Engineering Construction Specification

C31 Sewerage Systems – Reticulation and Pumping Stations (Construction)

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This document is a modified version of AUS-SPEC 1361 Sewerage Systems – Reticulation (Construction) and 1362 Sewerage Systems - Pumping Stations (Construction) October 2018 version

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1 General

1.1 Responsibilities

1.1.1 General

Requirement: Provide sewerage reticulation, as documented.
Requirement: Provide sewerage pump stations, as documented

1.2 Cross references

1.2.1 General

Requirement: This worksection is not a self-contained specification. In addition to the requirements of this worksection, conform to the following:

- *C01 General requirements (Construction)*
- *C02 Quality management (Construction)*
- *C03 Control of traffic*
- *C04 Control of erosion and sedimentation (Construction).*
- *C06 Earthworks (Road reserve).*
- *C13 Road openings and restoration*
- *C29 Landscape - road reserve and street trees*

1.3 Standards

1.3.1 General

Gravity sewerage: To WSA 02.
Vacuum sewerage: To WSA 06.
Pressure sewerage: To WSA 07.
Buried flexible pipes design and installation: To AS/NZS 2566.1 and AS/NZS 2566.2.
PVC-U installation: To AS/NZS 2032.
PE installation: To AS/NZS 2033.
ABS installation: To AS/NZS 3690.
Pump station: To WSA 04.
Vacuum pump station: To WSA 06.
Pressure sewerage pump units: To WSA 07.
Wingecarribee Shire Council Standard Drawings

1.4 Interpretation

1.4.1 Abbreviations

General: For the purposes of this worksection the following abbreviations apply:

- ABS: Acrylonitrile butadiene styrene.
- DAV: Double air valve.
- DI: Ductile iron.
- DICL: Ductile iron cement (mortar) lined pipe.
- DN: Nominal diameter.
- GRP: Glass reinforced plastic.
- IS: Inspection shaft.

- MC: Maintenance chamber.
- MH: Maintenance holes.
- MS: Maintenance shaft.
- PE: Polyethylene.
- PIPA: Plastic Industry Pipe Association of Australia Limited.
- PN: Pressure class (number).
- PP: Polypropylene.
- PVC-U: Unplasticised polyvinyl chloride.
- PVC-M: Modified polyvinyl chloride.
- PVC-O: Oriented polyvinyl chloride.
- RC: Reinforced concrete.
- SDR: Standard dimension ratio.
- SRM: Sewer rising main.
- TMS: Terminal maintenance shaft.
- VC: Vitrified clay.
- WSAA: Water Services of Australia.
- MEN: Multiple earthed neutral.
- MH: Maintenance hole.
- MTWL: Maximum top water level.
- NPSHR: Net positive suction head required.
- PLC: Programmable logic controllers.
- PTFE: Polytetrafluoroethylene.
- RTU: Remote telemetry unit.
- SCADA: Supervisory control and data acquisition system.
- SCA: Switchgear and control assembly.

1.4.2 Definitions

General: For the purposes of this worksection the definitions given in WSA 02 and the following apply:

- Commissioning: Running of the plant and equipment to make sure there is flow through the pumping system, carrying out any necessary testing and making adjustments until it is ready and suitable for normal starting and running under service conditions.
- Inadequate foundation material: Material beneath or adjacent to the proposed drainage structures with insufficient strength to support the structure and loads on the structure, or material with characteristics that would adversely affect the performance or construction of the drainage structure.
- Pre-commissioning: Preparation of plant or equipment so that it is in a safe and proper condition and ready for commissioning and operation. It includes all aspects of plant operation such as safety, electrical, mechanical and instrumentation and testing of components.
- Section: A length of pipeline which can be effectively isolated for testing, e.g. by means of main stop valves.

- Selected material zone: The top part of the upper zone of formation in which material of a specified higher quality is required.
- Electricity distributor: Any person or organisation that provides electricity from an electricity distribution system to one or more electrical installations. Includes distributor, supply authority, network operator, local network service provider, electricity retailer or electricity entity, as may be appropriate in the relevant jurisdiction.
- Water agency: An authority, board, business, corporation, Council or local government body with the responsibility for planning or defining design, construction and maintenance requirements for a water supply and/or sewerage system.

1.5 Tolerances

1.5.1 General

Gravity sewerage: To WSA 02 clause 22.
Vacuum sewerage: To WSA 06 clause 43.
Pressure sewerage: To WSA 07 clause 22.
Pumping Stations: To WSA 04 clause 38.

1.5.2 Trench

Trench depth: To WSA 02 clause 14.8.1.

1.5.3 Access covers and frames

Cover: - 3 mm + 0 mm.
Frame: ± 3 mm.

1.6 Submissions - reticulation

1.6.1 Authority approvals

Requirement: Submit details of all authority approvals Obtain approval under Section 68 of the Local Government Act 1993 prior to commencement of any construction works. Approvals may include but not limited to the following:

- Acceptance testing: Approval from Water Agency of completed acceptance testing before acceptance of works.
- Alternative products and materials: Approval of Water Agency of proposed alternative products and materials.
- Blasting: Approval from the relevant authority and affected owners of assets before undertaking blasting.
- Compaction: Approval from Water Agency for any proposed flooding compaction methods before starting compaction.
- Crossings: Approval for works from the relevant authority if a pipeline crosses a road or creek, rail, gas or petroleum lines.
- Drainage and dewatering: Approval from the appropriate authority for any discharge to sewers, stormwater drains or watercourses.
- Field welding of flanges: Submit proposal for field welding.
- Improved surfaces: Approval from land owners for excavation across improved surfaces.
- PE weld pre-qualification: Approval from Water Agency of proposed electrofusion and butt welding.

- Road openings permit: Approval road opening permit before starting any works within a road or road reserve.
- Recycled material: Approval from the relevant authority to use recycled materials for embedments.
- Surplus material: Approval from the property owner for the disposal of any surplus material on that property.
- Temporary drainage: Approval from the relevant authority to dam up or divert existing watercourses.
- Protection of trees: Approval from tree owners for cutting roots over 60 mm diameter, tree removal or works under the tree canopy or within the root zone.
- Underground services: Approval from relevant authority of excavation methods adjacent to existing underground services.

1.6.2 Execution details

Blasting: If permitted, submit blasting plan to AS 2187.
Connecting to existing sewers: Submit proposal for connection to existing sewers including work method, timing and equipment.
Disposal of surplus material: Submit proposal for spreading any surplus material in the vicinity of the trench.
Embankment fill: Submit details of embankment construction method including method of placement and compaction and limitations to the placement/compaction over the top of the pipeline.
Existing asbestos pipe: Submit method statement for cutting and disposal complying with the WHS legislative requirements.
Inadequate foundation material: Submit details for providing adequate foundation where the bottom of an excavation does not provide the foundation required.
Protection of property and environment: Submit proposed work method statement for any interference to the works caused by an existing service.
Support of excavation: If trenching works cause ground instability, submit proposals to provide adequate permanent stability.
Trenchless technology: Submit proposal for conduit location and trenchless installation to the *C34 Trenchless conduit installation* worksection.

1.6.3 Operation and maintenance manuals

Operation and maintenance information: Submit operation and maintenance information, as documented.

