shall be parallel to the centre line of the carriageway. Special care shall be taken in the forming of longitudinal joints at ramp terminals and at all intersections to avoid joint layouts and an appearance that would tend to misdirect traffic from the designed travel paths. The plan of jointing in critical traffic path areas shall be approved by the Superintendent prior to placing the wearing course.

Transverse joints shall be at right angles to the direction of spreading and cut to a straight vertical face for the full depth of the layer.

When necessary, after asphalt has been placed by the paver along any abutting edge such as a kerb, manhole or an adjoining pavement, just enough hot asphalt shall be carried back to fill any space left unfilled. This joint shall be properly 'set up' at the proper height and level to receive the specified compaction under rolling.

Any longitudinal edge that is damaged by traffic or rolling shall be treated as set out before additional asphalt is laid alongside it.

Where asphalt is required to match an existing surface or other fixture, the contractor shall place the asphalt in such a manner as to provide a smooth riding surface across the junction. Where required, the contractor shall remove sufficient of the existing pavement to enable a smooth riding surface to be constructed across the junction.

Where it is necessary to re-sheet an existing asphalt surface in order to provide a smooth riding surface across the junction, the section of tapering thickness asphalt shall end at a chase cut into the existing asphalt. This chase shall be approximately 25mm deep and 150mm wide unless otherwise directed by the Superintendent. When necessary, removal of coarse particles from tapering thickness asphalt will be allowed using hand raking.

Where the depth of asphalt being placed in tapers is less than twice the size of the asphalt, the area upon which such reduced thickness is to be placed shall be uniformly covered with tack coat at an application rate of 0.50 L/m^2 as directed by the Superintendent.

6.9.7 Compaction Procedures

After spreading, the asphalt shall be thoroughly and uniformly compacted as soon as it will support the roller without undue displacement, other delays in rolling freshly spread asphalt will not be permitted.

Where asphalt is being placed in layers of less than 100mm and greater than 25mm compacted thickness, the following procedure shall be adopted for compaction unless otherwise directed or approved by the Superintendent.

- Initial rolling shall be performed with a steel-wheeled tandem roller with the driving roll nearer the paver except on steep grades or on sharp curves where the steering roll shall be nearer the paver. Any transverse and/or longitudinal joints shall be rolled first. Rolling shall then continue and be in longitudinal straight runs, commencing on the lower side and proceeding to the higher side of the spread asphalt. The roller shall overhang the unsupported edges of the paver run approximately 0.1m.
- Each longitudinal run shall overlap the previous run by approximately 0.1m, and adjacent passes of the roller shall be of differing lengths.
- Secondary rolling shall be performed as soon as possible after initial rolling and shall be performed with a self-propelled pneumatic tyred roller or vibratory of gross mass not exceeding 12 tonnes, with the driving wheels nearer the paver. Rolling shall be in longitudinal straight runs commencing on the lower side and proceeding to the higher side of the spread asphalt, each run substantially overlapping the previous.
- Final rolling, if necessary and directed by the Superintendent, shall be performed with a steel-wheeled tandem roller whilst the asphalt is sufficiently warm to permit all roller marks to be eliminated. Rolling shall be limited to a maximum of two coverages in a similar manner and pattern as for the initial roller, except that the prior rolling of joints shall not be necessary.

The speed of rollers shall not exceed 5km/h for steel wheeled roller or 25km/h for self-propelled pneumatic tyred or vibratory rollers or shall be as directed by the Superintendent, and at all times shall be slow enough to avoid displacement of the asphalt. Any displacement occurring as a result of reversing the direction of the roller or from any other cause shall be corrected immediately. Rollers shall be operated by competent and experienced drivers and shall be kept in continuous operation so that all parts of the pavement shall receive substantially equal compaction.

Rollers shall not remain stationary on recently compacted work. All roller wheels shall be kept clean of any build up including tack coat material.

Around manholes and similar structures and at all places not accessible to the roller, thorough compaction shall be obtained by means of approved tampers. The joints between these structures and the asphalt shall be effectively sealed.

Each layer shall have a characteristic Marshall density of 94.5%.

6.9.8 Clean Up

During the progress of the work, the contractor shall always keep all channels and pits free of debris. The contractor shall remove all sweepings, spoil and excess or rejected material from the site and shall leave the area clean to the satisfaction of the Superintendent. The disposal of such material shall be in accordance with any requirements of the Local Authority.

6.9.9 Testing

All tests shall be conducted in accordance with Marshall design parameters by a NATA registered testing laboratory to current Australian Standard or Main Road Western Australia standard.

The acceptance of the asphalt surface will be determined in accordance with the requirements of the Institute of Public Works Engineering Australia (WA Division) and Australian Asphalt Pavement Association (WA Branch) Technical Specification for Supply and Laying of Hot Asphalt Road Surfacing.

