



City of Kalgoorlie Boulder
Technical Specification for
Construction of
South Boulder WWTP Inlet Works

Revision 0, March 2024

CITY OF KALGOORLIE BOULDER
SPECIFICATION FOR
CONSTRUCTION OF SOUTH BOULDER WWTP INLET WORKS

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S1 GENERAL INFORMATION

S1.1 EXISTING OPERATIONS

Kalgoorlie is located approx. 600 km east of Perth, Western Australia.

The City of Kalgoorlie-Boulder (CKB) owns and operates the South Boulder Wastewater Treatment Plant (WWTP), which is located approximately 4 km south of Kalgoorlie, at Lot 218 - 220 Goldfields Hwy, South Boulder, Western Australia.

The WWTP services the Kalgoorlie-Boulder (approx. 12,000 services) and operates under Department of Water and Environmental Regulation (DWER) **Licence L8560/2011/2**. The facility licence covers categories 54 sewage treatment, and 61 liquid waste, according to the *Environmental Protection Regulations 1987*.

The WWTP operations consist of two treatment trains (refer Figure 1):

- i. An intermittently decanted extended aeration (IDEA) plant with design capacity of 8 ML/day (currently offline), and
- ii. Wastewater stabilisation ponds that operate in parallel to the IDEA plant.

The **inlet structure** functions to measure flow rates and to split flows between the two treatment trains. The new works will add bulk solids screening to reduce maintenance works and improve treatment capacity of the WWTP treatment trains.

Figure 1: Existing CKB South Boulder WWTP Operations



S1.2 BASIS OF WORKS

Replacement of the WWTP inlet structure and installation of new screening equipment is required to:

- Remove the existing, corroded concrete inlet structure which is at end of asset life,
- Install coarse screening for all sewage entering the plant (currently only screened at IDEA plant inlet),
- Improve flow metering accuracy,
- Add overflow management pipework,
- Improve liquid waste receival infrastructure including metering,
- Improved site traffic management and access control for improved safety at the WWTP.

The IDEA plant is currently isolated from sewage flow.

S1.3 EXISTING SITE PHOTOS

Photos of the existing site conditions and equipment are included in Appendix C. These do not form part of the contract or required dilapidation reporting.

S2 GENERAL PRELIMINARIES

S2.1 PRINCIPAL'S CONTRACT PRELIMINARIES

The Principal's Contract Preliminaries apply to the following:

- Occupational Health & Safety planning and compliance,
- Contractor's Works Program,
- Repair of damaged utility services,
- Water supply for compaction & dust suppression,
- Waste disposal.

S2.2 ORDER OF PRECEDENCE

The Formal Instrument of Agreement defines contractual order of precedence in the documentation.

If there is conflict or inconsistency between the technical specifications, the order of precedence will be:

- Legislation and Regulations
- Technical Codes of Practice
- These Specifications,
- The Issue For Tender (IFT) Drawings, to be superseded by the Issue For Construction (IFC) drawings at Award.
- Australian Standards
- Other Standards

All conflicts or inconsistencies between the specifications, drawings or Australian Standards shall immediately be referred to the Superintendent's Representative for clarification.

S2.3 STANDARDS, CODES AND REGULATIONS

Materials and workmanship shall comply with this Specification and the relevant current Australian Standards, Government Codes and Regulations, including but not limited to those listed below.

The Specification takes precedence over the Australian Standards.

S2.3.1 Legislation

Electricity Industry (Licence Conditions) Regulations 2005

Energy Safety Regulations 2006

Electricity (Supply Standards and System Safety) Regulations 2001

Licensed Surveyors Act 1909 (WA)

National Code of Practice for the Safe Removal of Asbestos (2005)

National Construction Code (NCC)

Workplace Health and Safety Act 2020

Work Health and Safety Regulations 2022

S2.3.2 Australian Standards

AS 1012	Methods of testing concrete
AS 1141	Methods for sampling and testing aggregates
AS 1214	Hot dip galvanized coatings on threaded fasteners
AS/NZS 1252	High strength steel bolts with associated nuts and washers for structural engineering
AS 1289	Methods of testing soils for engineering purposes - Definitions and general requirements
AS 1302	Steel reinforcing bars for concrete
AS 1319	Safety Signs for the Occupational Environment
AS 1379	Specification and supply of concrete
AS 1419.3	Cranes, hoists and winches
AS 1554	Structural steel welding
AS 1579	Arc-welded steel pipes and fittings for water and wastewater
AS 1594	Hot-rolled steel flat products
AS 1657	Fixed platform, walkway, stairways & ladders
AS 1627	Metal finishing – Preparation and pretreatment of surfaces
AS 1646	Elastomeric seals for waterworks purposes
AS 1650	Hot-dipped galvanised coatings on ferrous articles

AS/NZS 1665	Welding aluminium structures
AS 1674	Safety in welding and allied processes
AS1725 Part 1	Chain link fabric security fences and gates
AS/NZS 2033	Installation of polyethylene pipe systems
AS 2129	Flanges for pipes, valves and fittings
AS/NZS 2280	Ductile iron pipes and fittings
AS 2550	Safe Use of Cranes, hoists & winches
AS/NZS 2566	Buried flexible pipelines
AS 2638.2	Gate Valves for waterworks purposes-Resilient seated
AS 2758	Aggregates and rock for engineering purposes
AS 2780	Residential slabs and footings
AS/NZS 2865	Safe Working in a Confined Space
AS/NZS 3000	Electrical Installations – Wiring Rules
AS/NZS 3008.1	Electrical Installations – Selection of Cables
AS/NZS 3012	Electrical Installations – Construction and Demolition Sites
AS/NZS 3017	Electrical Installations - Verification Guidelines
AS 3500	Plumbing and Drainage
AS3600	Concrete structures
AS 3610	Formwork for concrete
AS 3566	Self-drilling screws for the building and construction industries
AS 3735	Concrete structures for retaining liquids
AS/NZS 3750.15	Paints for steel structures - Inorganic zinc silicate paint
AS 3799	Liquid membrane-forming curing compounds for concrete
AS 3894.1	Site testing of protective coatings, Non-conductive coatings - Continuity testing - High voltage ('brush') method
AS 3894.3	Determination of dry film thickness
AS 3894.4	Assessment of degree of cure
AS 4041	Pressure Piping
AS/NZS 4087	Metallic flanges for waterworks purposes
AS/NZS 4131	Polyethylene (PE) compounds for pressure pipes and fittings
AS/NZS 4331.2	Metallic flanges- Cast iron flanges
AS/NZS 4600	Cold-formed steel structures
AS/NZS 4671	Steel reinforcing materials

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

S2.3.3 Water Services Association of Australia

WSA 01-2004 *Polyethylene Pipeline Code* Version 3.1

S2.3.4 Water Corporation Standards

Latest versions of the Water Corporation specifications and standards are available on the following website: [Design standards \(watercorporation.com.au\)](https://www.watercorporation.com.au/design-standards)

DS95 Specification L1 - Tape Wrapping Procedure, System "B"

WS-1 Metal Arc Welding Specification

WS-2 Welding and Joining Specification Thermoplastics

S2.3.5 Other Standards

Precast Concrete Handbook, Concrete Institute of Australia

PIPA Technical Guidelines [Technical Guidelines – Plastics Industry Pipe Association of Australia \(pipa.com.au\)](https://www.pipa.com.au/technical-guidelines)

POP 003 Butt Fusion Jointing of PE Pipes and Fittings – Recommended Parameters

POP 007 Metal Backing Flanges for Use with Polyethylene (PE) Pipe Flange Adaptors

S2.4 HEALTH AND SAFETY REQUIREMENTS

S2.4.1 Safety in Design (SiD) Register & CRAW

Hazard identification and risk mitigation planning have been documented in the safety in design risk register (SiD); Refer appendix B, document number 1034-04-08-SID-001.

The report includes some mitigation actions required to be completed by the Contractor. The Contractor shall incorporate the SiD into the Contractor's Safety Risk Register with the aid of a Construction Risk Assessment Workshop (CRAW) including relevant stakeholders and sub-contractors representatives for any high risk activities, eg. bypass isolation.

S2.4.2 Safety Codes of Practice

Safe Work Australia (2006) *National Standard for Licensing Persons Performing High Risk Work*

National Occupational Health and Safety Commission - *National Guidelines For Occupational Health And Safety Competency Standards For The Operation Of Loadshifting Equipment And Other Types Of Specified Equipment* [NOHSC: 7019 (1992)]

National Occupational Health and Safety Commission - *Code of Practice for the Safe Removal of Asbestos*

National Transport Commission (2018) *Load Restraint Guide*

Government of Western Australia, Worksafe [Approved guidance notes | Department of Mines, Industry Regulation and Safety \(commerce.wa.gov.au\)](https://www.commerce.wa.gov.au/industry-regulation-and-safety), including but not limited to:

Government of Western Australia (2019) – *Code of Practice – Concrete and masonry cutting and drilling*

Government of Western Australia (2022) – *Code of Practice – Confined spaces*

Government of Western Australia (2022) – *Code of Practice – Construction work*

Government of Western Australia (2022) – *Code of Practice - Excavation*

Government of Western Australia (2022) – *Code of Practice – First aid in the workplace*

Government of Western Australia (2022) *Code of Practice – Managing the risk of falls at the workplace*

S2.4.3 Hygienic Practice for Working Near Wastewater

Vaccination recommendations for workers exposed to wastewater should be developed in consultation with local health authorities and consider the best practice developed by the Department of Health and the Department of Mines, Industry Regulation and Safety.

Tetanus vaccinations should be up to date, with consideration also given to the need for polio, typhoid fever, Hepatitis A and Hepatitis B vaccinations.

Refer Department of Mines, Industry Regulation and Safety website for more information:

[Best practice guidance for reducing health risk for workers handling sewage, biosolids or recycled water | Department of Mines, Industry Regulation and Safety \(commerce.wa.gov.au\)](https://www.commerce.wa.gov.au/industry-regulation-and-safety/best-practice-guidance-reducing-health-risk-workers-handling-sewage-biosolids-recycled-water)

S2.5 SEQUENCING OF WORKS

The sequence of works has been identified as a critical risk for safety, continuity of operations and potential sewage discharge.

The Contractor shall prepare a baseline Program, including sequencing of works and critical path sequence, with particular detail for Works during the sewer diversion period.

The final baseline Program will be dependent on, but not limited to, the following constraints for sequencing of Works:

- Continuous sewer flow directed into the wastewater treatment plant must be maintained during the Works at all times. The sequencing of Works will seek to minimise the sewer diversion temporary works, targeting 14 days of diversion or less.
- The Contractor shall prepare a Traffic Management Plan (TMP) as per MRWA's Traffic Management for Works on Roads, Code of Practice and WC-OSH111 *Traffic Management*. The plan shall include timing and coordination of all major materials and equipment import to Site and coordination of area-constrained movements.
- Craneage and lifting plan acceptance, as incorporated into baseline Program, and to suit minimisation of the sewer diversion works.

S2.6 TRAFFIC MANAGEMENT PLAN

The Contractor shall prepare a Traffic Management Plan (TMP) according to Main Roads WA's *Traffic Management for Works on Roads, Code of Practice* and WC-OSH111, *Traffic Management*. The Traffic Management Plan will also be compliant to any requirements of the City of Kalgoorlie-Boulder.

The Contractor shall comply with Main Roads WA Oversize Overmass (OSOM) Class 1 RAV Oversize permitting and fees requirements, including preparation of the OSOM transport management plan.

<https://www.mainroads.wa.gov.au/heavy-vehicles/permit-order-scheme/osom/>

When traffic control measures are required, the Contractor shall always provide a Representative on Site who has successfully completed the Main Roads WA (MRWA) accredited "*Basic Worksite Traffic Management & Traffic Control*" training course.

The Contractor will prevent undue damage to any roads during the Works, including any mobilisation / demobilisation haulage.

S2.7 HOLD POINT: CRANAGE, DOGGING & LIFTING

The Contractor is responsible for all legislative and regulatory compliance, including insurance coverage, for all lifting, dogging and rigging works.

