



Temporary Overflow Workers Caravan Accommodation Facility

Technical Specification

Shire Of Northampton

19 February 2024

→ The Power of Commitment



Project name		Northampton Disaster Recovery Works					
Document title		Temporary Workers Caravan Accommodation Facility Technical Specification					
Project number		12596020					
File name		12596020 - Technical Specifications -0_Temporary Overflow Workers Caravan Accommodation Facility.docx					
Status Code	Revision	Author	Reviewer		Approved for issue		
			Name	Signature	Name	Signature	Date
S4	A	Gaurav Rouniyar Sam Mosaval Cristian Bonaobra	Antoinette Krause Richard Hesnan Neil Zanich		Antoinette Krause		14.02.24
S4	0	Gaurav Rouniyar Sam Mosaval Cristian Bonaobra	Antoinette Krause Richard Hesnan Neil Zanich		Antoinette Krause		19.02.24
[Status code]							
[Status code]							
[Status code]							

GHD Pty Ltd | ABN 39 008 488 373

Contact: Gaurav Rouniyar, Civil Engineer | GHD
 Foreshore Business Centre, Level 1, 209 Foreshore Drive
 Geraldton, Western Australia 6530, Australia
T +61 8 9920 9400 | **F** +61 8 9920 9499 | **E** getmail@ghd.com | **ghd.com**

[Compliance statement]

© GHD 2024

This document is and shall remain the property of GHD. The document may only be used for the purpose for which it was commissioned and in accordance with the Terms of Engagement for the commission. Unauthorised use of this document in any form whatsoever is prohibited.

Contents

1.	Introduction	1
1.1	General	1
1.2	Location of works	1
1.3	Scope of Work	1
1.4	Definitions	3
2.	General Requirements	4
2.1	Australian Standards	4
2.2	Precedence and Discrepancies of Drawings	4
2.2.1	Documentation	4
2.2.2	Discrepancies	4
2.1	Electronic information	4
2.2	Interpretation of Documents	4
2.3	Omissions	4
2.4	Warranty	5
2.5	Traffic Management	5
2.6	Programme and staging of work	5
2.7	Survey set out	5
2.8	Inspections	6
2.9	Behaviour of personnel	6
2.10	Pets prohibited on site	6
2.11	Trespass	6
2.11.1	By contractor	6
2.11.2	By others	6
2.12	Site meetings	7
2.13	Protection of existing vegetation	7
2.14	Safety	7
2.15	Work by others and other work at site	8
2.16	Damage	8
2.17	Existing services	8
2.18	Diverting water and dewatering	8
2.19	Nuisance	8
2.20	Rock excavation	8
2.21	Restoration	9
2.22	Testing	9
2.23	Payments	9
2.24	Practical completion	9
2.25	Final certificate	10
3.	Earthworks	11
3.1	General	11
3.2	Hold Points	11
3.3	Discrepancies	11

3.4	Clearing and Grubbing	11
3.4.1	General	11
3.4.2	Disposal of Material	12
3.5	Excavation	12
3.5.1	General	12
3.5.2	Stripping and stockpiling of topsoil	12
3.5.3	Disposal of surplus spoil	12
3.5.4	Hazardous Material	12
3.5.5	Excess Excavation	12
3.6	Filling	12
3.6.1	General	12
3.6.2	Materials	13
3.6.3	Compaction equipment	13
3.6.4	Compaction	13
3.6.5	Backfilling near structures	13
3.7	Trimming and finishing of surfaces	13
3.8	Acceptance	14
3.8.1	General	14
3.8.2	Compaction requirements	14
3.8.3	Tolerances	15
3.8.4	Defective work	15
3.9	Removal of existing structures	15
4.	Service trenching	16
4.1	Responsibilities	16
4.2	Standards	16
4.3	Tolerances	16
4.4	Submissions	16
4.5	Inspection	17
4.6	Fill materials	17
4.7	Surface restoration materials	17
4.8	Existing services	17
4.9	Excavation	18
4.10	Trench backfill	19
4.11	Surface restoration	20
4.12	Completion	20
5.	Road works	21
5.1	Scope	21
5.2	Standards	21
5.3	Quality and Process Control	21
5.4	Base and Sub-Base Courses	21
5.4.1	Materials	21
5.4.2	Sampling and testing sub-base and base course material	22
5.4.3	Construction	23
5.4.4	Testing dry density and layer thickness	23
5.4.5	Acceptance	23
5.5	Primer sealing	24
5.5.1	Authority to commence priming	24
5.5.2	Plant	24

5.5.3	Application	25
5.5.4	Blinding	25
5.5.5	Acceptance tolerances	25
5.6	Specification for Asphalt	25
5.6.1	Scope	25
5.6.2	Nominal Size	26
5.6.3	Materials	26
5.6.4	Sampling and testing asphalt materials	28
5.6.5	Construction plant	28
5.6.6	Preparation of surface	29
5.6.7	Tack coat	29
5.6.8	Corrector course	29
5.6.9	Spreading	29
5.6.10	Thickness control	30
5.6.11	Joints and junctions	30
5.6.12	Compaction procedures	31
5.6.13	Testing density and layer thickness	31
5.6.14	Acceptance	32
5.7	Pavement Markings	32
5.8	Concrete Footpaths	33
5.8.1	General	33
5.8.2	Approvals	33
5.8.3	Layout	33
5.8.4	Sub-grade	33
5.8.5	Construction	33
5.8.6	Surface finish	33
5.8.7	Joints	33
5.8.8	Joint filler	34
5.8.9	Tolerances	34
5.8.10	Acceptance	34
5.9	Test Certificates	34
5.9.1	Sub-grade	34
5.9.2	Sub-base and base course	34
5.9.3	Sprayed Primes and Seals	35
5.9.4	Asphalt seal	35
6.	Hydraulics Sewer and water general	36
6.1	General	36
6.1.1	Responsibilities	36
6.1.2	Standards	36
6.1.3	Interpretation	36
	6.1.3.1 Certification	36
	6.1.3.2 Products and materials	36
	6.1.3.3 Shop drawings	37
6.1.4	Inspection	37
	6.1.4.1 Notice	37
	6.1.4.2 Hold points	37
6.2	Products	37
6.2.1	Authorised products	37
	6.2.1.1 Lead content	37
	6.2.1.2 Water efficiency	37
	6.2.1.3 Labelling	38
	6.2.1.4 Bushfire-prone areas	38

6.3	Execution		38
6.3.1	Work on existing systems		38
	6.3.1.1	Demolition	38
	6.3.1.2	Existing systems	38
6.3.2	Installation		38
	6.3.2.1	Accessories	38
	6.3.2.2	Connections to mains	38
	6.3.2.3	Movement compensation	38
6.3.3	Commissioning		39
	6.3.3.1	General	39
6.3.4	Maintenance		39
7.	Water Reticulation		40
7.1	General		40
7.1.1	Responsibilities		40
7.1.2	Standards		40
	7.1.2.1	General	40
7.1.3	Submissions		40
	7.1.3.1	Operation and maintenance manuals	40
	7.1.3.2	Samples	40
	7.1.3.3	Tests	40
7.1.4	Inspection		40
	7.1.4.1	Notice	40
7.2	Products		41
7.2.1	General		41
7.2.2	Components		41
	7.2.2.1	Backflow prevention devices	41
	7.2.2.2	Line strainers	41
	7.2.2.3	Water meters	41
7.3	Execution		41
7.3.1	Piping		41
	7.3.1.1	Mains connection	41
	7.3.1.2	Finishes	41
	7.3.1.3	Fittings and accessories	41
	7.3.1.4	Material identification marks	41
	7.3.1.5	Pipes under pressure embedded in concrete	41
	7.3.1.6	Valve spindles	42
	7.3.1.7	Protection from sunlight	42
7.3.2	Backflow prevention		42
	7.3.2.1	Location	42
	7.3.2.2	Installation	42
	7.3.2.3	Vacuum breaker valves	42
7.3.3	Marking		42
	7.3.3.1	Notice plate	42
	7.3.3.2	Buried services	42
7.3.4	Valve boxes		43
	7.3.4.1	General	43
	7.3.4.2	Installation	43
7.3.5	Testing		43
	7.3.5.1	Hydrostatic tests	43
	7.3.5.2	Other tests	43
	7.3.5.3	Completion test	43
7.3.6	Commissioning		43
	7.3.6.1	General	43
7.3.7	Completion		44
	7.3.7.1	Charging	44

	7.3.7.2	Operation and maintenance manuals	44
	7.3.8	Maintenance	44
	7.3.8.1	General	44
7.4		Selections	44
	7.4.1	Potable & non potable Cold water	44
	7.4.1.1	Piping system schedule	44
	7.4.1.2	Isolating valves schedule	44
	7.4.1.3	Backflow prevention devices schedule	45
	7.4.1.4	Water & Power Pedestal	45
8.		Sewer Reticulation	46
8.1		General	46
	8.1.1	Responsibilities	46
	8.1.1.1	General	46
	8.1.2	Standards	46
	8.1.2.1	Sanitary plumbing and sanitary drainage	46
	8.1.3	Submissions	46
	8.1.3.1	Products and materials	46
	8.1.3.2	Tests	46
	8.1.4	Inspection	46
	8.1.4.1	Notice	46
8.2		Products	46
	8.2.1	General	46
	8.2.1.1	Material selection	46
	8.2.2	Traps and gullies	47
	8.2.2.1	General	47
	8.2.3	Sewer maintenance shafts	47
	8.2.3.1	General	47
8.3		Execution	47
	8.3.1	Sewer drainage	47
	8.3.1.1	Laying	47
	8.3.1.2	Pipeline identification	47
	8.3.2	Piping	47
	8.3.2.1	Finishes	47
	8.3.2.2	Pipe supports	47
	8.3.3	Sewer maintenance shafts	47
	8.3.3.1	General	47
	8.3.4	Testing	48
	8.3.4.1	Pre-completion tests	48
	8.3.5	Completion	48
	8.3.5.1	Cleaning	48
	8.3.6	Maintenance	48
	8.3.6.1	General	48
8.4		Selections	48
	8.4.1	Wastewater	48
	8.4.1.1	Sanitary drainage piping schedule	48
	8.4.1.2	Gullies schedule	48
9.		Electrical Reticulation and Lighting	49
9.1		General	49
9.2		Contractor to Inform Himself	49
9.3		Electrical Services Documentation	49
9.4		Scope of Work	49
	9.4.1	Miscellaneous	49
	9.4.2	Co-Ordination and Liaison	50

9.4.3	Documentation	50
9.4.4	Maintenance and Warranty	50
9.4.5	Testing and Commissioning	50
9.5	Codes, Rules, Permits, Fees	50
9.6	Defects Liability	50
9.7	Location of Services	51
9.8	Workmanship	51
9.9	Red-line Drawings	51
9.10	Licensed Electrical Contractor	51
9.11	Drawings	51
9.12	Switchboards	51
9.13	Lighting	51
9.14	Caravan Power Outlets	52
9.15	Earthing	52
9.16	Conduits	52
9.17	Other Items	52
9.18	Testing and Commissioning	52
9.19	Shop Drawings	53
10.	Limestone Block Retaining Wall	54
10.1	General	54
10.2	Hold Points	54
10.3	Standards	54
10.4	Limestone Blocks	54
10.5	Mortar	55
10.5.1	Materials for mortar	55
10.5.2	Mortar mixing method	55
10.5.3	Mortar mix	55
10.6	Workmanship	55
10.7	Coursing and bond	56
10.8	Joints	56
10.9	Samples	56
10.10	Footings to Limestone Walls	56
10.11	Drainage	56
10.12	Cleaning	56
10.13	Protection of Finished Work	56
11.	Miscellaneous Items	57
11.1	Handrails	57
11.2	Mulching	57
11.3	Concrete work	57
11.4	Shelter and bin stall	57
11.5	Fencing and gates	57
11.5.1	Responsibilities	57
11.5.1.1	General	57
11.5.1.2	Performance	58
11.5.1.3	Products and materials	58
11.5.2	Inspection	58

11.5.3	Products	58
11.5.4	Execution	58
11.5.4.1	Construction generally	58
11.5.4.2	Gates	59
11.5.4.3	Chain link fabric fencing	59
11.5.5	Completion	59
12.	Quality Assurance	60

Table index

Table 1	Scope of Work for Temporary Workers Caravan Accommodation Facility	1
Table 2	Definitions	3
Table 3	Hold points for earthworks	11
Table 4	Compaction requirements	14
Table 5	Tolerances	15
Table 6	Laterite gravel pavement – conformity table	21
Table 7	Crushed Limestone – Conformity Table	22
Table 8	Tolerances	24
Table 9	Nominal size	26
Table 10	Aggregate Grading	26
Table 11	Percentage of bitumen binder	27
Table 12	Marshall testing	27
Table 13	Air voids within total mix	28
Table 14	Maintenance Requirements Schedule	39
Table 15	Piping system schedule	44
Table 16	Isolating valves schedules	44
Table 17	Backflow prevention schedules	45
Table 18	Water and Power Pedestal	45
Table 19	Sanitary drainage piping schedule	48
Table 20	Gullies schedule	48
Table 21	Minimum required hold points for limestone block retaining wall	54

Figure index

Figure 1	Site location for temporary workers caravan accommodation facility	1
----------	--	---

Appendices

Appendix A	Safety in Design
------------	------------------

1. Introduction

STC Seroja, a category 3 cyclone, impacted the coastline of Western Australia in April 2021 which led to the declaration of disaster event AGRN965 in accordance with the Disaster Recovery Funding Arrangements of Western Australia (DRFAWA). This project is to be delivered in accordance with the DRFAWA requirements.

1.1 General

This Specification is for the temporary overflow workers caravan accommodation facility. This Specification should be read in conjunction with the relevant drawings, regulations, Codes and Standards.

1.2 Location of works

Figure 1 outlines the sites which coastal work will be undertaken.



Figure 1 Site location for temporary workers caravan accommodation facility

1.3 Scope of Work

Refer to GHD's 12596020-SOW Temporary Overflow Caravan Accommodation Facility, Construction Scope of Work.

Table 1 outlines a summary of the Scope of Work.