6.10 Roadside Structures

6.10.1 Guideposts and Delineators

Guideposts in accordance with the drawings shall be placed along the roadway at horizontal and vertical curves, straight sections where embankments exceed 2m in height, each side of culvert headworks and cul-de-sac turn rounds, in accordance with spacings as defined in AS1742.2.

The posts shall be placed not less than 1.5m from the seal edge with the broad face towards the oncoming traffic.

The colour shall be white.

The height should generally be 1.0m

The height of the posts shall be adjusted so that the tops are on a uniform grade taking into account shoulder contours and the effects of superelevation.

Retroreflective delineators shall be attached to the guideposts with white on the right side of the carriageway and red on the left side of the carriageway as seen by approaching drivers, as per Class 1A Material in AS 1906.1 “Retroreflective Materials and Devices for Road Traffic Control Purposes - Reflective Materials”.

The spacing of guideposts shall be in accordance with Austroads “Guide to Traffic Engineering Practice Part 8, Traffic Control Devices” and Australian Standard AS 1742.2 “Manual of Uniform Traffic Control Devices, Part 2: Traffic Control Devices for General Use”.

6.10.2 Guardrail

General

Guardrails shall not be erected prior to the application of the bituminous surfacing for the section concerned.

Guardrails shall be galvanised steel Flexbeam type or similar approved with galvanised steel posts and separators. All rail sections and fittings shall be supplied and erected by the contractor to the details shown in the drawings.

All steelworks shall be treated as indicated in the drawings. All metalworks shall be shop-fabricated, and no punching, cutting or welding will be permitted in the field.

The installation of the guardrail shall be in accordance with AS 3845 and Main Roads Western Australia’s standard drawings.

Posts

All posts and separators or packers shall be fabricated from 178 x 76 x 6 pressed steel channel sections conforming to AS 1204 and shall be hot dip galvanised as indicated in the drawings.

The first and last two posts at each end of the guardrail assembly shall be anchored in unreinforced 32 mPa concrete to the dimensions and other details as shown on the drawings. Holes to receive these posts shall be excavated to the required depth, and the bottom of the holes adequately rammed. The posts shall be supported in their proper position to true line and level until the concrete has gained sufficient strength.

Unless otherwise directed by the Superintendent, all other posts shall be driven vertically in their correct locations, generally at 2 metre spacings. The front faces of the posts shall be positioned to their true line and level. The surrounding ground surface shall be levelled and made good to the satisfaction of the Superintendent.

Tolerances

All posts shall be set within 20mm of their true plan position on the ground and all elevated dimensions shall be within 10mm of those specified.

Bolts shall be sufficiently long to extend at least 6mm beyond the nuts but not more than 12mm beyond the nuts except where required for adjustments. All drilled holes shall be within 5mm of their true position.

6.11 Kerbing

6.11.1 General

Cast in-situ kerbing shall be constructed using extruded concrete and finished as required in AS2876 concrete kerb and channel (gutters).

Cross section of kerbing shall be in accordance with detail drawings show on the drawings. Refer City standard drawing KSD/KP/001

Transitions from one kerb profile to another shall be made uniformly and neatly over a 600mm length.

6.11.2 Placement

Construction shall be carried out in approved method and shall be extruded and vibrated to give maximum density. Concrete strength shall develop a minimum 28-day strength of 32 MPa with a maximum slump of 100mm and a maximum graded aggregate size of 20mm in accordance with City of Karratha Concrete Specification CKS-100.

The extruded kerb shall be laid on the freshly swept surface of the single/single seal, the surface is to be cleaned of all foreign or loose and broken pavement material.

Finish to the top and road face of the kerb shall be uniformly smooth and free from voids and air pockets.

The line of the kerbing shall be parallel to the centre line of the road, and the kerbing on both sides of the road shall be exactly parallel to each other unless shown otherwise on the drawings.

All kerbing shall be laid to correct grades corresponding to the design grade of the road and radius sweeps and intersections.

All kerbing on radii less than 30m shall be fully keyed into the pavement.

All kerbing shall be protected by the contractor from marking and from bitumen overspray.

6.12 Curing

Kerbs shall be sprayed with Calcure "D" or equivalent curing membrane within two hours of surface finishing of the concrete.

6.13 Joints

Kerbs shall be cut completely through to give 10mm expansion joint every 6.0 metres of kerb length. Immediately after extrusion, contraction joints shall be formed by a grooving tool at every 2.0 metres. Refer City standard drawing KSD/JC/001.

A 10mm expansion joint shall be left on either side of all road drainage gullies and tangent points of all curves.

Expansion joints shall be cut by a suitable cutting wheel and filled with an approved Butylmastic compound filler and foam or polyurethane backing.

All failed and surplus material shall be removed from the Site. On no account are these materials to be disposed of within the Contract area.

Where the kerb adjoins a footpath, the contraction and expansion joints are to coincide with the footpath joints. An isolation joint shall be placed where the footpath runs along kerb. Refer City standard drawing KSD/JC/001.