Refer to drawing 1034-03-08-DWG-008 for precast channel lifting points detail. The designed precast concrete was calculated to weigh 99 tonne. The Contractor shall verify the weigh of final precast unit for the lifting plan and selection of crane.

The Contractor shall submit a detailed lifting plan to the Superintendent's Representative a minimum of 10 days prior to lifting works. The lifting plan shall include but not be limited to:

- Nomination of authorised and licensed personnel
- Load specifications
- Crane specifications
- Site / ground conditions, including any required testing and wind conditions, and planning for proximity to inlet chamber excavation
- Stability planning including outriggers, stabilisers and/or counterweights design, as applicable
- Lifting risk assessment
- Rigging selection and inspection schedules, and other equipment (eg wind anemometers)
- Safety zone and access control
- Dogging works, including communication protocols
- Monitoring and supervision
- Emergency response plan
- Inspection and testing documentation records of the above

Proforma inspection lists can be referenced as follows, without limitation:

[Guide to inspecting and maintaining cranes \(safeworkaustralia.gov.au\)](https://safeworkaustralia.gov.au/guide-to-inspecting-and-maintaining-cranes)

[Cranes information and checklist \(commerce.wa.gov.au\)](https://commerce.wa.gov.au/cranes-information-and-checklist)

[Guidance about dogging, rigging and lifting \(dmp.wa.gov.au\)](https://dmp.wa.gov.au/guidance-about-dogging-rigging-and-lifting)

The Contractor's personnel shall be licensed for the following roles of persons performing high risk work, without limitation:

- Crane & hoist operation Slewing mobile crane—with a capacity over 100 tonnes
- Dogging
- Rigging

S2.8 ENVIRONMENTAL REQUIREMENTS

S2.8.1 Prescribed Premise Licence L8560

The South Boulder WWTP is operated under the Department of Water and Environmental Regulation (DWER) License **L8560/2011/2**.

The Principal shall manage the wastewater treatment plant operations, excluding temporary sewer diversion, and third party liquid waste acceptance. Principal compliance with the License is mandatory and the Contractor shall follow directions from the Superintendent's Representative for regulatory compliance.

The Contractor shall not spill or discharge untreated sewage at any time. Any spill shall be reported to the Superintendent's Representative immediately.

S2.8.2 Desludging Waste Disposal

The Contractor shall carry out desludging works of existing liquid waste pit and screening pit. Volumes of sludge have not been surveyed. Refer appendix C photographic records.

The existing liquid waste pit has dimensions 2.38 m x 3.88 m and is estimated to have sludge depth of approx. 1.5 – 2.0 m.

Waste sludge can be disposed to the South Boulder WWTP sludge lagoons. The Contractor will advise the Superintendent's Representative at least 5 days prior to sludge disposal for approval and directions from the Principal regarding WWTP interface.

S2.8.3 Asbestos

The Works involve the handling and working on asbestos cement (AC) pipes – an asbestos containing material (ACM). Asbestos poses a very significant health hazard; its handling shall be done by competent personnel.

Asbestos cement shall be removed from site and shall not be used as backfill material.

The Contractor shall handle/work on all ACM in accordance with the following Codes of Practice and standards:

- SafeWork Australia, *Code of Practice, How to Safely Remove Asbestos*.

- National Occupational Health and Safety Commission, *Code of Practice for the Safe Removal of Asbestos 2nd Edition [NOHSC:2002(2005)]*

S2.8.4 Disposal of Unsuitable Materials

All excess materials produced, cleared, or cut in accordance with this specification shall become the property of the Contractor. Dispose of excess materials at CKB Yarri Road landfill facility, including fees, to the approval of the Superintendent's Representative.

Waste concrete, pipework, steel and any other waste or spoil materials that are not recoverable shall be broken down and disposed at CKB Yarri Road landfill facility, including fees.

S2.8.5 Dust Control

The Contractor shall carry out all operations in compliance with Department of Environmental Conservation "A guideline for managing the impacts of dust and associated contaminants from land development sites, contaminated sites remediation and other related activities". This shall include the use of watering carts as determined by the soil and wind conditions on Site, to the Superintendent's Representative approval. Contractor is responsible for water supply; refer Section S2.12.2.

S2.8.6 Noise Control

The Contractor shall prevent nuisance and unreasonable disturbance and ensure all work under the Contract is undertaken in accordance with the *Environmental Protection (Noise) Regulations 1997*.

S2.8.7 Stormwater

The Contractor shall be responsible for preventing the Works becoming flooded from any runoff or rainfall. Keep groundworks and excavations free of water. The contractor shall ensure that all materials, services, including concrete is stored to prevent damage or inundation from stormwater or run off. Materials shall not be stored directly on the ground or in areas that have been or are likely to be inundated.

Where excavations become wet from stormwater or are below the water table the Contractor shall promptly remove water by pumping or other suitable means and provide adequate means of disposing of water to Superintendent's Representative approval.

S2.8.8 Groundwater

The Contractor shall provide a provisional sum for pumping of groundwater, to be activated if it is discovered that works are below background groundwater table. This does not include the stormwater pumping specified above or if groundwater is raised by rains current at the time of construction; these are deemed covered in section S2.8.7.

Dewatering and disposal of dewatering water must be in accordance with DWER's Water Quality Protection Note 13, *Dewatering of soils at construction sites*, November 2012 (WQPN 13).

South Boulder routine groundwater monitoring for the WWTP License indicates depth to groundwater of approx. 2.7 m (330.7 mAHD).

S2.9 SUB-CONTRACTORS AND SUPPLIERS

The Contractor shall maintain their sub-contractor's compliance to the Contractor's contract conditions, including but not limited to, all job safety and sequencing planning, and the Quality Management Plan.

Any sub-contractor undertaking work under the Contract, as approved by the Superintendent's Representative in accordance with the Contract Preliminaries, shall maintain a third-party Certified Quality Management System. All other sub-contractors and suppliers which do not possess formal third-party accreditation shall supply their products and services under the Contractor's Quality Management Plan.

S2.10 PROPRIETARY PRODUCTS OR BRANDS

Wherever a proprietary product or brand has been specified, an alternative proprietary product or brand may be used only if approved by the Superintendent's Representative, subject to it being of equal function and quality to the specified product or brand. The cost associated with evaluating alternative products may be charged to the Contractor at the discretion of the Superintendent's Representative.

S2.11 HOLD POINT: PHOTOGRAPHIC RECORD/ DILAPIDATION REPORT

The Contractor shall provide a report on the condition of the existing assets, vegetation and features using photographic records, and video recording as necessary, looking in both directions. This may include Main Roads or CKB road conditions, as required.

This shall be of land, vegetation conditions and features on or around the Site, including established walls, roads, road verges, fences road furniture, footpaths, drains etc. for all areas likely to be affected by the Works. This information will be used for subsequent restoration work, quality assurance and insurance claims assessment.

A copy of the report and photographic record with each photograph duly identified shall be supplied to the Superintendent's Representative at least 5 working days prior to the commencement of construction work, the Superintendent's Representative shall release the Hold Point in writing.

If the Contractor's photographs are not of adequate quality or content to assess the pre-construction condition of the site, the Contractor may be liable for the cost of restoration as directed by the Superintendent's Representative.

Prior to the completion of the works, the Contractor and the Superintendent's Representative shall inspect the assets, vegetation and features to determine what repair or remediation works are required to return their original condition. The Contractor shall submit a Completion Report of corresponding photos and videos to the Dilapidation Report.

S2.12 PROTECTION OF SERVICES

S2.12.1 Above & Below Ground Services

The Contractor shall be responsible for the positive identification and protection of all services within the Site including the solar array. Limited survey and As Constructed drawings are available and are included in this documentation.

S2.12.2 Repair of Service Damages

All damage by the Contractor or its agents shall be reported immediately to the Superintendent's Representative and shall be repaired and restored to its original condition at the Contractor's expense.

Where the Contractor fails to take action within the time specified by the Superintendent, the Superintendent's Representative may take such actions as may be necessary to minimise damage to the services and utilities.

The Contractor shall be responsible for repairing any damage caused by the Works to adjacent and nearby properties and for responding to any claims in this regard.

The Contractor is advised that the cost of any work undertaken by the Principal due to the failure of the Contractor to observe the terms and conditions of this Clause shall be a debt due from the Contractor to the Principal and shall be recovered by the Principal in accordance with the terms and conditions of the Contract.

S2.13 CONTRACTORS' WORK AREA, FACILITIES & SERVICES

S2.13.1 Contractors' Work Area

The Contractor shall establish the work area, laydown area, construction facilities and necessary services within an area identified by the Superintendent's Representative. No other area will be permitted for use by the Contractor unless approved by the Superintendent's Representative.

The recommended Contractor laydown area(s) are shown in drawing 1034-03-08-DWG-001-1.

S2.13.2 Construction Water Supply

The Contractor will be responsible for all costs associated with the procurement, transport and disposal of scheme water used for construction, testing and dust suppression to the Works.

Bulk water for construction and testing purposes is available as potable water from a 50mm standpipe on **Piccadilly St, adjacent to Sir Richard Moore Oval** (Figure 2). The Principal's vehicles and services will have access priority at the standpipe.

Scheme water is available from a 50mm pipe with a 40mm ball valve at WWTP Site north of the existing inlet flume structure. Access and amount of water available to the Contractor from this tap is subject to Principal's approval.

Water disposal is permitted at the WWTP sludge lagoons subject to notifying the Superintendent's Representative for access to the Principal's site,

Figure 2: Location of potable water standpipe – Sir Richard Moore Oval, Piccadilly St



S2.13.3 Power Supply

The Contractor shall provide and maintain any temporary electrical power and distribution facilities required for construction.

Use of generators on Site shall be subject to noise abatement and fuel bunding compliance as required by WorkSafe Western Australia and local authority regulations.

S3 WORKS UNDER CONTRACT (WORKS)

S3.1 SCOPE OF WORKS

S3.1.1 Works Exclusion

Aqseptance Group has been contracted for third-party design, manufacture, delivery and commissioning of the center flow band screens, launder, wash press and Program Logic Control, as included in Appendix F of this Specification.

The supply of the screens, launder, wash press and PLC is excluded from the Works. Commissioning of the same equipment is also excluded from the Works.

S3.1.2 Scope of Works

The Works shall include the supply, construction, installation and testing of earthworks, concrete, pipework, valves and meters, penstocks, filtration equipment, FRP grating and ancillaries for inlet works as described in this Specification and detailed in the Issue for Tender Drawings.

This list is not exhaustive and should not be considered a substitute for regulations, statutory requirements, construction practice or contractual obligations.

The Scope of Works will include, but is not limited to:

- i. Decommissioning works:
 - a. Decommission the existing IDEA plant step screen pit (refer drawings FY88-3-1 & 3-2), including isolation of electrical and scheme water services to the location. Connect the existing DN600 FRC pipework with approx. 3 m DN630 PE through the redundant pit with two (2) AVK SUPA-GIB couplings (or approved equivalent). Break out existing structures as required.
 - b. Remove existing bollards, guardrails, fencing and gate at liquid waste discharge pit and existing inlet structure as shown on 1034-03-08-DWG-001-2.
 - c. Relocate existing scheme water pipes and entry gate swipe card reader as shown on 1034-03-08-DWG-001-3.
 - d. Remove redundant equipment items as specified, and secure in Principal's laydown areas at Site, at Superintendent's Representative direction.
- ii. Fabrication and freight to Site of the precast concrete channel, including the bellmouth pipe protrusions and puddle flanged pipe protrusions, in accordance with structural drawings. Transport planning and permitting shall be in accordance with Main Roads WA oversize overmass (OSOM) standards.
- iii. Works during sewer temporary diversion will be minimised by the Contractor such that all Works can be constructed safely, including:
 - a. All temporary wastewater diversion works from the main sewer to the wastewater treatment plant (WWTP) ponds to safely isolate the Works.
 - b. Remove and dispose of existing concrete inlet structure and apron, commencing at the DN750 gravity sewer pipe, and ending at the north-south DN600 AC splitter cut-ins (no drawings available). Location of structure for final decommissioning is shown on 1034-03-08-DWG-001-2.