Table 1 Scope of Work for Temporary Workers Caravan Accommodation Facility

Items	Scope of works
General Items	Site setup and establishment
	Survey and setout
	Provision of all Management Plans and supervision to undertake the works
	Provision of all HSE and OHS requirements
	Obtaining approvals for undertaking works where required
	Locating and protecting services prior to commencing work

Items	Scope of works
	<ul style="list-style-type: none"> — Liaison with Western Power and Water Corporation, as required — Testing, Quality Control and Quality Assurance requirements — As constructed plans on completion of the Works. All waste and debris shall be correctly disposed of at the Kalbarri Landfill facility — Site cleanup and demobilisation
Summary of the Works	<ul style="list-style-type: none"> — Disconnection, removal and safe disposal of all existing cabling associated with services becoming redundant within the area of works. — Clearing, site preparation and earthworks — Construction of a 7m wide gravel access road — Construction of two sealed parking spaces as well as a disabled parking space — Installation of linemarking for the sealed parking area — Construction of a 30mm asphalt crossover on Anchorage Lane — Construction of two unsealed parking spaces — Construction of 15 caravan sites with compacted gravel surface — Replacement of the existing access gate with 2x3m wide access gate — Installation of chain link fence and tie into existing fencing — Construction of a service vehicle access gate 2x3m wide and unsealed parking bay near the transportable ablution facility — Construction of 0.6m high limestone block retaining walls — Construction of a concrete staircase from the sealed car park to the shelter footpath with handrails — Construction of a disability access ramp with handrail and tactile indicators — Construction of concrete footpaths and staircase with handrails — Blue metal aggregate surface covering around the proposed transportable ablution facility — 100 mm heavy mulch to be placed on batter slopes and all disturbed areas on site — Installation of a steel framed shelter, solar shield and 2.4m high privacy screen on a concrete base slab. Shelter to match with other shelters within Kalbarri. Shop drawings to be provided for review and approval. — Installation of two Replas table and bench seating areas. Replas product required to match other existing picnic tables used within Kalbarri. Proposed product details to be provide for review and approval. — Installation of a premium barbecue, hot plate and sink, with wastewater, water and electrical supply. Proposed product details to be provided for review and approval. — Installation of a bin stall with a concrete floor and an external tap adjacent to the transportable ablution facility near the service parking area — Installation of a portable toilet dump point — Installation of wastewater reticulation, including reticulation to caravan sites — Wastewater connection inside Lot 500 Anchorage Lane (205m in length) — Installation of water reticulation, including reticulation to each caravan site — Electrical works <ul style="list-style-type: none"> • Supply and installation of new solar bollard lighting. • Supply and installation of new weatherproof switched socket outlets, and its associated cabling. • Supply and installation of new Site Main Switchboard, Building Main Switchboard, and Distribution Board.

Items	Scope of works
	<ul style="list-style-type: none"> • Supply and installation of new incoming submain cables. • Supply and installation of new protective devices. • Discrimination and grading of new protective devices. • Supply and installation of new underground PVC conduits. • Supply and installation of new power pits. • Supply and installation of new submain cables to the proposed ablution building Distribution Board. The Electrical Trade shall liaise with the supplier of the transportable ablution facility. <p>— Connection of water, waste water and electrical services to the transportable ablution facility inlet and outlet points.</p>
Works by others	<p>— Bins will be provided by the Shire</p> <p>— Fire extinguishers will be provided by the Shire</p> <p>— Installation of proposed transportable ablution facility excluding connection to services.</p> <p>— Western Power to supply and install new WPC unipillar and connection to unipillar, including demolishing of existing power pole, and aerial lines in the area of works.</p> <p>— Western Power to supply and install the Service Protection Device in the Site Main Switchboard.</p>

1.4 Definitions

Table 2 outlines definitions used throughout this document.

Table 2 *Definitions*

Item	Description
Principal	Shire of Northampton.
Contractor	Party awarded the Contract to complete the Works.
Superintendent	The Kalbarri Coastal Remediation Project Superintendent will be overseeing the Works for the Principle.
Works	All construction works required to deliver the project as defined by the Scope of Works, Specifications, drawings, and Contract documents.

2. General Requirements

2.1 Australian Standards

All workmanship and materials used in the Works shall conform to the current edition of the appropriate Australian Standard. Where the regulatory Authority's requirement differs from the Australian Standard, the regulatory Authority's requirement shall prevail.

2.2 Precedence and Discrepancies of Drawings

2.2.1 Documentation

The order of precedence of the contract documents shall be:

1. The Drawings
2. The Technical Specification
3. Conditions of Tendering
4. The General Conditions of Contract and Amendments

2.2.2 Discrepancies

All discrepancies shall be immediately notified in writing to the Superintendent.

2.1 Electronic information

PDF Drawings takes precedence over the electronic models and survey data issued. The Tenderer / Contractor shall solely be responsible for checking all electronic information provided against the current PDF Drawings and must report any discrepancies in writing to the Superintendent.

2.2 Interpretation of Documents

The tenderer shall make their own interpretation, deductions and conclusions from the information made available and shall accept full responsibility for such interpretations, deductions or conclusions.

The Contractor or any Subcontractor to them shall check all relevant dimensions on site before proceeding with the works. No claim for additional costs arising from failure to obtain measurements and other information on site will be allowed.

2.3 Omissions

The Principal does not represent that information made available shows completely the existing site conditions. The Principal is not responsible for any interpretations, deductions and conclusions made by the Contractor from the information made available and the Contractor shall accept full responsibility for any such interpretations, deductions and conclusions.

As the information supplied to the Contractor could include errors or omissions or could be ambiguous or misleading, the Contractor shall advise the Superintendent of any discrepancies at the earliest possible time.

If the Contractor supplies information to anyone else, including a Contractor or Subcontractor, for any information supplied the Contractor shall indemnify the Principal and Superintendent for any claim by that person arising out of errors or omission or the misleading nature of the advice.

2.4 Warranty

The accepted Tender under this Contract is deemed to be a warranty that notwithstanding that any part of the equipment or the materials supplied has been satisfactorily factory tested and/or inspected before installation, if any item or part thereof shall fail to perform its specified function under test or during the Contract defects liability period, then all costs of replacing all faulty equipment or parts thereof shall be borne by this Contractor.

2.5 Traffic Management

The Contractor shall undertake all necessary traffic management requirements including:

- Submit a TMP in accordance with the Shire of Northampton's traffic management requirements for review and approval prior to mobilisation.
- The intent is that public access to work site will be restricted during the Works, but where this may not be possible, the TMP is to provide a safe working environment for both construction workers and the public. Note that a portion of Lot 501 Anchorage Lane is occupied by others who may require access.
- Provide traffic management as per the approved TMP.

All signs and method of traffic control shall be generally in accordance with AS 1742 and to the approval of the relevant Statutory Authority.

All damage to existing pavements and improvements shall be made good to the standard of the pre-existing conditions. These works shall comply with the Local Authority requirements for works on public lands.

2.6 Programme and staging of work

The Contractor shall submit to the Superintendent for approval within one week of acceptance of his tender, a diagrammatic or other approved form of time schedule for the carrying out of the various parts or stages of the works. The programme shall:

- Include consideration of Saturdays, Sundays, Statutory Public Holidays, building industry annual close down holidays and Rostered Days Off shall be clearly shown on the program;
- Clearly identifies each area/location, trade and element of work;
- Indicates closure of sites
- Indicates starting and finishing dates for each activity, milestone events, logic dependencies and critical path activities;
- Highlights in colour the critical path;
- Does not show any activity with a duration more than 10 days unless related to supply and/or prefabrication lead times;
- Does not include any activity describing more than one major element and/or trade and/or area;
- Shows all major critical off-site activities of supply, prefabrication, testing, samples, prototypes, shop drawings, approvals required; and
- Includes the activities of all the Contractor's, subcontractors, suppliers etc.

The Construction Program shall be accompanied by notes which outlines the basis of the program including assumptions made, allowances incorporated, external interfaces and constraints provided for.

2.7 Survey set out

The works shall be set out by the Contractor and constructed in accordance with the alignments, levels, grades and cross sections as shown on the approved drawings or as directed by the Superintendent in accordance with this specification.

The Contractor shall have on site at all times survey equipment of a standard suitable to accurately confirm detailed set-out and levels, plus personnel skilled in the proper operation of this equipment.

The works shall be set out, using all the necessary survey equipment, from the pegs and benchmarks given and these shall be used constantly during the progress of the works to check the accuracy thereof. Care shall be taken not to disturb any survey peg, survey recovery pegs or survey marks.

Under no circumstances will any interference with any official benchmark be permitted. Before commencing work, all such benchmarks in the area covered by the Contract shall be protected.

Where it is necessary to cover a survey peg, such a peg must have a substantial stake driven beside it and this stake shall extend at least 75mm above the finished surface and be appropriately marked to identify it. Any State Survey mark affected by the works shall be identified and reported.

Set out amendments, if required, shall only be undertaken on site in conjunction with the Superintendent and are subject to Approval.

Approval to proceed shall not constitute acceptance of the accuracy of the work nor relieve the Contractor of their contractual obligations and responsibility for the work.

Payment for survey set out will be assumed to be included in the relevant schedule item for each activity.

2.8 Inspections

The Contractor shall notify the Superintendent and the relevant service Authority inspector not less than 48 hours prior to an inspection being required for those phases of the work specified in the Technical Specifications.

2.9 Behaviour of personnel

The Contractor shall ensure that persons employed in connection with the work under the Contract conform to a code of behaviour and cooperation which shall be above reproach in all dealings or liaison with the public and with property owners or occupiers. Offensive behaviour or language in public by any person employed in connection with work under the Contract shall not be permissible.

2.10 Pets prohibited on site

The Contractor shall ensure that persons employed in connection with the work under the Contract shall not permit pets or animals, which are in the control or ownership of such persons to be on the Site.

2.11 Trespass

2.11.1 By contractor

- a. The Contractor and his employees shall not trespass on any land adjoining the area in temporary possession of the Contractor for purposes of the Contract.

2.11.2 By others

- a. The contractor shall ensure that all machinery, excavation works and building works are left and maintained (both during and after working hours) in a safe condition, including but not limited to provision of advisory signing, reflectorised posts, temporary barriers etc.
- b. The contractor shall take care when moving machinery or carrying out the works to ensure trespassers are not subject to unreasonable danger.
- c. In the event that trespassers are noted entering the site, the contractor shall erect appropriate warning signs at identified trespass access locations. The contractor shall warn trespassers by way of secure signage that they should not enter the area as they may be exposing themselves to risk of injury.

2.12 Site meetings

Site meetings will occur on a regular basis as advised by the Superintendent. The Contractor, or his representative, and the Superintendent's representative shall attend the meeting.

The Contractor shall, if required, arrange for the attendance of Subcontractors and other staff members as may be required.

The Superintendent, or their representative, will chair the meeting and provide copies of the minutes of the meeting to the Principal and the Contractor.

2.13 Protection of existing vegetation

Great importance is placed upon retention of the natural vegetation within the areas not affected by the works. The Contractor shall not disturb any existing vegetation unless specific directions or approval to do so has been given. The Contractor shall not under any circumstances clear, stockpile site sand, topsoil or other materials, or travel with plant or vehicles outside of those areas specifically requiring such operations. Any clearing, or damage by other means, extending beyond the prescribed limits, without the authorisation of the Superintendent, shall be assessed accordingly and any such costs shall be borne solely by the Contractor by way of a reduction in the monies payable under this Contract.

2.14 Safety

The Contractor is responsible for maintaining a safe site at all times in accordance with Worksafe requirements.

All site staff shall be deemed to be employed by the Contractor, and the Contractor shall arrange for all staff to meet the site safety requirements.

Possible hazards shall be addressed by the Contractor, and managed to ensure that no significant hazard is overlooked, and that all risks are properly assessed and adequately controlled.

Trenching shall be carried out in accordance with the West Australian Work Health and Safety Act 2020 (WHS Act). All excavation shall be fenced off with warning signs and lighting if required. The Contractor is responsible for the complete supply and maintenance of all such safety measures and costs for these works shall be deemed to have been included with the Tender.

The Contractor's safety plan shall include the following;

- Have an adequate number of employees trained in first aid to meet potential hazards in the workplace, with an experienced First Aid officer available at all times when work is in progress.
- Have an adequate training program for all employees and subcontractors, which is relevant to work undertaken and includes hazard identification, assessment and reporting.
- Adequate fire prevention equipment, including portable fire extinguishers.
- Good housekeeping onsite, and an accident notification procedure
- Promotion of safety information to all employees.
- Should the Works involve any unusual activities such as trenchless technology, deep excavations, work close to existing structures or large/high pressure services, unusual ground conditions, work at height, etc then the Contractor shall submit a Method Statement to the Superintendent defining the timing, plant, labour, materials and other temporary facilities associated with the works at least 48 hours before commencing such activity.
- The Contractor shall notify the Superintendent of any and all accidents within the meaning of the Workers' Compensation Acts and/or Regulations which may happen to his employees or employees of his Sub-Contractors or nominated Sub-contractors engaged on the Contract work within 24 hours of the occurrence of each such accident.

2.15 Work by others and other work at site

During the currency of the Contract, other work may be preceding at or in the vicinity of the site. The Contractor shall act and cooperate at all times with any other contractors so as to ensure the expeditious completion of the project, and to ensure that no obstruction or interference with other contractor's occurs.

The Contractor shall be responsible for arranging the progress of the work and the attendance at appropriate times of sub-contractors and service authorities (including inspectors).

The Contractor shall be responsible for the making good of damage caused by sub-contractors and service authorities, and for finishing surfaces to match adjacent surfaces.

2.16 Damage

The Contractor shall be responsible for any damage caused to buildings, grounds, fences, persons or services by whatever cause due to the works and shall make these good and bear any compensation. Where services are damaged, the relevant Authority is to be notified immediately, and all charges, fees etc. paid by the Contractor, at his cost.

The Contractor shall make good all damage or present proof of settlement of all claims for damage caused by his works before the issue of the Certificate of Practical Completion for the section of the work in which the damage has occurred.

The Contractor shall present proof of settlement of all claims by Public Authorities for works carried out by the Authorities as a result of works under this Contract before the Final Certificate will be issued.

2.17 Existing services

It shall be the Contractor's responsibility to verify the position of underground and other services before commencing excavation and further, to arrange repair by the responsible servicing authority, at his own cost, all damage caused to these services during the works.

Where existing services must be interrupted to enable carrying out of the works such interruption shall be at a time agreed by the Superintendent. The Contractor shall organise with the responsible servicing Authority so that the interruption shall be for the minimum practical time. All costs shall be considered to be included in the Contractors price to complete the works.

2.18 Diverting water and dewatering

The Contractor shall do all work necessary to drain and/or divert any water interfering with the progress of the works, keep the excavations free from water while the works are in progress and prevent any injury to the works by water due to floods or other causes. The cost of such work shall be deemed as having been included in the Contractor's Tender Price.

2.19 Nuisance

The Contractor shall take all necessary precautions to prevent nuisance to adjoining or nearby owners or tenants including but not limited to nuisance by way of dust, smoke, wind-blown sand or debris, noise, vibration and electrical interference.

2.20 Rock excavation

No extra payment shall be made for rock excavation unless the Contract Documents specifically provide for such payment.

When necessary for the purpose of payment, the different kinds of material met with in excavation shall be classified under the headings "Other than Rock" or "Rock", and where such words occur in the Contract Documents they shall have the following meanings:

- a. "Other than Rock" shall mean all kinds of materials, which in the opinion of the Superintendent do not require blasting or removal by jackhammer or mechanical rock breaker.
- b. "Rock" shall mean hard rock, which in the opinion of the Superintendent requires blasting and is in fact blasted, or removed by jackhammer or mechanical rock breaker.

2.21 Restoration

Excavation is to be kept to a minimum in all established areas such as roadways, footpaths and other paved areas. Unless otherwise specified or shown, all damage to existing improvements as a result of construction works, shall be made good by the Contractor, to pre-existing conditions. No existing trees, shrubs, sheds or other permanent structures shall be removed without the prior approval in writing of the Superintendent.