6.14 Backfilling

Backfill material shall be of suitable earth free from stones greater than 100mm as approved by the Superintendent. Backfill shall be compacted to a minimum dry density ratio of 92% when tested in accordance with AS1289 E2.1. The road verge shall be graded from the top of the kerb to the profile shown on the drawings.

Backfilling shall not proceed before 48 hours after the initial set.

6.15 Brick paving

6.15.1 General

Brick paving shall be constructed according to the details shown on the drawings. The preparation and construction of the subgrade and base courses shall be as specified in the Pavement Section of this Specification.

6.15.2 Bedding Sand

The sand shall be siliceous, non-plastic type, free from deleterious materials and organic matter.

The sand shall all pass a 4.75mm sieve and have a maximum of 5% passing a 0.075mm sieve. The moisture content of sand in place shall be in the range of 4% to 8% by weight.

The sand shall be spread loosely, screeded to the profile and depth shown on the drawing, and protected from pre-compaction.

6.15.3 Laying Patterns

The laying patterns shall be herringbone at 45º to the main traffic flow unless otherwise specified on the Drawings.

6.15.4 Laying of Bricks

Bricks shall be placed on the screeded bedding sand by hand with 2mm to 3mm gaps between adjacent faces and the edge restraints. Bricks should be laid so that they do not come into contact with adjoining bricks. All full bricks shall be laid first. Closure bricks shall be cut with a saw and fitted into the spaces as required.

Cutting bricks to less than 25% of the whole paver size should be avoided. Alternative cutting-in methods should be adopted using half or three-quarter bricks.

6.15.5 Compaction of Bricks

A high frequency, low amplitude plate compactor, with a plate area sufficient to cover a minimum of 12 paving bricks, shall be used. The metal base should be covered to prevent it from coming into direct contact with the bricks. A plywood sheet of a minimum thickness of 12mm or a thick rubber-based carpet square attached to the base of the compactor can be used to protect the bricks.

Compaction shall be sufficient to achieve a firm, even surface. A minimum of 3 passes is required.

Compaction shall precede all other traffic.

Any bricks damaged during compaction shall be immediately replaced.

6.15.6 Joint Filling

After initial compaction and prior to traffic, clean, dry siliceous sand, which has 5% to 15% particles passing 0.075mm sieve, shall be spread over the pavement and swept into the joints.

After joint filling, two passes with the plate compactor shall be applied. Further sand shall be swept into any joints as required, and the compaction process shall be repeated until all joints are completely full.

The final surface shall be true to grade and free from loose sand.

6.16 Concrete Footpaths

6.16.1 General

Cast insitu concrete footpaths shall be laid on the alignments and at the locations shown on the drawings.

The road verge shall be constructed to grade to the top of the kerb.

All Service Authorities (including power, water, sewer, gas, telecommunications, etc) and the Local Authority are to be advised 48 hours prior to commencement of construction.

Material quality assurance shall be in accordance with City of Karratha Concrete Specification CKS-100 and AS 1379.

6.16.2 Placement

The foundation material shall be compacted to a minimum dry density ratio of 95% when tested in accordance with AS1289 E2.1 to a depth specified in Section 2.4 in CKS-200. Special attention shall be given to Service Authority trenches. The Superintendent shall be given 24 hours prior notice of the concrete pour.

The path shall be constructed from concrete with at least a 28 day cylinder compressive strength of 32MPa with a maximum slump of 100mm and a maximum graded aggregate size of 20mm in accordance with *City of Karratha Concrete Specification CKS-100*. The ground shall be thoroughly wetted immediately prior to laying the concrete. The concrete shall be compacted by a vibrating screed board of sufficient capacity to effectively vibrate and compact the full thickness of the path. Footpaths shall include reinforcement in accordance with *City of Karratha Footpath Design Specification CKS-200* Clause 2.

The paths generally shall be constructed with a crossfall of 2% towards the kerb. The surface finish shall be brushed with a smooth edge to all outside edges and joints. All work shall be of high quality, uniform appearance and executed in a tradesman-like manner.

All paths shall be protected by the contractor from marking by children, animals or other causes.

6.16.3 Joints

Joints shall be installed to the depth and spacing requirements in accordance with *City of Karratha Footpath Design Specification CKS-200* Clause 2.6.

Expansion joints shall be constructed at every third (3) construction joint. i.e., Six (6) metres apart. They shall be full depth joints 12mm wide and shall be filled with bitumen impregnated compressible filler or similar approved material. The joint filler material shall be such that when it is subjected to compression in hot weather, no bitumen is extruded.

Contraction joints shall be constructed every two (2) metres. The typical contraction joint shall be made by tooling into the surface at the time of placement to a depth of ¼ of the pavement thickness.

For shared paths, intervals of expansion and contraction joints are same as the above for footpaths. Contraction joints should be created by saw cutting the slab within 24 hours of placement.

6.16.4 Finish

Broom finished to provide a non-slip dense surface free of any depressions, marks, honeycomb sections or accumulation of fine dust.