- c. Remove and dispose of 25m of existing DN750 corrugated PE sewer pipe and 30m of existing DN600 AC pipe between existing inlet flume structure to existing liquid waste discharge pit.
- d. Decommission approx. 4m deep concrete liquid waste discharge pit and apron located on the ponds pipework (no drawings available), location of pit and apron is shown on 1034-03-08-DWG-001-2.
- e. For ponds pipework (south of inlet works), replace 30m of existing DN600 AC pipe with DN630 PN8 PE pipe, joint with two (2) AVK SUPA-GIB couplings (or approved equivalent).
- f. Excavate and compact the foundation subgrade and install concrete blinding for new precast concrete structure,
- g. HOLD POINT: Install precast concrete channel to specified levels and to comply with existing pipework levels,
- h. Install SS316 PN16 AVK SUPA-GIB coupling (or approved equivalent) to connect the new DN750 SS316 pipe protrusion to existing DN750 corrugated PE sewer pipe,
- i. Install two (2of) SS316 PN16 AVK SUPA-GIB couplings (or approved equivalent) to connect two (2of) DN600 SS316 pipes to existing DN600 FRC pipe and replaced DN630 PE pipe (item i, c.),
- j. Within new concrete chamber, install two sets of (2of) DN450 SS316 flanged pipe spools, DN450 magflow meters, DN450 dismantling joints, DN450 knife gate valves and Binder pipe supports for the flowmeters, valves and dismantling joints,
- k. HOLD POINT: Install 55m of DN500 PN8 PE overflow pipe from screen channel to pond 1A, install SS316 PN16 AVK SUPA-GIB coupling (or approved equivalent) to connect the DN500 SS316 pipe to new overflow pipe. Cover the overflow pipe under the truck route with cement stabilised sand. Concrete encase the overflow pipe outlet at pond 1A and reinstate clay lining. **Principal will lower pond water for pipe installation.** Can be done in stages to minimise sewer diversion period,
- l. Install electrical, communications conduits, scheme water minor pipework to equipment as required, refer to drawing 1034-03-08-DWG-005. Contractor T to provide notification to Principal for cabling installation into operations building PLC and switchboard.
- m. Supply and install four (4of) AMWA manufactured ULF penstocks in the screen channels,
- n. Supply and install two (2of) AMWA manufactured DLF downward opening penstocks in the screen channel splitter pits,
- o. Install DN150 HDPE wall mounted Fernco flap valve, or approved equivalent, on the drain from wash press pit,
- p. Install DN315 PN8 PE drop structure pipework between the liquid waste pit and precast channel grit sump,
- q. Fill the void underneath the precast screens channel with pumped blinding concrete,
- r. Install FRP grating over concrete channel including structural supports as shown on 1034-03-08-DWG-009 and DWG-010, and manufacturer's specifications,
- s. HOLD POINT: Testing of pipework, and two (2) flow meters commissioning,

- t. Close penstocks in one screen channel with stop board installed for isolation and future screen installation. DLF penstock to IDEA plant to be closed, DLF penstock to ponds to be open,
 - u. Commission sewer flows into inlet chamber and remove temporary diversion works. Additional works to be completed during sewer diversion works will be determined by the Contractor on the basis of construction safety.
- iv. Cast in-situ the reinforced concrete wash press pit, including anti-slip stairs,
- v. Cast in-situ the reinforced concrete pad for screenings bin,
- vi. Cast in-situ the concrete pad for future filtration unit,
- vii. Cast in-situ the reinforced concrete liquid waste pit including puddle flanged pipework,
- viii. Backfill and compact around the cast in-situ concrete structures' levels (wash press pit, liquid waste pit, screenings bin pad, liquid waste discharge hardstand and future filtration unit pad),
- ix. Cast in-situ the reinforced concrete hardstand in the road alignment, including side kerbing and entry / exit berms. Hardstand includes underdrain to liquid waste pit.
- x. Build cement stabilised pavement over the access areas into and out of liquid waste discharge pad.
- xi. Construct the earth berm island between the hardstand and truck route.
- xii. Install DN250 PN8 PE below ground pipe and DN250 above ground pipe from the liquid waste hardstand to the liquid waste pit including a potted DN250 magflow meter, headwall support and stainless steel camlock, with flexible hose,
- xiii. Install access platform over wash press pit including FRP grating, support structure,
- xiv. Install guard railing according to drawing 1034-03-08-DWG-002. The guardrails on the west side of the grit sump and liquid waste pit shall be removable (refer drawing DWG-003),
- xv. Install wash water piping and valving from existing 50mm scheme water pipe to the screens, launder and wash press.
- xvi. Install scheme water taps (2of) at hardstand and filter pad,
- xvii. Install electrical and communications conduits from operations building to equipment according to drawing 1034-03-08-DWG-006,
- xviii. Retain and refurbish the bitumen seal within the truck route and build unsealed pavement for the remaining of the route according to drawing 1034-03-08-DWG-001-3,
- xix. Reinstate concrete crossover to existing shed,
- xx. Install new fencing and gates around the truck route as shown on 1034-03-08-DWG-001-3,
- xxi. Relocate existing screenings bin,
- xxii. Install signage for entry to liquid waste entry, one-way signs, give way sign, and other safety signs
- xxiii. Paint top perimeter of all concrete pits and pads yellow,
- xxiv. Supply valve spindle(s),

- xxv. HOLD POINT: final testing of all new pipework, additional flow meter (1of) and cabling. Submission of all completion documentation for Works.
- xxvi. SEPARABLE PORTION: Install and fasten the Third Party Supplied band screens, launder and wash press according to Supplier's drawings and specifications, for commissioning by Others.

S3.2 DRAWINGS

S3.2.1 Drawing List

The Drawings register and Drawings for this Specification are included in Appendix A.

S3.2.2 Contractors Drawings, Documentation, and Calculations

The Contractor shall provide to the Superintendent's Representative any shop and fabrication detail drawings and supporting calculations, as are necessary for the construction of the Works, prior to construction, for the Superintendent's Representative approval.

S3.3 SITE

Site is defined in drawing 1034-04-08-DWG-001-1 Site Plan including:

- Construction Site covering all contracted Works,
- Contractor's laydown area, with access gates at north end and main entry gate at south end of Site,
- Temporary works area is not demarcated but pipe alignment is shown.

The Principal shall retain access to the administration building, storage sheds and all other operational areas of the wastewater treatment plant.

S3.4 CONTRACTOR LAYDOWN

The Contractor is permitted to establish and access Contractor Laydown areas, to the Superintendent's Representative approval, at the following locations:

- South Boulder WWTP Site as shown 1034-04-08-DWG-001-1, and if required

S3.5 MATERIALS SUPPLIED BY THE PRINCIPAL

The Principal will supply the Aqseptance center flow band screens, launder, wash press and PLC as detailed in Appendix F.

The Principal will not supply any other materials or plant to the Works unless specified by the Superintendent's Representative, in writing to the Contractor.

S3.6 WORKS PERFORMED BY THE PRINCIPAL

S3.6.1 Notification

The Principal shall advise relevant authorities and public on the commencement of the Works.

S3.6.2 Isolations

The Principal shall complete Site electrical isolations using lock out - tag out protocols with the Contractor.

S3.6.3 Operations

The wastewater treatment plant will require operations to be maintained. The Principal will conduct all normal operations of the WWTP with access to the plant and operations building.

The Contractor shall define safety management of the operations – construction interface to the Superintendent's Representative approval.

The Contractor shall notify the Superintendent's Representative of any change in operational access at least 7-days prior to any change.

S3.6.4 Tie-in to Building Switchboard and PLC

The Principal shall complete electrical and communications cabling into the operations building PLC and switchboard.

S3.7 SITE ESTABLISHMENT AND SETTING OUT

S3.7.1 General

The Contract Works will include the following set-out and site preparation:

- Establishment of temporary infrastructure for site management (e.g. laydown areas)
- Establishment and control of survey marks and all survey and setting out work

Survey detail provided in the drawings are partial drone survey only.

S3.7.2 Surveyors Qualification

The Contractor shall be responsible for surveying, setting out, cadastral boundary locations and as-constructed information pick-up by a qualified engineering surveyor as defined in the *Licensed Surveyors Act 1909, WA*.

S3.7.3 Survey Control

Survey control shall be established by a qualified engineering surveyor, for the purposes of all work on site, prior to the commencement of any work. Where provided, the positions of survey marks on-site (e.g. survey pins, pillars and beacons) shall be shown on the 'As-Constructed' drawings.

Survey work shall include setting out the levels, lines, alignments and positions of all components of the Works.

Survey set-out including potholing location of DYBD services and identification of all services and utilities.

S3.8 TEMPORARY WORKS

S3.8.1 Sewer Flow Rate

The Contractor shall size the temporary works equipment (pipe, pump/s etc.) adequately for the inflow rates detailed in Appendix D. Spillage of sewage flows is not permitted under the *Environmental Protection Act 1986*.

The bypass infrastructure should allow for management of any rainfall events and potential peaking in sewage flows.

The Principal's sewer scheme can be reviewed on Intramaps site: [Online Maps » City of Kalgoorlie-Boulder \(ckb.wa.gov.au\)](https://online-maps.cityofkalgoorlie-boulder.wa.gov.au).

S3.8.2 Temporary Works General Arrangement

Refer to drawing 1034-03-08-DWG-001-1.

The Contractor shall isolate the sewer scheme upstream of sewer access chamber T1 for Contractor's sewer temporary diversion works installation and removal.

The Contractor shall submit a temporary sewer diversion plan to the Superintendent's Representative approval for the safe isolation of sewer flows at sewer access chamber T1. The temporary pumping arrangement shall discharge at the specified splitter chamber to the ponds, located south of the Site.

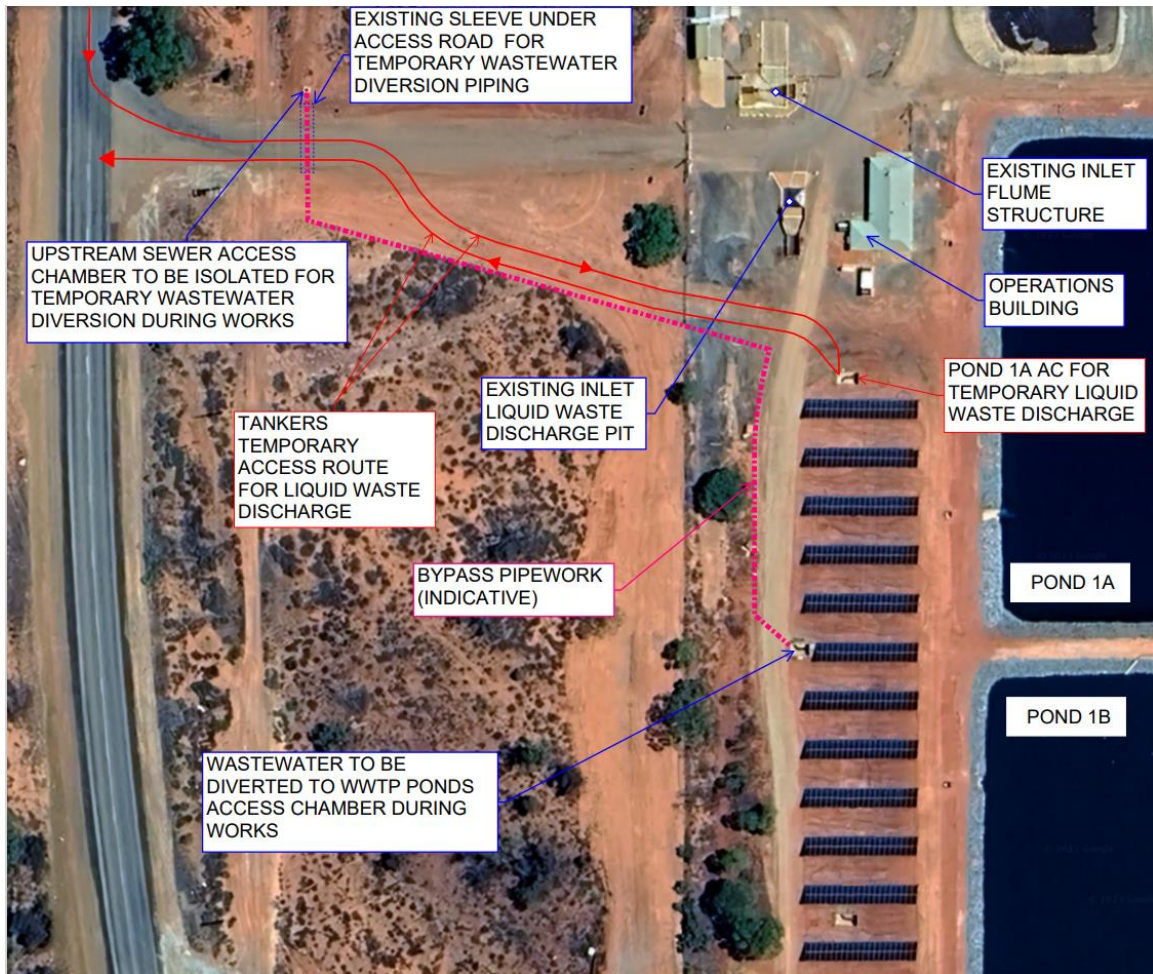
The access road to the WWTP has a pipe sleeve installed for installation of temporary carrier piping. The Contractor shall review the arrangement when planning the haulage and crane movement into the Site.