The Contractor shall liaise with the relevant local authority where such works are located on public land. Construction and reinstatement works shall conform to the local authorities requirements. The cost for reinstatement work shall be deemed to have been included in the tender.

Existing pavements and kerbs shall be saw cut to provide a neat edge for reinstatement works.

Excavation material shall be deposited in an area causing the least interference to vehicular and pedestrian traffic.

During the period of the Contract, the Contractor shall clean up the construction site and remove all surplus construction material and debris from the site. At the completion of the Contract the site shall be left clean and tidy, all excavation filled flush with the natural ground level, and all excess material removed to the satisfaction of the Superintendent.

2.22 Testing

The Contractor shall be responsible for providing verification that all materials and work comply with the requirements of this specification.

The Contractor shall allow within the Lump Sum Breakdown for all testing as required by the Technical Specification.

Where the tests fail, the work shall be rectified and retested until the work falls within the specified tolerances to the satisfaction of the Superintendent.

The Principal shall pay for additional testing requested by the Superintendent unless such tests fail, in which case, such testing shall be at the Contractors expense. All re-tests shall be at the Contractors expense.

2.23 Payments

Progress payments will be assessed for all work installed in accordance with the contract. Full certification of payment will not be made until each section of the work has been tested, approved, backfilled and measured for as-constructed requirements.

2.24 Practical completion

The intended purpose of the Works is to achieve the relevant Authority acceptance and takeover of the Works.

Practical Completion shall therefore be awarded when;

- All Authority inspections have been successfully completed and works have been accepted by the Principal;
- All testing has been successfully completed;
- All as-constructed details and drawings have been accepted by the Principal.

2.25 Final certificate

The Final certificate at the end of the Defects Liability Period shall not be issued until the Council or relevant statutory authority has inspected the works and provided a defects clearance list and accepted takeover of the works.

3. Earthworks

3.1 General

All works shall be constructed in accordance with the Drawings, the current version of AS 3798 and this Specification. The specific requirements of this section of the Specification describe the formation of earthworks by cutting, filling and/or importing of suitable material.

3.2 Hold Points

Table 3 Hold points for earthworks

Specification Section	Detail	Hold Point Timing
3.4	Commencement of clearing to allow for identification of any trees, etc which require protection	7 days prior to commencement
3.5.4	If unsuitable subgrade or hazardous material is found on site, Contractor to notify Superintendent immediately and await direction from Superintendent.	During excavation
3.5	Completion of excavation to ensure that the profile is to the lines and levels specified and all debris is removed. Contractor to await direction from Superintendent for retaining wall transition.	Completion of excavated sections
3.6	Method statement for compaction behind limestone retaining wall.	14 days prior to works commencement
3.8.2	Testing and results of compaction tests for each layer specified within Specification	At completion of compacted layer and prior to placement of next layer

3.3 Discrepancies

"Discrepancy" for the purposes of this section means a difference between contract information about the site and conditions encountered on the site, including but not limited to discrepancies concerning:

- The nature or quantity of the material to be excavated or placed;
- Existing site levels; and
- Services or other obstructions beneath the site surface.

If the Contractor considers that he has discovered a discrepancy, he shall notify the Superintendent immediately, and obtain a determination before proceeding with the Works, otherwise no claim for extra cost shall exist.

3.4 Clearing and Grubbing

3.4.1 General

Remove any objects and debris from the working area which do not form part of the works. The cost of such removal and of any disruption to the works as a consequence shall be borne by the Contractor.

The Contractor shall give seven days notice of intention to clear any section of the works so that the Superintendent may determine and demarcate the trees and plants which are to be preserved.

Within the area of works, only clear vegetation where necessary to enable construction.

All suitable spoils from clearing shall be chipped/mulched and stockpiled on site as directed.

3.4.2 Disposal of Material

Unless otherwise permitted or directed, all debris resulting from clearing operations together with all lying and fallen timber which is not chipped or mulched shall be removed from the site. All cleared material removed from the site shall, unless required by the Contractor for other purposes, be loaded, hauled and dumped in compliance with statutory requirements.

No burning is permitted.

3.5 Excavation

3.5.1 General

Excavate to conform to the lines, grades, cross-sections and dimensions shown on the Drawings. The Superintendent may order the removal of any soft spots, debris or organic material exposed when excavated areas have been trimmed to finished formation levels. The Contractor shall remove any unsuitable material exposed when excavated areas have been trimmed to finished formation levels.

Separate the clean sand material from excavations for use as backfill at appropriate locations following placement of new materials.

Over excavation shall be backfilled as specified herein.

3.5.2 Stripping and stockpiling of topsoil

Strip topsoil from all areas to be cut or filled. Nominally 150 mm deep.

Unless otherwise directed, the depth of stripping shall be to the bottom of the grass root zone, or to the bottom of any organic layer, whichever is the deeper. Any uncertainty in strip depth shall be brought to the Superintendents attention prior to fill being placed. Avoid contamination by any other material.

3.5.3 Disposal of surplus spoil

Surplus spoil is to be stockpiled where specified or disposed off site as directed.

3.5.4 Hazardous Material

Give notice immediately if hazardous materials or conditions are encountered during excavation.

Stockpiling of Excavated Material

The Contractor shall identify a stockpile area for placement of excavated material required for backfilling. This stockpile area is to be approved by the Superintendent prior to the commencement of earthworks.

3.5.5 Excess Excavation

The Contractor is not entitled to contract variation or extension of time for excavation in excess of that required by the contract, including excavation below required depths, or additional excavation which the Contractor may elect to undertake to permit the use of certain constructional plant, and any consequent additional backfilling or testing.

Where excavation exceeds the required extent, reinstate to the correct depth and required density.

3.6 Filling

3.6.1 General

Backfilling is required following placement of new materials.

Backfill material shall be sourced from excavated material and shall be free from all organic and other deleterious materials. The Superintendent may direct that stockpiled excavated material is unsuitable as fill and shall be screened to produce clean sand fill.

Place and compact fill to conform to the lines, grades, cross-sections and dimensions shown on the drawings.

Before filling commences, the Contractor shall remove any unsuitable material exposed when topsoil has been stripped.

Contractor to measure by survey in situ the volume of additional material required to replace unsuitable material.

3.6.2 Materials

Unless otherwise specified or directed, the fill materials shall be obtained from cutting in situ material and/or importing material from approved sources off-site.

Sand

All fill shall be clean, free draining, medium to coarse sand or equivalent, free from foreign and organic matter. It shall be non-plastic with all material passing the 4.75 mm sieve and not more than 10 % passing the 0.075 mm sieve, with a soaked CBR of 15 % minimum when compacted to 100 % of MMDD at OMC.

Clay

Where in situ clay is used as fill, it shall be taken directly from the excavation to the fill site, placed and compacted at optimum moisture content in maximum 200 mm layers.

3.6.3 Compaction equipment

It is the Contractors responsibility to assess the nature of the soil being cut or filled and to select the appropriate method and machinery to be used in order to achieve the specified results.

Light compaction equipment shall be used 1.5 m from back edge of retaining wall.

3.6.4 Compaction

Place and compact in uniform layers of appropriate thickness and using compaction equipment capable of achieving the level of compaction specified. Layers should extend for the full width of embankments. Each layer shall be compacted to the appropriate density prescribed in Table 4 and as indicated on Drawings.

During compaction the moisture content of fill should be maintained in the range OMC \pm 2% by drying, or by the addition of moisture, as appropriate. Water spraying equipment used for this purpose shall be capable of distributing water uniformly in controlled quantities. Mechanical mixing of the fill material can be used to help ensure uniform distribution of moisture before commencement of rolling.

3.6.5 Backfilling near structures

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

3.7 Trimming and finishing of surfaces

Prior to Practical Completion, the entire work site is to be trimmed and graded in order to achieve a uniformly neat and tidy Site free of wheel tracks and ruts.

3.8 Acceptance

3.8.1 General

All tests specified herein shall be undertaken by a laboratory, certified by the National Australian Testing Authority, NATA, and approved by the Superintendent.

The Contractor shall monitor and test all works specified herein to ensure compliance with requirements specified in Clause 3.6.2.

Upon completion of the compaction process of each and any layer, the Contractor shall determine the in-situ moisture content, dry density and layer thickness of the compacted material throughout the full thickness of the layer at random locations in every 500m² of surface area. The rate of testing shall be not less than one for each 500m² of surface area, with a minimum of three tests where the area of each section is less than 500m².

The in-situ dry density shall be determined in accordance with the requirements of AS 1289 5.3.1 or 5.8.1 as required by the Superintendent except that the nuclear density gauge shall be calibrated in accordance with the Main Roads Western Australia Test Method not AS 1289 5.8.3. The density ratio shall be determined in accordance with AS 1289 5.4.1.

For each uniform section of each layer of the material, which has been placed, and compacted, the Contractor shall determine the dry density ratio of the material at random locations throughout the uniform section.

A uniform section is defined as a section in which all of the material has been placed and compacted within a 48 hour period.

Modified maximum dry density determinations shall be made at a rate of not less than one for each uniform section, in accordance with the requirements of AS 1289 5.2.1 (for cohesive soils) and AS 1289 5.5.1 (for cohesionless soils).

3.8.2 Compaction requirements

Compaction requirements for work carried out under this Section of The Specification are itemised in Table 4.

Table 4 Compaction requirements

Item		Minimum Relative Density		
		Cohesive Soils	Cohesionless Soils	
		Minimum Dry Density Ratio (AS 1289.5.2.1)	Minimum Dry Density Ratio AS 1289.5.2.1	Minimum Density Index AS 1289.5.5.1
1	Backfilling of Grub holes and replacement of unsuitable material	Fill with cohesionless soils & compact as per specification.	95% Mod	70%
2	Fill	95% Mod (if $\rho_{0.075} < 10\%$) 93% Mod (if $10\% < \rho_{0.075} < 20\%$) Not acceptable if $\rho_{0.075} > 20\%$	95% Mod	70%
3	Subgrade (to a depth of 0.3m)	93% Mod	98% Mod	80%

Notes:

- All dry density ratios relate to AS 1289.5.2.1 and AS 1289.5.4.1.
- Density Index as a means for control of achieved relative compaction may be difficult to use and interpret. Local correlations with other methods may exist and can be used where these are well established.

For cohesionless soils a calibration of the Perth Sand Penetrometer (PSP) shall be carried out against the Density Index. Where the Density Index specified in Table 3.1 corresponds to less than 7 blows/300mm of the PSP the compaction required shall be a minimum of 7 blows/300mm. Where the Density Index specified in Table 3.1 corresponds to more than 7 blows/300mm of the PSP the compaction required shall be that which yields the specified Density Index or the PSP blows that corresponds to this.

Acceptance of each layer is conditional upon the application of uniform and sufficient compactive effort by appropriate equipment over the whole of the layer.

Where fill material is being placed which the Superintendent considers is not suitable for testing by standard laboratory methods, then compaction operations shall be carried out as directed. The Superintendent may specify the type of compaction requirement, layer thickness and the means of adjustment of moisture content. Rollers may be required to operate singly or in combination up to a total of 12 coverages.

3.8.3 Tolerances

On completion of cutting, filling and all incidental operations, and before the placement of covering materials, finished surfaces shall conform to the tolerances in level and shape itemised in Table 5.

Table 5 Tolerances

Item	Description	Tolerance
1.	Clearing and grubbing (width of design earthworks plus 2m)	±0.5m
2.	Earthworks - level	±20mm
3.	Verge level	±15mm
4.	Cut or fill batters	±2°
5.	Topsoiling thickness	±10mm
6.	Subgrade - Width - Level	±100mm -20mm, +0mm

3.8.4 Defective work

Where a section of the work is rejected on the basis of inspection of test results, further compactive effort shall be applied to the section or nominated parts of the section until the specified standard is achieved. Scarify the area for the full depth of the layer and add water as necessary. Mix mechanically to ensure uniform distribution of moisture before commencement of rolling.

3.9 Removal of existing structures

Removal of existing structures, if applicable, shall be undertaken as indicated on the Drawings. The disposal of these materials shall be undertaken under the direction of the Superintendent.

4. Service trenching

4.1 Responsibilities

General

Requirement: Provide trenching for underground services, as documented.

- the Combined Service trenching,
- individual service trenching

Supervise the backfill of all trenching by the civil subcontractor and provide written sign off that the work is fit for purpose for the Subcontractors requirements.

The Subcontractor shall be responsible for

- the installation of all services, sumps and pits and including backfilling.
- Achieving minimum separation between services in shared or combined trenches.

4.2 Standards

Trenching

Earthworks: To AS 3798.

Hydraulic services: To the AS/NZS 3500 series.

Electrical services: To the AS/NZS 3000 series.

4.3 Tolerances

Surface levels

Earthworks: Finish the surface to the required level, grade and shape within the following tolerances:

- Under building slabs and load bearing elements: + 0, - 25 mm.
- Pavement subgrades: + 0, - 40 mm.
- Batters: No steeper than the slope shown on the drawings. Make sure flatter slopes do not impact on boundaries or required clearances to buildings, pavements or landscaping.
- Other ground surfaces: ± 50 mm, provided the area remains free draining and matches adjacent construction where required. Provide smoothness as normally produced by a scraper blade.

Pavement base and subbase: Finish the surface to the required level, grade and shape within the following tolerances:

- Subbase: + 10 mm, - 25 mm.
- Base: + 10 mm, - 5 mm.

4.4 Submissions

Records

As-built location: Upon completion submit as-built documentation to show the location of the installed services.

4.5 Inspection

Notice

Inspection: Give notice so that inspection may be made at the following stages:

- Items to be measured as listed in GROUND CONDITIONS, Records of measurement.
- Service trenches excavated before laying the service (with the exception of the CSR which is by others).
- Services laid in trenches and ready for backfilling.
- Completed surface restoration.

4.6 Fill materials

General

Suitable material: To AS 3798 clause 4.4 including inorganic, non-perishable material suitably graded and capable of compaction to the documented density.

Unsuitable materials: Do not use unsuitable material for fill in conformance with AS 3798 clause 4.3.

Sulfur content: Do not provide filling with sulfur content exceeding 0.5% within 500 mm of cement bound elements (for example concrete structures or masonry) unless such elements are protected by impermeable membranes or equivalent means.

Re-use of excavated material: Only re-use suitable material in conformance with AS 3798 clause 4.4.

Material in reactive clay areas: In sites classified M, M-D, H1, H1-D, H2, H2-D, E or E-D to AS 2870, re-use excavated site material at a moisture content within $\pm 1\%$ of that of the adjoining in situ clay.

Selected material zone: Selected material free from stones larger than 100 mm maximum dimension and the fraction passing a 19 mm Australian Standard sieve to have a 4 day soaked CBR (California Bearing Ratio) value, in conformance with AS 1289.6.1.2, and not less than that of the adjacent selected material zone.

4.7 Surface restoration materials

General

Re-use: If possible re-use the existing surface materials that were removed during trench excavation, whilst conforming to the documented material requirements.

Subbase and base

Requirement: Provide crushed rock material configured in layers and depths to match existing and adjacent work, as follows:

- Refer to section 5.4

Pathways and paved surfaces generally

Requirement: Provide materials consistent with those of the existing surface before service trenching works commenced.