For non-shared paths, every two-metre panel is to have a “Picture frame” edge to create a smooth border to each panel of the footpath.

For shared paths, picture frame borders shall be on longitudinal edges only; no picture frame finish is required at construction and expansion joints.

6.16.5 Footpath

Broom finished to provide a non-slip dense surface free of any depressions, marks, honeycomb sections or accumulation of fine dust.

Every 2m panel is to have a “Picture frame” edge so as to create a smooth border to each panel of the footpath.

6.16.6 Kerb Ramp

Kerb ramps and TGSIs to be installed as per the City of Karratha Footpath Specifications.

6.17 Underground Ducts (Power, Gas And Telecommunications)

The contractor will be provided with duct layout plans showing proposed duct crossings under the road system. The contractor shall supply and install the ducts under the road and in strict conformity with the requirements of the relevant Authority prior to base course construction.

Utility installation shall be subject to any Utility owner and provider requirements, including requirements for installation and approvals. contractors shall liaise with the utility authority prior to, and after installation of utilities.

The contractor shall refer to the Utility Providers Code of Practice for detailed guidance on service installation and the City of Karratha’s Conduit Under Pavement Design Guidelines.

6.17.1 Materials

Road crossing ducts shall be conduits of pipes complying with AS 2053.

6.17.2 Size of Ducts

40mm - UPVC, light orange colour, heavy duty.

80mm and 150mm - UPVC, light orange colour, heavy duty or fibre cement, heavy duty.

6.17.3 Installation of Ducts

All ducts shall have a minimum cover of 750mm to the top of the duct and bedded in sand for a minimum distance of 150mm below the lowest duct, and 150mm above the highest duct. No ducts shall be installed with more than 1100mm cover. Ducts are to be laid in horizontal formation up to four in number, and thereafter in tier formation. The length of the ducts is to be the road width plus 1000mm minimum on either side of the kerb. All ducts shall be plugged with suitable end caps. Draw wires shall be provided in all ducts. Marker tape shall be installed 300m below ground level and above the duct and brought out to ground level at each end, with a marker peg at one end. Conduits are to be marked to clearly identify location and service type.

6.17.4 Supervision and Installation

The contractor shall contact the relevant Authority Liaison Officer concerned, prior to any road ducts being installed to enable Authority staff to supervise the installation and to provide the special marker tape.

6.18 Signs And Line-marking

6.18.1 General

All regulatory and warning signs and pavement linemarking shall be provided to the requirements of Main Roads Western Australia. MRWA approval is required for the Signs and Linemarking design prior to the installation. The Developer shall seek approval from MRWA for signage design.

6.18.2 Sign Sizes

Sign sizes are stipulated in AS 1742.1 involving sizes AA (smallest), A, B, C, D (largest). Due to the difference in sign shapes and aspect ratio, (i.e., triangular “Give Way” sign vs. rectangular “Keep Left” sign), exact dimensions cannot be used for all signs of a given size type. Therefore, for structural engineering purposes, refer to the dimensions for each sign type in AS 1742.1.

6.18.3 Sign Footing & Post Size

Main Roads WA provide a method to size engineered sign structures:

- Use MRWA Drawing 1830-0002 to determine wind speed region and terrain category.

- Use MRWA Drawing 1830-0003 to determine sign area and post spacing.
- Use MRWA Drawings 1830-0004 and 1830-0005 to determine the force acting upon the sign.
- Use MRWA Drawing 2130-0654 for post selection.
- Use MRWA Drawings 1830-0013, 1830-0014 and 1830-0015 to determine the footing dimensions and reinforcement required.

6.18.4 Temporary Signing and Line-marking

The contractor shall ensure that the site is maintained in a safe condition for all traffic during the construction works and until permanent signing and marking is installed. Temporary signing and pavement markings shall be provided to Main Roads Western Australia's requirements, pending the installation of permanent markings.

6.18.5 Permanent Roadways Signing and Line-marking

The contractor shall insert 150mm PVC diameter sleeves at the location of all new signs.

The contractor shall spot the approved pavement marking in accordance with Main Roads Western Australia's "Specification for spotting in preparation for longitudinal line marking on roads". The contractor shall remove any unnecessary pavement marking with a 5-7mm aggregate seal or by grinding off, depending on the condition of the existing surface. The contractor shall then notify Main Roads Western Australia by completing the "Advice of Completion of Conditions Required Prior to the Provision of Services by Main Roads Western Australia" form. The contractor shall install, maintain, and remove temporary signs and linemarking. The contractor shall also install permanent linemarking.

6.18.6 Permanent Parking Area Signing and Line-Marking

The pavements shall be marked by one of the following materials to AS 4049:

- Paint - with or without glass beads.
- Thermoplastic or other applied insitu plastic materials - with or without reflective properties.

Paint shall be resistant to bleeding when applied to a bitumen surface.

The colour of line markings shall be white, except that yellow may be used for parking lines to indicate where parking is restricted, and blue may be used to indicate areas for disabled persons parking.