S3.8.3 Liquid Waste Carriers Access

The Principal requires continued access for liquid waste (LW) discharge operations. The LW will access the Operations area via a gate outside of the Contractor's Site for discharge to an access chamber, according to drawing 1034-03-08-DWG-001-1 and Figure 3 below.

The Contractor is required to work with the Principal to develop the traffic management plan with respect to liquid waste carriers and safe management of the construction – operation interface.

Figure 3: South Boulder WWTP Inlet Works - Wastewater Diversion Plan



S4 CIVIL WORKS

S4.1 DECOMMISSIONING OF REDUNDANT ASSETS

The Works area is an operating inlet to the WWTP. The existing inlet assets and equipment are at end of asset-life and will be decommissioned for the new Works. Refer drawing 1034-03-8-DWG-001-2 and Appendix C photographic records of existing site.

The Works will include decommissioning of the following equipment:

- Removal of the existing WWTP inlet concrete structure, including flume, surrounding bollards (11of) and guardrails.
- Removal of approx. 25m of DN750 corrugated PE pipe and approx. 30m DN600 AC pipe
- Excavate contaminated soil surrounding the above, including excavation to a minimum of 500 mm for the precast concrete channel subgrade works, includes Provisional Sum for unplanned quantities.
- Removal of southern, existing liquid waste discharge pit and apron, steel gate, guardrails, ladder, signage, gazebo cover, bollards (2of).
- Decommission the existing IDEA plant step screen pit (refer drawings FY88-3-1 & 3-2), including isolation of electrical and scheme water services to the location.
- All excavated concrete, spoil, equipment and materials shall be disposed at Yarri Road landfill, at Contractor cost. Asbestos cement pipe is to be handled and disposed according to legislated permit requirements, including disposal fees.
- Decommissioning of the inlet level transducer, support frame, communications and electrical cables, solar panel and control cubicle.
- Remove approx. 60 m of 1.0m high fence including gates.
- Relocate two (2of) street lighting poles.

All electrical materials, fittings, accessories, equipment, etc., removed from an existing installation shall not be reused in a new installation, unless approved by the Superintendent's Representative.

S4.2 EARTHWORKS

S4.2.1 Geotechnical Information

No geotechnical testing has been completed.

The Contractor must satisfy themselves that the existing ground conditions and formation levels as shown on the drawings are correct before commencing earthworks. All works are within the footprint of existing installations.

S4.2.2 Geotechnical Verification of Foundations

The Contractor shall be responsible for foundation verification. Engagement of a geotechnical engineer to test and verify the foundation condition is at the Contractor's discretion.

S4.2.3 Rock Excavation

Rock is defined as any monolithic material with volume greater than 0.8 m^3 which cannot be removed unless broken up by mechanical means such as percussion tools or a single ripper, with a flywheel output not less than 400kW ripping in two directions (e.g., caterpillar D9G).

The Contractor shall advise the Superintendent's Representative immediately of rock encountered and confirm in writing within two (2) days.

The rock profile is to be agreed with the Superintendent's Representative before rock excavation commences. Surveyed profiles of the rock shall be submitted by the Contractor to enable the Superintendent's Representative to assess the accurate measurement of rock.

Except as noted below, rock excavation will be measured in its original position by taking the difference between the rock surface at the time the trench is excavated and that after the excavations are complete, without bulking factor.

S4.2.4 Stockpiling and Spoil

The Contractor will stockpile all excavated materials and/or imported materials, within the designated Site or nominated Contractor Laydown areas, to Superintendent's Representative approval.

Stockpiles shall not be greater than 2m in height and shall not be stockpiled adjacent to excavation works.

Spoil materials that are unsuitable for reuse in the works as general and/or for landscaping purposes shall be removed in accordance with this specification.

S4.2.5 Fill Material Specification & Testing

The following fill specification excludes pipe bedding material; refer section S5.4.4.

Unless otherwise specified or directed, the material used for fill shall be obtained from the Works excavation. Fill material shall be free from logs, stumps, weeds and all organic matter. Material used as general fill shall be free of particles larger than 75mm unless otherwise noted.

Borrow pits shall not be developed at the Site. Imported fill material obtained from a suitable source shall comply with the necessary regulations and bylaws of the City of Kalgoorlie – Boulder. Imported fill shall be clean sand free of deleterious material or suitable clayey sand with a small percentage of low-plasticity material.

Materials shall be well mixed to provide a consistent material grading. Fines clay material (CL) shall be low plasticity (maximum plasticity index of 6%) inorganic clay tested to be above the Casagrande A-line including Liquid Limit less than 40.

Table 1: General Fill Material Grading

SIEVE (mm)	% PASSING (DRY WEIGHT)
37.50	100
19.0	80 – 100
9.5	60 – 95
4.75	45 – 95
2.36	35 - 90
1.18	25 – 88
0.425	18 – 75
0.075	12 - 30

If import material is required, the Contractor must submit material testing reports demonstrating suitability of the material before procuring the materials.

All materials tests for the Works shall be undertaken by a laboratory, certified by the National Australian Testing Authority (NATA) and approved by the Superintendent's Representative. All tests shall be completed to AS 1289 Methods of testing soils for engineering purposes.

The tests conducted on the material must be adequate to demonstrate compliance to the specification including the following:

1. Sieving analysis,
2. Atterberg Limit tests (plasticity index (PI) and liquid limit (LL)),
3. Modified Maximum Dry Density (MMDD) and Optimum Moisture Content (OMC).

S4.2.6 Material Affected by Moisture

Control of moisture content should be completed through stockpile blending.

When material is unable to support construction equipment, or it is not possible to compact overlying material because of high subgrade moisture content, then one or more of the following alternative actions may be taken:

- Allow the material to dry to a moisture content which will allow compaction and the placement of the clay material.
- Excavate the soft or weak material and place and compact with approved fill material.

S4.2.7 Compaction

Compacted fill is to be completed in lifts of maximum 300 mm loose thickness and minimum 150 mm.

The Contractor must nominate a compaction method to achieve the compaction results specified. The method shall be added to the Contractor's ITP.

Compaction shall comply to the minimum targets in Table 2.

The Contractor shall maintain moisture content of fill in the Optimum Moisture Content (OMC) range $\pm 2\%$ by drying or the addition of moisture as required, preferably dry of OMC.

Table 2 Compaction Specification

DESCRIPTION	MINIMUM RELATIVE DENSITY
Replacement of unsuitable material in cuttings and subgrades	Density of Undisturbed Soils
Replacement of over excavation	95% MMDD
Foundation	95% MMDD
Road base finish	95% MMDD
Cement stabilised approach / exit to hardstand	98% MMDD

S4.2.8 Compaction Testing and Completion Tolerances

The Contractor shall carry out all quality control tests on site and at a NATA accredited laboratory. Tests reports shall be provided for the Superintendent's Representative within 2 days of receipt.

The parameters to be tested include:

- Field Density- Nuclear density gauge,
- Field Moisture Content, and
- Modified Maximum Dry Density test.

The Contractor shall include any other tests necessary to help them determine compliance of the works to specification.

Minimum Frequency of Testing

The Contractor shall ensure that the testing regime and frequency is adequate for assessment of Specification compliance.

As a minimum, the tests frequency shall be one (1) test per 250m² surface area for every lift at weakest compaction locations. A minimum of four (4) tests shall be completed at the foundation subgrade of the concrete channel section prior to blinding concrete placement.

The Contractor must calibrate and utilise DCP testing or Perth sand penetrometer (PSP) as required in-between nuclear density gauge tests to ensure strict compliance to compaction targets.

Adequate control of earthworks shall be through appropriate inspection and will not rely on these tests alone; it shall include measures such as visual assessments of fill, test rolling, surveillance of compaction procedures and compaction trials.

Failed compaction

The acceptance of the earthworks tested according to these specifications shall be on a "not one to fail" basis.

Any lot that fails the compaction test shall be scarified to a passed lift / lot level, moisture conditioned, recompacted and retested until it passes- at the cost of the Contractor.

Earthworks tolerances

On completion of cutting, filling and all incidental operations and before the placement of covering materials, finished surfaces shall conform to the tolerances in level and shape shown in Table 3.

Table 3 Earthworks Tolerance and Compaction Specification

Item	Description	Tolerance
1	Earthworks – level	+ 100 mm, no less than specified level
2	Cut or fill batters	± 2°
3	Moisture Content	OMC ± 2%,

S4.3 INTERNAL ACCESS ROADS

S4.3.1 Existing Bitumen Seal

The Contractor will protect and retain existing bitumen sealed access roads as shown on drawings 1034-03-08-DWG-001—2 and DWG-001-3.

S4.3.2 General: Class U3 Unsealed Pavement

The access road shall be in accordance with Austroads *Guide to Pavement Technology Part 6 Unsealed Pavements* and Main Roads WA design standards.

The access road will be to U3 class according to *Guide to Pavement Technology Part 6 Unsealed Pavements*, consisting of one wearing course over one subgrade with surface *drainage* including the following pavement configuration:

- 40 mm max. particle size wearing course, min. 100 mm thick,
- 55 mm max. particle size subbase, min. 150 mm thick.

Subgrade shall be formed of the in-situ material.

Road drainage fall shall be 3 % in all sections.

S4.3.3 Pavement Materials

Natural gravel, pit materials or quarry waste is to be used for the construction of the road.

Granular or modified materials will be adopted in the wearing course, to the Superintendent's Representative approval, as shown in Table 4 and Table 5.

Table 4 Properties for unsealed road subgrade

Sieve size (mm)	Per cent passing
26.5	100
19	75-95
2.36	35-45
0.425	20-25
0.075	10-15
Plasticity	Weighted Plasticity Index (PI x % passing 2.36) Max. 20
4 day Soaked CBR	Minimum 40%

Table 5 Properties for unsealed road wearing course

Sieve size (mm)	Per cent passing
55	100
37.5	95-100
26.5	90-100
19	80-100
2.36	35-65
0.425	15-50
0.075	10-40
Plasticity	Weighted Plasticity Index (PI x % passing 0.425) Max. 20
4 day Soaked CBR	Minimum 40%

S4.3.4 Stabilisation Binders

Where available, subgrade material will have a four-day CBR < 5%, the Contractor shall make recommendation of lime or chemical binder to achieve CBR > 5 % to the Superintendent's Representative approval. Notice of lime or chemical binder application must be submitted to Superintendent's Representative at least 5 days prior to construction.

S4.3.5 Compaction

The Contractor shall uniformly compact each layer of the subgrade, subbase and wearing courses over the required area and depth in accordance with AS 1289.

Compaction of each pavement layer shall be 98% of maximum dry density (MDD). To determine the maximum dry density the sample shall be tested in accordance with AS 1289.5.2.1.

The Contractor shall maintain compaction moisture content of fill in the Optimum Moisture Content (OMC) range $\pm 2\%$ by drying or the addition of moisture as appropriate, though preferably dry of OMC. Water spraying equipment used for this purpose shall be capable of distributing water uniformly in controlled quantities over uniform compaction widths.

