

Cootamundra-Gundagai Regional Council
Betts Street Rising Main Project
Technical Specification

Contract Number: RFT 2024/3

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1. Technical Specifications

1.1 Project Background

GENERAL: The existing Betts Street Sewage Pumping Station (SPS) constructed in 1989 is a critical asset for the operation of the Cootamundra sewerage system. The Cootamundra-Gundagai Regional Council (CGRC below) Sewerage network consists of approximately 58 km of sewer main. The network consists of 5 Sewer Pump Stations (SPS), and 1 Sewage Treatment Plant (STP) and is primarily 90% gravity mains with 4 minor upstream sewerage pumping stations and a major SPS at Betts Street.

Over the past 5 years, the Betts St SPS and rising main has had solid deposition problems due to low velocities and corrosion which has resulted in pipeline failure within the Cootamundra sewerage network on several instances. As such, CGRC has decided to replace and realign the rising main to prevent future failures. This Technical Specification covers the proposed new rising main from the Betts St SPS to the Cootamundra STP.

1.2 Project Specific Clauses

Attention is brought to the following Project Specific clauses which have been added to the Technical Specification and which are specific to this project.

1. The disposal of surplus spoil from the excavations shall be the responsibility of the Contractor and approved by the Principal Authorised Person. Cross-reference 7.14 Excavation. Disposable may be allowed at Cootamundra Tip/landfill. Transportation of surplus or spoil will be responsibility of contractor.

1.3 Hold Points

NOTICE: So that inspections can be undertaken (if required) give the Principal Authorised Person a minimum of 48 hours' notice prior to the following hold points being reached:

General

- Submission and sighting by the Principal Authorised Person of all management plans (prior to commencement of any works on site);
- Duty to consult with other duty holders (as defined in the Work Health and Safety Act 2011 and subordinate regulations);
- Nomination of materials and components;
- Non-compliance with respect to material quality;
- Proposed changes in nominated materials and components;

Decommissioning and Demolition Works

- Draining in a controlled manner of the existing rising main
- Cutting of and decommissioning of the existing rising main

Site Works

- Installation of silt fences, sediment traps and other environmental protection measures;
- Completion of site set out;
- Completion of site clearing;
- Prior to blasting (should any be required);
- All subgrade surfaces at the completion of excavation upon which fill, drainage filter, topsoil, pavement or foundation material is to be placed;
- Completion of placement and compaction of FCR material;
- Topsoiling and grassing of the fill batters and areas of disturbed ground.

Temporary Works

- *Any temporary works required to suit the Contractor's construction methodology*

Concrete Work (including precast components)

- Foundations prior to the placement of blinding slabs;
- Completed formwork and reinforcement fixed in place prior to placing concrete;
- Cores, blockouts and embedments fixed in place prior to placing concrete;
- Scabbled, cleaned and prepared construction joints;
- Installed waterstops prior to placing concrete;
- Placing and vibration of in-situ concrete;
- Surfaces or elements to be concealed in the final work prior to covering;
- Completed pre-cast component formwork, reinforcing fixed in place, blockouts fixed in place, and panel inserts positioned and fixed, prior to placing of concrete;
- Placing and vibration of concrete for precast components;
- Completion of pre-cast component installation plan; and
- Installation and fixing of pre-cast components.

Pipework

- Trenches excavated and ready for laying of pipes;
- Laying and jointing pipes;
- Denso wrapping of buried flanges;
- Work ready for specified testing;
- Completed work ready to be covered up, concealed or backfilled;
- Pipe anchor and thrust block bearing surfaces;
- Pipe anchor and thrust blocks concrete ready to be placed;
- Installation of air valve pits and scour pits and the like;
- Works affecting existing pipe systems;
- Inspection and testing of all pipework and fittings; and
- Backfilling of pipework with embedment zone material.

2. Design Changes

REQUIREMENT: During the course of construction it may become apparent that it may be advantageous to alter or modify the proposed design. This may be as a result of such things as facilitating ease of construction, incorporating alternative products into the works that may be more appropriate or cost effective, modifications required to accommodate existing or future third party infrastructure.

Where a design change is proposed the following will be applied:

Design Changes Proposed by the Contractor

The Contractor shall submit details of the proposed changes and a supporting case to the Principal Authorised Person for approval by the Principal.

The onus is on the Contractor to undertake and supply all design details and provide a supporting case for the proposed changes. All costs associated with redesign shall be borne by the Contractor.

Where the proposed change affects the value of the Contract it shall be treated as a variation.

Design Changes Proposed by The Principal

The Principal shall submit details of the proposed changes to the Principal Authorised Person for discussion with the Contractor.

The onus is with the Principal to undertake and supply all design details and provide a supporting case for the proposed changes. All costs associated with redesign shall be borne by The Principal.

Where the proposed change affects the value of the Contract it shall be treated as a variation.

The Principal Authorised Person, in the role of Principal Authorised Person, shall not be responsible or undertake any redesign work or prepare a supporting case for a proposed change during the course of the Contract.

3. Decommissioning and Demolition Works

3.1 General

SPECIFIED IN THIS SECTION: The scope of works shall include the provision of all plant, labour and materials of whatever kind necessary for the decommissioning of the existing rising main.

REQUIREMENT: Prepare a detailed Decommissioning/Demolition Plan setting out all tasks in order of sequence and submit to the Principal Authorised Person (for sighting and information only) prior to undertaking any decommissioning/demolition work. Do not decommission any existing infrastructure until approval in writing is obtained from the Principal Authorised Person.

The activities listed below are not in any order. They provide a summary of decommissioning activities required as part of the works. The order of decommissioning activities will be dictated by the proposed construction methodology.

- Preparation of a Decommissioning/Demolition Plan.
- Draining in a controlled manner and approved disposal of the rising main.
- Cutting of and decommission the disused rising mains.

3.2 Inspection

NOTICE AND HOLD POINTS: Refer 1.3:

IMMEDIATE NOTICE: Upon identifying any of the circumstances below immediately notify the Principal Authorised Person:

- Prior to any deviation from the Decommissioning/Demolition Plan prepared by the Contractor
- Any discovery of latent conditions

4. Siteworks

4.1 Scope

SCOPE: This section contains clauses applicable to the following siteworks:

- Clearing and grubbing in preparation for excavation of pipeline trenches

4.2 Standards

REFERENCE DOCUMENTS: The following Australian Standards are referenced in this Section:

AS/NZS 2566	Buried flexible pipelines
AS 4419	Soils for landscaping and garden use

4.3 Discrepancies

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

- The nature or quantity of the material being removed
- Existing site levels
- Services or other obstructions below the surface

NOTIFICATION: Upon discovery of a potential discrepancy, notify the Principal Authorised Person immediately, and obtain a determination before proceeding with the Works.

4.4 Inspection

NOTICE AND HOLD POINTS: Refer 1.3:

IMMEDIATE NOTICE: Upon identifying any of the circumstances below immediately notify the Principal Authorised Person:

- Rock or bad ground; notify the Principal Authorised Person and obtain instructions before carrying out any further work in the area
- Any latent conditions that impede the works

4.5 Construction Proposals

REQUIREMENT: Submit for sighting the methods and equipment proposed for the Clearing and grubbing in preparation for excavation of pipeline trenches.

4.6 Definitions

TOPSOIL: Shall be imported general purpose soil complying the AS 4419 and shall be free from weeds. Topsoil texture shall be sandy loam.

ROCK: Any natural or artificial material which cannot be removed using a 200 kW excavator until broken up either by explosives or by mechanical means such as rippers, jackhammers, rock breakers or percussion drills.

OTHER THAN ROCK: All other material encountered in the excavations.

LINE OF INFLUENCE: A line extending downwards and outwards from the bottom edge of a footing, slab or pavement and defining the extent of foundation material having influence on the stability or support of the footing, slab or pavement.

FILL: A general term for all material spread and compacted over the subgrade to make up finished levels or levels to the underside of the base.

SELECTED REFILL MATERIAL: Shall be material excavated from the site free from clay lumps retained on a 75 mm sieve and stones retained on a 25 mm sieve and be to the approval of the Principal Authorised Person.

STONE DUST: Shall be crushed rock screening with 100 percent by mass passing a 6.7 mm sieve.

APPROVAL: All imported materials proposed to be used for drainage filter, topsoil, pavements and refill shall be submitted for approval at least two weeks prior to their proposed use and they shall not be used without the written permission of the Principal Authorised Person. Further samples may be taken during construction and the materials may be rejected at any time if they do not conform to this Specification.

BAD GROUND: Ground that is excessively soft or hard that prevents the works progressing in a normal manner that would be expected for the installation of the works using labour and machinery that would typically be used.

If bad ground is encountered, give notice to the Principal Authorised Person immediately and obtain instructions before carrying out further work in the affected area.

4.7 Measurement

GENERAL: Where provisional quantities are specified, or there are variations to the Contract dimensions of excavations, do not commence backfilling or place any material in the excavation until the excavation and backfilling quantities have been agreed and recorded.

MEASUREMENT: All quantities shall be the compacted in-place volume.

ROCK: Where rock is to be measured for payment purposes, do not remove the rock until the volume of rock has been determined.

4.8 Examination, Testing and Approval

GENERAL: A Testing Program is to be instigated by the Contractor to ensure all works are completed in accordance with the Design Drawings and the Specification.

RESPONSIBILITY: Notwithstanding anything contained in this Clause, the Contractor shall remain entirely responsible for ensuring that the works are constructed in accordance with the requirements of this Specification. Any approvals which may be given by the Principal Authorised Person as to acceptability or adequacy of the Works during construction will not relieve the Contractor of his obligation under this Contract.

REQUIREMENTS: For road and driveway access pavements.

Undertake specified compaction tests, using an approved NATA certified material testing laboratory to ensure that the pavements are constructed in accordance with the requirements of the Specification. The Contractor shall allow compaction tests to the pavements. A testing programme shall be established by the Contractor, and approved by the Principal Authorised Person, prior to pavement construction to ensure that the required compaction standards are achieved. Additional compaction tests required by the Principal Authorised Person shall be paid as a variation to the Contract.

NON-COMPLIANCE: Promptly advise the Principal Authorised Person of any non-compliance together with its location and proposals for corrective action. In the absence of a non-compliance report issued by the Contractor, the Principal Authorised Person shall have the right to issue non-compliance reports on the Contractor's work.

INSPECTION, EXAMINATION AND TESTING: Allow the Principal Authorised Person unrestricted access to all areas of the Works site at all times for the duration of the Contract.

Control testing may be undertaken by the Principal Authorised Person to satisfy themselves that the requirements of this Specification are being adhered to. The Contractor shall provide free of charge whatever assistance, whether plant or labour, the Principal Authorised Person may request to assist with the carrying out of testing and/or the obtaining of samples.

TEST RESULTS: Results of the Contractor's testing is to be made available to the Principal Authorised Person on a regular basis.

REMEDIAL WORK: Remedial works, if required, will be at the Contractor's expense. These works are to be identified by the Contractor to the Principal Authorised Person in the form of a non-conformance report. Typical remedial action required for unacceptable fill placement will include but may not be limited to the following:

Nature of Defect	Remedial Action Required
Moisture ratio outside the range specified in Clause 2.17.	Removal material from embankment and recondition.
Density of fill below but within 5 percent of Specification requirements.	Rework fill.
Density of fill more than 5 percent below Specification requirements.	Remove fill and replace.
Inadequate bonding between successive lifts of fill, including poor mixing and presence of laminations or discontinuities. Uneven moisture conditioning within layers.	Remove fill and replace.

The Principal Authorised Person may vary the remedial action required during the course of the project.

4.9 Protection Against Water Damage

REQUIREMENT: Take all precautions and do all works necessary to protect the excavated areas and the filled areas from damage due to flooding and/or scour by rain or floods. Any damaged sections of the excavated and filled areas shall be removed and/or make good at the Contractor's cost.

At all times provide suitable drainage or bypasses to protect the works and excavated areas and remove all water promptly from the excavation and keep them dry during the construction period.

4.10 Site Clearing

REQUIREMENT: Clear such areas of the site as required to carry out the works comprising this Contract and to the approval of the Principal Authorised Person. Clearing shall comprise the complete felling and grubbing of any trees specified to be removed, including stumps, roots, scrub or brushwood and the removal from site by approved means. Dispose of any debris to the satisfaction of the Principal Authorised Person.

EXTENT: Clear only to the extent necessary for the construction of the Works.

4.11 Fencing

REQUIREMENT: Provide secure fencing to the site for site works and to excavations for excavation/trenching works for the duration of the Contract.

PIPELINE TRENCHES: Provide temporary safety fencing complying with statutory requirements around all trench excavation and other works.

PUMP STATION VALVE PIT and SEWAGE TREATMENT PLANT INLET WORKS: Provide temporary safety fencing complying with statutory requirements around the structures, trenches, excavations and other works.

REMOVAL: Remove all fencing upon completion of the Work.

4.12 Excavation

GENERAL: Cut all excavations to the lines, levels, grades and forms shown on the Drawings, and provide dewatering, stabilisation and access as may be required for the completion of the Works.

SAFETY: Undertake all excavation work in a safe and tidy manner in accordance with the applicable standards and statutory regulations. Take precautions to ensure that all excavation is made in a careful manner and that it is rendered secure at all times.

In particular ensure that excavations adjacent to existing and proposed structures including roads and drains are carried out in such a manner as not to endanger or interfere with the stability of those structures.

For excavations greater than 1.5 m provide a secured access ladder.

FOR STRUCTURES: Excavations shall be taken to the depths shown on the Design Drawings or, in the case of footings or load bearing elements, to such greater depth as determined on site by the Principal Authorised Person to achieve the specified soil bearing capacity.

Soft, wet or unstable areas beneath foundation areas and any over-excavation under the base of structures shall be reinstated as specified below.

Over excavation on the sides of the structures shall be kept to the minimum necessary to provide working room for installation of reinforcing steel, formwork and for the provision of excavation supports and/or batter stability. The backfill shall be deposited in loose layers not exceeding 150 mm thickness and shall be compacted to not less than 95 percent of maximum dry density (Standard Compaction Test) using hand held rammers, tampers and mechanical equipment. The backfill shall not contain any rock, concrete or building material waste.

Particular care shall be taken to ensure that damage is not caused to the structures during backfilling operations. The Contractor shall at own cost make good all damage to the approval of the Principal Authorised Person.

Excavation supports, including sheet piling, shall be designed by a competent and experienced person. Any approvals given by the Principal Authorised Person or their representative shall not relieve the Contractor from responsibility for the safety of the excavations.

SPECIFIC REQUIREMENTS *Nil identified*

PREPARATION OF FOUNDATIONS: Foundations shall have the bottoms cut square, consolidated and cleaned of all loose earth, rock or debris and the bottoms shall be free of water before concrete is placed.

Provide even plane bearing surfaces for load bearing elements including slabs, footings, and the like. Excavations and footings shall be stepped as necessary, or as shown on the Design Drawings, to accommodate level changes with the steps made to suit the appropriate courses if supporting masonry.

The Contractor shall proof roll the excavation for pavements and sub-grades for embankments with a loaded truck to determine the extent of any bad ground.

OVER EXCAVATION: The Contractor shall not be entitled to a Variation or an Extension of Time for Practical Completion 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 or techniques, and any consequent additional backfilling, compacting or testing.

REINSTATEMENT: Where excavation exceeds the required extent, whether as a result of directions in respect of bad ground, or over excavation by the Contractor, or the discovery of voids, fissures and the like, the Contractor shall reinstate to the correct depth and required bearing value, in accordance with the following:

- Below or within the 'line of influence' of slabs, footings, beams, or other structural elements. Class N15 concrete.
- **Below suspended slabs or pavements.** Selected filling compacted to the specified density. In cut subgrades, if the over excavation is less than 100 mm, the over excavation shall be made good by increasing the thickness of the layer above.
- **In service trenches.** Class N15 concrete or approved compacted pipe bedding material, as directed.
- **SUPPORTING EXCAVATIONS:** The Contractor shall support the sides of each excavation as necessary to ensure safe working and shall guard against the formation of voids outside sheeting or sheet piling if used. Should any voids form, the Contractor shall fill and compact them to a dry density similar to that of the surrounding material.
- The Contractor shall remove temporary supports progressively as backfilling proceeds.
- **DISPOSAL OF SURPLUS MATERIAL:** Surplus excavated material shall be the responsibility of the Contractor.

4.13 Subgrades Affected By Moisture

REQUIREMENT: Where the subgrade is unable to support construction equipment, or it is not possible to compact the overlying material only because of high moisture content, perform one or more of the following:

- Allow the subgrade to dry until it will support equipment and allow compaction.
- Scarify the subgrade to a depth of not less than 150 mm, work as necessary to accelerate drying and recompact when the moisture content is satisfactory.
- Excavate the wet material and remove the spoil, and backfill excavated areas.

4.14 Embankment Foundation Preparation

REQUIREMENT: After excavation of the foundation for the embankment has been completed, remove all surplus water and/or unsuitable material from the foundation to the approval of the Principal Authorised Person. Immediately prior to placing fill material, rip the exposed foundation to a depth of 150 mm. Moisture condition the ripped foundation as necessary and recompact to the requirements of Clause 4.15 so that the surface materials of the foundation will be compacted and well bonded with the first layer of fill. Methods of placing and compaction shall be such as to obtain the best possible adhesion between the stripped foundation and the embankment fill.

MEASUREMENT AND PAYMENT: Payment for foundation preparation shall be included in the relevant item in the Schedule for Fill and Embankment Construction and shall include all ripping, moisture conditioning and compaction as required by this clause.

4.15 Fill and Embankment Construction

MATERIAL: Construct embankments and filled areas from approved refill material excavated from the site which conforms to the requirements of this Specification.

Ensure no material contamination occurs.

SURFACE PREPARATION: Prior to placing a layer of fill, prepare the surface of the preceding layer by scarifying to 50 mm depth and moisture conditioning and rerolling if necessary. Scarify and compact only in a direction parallel to the embankment axis. Produce a contact surface which is compacted but adequately roughened and broken up to allow bonding between layers and the construction of a uniform fill. Ensure that the moisture condition throughout the surface layer is similar to that of the material to be placed.

PRECAUTIONS: Take all necessary precautions and do all necessary works to protect the foundations for the embankments, the excavated surfaces, and all stockpiles. Precautions shall allow for possible flooding, rain scour, drying/cracking due to the sun or wind and similar damage.

DRAINAGE: Placement and compaction of fill materials shall commence in the lowest areas of the work. No fill shall be placed until the Principal Authorised Person, or representative, has approved the foundation preparation.

Placement and compaction of the fill shall be carried out in horizontal lifts and the fill surface shall be sloped to provide drainage during construction. Water shall not be allowed to pond on the fill surface. Local sumps shall be provided to collect any rain water or seepage water. Any water in the sumps is to be pumped out.

SEGREGATION: Material that has segregated during transportation or placing shall be mixed prior to compaction.

GRADUATION: The fill shall be free from lenses, pockets or layers of material that are significantly different in gradation from the surrounding material of the same zone. Material placed which does not meet the specified graduation requirements shall be removed or otherwise reworked to produce material that does.

OVER SIZE PARTICLES: Oversize particles larger than 50 percent of the loose lift thickness shall be removed prior to compaction. Oversize materials that are removed shall be disposed of in a manner approved by the Principal Authorised Person, or representative.

PLACEMENT: Place the material into the embankment in continuous, approximately horizontal layers of not more than 200 mm loose thickness. Place the material so as to provide a

homogeneous mixture of soil with no significant variation in moisture content, soil type or particle size within or between any layer.

Prior to the placement of a lift, the exposed surface of the previous lift shall be lightly scarified to a depth of 30 mm and watered.

COMPACTION: Compaction shall be as uniform as practicable over the entire lift surface and compaction equipment shall travel in a direction parallel to the embankments except where unavoidable near to the corners. The compaction equipment shall not travel at speeds exceeding 4 kilometres per hour, and a minimum 20 percent overlap between adjacent passes of the compactor shall be provided. Static rollers with minimum static foot pressure of 3 MPa or other approved compaction equipment shall be used for compacting all earth fill. Vibrating rollers may create problems with adjacent structures and shall not be used.