White	off white Y35 in AS 2700
Yellow	golden yellow Y14 in AS 2700
Black	charcoal B65 in AS 2700
Blue	to ACROD requirements

The width of longitudinal or broken lane lines shall be 80mm minimum, with 100mm preferred.

The width of parking bay lines shall be 80mm minimum, with 100mm preferred.

Parking bays shall be marked with an unbroken line between spaces except those indicated by kerbing or other contrasting paving and a 1200mm T at the line of the carriageway.

The surface shall be dry and swept clean before paint is applied.

Paint application shall produce a wet film thickness of 375 +/- 25µm and have a no pickup time of not more than 4 minutes.

Signs shall be consistent with those used in the street network in accordance with AS 1742.

Direction signs for vehicles and pedestrians shall comply with AS 2890.1.

The contractor shall install 150mm diameter PVC sleeves at the location of all new signs.

In pedestrian areas, the clearance to the underside of the sign shall be 2500mm. Signs shall not obstruct driver or pedestrian visibility.

6.19 Road Crossings

Where services or ducts are placed across the road after subgrade preparation, the backfill shall be mixed dry with 1% by weight with cement and then water bound, placed, and compacted.

The contractor is to refer to the City of Karratha's Trench Restoration of Road Crossings Design Guidelines.

Refer to *City of Karratha Road Design and Construction Specification CKS-400*, CKS-910 (Survey and Construction Drawings).

6.20 Testing

Testing of materials, compaction, thickness, and shape is required at each stage of the roadworks.

All tests shall be arranged and paid for by the contractor with a NATA registered testing authority. All test results shall be forwarded to the Superintendent at each stage of the roadworks.

The testing schedule shall be as follows for each pavement course:

1. Compaction Testing shall be carried out in accordance with test method MRWA WA 133.2. Tests shall be carried out for each course, for a minimum of 1 test per 30 linear metres of road or a minimum of 3 tests per course. Maximum Dry Density and OMC shall be accepted within the standard deviation limits in test method WA 100.1.
2. Surface Profile Testing of all courses – shall be conducted in accordance with MRWA WA 313.4 using a Walking Profiler. 1 test per 200 linear metres of road.
3. Surface Shape Testing shall be conducted in accordance with MRWA WA 313.2 using a 3m straightedge. The acceptance criteria are in accordance with MRWA Spec 501 (Maximum deviation of 10mm for the subbase, 6mm for the base course). 1 test per 200 linear metres of road.
4. Surface levels shall be measured and tested in accordance with MRWA Spec 501.46.01. 1 test per 200 linear metres of road.

6.21 'As Constructed' Information

The contractor shall ensure that no part of the work is backfilled or otherwise covered up until 'as constructed' information has been obtained to the satisfaction of the controlling authority.

Roadwork 'as constructed' information shall include, but not be limited to the following:

- Pavement and surface width.
- Pavement centre line, right and left-hand side levels at 20m intervals.
- Pavement position within the road reserve.
- Finished levels (FL) recorded of each pavement layer – subgrade, subbase, basecourse and top of surface wearing course.

Such information shall be certified by the contractor's Surveyor.

7. STORMWATER DRAINAGE

7.1 General

Stormwater drains and subsoil drains shall be constructed in accordance with the drainage layout plans. Pile and keel or bearers will be required in soft ground and where drains cross existing services. Drain construction shall take place in dry conditions, and where necessary, the contractor shall provide dewatering equipment to ensure such suitable conditions exist.

A Dial Before You Dig enquiry shall be completed prior to commencing any excavation or earthworks. This must be confirmed on site by undertaking physical service location of underground services prior to commencing construction. The service location must be undertaken by a licenced surveyor, and plans must be submitted to the City for record-keeping purposes.

7.2 Materials

Materials used in the construction of Stormwater Drainage infrastructure shall comply with the following:

7.2.1 Pipe Materials

Pipe materials used for drainage shall comply with *City of Karratha Stormwater Drainage Design Guidelines CKS-500.*

7.2.2 Bedding

Bedding materials used shall comply with Select Bedding Material; refer to MRWA 405.09.

7.2.3 Cement Stabilised Fill

Cement stabilised fill shall be used as backfill, as an alternative to mechanically compacted soil backfill around services.

Table 8: Cement Stabilised Fill Requirements

Property	Requirement	Test Method
Minimum unconfined compressive strength (MPa)	1.7 to 3.0 (28-day)	WA 143.1
Slump (mm)	150 - 200	AS 1012.3.1

Table 9: Cement Stabilised Fill - Composition

Material	Percentage by mass	Australian Standard
GP Cement	3 – 6	AS 3972
Fly Ash	0 – 20	AS 3582.1
Granular Material	60 – 80	-

7.2.4 Water

Water used in concrete or mortar shall be of potable quality, free from suspended material, organic matter, alkali, salts and other impurities.