1.6.4 Products and materials

Authorised products and materials: Submit certification that all products and materials used are authorised by the Water Agency before delivery to the works.
General: Submit product information for components of the water supply reticulation system. The contractor is to supply materials which are new (unless otherwise specified), free from defects and fit for purpose.
Temporary Storage of Materials; materials shall be stored to ensure the preservation of their quality and fitness for the Work. When considered necessary, they shall be placed on wooden platforms or other hard, clean surface.
Capping off; Cap off all open ends of pipes to prevent the entry of foreign matter into the pipework.
Product conformity: Submit current assessment of conformity to WSA TN-08 as follows:

- Certificates for all pipes, fittings, valves and hydrants and all materials and components. Identify the item and record the inspection and test records that verify conformance to the specification.

Recycled materials: Submit details of any recycled materials proposed for use.
Alternative products and materials: Submit details of alternative products and materials proposed.

1.6.5 Records

Work-as-executed drawings: Submit work-as-executed details, refer to Design Specification D13 Sewerage Systems – Reticulation & Pumping Stations (Design).

1.6.6 Tests

Results: Submit results of testing to relevant WSA requirements

1.6.7 Variations

Alignment: Submit any proposals to adjust alignment or position to suit on site measurements.
Soil conditions: Submit details of soil conditions, if inconsistent with design assumptions.

1.7 Submissions – Pumping Stations

1.7.1 Authority approvals

Requirement: Submit copies of documents submitted to the electricity distributor including:

- Application for connection.
- Notification of completion.

1.7.2 Certification

Electrical safety and earthing to sewer services: Submit electrical safety declaration verifying that works are safe to proceed.

1.7.3 Execution details

Underground cables: Submit the following:

- Cable route, 5 days before commencing construction.
- Calculations for supply cables and major submains to equipment, 10 days before installation.

1.7.4 Operation and maintenance manuals

Requirement: Submit 3 copies, with notice of commissioning.

1.7.5 Products and materials

Electrical and pump equipment: Submit proposal for all products and materials.
Switchboard: Submit manufacturer's certificate, before delivery.

1.7.6 Records

Commissioning: Submit a copy of signed and witnessed commissioning documents in **Commissioning schedule,** as evidence of conformity to documented requirements. The applicant is to submit a commissioning schedule for Council's approval.
Pre-commissioning: Submit a copy of signed and witnessed pre-commissioning documents in **Pre-commissioning schedule,** as evidence of conformity to documented requirements, 5 days before commissioning.
Survey: Submit set-out of pump stations and equipment locations, 3 days before commencing construction.

Work-as-executed details: Submit details, including sewerage pump stations information sheets and works.

1.7.7 Shop drawings

Submit shop drawings to a scale that best describes the detail, showing the following:

- Switchboards: Submit drawings, 5 days before commencing manufacture.

1.7.8 Tests

Results: Submit results of testing to relevant WSA requirements

1.7.9 Warranties

Requirement: Submit the following:

- Products, materials and equipment: Manufacturer's warranty against defects in materials and workmanship.

1.8 Inspections

1.8.1 Notice

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

- Underground services: Location and marking of existing services before excavation.
- Foundation and foundation stabilisation:

  Area of the foundation including the sides of the trenches that may contain material that is inadequate to support the proposed drainage structure.

  Additional excavation of rock, including backfill and compaction.
- Trench floor preparation: Completion of trench excavation, including any rock trimming and backfilling to design trench floor level.
- Pipe embedment and support: Completed pipe laying, jointing and corrosion protection before trench backfilling.
- Restoration of surfaces: Carriageway pavements, pathways, lawns, fencing and other improved areas progressively restored to pre-construction condition.
- Acceptance testing: When testing is due to take place for compaction, air pressure and vacuum, hydrostatic pressure, infiltration and ovality.
- Connections to existing sewers: When connection is due to take place, notify any affected occupants.
- Commissioning of pumping station: Intention to begin commissioning.
- Acceptance testing of pumping station: Intention to begin testing.

2 Materials – reticulation

2.1 General

2.1.1 Products and materials

Requirement: To WSA 02 clause 13 and as documented.

2.2 Pipes and fittings

2.2.1 Ductile iron (DI)

Requirement: To AS/NZS 2280 and the **Ductile iron (DI) pipes and fittings schedule**.

Flanges: To AS/NZS 4087 or AS 2129.
Bolts and nuts for flanged joints: To AS 2129, galvanized to AS/NZS 1214 or stainless steel to ASTM A276/A276M.

2.2.2 Polyvinyl (PVC-U) non-pressure

Requirement: To AS/NZS 1260 and the **Polyvinyl (PVC-U) non-pressure pipes and fittings schedule.**

2.2.3 Polyvinyl (PVC) pressure/vacuum

Requirement: To the **Polyvinyl (PVC) pressure pipes and fittings schedule** and the following:

- PVC-U pressure/vacuum: To AS/NZS 1477.
- PVC-M pressure: To AS/NZS 4765.
- PVC-O vacuum: To AS/NZS 4441.

PVC-U pipe sockets: Do not connect to ductile iron spigots.
Jointing: Solvent cement jointing of PVC-U mains to AS/NZS 3879 and PIPA POP102 .

2.2.4 Polyethylene (PE)

Requirement: To AS/NZS 4130, WSA 01 and the **Polyethylene (PE) pipes and fittings schedule**.
Property service pipe: PE 100, PN 16, series 1.

2.2.5 Polypropylene (PP) non-pressure

Requirement: To AS/NZS 5065 Type B ID series and the **Polypropylene (PP) pipes and fittings schedule**.

2.2.6 Glass reinforced plastic (GRP)

Requirement: To AS 3571.1 and the **Glass reinforced plastic (GRP) pipes and fittings schedule**.
Surge cycles: Refer to the manufacturer if the temperatures are likely to exceed 35°C.

2.2.7 Reinforced concrete (PVC-U lined)

Requirement: To AS/NZS 4058, WSA 113 and the **Reinforced concrete (PVC-U lined) pipes and fittings schedule**.

2.2.8 Vitrified clay (VC)

Requirement: To EN 295-1 and the **Vitrified clay (VC) pipes and fittings schedule**.

2.2.9 Steel

Requirement: To AS 1579 and the **Steel pipes and fittings schedule**.
Steel pipe rated pressure: Make sure hydrostatically tested.
Bolts and nuts for flanged joints: To AS/NZS 4087 clause 3.2.

2.2.10 Acrylonitrile butadiene styrene (ABS)

Requirement: To AS/NZS 3518, WSA 117 and the **Acrylonite butadiene styrene (ABS) pipes and fittings schedule**.
Pipe class: Provide for cyclic loading.

2.3 Valves, holes/shafts, Chambers and access covers

2.3.1 General

Flanges: To AS 2129 or AS/NZS 4087.
Vacuum and moisture removal vessels: To WSA 06 clause 24.8.
Vacuum interface valves: To AS 4310 and the following:

2.3.2 Stop valves

Standard: To the **Stop valve schedule** and the following:

- Gate valves: To AS/NZS 2638.1 and AS/NZS 2638.2.
- Knife gate valves: To AS 6401.

2.3.3 Air valves

Air valves for DN 50 to DN 200 sewerage: To AS 4883 and the **Air valve schedule**.

2.3.4 Non-return valves

Requirement: To AS 4794 and the **Non-return valve schedule**.
Maintenance requirement: Body cover to be located, and of a sufficient size, to allow removal of ball or valve flap and seat for inspection without removal of the valve body.