4.8 Existing services

Location

Requirement: Before commencing service trenching, locate and mark existing underground services in the areas which will be affected by the service trenching operations.

As found site conditions

Unexpected conditions: If the following are encountered, give notice immediately and obtain instructions before carrying out any further work in the affected area:

- Bad ground.
- Discrepancies to expected ground conditions.
- Unexpected/undocumented services.
- Rock.
- Springs, seepages.
- Topsoil > 100 mm deep.

Records of measurement

Excavation and backfilling: If a schedule of rates applies, provisional quantities are specified, or there are variations to the contract levels or dimensions of excavations, do not commence backfilling or place permanent works in the excavation until the following have been agreed and recorded:

- Depths of excavations related to the datum.
- Final plan dimensions of excavations.

4.9 Excavation

General

Requirement: Excavate for underground services in conformance with the following:

- To required lines and levels, with uniform grades.
- Straight between access chambers, inspection points and junctions.
- With stable sides.
- Width tolerance: ± 50 mm, unless constrained by adjacent structures.

Adjacent structures

Existing footings: If excavation is required within the zone of influence of an existing footing, use methods including (temporary) shoring or underpinning that maintain the support of the footing and make sure that the structure and finishes supported by the footing are not damaged.

Temporary supports: Provide supports to adjacent structures where necessary, sufficient to prevent damage arising from the works, as follows:

- Lateral supports: Provide lateral support using shoring.
- Vertical supports: Provide vertical support where necessary using piling or underpinning or both.

Permanent supports: If permanent supports for adjacent structures are necessary and are not described, give notice and obtain instructions.

Encroachments: If encroachments from adjacent structures are encountered and are not shown on the drawings, give notice and obtain instructions.

Trench widths

General: Keep trench widths to the minimum, consistent with the laying and bedding of the relevant service and construction of access chambers and pits. Refer to pipe or conduit manufacturer requirements.

Trench depths

General: As required by the relevant service and its bedding method. Refer to pipe or conduit manufacturer requirements.

Obstructions

General: Clear trenches of sharp projections. Cut back roots encountered in trenches to at least 600 mm clear of services. Remove other obstructions including stumps and boulders which may interfere with services or bedding.

Excess excavation

General: If trench excavation exceeds the correct depth, reinstate to the correct depth and bearing value using compacted bedding material or sand stabilised with 1 part of cement to 20 parts of sand by volume.

Stockpiles

Topsoil removal: Stockpile topsoil intended for re-use to a maximum height of 1500 mm.

Excavated material for backfill: If required, segregate the earth and rock material and stockpile, for re-use in backfilling operations.

Locations: Do not stockpile excavated material against tree trunks, buildings, fences or obstruct the free flow of water along gutters where stockpiling is permitted along the line of the trench excavation.

Disposal: If stockpiling is not permitted, dispose of excavated material off-site.

Unsuitable material

Disposal: Remove unsuitable material from the bottom of the trench or at foundation level and dispose of off-site. Replace with trench backfill material.

4.10 Trench backfill

General

Place fill: To AS 3798 clauses 6.2.2 and 6.2.6.

Timing: Backfill service trenches as soon as possible after laying and bedding the service, if possible on the same working day.

Removal of supports: Remove temporary supports progressively as backfilling proceeds.

Marking services

Marking tape: Provide marking tape above service, with appropriate labelling, to AS/NZS 2648.1 and as follows:

- Non-metallic services: Provide tape capable of being detected by inground scanning devices.
- Location: Locate tape approximately half the depth of the service being marked, to a maximum depth of 300 mm above piping.

Bedding, haunch, side and overlay zones

Installation and material: To the particular service requirements. Secure pipes against floatation.

Bedding of services: Surround pipes or conduits on all sides with a minimum of 75 mm compacted bedding sand, or as documented.

Overlay zone thickness: Maximum 300 mm immediately over the service.

Compaction

Control moisture within backfill: To AS 3798 clause 6.2.3.

Layers: Compact all material in layers not exceeding 300mm compacted thickness. Compact each layer to the required relative compaction before starting the next layer.

Compaction: To AS 3798 Section 5.

Frequency of testing: To AS 3798 clause 8.7.

Precautions: Use compaction methods which do not cause damage or misalignment to utility services.

4.11 Surface restoration

Subbase and base

Compaction: Uniformly compact each layer of the subbase and base courses over the full area and depth within the trench to a relative compaction of 95% when tested in conformance with AS 1289.5.4.1.

Compacted layer thickness:

- Maximum: 200 mm.
- Minimum: 100 mm.

Compaction test frequency: Minimum 1/every second layer/50 m² of restoration surface area.

4.12 Completion

General

As-built documentation: Upon completion, record the location of all installed services on the Redline and Record documentation.

5. Road works

5.1 Scope

This section of the specification covers the construction of road pavements & footpaths. Current Council specification shall apply where available. Whenever Council specifications are unavailable or where they do not cover the required scope of works then the following clauses in this section of the specification shall apply.

5.2 Standards

All work and associated performance tests shall comply with the requirements of all relevant Australian or Main Roads WA (MRWA) standards.

5.3 Quality and Process Control

The Contractor shall continuously monitor the processes used in the supply, filling, mixing, placing, compacting and finishing of construction works and shall continuously monitor the quality of all materials incorporated into the works. As part of the quality and process control, the Contractor shall undertake a program of inspection, testing and supervision with the aim of ensuring that all the materials incorporated in the works conform with the requirements of this specification and the requirements of the Local Authority.

All tests specified herein or required by the Local Authority shall be undertaken by a laboratory, certified by the National Australian Testing Authority (NATA), and results produced within 7 days of the test sample.

Copies of all test results shall be supplied to the Superintendent within 48 hours of receiving the test results unless otherwise required / noted in this specification. All test results shall include at least all the information listed in the following conformity tables (which have been set-up to enable results to be readily recorded for each test sample).

5.4 Base and Sub-Base Courses

5.4.1 Materials

Laterite Gravel - shall consist of durable laterite pebble quarried from sources approved by the Superintendent, containing no organic matter or other deleterious material, and shall conform to the following requirements:

Table 6 Laterite gravel pavement – conformity table

Particle Size Distribution: (Grading for portion passing a 37.5mm AS sieve)			
	AS Sieve Size (mm)	Required Percentage (%) Passing by mass	Actual Result
1.1	37.500	100	
1.2	19.000	71 - 100	
1.3	9.500	50 - 81	
1.4	4.750	36 - 66	
1.5	2.360	25 - 53	
1.6	1.180	18 - 43	
1.7	0.425	11 - 32	
1.8	0.075	4 - 19	
2.	Portion of the total sample retained on the 37.5mm sieve shall not exceed 10%		
3.	Ratio of portion passing 0.075mm sieve to the portion passing 0.425mm sieve to be in the range of 40-60%		

Particle Size Distribution: (Grading for portion passing a 37.5mm AS sieve)			
4.	Material Constraints: (For portion of sample passing the 0.425mm sieve)		
	Material attribute	Required Measurement	Actual Result
4.1	Liquid Limit	not greater than 25%	
4.2	Plasticity Index	not greater than 6	
4.3	Linear Shrinkage	not greater than 3%	
4.4	Maximum Dry Compressive Strength	not less than 2 MPa	
4.5	California Bearing Ratio (soaked)	Basecourse not less than 80 % when compacted to 98 % MMDD at OMC Subbase not less than 40 % when compacted to 95 % MMDD at OMC	

** Location of where “tested material” was placed must be indicated on a locality plan

Crushed Limestone Rubble - shall be obtained from an approved source, and shall be free from sand, organic and other deleterious material and conform to the following table:

Table 7 Crushed Limestone – Conformity Table

1. Particle Size Distribution: (Grading for portion passing a 75mm AS sieve)			
	AS Sieve Size (mm)	Required Percentage (%) Passing by mass	Actual Result
1.1	75.00	100	
1.2	19.00	55 - 85	
1.3	2.360 & less	35 - 65	
2.	% of wear of crushed limestone not to be less than 30% or exceed 55% (calculated by the Los Angeles test)		
3.	Calcium Carbonate Content (CaCO ₃) shall not be less than 60% or greater than 80%.		
4	California Bearing Ratio (soaked) Subbase not less than 40 % when compacted to 96 % MMDD at OMC		
5.	Maximum Dry Compressive Strength (MDCS) shall be no less that 700 kPa.		

** Location of where “tested material” was placed must be indicated on a locality plan

5.4.2 Sampling and testing sub-base and base course material

At the commencement of production or supply of sub-base and base course material, the Contractor shall take two representative bulk-samples from the first 500t of each material. During placement, the Contractor shall take at least one representative bulk-sample of the material from each successive 1000t of material from each source to be used at the site of the works.

All test results shall be submitted to the Superintendent for approval and shall include at least the information listed in the conformity tables in the preceding paragraphs for the sub-base and base course material.

5.4.3 Construction

Delivery and spreading

Pavement material shall not be placed on the sub-grade or previous layers of pavement until the Local Authority (L.A.) inspector or Superintendent has given their approval. Material shall not be placed over a layer weakened by moisture.

Crushed materials, when delivered, shall have moisture content with $\pm 2\%$ of the modified optimum moisture content.

Spread material in uniform layers as near as practicable to the required thickness by direct tipping from suitable vehicles. Care shall be taken to avoid segregation of material during tipping and spreading. The tipping of material in heaps and spreading by grader is to be avoided. If material becomes segregated it shall be remixed.

Compaction and finishing

Layers of pavement material shall be not less than 100mm in compacted thickness. Maximum layer thickness shall be limited to that which will allow compaction to specified densities by the equipment in use. Where a course of a particular material is composed of several layers they shall be of equal thickness within these limits.

Rollers of variable mass shall be ballasted to the greatest mass which can be supported without distress to the pavement or sub-grade. Tyre pressures of pneumatic tyred rollers shall be adjusted to at least 700 kPa.

During compaction, maintain moisture content of pavement materials in the range specified above. Water spraying equipment used for this purpose shall be capable of uniformly distributing water in controlled quantities over uniform lane widths.

Surfaces to be primed shall be constructed slightly higher than the specified levels and cut to profile towards the end of the compaction process. Rolling shall then continue to specified density and to produce a tight, even surface without loose stones or a slurry of fines.

The finished base course shall be in a uniformly bound condition with no evidence of layering, cracking or disintegrating. The finished surface shall be of even texture, tightly bound, free from loose, dusty, stony or slurred areas and suitable to receive a bituminous surfacing.

Matching to Existing Pavements.

Where the pavement is to be joined to an existing pavement, remove a strip of the existing pavement at least 300mm wide for its full depth and trim the edge to an angle of approximately 45 degrees in steps of maximum height 150mm before placing new pavement material. If the existing pavement is sealed, saw cut the seal, to a neat edge.

5.4.4 Testing dry density and layer thickness

Upon completion of the compaction process of each and any layer, the Contractor shall determine the in-situ moisture content, dry density and layer thickness of the compacted material throughout the full thickness of the layer at random locations in every 1500m² of surface area. The rate of testing shall be not less than one for each 1500m² of surface area, with a minimum of three tests where the area of each section is less than 2000m² and a minimum of four tests where the area of the section is greater than 2000m².

When used, nuclear density meter shall be calibrated in accordance with the MRWA Test Method.

5.4.5 Acceptance

Compaction requirements

Sub-base shall be compacted to 95% of modified maximum dry density.

Base course shall be compacted to 98% of modified maximum dry density.

Tolerances

On completion of placement, compaction and trimming, pavement courses shall comply with the tolerances specified in the table below, except that surface shape shall be such that water cannot accumulate at any point:

Table 8 Tolerances

Component	Tolerances in mm	
Sub-grade	Thickness	Level
	-	+ 0 - 20
Base Course	+ 10	+ 10
	- 0	- 0
Asphalt	+ 5	+ 10
	- 0	- 0

Sampling and testing

(a) Procedures

Sampling shall be carried out in locations selected by a qualified independent materials tester or as directed by the Superintendent.

(b) Materials

The properties required are applicable to the materials in their final condition in the pavement.

(c) Costs for testing

The Contractor shall allow for and include the costs of all testing.

5.5 Primer sealing

5.5.1 Authority to commence priming

Primer sealing shall not be undertaken until the Superintendent or the Superintendent's representative has inspected the pavement and approved the works to proceed.

5.5.2 Plant

Spraying equipment

All spraying equipment shall comply with the requirements of the MRWA "Specification 503 Bituminous Surfacing".

When requested by the Superintendent, the contractor shall provide a current certificate and calibration chart issued by the Main Roads Department before commencing spraying operations.

Rollers

The following rollers may be used:

- (a) Three point self-propelled steel roller of minimum 8 tonnes mass;
- (b) Self-propelled rubber tyred roller minimum 15 tonnes mass,

Trucks

Sufficient numbers of single or tandem-axle trucks with tipper bodies should be made available. The trucks should be fitted with approved tailgate mounted metal spreaders. In addition, at least one truck with drop-sided or tray body for the manual application of aggregate should be provided (as required).

Brooms

A mechanical broom capable of removing all dust and debris from the surface of the road (prior to spraying), and a drag-broom, capable of evenly spreading aggregate but not so as to dislodge stones from the mat, should also be provided.

5.5.3 Application

The prepared base course shall be sufficiently dry with no primer sealing to be carried out during inclement weather conditions unless special provisions made to the approval of the Superintendent.

Before primer sealing, the pavement shall be broomed free of all loose material and dust, and any defects made good. Should conditions require, and if approved by the Superintendent, the surface may be lightly watered immediately prior to primer sealing. The primer seal shall be applied to the approved surface course for its full width.

For tendering purposes the primer seal shall be a cutback primer consisting of 90% residual bitumen and 10% power kerosene at a rate of 1.2 l/m², measured at a temperature of 15°C and applied at a temperature of between 80 and 100°C. The actual application rate shall be determined on site by an experienced and competent operator.

The bitumen shall be modified with 0.40% wet fix or similar approved during wet weather application.

Should weather conditions preclude the use of cutback primer, the Superintendent may approve a 60/40 cationic bitumen emulsion applied at a rate of 1.20 litres per square metre, measured at a temperature of 15°C. Emulsion primer may be heated to a maximum temperature of 50°C if conditions warrant.

5.5.4 Blinding

Unless otherwise approved, the blinding shall be a nominal 7mm aggregate applied immediately after spraying at a rate not less than 1 cubic metre per 150 square metres and sufficient to prevent lifting of the primed surface by vehicles. For the road widening sections the blinding shall be 10mm aggregate applied at 1 cubic metre per 100 square metres.

For emulsion primer the blinding shall be a normal 3-5mm aggregate applied immediately after spraying at a rate not less than 1 cubic metre per 150 square metres and sufficient to prevent lifting of the primed surface by vehicles.

Aggregate shall be crushed from hard, sound, durable rock. The percentage loss as measured by the Los Angeles Abrasion Test shall not exceed 30. All aggregates shall be free of excess dust, and the Superintendent may order the pre-washing of dusty aggregate.

The surface is to be rolled until the aggregate is firmly embedded in the primer.

The surplus aggregate shall be swept up and removed from site not less than seven days after the completion of the rolling or as approved by the Superintendent.