7.2.5 Coarse Aggregate

The term "Coarse Aggregate" is used to designate aggregate that is in the range of sizes of 4.75mm to 19.0mm. The coarse aggregate shall be free from clay lumps, dust, organic material or other deleterious substances and in accordance with AS 2758.

To obtain a reasonable grading, the coarse aggregate shall be batched in two size designations or graded as 19.0mm "all in". All grading shall be to the approval of the Superintendent.

7.2.6 Reinforcing Steel

Reinforcing steel shall be structural grade and shall be in accordance with AS/NZS 4761.

7.2.7 Concrete

All concrete work shall be carried out in accordance with AS 3600. No concrete shall be placed before the Superintendent has checked the base, formwork, and reinforcement. All materials shall be weighed and batched, and the proportions for each mix shall be approved by the Superintendent before concrete is made.

7.2.8 Concrete Proportions

Concrete for kerbs and manholes shall contain not less than 213 kg of cement per cubic metre, and the water/cement ratio shall not exceed 0.60.

Concrete for other works shall not contain less than 171 kg of cement per cubic metre, and the water/cement ratio shall not exceed 0.60.

7.2.9 Steel

All steel shall comply with the requirements of AS 3679.

All steel shall be new and each member free of any welding or other form of splice.

7.2.10 Galvanising

Miscellaneous steel fittings and fixings shall be hot dip galvanising to requirements of AS1214 and ASB193.

Zinc coating shall be not less than 600 g/m^2 of surface area.

7.2.11 Cement Mortar

Cement mortar shall consist of cement and sand gauged by volume in the following proportions: one part by volume of Portland Cement to 3 parts of sand. This shall be employed for all instances unless otherwise directed by the Superintendent.

The ingredients shall be mixed in an approved mechanical mixer or shall be mixed together dry on a clean wooden stage until the mix is homogeneous in colour. Water shall then be added in sufficient quantity to give more than stiff workability. The whole shall then be turned until perfectly mixed.

Mortar shall be used within 2 hours of mixing and shall not be remixed or worked up again after it has stiffened. Any mortar that has commenced to set shall be removed from the works.

7.3 Excavation

The contractor shall excavate trenches on the alignments and to the widths shown on the drawings and shall keep to the minimum width reasonably necessary to construct the Works.

No more than 300m of excavated trenches shall be open at any time. At no time shall more than 100m of pipe be laid without the approval of the City.

The contractor shall provide all intermediate benches, side-lacings, shorings, frames, timbers, and other materials to ensure that the trench sides are maintained at all times in a safe condition.

Care shall be exercised when excavating near existing services, structures, or other items likely to be damaged by the contractor's activities, in particular, machinery causing vibration shall be operated only at a safe distance in such areas, and the contractor shall allow for use of alternative methods of construction where machines of this nature cannot be used.

Where over-excavation has occurred, the contractor shall backfill the over-excavation with clean well-graded sand. Compacted to a minimum dry density ratio of 95% when tested in accordance with AS 1289 E2.1 or other approved remedial actions.

The contractor shall at all times maintain excavation free from water regardless of source or method of entry to the excavation. The contractor shall provide cut-off drains, well points, bores, drain diversions, pumps and any other means necessary to keep excavations dry and in a safe condition and shall repair or reinstate any damage caused by failure to keep the excavation free from water.

7.4 Pipe Installation in Trenches

Stormwater pipes shall be reinforced concrete, rubber ring jointed pipes manufactured to AS/NZS 4058 unless otherwise specified on the drawings.

AS/NZS 4058 Load Class 2 pipes shall be used for non-trafficable areas.

For trafficable areas, a suitably qualified and experienced structural engineer shall determine the minimum burial depth and select the appropriate AS/NZS 4058 Load Class for the pipe.

Pipes shall be laid on the prepared bedding to the line level and grade shown on the approved drawings. No pipes shall be laid on filled ground until such ground has been compacted to a minimum dry density ratio of 95% when tested in accordance with AS1289 E2.1.

The pipe shall be supported uniformly along its length in the trench – this shall be ensured by excavating to accommodate flanges or other joint protrusions.

Bell & spigot rubber ring joints shall be installed in accordance with the manufacturer's recommendations. Pipes shall be in straight alignment before the joint is closed. After the joint has been fully inserted, any necessary angular adjustment shall not be made.

Pipes laid in wet conditions shall be laid on coarse aggregate bedding for the full width of the bottom of the trench.

7.5 Subsoil drains

Subsoil drains and stormwater pipe materials, design and construction shall comply with MRWA Spec 403 and shall be installed in the locations shown on the project drawings.

If specified on the drawings, stormwater pipes shall be PVC pipes manufactured and installed to AS1254 and the manufacture's standards.

Subsoil drains shall consist of slotted pipes or strip drain wrapped in a geofabric filter sock, and backfilled with screened, graded aggregate.

The aggregate shall be clean and uniformly graded from 2mm to 10mm. The aggregate shall have a minimum thickness of 100mm surrounding the pipe or strip drain.