The Contractor shall adjust and maintain the fill materials at the specified water content for compaction in a manner that shall ensure uniform moisture distribution throughout each lift thickness.

Compact all earth fill materials to the densities and moisture conditions shown in the following table. Compact only in a direction parallel to the embankment/fill axis and ensure that adequate compaction is achieved at material boundaries and to the design lines.

4.15.1 Embankment and Foundation Placement

Moisture Content Range and Density Requirements

Location and Zone	Compaction Specification	Compaction Water Content Range (%)	Minimum Dry Density Ratio (%)
Embankments and hardstands	Modified (1)	-2 to +2	100
Sub-slab preparation	Modified (1)	-2 to +2	100

(1) Modified Compaction to AS 1289.5.2.1.

Ensure that after compaction is achieved for each layer of fill placed, that adequate bonding between layers has been achieved with the embankment free of laminations and discontinuities.

Compacted fill that has suffered a reduction in density due to precipitation, or for any other reason, or that has cracked due to drying, shall be reworked or replaced to the full depth of damage prior to placing the next lift. If the surface of a compacted lift is too dry or too smooth to bond properly with the next lift of material to be placed, the fill surface shall be scarified to a minimum depth of 30 mm and water shall be added as necessary. The scarified surface shall then be recompacted to provide a satisfactory bonding surface before the next lift is placed.

SUSPENSION OF OPERATIONS: Before the suspension of operations each day and before inclement weather, the fill in place shall be compacted, graded towards the upstream side of the crest and the surface rolled smooth to facilitate runoff of rain water.

CONSTRUCTION TRAFFIC: Construction traffic shall be routed to existing, or proposed, cleared areas to limit the extent of later rehabilitation of natural areas. Hauling and spreading equipment shall run approximately parallel to the axis of the embankments and traffic paths varied to prevent rutting of the fill. Transverse traffic across the embankment shall be avoided. Any damage to the embankments, or to the fill already placed, due to construction traffic, shall be repaired prior to the placement of the next lift. This may include, but shall not be limited to, the removal of ruts, contaminated fill materials and repairs to fill boundaries.

TOLERANCES: Dimensions shall not be less nor the slopes steeper than those specified. Dimensional tolerances of all zones shall be the following unless specifically otherwise noted:

- Level tolerance -0.05 m to + 0.05 m
- Horizontal tolerance -0.2 m to + 0.2 m

The Contractor shall provide and have available at all times during approved working hours, the necessary staff and equipment to ensure that proper and correct setting out of the Works is continuously maintained during construction. Should any errors in setting out of the Works occur, such errors shall be corrected and any necessary adjustments to previously placed fill

materials made to the satisfaction of the Principal Authorised Person, or representative prior to further placement of fill materials.

Methods of carrying out the fill placement shall be subject to approval by the Principal Authorised Person, or representative. Equipment suitability, method of working, rate of progress and quality of work shall be demonstrated during the initial stages of the work. In the event that the work performance is unsatisfactory, the Contractor shall immediately implement such changes as are required to ensure the proper completion of the work.

TESTING: Compaction testing shall be arranged and paid for by the Contractor in accordance with AS 1289, and undertaken by an accredited NATA testing laboratory.

The minimum testing frequency required is shown in the following table:

Test	Zone/Location	Testing Frequency Per Lift	
		One Test Every	Minimum of Tests Per Lift
Field Density	Embankment, hardstand gravel sheeting and sub-slab preparation	50 m ³ or 250 m ² (whichever provides the greater amount of testing).	1 per layer
Plasticity Index and Grading	Sub-slab preparation	2000 m ³	1 per grading size
Layer Thickness	Sub-slab preparation	-	1

MEASUREMENT AND PAYMENT: Payment for excavation and embankment construction will be made according to the relevant items in the Schedule. The schedule items shall be deemed to include provision for excavation, operation and maintenance of moisture conditioning equipment and procedures, excavation, haulage and placement of materials on the embankment, and compaction and moisture conditioning of the fill.

4.16 Drainage During Construction

GENERAL: Make all necessary allowances and temporary works to ensure that adequate drainage is maintained across the site during construction. Include allowances for provision, operation and maintenance of all equipment which may be required including pumps pipework and culverts.

DRAINAGE OF FILL: Ensure that all placed fill is free draining away from the embankment centreline during construction.

DRAINAGE OF SITE: Provide adequate drainage around the whole site, including the access and site offices, road, and stockpiles, to ensure that any disruption to the works due to adverse weather conditions is minimised.

PAYMENT: Payment for providing the services required under this Clause will be deemed to be provided in the item in the Schedule of Prices.

4.17 Backfilling To Structures

FILLING AROUND STRUCTURES: Unless otherwise shown on the drawings filling around concrete structures shall be approved Stone Dust material. It shall be deposited in loose layers not exceeding 250 mm thickness and shall be compacted to not less than 95 percent of the maximum dry density (Standard Compaction Test), using hand held rammers, tampers and mechanical equipment.

PROTECTION OF STRUCTURES DURING BACKFILLING: Do not place filling against concrete until the concrete has been in place for not less than seven (7) days. Particular care shall be taken to ensure that damage is not caused to structures during backfilling operations. Support all structures and structural elements as necessary. All damage caused shall be made good by the Contractor to the approval of the Principal Authorised Person.

4.18 Supporting Excavations

GENERAL: Provide support to excavation to comply with regulatory requirements to ensure safe working.

SIDES: Support sides of excavations as necessary to ensure safe working.

VOIDS: Guard against the formation of voids outside sheeting or sheet piling if used. Should any voids form, fill and compact them to a dry density similar to that of the surrounding material.

REMOVAL: Remove temporary supports progressively as backfilling proceeds and in accordance with AS/NZS 2566.2:2002 Section 5.4.6.

4.19 Adjacent Structures

SUPPORTS: Provide supports to adjacent structures where necessary, sufficient to prevent damage resulting from the work under the Contract. Supports will be deemed to be temporary works unless the Contract provides otherwise.

LATERAL SUPPORT: Provide lateral support by means of temporary ground support and the like.

VERTICAL SUPPORT: Provide vertical support by means of piling, underpinning and the like.

PERMANENT SUPPORTS: Where permanent supports for adjacent structures are necessary and are not shown on the Drawings or specified, notify the Principal Authorised Person and obtain his instructions.

ENCROACHMENTS: If encroachments from adjacent structures are encountered and are not shown on the Drawings, notify the Principal Authorised Person and obtain their instructions.

4.20 Pavement Construction

PAVEMENT MATERIAL: The pavement material shall be Principal approved material.

SEALED SURFACING: The pavement shall be surfaced with asphalt to the extent shown on the Drawings.

4.21 Siteworks - Project Specific Issues

- Ensure property owners are consultant when undertaking work on private property. When carrying out work and reinstatement in private property take steps to ensure:
 - Gates are closed when not in use,
 - That, when entering or leaving the property (going to/from the work activity or other designated areas), all work vehicles utilise agreed access points.
 - That any fence, sign or other items removed to facilitate the installation of the works are properly reinstated.

5. Temporary Support Works

5.1 Scope

The Contractor shall design, certify, supply, install and construct temporary support works (shoring/sheet piling) suitable for the ground conditions to allow for completion of the project, and associated works, and the protection of all infrastructure and personnel during the works.

5.2 Contractor's Temporary Works Proposal

- (a) Not less than 14 days before commencing erection or construction of any Temporary Works, or implementation of any construction method for the work under the Contract, the Contractor shall, unless otherwise specified, submit to the Principal Authorised Person in sufficient detail the type, size and location of such Temporary Works and construction methods for the Principal Authorised Person's sighting and release of the hold point.
- (b) Should the Contractor wish to vary the accepted proposals for Temporary Works and construction methods the Contractor shall at least 14 days prior to proceeding with the variation submit for sighting and release of the hold point by the Principal Authorised Person details of the new proposal. Where the Principal Authorised Person considers that more information is required to adequately assess the Contractor's new proposal, the Contractor shall supply within the time specified by the Principal Authorised Person such additional information as is requested. The Contractor shall not proceed with any variation to its proposal without discussion with the Principal Authorised Person.
- (c) Temporary Works erected or constructed without the prior sighting and hold point release may be subject to alteration, relocation or demolition and replacement by the Contractor at its sole expense and no extension of time will be granted.

5.3 Temporary Works Construction

5.3.1 Supply

REQUIREMENT: The Contractor shall be responsible for supply of all materials, labour, structural items, plant, fixtures, fittings and consumables for the installation and construction of the temporary support works.

5.3.2 Installation and Construction

REQUIREMENT: The Contractor shall install and construct the temporary support works in accordance with the proposal submitted and approved by the Principal Authorised Person. The Contractor shall undertake the works in accordance with the relevant codes and statutory requirements.

5.3.3 Removal of Support

REQUIREMENT: The Contractor's Temporary Works Proposal shall include details on the removal and disassembly of temporary supports and any remnant temporary structural items to be abandoned, i.e. not salvaged.

5.3.4 **ABANDONMENT: The Principal Authorised Person is to approve remnant and temporary structural support items that are to be abandoned. The Contractor shall include locations, depth, material, and type of any abandoned items on the As-Constructed drawings\Reinstatement**

REQUIREMENT: The Contractor shall be responsible for supplying all material, labour, plant and consumables for the reinstatement of all assets and land disturbed by the supply, installation, construction, disassembly and abandonment of temporary support works.

The Contractor shall reinstate to pre-construction levels all surfaces and resurface to match existing.

5.4 Inspection

NOTICE AND HOLD POINTS: Refer 1.3:

IMMEDIATE NOTICE: Upon identifying any of the circumstances below immediately notify the Principal Authorised Person:

- Discovery of latent conditions.

6. Concrete Works

6.1 General

6.1.1 Scope of Work

SPECIFIED IN THIS SECTION: The scope of works shall include all concrete works necessary under this Contract, including but not limited to the following:

- Supply and install the following concrete protection systems:
 - External joint sealant
 - Internal joint sealant polyurethane
 - Internal waterproofing coating
- Concrete for access pits work on the new air valves and scour pits.

6.1.2 Standards

DOCUMENTS: The following standards are referred to in this section.

AS 1012 Methods of Testing Concrete

AS 1214 Hot-dip Galvanised Coatings on Threaded Fasteners

AS 1379 Specification and Supply of Concrete

AS 1478 Chemical admixtures for concrete, mortar and grout

AS 1599 Pressure Sensitive Adhesive Packaging Tapes

AS 3600 Concrete Structures Code

AS 3610 Formwork Code

AS 3735 Concrete Structures for Retaining Liquids.

AS 3799 Liquid membrane-forming curing compounds for concrete

AS 4198 Precast concrete access chambers for sewerage applications

AS 4671 Steel Reinforcing Materials

AS 4680 Hot-dip galvanized (zinc) coatings on fabricated ferrous articles

6.1.3 General Requirements

STANDARD: Construct all concrete works in a safe manner using materials and methods complying with this Specification and the relevant requirements of AS 3600, AS 3610 and AS 4198.

6.1.4 Adjoining Elements

REQUIREMENT: Obtain the requirements for all adjoining elements to be fixed to or supported on the concrete and provide for the required fixings. Where applicable provide for temporary support of the adjoining elements during construction of the concrete.

6.2 Inspection

NOTICE AND HOLD POINTS: Refer 1.3:

6.3 Quality Control

6.3.1 Quality Assurance

REQUIREMENT: Where there is a recognised quality assurance program applicable to a specified product, provide assurance of product quality under the authority of that program. The program shall be one in which the manufacturer has in place a quality control management system which is subject to continual monitoring through quality audits by a recognised independent organisation.

6.3.2 Construction Proposals

REQUIREMENT: Submit for approval proposals for mixing, placing, finishing and curing concrete including those items listed below:

- Sources of materials.
- Ready mixed concrete supplier.
- Handling, placing, compaction and finishing methods and equipment.
- Temperature control methods.
- Curing and protection methods.
- Target strength, slump and proposed mix for each type and grade of concrete.

6.3.3 Reinforcement Fabrication

BENDING SCHEDULES: If reinforcement bending schedules are required submit marking plans and schedules showing location, shape, size and grade of all reinforcement.

CHANGES: Obtain approval for changes, if any, in the reinforcement shown on the Drawings, including additional splicing.

MECHANICAL SPLICES: If mechanical bar splices are proposed or required submit for approval details of the proposed splices and test certificates for each size and type of bar to be spliced.

6.4 Testing and Assessment

6.4.1 Authority and Personnel

REQUIREMENT: The organisation responsible for testing and assessment of concrete and concrete materials shall be NATA registered.

For each test, maintain the records and reports of test results as required by AS 1012. Submit a copy of each test report to the Principal Authorised Person.

6.4.2 Sampling and Testing

REQUIREMENT: Undertake sampling and testing to AS 1012 Parts 1-3 inclusive.

The following minimum number of 200 mm x 150 mm diameter test cylinders shall be tested:

- One sample of 3 cylinders for each 10 m³ or part thereof placed in an essentially continuous manner.
- One cylinder of the three taken shall be tested at 7 days or as directed by the Principal Authorised Person.
- The remaining two cylinders shall be tested at 28 days.

6.4.3 Assessment

REQUIREMENT: The test results shall be assessed in accordance with AS 3600. Should the 28 day cylinder strength as determined not comply with the specified strength, the Principal Authorised Person shall reject the concrete and direct the Contractor to remove rejected concrete from the site.

Alternatively, approval may be given to the retention of the hardened concrete liable to rejection, on the basis of:

- The criteria in AS 3600 Clause 19.1.10.3
- An appraisal of the statistical information related to the concrete strength.
- Approved remedial work.
- Reduction in cost.

6.4.4 Surface Repairs

REQUIREMENT: Concrete liable to rejection because of surface defects may in some cases be accepted subject to the specified exposure classification and the successful repair of the defects. Repairs to concrete surface shall be performed by skilled workers.

Repairs of imperfections shall be completed within 24 hours after removal of forms.

Concrete that is honeycombed, fractured and the like, must be removed and replaced with suitable non shrinkage mortar as directed by the Principal Authorised Person.

Holes resulting from the removal of ends of form ties shall be filled with suitable approved type of non-shrinkage mortar.

Mortar shall not be used for filling behind reinforcement.

6.5 Formwork

6.5.1 General

REQUIREMENT: Design and construct formwork and false work to the approval of the Principal Authorised Person so that concrete when cast in the forms, will have the dimension, shape, and surface finish as required by the Contract.

If formwork fails to meet the requirements of the Contract, any concrete which has been cast in that formwork may be rejected.

If required by the Principal Authorised Person, submit formwork or false work drawings for approval.

6.5.2 Formwork Tolerances

REQUIREMENT: The finish concrete surfaces shall be within the tolerances stated in the following table:

Formwork Class To AS 3610	Deviation From Correct Positions		Maximum Misalignment	
	Maximum	Relative	Between Pours	Across Form Joints
1	10 mm	1.5 mm	1 mm	0 mm
2	15 mm	2.5 mm	2 mm	2 mm
3	20 mm	3.5 mm	3 mm	2 mm
4	25 mm	4.5 mm	4 mm	4 mm

The deviation in beams and slabs shall be measured before the removal of false work or shoring.

6.5.3 Formed Surfaces Schedule

STANDARD: The minimum standard of finishes to formed concrete shall be as follows:

Concrete Element	Formwork Class	Colour Control Type
Normal architectural work and surface not otherwise specified.	2	B
Civil engineering works (Pump Stations).	3	C
Surfaces to be rendered or hidden by other finishes.	4	Not Applicable
Surfaces permanently concealed (e.g. Footings, rear faces of retaining walls).	5	Not Applicable

6.5.4 Visually Important Surfaces

REQUIREMENT: Visually important surfaces include concrete surfaces from AS 3610, formwork classes 1, 2, and 3.

Set out formwork to give a regular arrangement of panels, joints, bolt holes, and the like visual elements in the formed surface.

Unless otherwise specified form a 45 degree bevel, 25 mm on the face, by chamfering or filleting the forms.

6.5.5 Formwork Construction

REQUIREMENT: All forms shall be built mortar-tight and of sufficient rigidity to prevent distortion during construction.

Where forms are re-used, their original shape, strength, rigidity and surface smoothness shall be maintained at all times.

Before placing reinforcement, all forms shall be treated with a release agent, to the interior surfaces of the formwork, except where directed by the Principal Authorised Person. Where necessary clean reinforcement to remove all traces of release agent to the satisfaction of the Principal Authorised Person.

If ties are used to secure and align the formwork, effective precautions shall be taken to ensure watertightness after their removal.

STRIPPING TIMES: The period elapsing between placing concrete and removing formwork shall be as follows, unless otherwise approved in writing by the Principal Authorised Person:

- Walls 72 hours
- Footings 24 hours

6.5.6 Form Tie Bolts

REMOVABLE BOLTS: Remove the bolts without causing damage to the concrete.

COVER: Position formwork tie bolts left in the concrete so that the tie does not project into the concrete cover.

BOLT HOLE FILLING:

Recessed Filling: Fill or plug the hole to 6 mm below the surface level. Use material matching the surface colour.

Flush filling: Use material matching the surface colour.

6.5.7 Permanent Loading

REQUIREMENT: Do not place permanent loads, including masonry walls and the like, on the concrete structure while it is still supported by framework.

6.5.8 Lost Formwork

REQUIREMENT: Permanent or lost formwork, if required, shall not contain chlorides, and shall not impair the structural performance of the concrete members.

6.6 Concrete Materials

6.6.1 Concrete Materials Generally

STANDARD: To AS 3600

RESTRICTIONS ON CHEMICAL CONTENT: Chemical admixtures shall comply with AS 1478. Use of the admixtures shall be as agreed with the Principal Authorised Person.

Fly ash or blended cement shall not be used without the written approval of the Principal Authorised Person.

AGGREGATE SIZE: Maximum aggregate size shall be 20 mm.

6.6.2 Ready Mixed Supply

STANDARD: To AS 1379. Deliver in agitating trucks.

ADDITION OF WATER: Obtain approval before adding water at the site.

ELAPSED DELIVERY TIME: Concrete is liable to be rejected if the elapsed time between the wetting of the mix and the discharge of the mix at the site exceeds the following:

Concrete Temperature (at time of discharge °C)	Maximum elapsed time (hours)
10-24	2.00
24-27	1.50
27-30	1.00
30-32	0.75

DELIVERY DOCKET: For each batch, supply a docket listing the information required by AS 1379 including the following:

- The works for which the concrete was ordered.
- The total amount of water added to the plant.
- The maximum amount of water permitted to be added at site.
- Slump achieved and the design slump.
- Cement content in the mix.

Supply the following additional information:

- The concrete element or part of the Works for which the concrete was ordered.
- The total amount of water added at the plant and the maximum amount permitted to be added at the site.

6.6.3 Site Mixed Supply

MANUFACTURE: Site mixed concrete shall not be used unless approved in writing by the Principal Authorised Person.

Mix concrete in an approved plant located on the construction site but complying with the relevant requirements of AS 1379.

HAND MIXING: Hand mixing is not permitted.

6.6.4 Grout

STANDARD: To AS 3600.

SHRINKAGE: Shall not exceed 1 percent value after 24 hours.

MAXIMUM WATER CEMENT RATIO: 0.45 (by weight).

MAXIMUM COMPRESSIVE STRENGTH: (75 mm cube): 24 MPa at 7 days and 40 MPa at 28 days.

6.6.5 Epoxy Grout

MATERIAL: An approved commercial epoxy formulation of high compressive strength.

6.7 Design of Mixes

6.7.1 Class of Concrete

REQUIREMENT: The target slump values, maximum water cement ratios and minimum and maximum cement contents shall be within the following values.