5.5.5 Acceptance tolerances

The width of the prime shall not vary by more than +150mm - 0mm.

Acceptance of sealed surfaces will be subject to the availability of certified records of the works carried out. Actual rate of application of binder shall be in the range of 95% to 110% of the ordered rate. If the application rate is less than 90% or more than 110% the surface shall be resealed (unless otherwise directed).

5.6 Specification for Asphalt

5.6.1 Scope

This section covers the manufacture, delivery, laying and testing of dense graded asphalt for road pavements.

5.6.2 Nominal Size

The nominal size of the asphalt shall conform to the following:

Table 9 Nominal size

Item	Description	Nominal Size
1	Local Road (pavement width less than 10m) - AC7, 7mm nominal size with compacted thickness of 30mm	(+ 5mm) (- 0mm)
2	Local Road (low volumes of light vehicles traffic) - 'Gap Graded' 7mm nominal size with compacted thickness of 30mm	(+ 5mm) (- 0mm)

5.6.3 Materials

Asphalt shall be a mix of clean, dry graded, coarse and fine aggregates, mineral filler and bitumen in accordance with the current relevant Australian Standard(s) and conforming to the following requirements:

1. The binder shall be residual asphaltic Class 170 bitumen.
2. All aggregate, with the exception of naturally occurring sands, shall be the product of crushing sound stone quarried from approved deposits.
3. The aggregate shall be free from all clay overburden, soft or weathered material, and other foreign matter.
4. The coarse aggregate shall consist of a combination of separate sizes produced from sound crushed and screened stone which shall be uniform in quality throughout. It shall be clean and free from particles which are soft, friable, composed of clay or weathered rock. Its wearing qualities shall be determined by the Los Angeles Abrasion Test and the percentage loss permitted shall not exceed 30. The shape of each size of material to be combined in the coarse aggregate shall be determined by the Flakiness Index which shall not exceed 35. The size distribution within the separate aggregates shall not be such as to cause undue segregation. The grading shall comply with the current relevant Australian Standard and as shown in the following table. Other job mixtures may be proposed, such that the separate sizes of the aggregates will combine with fine aggregates and mineral fillers to form a satisfactory pavement surface.

Table 10 Aggregate Grading

AS Sieve Size	AC5 Nom Size 5mm	AC7 Nom Size 7mm	AC10 Nom Size 10mm	Gap Graded Asphalt
19mm				
13.2mm			100	
9.5mm		100	90-100	100
6.7mm	100	80-100	70-90	93-100
4.75mm	85-100	70-90	58-76	75-85
2.36mm	55-75	45-60	40-58	57-67
1.18mm	38-75	35-50	27-44	44-64
0.60mm	26-43	22-35	17-35	35-45
0.30mm	15-28	14-25	11-24	18-24
0.15mm	8-18	8-16	7-16	6-12
0.075mm	4-11	5-8	4-7	

5. The fine aggregate shall comprise of a mixture of one or more natural sands and crusher sand. The natural sands shall consist of clean, tough, rough surfaced grains, free from clay, loam, mica, lumps or other foreign matter. Crusher sand shall consist of a uniformly graded product from the crushing of clean sound stone.

6. Mineral filler shall consist of a finely divided mineral material of a type and from a source approved by the Superintendent. It shall be thoroughly dry and free from lumps of any kind.

If filler is required to be added to the mixture in order to make it comply with the specified limits of the paving mixture, it shall consist of Portland cement, ground limestone, stone dust or other approved material. The aggregate for the wearing course shall be subjected to the Sand Equivalent Test by the method specified in A.A.S.H.O. T176 - 56.

If in order to comply with the grading limits of the paving mixture filler other than stone dust has been added, the sand equivalent test shall be carried out on that portion of the aggregate passing a 4.75mm A.S. sieve, excluding such added filler. If the combined aggregate mixture contains the specified amount of material passing a 0.075mm sieve without the addition of Portland Cement, ground limestone or other similar material, or if stone dust has been added to the mixture in order to comply with the specified requirements, the sand equivalent test shall be carried out on the whole of the portion of the combined aggregate passing a 4.75mm sieve. The requirement for the sand equivalent test shall be not less than 50.

The mix should contain 1.5% of total mix by mass of hydrated lime. Hydrated lime shall comply with the requirements of the current relevant Australian Standard. If the case where hydrated lime is difficult to source, an approved adhesion agent can be selected from Table 511.16 within the Specification 511 "Materials For Bituminous Treatments".

7. The paving mixture for the surface course &/or the binder course shall be submitted to the Superintendent for approval at least 7 days before laying.
8. The Superintendent shall have the right, without extra cost, to increase the filler in the job mixture by 1% of the total mix by weight, when necessary to correct the workability of any batch or batches.

The exact amount of bitumen shall be determined for the job mixture with due regard to the nature of the aggregates to be used.

The percentage of bitumen binder to total mix by mass shall meet the following requirements:

Table 11 Percentage of bitumen binder

Nominal Size mm	Percentage of Bitumen to Total Mix (By Weight)
5	5 to 7
7	5 to 7
10	4.5 to 6.5
7 (Gap Graded)	7.95 to 8.5

The mix when compacted in the laboratory in accordance with the Marshall Test using 50 blows of the hammer on each end of the cylinder, shall meet the requirements as stated in the current relevant Australian Standard. For nominal mix size of 14, mix shall be compacted to 75 blows under the Marshall Test.

Table 12 Marshall testing

Nominal Mix Size (mm)	Minimal Marshall Stability of Compacted Mix (kN)	Marshall Flow Value (mm)
5	5.0	2 to 4
7	5.5	2 to 4
10	6.6	2 to 4
7 (Gap Graded)	5.0	2 to 5

The air voids in the total mix when compacted shall be as follows:

Table 13 Air voids within total mix

Nominal Mix Size (mm)	Range of Voids Content (%)
5	3 to 7
7	3 to 7
10	3 to 7
7 (Gap Graded)	2 to 4

At no stage shall the temperatures of the bitumen in the mixture exceed 165°C and the plant shall be such that the temperature of the mixture may be controlled to within (+) or (-) 5°C.

The temperature of the mixture as delivered to the point of spreading shall be not less than 150°C.

The delivery of asphalt shall be in accordance with the current relevant Australian Standard. The material shall be delivered to the point of spreading in tipping trucks have steel lined bodies and tarpaulins covering the loads.

5.6.4 Sampling and testing asphalt materials

During the course of production and supply of asphalt, the Contractor shall carry out sufficient sampling and testing to satisfy himself that:

- The material ingredients satisfy the requirements of this Specification.
- The material supplied is in accordance with the mixture design as submitted to, and approved by, the Superintendent.

Additionally, the Contractor shall carry out the following sampling and testing and submit the results to the Superintendent for approval.

At commencement of production or supply of an asphalt mixture design, the Contractor shall take two representative bulk samples from the first 50 tonnes of material delivered to site. As delivery proceeds, the Contractor shall take at least one representative bulk sample from each successive 100 tonnes of material.

The bulk sample shall be taken in accordance with the requirements of the current relevant Australian Standard, or alternatively Main Roads Department Test Methods.

For the material in each bulk sample, the Contractor shall determine the following properties:

- aggregate particle size distribution
- bulk density
- bitumen content
- Marshall stability, flow and air voids

The above properties shall be determined by current relevant Main Roads Department Test Methods or the current relevant Australian Standards.

The results of these tests shall be submitted to the Superintendent within 10 days of date of collection of the samples.

5.6.5 Construction plant

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 used for spraying bitumen emulsion shall be capable of operating at a continuous pressure of 175kPa.

Pavers shall be self-propelled and they 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. They shall be capable of spreading the asphalt without segregation.

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 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 tonne 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 with a mass of 10t to 20t ballasted 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 wheel paths and complete coverage for the effective width of the roller. The tyres shall be capable of being inflated to 700 kPa. The total operating mass and tyre pressures shall be varied as directed by the Superintendent.
- All rollers shall have approved brushes or similar devices so that each roll or 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.

5.6.6 Preparation of surface

The existing primed or primer-sealed surface shall be inspected in the attendance of the Superintendent to assess the required correction of any defects (such as filling of potholes and depressions, removal of excess binder, repair of edge breaks or irregularities etc).

The area to be surfaced shall be thoroughly swept with a power broom of all loose or 'foreign' material immediately prior to the application of the tack coat.

5.6.7 Tack coat

Tack coat shall be in accordance with MRWA Specification 503 and consist of CRS/60-170 diluted with water at a 50:50 ratio.

Tack coat shall be applied by a sprayer through jets in the spray bar at an application rate of 0.6 litres per square metre.

The tack coat shall cover the pavement with an even thin coat of bitumen to form a key to receive the asphalt.

5.6.8 Corrector course

When directed by the Superintendent, prior to surfacing those areas in which there are departures of more than 20mm from a 3m straight edge, a separate regulating course shall be placed for correction of both longitudinal and transverse pavement shape.

Unless directed otherwise, the maximum compacted thickness of any one layer of the corrector course shall not exceed five times the size of the asphalt used.

5.6.9 Spreading

Asphalt shall be spread with to the compacted thicknesses as shown on the drawings. The asphalt shall be laid on a foundation which is dry and free from puddles.

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

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

The asphalt shall be spread to such line, level and camber shown on the contract drawings.

Base corrector courses shall be completed to a surface parallel to the finished surface of the pavement and at a depth below it equal to the thickness of the subsequent 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 the Superintendent is satisfied that 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.

Asphalt shall be spread in such a manner as to minimise the number of joints in a carriageway, and unless otherwise specified, 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.

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.

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.

When hand laying of asphalt 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.

5.6.10 Thickness control

The Contractor shall carry out measurements to determine the thickness reduction achieved in the compaction of the asphalt courses. The appropriate allowance for compaction shall be incorporated in the spread depth of asphalt and if necessary adjusted as required to achieve the required compaction thickness within the specified tolerances.

The Contractor shall frequently measure the actual thickness of the spread material prior to compaction and shall compare this thickness with the thickness to be placed at that location. The thickness check shall be carried out for nominal thickness and variable thickness construction at intervals not exceeding 10 metres and the screed adjusted accordingly to give the desired thickness.

5.6.11 Joints and junctions

The number and extent of joints in asphalt layers should be kept to a minimum and the paving pattern should be designed accordingly in advance of the work.

All longitudinal and transverse joints shall be carefully made in such a manner as to be waterproof and the finished surfaces at all points shall have the same texture, density and smoothness as elsewhere.

Hot longitudinal joints are preferred.

When constructing hot longitudinal joints, a 150mm wide strip along the outer edge of each lane shall not be rolled until after the adjoining lane has been spread.

The longitudinal joint shall then be made by rolling this 150mm wide strip simultaneously with the adjoining material of the next lane after it has been spread. When no adjoining strip is to be placed during the same day, the last lane shall be rolled evenly across its full width. The roller shall not be allowed to overhang the free edge by more than 50mm.

With cold joints, the edge of the first run shall be formed while hot, by butting using hand lutes, or should be trimmed to a straight edge. Edges shall be lightly tack coated to aid the bending of the runs. The adjoining run is to

be placed against the prepared edge with an overlap of between 25 to 50mm. The overlap is to be pushed back, using lutes, immediately following placing form a slight ridge along the joint which is then compressed against the edge of the previously placed run by the breakdown roller.

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 cold edge need not be trimmed to a vertical face, but any loose material along the edge shall be discarded. The edge shall be painted with a bituminous emulsion before placing adjoining asphalt.

All longitudinal joints shall be continuous and parallel to the centre line of the carriageway.

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. The edge shall then be painted with bituminous emulsion before placing adjoining asphalt.

Where asphalt is required to match an existing surface, road, bridge deck, fixed rail, or other fixture, the Contractor shall place the asphalt in such a manner as to provide a smooth riding surface across the junction.

5.6.12 Compaction procedures

After spreading, the asphalt shall be thoroughly and uniformly compacted as soon as it will support the roller without undue displacement.

Initial, secondary and final rolling shall be done in accordance with the current relevant Australian Standard.

Initial rolling shall be performed with a steel wheeled tandem roller operating as close as possible to the paver. Steel rollers either vibrating or non-vibrating shall be used. Initial rolling shall be completed before the mix temperature falls below 105°C.

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 roller of gross mass not exceeding 12 tonne. Secondary rolling shall be completed before the mix temperature falls below 80°C.

Finally, before the mix temperature falls below 60°C, roll with two (2) passes of a self-propelled steel wheeled roller at 6-8 tonnes range to produce a smooth dense surface.

Compaction shall generally commence at the kerbside and work towards the centre of the roadway.

The speed of rollers shall not exceed 5km/h for steel wheeled rollers or 25km/h for self-propelled pneumatic tyred or vibrating rollers, and at all times shall be slow enough to avoid displacement of the asphalt.

Around access chambers and similar structures, and at all places not accessible to the roller, thorough compaction shall be obtained by means of approved tampers.

Each layer shall be compacted to a density not less than 94% of the Marshall density.

5.6.13 Testing density and layer thickness

The Contractor, as directed by the Superintendent, shall cut a minimum of one core per 1,000 square metres (minimum of four per mix type) after the asphalt has cooled throughout to ambient temperature. The cores shall be tested to determine the density ratio of the compacted material by an independent NATA registered laboratory.

Average thickness of the course will be determined on the basis of thickness measurements of the core obtained.

Measurement of individual cores will be made after cleaning of any adhering material from the bottom of the core and will be the average of four measurements of thickness made at approximately 90 degrees apart.

Measurements will be made to the nearest 1mm and the average of the four measurements expressed to the near 1mm.

All density holes shall be repaired by the Contractor.

5.6.14 Acceptance

Compaction Requirements

Each layer shall be compacted to a density not less than 94% of the Marshall density.

Tolerances on Level, Thickness and Shape of Finished Construction

Any course after final compaction shall be finished in conformity with the lines, grades, thicknesses, and cross-sections shown on the drawings within the following limits.

1. Level

The top of the course shall not differ from the specified level by more than 10mm.

2. Shape

No point on the finished surface of the wearing course shall differ more than 3mm either from a 3m straight edge laid parallel to the centreline of the pavement or at right angles to the centreline, except on crown sections. Surface shape shall be such that water cannot pond at any point.

3. Thickness

The compacted thickness of asphalt shall not be less than 25mm (+5mm - 0mm).

Defective Work

The Superintendent will inform the Contractor in writing of the areas of pavement which contain defective asphalt.

Areas of asphalt assessed as defective with respect to the requirements specified herein for mix quality, density, surface finish, surface smoothness, or thickness, shall be corrected by the Contractor.

Any asphalt mix that has become damaged or contaminated with foreign material shall be removed and replaced as specified herein as directed.

Skin patching of an area that has been rolled will not be permitted.

Defective areas shall be removed and replaced with fresh materials. Patches shall be prepared by cutting and removing the defective asphalt to the full depth of the course such that the sides of the area are at right angles or parallel to the direction of traffic and the edges are vertical. The internal edges and surfaces of the area to be patched shall be cleaned of all cutting residue by flushing with water and all free water removed. The surfaces shall be tack coated with bituminous emulsion prior to placing of fresh material which shall be spread, compacted and finished in accordance with the specification at the Contractor's expense.