To prevent lamination at the compaction-lift surface, the Contractor shall compact using a sheepsfoot vibratory roller.

At locations where it will be impracticable to use self-propelled compaction plant, the pavement material shall be compacted by alternative hand operated plant approved by the Superintendent's Representative.

Any unbound material in a layer that has attained the specified relative compaction but subsequently becomes wetted up shall be dried out and, if necessary, uniformly recompacted and trimmed to meet the specified density requirements and level tolerances.

The Superintendent's Representative shall assess compaction based on random sampling of test locations for insitu dry density testing.

The Contractor shall arrange for testing to assess compaction based on one (1) test per 500 m² and present the results to the Superintendent's Representative for approval. Sampling frequency may only be varied with prior written approval of the Superintendent Representative.

The cost of all testing for compaction assessment of any layer in an area of pavement shall be borne by the Contractor.

The relative compaction of pavement material at each location tested for in-situ dry density shall be calculated in accordance with AS 1289.5.4.1. The Superintendent shall approve some or all of the in-situ dry density testing to be carried out with a single probe Nuclear Density Meter in direct transmission mode, in accordance with AS 1289.5.8.1.

S4.3.6 Concrete Hardstand

Contractor shall construct the concrete hardstand according to drawing 1034-03-08-DWG-004 and following concrete specifications.

The concrete hardstand shall incorporate:

- Side walls 200mm height and 150mm to function as spills bund and provide truck alignment,
- Speed bumps each end for truck speed control and to function as spills bund,
- A 1% grading towards the drainage sump,
- Recessed drainage sump 600mm x 600mm with 600mm depth including trafficable mesh cover, and
- PE pipe from sump to sludge drying bed outlet.

S4.3.7 HOLD POINT: Cement Stabilisation of Hardstand Approach

Contractor shall cement stabilise the 10.0 m approach to the hardstand with cement compliant to AS 3972, Type LH. Sampling and testing of cement shall be in accordance with AS 2350. The cement must be sufficiently dry to flow freely during application.

Cement Material

HOLD POINT: Prior to commencing cement stabilisation the Contractor shall verify the cement compliance with ATIC – SP43 and submit CMRS registration number(s) to the Superintendent's Representative for approval.

Prior to commencing cement stabilisation, the Contractor shall certify to the Superintendent's Representative that the cement is no more than 3 months old.

Any transportation units and storage bins for bulk cement shall be weatherproof and shall be constructed so that there is no dead storage. If dead storage exists, the bins shall be emptied completely at least once every three months. Cement delivered in bags shall be stored in weatherproof structures having floors raised above the ground.

Cement Spreading

Pavement material shall be spread, mixed, and compacted to achieve uniformity, free from any evidence of segregation. Cement shall be spread uniformly at a controlled rate over the area to be stabilised using a suitable cement spreader.

The spreading equipment shall be a stabilising agent spreader, which has been specifically designed for such work. The spreader shall be capable of uniformly distributing cement and accurately controlling the spread rate.

It shall be the Contractor's responsibility to determine whether pre-ripping the in-situ pavement

material is necessary. Under no circumstances shall ripping to a depth exceeding the depth to be stabilised be permitted.

The spreading of cement shall not proceed when rain is imminent. The spread cement shall be incorporated into the Pavement Layer immediately following the spreading operation. All spread cement shall be incorporated into the Pavement Layer within the same working day. Cement shall not be spread when the prevailing wind velocity is sufficient to make the cement particles airborne.

Compaction

Compaction of each pavement layer shall be 98% of maximum dry density (MDD).

Initial compaction must be carried out using a vibratory pad-foot roller meeting the requirements of open mesh drum of approximately 1.7 m diameter and 1.8 m width. The drum mesh shall be 125mm x 125mm. The roller including ballast shall have a total mass not less than 13tonnes. The grid roller shall be towed by a rubber tyred tractor and each pass shall be made at speeds between 15 and 25km/hr.

Compaction and trimming of the mixed material to shape and level shall be completed within six (6) hours of the completion of incorporation of cement into the pavement layer.

The Contractor shall achieve and maintain the construction moisture content at any point in the Lot in the range 90% – 110% of the OMC of the stabilised material by controlling the amount of water added during the mixing process within the stabilising machine.

If a completed layer of cement stabilisation does not satisfy all the requirements of the Specification and must be reworked, the Contractor shall rework the layer without the addition of cement at no cost to the Principal.

Rework shall include any disturbance to the surface of the cement stabilized layer during trimming to meet shape or level requirements that occurs more than six (6) hours after the completion of incorporation of cement into the Pavement Layer. The rework depth shall not be less than the full depth of the affected layer.

S4.4 CONCRETE

S4.4.1 Precast Structure Foundation

Refer section S4.2.2 for optional geotechnical verification of foundation preparation, and section S4.1 for excavation of deleterious material.

After removal of deleterious and contaminated materials for disposal as spoil, and after verification of excavation depth to material of suitable strength, the Contractor shall compact the subgrade to a minimum density of 95% MMDD to a minimum of 600mm below the concrete channel foundation level, excluding rock excavation.

S4.4.2 HOLD POINT: Foundation Blinding

The Contractor shall install 100mm thick concrete blinding under the precast channel slab as specified below and in accordance with the drawings.

HOLD POINT: The blinding shall be surveyed prior to installation of the precast concrete chamber for verification of pipework invert level tolerances, to the Superintendent's Representative approval.

S4.4.3 Concrete Mix

Concrete materials shall be proportioned so that, when transported, placed, compacted, and cured in accordance with AS3600, the hardened concrete will comply with the strength grades as defined in AS1379. The concrete shall consist of cement, fine and coarse aggregates, water, and approved admixtures and shall be well mixed and brought to a uniform consistency. The design mix of concrete shall also ensure that the resultant concrete will be sound, dense, workable, and durable, without segregation, honeycombing or bleeding.

Admixtures may be used subject to engineering approval. The Contractor shall submit request for admixture approvals from the Superintendent's Representative no less than 10 working days prior to concrete casting.

Concrete test specimens shall be tested in accordance with AS 1012, Part 3 for the determination of slump. The cost of carrying out the assessments and tests, shall be deemed to be included in the tendered sum.

Table 6 Concrete specifications

Location	Concrete Grade	Cover to Reinforcement		Min Continuous Curing Period	Type of Cement
		Nominal (-5, +10)	Minimum		
Precast channel internal face	N40/20/80	55	50	7 days	GP
Precast channel external face	N40/20/80	45	40	7 days	GP
Insitu structure internal face	N40/20/80	55	50	7 days	GP
Insitu structure external face	N40/20/80	45	40	7 days	GP
Blinding	N15/20/80	NA	NA	NA	GP

S4.4.4 Precast Structure to be Watertight

The Contractor shall fabricate and cast the channel structure in accordance with AS 3735 Concrete structures for retaining liquids, including the following:

- Concrete joints will not be accepted,
- Grouting of holes will not be accepted due to dissimilar expansion properties causing cracking.

Use of curing compounds shall be in accordance with AS3799 with a water retention efficiency index of not less than 90% and be compatible with the specified surface finishes. Any curing compound proposal shall be submitted to the Superintendent's Representative for approval at least 10 days prior to concrete casting.

S4.4.5 Precast Concrete Pipe Protrusions, Threaded Inserts & Lifting Lugs

The Contractor shall not cast holes, chases or embedment of pipes in the concrete members other than those shown on drawings.

Puddle flanges of the stainless steel pipe protrusions shall be reinforced in accordance with drawing 1034-03-08-DWG-011. **There shall be no contact of stainless steel pipe material and carbon steel reinforcing.**

Cranage lifting lugs shall be cast into the precast concrete structure in accordance with drawing 1034-03-08-DWG-008, subject to submission of the Contractor's dogging and lifting plan, to the Superintendent's Representative approval.

Threaded inserts for adjoining, cast in situ wash press pit shall be precast into the structure according to drawing 1034-03-08-DWG-010.

S4.4.6 HOLD POINT: Precast Concrete Factory Acceptance Testing & Dimensions

The precast concrete structure shall have the following Factory Acceptance Tests (FAT) for water tightness and dimensions, as witnessed by the Superintendent's Representative, prior to transport:

- Cap all external protrusions and blank flange flow meter pipework.
- Fill the structure with potable water to hold for 24 hours. The structure will be deemed watertight if the water level falls less than 30mm over the 24 hours.
- Survey or digitally measure all dimensions for verification of blinding concrete level required at site to meet existing pipework levels.

S4.4.7 Steel Reinforcement Work

The Contractor shall supply and install all steel reinforcement as shown on the Drawings. Steel reinforcing bars, wire and fabric shall comply with AS/NZS 4671 Steel Reinforcing Materials.

Reinforcing bars shall be bent cold in a manner that will not damage them and shall be dimensioned and shaped in accordance with Reinforced Concrete Detailing Manual of the Concrete Institute of Australia, Appendix A and AS 3600 Concrete Structures.

Before reinforcement is placed, the surface of the reinforcement materials and supports shall be cleaned of loose rust, loose mill scale, dried mortar or grout, dirt, grease, and other deleterious substances. Welding of reinforcement shall comply with AS/NZS 1554.3.

Reinforcement shall be fixed in position by means of 1.6 mm diameter black tie wire to avoid displacement by concreting work. Protruding of the black-tie wire into the cover zone is not permitted. Reinforcement materials shall not be disturbed after incorporation in concrete.

S4.4.8 Concrete Formwork

A waterproof membrane of 0.2mm thick Fortecon or approved equivalent shall be placed under all in situ slabs poured on ground. All joints shall be taped.

Concrete forms and the use of formwork shall be in accordance with AS 3610.

Before placement of concrete in any section of the work, the formwork shall be checked and tightened, all joints effectively stopped, and all debris shall be removed from the space to be occupied by the concrete. The forms and all surfaces upon which concrete is to be placed shall then be thoroughly wetted with water. All chutes shall be flushed with water before and after each concreting operation.

Formwork shall be removed without causing damage to the concrete works, after achieving the specified strength and only in accordance with the minimum formwork stripping times set out in Table 5.4.1 of AS3610. Approved curing shall start immediately after the formwork is removed if the age of formwork removal is less than the minimum curing period.

The surface finish of formwork shall be equivalent to a Class 3 formwork surface finish in accordance with AS 3610 unless otherwise specified.

All concrete surfaces shall be true and free from stone pockets, depressions, or projections beyond the surface. Care shall be exercised in removing forms to ensure this result. All surfaces shall be free from voids, honeycombing, or other large blemishes. Exposed faces shall be uniform in appearance, free from obvious joint lines or with joint lines arranged in an approved regular pattern.

All unformed concrete surfaces above ground level shall have a smooth, steel trowelled surface finish and shall be uniformly and evenly shaped.

Form oils or releasing agents, if approved for use, shall be of the stable and non-toxic type.

Unless otherwise permitted, no fill shall be placed against a cast in situ concrete structure within fourteen (14) days of casting. Strut walls as necessary to prevent movement during placing and compaction.

S4.4.9 Gravity Placing of Concrete

All concrete shall be placed in position as soon as possible after the addition of mixing water and in accordance with the requirements of this Section of the Specification. Concrete that has begun to set before its final compaction has been completed shall be removed from the Works. Prior

written acceptance by the Superintendent's Representative of concreting methodology shall be required for the placing of concrete in water.

The temperature of all concrete when it is being placed shall not exceed 32°C. Concrete shall not be placed if the ambient temperature immediately prior to proposed placing exceeds 38°C or is less than 5°C. Whenever the ambient temperature is 32°C or higher, exposed surfaces of each structural concrete element shall be shaded from the direct rays of the sun in an approved manner for at least ten (10) days after concreting of that element.

In no case shall concrete be allowed to remain in the work if it has begun to set before final consolidation has been completed.

S4.4.10 Concrete Testing

All concrete to be incorporated in the Works shall be sampled in the plastic state and tested for determination of characteristic strength and for the determination of slump in accordance with AS1379. The Contractor shall supply a copy of the strength test results to the Superintendent's Representative no later than two (2) days after each specimen has been tested for strength.