Concrete Element	Footings, Slabs & Walls other than of Water Retaining Structures	Water Retaining Structures (including Benching)	Anchor Blocks, Mass Concrete Fill	Blasting Concrete
Class of Concrete	Normal	Special	Normal	Normal
Strength Grade	N40	S40	N20	N15
Characteristic Compressive Strength f_c (MPa)	40	40	20	15
Cement Type	GP	SR	GP	GP
Slump (mm)	80	60	80	80
Max Aggregate Size (mm)	20	20	20	20
Project Assessment	Required	Required	Required	Not Required

Project Assessment Testing Frequency	Every 10 m3 or part thereof	Every 10 m3 or part thereof	Every 10 m3 or part thereof	Not Required
Early Age Strength	Not Required	Not Required	Not Required	Not Required
Special Requirements (Special Class Concrete):				
Min Cement Content (kg/m ³)	N/A	320	N/A	N/A
Max Cement Content (kg/m ³)	N/A	400	N/A	N/A
Max Water/Cement Ratio:	N/A	0.50	N/A	N/A

6.7.2 Mix Design and Acceptance

REQUIREMENT: The Contractor shall be responsible for the design of mixes and for the production of concrete.

The Contractor shall submit for approval, details of the concrete mix proposed.

Not less than 28 days before placing concrete, the Contractor shall prepare trial mixes using the approved mix design. For each trial mix, the Contractor shall produce at least eight (8) test cylinders. The cylinders shall be tested as required by the Principal Authorised Person.

COSTS: All costs associated with the production of trial mixes and testing shall be included in the respective Schedule of Prices.

6.7.3 Ready Mix Supply

REQUIREMENT: If concrete is supplied by an approved supplier of Ready Mix Concrete, the Principal Authorised Person at his discretion may accept the results of test cylinders cast from identical mixes produced previously by the supplier.

The information and details of the mix shall nevertheless be supplied.

6.8 Reinforcement

6.8.1 Reinforcement Generally

STANDARD: To AS 3600.

COVER: As specified on the Drawings and to AS 3600 or AS 3735 as applicable. Cover shall be 50 mm unless otherwise specified.

REQUIREMENT: Supply and fix reinforcement, including the necessary tie wires, support chairs, spacers and the like.

MANUFACTURER CERTIFICATION: Reinforcement shall be readily identifiable as to the grade and origin.

When requested by the Principal Authorised Person, obtain from the manufacturer and furnish a certificate of compliance with the relevant standard or furnish a test certificate to the relevant standard from an independent testing authority.

6.8.2 Fixing Reinforcement

FIXING REQUIREMENTS: Secure the reinforcement against displacement by tying at intersections with annealed iron wire ties not smaller than 1.25 mm diameter, or by approved clips. Bend the ends of wire ties away from nearby faces of forms. The ends of the ties shall not project into the concrete cover.

Mats: For bar reinforcement in the form of a mat, secure each bar at alternate intersections, and at other points as required.

Beams: Tie ligatures to bars in each corner of each ligature. Fix other longitudinal bars to ligatures at not more than 1000 mm intervals.

PROVISION FOR CONCRETE PLACEMENT: If spacing or cover of reinforcement do not comply with the specified cover requirements or AS 3600, respectively notify the Principal Authorised Person and obtain instructions prior to placing concrete.

TOLERANCES: To AS 3600

WELDING OF REINFORCEMENT: Welding of reinforcement shall not be permitted without the written approval of the Principal Authorised Person.

6.8.3 Reinforcement Supports

SUPPORT TYPES: Use purpose-made concrete or plastic supports. For exposure classifications more severe than A1 use plastic supports of adequate strength and of a shape appropriate to the location, or concrete supports of the same concrete quality as the concrete element.

SUPPORTS OVER MEMBRANES: Prevent damage to waterproofing membranes or vapour barriers. Place a metal or plastic plate under each support to prevent puncturing.

SUPPORT SPACING: Not more than 60 diameters for bars and 750 mm for fabric.

6.8.4 Protective Coating

REQUIREMENT: Unless otherwise shown on the drawings, if an element is specified to contain protective coated reinforcement, provide the same coating type to all element reinforcement and embedded metal items including tie wires, stirrups and the like.

6.8.5 Lapping of Reinforcement

REQUIREMENT: Lapping of reinforcement or fabric shall be as required by standard AS 3600. In no case shall the lap length be less than 25 times the diameter of the reinforcement plus 150 mm.

6.8.6 Cleaning of Reinforcement

REQUIREMENT: At the time concrete is placed, reinforcement shall be free from mud, oil, grease and other non-metallic coatings and rust.

6.9 Placing

6.9.1 Placing and Compaction

STANDARD: To AS 3600.

GENERAL: All concrete shall be placed in dry conditions. No concrete shall be placed until the forms, reinforcing and foundations as applicable have been inspected and approved.

Place concrete in layers such that each succeeding layer is blended into the preceding one by the compaction process. Concrete exposed to rain before it has set, shall be protected by suitable covers.

HORIZONTAL MOVEMENT: Movement may be by means of suitable clean chutes, troughs or pipes. Do not use water to facilitate the movement.

VERTICAL MOVEMENT: In vertical elements, limit the free fall of concrete to 1500 mm per 100 mm element thickness, up to a maximum free fall of 3000 mm, by means such as enclosed chutes, access hatches in forms, and the like. As far as practicable keep chutes vertical and full of concrete during placement, with ends immersed in the placed concrete.

LAYERS: Place concrete in layers such that each succeeding layer is blended into the preceding one by the compaction process.

RAIN: Concrete exposed to rain before it has set, including during mixing, transport or placing, shall be liable to rejection.

COMPACTION: Use immersion and screed vibrators accompanied by hand methods as appropriate to remove air bubbles and compact the mix. Use form vibrators where the use of immersed vibrators is impracticable. Ensure concrete is fully compacted and entrapped air

removed, but avoid over vibration that may cause segregation. Do not allow vibrators to come into contact with partially hardened concrete, or reinforcement embedded in it. Do not use vibrators to move concrete along the forms.

PLACING RECORDS; Keep on site and make available for inspection a log book recording each placement of concrete including:

- Date
- The portion of work
- Specified grade and source of concrete
- Slump measurements
- Volume placed

6.9.2 Placing Schedule

REQUIREMENT: Minimise shrinkage effects by pouring the sections of the work between approved construction joints in a sequence such that there will be suitable time delays between adjacent pours.

The minimum periods between placing adjacent sections shall be as follows:

Description	Minimum Period (Days)
Adjacent pours abutting vertical construction joints in walls:	3
Adjacent pours abutting horizontal construction joints in floor or roof slabs:	3
"Pour Strips" and adjacent concrete:	3

6.9.3 Cold Weather Placing

REQUIREMENT: Maintain the temperature of the freshly mixed concrete within the limits shown in the following table. "Outdoor Air Temperature" shall apply to the air temperature at the time of mixing and to the predicted or likely air temperature at any time during the subsequent 48 hours:

Outdoor Air Temperature	Temperature of Concrete	
	Minimum	Maximum
Not less than 5o C	10° C	32° C
Less than 5o C	18° C	32° C

ADDITIVES: Do not use calcium chloride, salts, chemicals or other material in the mix to lower the freezing point of the concrete.

FROZEN MATERIALS: Do not allow frozen materials or materials containing ice to enter the mixer, and keep forms, materials and equipment coming in contact with the concrete free of frost and ice.

HIGH EARLY STRENGTH CEMENT: In severe weather conditions Type B high early strength Portland cement may be used, subject to approval, to enable the concrete to develop sufficient strength to permit formwork removal within the specified time, but not as a substitute for the heating of materials or for adequate protection of placed concrete against low temperatures. Do not use high alumina cement.

HEATING: Where so directed or permitted, heat the concrete materials, other than cement, to a temperature not greater than the minimum necessary to ensure that the temperature of the placed concrete is within the limits specified in this clause. The temperature of water shall be not greater than 60° C when it is placed in the mixer.

6.9.4 Hot Weather Placing

REQUIREMENT: The provisions of this clause shall apply to concreting when the surrounding shade outdoor temperature is greater than 32° C.

MIXING: Do not mix concrete when the outdoor shade temperature on the site exceeds 38° C, unless otherwise approved and then only subject to such conditions as may be imposed.

HANDLING: Take precautions to prevent premature stiffening of the fresh mix and to reduce water absorption and evaporation losses. Mix, transport, place and compact the concrete as rapidly as possible.

PLACING: Before and during placing maintain the formwork and reinforcement at a temperature not greater than 32° C by protection, cold water spraying, or other effective means. When placed in the forms, the temperature of the concrete shall not exceed the following:

Concrete Element	Temperature Limit:
Normal concrete in footings, beams, columns, walls and slabs	35°C
Concrete in large mass concrete sections or Concrete of strength 40 MPa or greater, in sections exceeding 600 mm in thickness	27°C

TEMPERATURE CONTROL METHODS: Submit for approval the proposed method or methods of maintaining the specified temperature of the placed concrete, which may include:

- Using chilled mixing water; or
- Spraying the coarse aggregate with cold water; or
- Covering the container in which the concrete is transported to the forms; or
- A combination of these methods.

6.10 Curing and Protection

6.10.1 Curing

STANDARD: TO AS 3600.

GENERALLY: Protect fresh concrete from premature drying and excessively hot or cold temperatures. Maintain the concrete at a reasonably constant temperature with minimum moisture loss for the curing period.

CURING PERIOD (from time of placing): Commence curing immediately after finishing, and cure continuously until the cumulative number of days or fractions thereof, not necessarily consecutive, during which the air temperature in contact with the concrete is above 10° C, totals not less than the following:

- For durability exposure categories A1 and A2: 3 days.
- For durability exposure categories B1, B2, and C: 7 days.

CURING METHODS: Submit for approval the proposed method of curing, which may include the following:

- Ponding or continuous sprinkling with water (moist curing – not for freezing conditions).
- An impermeable membrane.
- An absorptive cover kept continuously wet.
- Steam curing.
- An approved curing compound (not for hot weather curing).

CURING COMPOUNDS: To AS 3799. Do not use wax-based or chlorinated rubber-based curing compounds on surfaces forming substrates to concrete toppings, cement-based render and the like.

HOT WEATHER CURING: Immediately after placement cover the concrete with an impervious membrane, or hessian kept wet, until curing begins. As an alternative to immediate covering, where the temperature exceeds 25° C or where not protected against drying winds, protect the concrete with a fog spray application of aliphatic alcohol evaporation retardant.

VISUALLY IMPORTANT SURFACES: Produce uniform colour on adjacent surfaces by uniform curing methods.

6.10.2 Protection

LOADING: Protect the concrete from damage due to load overstresses, heavy shocks and excessive vibrations, particularly during the curing period. Do not place construction loads on self-supporting structures which will overstress them. Provide calculations to justify the adequacy of the structure to sustain any construction loads.

SURFACE PROTECTION: Protect finished concrete surfaces from damage from any cause, including mortar splashes and stains, timber stains, rust stains, chemical attack, additives, curing compounds, protective coatings, rain, running water, and the like.

6.11 Embedments Cores and Fixings

6.11.1 Fixings and Embedded Items

STANDARD: To AS 3600 Section 14.

SHOP DRAWINGS: If the locations of embedded items are not shown on the Drawings, or are shown diagrammatically, or if it is proposed to vary the locations shown, submit shop drawings showing the proposed locations, clearances, cover, and the like.

STRUCTURAL INTEGRITY: In locating embedded items, do not cut or displace reinforcement, or cut hardened concrete, unless prior approval has been obtained.

TOLERANCES ON PLACEMENT: Maximum deviations from correct positions:

- Embedded items generally: Plus or minus 10 mm.
- Fixings, anchor bolts and the like: Plus or minus 3 mm.
- Fixings and embedded items in precast units: To AS 3610 Table 3.4.3 and AS 3850.1 Clause 6.4 as applicable.

6.11.2 Protection Of Fixings

REQUIREMENT: For all embedded and inserted ferrous fixings (other than stainless steel), provide galvanised surface coating passivated by dipping in 0.2 percent sodium dichromate solution.

Threaded fastenings: To AS 1214

Structural sections: To AS 1650

6.11.3 Inserted Fixings

LIMITATION: Use fixings inserted by drilling (including masonry anchors and the like), or by explosive tools, only if specified or approved.

All masonry anchors shall be stainless steel chemical anchors.

6.12 Underlays and Membranes

6.12.1 Concrete Working Base/Blinding Slab

MATERIAL: Where specified on the drawings provide 15 MPa concrete to all structures. Lay over the base or subgrade and screed to the required level.

THICKNESS: 50 mm

FINISH: Where required to support a membrane, wood float finish or equivalent.

SURFACE TOLERANCE: ± 5 mm from the correct plane, ± 5 mm from a 2 m straight edge.

6.13 Joints

6.13.1 Construction Joints

REQUIREMENT: Make construction joints where shown on the Drawings. Do not relocate or eliminate a construction joint without prior approval of the Principal Authorised Person.

Before fresh concrete is placed at construction joint, the Contractor shall roughen and clean the hardened concrete surface of the joint so that all loose or soft material, free water, foreign matter and laitance is removed. Just prior to placement, the Contractor shall dampen the hardened concrete surface and apply thick slurry of cement-water to a depth of 5 mm.

Unless otherwise shown on the Drawings or specified, the Contractor shall butt join the surfaces of adjoining pours. In visually important surfaces, the Contractor shall make the joint straight and true, and free from impermissible blemishes relevant to its AS 3610 Class or Type.

6.13.2 Movement Joints

REQUIREMENT: Construct movement joints in the locations and to the details shown on the Drawings.

The following movement joint types are defined:

- **Contraction joint:** An unreinforced joint with a bond-breaking coating separating the concrete joint surfaces.
- **Expansion joint:** An unreinforced joint with the joint surfaces separated by a compressible filler and typically with joint sealant on the exposed surfaces.
- **Control joint:** A weakened plane Contraction joint created by forming a groove, extending at least one quarter the depth of the section, either by means of a grooving tool, by sawing, or by inserting a premolded strip.
- **Isolation joint:** A joint without keying, dowelling, or reinforcement, which imposes no restraint on movement in any plane.

6.13.3 Joint Dowels

REQUIREMENT: Where shown on the Drawings, the Contractor shall provide structural grade plain round bars in expansion and Contraction joints, of the sizes shown. Unless specified otherwise, the dowel bars shall be hot dip galvanised after friction cutting to length. The Contractor shall embed each dowel normal to the plane of the joint, so that half the dowel lies on each side of the joint.

The concrete face cast first, except the recess surfaces as detailed above, and protruding dowels shall be painted with two coats of a bitumen based paint to give a minimum dry film thickness of 400 microns prior to the casting of the adjoining concrete. The Contractor shall fit an expansion cap to the protruding end of the dowel.

6.13.4 Joint Filling

REQUIREMENT: Joints that are to be filled shall be constructed as shown on the Drawings. The joints shall be made by forming the concrete on one side of the joint and allowing it to set before concrete is placed on the other side of the joint.

The recess for later application of joint sealant shall be formed by accurately shaped formers of timber or other approved material and the concrete shall be particularly well compacted around and underneath the former when adjacent concrete is being placed so that no honeycombed or uncompacted concrete occurs in this location.

Placement of sealant shall not be carried out until all concrete construction is completed. The recess former shall be left in place until preparation of the recess prior to joint sealing is commenced. The recess surfaces shall be cleaned thoroughly, given one coat of approved primer and the recess filled with the approved sealant in accordance with the manufacturer's directions. Recess surfaces shall be kept free of bituminous paint unless the approved sealant is compatible with such paint.

SEALANTS: Internal joint sealants shall be "Conseal CS 231" or approved equivalent with an approved self-adhesive bitumen tape externally "Geofabrics Bitac" or approved equivalent. Installation is to be in accordance with the manufacturer's instructions. Details of the joint sealant and method of placing shall be submitted to the Principal Authorised Person for acceptance before delivery of any materials to the site. Any subsidence of the filler after testing of the structure shall be made good so that all recesses are completely filled to the specific depth or if none is specified then flush with the adjacent concrete surface.

6.13.5 Waterstops

REQUIREMENT: Where shown on Drawings supply and install a waterstop in the nominated position. The waterstop shall be:

- A hydrophilic rubber sealing strip such as Hydrotite RS-0723-3.51 or similar which shall be adhered to the first cast concrete face in accordance with the manufacturer's written instructions prior to the mating concrete section being cast.

6.13.6 Jointing Materials

REQUIREMENT: Use jointing materials, including sealants, mastics, primers, gaskets, compressible fillers, joint covers and the like, of the types shown on the Drawings in accordance with the written instructions of the material manufacturers for the location and type of joint, compatible when used together, and non-staining to concrete in visible locations.

6.14 Integral Finishes

6.14.1 Tolerance Classes for Finishes as Laid

CLASSES: Tolerance classes determined by a straight edge placed anywhere on the surface in any direction.

CLASS A: Maximum deviation from a 3 m straight edge: 3 mm.

CLASS B: Maximum deviation from a 3 m straight edge: 6 mm.

CLASS C: Maximum deviation from a 600 mm straight edge: 6 mm.

6.14.2 Finishes As Laid

SCREEDING: Finish slab surfaces by approved means to finished levels. In the absence of any other requirements produce surfaces to Class B.

STEEL TROWELLED FINISH: After screeding, produce the final finish with steel hand trowels, free of trowel marks and uniform in texture and appearance.

WOOD FLOAT FINISH: After screeding, produce the final finish with a wood float.

INTEGRAL FINISH SCHEDULE: Provide the following finishes: Not applicable

6.14.3 Scabbled Surface Finish

REQUIREMENT: A fully scabbled concrete surface shall consist of a complete surface intentionally roughened to a full amplitude of 5 mm and shall be clean and free from laitance to the Principal Authorised Person's approval.

6.15 Concrete Protection

6.15.1 Surfaces to be Coated

SCHEDULE: The internal concrete surfaces of the following structures shall be epoxy coated to prevent attack from wastewater and vapours and gases emitted from the wastewater:

- *Nil – Not applicable.*

The above areas, and any further areas indicated on the Drawings shall be coated with a minimum two coats of two component solvent free epoxy paint system such as "Epirez Supatuff HD" or approved equivalent. Application of the epoxy painting system, including surface preparation, shall be strictly in accordance with the manufacturer's written instructions. Where the structure is required to undergo a test for water retention, this shall be conducted prior to application of the epoxy system.

6.15.2 Preparation for Coating

REQUIREMENT: Light sand blast or acid wash to break up surface laitance and expose concrete matrix. Bag off and fill holes with a non-shrink grout equal to Epirez 633 to form a completely solid background for coating as required. Lightly scabble with a wire brush to remove unsound and excess bagging.

6.15.3 Coating

COATING: Epirez Supatuff HD (colour White) or approved equivalent.

REQUIREMENT: Prime the surface using “Epirez Epoxy Primer Sealer 123” or approved equivalent as per manufacturer’s recommendations.

6.15.4 Manufacturer’s Instructions For Coating

REQUIREMENT: Surface preparation, application, curing times etc. for the above products shall be in strict accordance with the manufacturer’s written instructions. Control of moisture and temperature level is particularly drawn to the Contractor’s attention.

6.15.5 Protection of Exposed Reinforcement

REQUIREMENT: Reinforcement exposed by the works will be protected by the application of 10 mm Nitomortar EL-HB prior to the application of other finishes.

Nitomortar shall be stored, mixed and applied in accordance with the manufacturer’s specification. The manufacturer’s specifications and method statements in regards to preparation and priming of the surface with Nitobond EP Primer shall be followed.

6.16 Project Specific Special Requirements

All works shall be designed in accordance with the following requirements.

- *Nil – Not applicable.*

6.16.1 Earthworks

Refer to the section titled Excavation and in Siteworks in Section 4 of this Specification.

Backfill and compact around the structures evenly so that any “out-of-balance” loads do not overstress the structures or damage joints/water-tightness.

6.16.2 Excavation

Refer to the section titled Excavation and in Siteworks in Section 4 of this Specification.

6.16.3 Tolerances – Wet Well

Every care should be taken by the Contractor to ensure that the pump well shaft remains vertical while being installed. Should the well tilt exceed 1 in 120 the Contractor shall correct the tilt with methods approved by the Principal Authorised Person.

6.16.1 Control of Uplift Pressures

The Contractor shall ensure that no uplift pressure is developed during construction.

To assist in relieving hydrostatic uplift pressures during construction, the structures shall be placed on a sub-base consisting of approved crushed aggregate, the sub-base being connected to the dewatering system.