2.3.5 Maintenance structures

Requirement: To WSA 137 and Council's Standard Drawing, and the following:

- Precast concrete access chambers: To AS 4198.
- PP maintenance structure: To AS/NZS 5065.
- PVC-U shaft: To AS/NZS 4999.
- Vitrified clay manholes and inspection chambers: To EN 295-6.

2.3.6 Surface fittings

Requirement: To WSA 132 and the **Access covers and frames schedule**.
Install trafficable Wingecarribee cast iron hinged lid for MH's. To WSA132 for access chamber shaft lids.
Areas below the 1 in 100 flood level: Provide covers capable of being bolted down.

2.4 Steel and concrete

2.4.1 Ancillary steelwork

Ancillary steelwork, including ladders, brackets, and covers: To AS 1657.
Abrasive blast cleaning: To AS 1627.4 Class 2.5.
Protection: Hot-dip galvanize to AS/NZS 4680.
Step irons: Provide step irons as documented or encapsulated in plastic.

2.4.2 Ancillary concrete works

Premixed, normal class concrete: To WSA PS-357.
Premixed normal class or special class concrete: To WSA 114 and WSA PS-358.
Reinforcement: To WSA PS-367.

2.5 Bedding, embedment and fill material

2.5.1 General

Requirement: To AS/NZS 2566.2, WSA 02 clause 19.2, WSA 02 clause 20, and Council's standard drawing.
Pressure sewerage trench fill: To WSA 07 clause 20.1.2.
Vacuum sewerage trench fill: To WSA 06 clause 38.3.

2.5.2 Recycled materials

Requirement: Use only approved recycled materials conforming to WSA PS-364, WSA PS-368 and WSA PS-369.

2.5.3 Geotextile

Standard: To AS 3705 and WSA PS-355.

2.5.4 Marking

Non-detectable marking tape: To AS/NZS 2648.1 and to WSA PS-319.
Detectable marking tape: To WSA PS-318.

2.6 Testing

2.6.1 Quality

Requirement: Test for all characteristics in conformance with WSA requirements
Quality verification: If material/product quality verification can be obtained from the supplier, documented tests need not be repeated.

3 Materials – Pumping Stations

3.1 General

3.1.1 Products, materials and equipment

Requirement: To WSA 04 clause 20 and as documented.
Minimum material requirement: To WSA 101 Table 2.1.

3.1.2 Warranty

Manufacturer's warranty for pumps: Obtain a written warranty from the manufacturer of the equipment, accepting liability for any defect in materials or workmanship within 2 years of delivery.

3.2 Electrical equipment

3.2.1 General

Switchboard, control panels, level control devices and level probe support brackets: To WSA 04 clause 20.3 and 20.9 and as documented.

3.2.2 Switchboards

Requirement: Complete switchboards with circuit breakers, contactors, fuses, motor starters, relays, timers, instruments and accessories, as documented.
Type: Outdoor, stationary, free standing, metal-enclosed, cubicle type series conforming to the following:

- Minimum degree of protection: IP56D to AS 60529.
- Securely mounted.
- Electrical components: Segregated into individual compartments, as documented.
- Steel galvanized channel base.

Fault current: Show prospective fault currents for each installation on the respective power circuit diagrams. Confirm all fault levels with electricity distributor.

3.3 Pump equipment

3.3.1 General

Electric submersible pumps: To WSA 101 and the **Pump equipment schedule**.
Multiple pump sets: All pumps in a set identical and interchangeable.
Selection: Select for the documented duty at not more than 47.5 Hz.
Motor protection: Provide each motor with thermistor protection to AS/NZS IEC 60947.8.

3.4 Pipes and fittings

3.4.1 General

Requirement: To **PIPES AND FITTINGS** in the *C31 Sewerage systems – reticulation and pumping stations (Construction)* worksection.

3.5 Valves, holes/shafts, chambers, access covers and frames

3.5.1 General

Requirement: To **VALVES, HOLES/SHAFTS CHAMBERS AND ACCESS COVERS** in the *C31 Sewerage systems – reticulation and pumping stations (Construction)* worksection.

3.6 Steel and concrete

3.6.1 Structural steel and concrete

Concrete: To AS 3600.
Structural steel: To AS 4100.

3.6.2 Ancillary steelwork and concrete works

Requirement: To Section 3.6 (**STEEL AND CONCRETE)**

3.7 Bedding, embedment and fill material

3.7.1 General

Requirement: To Section 3.7 (**BEDDING, EMBEDMENT AND FILL MATERIAL)**.

3.8 Fasteners

3.8.1 General

Bolts, nuts and washers: To WSA 04 clause 20.8 and the following:

- Extreme temperature variations: To AS 2528.
- Metalwork: To WSA 04 clause 25.4.

3.9 Testing

3.9.1 Quality

Requirement: Test for all characteristics in conformance with WSA requirements
Quality verification: If material/product quality verification can be obtained from the supplier, documented tests need not be repeated.

4 Execution – Reticulation

4.1 General

4.1.1 Construction

Gravity sewerage: To WSA 02 clause 12.
Vacuum sewerage: To WSA 06 clause 23.
Pressure sewerage: To WSA 07 clause 13.

4.1.2 Customer focus

Standard: To WSA 02 clause 12.4.

4.2 Establishment

4.2.1 General

Space allocations: Conform to any space allocation agreements, local agreements with road owners or other utility service provider.
Material and equipment: Locate material and equipment clear of watercourses or secure to prevent danger or damage in the event of large runoff flows.
Sewer mains in easements: Conform to documented requirements including positioning the main within the easement, as follows:

- 1/3 of the width into the easement, on the side away from any buildings.
- Centrally, where there are buildings on both sides or if the easement runs through narrow walkways.
- On the low side of any crossfall over the easement.

Supply of water for the works: To WSA 02 clause 13.5. Supply must be sourced from a metered water service, not a standpipe.
Protection: Provide protection from external factors such as external loading, third party intrusion as documented, including the following:

- Precast reinforced concrete removable slabs.
- Concrete encasement to WSA 02 clause 13.4.
- Service duct.
- Security fencing.
- Protection barriers.

Effect of overhead power lines and transmission towers: Conform to documented mains alignment, electrical protection, corrosion protection and construction details.
Above ground sewer mains: Provide above ground sewer main components, as documented.

4.2.2 Alignment

Set out: Verify all on-site measurements and confirm set-out before starting construction. If any adjustments to alignment or position are required, prepare proposals.

4.2.3 Road openings

Road opening permits: Obtain a road opening permit before starting works within a road or road reserve and conform to *C13 Road openings and restoration* worksection and Council's Standard Drawings.
Council prefers underbore to trench excavation of the road carriageway.

4.2.4 Crossings

Authority approvals: If a pipeline crosses a road or creek or involves features documented as under the control of any Authority, carry out the work in conformance with the requirements of that Authority.

4.3 Excavation

4.3.1 General

Requirement: To WSA 02 clause 14.
Excavation level: Excavate trench or foundation for sewerage works to the designed level of the bottom of the bedding or foundation. Remove all loose material.
Location: Carry out all excavations for structures and pipelines to the lines, grades and forms, as documented.
Authority requirements: Conform to the requirements of the appropriate Authority including drainage, dewatering, silt control, noise abatement, proximity to existing buildings and generally for the amenity of adjacent owners.
Safety fencing: At the completion of work each day, provide safety fencing along the edges of open excavations to statutory requirements. Plug any open pipelines to prevent ingress of soil or other material and backfill to prevent flotation of any laid pipelines.
Access to properties: Provide fenced walkways and vehicular crossings across trenches to maintain access at all times from the carriageway to individual properties or within individual properties and notify all affected occupiers.