S4.4.11 Pumped Blinding Concrete Fill Under Structure

Prior to backfilling on the sides of the precast concrete structure, the Contractor shall pump concrete under the structure recess. The concrete will be of the same specification as blinding concrete.

S4.5 PLATFORMS & HANDRAILS

The access platform structure shall be constructed from vinyl ester resin type according to the Manufacturer's specifications.

Platform grating shall be Treadwell Gratex square mesh FRP grating (GTX-383838SS) with anti-slip finish, or approved equivalent, in accordance with AS 1657. All fixings will be stainless steel grade 316. Any dissimilar metals will be protected against corrosion.

The top of the FRP grating shall finish flush with the precast chamber top of wall.

Handrails and kickplates shall be in accordance with AS 1657, requiring top guard rail, intermediate rail and kickboard, with minimum height 1000 mm from ground finished surface level. The handrails are required for pedestrian safety only, no vehicle impact loading was required.

S4.6 RESTORATION & REINSTATEMENT

S4.6.1 Restoration Requirements

The Contractor shall reinstate the surface as necessary to remove all ruts and depressions, in accordance with pre-Works photographic survey.

The Superintendent's Representative may suspend all other Works construction work in the event of failure by the Contractor to meet restoration requirements, until such time as all outstanding restoration works have been complete.

S4.6.2 HOLD POINT - Acceptance of Restoration

In the event of disagreement, the Superintendent's Representative shall determine the standard of restoration work by the Pre-Works Photographic Report for the purpose of acceptance.

Any defects or faults identified during the handover inspection shall be repaired within 10 working days or as otherwise agreed. A 12-month defects liability period shall apply unless otherwise agreed by the Principal. If any defects manifest during the defects liability period, the Contractor shall be responsible for repairing them as soon as possible. If the defect is a hazard to vehicle or pedestrian traffic, then the Contractor shall take immediate action to repair or install temporary measures to ensure the safety of pedestrians and vehicles.

S4.7 FENCE & SIGNS

S4.7.1 WWTP Site Perimeter Fencing

The Contractor shall supply and install WWTP site perimeter fencing of standard 1.8m high galvanized, chain link security fence with one new double gate, as shown on drawing 1034-04-08-DWG-001-3 and DWG-011, to match existing WWTP site fence.

The chain link material shall be Heavy Duty Fabric - 50mm Pitch x 3.15mm Wire Heavy Galvanized Quality (W10Z) compliant to AS1725-2010 Part 1 and AS2423, and 3-strand barbed wire. The Contractor shall provide proof of compliance for all fencing materials incorporated into the works.

S4.7.2 Site Internal Fencing

The Contractor shall supply and install standard internal site fencing of 1.0m high, two rail chain wire fence with two new double gates and one personnel gate, as shown on drawing 1034-04-08-DWG-001-3 and DWG-012, to match existing site fence.

S4.7.3 Signage

The Contractor will supply and install safety signage in completion works. All signs shall be compliant to AS 1319 *Safety Signs for the Occupational Environment*.

Table 7 Safety signage required

Sign Type	Number of	Location
Liquid Waste Disposal, single post	1	Liquid waste hardstand entry
Keep Left, single post	1	Liquid waste hardstand
No Entry, single post	2	Liquid waste hardstand (2of)
Give Way, attached to rear of above post	1	Liquid waste hardstand
Direction chevron, two posts	4	Truck turning circle
Confined Space, no posts	2	FRP grating on inlet channel
Authorised Personnel Only, no posts	2	Wash press pit gate, and 1.0m fence at liquid waste hardstand exit

Figure 4 Typical road signage format



Figure 5 Typical operations safety sign format



S5 PIPEWORK, EQUIPMENT & FITTINGS

S5.1 HYDRAULIC GRADE OF PIPEWORKS

The South Boulder WWTP and incoming sewer is a gravitational flow system. The elevation and grade of pipework and chambers is critical to the operations.

No constructed pipeline shall have a grade in the reverse slope direction to that shown on the design drawings. The Contractor shall grade all pipework to suit the existing pipework invert levels.

Pipe invert levels (ILs) refer to lowest point of pipe internal diameter. Pipe ILs level tolerance shall be to ± 3.0 mm.

S5.2 HOLD POINT: PIPE SPECIALS & COUPLINGS

HOLD POINT: The Contractor shall verify all existing pipe dimensions for verification of coupling selection prior to procurement and pipe specials dimensions (drawing 1034-03-08-DWG-014) prior to fabrication.

Existing pipe measurements include:

- DN750 corrugated PE sewer pipe
- DN600 asbestos cement (AC)
- DN600 fibre reinforced cement (FRC)

HOLD POINT: The Contractor shall verify the pipe special protrusions' alignment after the concrete channel cast and submit fabrication drawings to the Superintendent's approval.

Incorrect coupling selection or pipe specials' dimensions will be at Contractor cost.

S5.3 STAINLESS STEEL PIPE

S5.3.1 Pipe Materials & Fabrication

The Contractor will fabricate pipe specials as detailed in drawing 1034-03-08-DWG-014 for the precast concrete channel pipe protrusions and associated pipework, subject to the above Hold Point.

Stainless steel pipeline welding shall be in accordance with AS4041 Pipework Class 2P and Water Corporation Metal Arc Welding Specification WS-1. Weld inspection and testing to be according to Water Corporation standard WS-1.

All stainless steel shall be type 316L material and shall be manufactured in accordance with AS1579. Minimum yield strength will be 300 MPa.

The stainless steel plate material dimensions are to be in accordance AS/NZS 1365 and pipe dimensional tolerances will be according to AS/NZS 1579. Pipe shall have raised face flanges manufactured in accordance with AS 4087.

Welding shall be 3mm fillet in accordance with AS 1554, pickled and passivated in a accordance with ASTM A380.

S5.3.2 Storage & Handling

Direct contact between carbon steel and stainless steel is not permitted.

Tools containing carbon steel and grinding discs containing carbon steel particles shall not be used on, or stored near, the stainless steel materials. Tools used for fabrication of stainless steel shall be clearly identified.

Storage and handling of stainless-steel piping components shall be as follows:

- Stainless steel materials shall be stored on non-metallic pallets.
- End caps shall be kept on piping components.
- All flanges and flanged connections shall be sealed with blinds to prevent ingress of water, moisture and foreign matter. Threaded ends shall be capped with plastic cap and sealed.
- Stainless steel piping and components shall be stored in separate areas away from storage areas for carbon steel and other materials to avoid direct contact between carbon steel and stainless steel.
- Steel wire slings shall not be used for handling and transportation of stainless steel pipes. Canvas or nylon slings shall be used.
- The surfaces of components shall be cleaned with 'acetone' and then rinsed with demineralised water to remove deposits of foreign materials prior to installation.

S5.3.3 Welding Accreditation

Arc-welders shall have the following minimum qualifications and experience:

- Accredited certification of welding qualification compliant to AS 3992 and AS 1554,
- If required, revalidation in form of volumetric test for butt welding and surface flaw detection for fillet welding
- Training needs to be complemented with a minimum field experience (two continuous years) in either butt and / or fillet welding.

S5.3.4 Installation

The stainless steel pipework and magflow meters in the inlet chamber shall be installed in accordance with drawings 1034-03-08-DWG-002-1 and 2-2.

Puddle-flanged stainless steel pipe protrusions for the precast concrete structure shall be installed in accordance with structural concrete drawings 1034-03-08-DWG-009, DWG-010 and DWG-011 typical pipe penetrations detail.

Flanges and gaskets shall be installed in accordance with this specification section S5.5.

Pipe and valve supports shall be Binder Group BG135 adjustable pipe stands without clamp, installed to Manufacturer's Specifications.

Stainless steel or PTFE spacer strips of adequate size shall be installed in areas where stainless steel piping rests on carbon steel supports.

S5.4 POLYETHYLENE PIPE

S5.4.1 Pipe Materials

HDPE pipework and fittings shall be PE100 SDR21 (PN8) black, with cream stripe. Plain black pipe can be accepted, to Superintendent's Representative approval.

HDPE pipework shall comply with AS4130, and HDPE fittings are to comply with AS4129. The HDPE pipework and fittings will be butt-fusion welded on site in accordance with AS2033.

Nominated suppliers and products for HDPE piping include, but are not limited to the following:

Table 8 HDPE Nominated Products

Supplier	Product
Acu-tech	Acu-Sewer PE
Iplex Pipelines	POLIplex
Vinidex	Vindiex PE
David Moss	Damos PE

S5.4.2 Storage & Handling

Loading, unloading and transport operations for PE pipe shall be carried out in accordance with AS/NZS 2033.

Climbing or standing on pipes shall not be permissible. Pipes and supporting system load restraints shall be secured by means of straps, bolsters or other appropriate restraints in accordance with relevant codes of practice. Load restraint mechanisms shall be checked for tension at regular intervals not exceeding 300 kilometres of travel and shall not be released until the transporting vehicle is resting in a secure stable disposition on level ground.

Pipe stacking heights shall be in accordance with pipe manufacturer's specifications. Provision shall be made for side support to prevent stack collapse during removal and to prevent pipe deformation during lifting.

Mechanical equipment and slings used for handling of pipes and fittings shall be in accordance with AS 2550.1 and AS 2550.5 and shall be appropriate to the loads to be lifted.

S5.4.3 Welding Accreditation

Thermoplastic welders shall have the following minimum qualifications and experience:

- Electrofusion Welding (PE) - PMBWELD 302B AND PMBWELD 305B (Installation)
- Training needs to be complemented with a minimum field experience (two continuous years) in either butt fusion and / or electrofusion welding.

Where personnel do not meet these criteria but have successfully completed the training requirements, they shall work under direct supervision of a competent welder at all times.

S5.4.4 Excavation, Bedding & Backfill

All excavated material that is free of organic matter, and rocks or clay lumps greater than 200mm, shall be stockpiled for trench backfill. Excavated material (including clay/clayey soils) shall not be deemed unsuitable due to its moisture content, unless otherwise directed by the Superintendent's Representative.

Over-excavated trench shall be backfilled with pipe underlay material and shall be compacted in layers not greater than 300mm loose thickness to achieve a density of 95% of the maximum modified dry density in accordance with AS 1289.5.4.1.

Bedding material for pipe underlay, side support and overlay shall be sandy material, free of rock or sharp objects coarser than 13.2 mm test sieve. Reuse of in-situ excavated materials is preferred.

Acceptable alternative material for pipe underlay will be 14 mm nominal size coarse aggregate graded to AS 2758 where the base of the trench is in wet ground and comprises clay, rock or sand not effectively dewatered. Sand shall be washed through the crushed rock bedding to prevent settling.

All backfilling shall be placed in horizontal layers. Pipe bedding, haunch and cover material shall be compacted to achieve 95% Modified Dry Density as per AS1289.5.2.1, AS1289.5.8.1 and AS1289.5.4.1.

Pipe bedding shall be minimum of 100 mm thickness, compacted and shaped to receive pipes. Pipe side support material shall be placed in 150 mm layers and compacted. Overlay sand material shall be a minimum of 200 mm above the top of the pipe and compacted.

Backfill shall be placed in loose layers not exceeding 300 mm thickness and shall be compacted to a density ratio of not less than 95% of maximum modified dry density as determined by AS1289.5.2.1, AS1289.5.8.1 and AS1289.5.4.1.

Trench backfill at the access road shall include 5% cement stabilisation of backfill material in accordance with drawing 1034-03-08-DWG-017, Overflow Pipe Long Section.

S5.4.5 Laying and Jointing

All pipes shall be carefully examined for cracks and other defects immediately before being installed. Defective pipe shall not be used. Pipes shall be kept clean at all times. Care shall be taken to remove all sand and other material from the inside of the pipes before they are lowered into the trench.

Allowances shall be made for pipe movement due to temperature changes during installation and commissioning.

Unless otherwise advised by the Superintendent's Representative, a final service water temperature of 20°C should be assumed. Pipe lengths, bend locations etc. should be adjusted for changes in lengths that will occur when the pipe temperature stabilises at 20°C. To minimise residual stress in the pipeline, the pipeline shall be allowed to stabilise at approximately the service temperature before final connection and backfilling.