The base and the lower section of well shall be constructed as a single unit. The Contractor shall ensure that adequate dewatering equipment is operating and shall maintain standby equipment ready in position to ensure that no uplift pressure is applied to the floor of the pump well.

6.16.2 Watertightness of Structures

REQUIREMENT: Following the sealing of the structures all refilling shall be completed and any external dewatering system stopped. All water retaining structures and roofs constructed of concrete shall be tested for watertightness in accordance with Section 7 of AS 3735. Testing of such structures shall be undertaken prior to backfilling against the structure.

Testing shall consist of filling the structure with water to its maximum design level and maintaining this level for at least 7 days. The rate of filling shall not exceed 2 m in 24 hours, nor shall the rise be greater than 0.25 m in any hour, unless otherwise directed by the Principal Authorised Person.

Water for the initial testing is available on site, free of charge, from The Principal service connection to the existing pumping station site. The flow is limited to the capacity of the service.

Prior to testing for watertightness all pipelines and penetrations shall have been completed by the Contractor.

During the 7 day test period, the total permissible drop in level, after allowing for evaporation and rainfall (if the test is made for an unroofed structure) shall not exceed $1/500^{\text{th}}$ of the average water depth of the tank or 10 mm whichever is the lesser. Any cracks, leaks or other defects identified during testing will be made good by the Contractor at its cost. Upon completion of remedial works the structure will be retested as detailed.

The structures shall dry internally for a period of three days prior to fitting out with pumps and pipework.

7. Pipework

7.1 Scope

SPECIFIED IN THIS SECTION: This section of the Contract shall include, but not be limited to, the provision of all plant, labour and materials of whatever kind necessary for the installation, testing, and commissioning of pipeworks, as shown on the drawings, necessary under this Contract. The pipeworks include:

- Installation of a new rising main from the Betts Street SPS valve pit to the Sewage Treatment Plant Inlet Works.
- Associated minor pipework and decommissioning of pipelines.

7.2 Standards

REFERENCED DOCUMENTS: The following standards are referred to in this section. All works shall be undertaken in accordance with these standards:

Water Services Association of Australia

- WSA 04 **Sewage Pumping Station Code of Australia** Version 3.1 (2022)
- WSA 01-2004 Polyethylene Pipeline Code 2004 Version 3.1

Australian Standards

- AS 1281 Cement Mortar Lining of Steel Pipes and Fittings
- AS 1289 Methods of Testing Soils for Engineering Purposes
- AS 1315 Portland Cement
- AS 1326 Polyethylene (Polythene) Film for Packaging for Allied Purposes
- AS 2033 Installation of Polyethylene Pipe System
- AS 2129 Flanges for Pipes, Valves and Fittings
- AS 2280 Ductile Iron Pressure Pipes and Fittings
- AS 2566.1 Buried flexible pipelines – Part 1, Structural Design
- AS 2566.2 Buried flexible pipelines – Part 2, Installation
- AS 2638 Sluice Valves for Waterworks Purposes
- AS 2758 Aggregate and Rock for Engineering Purposes
- AS 3725 Loads on Buried Concrete Pipes
- AS 3902 Quality Systems for Production and Installation
- AS 4038 Precast Concrete Pipes
- AS/NZS 2566 Buried Flexible PipelinesAS/NZS 4130 Polyethylene Pipes for Pressure Pipes and Fittings

7.3 General Requirements

METHOD: Install the pipework in a safe manner, without interfering with or damaging adjacent pipework or structures, using methods complying with the requirements of appropriate Standards for materials, construction, fabrication and installation.

LOCATIONS, LEVELS AND DIMENSIONS: Construct the pipework to the locations, levels and trench depths specified and shown on the Drawings, and listed in the Specification.

VARIATION DRAWINGS: If it is proposed to change the installation from that shown on the drawings, or if a change is required by a Regulatory Authority, prepare and submit a variation drawing showing the proposed change, and obtain prior written approval from the Principal Authorised Person.

7.4 Quality Assurance

REQUIREMENT: Where there is a recognised quality assurance program applicable to a specified product, provide assurance of product quality under the authority of that program. The program shall be one in which the manufacturer has in place a quality control management system which is subject to continual monitoring through quality audits by a recognised independent organisation.

Provide test certificates prepared by an independent testing authority to show that materials comply with the relevant standards.

7.5 Pipework Assembly Drawings

REQUIREMENT: Submit all pipework assemblies in detail on fabrication drawings for acceptance prior to fabrication and installation. The drawings shall include set-out dimensions, pipe inverts/centreline levels, valve and fitting details, supports/anchors, coating/wrapping details, joint details, etc. No pipework shall be installed without the prior approval, in writing, of the Principal Authorised Person.

7.6 Inspection

NOTICE AND HOLD POINTS: Refer 1.3:

7.7 Joints

Unless indicated otherwise on the drawing pipe joints shall comply with the following:

7.7.1 Flanges

PRODUCT: Grey cast iron full face flanges either integral or screw-on type. Screw on flanges shall only be attached to flange class pipe.

TABLE: Table PN16 of AS 4087.

WEEP FLANGES: Shall be designed to transmit a thrust equal to the force due to the test pressure acting on the equivalent of a closed ended pipe or valve to the thrust block or pipe anchor.

SLIP FLANGES: Shall be manufactured from steel plate or cast iron to dimensions set out in Table PN16 of AS 4087.

UNIFLANGES: "Uniflange" joints shall be supplied complete with rubber gasket, nuts, bolts, washers and set screws. The joints shall be designed to specifically match the outside diameter of the pipe being joined.

BOLTS, NUTS AND WASHERS: To be stainless steel, unless otherwise specified in the Design Drawings.

FLANGE FACES: To be machined.

7.7.2 Jointing Rings and Gaskets

PRODUCT: Rubber rings and gaskets for joints.

STANDARD: To AS 1646.

FOR POTABLE WATER PIPEWORK: Natural rubber.

FOR SEWERAGE PIPEWORK: Synthetic rubber.

7.8 Handling

HANDLING: Use slings or forks supporting the barrel of pipes when handling pipes during storage and delivery.

Keep lifting hooks, slings or forks clear of joint surfaces at pipe ends.

Handle pipes in a manner which prevents contact with each other or hard parts of equipment.

Place suitable packing between pipes placed close to other pipes or where pipes are stacked more than one pipe high.

Do not drop or push pipes with mechanical equipment.

UNLOADING AND STACKING: Use cranes or forklift trucks when unloading and stacking pipes and fittings.

Under no circumstances unload pipes or fittings by rolling or dropping.

Any pipes or fittings which have been rolled or dropped shall be rejected immediately and removed from the site whether damage is obvious or not.

COATINGS: Support coated fittings on padded supports approved by the Principal Authorised Person.

Make good or repair any damage to pipes, fittings, coatings or linings.

7.9 Identification

PIPEWORK: Supply pipes which, after lining and coating (if applicable) have been clearly stencilled by the manufacturer with an identifying mark indicating:

- The manufacturer's name or registered mark.
- The date of manufacture.
- The nominal size of the pipe.
- The class of pipe or factory test pressures if applicable.
- All other information to comply with the provisions of the relevant Australian Standard.

FITTINGS: Supply fittings which, after lining and coating, have been clearly stencilled by the manufacturer with an identifying mark indicating:

- The manufacturer's name or registered mark.
- The nominal size of the fitting and the fitting identification.
- The class of pipe or factory test pressures if applicable.

7.10 Clearing and Grubbing

PRIOR INSPECTION: No clearing shall be undertaken until a joint inspection by the Contractor and Principal Authorised Person has been carried out and the limits of the clearing have been determined.

TREES: Trees whose trunks are located within 1.5 metres of the centreline of any pipeline or that in the opinion of the Principal Authorised Person are likely to damage or obstruct the works in any way, shall be root-felled and grubbed and removed from the site. Seek the approval from the Principal Authorised Person prior to the removal of any trees or shrubs. Holes made by grubbing or otherwise shall be filled with sound material in a manner approved by the Principal Authorised Person.

UNAUTHORISED CLEARING: Make good the loss or damage to trees, shrubs and other vegetation cleared beyond the limits stated in sub-clause TREES. For the purpose of determination of compensation in road and other reserves, the responsible Authority shall be the relevant Municipal Council and/or Road Construction Authority.

DAMAGE TO TREES: If in the opinion of the Principal Authorised Person the cutting of roots or branches has caused any tree to become a danger, it shall be root-felled, grubbed and removed from the site and no additional payment will be made for this work. Such work shall be included as emergency works as defined by the General Conditions of Contract.

Should trees be damaged the damaged portions shall be cut neatly and the trimmed portions removed from site.

7.11 Diverting Water and Dewatering

DIVERT WATER: Divert water which the Principal Authorised Person considers may interfere with the progress of the works.

Keep the excavations free from water while the works are in progress and prevent injury to the works by water due to floods or other causes.

Dispose without nuisance or damage to adjacent works and/or property, of water removed from the works.

EQUIPMENT: Equipment operating beyond normal working hours shall be driven by electric motors to ensure minimum noise level. The equipment shall be operated 24 hours per day and diesel stand-by units shall be kept on site which shall immediately be placed in service as the driver in the event of any interruption to power supply or failure of motor.

Install sound attenuation such as hay bales around pumps to minimise noise levels.

SAND TRAPS: Provide, where directed, extensions to the discharge line of each pump and sand traps to discharge lines to prevent the deposition of sand in street channels and stormwater drains.

WATER DAMAGE: When directed by the Principal Authorised Person take up and replace any work or material damaged by water.

7.12 Diverting Sewage

GENERAL: During the construction of the works and until their completion execute all works required to prevent injury to private property or to existing or new works by sewage and/or septic tank effluent and arrange for its diversion to the satisfaction of the Principal Authorised Person.

COSTS: The cost of all work required by clause DIVERTING SEWAGE is to be included in the amount in the Schedule of Prices.

7.13 Road Reserves

REQUIREMENTS: Arrange the program and construct works within road reserves in accordance with the requirements of the responsible road authority.

COSTS: The cost of all work required by clause ROAD RESERVES is to be included in the rates of the Schedule.

7.14 Excavation

GENERAL: Excavation shall be performed by either trenching (open cut) or trenchless technology to the lines and grades shown on the Drawings or directed by the Principal Authorised Person. Shafts, drives, tunnels and maintenance hole excavations shall have vertical sides. Trenches shall have vertical sides unless otherwise approved by the Principal Authorised Person. In no case shall the clear width of vertical sided trenches, shafts, drives and tunnels be less than or exceed by more than ten per-cent the clear width nominated on the drawings for the relevant nominal diameter of sewers or rising main. Where shoring is required to secure the sides of trenches, shafts, drives and tunnels the clear width shall be taken to be the distance between the shoring supports. Unless otherwise approved the shoring for maintenance hole excavations shall be installed as the excavation proceeds and will form part of the external formwork for the maintenance hole. There shall be no excavation beyond the shoring.

SITE SPECIFIC REQUIREMENTS: Excavation of pipeline and conduit trenches must be carried out so that topsoil is stockpiled separately to material below the topsoil layer. Material below the topsoil layer may be used for trench refilling if approved by the Principal Authorised Person. Only topsoil removed and stockpiled from the trenching site shall be used for topsoiling. Do not blend topsoil with excavated trench material.

CLEAR DISTANCE: The clear distance between pipe socket and trench, drive or tunnel wall or shoring support shall not be less than 200 mm.

SAFETY: Ensure that excavations are rendered secure and safe by means of shoring, props, wedges, packaging and/or caulking. No material shall seep, run, fall in or be removed beyond the dimensions specified. Provide and execute all measures necessary to prevent the movement of this material and provide and have in constant readiness all appliances and materials such as straw, bags, asphalted felt, tarred gasket, et cetera to close up and pack all joints and open spaces wherever they occur.

Attend to and execute and maintain shoring, et cetera, until the completion of the work. Remove material that has caved into the excavation.

GROUND STABILISATION: Where necessary due to the ground conditions and/or the proximity of structures or other works adopt forms of ground stabilisation most suitable to conditions encountered and be responsible for their effectiveness in averting damage, injury and collapse of trench, shaft, drive or tunnel. The selected form of ground stabilisation shall not in any way restrict or prevent the specified inspection and testing of pipelines and be such that refilling is in conformity with this Specification. Where the water table during construction is located above the bottom of the trench use a system of

trench support based on pre-driven interlocked sheeting or other system approved prior to construction by the Principal Authorised Person.

The adopted form of ground stabilisation for each machine shaft for power boring shall be installed prior to the commencement of boring.

PRECAUTIONS: Throughout the whole of the work take precautions against accidents, et cetera, whether arising from failure to stabilise the ground by shoring or other means, bad workmanship, breakage of machinery or plant, inadequate caulking or packing, floods or other cause whatsoever. Be responsible for damage, injury or loss that may be occasioned during the progress of the work, to structures and other things above or adjacent to the work, to persons employed by the Contractor, by the Principal or otherwise, to the general public or to the Contractor's own or other works.

SPECIAL PRECAUTIONS: Take measures to protect the integrity of existing structures at all times. Ensure that any incident that causes damage to or reduces the integrity of existing structures is reported to the Principal Authorised Person immediately.

If the Principal shall suffer any expense by reason of such damage, injury or loss, in addition to any other rights the Principal may have, the Principal may deduct the amount of such expense from any moneys due to the Contractor.

CLEAR DISTANCE: Leave a minimum clear distance of 1.0 m or as directed between the edge of any excavation and the inner toes of the spoil banks. No fine or coarse aggregate, cement or other material shall be stacked within one metre of the edge of excavations. No excavated materials shall be stacked against the walls of buildings or fence without the written permission of the owner of such building or fence.

DISPOSAL OF SPOIL: The disposal of surplus spoil from the excavations shall be the responsibility of the Contractor and approved by the Principal Authorised Person.

DHAND EXCAVATION: Where the construction of works under this Contract by mechanical equipment could cause damage to any adjacent building, works or services carry out such operations by hand. No additional payment above the rates in the Schedule will be made for this hand work.

CONSTRUCTION OVER EXISTING: Where a pipeline is to be constructed over an existing pipeline of diameter greater than 600 mm, then prior to laying the pipeline excavate by hand to the invert of the existing pipeline for a width of 300 mm minimum each side of that pipeline for at least the full width of the trench. The Contractor shall then backfill this excavation with fine crushed rock, placed and compact in 250 mm (maximum) thick layers up to the bottom of the section type supporting the pipeline and properly and carefully compact the material to the satisfaction of the Principal Authorised Person.

OVER EXCAVATION: Should excavation occur below the depth for the required section type, refill as directed by the Principal Authorised Person to the correct depth. Where the over-excavation does not exceed 250 mm approval may be given, to refilling with fine crushed rock conforming to the grading limits set out below, compacted in 75 mm layers. Even for this extent of over-excavation if directed by the Principal Authorised Person, and for greater depths of over-excavation in every case, refill with mass concrete.

Sieve Size	Percentage Passing (By Mass)
9.5 mm	98-100
6.7 mm	50-100
4.75 mm	15-75
No. 7 (2.36 mm)	0-40
No. 14 (1.18 mm)	0-5

BLASTING: Blasting will be permitted subject to the approval of the Principal Authorised Person who shall have the right to limit the sizes of the charges used and to fix the hours of the day or night within which blasting may be carried on. Before using any explosives the Contractor shall comply with all statutory requirements.

The Contractor shall be wholly responsible for any damage to life or property and shall take at his sole risk every precaution. Approved means shall be employed to effectively and thoroughly prevent any stones and other materials from being thrown out of a trench or shaft. The Contractor shall give, to the requirements of the Principal Authorised Person and proper authorities, sufficient warning to the general public and workers when blasting operations are in progress.

Prior to commencing any concrete work against rock faces, remove all soft, shaken or loose rock and ensure rock surfaces are washed and wetted.

DIRECTIONAL BORING: Where shown on the drawings or ordered by the Principal Authorised Person excavations shall be carried out by directional boring and, unless otherwise approved, will be restricted to locations with suitable ground conditions.

Submit to the Principal Authorised Person with the Program of Work the name and relevant details of the firm nominated to undertake the directional boring. The Principal Authorised Person reserves the right not to approve any nominated firm.

Machine shafts shall have vertical sides, comply with the requirements of the General Specification and be the minimum size nominated by the firm undertaking the directional boring.

The auger size shall be the minimum suitable for the diameter and material of the specified pipes to be laid in the bore and the approved method for refilling with sand-cement slurry.

Prior to excavation of machine shafts locate all existing underground utilities that cross or are within 1.5 m of the centreline of the bore.

A pilot bore will be completed and checked for line and level and:

- (i) If the Principal Authorised Person determines that the pilot bore complies with the tolerances of this General Specification then drilling of the full diameter bore may proceed.

OR

- (ii) The Principal Authorised Person determines that the pilot bore does not comply with the tolerances of this General Specification then a second pilot bore will be drilled and be subject to the requirements of (a) above.

Should the second pilot bore fail to satisfy the requirements of (a) above the Principal Authorised Person shall direct the alternative method of excavation to be used.

Following the laying, jointing and testing of the pipeline the annulus between the pipes and the bore shall be filled with sand-cement slurry placed using a pump or other approved method.

The rates in the Schedule for works associated with directional boring include the entire cost of excavation and refilling of machine shaft(s) and drilling of pilot bore that complies with the tolerances for line and level and disposal of spoil and the cost of drilling full diameter bore to the tolerances above, disposal of spoil, laying, jointing and testing of pipe and supply and refill annulus with sand-cement slurry placed by pump.

7.15 Laying and Jointing of Sewers and Branch Sewers

Not Applicable - Deliberately left black

7.16 Laying and Jointing of Pressure Mains

GENERAL: Laying and jointing of each section of a pressure main shall proceed as soon as possible after excavation of that section. In no case shall any main be laid more than 150 m behind the trench excavation in urban areas or more than 300 m in undeveloped areas. Pipes, valves and fittings shall be of the diameter, type and class shown on the drawings, or directed by the Principal Authorised Person and have thoroughly clean barrels and jointing faces. The maximum divergence at any point from the line or level shown on the drawings, or directed by the Principal Authorised Person, shall not exceed 10 mm. Where joints are required to be deflected to meet the requirements of the drawing (and in particular to follow a design curve) the deflection shall be equally distributed over all joints and shall not exceed the manufacturer's specified maximum deflection per joint.

The Principal Authorised Person, or the Project Supervisor, shall check each section, after the placing of the specified section type but prior to the water test using a dumpy level, string line et cetera, and no section will be accepted that does not comply with the above tolerances.

CURVED PRESSURE PIPELINE: Bending of pipes shall not be permitted. Bends in the pipeline shall only be made through joint deflection or proprietary bends.

CUTTING PIPES: Where it is necessary to cut a pipe or fitting, before jointing, it shall be cut with either a saw in a mitre box or an approved mechanical cutter and the cut shall be perpendicular to the longitudinal axis of the pipe or fitting. Spigots shall be chamfered before jointing with an approved chamfering tool.

SEALING PRESSURE MAINS: Seal open end sections of pressure mains, when work is not actually in progress, with gibault blank ends to prevent the ingress of stormwater, animals, rubbish or other foreign matter. Hessian bags or similar shall not be used to block open ends.

TIGHTENING BOLTS: Ensure even pressure on bolts is applied when tightening flanged and gibault joints.

JOINTING: Pressure main pipes shall be jointed with flexible ring joints or gaskets as supplied for the particular pipe used. The valves and fittings shall be jointed in accordance with the details shown on the drawing(s).

The rings and gaskets shall be inspected for flaws before making each joint and the Contractor will be responsible for remaking, at his own expense, any joint that proves unsatisfactory for any reason.

DENSO WRAPPING: Following the satisfactory completion of the field pressure test(s) clean all buried gibault, flanged and welded joints, tapping saddle bolts and nuts and valve stuffing boxes and the like in accordance with AS CK9 and wrap with Denso 300 Primer, 400 Mastic, 500 tape, 901 overwrap and 930 self-adhesive tape applied in accordance with the instructions of the manufacturer, Denso (Australia) Pty Ltd. Overlap shop coatings by 100 mm.