The contractor shall undertake a particle size distribution analysis of the soil prior to selection of the filter fabric and shall forward the results to the City.

Geotextile filter fabrics shall be used to reduce blockages of drainage systems, by retaining fine soil particles, while allowing stormwater to pass through.

The geofabric filter sock shall be non-woven and have the following filtration requirements in relation to the soil being drained.

Table 10: Geotextile Fabric requirements for Subsoil drains

Description	Requirement	Standard
Geotextile Fabric type	Non-woven	
Elongation at break	45%	AS 3706.2
Effective Opening Size (EOS)	Between 85 and 230µm	
Minimum Mass	260 gsm	
Puncture Resistance (G Rating)	Greater than 900	AS 3706.5
Minimum Permittivity	0.2 s^{-1}	ASTM D4491

7.6 Backfilling Pipe

Backfill materials shall be select fill complying with MRWA Spec 302.09.

Initial backfill to the top of the pipeline shall be carried out by hand placing approved fill material, free from rock, soil lumps or other unsuitable material.

The fill shall be placed uniformly on both sides of the pipe and compacted as firmly as can be managed by hand tamping.

Care should be taken to avoid damaging the pipe by direct impact.

Final backfill above the pipe shall be placed in uniform layers along the total length of pipeline to prevent overload or displacement and compacted at optimum moisture content by mechanical methods to achieve a compacted density not less than that of the same material in an undisturbed state.

Surplus material from excavations shall be graded out over the Site and any unsuitable materials removed from the site.

No excavation shall be backfilled until the pipeline or structure has been inspected and approved by the City.

Should any section of pipe be disturbed or damaged during backfill it shall be removed and re-laid at the contractors' expense to the satisfaction of the City.

7.7 Backfilling against Structures

Filling shall not be placed against structures until the structure has been inspected and approved for filling.

Fill materials shall be placed in horizontal uniform layers not exceeding 150mm thickness and shall be compacted to a minimum dry density ratio of 95% when tested in accordance with AS1289 E2.1 or E3.3.

Backfilling over and around structures shall avoid unbalanced loading or create movement.

The contractor shall be responsible for any damage to existing structures as a result of filling and compacting operations.

7.8 Box Culvert Installation

Box culverts shall be precast reinforced concrete culverts manufactured to AS1597 unless otherwise specified on the drawings.

Box culverts shall be laid on a poured in-situ reinforced concrete base. The base shall be laid on the prepared bedding to the line level and grade shown on the approved drawings. The subbase shall be compacted to a minimum dry density ratio of 95% when tested in accordance with AS1289 E2.1.

Bitumastic sealant tape 300mm wide shall be applied to the external face of all box culvert joints.

Headwalls, end-walls, and aprons shall be constructed using reinforced concrete with a minimum compressive strength of 32MPa as detailed on the drawings. All structures shall have at least a 300mm buried toe.

7.9 Open drains, Basins, and Berms

Open drains, basins and berms shall be constructed at the locations and to the details shown on the drawings at the earthwork stage.

All batters shall be trimmed prior to stabilisation. Batters steeper than 1 in 4 shall be treated with soil stabiliser, proprietary geotextile, or stone revetment.

Open drains having a grade greater than 1 in 200 or water velocity of greater than 2m/s shall have stone scour prevention structures constructed at even intervals to achieve the maximum permitted grade.

Inlet and outlet scour protection shall be constructed at the locations shown on the drawings using mortared stone pitching.

Stones shall be hard, durable local stone spalls weighing generally more than 5kg each with the greatest dimensions not exceeding 1.5 times the least dimension. Stones shall be set on a prepared soil bed in a close-fitting pattern and rammed into position.

Joints shall be raked for their full depth and grouted with cement mortar.

7.10 Manholes and Gully Pits

Manholes and gully pits shall be constructed of reinforced concrete segments, at the locations and to the detail shown on the drawings.

Manholes and gully pits shall finish flush with the final level of the surrounding ground, footpath, road or kerb.

All covers shall be aligned to be parallel to the adjacent kerb, road or path.

Step irons (ladders) shall be installed to the requirements of AS 4198.

7.11 Tolerances

Drainage infrastructure shall be constructed to the following tolerances.

- Alignment – the horizontal positioning or orientation of a drainage pipe or channel. Ensure pipes are laid out in a straight line or follow a specific path as designed
- Grade – the overall slope or vertical incline of the drain
- Level – the evenness of the flowable surface of the drain

Table 11: Drainage Infrastructure Tolerances

COMPONENT	TOLERANCE		
	ALIGNMENT	GRADE	LEVEL
Pipes, Box Culverts And Lined Channels	+/- 25mm	+ 10mm per metre - 20mm per metre	+/- 10mm
Concrete Drainage Structures	+/- 20mm	-	+/- 10mm

7.12 Hold Points

During construction, the consulting engineer must notify the City to carry out a joint inspection of the hold points activities identified in the table below. **All hold points must first be inspected/reviewed and approved by the consulting engineer prior to the joint inspection.**