4.3.2 Protection of trees

Requirement: To WSA 02 clause 14.3, including:

- Obtain approval from the tree owner and Council for tree removal or work within allowed distances.
- Seek qualified wildlife handlers when wildlife are encountered during tree removal or pruning.

4.3.3 Blasting

Requirement: To WSA 02 clause 14.4.
Approval: Do not blast without approval.

4.3.4 Support of excavation

Trench support: Shore, sheet pile or use other stabilisation methods, as required to the sides of trench excavations, to conform to statutory requirements and WSA 02 clause 14.5.
Instability: Where trenching works cause ground instability, provide adequate permanent stability.

4.3.5 Temporary drainage

Requirement: For each part of the system, complete the erosion and sedimentation control measures before starting the works.
Control of erosion and sedimentation: Make adequate provision for runoff flows at area of works and surrounds. Conform to the *C04 Control of erosion and sedimentation (Construction)* worksection and to WSA 02 clause 12.5.4.4.
Dams and diversions: Do not dam up or divert existing watercourses (either temporarily or permanently), without approval from the relevant Authority.

4.3.6 Drainage and dewatering

Requirement: Keep all excavations free of water, provide dewatering including any equipment required. Make sure no damage is caused to adjacent structures and services. Obtain approval for any discharge to sewers, stormwater drains or watercourses by the relevant authority.

4.3.7 Excavation across improved surfaces

Requirement: To *C13 Road openings and restoration* worksection and WSA 02 clause 14.7, and Council's Standard Drawings and the following:

- Obtain approval from the land owner before commencing any excavation across improved surfaces.
- Council prefers underbore to trench excavation of the road carriageway

4.3.8 Foundations and foundation stabilisation

Non-conformance: Provide foundation, as documented.
Removal: Remove and dispose of inadequate foundation material to the *C06 Earthworks (Road reserve)* worksection.
Replacement material: To **BEDDING, EMBEDMENT AND FILL MATERIAL**.

4.3.9 Trench excavation

Requirement: To WSA 02 clause 14.8.
Soil conditions: Confirm soil conditions are consistent with design assumptions.
Trench size for pipelines: Excavate the trench, as documented and to the following:

- General buried flexible pipelines: To AS/NZS 2566.2.
- PVC: AS/NZS 2032.
- PE: AS/NZS 2033.

Bitumen and concrete surfaces: Sawcut a straight line free from broken ragged edges.
Easement: Do not excavate outside the easement.
Minimum trench width: Pipe outside diameter plus 300 mm
Maximum trench width: 500 mm greater than the documented minimum trench width.
Fittings: Widen the trench where required for the installation of valves and fittings and protective coating systems.
Embankment installation condition: If required, before placing bedding and laying pipes, place and compact embankment fill to a height equal to the top of the pipe embedment zone and for a minimum lateral distance outside each trench wall of 2.5 times the external diameter of the pipe. Place earthworks to the *C06 Earthworks (Road reserve)* worksection.
Rock foundations: Excavate trenches to 75 mm below the underside of the pipe barrel and socket or coupling, or as documented.
Minimum clearance requirements: Clearances between sewers and other underground services to WSA 02 Table 5.4.

4.3.10 Excavation for under pressure cut-in connection to pressure pipes

Applicants are required to apply to Council in relation to under-pressure cut-ins.
Requirement: WSA 07 clause 16.2 and the following:

- Excavate below and behind the host pipe ≥ 100 mm.
- Host pipe: Support during excavation and drilling.

Excavation sides: Keep sides of excavation vertical ≥ 150 mm above the pipe.

4.3.11 Refill of excessive excavation

Requirement: To WSA 02 clause 14.9.

4.3.12 Surplus excavated material

Requirement: To WSA 02 clause 14.11 and the following:

- Do not stockpile excavated materials against the walls of any building or fence.
- 600 mm minimum between the edge of any excavation and the inner toe of stockpiles.
- Stockpile excavated topsoil separately and use for surface restoration after backfilling.

4.3.13 Cover over pipelines

- Gravity sewer: Provide mains pipelines with the minimum depth of cover as documented to WSA 02 clause 14.2 measured vertically from the finished ground level to the top of any socket and the following:
- Minimum cover: To WSA 02 Table 5.11.
- Reduced cover: Less cover may be provided where special protection of the pipelines is documented.
- Increased cover: Greater cover may be provided in situations where there is conflict with other services or to meet grading requirements.

4.3.14 Underground services

Marking: Before starting earthworks, locate and mark existing underground services in the areas which will be affected by the earthworks operations including clearing, excavating and trenching.
Protection: Protect and repair, as required, all services within the extent of the works.
Public utilities within proximity of the excavation: Obtain approval from the relevant authority for the method of excavation, before commencing excavation.
Protection of property and environment: To WSA 02 clause 12.5.

4.3.15 Trenchless technology

Requirement: To WSA 02 clause 14.12 and to *C34 Trenchless conduit installation* worksection.
Existing road crossings: If documented, use trenchless methods for the installation of the mains.
Encasement pipe: As documented and to the requirements of the relevant authority. Extend the encasement pipe 1.0 m behind the back of the kerb on either side of the carriageway.
Support cradles: Position the carrier pipe on support cradles centrally located within the encasement pipe.
Ductile iron cement lined (DICL) carrier pipe: Polyethylene sleeving is not required for any length of DICL carrier enclosed within the encasement pipe.
Grouting: If required, after installation and pressure testing of the carrier pipe, fill the annular space between the carrier pipe and the encasement pipe with gravity or pressure grouting.

4.4 Bedding for pipes and maintenance structures

4.4.1 Trench floor preparation

Requirement: To WSA 02 clause 15.1.

4.4.2 Bedding and pipe support

Standard: To WSA 02 clause 15.2.
Minimum thickness: 75 mm below the barrel and socket of the pipe.
Geotextile envelope: Install as documented.
Bedding for maintenance holes: To WSA 02 clause 15.5.

4.5 Pipe laying and jointing

4.5.1 Installation of pipes

Requirement: To WSA 02 clause 16.1 and the following:

- PVC pipes: To AS/NZS 2032.
- PE pipes: To AS/NZS 2033.

Field cuts of ductile iron or steel: Make sure that firefighting equipment is on the site before making the cuts.

Petrol engine pipe cutter: If using a petrol engine pipe cutter in an excavation, maintain a safe atmosphere in the excavation at all times.

Witness mark on field cut pipes: Except for butt welded PE pipes, make a clearly identifiable witness mark on the pipe at the length recommended by the manufacturer from the end of the pipe.

Witness marks on PVC/PE pipes: Do not use PVC/PE pipes with scored witness marks.

Horizontal and vertical separation of crossing pipelines: To WSA 02 clause 16.3.

Aqueducts: To WSA 02 clause 16.13.

4.5.2 Horizontal and vertical deflections of pipes

Requirement: To WSA 02 clause 16.2 or WSA 06 clause 34.2 and WSA 06 Table 34.1.