DICL PIPE WRAPPING: Wrap all buried DICL pipework with approved polyethylene sleeving and in accordance with the manufacturer's written instructions and AS 3681.

DETECTABLE MARKER TAPE: Detectable marker tape shall be installed above all non-metallic pipelines, on top of the embedment zone or 1 m below the surface and directly above the centreline of the pipeline. The marker tape shall be attached to metal surface fittings to provide connection points for tracking.

7.17 Pipe Anchorages

INSTALLATION: Install anchorages constructed from concrete at all bends, tees valves, ends and elsewhere shown on the Drawings and to the dimensions shown on the Drawings or nominated by the Principal Authorised Person.

POURING: Construct concrete thrust anchorages by pouring the concrete anchorage against the prepared face of the adjacent soil, which shall be vertical and free of all loose, cracked or other unsuitable material and to the approval of the Principal Authorised Person or his representative.

UNSUITABLE SOIL FACE: Where, in the opinion of the Principal Authorised Person, it is not possible to pour concrete against a suitably prepared vertical soil face, form up and pour the anchorage so as to provide a vertical concrete face and fill the intervening space between the concrete face and the adjoining soil with approved selected refill mechanically compacted to not less than ninety-five percent (95 percent) of maximum dry density. Prepare the adjoining soil by removing all loose and other inferior material and prepare and slope this face to the approval of the Principal Authorised Person.

7.18 Embedment Types (Bedding, Haunching and Pipe Overlay)

GENERAL: The embedment types indicate the proposed method of support or protection of the pipes and may be shown on the typical trench cross sections or directed by the Principal Authorised Person on site. The type may be varied at any time during the currency of the Contract.

EMBEDMENT TYPES: Consists of a prepared bedding and support material placed in accordance with the details shown on the drawing. The material shall be 7 mm nominal clean metal or approved fine granular material. The approved fine granular material grading shall be such that 100 percent passes a 6.7 mm sieve and not more than 5 per cent passes 0.15 mm sieve.

Where the material in the bottom of the trench does not satisfy the above requirements, the trench bottom shall be excavated to the depth, specified on the drawing, below the underside of the pipe. The rates in the Schedule shall include excavation below the underside of the pipe where necessary, and the placing and compaction of the imported approved fill and the placing and compaction of the material.

7.19 Refilling

SELECTED REFILL: Shall be soil that is free from clay lumps retained on a 75 mm sieve and stones retained on a 25 mm sieve and be to the approval of the Principal Authorised Person. Where non clayey soil is available it shall be used in preference to clayey soil. The soil shall be either excavated from the works or, where insufficient suitable soil is available, imported.

Imported selected refill shall comply with the above requirements. The selected refill shall be carefully packed and rammed solidly in layers not exceeding 100 mm thick at the sides and over the pipes, as indicated on the drawings, with spades and other approved tamping tools.

ORDINARY REFILL: Shall comprise the material excavated from the works. Where, in the opinion of the Principal Authorised Person, this material is not considered satisfactory for use as ordinary refill the Contractor shall be required to refill above the normal limit of the selected refill with selected refill or sand refill as directed.

IMPORTED SELECTED REFILL AND SAND REFILL: Shall be material, which in the opinion of the Principal Authorised Person, it is necessary to load onto trucks and transport to or adjacent to the point of use.

The rate in the Schedule for "Excavation and Refilling of Trenches, etc." will include the cost of supply and dumping refill material adjacent to the point of use of the imported material. The basis of measurement shall be the compacted volume placed. No additional payment will be made for the disposal of surplus spoil caused by the works being refilled with other than ordinary refill.

REFILL PROCEDURES: Ordinary refill in trenches and shafts may be placed with the aid of mechanical plant, but care must be taken to ensure that the material is not dumped into the trench or shaft, and that no rock shall be placed until the pipes are covered by at least 600 mm of ordinary refill.

Submit to the Principal Authorised Person for approval, prior to commencement of excavation for any drive or tunnel, details of the method of placing and compacting the refill.

When directed supply and install polyethylene pipes or similar along the roofs of drive and tunnel to facilitate the placing by pump of sand-cement slurry in the space above the refill and until it is filled to the satisfaction of the Principal Authorised Person. The whole of the cost of supply and placing of sand-cement slurry shall be included in the rates in the Schedule.

CONCRETE AS SECTION PART: Where concrete is placed as part of the section type, the maximum depth of ordinary refill placed within five days of construction shall not exceed 1.5 m.

REFILL COMPACTION: Except where Council or other Authorities requirements differ, achieve the following standards for compaction for the full depth of refilling. The Contractor will arrange all necessary compaction testing to be performed by an approved NATA registered testing body.

MINIMUM REQUIRED COMPACTION OF REFILL (AS 1289 - E1.1 AND E4.1)

Location	Compaction (Percent of Maximum Dry Density)	Compaction Test Frequency
Easements within properties	90	1 test per 250 m of pipeline
Under future or existing footpaths	95	1 test per 50 m
Road crossings and road shoulders	98	3 per crossing or 1 test per 50 m of pipeline
Generally in road reserves	90	1 test per 100 m of pipeline
Pump Station	95	4 minimum or 1 per 10 m ³ of refill

The Contractor shall schedule compaction testing and relevant approvals so as not to delay the progress of the works.

COST OF COMPACTION TESTS: The cost of compaction testing to the specified frequencies shall be included in the relevant rates in the Schedule for excavation and refilling, etc.

Failed tests will be repeated at the Contractors expense.

Additional testing ordered by the Principal Authorised Person in excess of the specified frequency shall be paid at a rate approved by the Principal Authorised Person and issued in a Variation.

OVER EXCAVATION: Over excavation at pipes and other concrete structures shall be refilled as directed by the Principal Authorised Person with concrete and/or compacted Base Class A fine crushed rock or compacted sand refill. No additional payment will be made for costs associated with over excavation.

CLAY (CUT-OFF BULKHEADS) PUDDLE DAMS: Where shown on the Drawings or directed by the Principal Authorised Person, refilling shall include the supply of approved clay and installation of clay puddle dams across the trench. Payment for this work shall be made in accordance with the rates in the Schedule.

ALLOWANCE FOR SETTLEMENT: Prior to the issue of the Certificate of Practical Completion and irrespective of the pipelines being in service, the surface of refilled trenches and shafts other than paved surfaces shall, be sufficiently high as necessary to allow for settlement and surplus soil shall be removed and/or spread neatly as directed. The surfaces shall be maintained throughout the construction and defects liability periods and including making good any sinkings in the surfaces.

Any additional material that may be necessary for this purpose shall be provided by the Contractor. Excess refilling shall be dressed off and removed prior to the end of the defects liability period.

STOCKPILE AREAS: The walls of buildings or fences against which spoil has been stacked shall, following the removal of the spoil, be restored to a condition equal to that existing prior to the stacking of spoil.

DEWATERING: Dewatering systems shall be operated during the refilling of trenches, tunnels, drives or shafts so that no refill material is placed under water.

REMOVAL OF SHORING: Removal of shoring systems for trenches, tunnels, drives or shafts shall be carried out in the following manner:

- (a) No strut, waling or other support shall be removed until the level of compacted refill has reached the level of the strut, waling or other support.
- (b) No sheet piles shall be removed until the level of compacted refill is within 600 mm of the surface.
- (c) The removal of trench shields shall be undertaken by a series of vertical lifts. A minimum depth of 600 mm of compacted refill shall be placed within the shield before each lift. A shield shall not be removed from the trench until the compacted refill within the shield is within 600 mm of the surface.
- (d) Where removal of the shoring system may endanger the works or any buildings or other works, the Contractor shall not remove the shoring system.
- (e) The Contractor shall ensure that the works are not disturbed during the withdrawal of the shoring system.
- (f) Following the placing of selected refill over pipes in tunnels and drives, they shall be filled to the roof level with selected sand refill placed by mechanical means. Tunnels and drives shall then be further refilled with a sand-cement slurry which complies with Part 2 of this Specification. This slurry shall be introduced either under head or pumped until all voids are filled for the full length of the tunnel or drive. If pre-mix trucks are used, all trucks shall be on-site before pouring commences. Adequate provision (up to 50 percent excess) shall be made for loss of water during the pour. Payment for this slurry refill shall be included in the scheduled rates for select refill in tunnels and drives.

COSTS OF SHORING: The whole cost of supply fixing and withdrawing of the shoring system and of the shoring system left in place to secure the works and adjacent things shall be included in the rates in the Schedule for "Excavation and Refilling of Trenches, etc."

IMMEDIATE REFILL: When directed by the Principal Authorised Person immediately refill that portion of the works whether previously tested or not. Such refilling shall not relieve the Contractor of his responsibility for obtaining a satisfactory test.

POWER BORED PIPELINES: Following the completion of power boring of pipeline lengths or sections, surplus material is to be removed from the excavation. Following the completion of laying of pipes, the annulus between the pipe and the bore hole is to be refilled with a sand-cement slurry which complies with this Specification. The slurry shall be introduced; either under head, or pumped, until the annulus is completely filled for the full length of the borehole. Payment for this refill shall be included in the scheduled rate for excavation of power bored pipelines.

SAND – CEMENT SLURRY: Sand-cement slurry to be used for the refilling of tunnels and final refilling of drives and tunnels shall be composed of one part of cement and fifteen parts concrete sand. Sufficient clean water shall be added to permit the mix to just flow under its own weight.

Where the slurry is to be pumped, or enhanced flow properties are required, add the following:

- (i) An air entraining agent at the rate of 2 litres per cubic metre.

OR

- (ii) Slaked lime ("Limil") at the rate of 25 kg (1 bag) per cubic metre.

BORED PIPES: Sand-Cement slurry to be used for refilling of the annular space around pipes in bored lines shall be composed of one part of cement, twenty parts concrete sand and two parts lime.

Add sufficient clean water to permit the mix to just flow under its own weight.

7.20 Restoration

GENERAL: Concrete, bitumen, gravel and paved surfaces, pasture, lawns, gardens and other surfaces shall be restored to the levels and condition existing prior to the commencement of the work including where necessary the replacement of garden top-soil and sowing of grasses. All restoration shall be maintained until the issue of the Final Certificate.

PRIVATE LANDS: Within private lands carry out the restoration necessary due to the construction of the works during any calendar month, by the end of the following calendar month.

STEEP SLOPES: Immediately following refilling and removal of excess spoil from steep slopes, disturbed ground shall be seeded and immediately covered with approved stabilisation method.

AUTHORITY REQUIREMENTS: The refilling of trenches within road and other Council reservations shall be in accordance with the requirements of the appropriate Road and/or Municipal Authority. If required by the authority, the restoration and maintenance of these surfaces during the construction and defects liability periods shall be carried out by the appropriate Road and/or Municipal Authority and the Contractor shall pay all charges or the Principal Authorised Person may arrange for direct payment of the charges by the Principal and the amounts deducted from moneys due to the Contractor.

Unless otherwise required by the responsible authority for a road reserve:

1. Where the works are constructed under trafficked areas, road pavement, road shoulder or driveways, refill the excavation with 19 mm nominal material placed in 150 mm maximum layers and compacted to 98 percent MDD and to the satisfaction of the Principal Authorised Person. The excavation shall be refilled with this material for the full or future road formation width, whichever is the greater, and for a further three metres beyond each side of the formation width.
2. Where the works are constructed under footpath pavement (existing or proposed) and the material excavated from the site, is in the Principal Authorised Person's opinion not satisfactory, supply and refill the excavation with sand refill compacted in layers to the satisfaction of the Principal Authorised Person.
3. The Principal Authorised Person may approve the use of material excavated from the works for refill of excavations. The refill material shall be properly compacted in layers to the approval of the Principal Authorised Person.

STRUCTURES AND SERVICES: Reinstate structures, services and other works to the conditions existing prior to the commencement of works. Where such remedial works are considered by the Principal Authorised Person to be urgent works they shall be completed as promptly as practicable as directed by the Principal Authorised Person.

7.21 Works Included in Rates for Excavation and Refilling for Sewers

Not Applicable - Deliberately left black

7.22 Works Included in Rates for Pressure Mains

GENERAL: The rates in the Schedule for "Excavation; Laying and Jointing of Pressure Mains inclusive of any Pipe Anchorages; Embedment Types (Bedding, Haunching and Pipe Overlay); Refilling; Restoration" shall include the cost of excavation of trenches, shafts, drives or tunnels to the underside

of pipes and cutting hand holes; additional excavation at crossings of large pipelines; disposal of surplus spoil as specified, supply and install pipework, shoring, staying, ventilation as required; refilling with selected and ordinary refill and 19 mm fine crushed rock; restoration as specified within road reservations (including foundations) and crown and private land including surfaces, fences, buildings, outhouses or sheds damaged in by the works.

No extra payments will be made for work necessary to meet road and other service authorities' requirements nor for excavation in water bearing ground or other abnormal conditions.

No extra payments will be made for excavation in rock or boulders unless otherwise provided for in the Schedule.

PIPELINES: Payment will be on the basis of the rates in the Schedule for the length of a particular diameter and be irrespective of depth.

The length of each pipeline and rising main in each test section shall be measured along the centreline and shall include all valves and fittings.

EXCAVATED MATERIAL: Unless otherwise stated in the Specification, the different kinds of material met within the excavation for pipelines shall be classified under the heading of "Other than Rock", "Rock" and "Boulders" and where each word occurs in the Specification, this General Specification or the Schedule of Quantities they shall have the following meanings:

"Other than Rock" shall mean all descriptions of materials that can be excavated more economically in the opinion of the Principal Authorised Person by means other than those prescribed as being required for "Rock" and "Boulders".

"Rock" shall mean material that, in the opinion of the Principal Authorised Person, requires the use of explosives with or without the use of pneumatic or mechanical equipment worked in conjunction to remove it.

"Boulders" shall mean portions of rock disassociated from their parent source. Payment for boulders will be made as follows:

1. Where a boulder extends across the entire width of the excavation, so that both sides of the excavation have to be cut through it, payment shall be made for the quantity of boulder excavated.
2. Where a boulder projects beyond the centreline for the excavation, and requires to be cut through on one side, payment shall be made for half of the quantity of the boulder excavated.

No additional payment will be made for boulders that do not satisfy one of the above conditions.

ROCK: Claims for payment for excavation in rock must be made to the Principal Authorised Person before pipes are laid. It is to be clearly understood that the Principal Authorised Person will not certify payment unless detailed measurements approved by the Principal Authorised Person of the actual quantity of rock in pipeline rising main test section are submitted by the Contractor to the Principal Authorised Person. The Principal Authorised Person's decision in any disagreement in quantity or classification shall be final.

7.23 CCTV Inspection and Testing of Sewers and Branch Sewers

Not Applicable - Deliberately left black

7.24 Testing of Pressure Mains

7.24.1 General

REQUIREMENT: Hydrostatic testing of all pressure mains shall be carried out in accordance with AS 2566.2 and witnessed by the Principal Authorised Person. Hydrostatic testing shall be carried out not sooner than seven days after the last anchor block in the section has been poured and in fine weather conditions.

7.24.2 Scope

REQUIREMENT: A test procedure shall be prepared by the Contractor setting out the requirements for undertaking pressure pipeline hydrostatic pressure testing for the purpose of determining pipeline acceptability. The test procedure is to be in accordance with AS 2566.2 2002.

The hydrostatic test method set out in Section 6.3.4 of AS 2566.2 2002 for testing PVC and DICL pipelines is 6.3.4.1 Constant Pressure (Water Loss) Method. This method is detailed in Appendix M, Paragraph M4 of AS 2566.2 2002.

The hydrostatic test method set out in Section 6.3.4 of AS 2566.2 2002 for testing PE pipelines is 6.3.4.2 Constant Pressure (Water Loss) Method for Visco-Elastic Pressure Pipelines. This method is detailed in Appendix M, Paragraph M5 of AS 2566.2 2002.

In accordance with AS 2566.2 pipeline test lengths should not exceed 1000 metres unless authorised by the Principal Authorised Person or as indicated on the drawings.

The test procedure shall be submitted to and approved by the Principal Authorised Person a minimum of seven (7) days prior to the commencement of the inspection and testing of all pipelines.

All pipeline pressure tests shall be undertaken in accordance with the approved test procedure without variation unless an approval or direction in writing is given by the Principal Authorised Person to vary the test procedure.

REQUIREMENT: The Contractor shall be responsible for supplying and disposing of all water to be used for undertaking pipeline hydrostatic pressure testing with all costs whatsoever associated with supply and disposal being borne by the Contractor.

7.24.3 Test Procedure

REQUIREMENT: The following sections detail the general test procedure to be followed when hydrostatic pressure testing of pipes under this Contract:

Pre-Test Procedure

GENERAL: The pre-test procedure for undertaking hydrostatic testing of pipelines is to be in accordance with section M2 Pre-Test Procedures in Appendix M of AS 2566.2 2002.

REQUIREMENT: It must be ensured that there are two calibrated test gauges of sufficient accuracy and pressure rating mounted on the pipeline length undergoing hydrostatic testing. Test pressure gauge calibration certificates must be submitted to the Principal Authorised Person prior to the commencement of testing.

Test Procedure

GENERAL:

- Clearly inform all personnel involved with the hydrostatic testing process of the test procedure, loading limits on temporary supports and fittings, and safety procedures.
- Visually inspect the whole pipeline route including all valves, fittings and thrust restraints/blocks for completeness and condition. If faulty or incomplete pipes, valves, fittings or thrust restraints/blocks are identified the pressure test is not to be undertaken until all faulty and incomplete components are repaired or replaced to the approval of the Principal Authorised Person.
- Ensure all valves are open and that testing is not being undertaken against valves.
- Pressurise the pipeline test section to 75 percent of the test pressure and leave for a minimum of 12 hours.
- After the 12 hour preliminary pressurisation period the pipeline test section shall be visually checked for obvious leaks or failures.
- Having achieved a satisfactory 12 hour preliminary pressurisation period, steadily increase the pressure in the test section until the specified test pressure is reached.
- Maintain the specified test pressure for four (4) hours. At half hour intervals measure and record the quantity of makeup water required to maintain the specified test pressure.
- Visually check the pipeline test section for leaks or failures.
- Calculate the allowable quantity of makeup water using the appropriate method set out in AS 2566.2 2002 and compare this to the actual quantity of makeup water used to maintain the specified test pressure.

Test Acceptability

GENERAL: A hydrostatic test on a length of pipeline will be deemed to have been acceptable where:

1. There has been no failure of any pipeline component in the section including, but not necessarily limited to, thrust blocks, anchor blocks, pipe, fittings, valves, and joints;
2. There is no visible leakage from the test length; and
3. The quantity of makeup water necessary to maintain the test pressure in the test length shall comply with allowable quantity of makeup water determined by the appropriate method set out in AS 2566.2 2002.

7.24.4 Post Test Procedure

GENERAL: The post-test procedure for undertaking hydrostatic testing of pipelines is to be in accordance with section M3 Post-Test Procedures in Appendix M of AS 2566.2 2002.

7.24.5 Reporting

REQUIREMENT: A full detailed test report shall be kept during all hydrostatic testing of pipelines and submitted to the Principal Authorised Person at the completion of each test, regardless of whether the test has achieved acceptability or not. The test report, to be kept for all hydrostatic tests, shall be recorded on a pro forma report prepared by the Contractor and approved by the Principal Authorised Person at least seven (7) days prior to the commencement of any pipeline hydrostatic pressure testing.

7.25 Maintenance Structures (Manholes, Maintenance Shafts and Inspection Shafts)

Not Applicable - Deliberately left black

7.26 Concrete Surrounds, Indicator Posts and Markers

CONSTRUCTION: Construct concrete surrounds around valves in accordance with the details indicated on the drawings. Construct so as to avoid direct bearing on any component of the pipeline.

SURROUNDS FINISH: Surrounds shall be true in detail and of good finish, which shall be obtained by the use of good forms and workmanship. Surrounds may be precast in which case they will incorporate the cast iron cover box in the surround. The exposed surfaces of surrounds shall be smooth, dense and free from honeycomb or other defects.