Table 12: Drainage Infrastructure Hold Points

No	Stage	Hold Points (Y/N)	Required Attendees
1	Excavation to base level	N	
2	Inspection of base level	Y	City of Karratha engineer, consulting engineer and contractor Representatives
2	Review and approval of compaction testing of the base level	Y	City of Karratha and consulting engineer
3	Bedding installation and compaction	N	Consulting engineer to provide photographic evidence to the City
4	Overlay installation and compaction	N	
5	Overlay compaction test results review and approval	Y	City of Karratha and consulting engineer
6	Backfill	N	
7	Backfill material every 300mm lift (maximum) compaction test result review and approval	Y	City of Karratha and consulting engineer

7.13 As-constructed information

The contractor shall ensure that no part of the work is backfilled or otherwise covered until 'as constructed' information has been obtained.

contractors shall comply with the requirements of the City of Karratha's Survey and Construction drawing guidelines.

The drainage 'as constructed' information shall include, but need not be limited to the following:

- Type of structure

- Pipe invert levels at all structures
- Grade of pipes and open drains
- Distance between structures
- Pipe size and class
- Invert levels of open drains and dimensions of basins
- Cross-section of open drains
- Change of locations e.g., line alignments tied to properties/lot boundaries.

Such information shall be certified by the contractor's Surveyor and forwarded to the City in a .pdf and .dwg format. Practical Completion will not be issued until a compliant drainage 'as constructed' drawing is provided.

8. DEMOBILISATION

8.1 Clean Up

At the completion of all paving works, the contractor shall clean away all debris.

Kerbs shall be left clean and true to line and verges graded off to ensure full drainage of the pavement.

Verges shall be compacted to a density not less than that of the surrounding undisturbed soil and be free from unsightly windrows and wheel marks.

8.2 Waste Disposal

The contractor shall allow for all costs and charges in relation to rubbish disposal. The contractor shall provide for the collection, stockpiling and removal of all rubbish, debris, stripped vegetation and other deleterious matter from the Site in a manner approved by the City.

All rubbish, debris and other deleterious matter shall be removed from the Site to an approved tip.

The contractor shall allow for the cleaning of all drains and other structures prior to the completion of the Works regardless of the agent by which the rubbish debris or other deleterious matter was deposited in the Works.

The contractor shall allow for the sweeping of all pavements with the provision that the paving be swept only once unless further material has been deposited due to the operation of the contractor or the contractor's agents.

8.3 Defects Liability Period

It is the responsibility of the developer to repair any defects resulting from faulty workmanship and/or defective materials on all associated works for a period of 24 months from the date of practical completion – referred to as the defects liability period.

8.4 Practical Completion

Documents required prior to Practical Completion:

Prior to Practical Completion, the developer shall provide the City with a full set of 'as-constructed' engineering drawings in hard copy and digital format.

The City requires an As-Constructed survey of all infrastructure including, but not limited to, stormwater, kerbs, road pavement, line-marking, recycled water, footpaths, signage, and street trees. This is to be provided in both .pdf and .dwg format. These drawings shall be in a reproducible form and should include:

- Details of any alterations made during construction of the road network
- Drainage drawings and grades against the design lines, levels, and grades of the drainage network
- Street lighting and confirmation of luminaire
- Any other infrastructure information and specifications required by the City for its asset management systems

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

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

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

- Road construction (widths of verges and carriageways) is in accordance with approved engineering plans
- All stormwater drainage pipes, and associated infrastructure are located within easements, drainage reserves or road reserves and have the correct relationship to property boundaries as required by Council's standard drawings.

8.5 Road Reserve Reinstatement

The contractor shall allow to limit operations within existing road reserves to that reasonably necessary to construct the Works. The contractor shall allow for all costs associated with reinstatement of verges, crossovers, street trees and shrubs and all other improvements within the road reserve and shall conduct such reinstatement to the satisfaction of the City or relevant Controlling Authority.

Excavation within existing road reserves shall be backfilled as soon as is reasonably practicable and any unattended excavation shall be protected by suitable barricades, lights, signs and detours. The contractor shall allow to maintain at all times access to each property within the road reserve together with free Public thoroughfare of the roadway. The contractor shall bear all costs and charges related to the provisions of warning signs, barricades, flagmen and lights including endorsement of traffic management plans from Local Authorities or Main Roads Western Australia. The contractor shall obtain all necessary approvals from Public Utility Authorities, Local Authorities and other involved bodies and shall comply with all provisions and conditions rendered with such approvals.

Road pavements damaged or excavated shall be reinstated to the City of Karratha requirements. The contractor shall allow for all costs associated with such reinstatement.

Certification by the Local Authority that all reinstatement has been undertaken or that arrangements have been made to their satisfaction for such reinstatement will be required at Practical Completion.

Upon completion of the Contract, the contractor to clean out and remove from the drainage system and or landscape drainage pattern, regardless of source, any rubbish, debris or other deleterious matter that was deposited during the Works.

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