Limits of deflection: To the pipe manufacturer's recommendations.

Curving of pipe: If documented, cold bend pipes with a uniform radius along the length of the pipe to the manufacturer's recommendations. Join pipes directly before making the curve. Do not use temporary pegs or stakes to restrain the pipe during curving.

4.5.3 Flotation control

Requirement: Provide thrust or anchor blocks as documented to WSA 02 clause 16.4, including the following:

- Position thrust and anchor blocks to bear against undisturbed material in the direction of the thrust and over the documented bearing area. Do not encase any part of adjacent joints.
- Provide a membrane between the fitting and the concrete to prevent damage to the coating of the fitting.
- Make sure that thrust and anchor blocks are central to the fitting and do not interfere with any other services.

Concrete strength: 20 MPa.

Concrete placement: To WSA 02 clause 13.4.

4.5.4 Restrained joints

DI pipes: Conform to the manufacturer's recommendations.

Pressure and vacuum sewer: To WSA 07 clause 18.7 and WSA 06 clause 34.5.

4.5.5 Markers

Requirement: To WSA 02 clause 16.11 and the following:

- Pressure sewerage: To WSA 07 clause 18.10.
- Vacuum sewerage: To WSA 06 clause 34.9.

Tracer wire: Provide 2 mm diameter 316 stainless steel in trenchless installations.

Appurtenance location marking: Provide location marker posts, plates or as documented.

Timber posts: If there is evidence that the integrity of posts will be affected by rotting or termite activity, do not use.

Post length: Sufficient length to be set firmly in place under saturated ground conditions.

Installed post projection: Conform to the following:

- Generally: 1000 mm above the ground.
- If tall grass or crops are likely to obscure the post: 1500 mm above the ground.

Finish: Paint posts with 2 coats of white enamel for exterior use.
Pavement markers: Provide two-way reflective raised pavement markers to the road pavement and kerb.

4.5.6 Bored pipes under roads, driveways and other locations

Requirement: WSA 02 clause 16.12.
Cathodic protection: As documented.

4.5.7 Reinforced concrete (PVC-U lined) pipe

Requirement: To WSA 02 clause16.15.

4.5.8 Flanged joints

Requirement: To WSA 109 Appendix E.
PE pipe: Provide a butt welded PE stub flange adaptor with a stainless steel backing ring conforming to PIPA POP007.

4.5.9 Welding of steel pressure pipelines

Requirement: To AS/NZS 1554.1 Category SP and WSA 02 clause 16.16.
Field welding of flanges: Obtain approval before field welding to WSA 02 clause 16.16.2.
External corrosion protection to welded joints: Apply as follows:

- Tape system: To WSA 02 clause 16.16.4.
- Heat-shrinkable sleeve: To WSA 02 clause 16.16.5.

4.5.10 Wrapping of ductile iron pipelines

Standard: To AS 3681.
Requirement: Enclose ductile iron pipeline, or sections of pipelines, in layflat high impact resistance polyethylene sleeving with plastic tape adhesive as documented and to the manufacturer's recommendations.
Width of sleeving when flat: To the manufacturer's recommendations for the size and type of the pipeline being encased.
Exposure: Do not expose the sleeve to more than 48 hours direct sunlight.
Protection: Protect the sleeve from damage during application and the backfilling of the trench.
Damage to sleeving: Rectify any damage to the polyethylene sleeving before backfilling of the trench.
Plastic adhesive tape: 50 mm wide.
Field joints: Provide 250 mm minimum overlap of sleeving at each field joint.
Sleeving ends: Hold in position with at least three circumferential turns of adhesive tape.
Excess material: Neatly draw up loose, excess polyethylene sleeving material around the pipe barrel, fold into an overlap on top of the pipe and hold in place with strips of plastic tape at approximately 1 m intervals.
Bends, tapers and similar fittings: Cover with polyethylene sleeving as documented for the pipes.
Valves and irregular shaped fittings and joints: Hand wrap using flat polyethylene sheets secured with plastic adhesive tape, or other suitable material, to provide an adequate seal.

4.5.11 Steel bolts and nuts corrosion protection

Requirement: Wrap all galvanized steel bolts and nuts, used for below ground installation of flanges, bolted gland joints, mechanical joints and tapping bands with petrolatum tape system to the manufacturer's recommendations.
Preparation: Dry, clean and free from rust, immediately before wrapping.

4.5.12 Joints

General: Join pipes in the location and to the methods, as documented, including the following:

- Elastomeric seal joints:
  Roll-on or skid type.
  Lubricant: To the manufacturer's recommendations.
- Mechanical joints: Fixed flange, bolted gland type.
- PE pipe: System specific joint type.
- Solvent cement joints: To AS/NZS 3879 and the manufacturer's recommendations.

Roll-on rubber ring joints: Make sure spigots and sockets are clean and dry.
Witness mark: Make the joint so that the witness mark is not more than 3 mm from the end of the socket.

4.5.13 Welding PE pipelines

Weld PE pipe: To WSA 01.
Gravity sewerage: To WSA 02 clause 16.17.
Pressure sewerage: To WSA 07 clause 18.6 and 18.3.
PE weld pre-qualification: For pressure sewerage, obtain approval of electrofusion and butt fusion welds conforming to WSA 07 clause 18.3.
Electrofusion jointing of pressure pipes and fittings: To PIPA POP001.
Butt fusion jointing of pressure pipes and fittings: To PIPA POP003.

4.5.14 Jointing pipes of different materials

Standard: To WSA 02 clause 16.17.3.
DI to PVC/PE: If jointing, confirm the compatibility of the PVC/PE pipe, joint seal and DI socket. Make joints by inserting the PVC/PE spigot into the DI socket. Do not insert DI spigots into PVC/PE sockets.
Couplings: Use multi-fit mechanical couplings or flanged adaptor couplings. If jointing PE pipes with mechanical couplings, provide joint restraint.
Stainless steel leak/repair clamps: Do not use to join pipes of different materials.

4.5.15 Appurtenances and valves

Valves, valve chambers, scours and surface fittings for pressure sewers: Install as documented and to WSA 07 clause 18.13.
Compatibility: Provide compatible valves and other appurtenances which allow for effective sealing between the pipe flanges and the appurtenance.
Pipework concrete lining: Do not chip away or reduce the concrete lining of pipework to provide clearance from the working parts of valves or other appurtenances.
Maintenance: Install valves and other appurtenances to allow easy access for maintenance and repair.
Valve operation: Removable tee key or hand wheel, as documented and to the following requirements:

- Size tee key or hand wheel to operate valve, under all conditions throughout its full range, with a maximum force of 180 Newtons applied at the end of the key bar or the rim of the hand wheel.
- Hand wheels: Embossed or engraved with an arrow, together with the word open and/or close corresponding to the valve operation.

4.5.16 Rising main fittings

Location: Install rising mains, air release valves and inspection pipes as documented.
Markers: Top all rising mains with an appropriate identification tape and install posts conforming to **PIPE LAYING AND JOINTING, Markers** and the following:

- Marking plates: Provide at changes of direction and, at such chainages that the location of the main is marked, at least once each 100 m. Bear with the following letters:

  For double air valves: DAV.

  For scour pipes: SCOUR.

  For sewage rising main: SRM.
- Urban areas: Paint the kerb adjacent to each fitting with two (2) coats of non-slip paint coloured black.