7.27 Denso Wrapping

REQUIREMENTS: Following the satisfactory completion of the field pressure test(s) wrap all Gibault, flanged and welded joints, tapping saddle bolts and nuts and valve stuffing boxes with Denso 300 Primer, 400 mastic, 600 tape and 931 overwrap applied in accordance with the instructions of the Manufacturer, Denso (Australia) Pty Ltd.

7.28 Pipework - Project Specific Issues

7.28.1 Materials

Supply all materials unless otherwise approved by the Principal Authorised Person:

All DI fittings and valves shall be coated with fusion bonded epoxy resin unless otherwise specified in the Drawings.

All valves shall be clockwise closing.

8. Landscaping (Surface Reinstatement)

8.1 Scope of Works

Refer to the drawings for extent of landscaping surface reinstatement.

This specification sets out minimum supply and performance requirements for topsoil, planting, mulch and ongoing maintenance.

8.2 Submission Requirements

As a minimum, the Contractor shall submit the following proposed methodologies to the contract Principal Authorised Person for review and approval, prior to the ordering or delivery of materials to site. The Principal Authorised Person shall retain the right to reject any material delivered to site that has not been approved for use in this project.

- Submit details of the makeup of proposed topsoil to be used on this site;
- Submit details and sample of the proposed mulch;
- Methods for establishment of growth of all plantings, including watering and pruning regimes if required;
- Methods for protection of plants against damage from environmental causes, including high winds and cold weather;
- Methods for maintenance of all plantings during the contract maintenance period.

8.3 Inspection

NOTICE AND HOLD POINTS: Refer 1.3:

8.4 General Provisions

Submit details of all sub-contractors and suppliers for the landscape works for approval, and for the suppliers of materials, including soil, plants and mulch.

When working near existing trees or planting, protect from damage by groundworks. All areas damaged in the course of the works are to be reinstated to as-found condition, or to the satisfaction of the contract administrator.

Eradicate weeds by environmentally acceptable methods throughout the course of the works and during the planting establishment period.

Where existing ground surfaces are not required to be varied as part of the works, protect from damage where practicable and restore them to the condition existing at the commencement of the work under the contract.

8.5 Materials/Planting

Not Applicable - Deliberately left black

8.6 Plants

Not Applicable - Deliberately left black

8.7 Planting

Not Applicable - Deliberately left black

8.8 Topsoiling

REQUIREMENT: After completion of all other works, spread topsoil uniformly in a 200 mm minimum thick layer.

MATERIAL: Use approved stockpiled topsoil stripped from the site or import fresh topsoil.

COMPACTION: Lightly compact topsoil so that the finished surface is smooth, free from lumps of soil, at the required levels and grades, ready for cultivation and plant. Prevent excess compaction by constructional plant.

FINISHING: Finish topsoil flush with abutting undisturbed areas. Feather edges into adjoining undisturbed ground.

8.9 Grass Sowing

REQUIREMENT: Sow grass to all topsoil areas as specified below.

FERTILIZER: Pivot Map fertiliser, or approved equal, applied at the rate of 20 g/m².

At time of sowing or not more than 48 hours before, spread fertiliser evenly over the prepared surface and rake lightly into the surface.

Six weeks after the germination period (or as directed) spread fertiliser evenly over the grass area and then water in. Do not apply fertiliser to wet grass.

GRASS SEED: Demeter tall-fescue, or approved equal, applied at the rate of 15 g/m².

Grass seed mixture shall be thoroughly pre-mixed, and shall include a bulking material such as safflower meal or an approved equivalent if required by the method of sowing. Submit a certificate of germination before sowing. Deliver to the site in standard sized bags marked to show weight, seed species and vendor's name.

GRASS SOWING: Sow grass only when approved by the Principal Authorised Person. Do not sow if frost is likely before the grass has reached an established state, or in periods of extreme heat, cold or wet, or when wind velocities exceed 8 km/h, unless otherwise approved.

Prepare the areas to be sown as specified above. If a prepared area becomes compacted from any cause before sowing can begin, rework the ground surface before sowing the seed.

Sow the seed by a method which achieves the specified application rate and even distribution. Lightly rake the surface to cover the seed. Roll the seed bed immediately after sowing with a roller weighing not more than 300 kg/m of width for sandy or light soils.

GRASS ESTABLISHMENT: Provide an even sward of healthy grass over the whole of the seeded area, with no bare patches.

Thoroughly water the seeded area with a fine spray immediately after rolling until the soil is moistened to a depth of 150 mm. Continue watering until germination as necessary to keep the surface damp and the soil moist but not waterlogged. Then water as necessary to maintain the grass in a healthy condition progressively hardened off to the natural climatic conditions prevailing in the locality at the time.

Protect the newly sown areas against traffic until the grass is well established.

Rake over and reseed areas where the grass seed fails to germinate within one month of the date of the original sowing.

Make the first cut and subsequent mowing to maintain the grass within the specified height range throughout the contract period.

Remove weeds that emerge in the grassed areas or where necessary spray with a selected weedicide for broad-leafed weeds to the manufacturer's recommendations.

8.10 Maintenance

Commencement: The planting establishment-maintenance period commences at the date of Practical Completion.

- **Duration:** 52 Weeks

Recurrent works: Throughout the planting establishment period, continue to carry out recurrent works of a maintenance nature including, but not limited to, watering, weeding, rubbish removal, fertilising, pest and disease control, reseeding, returfing, staking and tying, replanting, cultivating, pruning, hedge clipping, aerating, renovating, top dressing, and keeping the site neat and tidy.

Replacements: Continue to replace failed, damaged or stolen plants.

Mulched surfaces: Maintain the surface in a clean and tidy condition and reinstate the mulch as necessary.

Stakes and ties: Adjust or replace as required. Remove those not required at the end of the planting establishment period.

Logbook: Keep a logbook recording when and what maintenance work has been done and what materials, including toxic materials, have been used. Make the logbook available for inspection on request (or at fortnightly intervals).

Appendices

Appendix A – Geotechnical Investigation Report

(For information only)

15 July 2024

Attention: Diwolka Sharma
GHD Pty Ltd
Level 1 Suite 3 169 Baylis Street
Wagga Wagga NSW 2650
Diwolka.Sharma@ghd.com

BY EMAIL

Dear Diwolka

Re: Geotechnical Data Report – Betts Street Rising Main Cootamundra NSW 2590

I refer to the written request from yourself to compile a geotechnical data report for a proposed new sewer rising main from Betts Street to Turners Lane option 4 (*Betts St SPS – Rising Main Alignment Options* GHD Pty Ltd) in Cootamundra NSW. A site location map and plan of the proposed development can be seen in **Attachment A**.

The intended recipient of this report is yourself, GHD Pty Ltd, and Cootamundra Gundagai Regional Council for use in the preliminary design of the structural and civil work associated with the proposed new sewer rising main to be constructed on site. It is assumed that third parties will rely on this report for preliminary rising main sewer design, however DM McMahon Pty Ltd is required to be consulted if the report is to be used for any other purpose.

Objective and agreed scope

The objective of this geotechnical data report is to document the procedures employed and the data collected, and despite the fact that soil and rock logging has an interpretive nature attached to it, this geotechnical data report is considered predominantly factual.

The agreed scope of works included:

- Where available, review plans and other general related documents provided to us to gain a comprehensive understanding of the site including location of services.
- Drill six holes to 2m depth (or refusal) at locations determined by yourself and undertake a visual and tactile assessment of investigated locations by reference to the Australian Standard 1726 (2017) Geotechnical Site Investigations.
- Take representative samples of subsurface materials in accordance with AS1289.1.2.1
- Test representative soil samples in a NATA accredited laboratory to the relevant Australian Standards and Transport for NSW test methods for moisture content, Atterberg limits, and particle size distribution.
- Supply a geotechnical data report by reference to the Australian Standard 1726 (2017).

Location and description of the project site and its history

The site of the proposed development takes in parts of Lot 1 DP190361, Lot 91 DP1125395 and Lot 21 DP1197449, an unnamed road easement running parallel to Gundagai Rd from Betts St to Cowcumbra Street, and road easements of Cowcumbra Street and Gundagai Rd to the Waste Water Treatment Plant (WWTP), a total distance of 2.3km (approx.).

From a review of available historical aerial photography and satellite imagery (1961-2024), the proposed route was through road easements passing through rural land, which was largely undeveloped until sometime shortly before 2010. There were some houses between the proposed route and Gundagai Rd from Betts St. past Florence St in 1961. The WWTP was built on its current site some time prior to 1977 and industrial building development was commenced along Gundagai Rd from the previous town limit to just past Cowcumbra St prior to 2010. The sports ground at O'Connor Park was constructed between 2010 and 2013 and further development along the western side of Gundagai Rd occurred during 2023. (**Attachment B**).

Plan showing investigation locations

A plan of the investigation locations can be seen in **Attachment C**.

Description of the regional and local geology

The regional geology consists of a valley of Cainozoic alluvial sediments infilling a valley running approximately north-south between uplands of the Brawlin Formation (slate, slaty siltstone and sandstone) to the east and the Cowcumbra Rhyolite to the west. This latter formation also underlies the valley.

The development corridor is slightly undulating land approximately following the course of Muttama Creek. For most of the distance along Gundagai Road, the sediments are unconsolidated grey to brown to beige alluvial silty clay and clay materials. From a review of the logs of nearby bores, clay is typically encountered to >15m below ground level (bgl) with some sand encountered in some bores. No groundwater was found closer to the surface than 15m. Colluvial sediments sourced from the western uplands may be found near the Treatment Plant site.

Records of fieldwork, including methods and results

Six boreholes were drilled using a power auger along the proposed route of the new rising main. Soil samples were taken at depths of ~0.8-1.2m and ~1.8-2.0m bgl in accordance with sampling method AS1289.1.2.1 (1998) Methods of testing soils for engineering purposes, sampling and preparation of soils, disturbed samples, standard method.

The log sheets including the visual and tactile assessment of the surface and subsurface can be seen in **Attachment D**. Photographs of the site can be seen in **Attachment E**.

Laboratory testing and summary of results

Tabulated laboratory results can be seen in **Attachment F**.

Laboratory reports can be seen in **Attachment G**.

If you have any queries about the contents of this geotechnical data report, please contact the undersigned.

Yours sincerely



David McMahon

Certified Professional Soil Scientist

Certified Environmental Practitioner

(Site Contamination Specialist)

BAppSc (Ag) GradDip (Water) MEnvMgmt

MALGA MEIANZ MSSA



Disclaimer

The information contained in this report has been extracted from sources believed to be reliable and accurate. DM McMahon Pty Ltd will not assume any responsibility for the misinterpretation of information supplied in this report. The accuracy and reliability of recommendations identified in this report need to be evaluated with due care according to individual circumstances. The results of the assessment undertaken are an overall representation of the conditions encountered. It should be noted that the recommendations and findings in this report are based solely upon the said site location and the ground level conditions at the time of testing. The properties of the soil within the location may change due to variations in ground conditions outside of the tested area. The author has no control or liability over site variability that may warrant further investigation that may lead to significant design changes.

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Attachments

- A.** Site location map and development plan
- B.** Aerial photography and satellite imagery
- C.** Plan of the investigation locations
- D.** Log sheets
- E.** Photographs
- F.** Tabulated results
- G.** Laboratory reports



Attachment A : *Site location and development plan*

Betts Street Rising Main Cootamundra NSW 2590

Geotechnical Investigation
Report No. 24
Google Earth image 2023

Legend

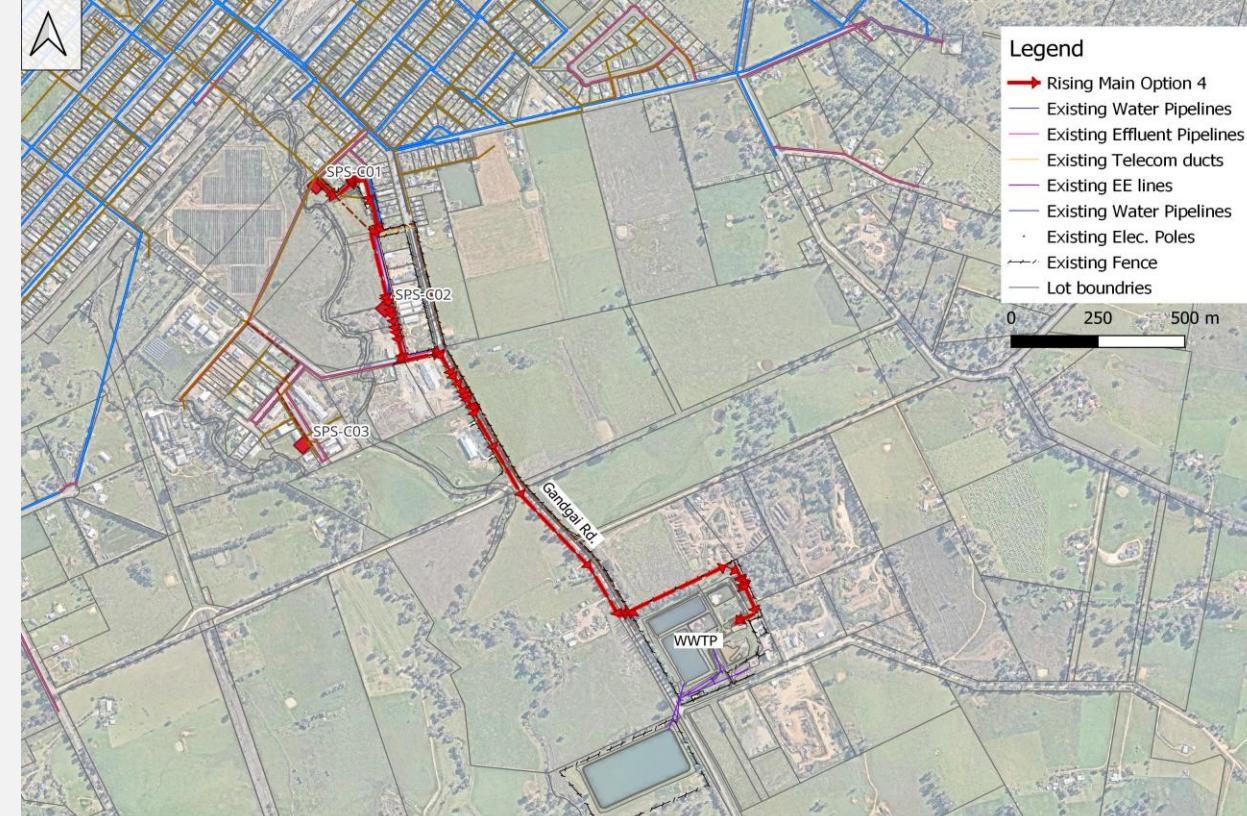
 Rising main (option 4)





Option 4

→ Trenching along the western side of the Gundagai Rd. up to the WWTP (Avoids trenching through O'Connor Park Soccer Field)



This option requires constructing the new rising main through trenching in the unnamed road (parallel to Gundagai Rd.) then along the southern side of Cowcumbra st. then along the western side of Gundagai Rd. up to the WWTP.

The total rising main length is 2,410m, the trench length will be approximately 2,350m and the boring length will be approximately 60m.



Attachment B : *Aerial photography and satellite imagery*

Betts Street Rising Main Cootamundra NSW 2590

Geotechnical Investigation
Report No. 24
Aerial photograph 1961

Legend

 Rising main (option 4)



Betts Street Rising Main Cootamundra NSW 2590

Geotechnical Investigation
Report No. 24
Aerial photograph 1977

Legend

 Rising main (option 4)



Attachment C : *Plan of the investigation locations*

Betts Street Rising Main Cootamundra NSW 2590

Geotechnical Investigation
Report No. 24
Google Earth image 2023

Legend

 Investigation location

 Rising main (option 4)





Attachment D : *Log sheets*



Inland Geotechnical

6 Jones St, Wagga Wagga

Phone: 02 6931 0511

Geotechnical Log - Borehole

BH01

UTM	: 55H	Drill Rig	: Christie (3.1m Mast)	Job Number	: 24
Easting (m)	: 594,392.00	Driller Supplier	: Inland Geo	Client	: GHD
Northing (m)	: 6,165,530.00	Logged By	: A. Rudd	Project	: Geotechnical Investigation
Ground Elevation	: -0.01 (m)	Reviewed By	: A. Rudd	Location	: Betts Street, Cootamundra NSW, Australia
Total Depth	: 2 m BGL	Date	: 05/07/2024	Loc Comment	:

Drilling Method	Depth (m)	Soil Origin	Graphic Log	Material Description	Samples	Observations
Solid flight auger	0.05	Topsoil		Topsoil CL: Silty CLAY, brown, low plasticity, soft, organic, w > pl.		
		Alluvial		Alluvial CL-CI: Silty CLAY, red brown, low to medium plasticity, soft to firm, inorganic, w > pl.		
	0.3	Alluvial		Alluvial CI: CLAY, brown red, medium plasticity, firm, inorganic, w > pl.		
	0.5	Alluvial		As above, w ≈ pl.	Plastic Bag: A	
	1.2	Alluvial		Alluvial CL-CI: CLAY, pale yellow brown, low to medium plasticity, firm, inorganic, w > pl.	Plastic Bag: B	
	2			BH01 Terminated at 2m		
	3					



Inland Geotechnical

6 Jones St, Wagga Wagga

Phone: 02 6931 0511

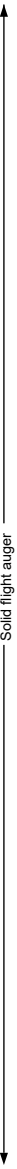
Geotechnical Log - Borehole

BH03

UTM	: 55H	Drill Rig	: Christie (3.1m Mast)	Job Number	: 24
Easting (m)	: 594,702.00	Driller Supplier	: Inland Geo	Client	: GHD
Northing (m)	: 6,164,955.00	Logged By	: A. Rudd	Project	: Geotechnical Investigation
Ground Elevation	: Not Surveyed	Reviewed By	: A. Rudd	Location	: Betts Street, Cootamundra NSW, Australia
Total Depth	: 2 m BGL	Date	: 05/07/2024	Loc Comment	:

Drilling Method	Depth (m)	Soil Origin	Graphic Log	Material Description	Samples	Observations
Solid flight auger		Fill		Fill Sandy GRAVEL GW: yellow brown, moderately to well compacted, medium to coarse sized, medium to coarse grained sand, moist.		
	0.4	Alluvial		Alluvial ML: SILT, pale grey mottled brown, low plasticity, soft, inorganic, w ≈ ll.		
	0.6	Alluvial		Alluvial CL: Silty CLAY, yellow brown, low plasticity, firm, inorganic, w > pl, trace fine grained sand.		
	0.9	Alluvial		Alluvial CL: CLAY, brown yellow, low plasticity, stiff, inorganic, w ≈ pl, with fine to medium grained sand.	Plastic Bag: E	
	1.4	Alluvial		Alluvial CL: CLAY, yellow, low plasticity, firm, inorganic, w > pl, with fine to medium grained sand.		
	1.7	Alluvial		As above, Silty pale yellow, w > pl to w ≈ ll, with fine grained sand.	Plastic Bag: F	
	2			BH03 Terminated at 2m		
	3					

UTM : 55H	Drill Rig : Christie (3.1m Mast)	Job Number : 24
Easting (m) : 594,886.00	Driller Supplier : Inland Geo	Client : GHD
Northing (m) : 6,164,619.00	Logged By : A. Rudd	Project : Geotechnical Investigation
Ground Elevation : Not Surveyed	Reviewed By : A. Rudd	Location : Betts Street, Cootamundra NSW, Australia
Total Depth : 3 m BGL	Date : 05/07/2024	Loc Comment :

Drilling Method	Depth (m)	Soil Origin	Graphic Log	Material Description	Samples	Observations
	0.05	Topsoil		Topsoil ML: Clayey SILT, brown, low plasticity, soft to firm, organic, w > pl.		
		Alluvial		Alluvial CL-CI: CLAY, red brown, low to medium plasticity, firm to stiff, inorganic, w > pl.		
	0.5	Alluvial		Alluvial CI-CH: CLAY, brown yellow, medium to high plasticity, stiff, inorganic, w > pl.		
	0.8	Alluvial		Alluvial CI-CH: CLAY, pale yellow mottled brown, medium to high plasticity, stiff to very stiff, inorganic, w ≈ pl.	Plastic Bag: G	
	1.2	Alluvial		Alluvial CI-CH: CLAY, yellow, medium to high plasticity, stiff to very stiff, inorganic, w > pl.		
	1.6	Alluvial		Alluvial CH: CLAY, red brown mottled pale grey, high plasticity, stiff, inorganic, w > pl, trace fine to medium grained sand, trace low plasticity silt.	Plastic Bag: H	
	2.5	Alluvial		Alluvial CH: CLAY, pale brown mottled grey, high plasticity, soft to firm, inorganic, w ≈ ll, trace fine to medium grained sand.		
	BH04 Terminated at 3m					



Inland Geotechnical

6 Jones St, Wagga Wagga

Phone: 02 6931 0511

Geotechnical Log - Borehole

BH06

UTM	: 55H	Drill Rig	: Christie (3.1m Mast)	Job Number	: 24
Easting (m)	: 595,560.00	Driller Supplier	: Inland Geo	Client	: GHD
Northing (m)	: 6,164,270.00	Logged By	: A. Rudd	Project	: Geotechnical Investigation
Ground Elevation	: Not Surveyed	Reviewed By	: A. Rudd	Location	: Betts Street, Cootamundra NSW, Australia
Total Depth	: 2 m BGL	Date	: 05/07/2024	Loc Comment	:

Drilling Method	Depth (m)	Soil Origin	Graphic Log	Material Description	Samples	Observations
Solid flight auger	0.1	Topsoil		Topsoil ML: Clayey SILT, red brown, low plasticity, firm, w > pl.		
		Colluvium		Colluvium CL-CI: CLAY, brown red, low to medium plasticity, stiff, inorganic, w > pl, trace low plasticity silt.		
	0.6	Residual		Residual CL-CI: Sandy CLAY, yellow, low to medium plasticity, stiff to very stiff, inorganic, w < pl, medium to coarse grained sand.	Plastic Bag: K	
	1.4	Residual		Residual CL: Sandy CLAY, yellow, low plasticity, very stiff, inorganic, w ≈ pl to w < pl, medium to coarse grained sand, trace fine to medium sized gravel.		
	1.6	Residual		Residual CL-CI: Sandy CLAY, brown yellow, low to medium plasticity, very stiff, inorganic, w < pl, medium to coarse grained sand.	Plastic Bag: L	
	2			BH06 Terminated at 2m		
	3					



Attachment E : *Photographs*



Figure 1: Location of BH01 in nature area immediately north of O'Connor Park playing field - Facing southwest.