Patches shall be prepared by cutting and removing the defective asphalt to the full depth of the course such that the sides of the area are at right angles or parallel to the direction of traffic and the edges are vertical. The internal edges and surfaces of the area to be patched shall be cleaned of all cutting residue by flushing with water and all free water removed. The surfaces shall be tack coated with bituminous emulsion prior to placing of fresh material which shall be spread, compacted and finished in accordance with the specification at the Contractor's expense.

5.7 Pavement Markings

All pavement markings shall have retro reflective properties in accordance with the current relevant Australian Standard and shall be installed in accordance with Main Roads standards and requirements.

Contractor is to maintain the site in a safe condition for all road users by the use of temporary signing and pavement markings, until permanent signs and pavement markings are installed.

The Contractor is to arrange for the removal of all existing redundant signs and pavement markings. Redundant signs to be taken to the Council depot.

5.8 Concrete Footpaths

5.8.1 General

Unless otherwise shown on the approved drawings, the road verge shall be constructed to the approved cross-section of 2% positive grade from the top of the kerb.

5.8.2 Approvals

All service authorities (including Western Power, Alinta Gas, Water Corporation WA, Telstra, Dept of Land Administration etc.) are to be advised and to give written approval for construction of the path. No work is to commence until all approvals are received and copies provided to the Superintendent.

5.8.3 Layout

Footpaths and dual use paths within the road reserve to be constructed to the dimensions as shown on the drawings. The footpath shall generally extend from 1.8m to 3m from the kerb and be parallel to the kerb. Any deviation from this alignment requires the approval of the Superintendent.

At corners the footpath shall follow the general alignment, but may be formed in segments of up to 4 metres in length. The edges shall be parallel and the width maintained. A crossing connection shall be provided from the footpath to the edge of the road to allow crossing to each side of the intersection at corners and to roads intersecting with the road containing the footpath. The crossing connection shall be at the tangent point where the kerb starts to curve at the corners.

Where shown on the drawings provide standard kerb ramps.

Provide standard barrier rails at each end of Public access ways or at other locations as shown on the drawings in accordance with this specification.

5.8.4 Sub-grade

The sub-grade material is to be compacted to not less than 95% of maximum dry density as determined by the modified compaction test to a depth of at least 500mm. Special attention should be given to service authority trenches. This shall be certified by a practising Civil Engineer and shall be submitted prior to the concrete pour. The Superintendent shall be given 24 hours' notice of concrete pours.

5.8.5 Construction

The path shall be constructed from concrete with at least a 28 day cylinder compressive strength of 20MPa. 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.

5.8.6 Surface finish

Surface finish to be brushed with smooth edge to all outside edges and joints. All work to be of high quality, uniform appearance and executed in a tradesman-like manner.

5.8.7 Joints

Groove crack control joints to be at 1.25m centres for footpaths and 2.5m for footways and cycleways with a 12mm wide expansion joint at 5m centres (every fourth joint for footpaths and second joint for footways and cycleways). Expansion joints to be filled to full depth with 10mm thick bitumen impregnated canite-type material of approved type. An expansion joint shall be installed where the pathway butts to service access chambers and existing crossovers.

5.8.8 Joint filler

Approved canite-type material shall be such that when it is subjected to compression in hot weather, no bitumen is extruded. The following materials are approved.

Dimet - Jointex (58 – 62°C softening point bitumen)

Nonporite - bitumen impregnated canite by the cold solvent process.

Expandite - Flexcell.

5.8.9 Tolerances

Works shall be undertaken in the following tolerances:

- Vertical location of footpath in relation to 2% grade line from top of kerb \pm 10mm.
- Grade access footpath shall be 2% \pm 0.5%.
- Path surface shall be true to line and not deviate more than 10mm under a 3m straight edge.
- Surface irregularities, including abutting to service authority access chambers, etc shall not exceed 2mm.
- Spacing of expansion joints shall average 5m over any 30m section. Individual spacing shall be 5m \pm 10mm.
- Thickness of footpath 100mm (-0mm + 10mm).
- A random testing programme will be used to check thickness and if any point is outside the tolerance, further testing shall be undertaken within that 5m section of the adjoining 2 sections on each side. Three of more additional thickness tests will be taken on each of the sections. If any of these show a reading that is outside the required tolerance, that section of footpath shall be removed and replaced with new work to this Specification.
- Width of footpath - 0mm + 20mm.

5.8.10 Acceptance

Any sections of footpath not meeting the requirements of this Specification or that in the opinion of the Superintendent is of inferior quality, shall be removed from the site and replaced to the satisfaction of the Superintendent, all at the Contractor's expense.

5.9 Test Certificates

5.9.1 Sub-grade

A marked up plan shall be provided detailing areas and extent of areas of unsuitable material removed.

A marked up road plan showing finished level, alignment and width at minimum 20m intervals.

A compaction certificate from a NATA registered laboratory detailing compaction results undertaken at a minimum of 1 test per 20m of road or as otherwise specified.

5.9.2 Sub-base and base course

A marked up road plan shall be provided showing finished level depth of layer, alignment and width at a minimum of 20m intervals.

A compaction certificate detailing compaction results undertaken at a minimum of 1 test per 50m of road or as specified.

A NATA test certificate of materials tests results taken at a minimum of 1 test per 100m of road length or part thereof, with a minimum of 4 tests.

5.9.3 Sprayed Primes and Seals

A Suppliers certificate detailing material supplied and quality. A certificate for each coat per run is required.

A bitumen spray record detailing actual bitumen application rate, temperature and area sprayed for each run.

An application record of cover application rate for metal for each run.

5.9.4 Asphalt seal

A Suppliers certificate detailing mix supplied, at a rate of 1 per day. Delivery dockets detailing actual quantity supplied each load.

A certification by the Contractor that the rolling procedure required has been performed.

A marked up road plan detailing at minimum 20m intervals, the depth of layer and finished levels.

A certification by the Contractor for each road that no ponding occurs. A certification by the Contractor that the final surface shape is satisfactory.

6. Hydraulics Sewer and water general

6.1 General

6.1.1 Responsibilities

Requirement: Provide the hydraulic services, as documented.

Summary: The hydraulic services are summarised as follows:

- Authority water meter upgrade
- Potable cold water service including containment and individual backflow prevention.
- Non potable cold water including individual backflow prevention
- Sewer reticulation including dump points
- Fire Extinguishers
- Connection to transportable building including onsite coordination
- Demolition of existing septic system in accordance with local government and department of health requirements.

6.1.2 Standards

6.1.2.1.1 General

Sanitary plumbing and drainage: To AS/NZS 3500.2 (2021).

Water supply: To AS/NZS 3500.1 (2021).

6.1.3 Interpretation

6.1.3.1 Certification

Plant and equipment - proposed: Submit certification that the plant and equipment proposed meet the requirements and capacities documented. If proposed plant and equipment departs from performance or other requirements documented, submit technical details for review.

Plant and equipment - installed: Submit certification that each plant and equipment installation is operating correctly.

6.1.3.2 Products and materials

Equipment: Before ordering equipment, calculate the respective system pressure losses based on the equipment offered and layouts shown on the shop drawings using software verified as accurate for the calculations performed and submit the proposed selections.

Data: Submit technical data for all items of plant and equipment, including the following:

- Assumptions.
- Calculations.
- Model name, designation and number.
- Capacity of all system elements.
- Country of origin and manufacture.
- Materials used in the construction.
- Size, including required clearances for installation.
- Certification of conformance to the applicable code or standard.

- Technical data schedules corresponding to the equipment schedules in the contract documents. If there is a discrepancy between the two, substantiate the change.
- Manufacturers' technical literature.
- Type test reports.

6.1.3.3 Shop drawings

Requirement: Submit detail drawings at minimum 1:100 scale, showing the following:

Pipework and equipment layout and sections showing the work to be installed on the level that the services are installed.

- Long sections of below ground drainage.
- Piping and other schematic drawings including numbering of each valve to correspond to valve tags notation.
- Access openings, cover plates, valve boxes and access pits.
- Location, type, grade and finish of piping, fittings, valves, meters and pipe supports.
- Provision of trafficable cover plates in the public domain.
- Relevant survey levels.
- Site and floor set out points.

6.1.4 Inspection

6.1.4.1 Notice

Inspection: Give notice so that inspection may be made of the following:

- Excavated surfaces.
- Concealed or underground services.
- Excavation.
- Shoring.
- Installed pipe.
- Backfill.
- Testing.
- Authorities approvals.

6.1.4.2 Hold points

Prior to backfill of all below ground services until all inspection, testing and surveyed levels are completed and passed.

6.2 Products

6.2.1 Authorised products

Requirement: Listed in the WaterMark Product Database, unless otherwise required by the Network Utility Operator.

6.2.1.1 Lead content

Copper alloy plumbing products in contact with drinking water: Weighted average lead content $\leq 0.25\%$.

6.2.1.2 Water efficiency

Requirement: Provide products with documented water efficiency but not less than that in the PCA (2022).

6.2.1.3 Labelling

Water efficiency labelling: Provide products conforming to and labelled to the Water Efficiency Labelling Scheme (WELS).

6.2.1.4 Bushfire-prone areas

Site with Bushfire Attack Level (BAL) 12.5, 19, 29, 40 or FZ to AS 3959 (2018): If external and above ground, provide metal pipes and fittings to AS 3959 (2018).

6.3 Execution

6.3.1 Work on existing systems

6.3.1.1 Demolition

General: Decommission, isolate, demolish and remove from the site all existing redundant equipment and reticulation including minor associated components that become redundant as a result of the demolition.

Breaking down: Disassemble or cut up equipment where necessary to allow removal.

Recovered materials: Recover all components associated with the listed items. Minimise damage during removal and deliver to the locations documented.

6.3.1.2 Existing systems

Condition of existing systems:

- If the existing condition does not conform to the documented requirements in the contract documents, submit proposals to rectify the deficiencies with related costing, time and other impacts.
- Subject to the rectification works on existing systems, achieve the performance in the contract documents.

6.3.2 Installation

6.3.2.1 Accessories

General: Provide the accessories and fittings necessary for the proper functioning of the systems, including taps, valves, outlets, pressure and temperature control devices, strainers, gauges and pumps.

Isolating valves: In addition to valves required to meet statutory requirements, provide valves to allow safe isolation of parts of the system, with minimum inconvenience to the building occupants, in event of leaks or maintenance.

6.3.2.2 Connections to mains

General: Excavate to locate and expose the connection points and connect to the Network Utility Operator mains. On completion, backfill and compact the excavation and reinstate surfaces and elements that have been disturbed, such as roads, pavements, kerbs, footpaths and nature strips.

- Connections: Connect to Network Utility Operator mains.
- Metering: Provide metering, valves and fittings to Network Utility Operator requirements.

6.3.2.3 Movement compensation

Compensation: Arrange piping so that moment in the joint does not cause damage.

6.3.3 Commissioning

6.3.3.1 General

Requirement: Provide commissioning as documented. Conform to SA TS 5342 (2021).

- Off-site testing by an Accredited Testing Laboratory.
- Testing equipment and calibration.
- Commissioning planning, program, procedures and methodology.
- Integrated system tests.
- Training.
- Operation and maintenance manuals.

6.3.4 Maintenance

Table 14 Maintenance Requirements Schedule

Provision	Requirement
Maintenance period	12 months
Maximum call out response time	3 hours
Maximum time between programmed service visits	3 months
Frequency of periodic maintenance and performance reports	Annually

7. Water Reticulation

7.1 General

7.1.1 Responsibilities

Requirement: Provide cold water and heated water systems, as documented on drawings:

Drawing number	Drawing Title
12596020-GHD-01-02-DRG-HY-00100	WATER RETICULATION PLAN
12596020-GHD-01-02-DRG-HY-00200	WASTEWATER RETICULATION PLAN
12596020-GHD-01-02-DRG-HY-00300	SECTIONS AND DETAILS WASTEWATER

7.1.2 Standards

7.1.2.1 General

Water supply: To AS/NZS 3500.1 (2021).

Backflow prevention: To AS/NZS 2845.1 (2022) and AS 2845.2 (2010).

Copper pipe: To AS 1432 (2004) and AS 4809 (2017).

Microbial control: To AS/NZS 3666.1 (2011) and AS/NZS 3666.2 (2011) and the recommendations of SA/SNZ HB 32 (1995).

7.1.3 Submissions

7.1.3.1 Operation and maintenance manuals

Requirement: Submit **Operation and maintenance manuals** for review and approval

7.1.3.2 Samples

General: Submit samples of accessories identified by proprietary item, including the following:

Valves.

- Hose taps
- Backflow prevention devices
- Sullage dump points
- Piping

7.1.3.3 Tests

Pre-completion tests: Submit results from pre-completion leak testing.

Certification: Submit certificate stating that network is leak free upon completion.

7.1.4 Inspection

7.1.4.1 Notice

Inspection: Give notice so that inspection may be made of the following:

Excavated surfaces.

Concealed or underground services prior to being covered.

7.2 Products

7.2.1 General

7.2.2 Components

7.2.2.1 Backflow prevention devices

Standard: To AS/NZS 2845.1 (2022) and AS 2845.2 (2010).

Pressure drop: Select for lowest pressure drop compatible with the required functions.

7.2.2.2 Line strainers

Type: Low resistance, Y-form bronze bodied type, with screen of dezincification resistant brass, corrosion-resistant stainless steel, or monel.

Screen perforations: 0.8 mm maximum.

7.2.2.3 Water meters

Standard: To AS 3565.4 (2007).

Installation: To the requirements of the Network Utility Operator.

7.3 Execution

7.3.1 Piping

7.3.1.1 Mains connection

Requirement: Connect the cold water supply system to the Network Utility Operator's main through a stop valve and meter, as documented.

Cold water system: Provide the cold water supply system, installed from the meter to the draw-off points or connections to other services as documented. Including high hazard backflow prevention device downstream of authorities meter.

7.3.1.2 Finishes

Exposed piping: Finish exposed piping, including fittings and supports, as follows:

Externally and steel piping and iron fittings: Paint.

Valves: Finish valves to match connected piping.

7.3.1.3 Fittings and accessories

General: Provide the fittings required for the proper functioning of the water supply system, including taps, valves, backflow prevention devices, pressure control devices, strainers, gauges and automatic controls.

Provision for dismantling: Provide unions or similar so that valves, taps and other maintainable components can be removed for maintenance without disturbing or cutting adjacent piping.

7.3.1.4 Material identification marks

Pipes with grade or class identification markings: Install so that the markings are visible for inspection.

7.3.1.5 Pipes under pressure embedded in concrete

Prohibition: Do not embed or cast water service pipes into concrete structures.

7.3.1.6 Valve spindles

General: If practicable, install valve spindles in a vertical position.

7.3.1.7 Protection from sunlight

Protection: Protect plastic pipes and fittings exposed to sunlight to AS/NZS 3500.1 (2021).

7.3.2 Backflow prevention

7.3.2.1 Location

Requirement: Provide backflow prevention devices in the following locations:

- On main incoming domestic cold water supplies, downstream of meter.
- At each connection to caravan site
- At the sullage dump point hose tap

In other locations required by the PCA (2022), Network Utility Operator, AS/NZS 3500.1 (2021) and as documented.