All joining procedures will be carried out according to the Manufacturer's Specifications.

Pipes shall be joined by butt fusion welding using a machine incorporating a heated plate or collars with integral heating coils in accordance with AS 2033. The joints shall be held under pressure whilst being cooled. The cooling time shall be as specified by the manufacturer.

Joints shall be placed so as to avoid placement of joints on curved section of PE pipe, where possible.

Should a joint be found to be defective, the joint shall be cut out and a new joint made. All such work shall be at the cost of the Contractor.

The Contractor shall provide weld and testing records for each weld. The minimum required information to be supplied on each weld is provided on the templates provided in Water Corporation WS-2 Appendix A. The Contractor is permitted to use their own templates to the Superintendent's Representative approval.

S5.4.6 HOLD POINT: Overflow Pipe Install to Pond 1A

HOLD POINT: The Contractor shall notify the Superintendent's Representative at least 15 days prior to the DN500 PE overflow pipe installation into wastewater treatment pond 1A to enable the Principal's lowering of the pond water level.

The Contractor shall install the DN500 PE pipe with protrusion into pond 1A, according to drawing 1034-03-08-DWG-017, Detail 2.

The Contractor shall retain the clay lining material and rock armour material for reinstatement works on the pond embankment. The pond was refurbished in 2022 and must be reinstated for DWER License compliance.

The pipe protrusion shall be concrete encased.

S5.5 COUPLINGS & FLANGE JOINTS

S5.5.1 Restrained Couplings

Refer section S5.1 Hold Point, the Contractor shall verify all existing pipe dimensions for coupling selection prior to procurement.

The corrugations of the existing DN750 PE sewer pipe shall be stripped and PE stiffener inserted for coupling installation to enable coupling seal.

The surface of the pipes shall be prepared to manufacturer's specification prior to the installation of the couplings.

Couplings will be stainless steel AVK SUPA-GIB straight or stepped couplings (PN16), or approved equivalent.

Refer drawing 1034-03-08-DWG-002-2. The following couplings are specified for each joint of dissimilar pipes based outer diameter (OD) dimensions.

Table 9 Pipe Couplings Specification on Concrete Channel Protrusions

AVK product no.	Seal range 1 (mm)	Seal range 2 (mm)	SS end pipe size		Connecting pipe size	
			Nominal (DWG-014 Reference)*	OD (mm)	Nominal (DWG-002-2 pipe name)	OD (mm)
Straight coupling 601-5-0522-171	498-522	NA	DN500 (Item 7A)	508	DN500 (New overflow PE pipe)	502.4
Stepped coupling 602-5-0620-0644-171	596-620	620-644	DN600 (Item 7B1)	610	DN600 (Existing FRC pipe)	635
Stepped coupling 602-5-0620-0644-171	596-620	620-644	DN600 (Item 7B2)	610	DN630 (New PE pipe to ponds)	633
Straight coupling 601-5-0774-171	750-774	NA	DN750 (Item 7C)	762	DN750 (Existing corrugated PE sewer pipe)	774

Refer drawing 1034-03-08-DWG-001-3. The following couplings are specified for each joint of dissimilar pipes based outer diameter (OD) dimensions.

Table 10 Pipe Couplings Specification, other

AVK reference no.	Seal range 1 (mm)	Seal range 2 (mm)	Pipe 1 size		Pipe 2 size	
			Nominal (Reference)	OD (mm)	Nominal (Reference)	OD (mm)
Stepped coupling 602-5-0644-0672-171	620-644	648-672	DN630 (New PE pipe to ponds)	633	DN600 (Existing AC pipe to ponds)	657
Straight coupling 601-5-0654-171	630-654	NA	DN600 (Existing FRC pipe from inlet channel)	635	DN630 (New PE connector pipe)	633
Straight coupling 601-5-0654-171	630-654	NA	DN630 (New PE connector pipe)	633	DN600 (Existing FRC pipe to IDEA plant)	635

S5.5.2 Flange Specification

Flanged DI pipe fittings shall have integrally cast flanges in accordance with AS 4087 Figures B5 (PN 16).

Flanged connections are to incorporate the following specifications:

Table 11 - Flange Specification

Standard:	AS4087
Material:	Same type or grade as the parent article
Class:	PN16
Configuration:	Type – Integral Face – Raised
Bolting:	Property class 4.6 carbon steel bolts to AS2528
Gasket:	Standard – WSA109 Type – full face 3mm thick elastomeric type Material – EPDM or NBR Application – WC (refer table 5.1 of WSA 109)
Additional requirements:	Insulating flange kits (gaskets and bolts) to be provided where dissimilar metals form the flange connection.
Sampling and testing:	In accordance with AS4087
Dimensions and tolerances:	In accordance with AS4087 section 4

S5.5.3 Gaskets

Gaskets shall be elastomeric (NBR, EPDM or Viton) gaskets, of 3 mm thickness, with hardness between 55 and 75 IRHD, and complying with AS4087.

Gaskets shall be dimensioned such that the ID does not protrude into the bore of the pipe.

The gasket outside diameter (OD) must not be less than the PE stub minimum OD, nor shall the gasket inside diameter (ID) be greater than the mating pipe (or DI fitting) maximum ID.

Flange gaskets used shall be new, unused, undamaged and shall be clean without distortion in any plane.

S5.5.4 Fasteners

For non-stainless steel flanges, the fastener materials for flange connections shall be 8.8 property class hot dip galvanized carbon steel.

Bolts, nuts and washers shall be of the same material type within the flanged joint. Fasteners are to be supplied in accordance with AS1252.

The flange fastener used shall:

- Be to appropriate material specification and shall be free from material and coating defects. The capacity of nuts to run freely on the threads shall be verified prior to installation.
- For hot-dip galvanised nuts subject to tapping, nut threads shall be oiled for corrosion protection in accordance with Clause 5.1 of AS 1214.
- Bolt lengths shall be designed so that a minimum of 2 and a maximum of 5 threads protrude past the nut after installation.
- Include two washers for each bolt assembly.

S5.5.5 Flange Installation

During assembly of flanged joints, fasteners and bearing surfaces shall be lubricated (in addition to factory applied lubricants) as specified below. Contamination of flange and gasket faces with fastener lubricant shall be avoided.

Flange fastener and bearing surface lubricants selected for use in drinking and non- drinking water applications shall comply with AS/NZS 4020, using a scaling factor of 0.05.

The minimum lubrication required shall be light oiling. Grease shall not be used.

Flange fastener installation procedures shall be as follows:

- a) Flange bolt holes shall be numbered by marker pen or other suitable means in accordance with the sequence shown in Water Corporation standard drawing AY58-17-1 for the designated number of flange bolts in order to enable identification during the fastener tightening sequence.
- b) Flange mating holes shall be lined up to facilitate insertion of flange bolts without excessive tightening force.
- c) A thin uniform coating of lubricant shall be applied to fastener threads and to bolt, nut and washer bearing surfaces.
- d) One flat washer shall be placed under the bolt head and one under the nut.

Fasteners shall be tightened in the sequence as marked in Water Corporation standard drawing AY58-17-1. During assembly and tensioning, bolt heads shall be held fast. Tightening should be achieved using a minimum of 5 passes.

Suitable bolting torques are determined in consultation with the PE or gasket manufacturer. The pipes are not in pressurized application. Above ground pipes in the concrete channel will be under self-weight load only.

S5.5.6 Buried Joint / Coupling Corrosion Protection

All buried metallic flanged joints, nuts and bolts on fittings, valves, mechanical joints, tapping bands, shall be wrapped using Denso Petrolatum 4® step system in accordance with Water Corporation Specification L1 - Tape Wrapping Procedure, System "B".

S5.6 PENSTOCKS, VALVES & METERS

S5.6.1 Flow Meters

Magnetic flow meters shall be installed on new (2of) DN450 SS pipes within the concrete channel structure and on the (1of) DN250 PN8 pipe to liquid waste pit.

The flow meters shall be DN450 and DN250 DI SIEMENS MAG5100 model, or approved equivalent to the Superintendent's Representative approval.

A meter display, on field mounted stand, shall be installed for the DN250 magflow meter as shown on drawing 1034-03-08-DWG-002-2 and DWG-003.

S5.6.2 Gate Valves

Manual operation, ductile iron gate valves (4of) shall be in accordance with AS/NZS 2280 including compliance with the requirements of AS/NZS 4158 for thermal-bonded polymeric coating externally and lining internally.

Gate valve operators shall rotate anti-clockwise for closure of the valve. Flanges are to be rated to PN16 and comply with AS4087.

All DN450 DI PN16 flange fittings to AS4087 requires 12x M24 bolts to torque 204 Nm, or to Manufacturer's Specifications.

Extension spindles are to be supplied in accordance with Water Corp standard drawing AQ71-003- 001-01 (available online).

Table 12 Gate Valve Specification

Purpose	Magflow meters isolation
Standard:	AS2638.2
Type:	Resilient seated, non-rising spindle Double flanged; suitable for flanges in Table 11
Actuation	Manual – Hand wheel; anti-clockwise closure, allowance for padlock.
Pressure rating:	PN16
Transport, handling and storage:	AS2638.2
Components	
Body, bonnet and seal retainer housing (if applicable):	Ductile iron, epoxy lined
Gate:	Coated ductile iron, suitable for Class A chlorinated recycled water
Spindle:	Stainless steel; non rising type to hieghts shown on drawings
Actuation:	Manual

S5.6.3 Dismantling Joints

Refer drawing 1034-03-08-DWG-002-2. The Contractor shall install two (2of) dismantling joints in the above ground magflow meter pipe sections. Dismantling joints shall be Steel Mains DN450 restrained compact dismantling joint (WSA: PA 056). Flanges are to be rated to PN16 and comply with AS4087.

S5.6.4 Penstocks

Refer drawing 1034-03-08-DWG-002-2 and this Specification, Appendix E. The Contractor shall install six (6of) penstocks including:

- Four (4of) AWMA ULF penstocks 1.03m wide by 1.0m high, and
- Two (2of) 0.6m square downward opening AWMA DLF penstocks.

The ULF penstocks shall have 316SS side guide frames be and face mounted on the concrete channel walls. The penstock frame sill shall be in a flat sill configuration. The upstream penstock installation shall allow installation/ removal of stopboards.

The DLF penstock 316SS side frames shall be face mounted on the concrete channel at the DN600 pipe outlets.

All penstocks shall include a rising spindle and removeable handwheel.

S5.6.5 Fabricated Stop Board

The Contractor shall fabricate one (1of) HDPE panel stopboard according to drawing 1034-03-08-DWG-015. The Contractor shall confirm shop drawing dimensions suitable to the precast concrete channel stopboard recesses prior to the concrete casting, to the Superintendent's Representative approval.

The stopboard will include two (2) 25mm thick HDPE panels 1.0m x 1.0m, with sunken bolted fixings to clamp the two panels over a single, continuous silicone P-seal. The fixings shall be flush with the panel surface.

Two (2) holes will be drilled at the top of the stop board for lifting lugs.

S5.6.6 Flap Valve

A DN150 HDPE wall mounted Fernco flap valve, or approved equivalent, shall be installed on the drain from wash press pit as shown on drawing 1034-08-03-DWG-002 (C3 & G3). The flap valve shall be installed on the screens channel side using captive nuts or approved similar.

S6 ELECTRICAL AND COMMUNICATIONS

The Contractor shall install electrical and communications cabling and conduits according to Appendix G schedules and drawing 1034-03-08-DWG-006.

Conduits and cabling shall be installed to the Operations building only. The Principal will install cabling connection to the building PLC and switchboard.

The Contractor will notify the Superintendent's Representative within 5 days of completion of the cabling to enable Principal's works for the equipment commissioning.

S7 SEPARABLE PORTION: SCREENS EQUIPMENT INSTALLATION

Refer Appendix F for third-party supplied band screens, launder and wash press equipment fabrication drawings, including PLC.

The Contractor shall install the equipment including supply of all fixings as specified.

Timing of third-party supplied equipment delivery will be clarified by the Principal at contract Award for the Contractor's baseline Program planning of any demobilization – mobilisation requirements.