4.6 Junctions and property connection sewers

4.6.1 General

Property connection sewers: To WSA 02 clause 16.7 and Council's standard drawing.
Isolating PE pressure pipework sections: Squeeze-off to WSA 07 clause 18.12.
On-property items for pressure sewerage: To WSA 07 clause 18.9.
Refer to Council Policy for Pressure Sewerage (Pressure Sewer System Policy).

4.6.2 Marking of property connection sewers and dead ends

Requirement: Clearly mark the position of each riser, junction or end of a property connection sewer on completion of backfilling to WSA 02 clause 16.9.
Pegging is required of future connection points that connect to sewer greater than 1.5m deep.
Adjacent to fence or boundary structure: Stencil the letter J, 50 mm high on the fence or structure.
Marking tape: Finish flush with the existing ground surface as close to the boundary fence or structure as possible.
Peg marking: Drive a 75 50 600 mm long peg into the ground and leave flush with the surface of the surrounding ground. Connect the peg to an underground identification tape.
Tape marking: Tie the identification tape to the junction or end of the property connection sewer and hold the tape in a vertical position during backfilling. Spike the top end of the tape to the junction peg immediately upon completion of backfilling.

- Identification tape type: 75 mm red coloured polyethylene.
- Inscription: 'CAUTION – BURIED SEWER LINE', printed in heavy black letters every 200 mm.

4.7 Maintenance holes, shafts, chambers and inspection shafts

4.7.1 General

Requirement: To WSA 02 clause 17 and WSA 02 clause 18.
Collection chamber and vacuum vessel: Install level sensors to the manufacturer's recommendations and WSA 06 clause 25.10.
Extension spindle: Install as necessary so that top of spindle is no greater than 350 mm below finished surface level.

4.7.2 Maintenance holes (MH)

MH location: Position maintenance holes as documented and conforming to the work health and safety requirements for access by maintenance staff. Provide a working area around the top and access into the hole. Obtain approval to change positions of MH before starting the works.
MH base: Construct the MH base to WSA 02 clause 17.2.1.
Connections to MHs: Provide a hydrophilic seal around the fitting in at least 2 positions for PE, PP or similar materials used in connections.
Core drill holes: Use a diamond hole saw.
Connecting pipelines to maintenance holes, structures or embedded concrete: Connect with 600 mm long pipes. Provide 2 flexible joints, first joint less than 150 mm of the face of the structure.
Flexible joints: If flexible joints cannot be made with cut pipes, select pipes from the various lengths provided to make the second joint within 300 mm of the position documented.

4.7.3 Precast concrete MH systems

Requirement: To WSA 02 clause 17.2.2 and the following:

- Gas and watertight components: Provide components that make a gas and watertight system and satisfactory surface finish.
- Maintenance holes: Conform to the following:

  Make-up rings: Provide between cone sections and frames to make up height differentials.

  Minimum wall thickness of any reinforced component below the frame: 84 mm.

  Vertical distance to first step iron: As documented.

Installation: Install all preformed components to the manufacturers' recommendations.
Backfill: Place backfill for preformed maintenance holes and maintenance shafts and compact evenly to a level 300 mm above the top of the highest incoming pipe and for the full width of the excavation.
Import material: If required, import and compact non-cohesive granular material.

4.7.4 Cast in situ concrete MH

Requirement: To WSA 02 clause 17.2.3, WSA 02 clause 17.2.5 and WSA 02 clause 17.2.6.
Benching and channels: To WSA 02 clause 17.2.4.
Step irons: Fix step irons in formwork before placing concrete, so that step hold, alignment and spacing allow for safe access. Confined Spaces requirements apply.

4.7.5 Covers and frames

Install trafficable Wingecarribee cast iron hinged lid.
Installation: As documented.
Non-conformance: Warped or twisted covers and frames are not permitted.
Unformed surfaces: Provide a surface that is dense, uniform and free from blemishes.
Cover seating: Seat maintenance hole covers on a layer of bitumen impregnated fibre board with a cross-section of 25 x 25 mm or as documented.
Bolt down frames: Install bolt down frames and covers in areas subjected to 1 in 100 year flooding.

4.8 Embedment and backfill

4.8.1 Pipe embedment and support

Requirement: To WSA 02 clause 19.
Approval: Do not backfill trench without approval of completed pipe laying, jointing and corrosion protection.

Removal of trench supports: To WSA 02 clause 19.5.

4.8.2 Compaction

Requirement: Compact in layers no more than 150 mm thick. Conform to AS/NZS 2566.2 and WSA 02 clause 19.3.
Flooding compaction: Obtain approval from the Water Agency if flooding compaction is proposed.

4.8.3 Concrete embedment and encasement

Requirement: To WSA 02 clause 19.6
Concrete strength: 20 MPa.
Mechanical protection of pressure pipeline: To WSA 07 clause 18.11.

4.8.4 Trench fill

Requirement: To WSA 02 clause 20.1 and Council's standard drawing.
Prevention of damage to pipes, coating and wrapping: Backfill and compact all materials without damaging the pipe or its external coating or wrapping or producing any movement of the pipe.

4.8.5 Embankment fill

Requirement: To WSA 02 clause 20.2 and as documented.

4.8.6 Drives and tunnel fill

Requirement: To WSA 02 clause 20.3

4.8.7 Trench stops and concrete bulkheads

Requirement: Construct trench stops to WSA 02 clause 16.5 and concrete bulkheads to WSA 02 clause 16.6.
Concrete strength: 20 MPa.
Bedding: Conform to the following:

- Concrete bedding or encasement to pipe: Cast the 150 mm thick bulkhead integral with the concrete bedding or encasement across the width of trench and key into both sidewalls for a minimum of 150 mm. Extend the bulkhead 150 mm below finished surface level.
- Other bedding or no bedding: Key the bulkhead into the bottom of the trench 150 mm for the full width of trench.

Drain hole: Provide a 75 mm nominal diameter drain hole in the concrete bulkhead immediately above the top of the encasement bedding or foundation. Place crushed rock or gravel in and at the upstream end of the drain hole to act as a filter as follows:

- 10 to 20 mm in size within 150 mm in all directions upstream and above the invert of the drain hole.
- 2 to 10 mm in size for another 150 mm surround.

4.9 Testing

4.9.1 General

Quality: Test for all characteristics in conformance with WSA requirements.
Gravity sewerage: To WSA 02 clause 21.
Pressure sewerage: To WSA 07 clause 21.
Vacuum sewerage: To WSA 06 clause 41.
Timing: Carry out acceptance testing before practical completion and not earlier than one month after completion of construction of all sewers and maintenance holes in a section.

4.9.2 Visual inspection

Requirement: Inspect all system component markers for conformance with the documents.

4.9.3 Hydrostatic pressure testing

The applicant needs to make application to Council for Pressure Test at the applicant's expense. Council will engage a NATA registered tester to undertake testing

Sections: Test pipelines in sections as soon as practicable after each section has been laid, jointed and backfilled or 7 days after the last placement of concrete thrust or anchor block. Leave some or all pipe joints uncovered until the whole of the section has been successfully pressure tested.

Field joints: During pressure testing, make sure all field joints, which have not been backfilled, are clean, dry and accessible for inspection.

Stop valves: During pressure testing, test each stop valve to at least the full test pressure on one side of the valve in the closed position, with no pressure on the other side, for a minimum of 15 minutes.