7.3.2.2 Installation

External valve locations: Protect from damage and vandalism.

Arrangement: Provide each backflow prevention device with the following:

Unions if ≤ DN 50. Provide flanges for larger sizes.

Isolating valves upstream and downstream of each backflow prevention devices.

Dual check valves to AS/NZS 3500.1 (2021).

Line strainer upstream of each backflow prevention device.

Registration: Register valves to Network Utility Operator requirements.

Provide concrete plinth for the installation and support of the boundary containment backflow prevention device with vandal proof, lockable removable galvanised cage. Cage shall be 3mm galvanised wire mesh with 50mm square spacing. cage frame shall be 5mm thick 90° angle 50mm x 50mm. Mesh shall be welded to the frame and galvanised coating re-applied. Cage shall be hinged and bolted down to the concrete plinth. Concrete plinth must be a minimum of class N40 with SL81 with reinforcement fabric placed 50mm from top cover. Plinth to be a minimum of 150 thick concrete. Copper pipes passing through plinth shall be double wrapped in petrolatum tape and sleeved.

7.3.2.3 Vacuum breaker valves

Requirement: Provide vacuum breaker valves where required to prevent cross-connection of the cold water service.

7.3.3 Marking

7.3.3.1 Notice plate

General: Provide a notice plate to containing condensed emergency instructions permanently fixed in a convenient position at the control valves.

7.3.3.2 Buried services

Requirement: Provide a detectable marker tape with trace wire to identify the route of buried piping.

Marker tape: Provide a minimum 100 mm durable plastic in colour to AS 1345 (1995) continuously printed with the words DANGER – BURIED DRINKING WATER SERVICE BELOW.

Location: Lay in backfill 150 mm above the pipe.

Trace wire: Terminate with 1000 mm coil in a readily accessible location. Tag to match the record drawings.

7.3.4 Valve boxes

7.3.4.1 General

Requirement: Provide cast iron valve boxes with removable covers for access to underground valves.

7.3.4.2 Installation

General: Set beneath each box a shaft formed of PVC-U pipe to give clear access to the valve wheel/lever or spindle. Set top flush with pavement surface, or 15 mm above unpaved surfaces, and encase in formed concrete box 150 mm thick, with top surface trowelled smooth. Terminate riser with a screwed cap located under the cast iron hinged lid.

7.3.5 Testing

7.3.5.1 Hydrostatic tests

Standards:

Cold water: To AS/NZS 3500.1 (2021) Section 17.

Requirement: Hydrostatically test all piping, joints and pipeline components.

Test pressure: 1500 kPa.

Test duration: The greater of 30 minutes and the time required to inspect all joints and components under test.

Preparation for testing: Isolate items of equipment not designed to withstand test pressures. Leave pipe joints exposed to allow inspection during tests. Secure pipes and fittings in position to prevent movement during tests.

Procedure: Test completed piping systems including equipment designed to withstand test pressures. Isolate equipment not designed to withstand the test pressure.

Leak detection: Observation of pressure gauge and visual inspection.

Inspection: Begin inspection for leaks no less than 10 minutes from the time the system reaches the test pressure.

Test criteria: No leaks or loss of pressure over the test period after taking account of changes in ambient temperature.

Leaks: If leaks are found, rectify and repeat the test until test criteria are met.

7.3.5.2 Other tests

Cross connections: Isolate systems individually and check for cross connections.

Backflow prevention: To AS/NZS 3500.1 (2021).

7.3.5.3 Completion test

General: Carry out a full operational test to verify conformance.

7.3.6 Commissioning

7.3.6.1 General

Strainers: Remove, clean and replace strainer baskets.

Cleaning and disinfection: To AS/NZS 3500.1 (2021) Appendix G.

Cold water systems: Test and commission to AS/NZS 3500.1 (2021) Section 17.

Non-drinking water services: To AS/NZS 3500.1 (2021) Section 9.

Testable backflow prevention devices: Test and commission to AS/NZS 2845.3 (2020) by a licensed plumber with backflow device accreditation. Tag and certify to the requirements of the Network Utility Operator.

7.3.7 Completion

7.3.7.1 Charging

Completion: On completion of installation, commissioning, testing and disinfection, fill the system with water, turn on control and isolating valves and the energy supply and leave the water supply system in full operational condition.

7.3.7.2 Operation and maintenance manuals

Standard: Prepare a manual that includes details to AS/NZS 3666.2 (2011).

7.3.8 Maintenance

7.3.8.1 General

Requirement: Provide 12 months maintenance until the end of the defects liability period as documented. Allow to carry out all required maintenance and to rectify any defective works found during this period.

7.4 Selections

7.4.1 Potable & non potable Cold water

7.4.1.1 Piping system schedule

Table 15 Piping system schedule

	A	B
Location	Above ground exposed	Below Ground
Cold water: Material	Copper type B	Vinindex Chlorblue PE Pipe. CC2 PE100 AS/NZS 4130 Blue stripe SDR11 PN16
Cold water: Nominal size	15 - 50	20 63
Cold water: Jointing method	Copper Press Fittings to AS3688. Water applications use an EPDM (Ethylene Propylene Diene Monomer) O-ring sealing element.	≥50mm use compression fittings. ≥65mm Electrofusion Fittings

7.4.1.2 Isolating valves schedule

Table 16 Isolating valves schedules

	A
Location	As documented
Function	Main Potable/non potable Water Isolation.
Description	2 piece stainless steel valve "Zetco" series 4400

7.4.1.3 Backflow prevention devices schedule

Table 17 Backflow prevention schedules

	A	B	C
Cross-connection hazard rating	High	Medium	Low
Description	Reduced Pressure Zone Device (RPZD).	Double check valve assembly (DCV).	Atmospheric vacuum breaker
	Down stream of authorities meter at boundary.	N/A	All hose taps

7.4.1.4 Water & Power Pedestal

Table 18 Water and Power Pedestal

	A
Location	As shown on drawings, one for each 2 camp sites.
Function	To provide simple & safe connection of water and power
Description	Power and Wate Column
Power outlets	2 x 15 amp outlets
Hose taps	2 x hose taps with 3/4" bsp connection.
Manufacturer	KMAC Power Heads
Model	Eco Series removable power and water pedestal

8. Sewer Reticulation

8.1 General

8.1.1 Responsibilities

8.1.1.1 General

Requirement: Provide sewer drainage, as documented on drawings:

Drawing number	Drawing Title
12596020-GHD-01-02-DRG-HY-00100	WATER RETICULATION PLAN
12596020-GHD-01-02-DRG-HY-00200	WASTEWATER RETICULATION PLAN

8.1.2 Standards

8.1.2.1 Sanitary plumbing and sanitary drainage

General: To AS/NZS 3500.2 (2021).

8.1.3 Submissions

8.1.3.1 Products and materials

General: Submit evidence that proposed materials are listed in the WaterMark Product Database.

8.1.3.2 Tests

Pre-completion tests: Submit results from pre-completion leak testing.

Certification: Submit certificate stating that network is leak free upon completion.

8.1.4 Inspection

8.1.4.1 Notice

Inspection: Give notice so that inspection may be made of the following:

Excavated surfaces.

Concealed or underground services,

Provide test reports, surveyed levels prior to backfilling and services being covered.

8.2 Products

8.2.1 General

8.2.1.1 Material selection

Environmental conditions: Provide materials capable of withstanding the operational environmental conditions. Select and install to manufacturers' recommendations.

Dissimilar materials: Connect dissimilar materials using adapters to Network Utility Operator requirements and manufacturer's recommendations.

Rubber banded sleeves: Do not provide.

Piping: As documented.

8.2.2 Traps and gullies

8.2.2.1 General

Gullies: As documented.

8.2.3 Sewer maintenance shafts

8.2.3.1 General

Standard: To WSA 137 (2019) and AS/NZS 3500.2 (2021) unless otherwise required by the Network Utility Operator.

8.3 Execution

8.3.1 Sewer drainage

8.3.1.1 Laying

Installation: Lay in straight lines between changes in direction or grade with sockets pointing up hill. If other pipes are adjacent, set each pipe true to line and complete each joint before laying the next pipe. If work is not continuous, cap open ends to prevent entry of foreign matter.

Piping: As documented.

8.3.1.2 Pipeline identification

General: Lay detectable plastic warning tape, 300 mm above buried piping, for the full length of the piping and cover with a minimum depth of 150mm of clean sand.

8.3.2 Piping

8.3.2.1 Finishes

Exposed piping: Finish exposed piping, including fittings and supports, as follows:

Externally: Paint.

8.3.2.2 Pipe supports

Above ground piping: Vent piping for main and branch drains to be installed in 80mm schedule 40 galvanised pipe for above ground pipe. The vent shall transition from UPVC to galvanise below ground. All galvanise pipe below ground shall be protected by a double wrap of petrolatum tape. Provide a 600mm cube of concrete with the top 150mm extending above ground level.

8.3.3 Sewer maintenance shafts

8.3.3.1 General

Requirement: Provide sewer maintenance shafts as documented. Provide sewer maintenance shafts with a 100 mm riser and finished with a screwed cap below the cast iron hinged cover as documented.

8.3.4 Testing

8.3.4.1 Pre-completion tests

Requirement: Test to AS/NZS 3500.2 (2021) Section 15, before backfilling or concealing.

Leaks: If leaks are found, rectify and re-test.

8.3.5 Completion

8.3.5.1 Cleaning

General: On completion, clean and flush the whole installation.

8.3.6 Maintenance

8.3.6.1 General

Requirement: Provide maintenance as documented.

8.4 Selections

8.4.1 Wastewater

8.4.1.1 Sanitary drainage piping schedule

Table 19 Sanitary drainage piping schedule

	A	B
Location	Below Ground	Above Ground
Pipe material	uPVC	Galvanized
Nominal size	40 - 150	80mm
Grade or class	DWV - SN6	Schedule 40
Jointing method	SCJ	Threaded female iron for UPVC to screw in.

8.4.1.2 Gullies schedule

Table 20 Gullies schedule

	A	B	C
Location	As documented	As documented	As documented
Type	Overflow gully	Camp Site	Caravan dump point
Size (mm)	150	100	100
Cover type	Loose CI grate	Hinged CI Grate	Hinged CI Grate
Surround	Concrete sump finished 75mm above ground level	Concrete sump finished 75mm above ground level	Galvins concrete caravan sullage dump point.

9. Electrical Reticulation and Lighting

9.1 General

This specification forms the Electrical Services Trade Package serving this project and shall be read in conjunction with the whole specification inclusive of the General Conditions of the Contract, Australia/New Zealand Standards, services specifications and drawings, and the electrical services drawings. Work called for by one and not the other shall be fully executed.

9.2 Contractor to Inform Himself

Examine the specification, drawings and additional documentation noted to establish the extent of work, requirements, compliances, notifications, and the like to complete the project as detailed herein.

Contractor shall attend a compulsory site visit, at a time to be confirmed by Shire of Northampton, to familiarise himself with the site prior to tendering.

9.3 Electrical Services Documentation

The drawings comprising the electrical services are:

Drawing number	Drawing Title
12596020-GHD-01-02-DRG-EL-00100	SITE ELECTRICAL SERVICES LAYOUT PLAN
12596020-GHD-01-02-DRG-EL-00200	ELECTRICAL SERVICES SINGLE LINE DIAGRAM

9.4 Scope of Work

Carry out the work as detailed in the drawings and specification, the whole of which shall be deemed to be one document.

Whether or not the words "supply and install" appears in the specification, drawings, schedules, instructions, and the like it is to be understood that, unless specifically excluded, all materials and labour for the complete installation is to be supplied, delivered to site, installed, tested, commissioned into service, and ongoing maintenance for one year after completion of the works.

The works include but not limited to the following. Supply and installation of:

- New solar bollard lighting
- New weatherproof switched socket outlets, and its associated cabling
- New Site Main Switchboard, Building Main Switchboard, and Distribution Board
- New incoming submain cables
- New protective devices which include discrimination and grading
- New underground PVC conduits
- New power pits
- New submain cables to the proposed Ablution Building's Distribution Board. The Electrical Trade shall liaise with transportable

9.4.1 Miscellaneous

- Fire rating of all new penetrations required within the area of works to the approval of all controlling Authorities.
- Painting, marking, and labelling.

- Training.

9.4.2 Co-Ordination and Liaison

Co-ordination with all other services and trades.

9.4.3 Documentation

- Preparation of detailed "shop drawings" prior to fabrication.
- Preparation of "Builder's works drawings" prior to installation.
- Schedule of equipment to be installed prior to ordering.
- Preparation of a construction programme for the electrical services works.
- Preparation of new "as-constructed" and or "as-installed" drawings where existing drawings don't exist.
- Preparation of Installation, Maintenance and Operation Manuals.

9.4.4 Maintenance and Warranty

- Comprehensive maintenance and warranty commencing from the date of Practical Completion for a minimum of 12 months.
- Monthly preventative maintenance inspections.

9.4.5 Testing and Commissioning

- Testing of the complete installation including all equipment supplied and installed.
- Provision of test method statements and test results.
- Commissioning of all equipment supplied, installed or modified, into service.
- Preparation of detailed "shop drawings" prior to fabrication.
- Provision of testing certificates as documented.

9.5 Codes, Rules, Permits, Fees

All materials, supplies, and all work installed shall comply with the Codes, Standards, Rules and Regulations of all Statutory Authorities including, but not limited to:

- NCC 2022 (Building Code of Australia)
- AS/NZS 3000
- AS/NZS 3001
- AS/NZS 3008
- AS/NZS 3013
- AS/NZS 61439
- Supply Authority Regulations
- Client Requirements

Make all applications and pay all fees required to comply with relevant authority requirements, including metering costs and self-certification costs for electrical inspection.

9.6 Defects Liability

Guarantee all work and materials as to quality, workmanship and against defects, for a period of twelve months from the date of issue of the certificate of 'Practical Completion'. During this period, promptly replace all defective equipment, fixtures, and materials at no additional cost.

9.7 Location of Services

The location of the services shown on the drawings are approximately only. Final locations of all electrical services shall be determined on site to suit the Superintendent's approval and to provide optimum operation performance of the services.

9.8 Workmanship

All workmanship and materials shall be to recommended industry standards using new materials.

Any materials or workmanship, to be considered inferior or non-conforming, shall be replaced at the Contractors cost.

All new socket outlets and light switches that are mounted externally shall be at least IP56 rated and suitable to the environment into which they are installed.

9.9 Red-line Drawings

The Contractor shall keep a full set of full-size electrical drawings on site.

Any changes or alterations to the design shall be marked on the redline drawings. Final As-Constructed drawings shall be produced from the red-line drawings.

9.10 Licensed Electrical Contractor

All works shall be undertaken by Licensed Electrical Contractors, qualified and experienced in the type of work required for this project. Licenses shall satisfy the requirements of the State Authority having jurisdiction over the works.

9.11 Drawings

The drawings are a guide only for the location and layout.

Do not scale from these drawings. These drawings are to be read in conjunction with Civil, Structural, Storm and Wastewater, Hydraulics, Contract Documents, Specifications and Drawings. Final coordination of fixtures and fittings to take place on site in liaison with other trades.