Figure 2: Location of BH01 - Facing northwest.



Figure 3: Location of BH02 in unnamed road easement adjacent to undeveloped land behind 60 Gundagai Road - Facing south southeast.



Figure 4: Location of BH03 in road easement in front of 107 Gundagai Road - Facing north.



Figure 5: General profile of BH03 to 2m depth. Note large cobbles used as fill materials, likely to bridge underlying geotechnically unsuitable silts.



Figure 6: Location of BH04 adjacent to Muttama Creek in Gundagai Road easement immediately south of Nashs Lane intersection - Facing Southeast



Location of BH04 - Facing northeast.

Figure 7:



Figure 8: General profile of BH04 to 3m depth showing high plasticity alluvial clays directly adjacent to Muttama Creek and existing road culvert.



Figure 9: Location of BH05 in northwest corner of WWTP property adjacent to the Gundagai Road easement - Facing north northeast.



Figure 10: Location of BH06 in nature area immediately northeast of settlement ponds at WWTP on Turners Lane - Facing south.



Figure 11: General profile of BH06 to 2m depth showing brown red colluvium overlying yellow and brown yellow residual sandy clay materials to the investigated depth.

Attachment F : *Tabulated results*

1 of 1
24
Geotechnical data report - Betts Street Rising Main Cootamundra NSW



Attachment G : *Laboratory reports*

Material Test Report

Report Number: 24-1
Issue Number: 1
Date Issued: 11/07/2024
Client: GHD

Contact: Leona Zha
Project Number: 24
Project Name: Geotechnical investigation
Project Location: Betts Street Cootamundra NSW 2590
Work Request: 1928
Sample Number: 1928A
Date Sampled: 05/07/2024
Dates Tested: 08/07/2024 - 11/07/2024
Sampling Method: AS 1289.1.2.1 6.5.3 - Power auger drilling
Sample Location: BH01 E: 594392, N: 6165530, Depth: 0.8-1.2m
Material: CLAY
Material Source: In-situ



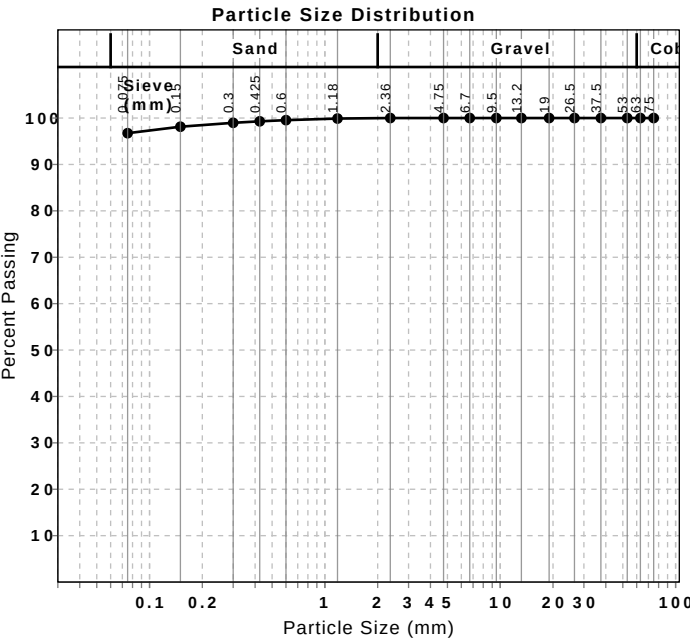
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Wagga Wagga Laboratory
6 Jones Street Wagga Wagga NSW 2650
Phone: (02) 6931 0510
Email: han@dmmcmahon.com.au



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Approved Signatory: Dr Hoang Han Nguyen
Lab manager
NATA Accredited Laboratory Number: 3349

Particle Size Distribution (AS1289 3.6.1)				
Sieve	Passed %	Passing Limits	Retained %	Retained Limits
75 mm	100		0	
63 mm	100		0	
53 mm	100		0	
37.5 mm	100		0	
26.5 mm	100		0	
19 mm	100		0	
13.2 mm	100		0	
9.5 mm	100		0	
6.7 mm	100		0	
4.75 mm	100		0	
2.36 mm	100		0	
1.18 mm	100		0	
0.6 mm	100		0	
0.425 mm	99		0	
0.3 mm	99		0	
0.15 mm	98		1	
0.075 mm	97		1	



Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	48		
Plastic Limit (%)	16		
Plasticity Index (%)	32		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	15.5		
Cracking Crumbling Curling	Cracking		

Moisture Content (AS 1289 2.1.1)		Min	Max
Moisture Content (%)	16.8		

Material Test Report

Report Number: 24-1
Issue Number: 1
Date Issued: 11/07/2024
Client: GHD

Contact: Leona Zha
Project Number: 24
Project Name: Geotechnical investigation
Project Location: Betts Street Cootamundra NSW 2590
Work Request: 1928
Sample Number: 1928B
Date Sampled: 05/07/2024
Dates Tested: 08/07/2024 - 11/07/2024
Sampling Method: AS 1289.1.2.1 6.5.3 - Power auger drilling
Sample Location: BH01 E: 594392, N: 6165530, Depth: 1.8-2.0m
Material: CLAY
Material Source: In-situ



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Wagga Wagga Laboratory
6 Jones Street Wagga Wagga NSW 2650
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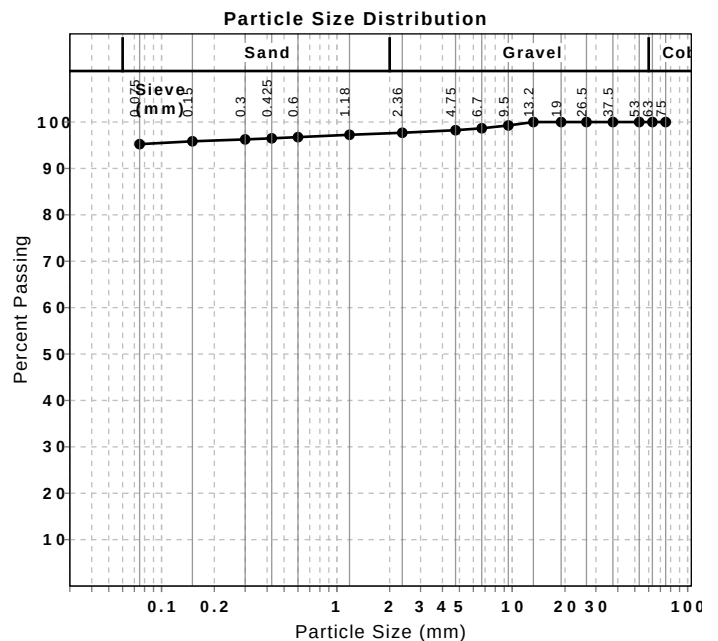
Approved Signatory: Dr Hoang Han Nguyen
Lab manager
NATA Accredited Laboratory Number: 3349

Particle Size Distribution (AS1289 3.6.1)				
Sieve	Passed %	Passing Limits	Retained %	Retained Limits
75 mm	100		0	
63 mm	100		0	
53 mm	100		0	
37.5 mm	100		0	
26.5 mm	100		0	
19 mm	100		0	
13.2 mm	100		0	
9.5 mm	99		1	
6.7 mm	99		1	
4.75 mm	98		0	
2.36 mm	98		1	
1.18 mm	97		0	
0.6 mm	97		1	
0.425 mm	96		0	
0.3 mm	96		0	
0.15 mm	96		0	
0.075 mm	95		1	

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	38		
Plastic Limit (%)	13		
Plasticity Index (%)	25		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	13.0		
Cracking Crumbling Curling	Cracking		

Moisture Content (AS 1289 2.1.1)		Min	Max
Moisture Content (%)	20.1		



Material Test Report

Report Number: 24-1
Issue Number: 1
Date Issued: 11/07/2024
Client: GHD

Contact: Leona Zha
Project Number: 24
Project Name: Geotechnical investigation
Project Location: Betts Street Cootamundra NSW 2590
Work Request: 1928
Sample Number: 1928C
Date Sampled: 05/07/2024
Dates Tested: 08/07/2024 - 11/07/2024
Sampling Method: AS 1289.1.2.1 6.5.3 - Power auger drilling
Sample Location: BH02 E: 594503, N: 6165224, Depth: 0.8-1.2m
Material: CLAY trace sand
Material Source: In-situ



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Wagga Wagga Laboratory
6 Jones Street Wagga Wagga NSW 2650
Phone: (02) 6931 0510
Email: han@dmmcmahon.com.au



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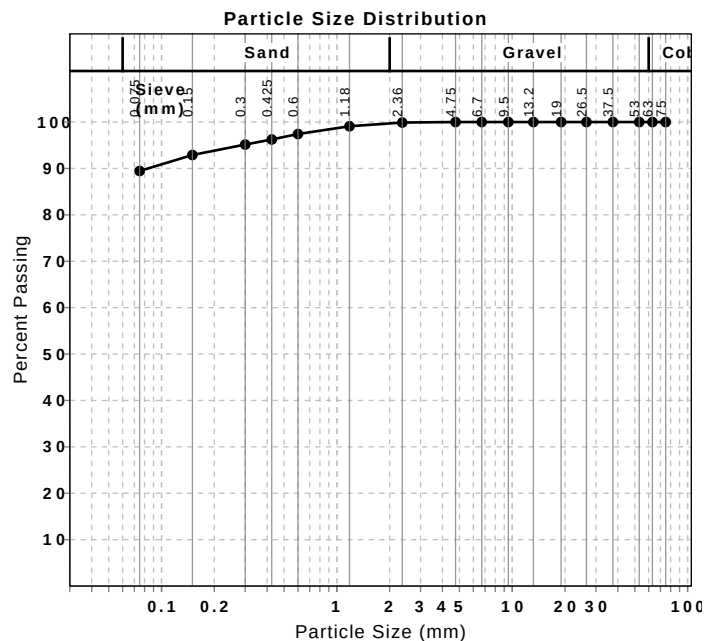
Approved Signatory: Dr Hoang Han Nguyen
Lab manager
NATA Accredited Laboratory Number: 3349

Particle Size Distribution (AS1289 3.6.1)				
Sieve	Passed %	Passing Limits	Retained %	Retained Limits
75 mm	100		0	
63 mm	100		0	
53 mm	100		0	
37.5 mm	100		0	
26.5 mm	100		0	
19 mm	100		0	
13.2 mm	100		0	
9.5 mm	100		0	
6.7 mm	100		0	
4.75 mm	100		0	
2.36 mm	100		0	
1.18 mm	99		1	
0.6 mm	97		2	
0.425 mm	96		1	
0.3 mm	95		1	
0.15 mm	93		2	
0.075 mm	89		3	

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	39		
Plastic Limit (%)	13		
Plasticity Index (%)	26		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	12.0		
Cracking Crumbling Curling	Cracking		

Moisture Content (AS 1289 2.1.1)		Min	Max
Moisture Content (%)	12.8		



Material Test Report

Report Number: 24-1
Issue Number: 1
Date Issued: 11/07/2024
Client: GHD

Contact: Leona Zha
Project Number: 24
Project Name: Geotechnical investigation
Project Location: Betts Street Cootamundra NSW 2590
Work Request: 1928
Sample Number: 1928D
Date Sampled: 05/07/2024
Dates Tested: 08/07/2024 - 11/07/2024
Sampling Method: AS 1289.1.2.1 6.5.3 - Power auger drilling
Sample Location: BH02 E: 594503, N: 6165224, Depth: 1.7-1.9m
Material: CLAY with sand
Material Source: In-situ



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Wagga Wagga Laboratory
6 Jones Street Wagga Wagga NSW 2650
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Approved Signatory: Dr Hoang Han Nguyen
Lab manager

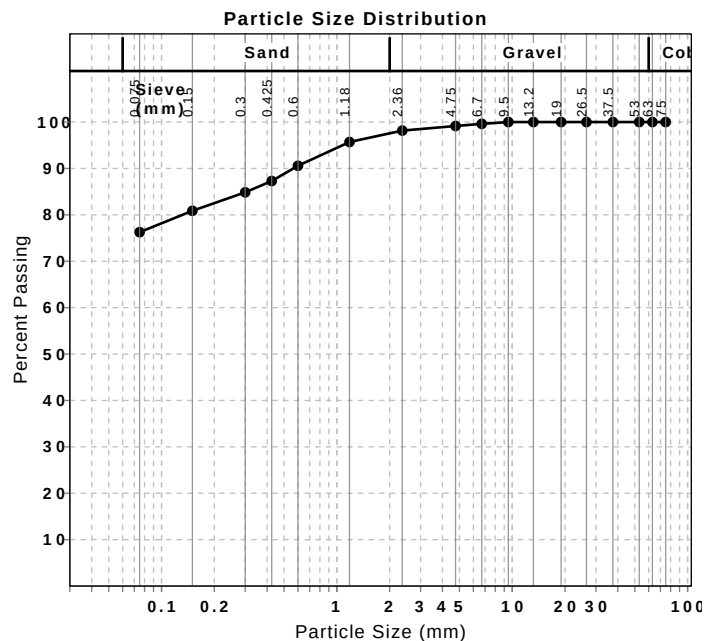
NATA Accredited Laboratory Number: 3349

Particle Size Distribution (AS1289 3.6.1)				
Sieve	Passed %	Passing Limits	Retained %	Retained Limits
75 mm	100		0	
63 mm	100		0	
53 mm	100		0	
37.5 mm	100		0	
26.5 mm	100		0	
19 mm	100		0	
13.2 mm	100		0	
9.5 mm	100		0	
6.7 mm	100		0	
4.75 mm	99		0	
2.36 mm	98		1	
1.18 mm	96		2	
0.6 mm	91		5	
0.425 mm	87		3	
0.3 mm	85		2	
0.15 mm	81		4	
0.075 mm	76		5	

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	31		
Plastic Limit (%)	14		
Plasticity Index (%)	17		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	8.0		
Cracking Crumbling Curling	Cracking		

Moisture Content (AS 1289 2.1.1)		Min	Max
Moisture Content (%)	14.3		



Material Test Report

Report Number: 24-1
Issue Number: 1
Date Issued: 11/07/2024
Client: GHD

Contact: Leona Zha
Project Number: 24
Project Name: Geotechnical investigation
Project Location: Betts Street Cootamundra NSW 2590
Work Request: 1928
Sample Number: 1928E
Date Sampled: 05/07/2024
Dates Tested: 08/07/2024 - 11/07/2024
Sampling Method: AS 1289.1.2.1 6.5.3 - Power auger drilling
Sample Location: BH03 E: 594702, N: 6164955, Depth: 0.9-1.1m
Material: CLAY with sand
Material Source: In-situ



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Wagga Wagga Laboratory
6 Jones Street Wagga Wagga NSW 2650
Phone: (02) 6931 0510
Email: han@dmmcmahon.com.au



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Approved Signatory: Dr Hoang Han Nguyen
Lab manager

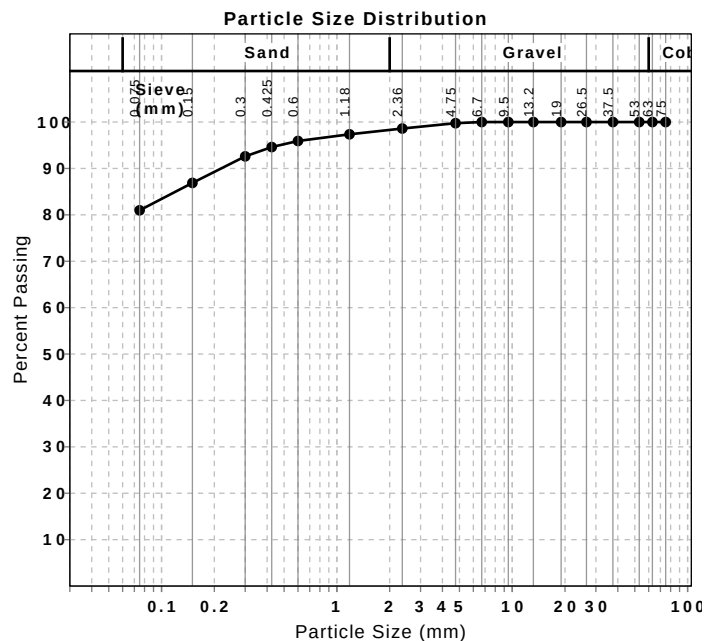
NATA Accredited Laboratory Number: 3349

Particle Size Distribution (AS1289 3.6.1)				
Sieve	Passed %	Passing Limits	Retained %	Retained Limits
75 mm	100		0	
63 mm	100		0	
53 mm	100		0	
37.5 mm	100		0	
26.5 mm	100		0	
19 mm	100		0	
13.2 mm	100		0	
9.5 mm	100		0	
6.7 mm	100		0	
4.75 mm	100		0	
2.36 mm	99		1	
1.18 mm	97		1	
0.6 mm	96		1	
0.425 mm	95		1	
0.3 mm	93		2	
0.15 mm	87		6	
0.075 mm	81		6	

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	30		
Plastic Limit (%)	12		
Plasticity Index (%)	18		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	8.0		
Cracking Crumbling Curling	Cracking		

Moisture Content (AS 1289 2.1.1)		Min	Max
Moisture Content (%)	12.5		



Material Test Report

Report Number: 24-1
Issue Number: 1
Date Issued: 11/07/2024
Client: GHD

Contact: Leona Zha
Project Number: 24
Project Name: Geotechnical investigation
Project Location: Betts Street Cootamundra NSW 2590
Work Request: 1928
Sample Number: 1928F
Date Sampled: 05/07/2024
Dates Tested: 08/07/2024 - 11/07/2024
Sampling Method: AS 1289.1.2.1 6.5.3 - Power auger drilling
Sample Location: BH03 E: 594702, N: 6164955, Depth: 1.8-2.0m
Material: CLAY with sand
Material Source: In-situ