The Contractor's Program shall include milestone for Principal's electrical and PLC cabling connection in the operations building to enable the commissioning sequence.

The Contractor will install the band screens either sequentially or concurrently, subject to temporary sewer diversion minimisation, and availability of equipment.

Contractor personnel safety risk of contact with pathogens in wastewater (sewage) will be reduced if both screens can be installed during temporary diversion works.

In the event of time delayed equipment delivery, the Contractor shall:

- Install wash press unit (location is independent of sewer operations), including water service, electrical and communications cabling.
- Prior to temporary diversion works completion, isolate northern channel with closure of two (2) penstocks and installation of stop board to retain clean channel for band screen and launder installation. Sewage flow to operate in southern channel only. Install band screen and launder including electrical cabling, control cabling want water service connections.
- At Superintendent's Representative acceptance of installation, remove northern channel isolations for Third Party commissioning of all equipment excluding southern screen.
- Concurrent to commissioning, the Contractor will isolate southern channel with closure of two (2) penstocks and installation of stop board. Pump out and clean isolated channel for personnel safety. Install final band screen including electrical cabling, control cabling want water service connections.
- At Superintendent's Representative acceptance of installation, remove southern channel isolations for final Third Party commissioning of all equipment excluding southern screen.

PROVISIONAL SUM: The Contractor may be required to assist with any installation or service modifications during commissioning.

S8 QUALITY ASSURANCE

S8.1 GENERAL

The Contractor is required to control the quality of the work using a quality management system under this Contract in accordance with AS/NZS ISO 9001 or an approved equivalent Quality Assurance (QA) system.

The Contractor shall manage the revision and release of all Contractor supplied documents, including drawings (if applicable) and be able to demonstrate to the Superintendent's Representative that the documents used for the Works are the approved revision.

The Contractor shall demonstrate the achievement of the specified standards through testing, measurement and the provision of documentation for the Works, both on-site and off-site including the activities of all subcontractors and suppliers.

The Contractor shall prepare its own Quality Management System in the form of Procedures, Inspection and Test Plans (ITPs), Inspection and Test Records (ITRs) and Check Sheets for the Works. They shall be relevant to the testing and audit testing procedures and frequency of testing requirements of the specification and be not less stringent than those set out in this Specification.

S8.2 PROJECT QUALITY PLAN (PQP)

The Contractor's proposed Project Quality Plan (PQP) shall be submitted to the Superintendent's Representative within fourteen (14) days of contract award. The Superintendent's Representative may, at its discretion, require modifications before the PQP is accepted for use. The purpose of the PQP is to take a risk-based approach to quality items required under the Contract.

The Contractor shall produce a PQP, for the purposes of Works, including:

- All the elements of the nominated management system, as applicable to Works, including a Quality Register of all ITPs and ITRs,
- Contractor organisation chart or list of nominated personnel showing their positions, management structures and the responsibilities of each position in detail,
- Details of specific work items and operating procedures together with the staff positions responsible for identifying implementing, verifying, registering and distributing the associated quality records,
- ITPs and ITRs of each work items submitted at least seven (7) days prior to commencement of the activity,
- Test facility NATA accreditation for all testing work proposed (and test apparatus and instrument calibration certificates if not included in the NATA accreditation), and
- Details of any other quality records to be generated by Works and pro-forma templates for these records.

S8.3 INSPECTION & TEST PLANS (ITP)

ITPs shall be implemented to record the following information for each significant activity and work item as defined:

- Description of activity,
- Specified requirements, Specification, and test method references,
- Staff position responsible for activity,
- Hold points and witness points,
- Activity checklists,
- Test type,
- Standards and codes compliance and other performance and acceptance criteria and tolerances,
- Identification of associated quality system procedures and records,
- Test frequency, and
- Work item identification.

ITPs shall be submitted to the Superintendent's Representative who may direct the addition of hold points and witness points to those already specified. Provision shall be made for sign-off at each hold point and witness point as appropriate. For each witness point and hold point, the Contractor shall notify the Superintendent's Representative at least seven (7) days prior to the work being undertaken.

S8.4 CERTIFICATION OF PRODUCT

Wherever this Specification requires compliance with nominated product and test standards, conformance shall be certified by means of a Certification Scheme, conducted by a Certification Body. Each Certificate shall expressly attest compliance of all product items with the nominated Standards. Wherever specified, Certificates shall be submitted to the Purchaser. Product shall be marked in accordance with the requirements of the Certification Body.

S8.5 IDENTIFICATION & TRACEABILITY

The Contractor shall maintain a Quality Register of all work items with numbers assigned. The Quality Register shall be proposed by the Contractor in the PQP. Each work item number shall, as a minimum, contain the following information:

- A unique number or reference,
- A drawing number, specification reference or chainage for the work item,
- A brief description of the work item,
- A column identifying Principal Supplied items,
- A column identifying the Contractor's nominated representative and the Superintendent's Representative nominated representative for inspection of the Works,
- A column identifying the status of Supply Verification (SV), Construction Verification (CV), Pre-Commissioning and Commissioning.

The Contractor shall:

- Maintain traceability of each record relating to a work item in the Quality Register,
- Maintain and display the Quality Register on site and allow Principal's SV documents to be co-located on site,
- Provide all quality records to the Principal progressively. The method and frequency of providing the records shall be proposed in the PQP and accepted by the Superintendent's Representative, and
- Maintain the Quality Register that all records are identified by a title combined with the unique item and the type of record (SV, CV, Pre-Commission, Commissioning). For example, the file name can be 10-1_SV_Submersible_Pump_1.

S8.6 COMPLIANCE TESTING

Compliance testing shall be based on work items as defined and carried out by NATA accredited test facilities (or, if appropriate, by equivalent overseas test facilities duly accredited in accordance with ISO/IEC 17025). The frequency of compliance testing shall be as specified.

Sampling methods shall be unbiased and either random or systematic in concept or as specified.

S8.7 NON-CONFORMANCE REPORTS (CONTINUAL IMPROVEMENT NOTICE)

The method of isolating or identifying non-conforming work or applying and releasing hold points shall be clearly stated in the PQP. The requirements of reviewing effectiveness of corrective actions shall be stated in the PQP.

Non-conformance reports shall be submitted within five (5) days of nonconforming work being identified. Non-conformance reports shall include:

- Nature and extent of non-conformance,
- Work item number,
- Any relevant information, data, test reports and/or measurements (as applicable),
- Corrective actions proposed to address all non-conformances and to prevent recurrence, and
- The timeframe within which the non-conformance will be rectified.

S8.8 QUALITY AUDITING

The Contractor and the Superintendent's Representative shall undertake audits of the Works using the Quality Register and associated ITPs/ITRs to verify the works being constructed are in accordance with the Contract. The Contractor shall support and aid the Superintendent's Representative for all audits.

S8.9 QUALITY RECORDS

The quality records produced, or any other documents required by the Contract for Works shall be submitted to the Superintendent's Representative prior to the date for Practical Completion, including:

- All non-conformance reports,
- The duly completed ITPs and ITRs,
- Red line markup drawings with all changes to the Works,
- Installation, operation, and maintenance manuals for the Works; and other records as defined in the Contract.

S8.10 HOLD POINTS

The Contractor shall allow Superintendent's Representative controlled Hold Points on the Inspection and Test Plans. The Superintendent's Representative may, at their discretion, include any additional Hold Points in the Construction Program.

The Contractor shall notify the Superintendent's Representative that inspection of an item or items of work, subject to a Hold Point, is required at least 6 working days prior to the required inspection.

If the Superintendent's Representative waives inspection the Hold Point refers, the Contractor shall state on the ITP, the time that the Superintendent's Representative was informed that inspection was required and the actual time of commencement of construction of the item of Works.

Currently specified hold points are summarised in the table below.

Table 13 Project hold points*

Hold point	Specification item
Cranage Lifting Plan	S2.7
Photographic record/dilapidation report	S2.11
Cement stabilisation of hardstand entry / exit	S4.3.7
Foundation blinding concrete	S4.4.2
Factory Acceptance Test (FAT) – precast concrete channel	S4.4.8
Pipe specials	S5.2
Inspection and test plans (ITPs) and pre-commissioning tests	Contract Preliminaries
Overflow pipe installation to pond 1A	S5.4.6

Note: The Superintendent's Representative may, at their discretion, include additional Hold Points in the Construction Program

S9 COMPLETION DOCUMENTATION

S9.1 MATERIALS DATA REPORT (MDR)

The Contractor shall submit to the Superintendent's Representative a Materials Data Report no later than fourteen (14) days after completion of works.

The MDR shall include but not be limited to:

- Materials certificates for all materials required for the Works, including pipework, fittings, valves and concrete.
- Product information sheets
- Pipe Test Record Sheet(s)
- Maintenance schedules and plans for all installed equipment (eg penstocks).

S9.2 WARRANTY

A Manufacturer's Warranty shall be supplied by the Contractor for pipe, valves and fittings. The warranty shall not be less than 20 years under any conditions.

S9.3 AS CONSTRUCTED DRAWINGS

S9.3.1 Data Capture

'As Constructed' information shall be progressively captured in step with construction work by an engineering surveyor who is duly certified in accordance with the requirements of the project specification. This information shall be progressively incorporated into 'As Constructed' drawings, prior to submission for review.

'As Constructed' drawing information shall show the true position of all structures and services relative to one another and to known cadastral boundaries, duly presented to a level of detail and drafting quality equal to that of corresponding working (or issued-for-construction) drawings. All information that is not in accordance with the Drawings shall be crossed out and corrected.

S9.3.2 Drawing Revision

Drawings shall be revisioned-up and annotated As Constructed in the title block. Each 'As Constructed' drawing shall be duly dated and endorsed by the accountable project personnel, including the constructor, to certify the accuracy of 'As Constructed' information. No constructed asset shall be deemed to have reached practical completion in the absence of signed-off 'As Constructed' drawings that show 'As Constructed' information for all constructed components of that asset.

A marked up set of 'As Constructed' electrical drawings shall be provided on site for the purpose of commissioning work. All changes to the originally specified electrical equipment prior to the commissioning date shall be shown on the drawings. Acceptance of the changes by an Electrical Engineer shall be verified and signed-off on each drawing.

S9.3.3 Electronic Format

As Constructed drawings shall be submitted to the Superintendent's Representative in both pdf and AutoCAD file formats, for approval and acceptance.

S9.3.4 Spatial Drawings Minimum Detail

As a minimum, 'As Constructed' drawings shall include the information indicated below and each point shall be fixed by at least two dimensions to cadastral boundaries and preferably by MGA94 coordinates.

- a. The site plan drawing shall show:
 - The position of the inlet pipe or pipes with invert levels, pipe materials, class and diameter of pipes.
 - The position of cables, water service, fences, gates and pressure main.
 - Details of access road levels and drainage.
 - Site levels.
- b. The pipework drawing shall show:
 - Horizontal alignments and running chainage
 - Invert levels at bends, changes of grade and point of discharge
 - Pipe material with position of any change in material.
 - Pipe classification, inside diameter, outside diameter and thickness.
 - Position of valves, couplings and bends
 - Status of redundant (not in use) pipes i.e. removed or left in place
 - Any disconnections, cutting and capping and the like must be specifically stated on the 'As Constructed' drawing

S10 ABBREVIATIONS AND TERMS

CKB	City Kalgoorlie - Boulder
DBYD	Dial Before You Dig (utility services locations)
ITP	Inspection & Test Plan
ITR	Inspection & Test Register
MDR	Manufacturer's Data Report
PE	Polyethylene (pipe)
PQP	Project Quality Plan
SiD	Safety in Design register
WWTP	Wastewater Treatment Plant

APPENDIX A – DRAWINGS

APPENDIX B – SAFETY IN DESIGN

APPENDIX C – PHOTO RECORDS OF SITE

APPENDIX D – SOUTH BOULDER WWTP FLOW ESTIMATION

APPENDIX E – PENSTOCK EQUIPMENT (AMWA)

APPENDIX F – BAND SCREEN EQUIPMENT (AQSEPTANCE)

APPENDIX G – ELECTRICAL & COMMS CONDUIT AND CABLING SCHEDULE