9.12 Switchboards

- Switchboards to comply with and be certified to AS/NZS 61439 series of standards.
- Provide protective devices and switchgear as required for the designated circuits.
- Supply, install and connect new circuit breakers as required.
- Provide a typed circuit schedule placed in a suitable holder mounted inside the door compartment of the switchboards.
- Supply, install and connect new residual current devices/circuit breakers on all new lighting and power sub-circuits.

9.13 Lighting

- Provide a complete operational lighting system, tested, and commissioned.
- Provide only proprietary luminaires, fittings, and accessories as documents.
- Provide all luminaires complete with lamp accessories, luminaire, control equipment, lighting control equipment, drivers.
- Provide controllers and contractors rated to the characteristics of the controlled load
- Refer to the 'Kalbarri Temporary Accommodation – Luminaire Schedule' for fitting types.

- Allow for 6mm² PVC/PVC for External Lighting.

9.14 Caravan Power Outlets

- Supply and install caravan power outlets as shown on the drawings.
- Final location of all outlets and equipment to be confirmed on site prior to installation.
- All power outlets shall be fitted with durable identification labels, displaying switchboard and circuit breaker numbers.
- Allow for 1 x 2C 6mm² Cu PVC + Earth and 1 x 2C 10mm² Cu PVC + Earth for caravan power outlets. Refer to drawing 12596020-GHD-00-02-DRG-EL-00200.

9.15 Earthing

- Provide earthing system in accordance with AS/NZS 3000.
- Locate and confirm the MEN location on site prior to any work commencing.
- Supply and install equipotential bonding in according with AS/NZS 3000.

9.16 Conduits

- Conduits to be installed below the level of on-ground slabs shall be made waterproof.
- Unless otherwise noted, all conduits shall be Clipsal Rigid PVC, or approved equal. Surface mounted shall be high impact type. External surface mounted conduit shall be steel type conduit.
- Accurately record the routes of concealed cables before covering. Include on the record drawings.
- Where conduits bends are used, bends shall be sweeping and at an equal or greater bending radius to accommodate the bending radius of the largest cable contained in the conduit.

9.17 Other Items

- The Contractor shall liaise with the Superintendent for any works which may affect the electrical supply to other services to the building. Where isolation to parts of the temporary accommodation is required outside the works area, the Contractor shall provide notice of the shutdown at least 10 working days prior to the shutdown event. Power interruptions shall occur at a time when there is minimum impact to the function of the site and shall be subject to the superintendent's approval.
- All existing services made redundant from these works shall be removed or sealed off in accordance with the contract documents and to the satisfaction of the building manager/superintendent.
- Seal all penetrations through fire rated construction with an approved fire sealant.
- Confirm locations and positions of all solar bollards, outlets, and equipment with the superintendent prior to ordering. Failure to do so shall result in location and/or replacing solar bollards, outlets, and equipment at the discretion of the superintendent at the electrical sub-contractor expense. Coordinate and liaise with other services for the location of outlets.

9.18 Testing and Commissioning

Complete all statutory testing in accordance with AS/NZS 3000 Section 8 using methods outlined in AS/NZS 3017. Submit test results and electrical compliance certificates to the superintendent. Tests shall include but not be limited to:

- Earth continuity testing and equipotential bonding
- Insulation resistance testing
- Polarity checks
- Correct circuit connections
- Earth fault loop impedance tests

9.19 Shop Drawings

- Provide shop drawings of all non-proprietary fixings and fittings for review and approval prior to procurement.
- Provide switchboard shop drawings for review and approval prior to procurement.
- Provide an updated set of As-Constructed drawings in .DWG format for review and approval.
- Provide Operations and Maintenance (O&M) Manuals for the installation including all warranties associated with the equipment installed, test certificates and As-Constructed drawings. O&M Manual to be provided in electronic format.

10. Limestone Block Retaining Wall

10.1 General

Construct limestone retaining walls as detailed on the Drawings, Scope of Work and the Technical Specifications.

10.2 Hold Points

Table 21 Minimum required hold points for limestone block retaining wall

Descriptions	Hold point timing
Submission of blockwork supplier and compliance with Australian Standards	14 days prior to ordering
Superintendent to inspect rock levels and direct Contractor on how the wall will transition as shown on the Drawings	After completion of excavation to rock levels
Provision of mortar colour to match blockwork colour	Completion of trial section of wall
Sample wall to be erected to control joint. Superintendent to inspect sample wall and control joint.	During or at completion of sample wall
Testing and results of compaction tests	At completion of compacted layer and prior to placement of limestone blocks

10.3 Standards

All equipment, materials and workmanship supplied by the Contractor for incorporation into the Works shall comply with the respective Australian Standard applicable which is current as at the date of close of tenders.

Where an Australian Standard is nominated in this documentation, it is provided as a guide to the Contractor for the selection of appropriate materials and/or work practices which are required by the Shire of Northampton. Where a nominated Standard or Interim Standard has been revised, amended and/or designated or not current as at the date of close of tenders, the applicable Standard shall be the Australian Standard which is current as at the date of close of tenders.

Materials and workmanship shall conform to the current Australian Standards, where such Standard exists, including the following:

- AS/NZS 4455.1:2008: Masonry units
- AS/NZS 4456.2:2003: Masonry units, segmental pavers and flags - Methods of test
- AS 3700:2018: Masonry structures

10.4 Limestone Blocks

Stone shall be sound, free from stakes, crakes, vents, pockets, veins, fissures and other like defects.

Limestone shall have a density not less than 1800 kg/m³ (dry).

Except where otherwise indicated on the Drawings, all limestone shall be tungsten cut to the sizes indicated on the Drawings and palletised for delivery to site.

Stone shall be stored on site clear of the ground on pallets and the stacks shall be covered with a waterproof cover to prevent wetting.

Blocks sizes as notated on the Drawings.

The Contractor shall ensure that the nominated blocks meet with the structural requirements of the specification and the appropriate Australian Standard.

10.5 Mortar

- Mortar shall comply with AS 3700:2018 and be used within 30 minutes of initial adding of water.
- Mortar in face stonework shall match the colour of the specified reconstituted limestone blocks to the approval of the Superintendent.

10.5.1 Materials for mortar

Materials to be included in mortar are as follows:

- Fine aggregate shall be sand
- Water shall be clean and of drinking quality, and
- Colouring pigments shall be metallic oxides insoluble in water.

Do not use admixtures unless specified. When specified, use admixtures strictly in accordance with the manufacturer's recommendations. When coloured mortar is specified, mix colouring pigments with cement and use fine aggregate compatible with the colour required.

10.5.2 Mortar mixing method

The mixing methodology is outlined below:

- Measure parts in mixes by volume in calibrated devices
- Thoroughly mix any colouring pigments with the cement before adding other ingredients,
- Mechanically mix mortar to an even colour and consistency.

10.5.3 Mortar mix

Proportions for mortar are as follows:

- 1 part ordinary Portland cement
- 1 part lime putty, and
- 6 parts fine aggregate.

10.6 Workmanship

All stone work shall be carried out by tradespersons experienced in limestone work.

Provide all accessories and perform all operations necessary for the proper execution of first class masonry work, including selecting, cutting, dressing, carving, bedding, setting, fixing, pointing, grouting, caulking and the like.

Build in where indicated and as necessary, all reinforcements, ties and the like.

Cut openings, chases, mortices and the like for other services and fixings. Well wet down stone which is to be laid or grouted in cement mortar.

Use non-staining softwood wedges or lead or plastic buttons for positioning stones.

Set work out, plumb, level and properly bonded, with no part rising more than 1000mm above adjacent unfinished work.

Corners and other advanced work shall be raked.

Re-lay in fresh mortar any stonework which has been moved or jarred after initial laying.

Construct all exposed areas of walls/piers to face work standard.

10.7 Coursing and bond

Stonework shall be to face sizes and pattern shown on Drawings and shall consist of carefully cut and dressed stone with even joints.

Stone shall be selected on site to ensure that only clean, square edges are visible in top course and facework.

All edges shall be kept true and straight, with jointing running horizontally and vertically and finished to dimensions indicated.

10.8 Joints

Form joints uniformly in facework, filled solidly with mortar, rolled to a smooth finish and finished with clean, straight edges against the stone. Joint thicknesses shall be 20mm.

Do not fill minor chips or hollows in stone of facework with mortar.

10.9 Samples

Erect samples of limestone work as follows and obtain the Superintendent's approval prior to proceeding. All limestone work shall match the standard of the approved sample:

- 2 m² wall showing bond pattern and mortar joints
- First control joint constructed by Contractor

10.10 Footings to Limestone Walls

A limestone retaining wall shall be constructed on the underlying rock. If conditions vary from what is expected, the contractor shall notify the Superintendent as soon as practicable.

10.11 Drainage

Provide drainage as necessary through limestone retaining walls to allow water flow from car park and road and as indicated on the Drawings. Any additional drainage requirements through wall will be advised by the Superintendent as a variation to the Contract works.

10.12 Cleaning

Upon completion, clean down all new work and adjoining surfaces where necessary, by appropriate methods, which shall be subject to the Superintendent's approval.

10.13 Protection of Finished Work

Clean off mortar drippings and the like as soon as they occur. Protect all finished stonework from staining or damage. Use sheeting or casing where necessary.

Do not use hardwoods in contact with stone.

Stained or damaged stonework shall be replaced, not repaired, unless otherwise permitted by the Superintendent. Similarly protect adjoining surfaces during masonry work.

11. Miscellaneous Items

11.1 Handrails

Weldlock handrails have been specified through-out the project. The handrails must comply with AS 1428.1.2022. Refer to below listed drawings for details of handrails.

Drawing number	Drawing Title
12596020-GHD-01-02-DRG-CI-00200	SITE CROSS SECTIONS SHEET 1 OF 2
12596020-GHD-01-02-DRG-ST-00100	CONCRETE DETAILS SHEET 1 OF 2
12596020-GHD-01-02-DRG-ST-00101	CONCRETE DETAILS SHEET 2 OF 2

11.2 Mulching

Mulched material shall be generally 75mm maximum length and 15mm maximum diameter and shall be capable of passing a 100mm max screen. Mulch is to be placed on all batter slopes and disturbed surfaces.

Mulch shall be clean from foreign objects.

11.3 Concrete work

Concrete works relate to the construction of footpaths and disability access ramps, stairs, shelter floor slab and bin stall floor slab.

Refer to the following drawings for concrete specifications:

Drawing number	Drawing Title
12596020-GHD-01-02-DRG-ST-00001	STRUCTURAL NOTES

11.4 Shelter and bin stall

The contractor will submit for approval the manufacturer's standard drawings (shop drawings) and product details for the following elements:

- Shelter
- Solar shield
- Privacy screen
- Replas table and benches
- Premium BBQ with sink and hotplate
- Bin stall (adjacent to the transportable ablution facilities, near service car park).

11.5 Fencing and gates

11.5.1 Responsibilities

11.5.1.1 General

Requirement: Provide fences and barrier systems, as documented.

11.5.1.2 Performance

Requirements:

- Complete for their function.
- Conforming to the detail and location drawings.
- Firmly fixed in position.

11.5.1.3 Products and materials

Requirement: Submit the manufacturer's standard drawings and details showing methods of construction, assembly and installation, with dimensions and tolerances.

11.5.2 Inspection

Inspection: Give notice so that inspection may be made of the following:

- Set-out before construction.
- Foundation conditions after excavation.
- Completion of installation.

11.5.3 Products

Storage and handling

General: Deliver, unload and store components and accessories in unbroken manufacturer's packaging.

Steel tubes

Posts, rails, stays and pickets: To AS/NZS 1163 (2016).

Fencing wire

Chainwire, cable wire, tie wire and barbed wire: To AS 2423 (2002).

AS 2423 (2002) covers fencing wire, barbed wire, wire netting and chainwire and requires that all products for fencing be protected against corrosion by application of a metallic-coating during manufacture, optionally overlaid with an organic coating. AS 2423 (2002) clause 1.3.13 defines organic coatings.

Concrete

Standard: To AS 1379 (2007).

Exposure classification: To AS 3600 (2018) Table 4.3.

11.5.4 Execution

11.5.4.1 Construction generally

Set-out

General: Set out the fence line and mark the positions of posts, gates and bracing panels.

Property boundaries: Confirm by survey.

Clearing

Fence line: Except for trees or shrubs to be retained, clear vegetation within 1 m of the fence alignment. Grub out the stumps and roots of removed trees and shrubs, and trim the grass to ground level. Do not remove the topsoil.

Excavation

Posts: Excavate post holes so that they have vertical sides and a firm base. Spread surplus material on the principal's side of the fence.

Earth footings

Base: Place 100 mm of gravel in the footing base under posts.

Compaction: Backfill with earth around posts, compacting firmly by hand or machine in 150 mm deep layers.

Concrete footings

In ground: Place mass concrete around posts to protect posts from waterlogged conditions and finish with a weathered top falling 25 mm from the post to ground level.

On slabs: Provide welded and drilled post base flanges for fixing with masonry anchors to the concrete.

Erection

Line and level: Erect posts vertically. Set heights to follow the contours of natural ground, unless documented otherwise.

11.5.4.2 Gates

Hardware

General: Provide the following:

- Drop bolt and ferrule to each leaf of double gates.
- Latch to one leaf of double gates.
- Provision for locking by padlock.
- Hinges with smooth operation and adjustment for future sagging.

Hand access

Requirement: Where required, provide hand holes to give access from outside to reach locking provision.

11.5.4.3 Chain link fabric fencing

Standard: To AS 1725.1 (2010).

11.5.5 Completion

Cleaning

Requirement: Remove excess debris, metal swarf and unused materials. Clean all visible metal surfaces with soft clean cloth or brush and clean water or approved cleanser, finishing with a clean cloth. Do not use abrasive or alkaline materials.

Powder coated aluminium architectural applications: Clean completed assembly to AS 3715 (2002) Appendix C.

Powder coated metal, other than aluminium, architectural applications: Clean completed assembly to AS 4506 (2005) Appendix D.

Protection: Remove protective coatings using methods required by the manufacturer after completion.

Warranties

Requirement: Cover materials and workmanship in the terms of the warranty in the form of interlocking warranties from the manufacturer and the installer.

- Form: Against failure of materials and execution under normal environment and use conditions.
- Period: As offered by the manufacturer and the installer.

12. Quality Assurance

The Contractor shall control the quality of the work and shall fully implement a quality management system under this Contract in accordance with the requirements of the current Australian and International AS/NZS ISO 9002:1994. In accordance with the Scope of Works (SOW), each section of this technical specification includes specific testing and reporting requirements. These requirements are integral to ensuring the quality, reliability, and compliance of the deliverables as they provide a clear framework for conducting tests, interpreting results, and reporting findings. Adherence to these requirements is crucial for maintain Quality Assurance/Control.

The Contractor shall be required to nominate a suitably qualified Quality Assurance Representative (QAR) who is at a management level with appropriate authority to effectively control the complete quality assurance process. For construction works the Representative shall be site based.

Appendices

Appendix A

Safety in Design



ghd.com

→ **The Power of Commitment**