Preparation before testing:

- Clean the pipe.
- Fill the pipe slowly with water to expel air.
- Purge air from rising mains by opening air valves or hydrants.
- Keep the section full of water for a period of minimum 24 hours before starting pressure testing to allow for absorption, movement of the pipeline and escape of entrapped air.

Test pressure: Do not exceed the manufacturer's recommended test pressure for the lowest rated component in the section.

Test duration: Maintain the required test pressure for a minimum 4 hours.

4.9.4 Internal inspection

CCTV inspection: To WSA requirements. The applicant is to submit CCTV information in a format compatible with WINCAN electronic file format.

4.9.5 Testing of vacuum sewers and service connections

Vacuum testing: To WSA 06 clause 41.4.

Vacuum vessels: Test vacuum vessels to AS 1210 and WSA 06 clause 24.10.5.

Moisture removal vessels: Test moisture removal vessels to WSA 06 clause 24.10.6.

4.10 Connections to existing sewers

4.10.1 General

Requirement: To WSA 02 clause 23.

4.10.2 Applicants must apply to Council prior to any work on live maintenance holes

General: Unless documented otherwise, complete all required works on live maintenance.

Work by others on live maintenance holes: Co-ordinate the works with any simultaneous and/or adjacent work by others and liaise with these contractors and Authorities to avoid disruption, delays and possible conflict.

4.11 Commissioning

4.11.1 General

Gravity sewerage: To WSA 02 clause 12.2.

Pressure sewerage: To WSA 07 clause 13.2. Applicants are to submit their precommissioning plans for Council approval.
Vacuum sewerage: To WSA 06 clause 42.

4.12 Restoration of surfaces

4.12.1 General

Requirement: To Council's standard drawings and WSA 02 clause 24.
Pavement reinstatement contractors: Use only the approved contractors listed in **ANNEXURE – APPROVED PAVEMENT REINSTATEMENT CONTRACTORS**.
Property owner advice: Provide notice to affected property owners of any pending works.

4.12.2 Backfill

Dry weather conditions: After the original backfilling and if the weather has remained dry, including during the defects liability period, consolidate the trench before removing surplus materials from the site.
Tunnelling: If tunnelling under paving, kerb and gutter or other improved surfaces was used, backfill to restore full support to those surfaces.

4.12.3 Stabilise topsoil

Requirement: Immediately following earthworks, stabilise the topsoil with hydroseed to the *C29 Landscape - road reserve and street trees* worksection.

4.12.4 Surplus material

Disposal: Obtain the property owner's approval for the disposal of any surplus material on that property.

4.13 Asset details

4.13.1 Work-as-executed

Requirement: Prepare work-as-executed details and operation and maintenance information as follows:

- Refer to Councils Facts Sheet for Asset Handover
- Work-as-executed drawings: Same format as the design drawings and certified by a registered surveyor.
- Refer to Design Specification *D13 – Sewerage Systems – Reticulation & Pumping Stations (Design).*
- Location and alignment of pipelines: Include the size, type, levels of pipelines, invert level of MH, valve and hydrant chamber types and cover details and easement requirements for maintenance.
- Asset register data.

5 Execution – pumping stations

5.1 General

5.1.1 Establishment

Requirement: To **ESTABLISHMENT** in the *C31 Sewerage systems – reticulation and pumping stations (Construction)* worksection.
Set-out: Confirm pump station and equipment location before construction.

5.1.2 Construction

Requirement: Construct the sewerage pump station and associated works to the documented levels, grades, materials and methods and to WSA 04 clause 19.
Excavation, bedding, pipe laying and jointing, pipe embedment and backfill: To the *C31 Sewerage systems – reticulation and pumping stations (Construction)* worksection.
Wet-well and MH's: To WSA 04 clause 31.
Steel and concrete construction: To the relavent standard.

5.1.3 Miscellaneous structures

Metalwork: Install associated metalwork conforming to WSA 04 clause 25 and as documented.
Access roads and hardstand areas: Construct access roads and hardstands conforming to WSA 04 clause 26 and as documented.
Retaining walls: Construct retaining walls conforming to WSA 04 clause 27 and as documented.

5.1.4 Installation of pump station

Requirement: Install pumping station as documented, including sewerage pumps, non-return valves, mechanical, connections to the network, pipework, manifold, equipment, devices, pressure accumulator tank, power, telemetry, alarms and housing structures.

5.1.5 Preformed pump stations and package pump stations

Preformed components or systems: Conform to AS 3518, AS 3571.1 or AS 4198 and the following:

- Preformed concrete wall units: Manufactured to AS/NZS 4058, excluding modifications to suit precast MHs.
- Internal joints: Flush.
- A watertight system.

Package pump stations: Provide for all components and units as documented.

5.1.6 Provision for maintenance

Maintenance: Provide dismantling joints and valves in the pipe work to facilitate removal of the pumps for maintenance and to minimise the need for surge control devices.

5.1.7 Odour control

Odour control system: If required, install an odour control system conforming to WSA 121, the manufacturer's recommendations and as documented.

5.2 Electrical works

5.2.1 General

Requirement: To AS/NZS 3000 and to WSA 04 clause 21.
Electrical safety and earthing to sewer services: Test for defects in the electrical supply, provide a conductive bridge around the work area if required and notify occupants and electricity suppliers of any change. Obtain a certificate of safety declaration before proceeding.
Safety of people: To WSA 04 clause 19.5.1.
Power system and supply: To WSA 04 clause 7.2.
Lighting: To AS/NZS 1680.2.4.
Primary power supply requirements: To the electricity distributor's requirements.
Lightning and surge protection: Protect all incoming power supply and control power supply, as documented.

Sealing: At the completion of commissioning tests, seal all conduits into the outdoor switchboard with a non-setting sealing compound to prevent the ingress of vermin.
Painting: Paint all equipment mounting panels, except aluminium alloy and stainless steel components conforming to WSA 04 clause 21.12.
Lock barrels: Liaise with the electricity distributor to supply a lock barrel for the metering equipment.
Tools: Make sure spare parts and tools are packed separately from the main plant and marked, as appropriate.
Spare parts: Supply spare parts to **Spare parts schedule**.

5.2.2 Electrical installation

Electricity distributor's requirements and metering: Conform to the following:

- Apply to the electricity distributor for connection, including electrical loads and type of service required.
- Pay all fees associated with the metering, including inspection fees and capacity charges.
- Mount the metering equipment inside the switchboard or as documented.

5.2.3 Point of supply

Requirement: Obtain a service marking from the electricity distributor. Confirm the point of attachment, as documented.

5.2.4 Lead-in pole and overhead mains construction:

Requirement: Install poles and aerial cables to WSA 04 clause 21.4.7 and as documented.
Pole termination method: As documented.

5.2.5 Underground cable installation

Requirement: To WSA 04 clause 21.4.8 or *C34 Trenchless conduit installation* worksection, as appropriate.
Cable route: Obtain approval for all underground cabling routes.
Underground conduits: Install HD-PVC underground conduits conforming to the electricity distributor's requirements and the following:

- Non-trafficable areas: Minimum 500 mm below the finished ground level.
- Trafficable areas: 600 mm below the finished ground level.
- Clear the trench and backfill material of rocks and other foreign matter likely to damage the conduits.