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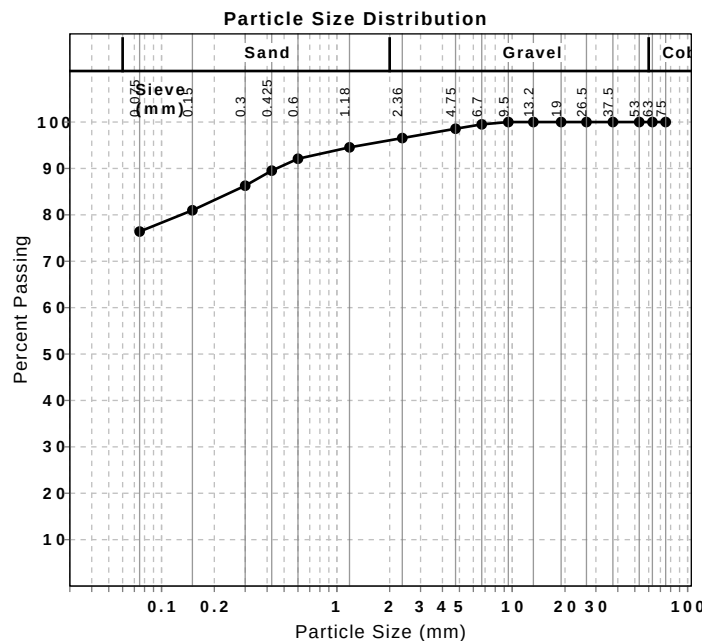
Approved Signatory: Dr Hoang Han Nguyen
Lab manager
NATA Accredited Laboratory Number: 3349

Particle Size Distribution (AS1289 3.6.1)				
Sieve	Passed %	Passing Limits	Retained %	Retained Limits
75 mm	100		0	
63 mm	100		0	
53 mm	100		0	
37.5 mm	100		0	
26.5 mm	100		0	
19 mm	100		0	
13.2 mm	100		0	
9.5 mm	100		0	
6.7 mm	100		0	
4.75 mm	99		1	
2.36 mm	97		2	
1.18 mm	95		2	
0.6 mm	92		2	
0.425 mm	90		3	
0.3 mm	86		3	
0.15 mm	81		5	
0.075 mm	76		5	

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	32		
Plastic Limit (%)	13		
Plasticity Index (%)	19		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	10.5		
Cracking Crumbling Curling	Cracking		

Moisture Content (AS 1289 2.1.1)		Min	Max
Moisture Content (%)	20.3		



Material Test Report

Report Number: 24-1
Issue Number: 1
Date Issued: 11/07/2024
Client: GHD

Contact: Leona Zha
Project Number: 24
Project Name: Geotechnical investigation
Project Location: Betts Street Cootamundra NSW 2590
Work Request: 1928
Sample Number: 1928G
Date Sampled: 05/07/2024
Dates Tested: 08/07/2024 - 11/07/2024
Sampling Method: AS 1289.1.2.1 6.5.3 - Power auger drilling
Sample Location: BH04 E: 594886, N: 6164619, Depth: 0.8-1.2m
Material: CLAY
Material Source: In-situ



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Wagga Wagga Laboratory
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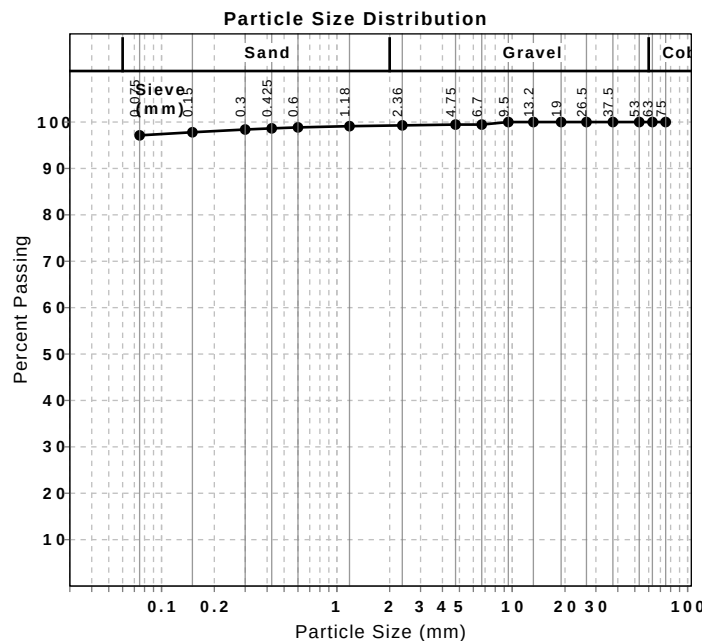
Approved Signatory: Dr Hoang Han Nguyen
Lab manager
NATA Accredited Laboratory Number: 3349

Particle Size Distribution (AS1289 3.6.1)				
Sieve	Passed %	Passing Limits	Retained %	Retained Limits
75 mm	100		0	
63 mm	100		0	
53 mm	100		0	
37.5 mm	100		0	
26.5 mm	100		0	
19 mm	100		0	
13.2 mm	100		0	
9.5 mm	100		0	
6.7 mm	99		1	
4.75 mm	99		0	
2.36 mm	99		0	
1.18 mm	99		0	
0.6 mm	99		0	
0.425 mm	99		0	
0.3 mm	98		0	
0.15 mm	98		1	
0.075 mm	97		1	

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	71		
Plastic Limit (%)	21		
Plasticity Index (%)	50		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	19.0		
Cracking Crumbling Curling	Cracking		

Moisture Content (AS 1289 2.1.1)		Min	Max
Moisture Content (%)	25.6		



Material Test Report

Report Number: 24-1
Issue Number: 1
Date Issued: 11/07/2024
Client: GHD

Contact: Leona Zha
Project Number: 24
Project Name: Geotechnical investigation
Project Location: Betts Street Cootamundra NSW 2590
Work Request: 1928
Sample Number: 1928H
Date Sampled: 05/07/2024
Dates Tested: 08/07/2024 - 11/07/2024
Sampling Method: AS 1289.1.2.1 6.5.3 - Power auger drilling
Sample Location: BH04 E: 594886, N: 6164619, Depth: 1.8-2.02m
Material: CLAY trace sand
Material Source: In-situ



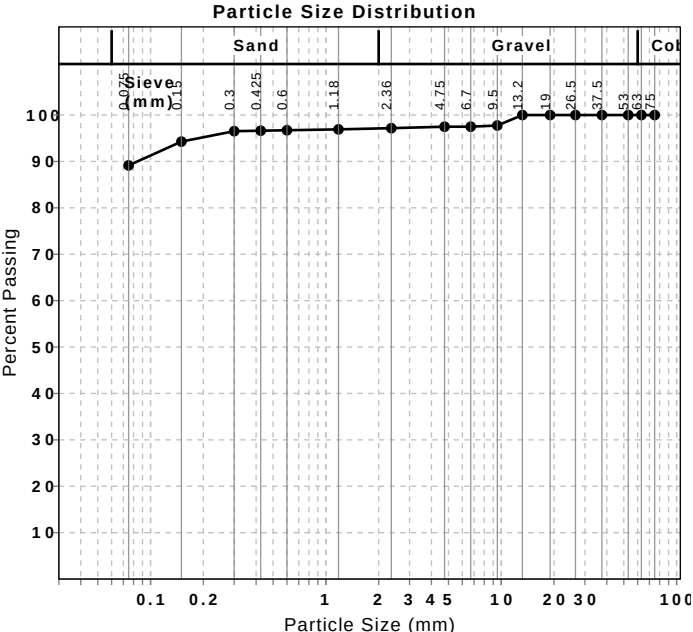
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Wagga Wagga Laboratory
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Email: han@dmmcmahon.com.au



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Approved Signatory: Dr Hoang Han Nguyen
Lab manager
NATA Accredited Laboratory Number: 3349

Particle Size Distribution (AS1289 3.6.1)				
Sieve	Passed %	Passing Limits	Retained %	Retained Limits
75 mm	100		0	
63 mm	100		0	
53 mm	100		0	
37.5 mm	100		0	
26.5 mm	100		0	
19 mm	100		0	
13.2 mm	100		0	
9.5 mm	98		2	
6.7 mm	97		0	
4.75 mm	97		0	
2.36 mm	97		0	
1.18 mm	97		0	
0.6 mm	97		0	
0.425 mm	97		0	
0.3 mm	97		0	
0.15 mm	94		2	
0.075 mm	89		5	



Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	42		
Plastic Limit (%)	14		
Plasticity Index (%)	28		
Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	14.0		
Cracking Crumbling Curling	Cracking		
Moisture Content (AS 1289 2.1.1)		Min	Max
Moisture Content (%)	23.3		

Material Test Report

Report Number: 24-1
Issue Number: 1
Date Issued: 11/07/2024
Client: GHD

Contact: Leona Zha
Project Number: 24
Project Name: Geotechnical investigation
Project Location: Betts Street Cootamundra NSW 2590
Work Request: 1928
Sample Number: 1928I
Date Sampled: 05/07/2024
Dates Tested: 08/07/2024 - 11/07/2024
Sampling Method: AS 1289.1.2.1 6.5.3 - Power auger drilling
Sample Location: BH05 E: 595219, N: 6164239, Depth: 0.8-1.2m
Material: CLAY with sand
Material Source: In-situ



DM McMahon Pty Ltd
Wagga Wagga Laboratory
6 Jones Street Wagga Wagga NSW 2650
Phone: (02) 6931 0510
Email: han@dmmcmahon.com.au



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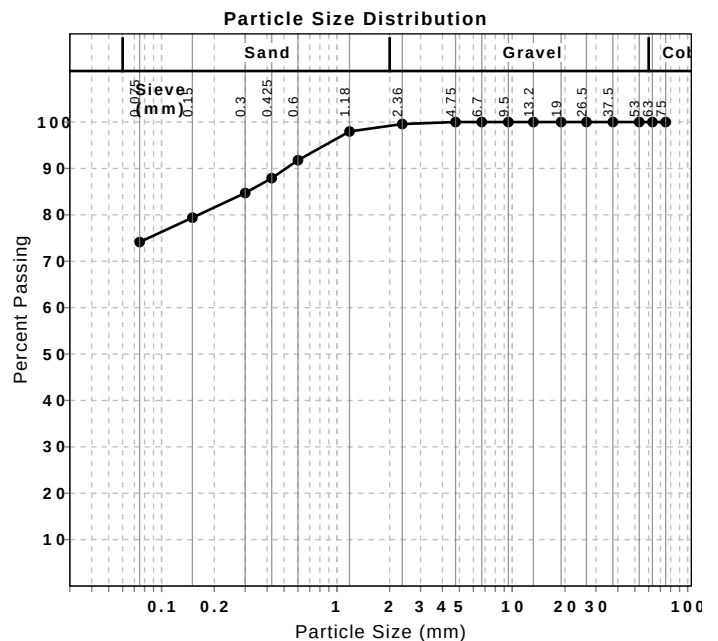
Approved Signatory: Dr Hoang Han Nguyen
Lab manager
NATA Accredited Laboratory Number: 3349

Particle Size Distribution (AS1289 3.6.1)				
Sieve	Passed %	Passing Limits	Retained %	Retained Limits
75 mm	100		0	
63 mm	100		0	
53 mm	100		0	
37.5 mm	100		0	
26.5 mm	100		0	
19 mm	100		0	
13.2 mm	100		0	
9.5 mm	100		0	
6.7 mm	100		0	
4.75 mm	100		0	
2.36 mm	100		0	
1.18 mm	98		2	
0.6 mm	92		6	
0.425 mm	88		4	
0.3 mm	85		3	
0.15 mm	79		5	
0.075 mm	74		5	

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	37		
Plastic Limit (%)	13		
Plasticity Index (%)	24		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	13.0		
Cracking Crumbling Curling	Cracking		

Moisture Content (AS 1289 2.1.1)		Min	Max
Moisture Content (%)	15.0		



Material Test Report

Report Number: 24-1
Issue Number: 1
Date Issued: 11/07/2024
Client: GHD

Contact: Leona Zha
Project Number: 24
Project Name: Geotechnical investigation
Project Location: Betts Street Cootamundra NSW 2590
Work Request: 1928
Sample Number: 1928J
Date Sampled: 05/07/2024
Dates Tested: 08/07/2024 - 11/07/2024
Sampling Method: AS 1289.1.2.1 6.5.3 - Power auger drilling
Sample Location: BH05 E: 595219, N: 6164239, Depth: 1.8-2.0m
Material: CLAY
Material Source: In-situ



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Email: han@dmmcmahon.com.au



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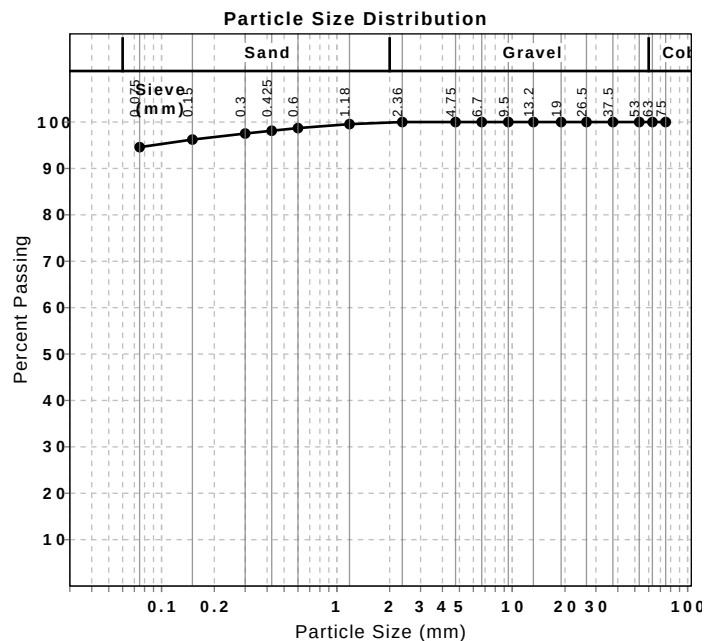
Approved Signatory: Dr Hoang Han Nguyen
Lab manager
NATA Accredited Laboratory Number: 3349

Particle Size Distribution (AS1289 3.6.1)				
Sieve	Passed %	Passing Limits	Retained %	Retained Limits
75 mm	100		0	
63 mm	100		0	
53 mm	100		0	
37.5 mm	100		0	
26.5 mm	100		0	
19 mm	100		0	
13.2 mm	100		0	
9.5 mm	100		0	
6.7 mm	100		0	
4.75 mm	100		0	
2.36 mm	100		0	
1.18 mm	100		0	
0.6 mm	99		1	
0.425 mm	98		1	
0.3 mm	98		1	
0.15 mm	96		1	
0.075 mm	95		2	

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	46		
Plastic Limit (%)	14		
Plasticity Index (%)	32		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	14.5		
Cracking Crumbling Curling	Cracking		

Moisture Content (AS 1289 2.1.1)		Min	Max
Moisture Content (%)	23.7		



Material Test Report

Report Number: 24-1
Issue Number: 1
Date Issued: 11/07/2024
Client: GHD

Contact: Leona Zha
Project Number: 24
Project Name: Geotechnical investigation
Project Location: Betts Street Cootamundra NSW 2590
Work Request: 1928
Sample Number: 1928K
Date Sampled: 05/07/2024
Dates Tested: 04/07/2024 - 10/07/2024
Sampling Method: AS 1289.1.2.1 6.5.3 - Power auger drilling
Sample Location: BH06 E: 595560, N: 6164270, Depth: 0.8-1.2m
Material: CLAY with sand
Material Source: In-situ



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Wagga Wagga Laboratory
6 Jones Street Wagga Wagga NSW 2650
Phone: (02) 6931 0510
Email: han@dmmcmahon.com.au



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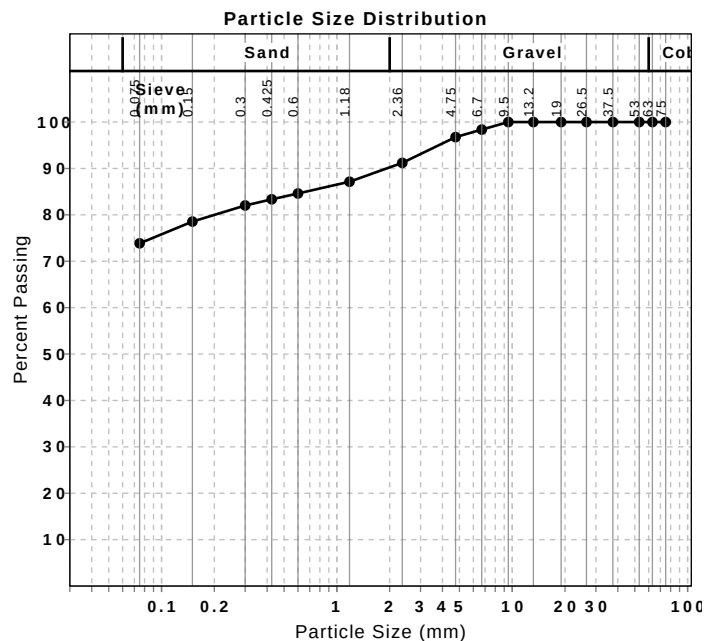
Approved Signatory: Dr Hoang Han Nguyen
Lab manager
NATA Accredited Laboratory Number: 3349

Particle Size Distribution (AS1289 3.6.1)				
Sieve	Passed %	Passing Limits	Retained %	Retained Limits
75 mm	100		0	
63 mm	100		0	
53 mm	100		0	
37.5 mm	100		0	
26.5 mm	100		0	
19 mm	100		0	
13.2 mm	100		0	
9.5 mm	100		0	
6.7 mm	98		2	
4.75 mm	97		2	
2.36 mm	91		6	
1.18 mm	87		4	
0.6 mm	85		3	
0.425 mm	83		1	
0.3 mm	82		1	
0.15 mm	79		3	
0.075 mm	74		5	

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	41		
Plastic Limit (%)	14		
Plasticity Index (%)	27		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	13.5		
Cracking Crumbling Curling	Cracking		

Moisture Content (AS 1289 2.1.1)		Min	Max
Moisture Content (%)	14.0		



Material Test Report

Report Number: 24-1
Issue Number: 1
Date Issued: 11/07/2024
Client: GHD

Contact: Leona Zha
Project Number: 24
Project Name: Geotechnical investigation
Project Location: Betts Street Cootamundra NSW 2590
Work Request: 1928
Sample Number: 1928L
Date Sampled: 05/07/2024
Dates Tested: 08/07/2024 - 11/07/2024
Sampling Method: AS 1289.1.2.1 6.5.3 - Power auger drilling
Sample Location: BH06 E: 595560, N: 6164270, Depth: 1.8-2.0m
Material: Sandy CLAY
Material Source: In-situ



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Wagga Wagga Laboratory
6 Jones Street Wagga Wagga NSW 2650
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Email: han@dmmcmahon.com.au



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NATA Accredited Laboratory Number: 3349

Particle Size Distribution (AS1289 3.6.1)				
Sieve	Passed %	Passing Limits	Retained %	Retained Limits
75 mm	100		0	
63 mm	100		0	
53 mm	100		0	
37.5 mm	100		0	
26.5 mm	100		0	
19 mm	100		0	
13.2 mm	100		0	
9.5 mm	99		1	
6.7 mm	98		1	
4.75 mm	94		4	
2.36 mm	79		15	
1.18 mm	68		11	
0.6 mm	62		6	
0.425 mm	60		2	
0.3 mm	57		2	
0.15 mm	53		4	
0.075 mm	47		6	

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	40		
Plastic Limit (%)	16		
Plasticity Index (%)	24		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	12.5		
Cracking Crumbling Curling	Curling		

Moisture Content (AS 1289 2.1.1)		Min	Max
Moisture Content (%)	12.4		