Electrical marker tape: Conform to the following:

- Colour: Orange.
- Width: 150 mm.
- Warning text: Mark with the words DANGER – ELECTRIC CABLES BELOW or similar.

Brass marking plates for cables under roads: Position on any concrete surround, showing the direction of the incoming consumer mains. Mark with the words DANGER - ELECTRICAL CABLES BELOW.

5.2.6 Earthing

Combined earthing system: Provide an MEN earthing system conforming to AS/NZS 3000, WSA 04 clause 21.5, the electricity distributor and the relevant state Service and Installation Rules.
Earthing conductor: Size and installation to the relevant state Installation and Service Rules and AS/NZS 3000. Run the main earthing conductor in conduit to the main earthing electrode.

Earthing connection: Contain the main earthing connection in an earthing electrode connection box.
Pipework: Bond the pump station metallic pipework to the main earth.
Surge diverters: Provide a separate earthing conductor and electrode for the surge diverters. Bond each electrode and label with engraved brass label.
Labelling: Label all major earth connection cables clearly at both ends.

5.2.7 Switchboard

Standard: To AS/NZS IEC 60947.5.1.
Minimum degree of protection: Within pump station buildings, IP51.
Barrier to gases: Provide an effective barrier to prevent gases from the wet-well entering the switchboard.

5.2.8 Switchboard components

Starter contactors: Provide starter contactors with the appropriate rating for the pumps to AC03 duty.
Terminal numbers: Number terminals and cables, as documented.
SCA electrical characteristics: Conform to the following:

- Main circuit: 415/240 V, 50 Hz, 3-phase, 4-wire.
- Motor control circuit: 240 V, 50 Hz.

Common control circuit: 240 and 24 V a.c.

- Prospective short-circuit current: 14 kA for 1 second or to the actual prospective short-circuit current where greater.
- Peak factor: 2.2.
- Power factor correction (determined in consultation with the Water Agency).
- Earthing (MEN system).
- Cable entry to switchboard: From below.

5.2.9 Switchboards installation

Requirement: To WSA 04 clause 21.6.
Thermal derating of equipment:

- Switchgear installed in indoor switchboards: To the manufacturer's recommended derating or to 88% of the equipments nominal current rating, whichever is the greater.
- Solid state power equipment installed in indoor switchboards: To the manufacturer's recommended derating or to 77% of its nominal 35°C current rating, whichever is the greater.

Switchgear: Confirm Type 2 coordination between contactors, motor protection relays and corresponding circuit breakers.
Starter contactors: Confirm starter contactors have the appropriate rating for the proposed pumps to AC03 duty.
Labelling: Clearly label every item of equipment within or on the switchboard to WSA 04 clause 21.6.4.

5.2.10 Pump control

Automatic control: Provide automatic control of the pump station pumping equipment by way of float switches/probes providing single pump duty operation, as documented. Provide switches/probes compatible with those in use in the system.
Levels: Use the following wet-well levels in the automatic control of the pump operation system:

- Bottom water level (BWL).
- Top water level (TWL).
- Maximum top water level (MTWL).
- Flood alarm level (FAL).

5.2.11 Pump operation

MTWL water level: To the operating procedures for the pump station. If there is further rise in water level, conform to one of the following:

- Cut out duty pump and operate with standby pump.
- Continue operating duty pump in parallel with standby pump.

Operation: Allow for overriding the AUTO by turning the starter selector switch to the ON position, conforming to the following:

- Manual operation: For use in the event of failure of the telemetry system or for function testing.
- Warning label (R/W/R): Advising selector switches to be left in the AUTO mode to common control cover.
- Factory and functional tests: To AS/NZS 3439.

5.2.12 Circuits

Requirement: Arrange and colour code all main circuit wiring and busbars to WSA 04 clause 21.7.

5.2.13 Cabling

Requirement: Cabling, including consumer mains, motor, control and flow meter cables, conduits and electrical pits, to AS/NZS 3000, AS/NZS 3008.1.1, the electricity distributor's requirements, WSA 04 clause 21.4.6 and WSA 04 clause 21.8.
Power and control cables: To AS/NZS 4961.
Cable sizing: Calculate cable sizes.
Consumer mains minimum size: Size consumer mains conforming to the following:

- Minimum current carrying capacity to be 130% of the calculated maximum demand current.
- A voltage drop less than 1.5% of the maximum demand as calculated.
- Single core PVC/PVC cables. XLPE insulated cable may also be used.

5.2.14 Installation of pump cables

Requirement: To WSA 04 clause 21.9.
Installation of generator cables: To WSA 06 clause 25.9.

5.2.15 Conduits

Conduits, cable protection, junction boxes and cable trays: To WSA 04 clause 21.8.2, as documented.
LD-PVC-U and HD-PVC-U: To AS/NZS 61386.21.
Galvanized screwed steel conduits, medium protection: To AS/NZS 61386.21.

5.2.16 Installation of wet-well level sensors

Requirement: Install level sensor probes, as documented, to the manufacturer's recommendations and as follows:

- Wet-well level sensor probes: To WSA 04 clause 21.10.
- Collection chamber level sensor probes: To WSA 06 clause 25.10.2.
- Vacuum vessel level sensor probes: To WSA 06 clause 25.10.3.

5.2.17 Terminations

Requirement: Suitably rated power and control terminals to WSA 04 clause 21.11.
Glands: Gland cables using non-ferrous metallic or plastic glands with neoprene compression seals, and connect the on-flow switch and pump motor cables to the appropriate terminals. Do not join cables. Gland all cables at the point of entry into switchboards conforming to WSA 04 clause 21.11.2.

5.2.18 Installation in valve pits

Requirement: To WSA 04 clause 21.13.

5.2.19 Completion of electrical works

Notification: Notify the electricity distributor of the completion of electrical works.
Switchboard metering panel: Attach a copy of the notification of wiring for the switchboard to the switchboard metering panel.
Acceptance testing: To WSA 04 clause 36.9.

5.3 Control and telemetry

5.3.1 Telemetry system

Telemetry hardware: To WSA 04 clause 22 and the following:

- Compatible with existing systems.
- Allow space in the switchboard for future installation of terminals.
- Analogue signals running to an interfacing strip with 2 terminals per signal, and of the disconnect type.
- Standby power supply for an 8 hour power supply failure.
- Lightning and surge protection housing within the cubicle.

Telemetry software: RTU/PLC programming and configuration conforming to the logic drawings, process and instrumentation drawings, configuration list, I/O lists, including central monitoring and display system.
Communication service: Provide a communication service compatible with the existing system.
SCADA: Configure the SCADA database to allow remote monitoring conforming to WSA 04 clause 22.5 or WSA 06 clause 26.5.
Alarms and controls: Provide an alarm and control system, as documented, and to the following:

- Do not use flashing lights.
- Wire digital input signals into a dedicated labelled terminal strip.
- Wire all signals from the dedicated terminal strip to an RTU cubicle marshalling terminal strip and then to the RTU.

5.4 Odour control system

5.4.1 General

Installation: To WSA 121 and as documented.

5.5 Mechanical installation of pumps, valves and fittings

5.5.1 General

Requirement: To WSA 04 clause 24.

5.5.2 Pressure gauge

Requirement: Provide diaphragm protected, glycerine or oil filled, direct mounting, bottom connection pressure gauge conforming to AS 1349 for centrifugal pump installation.
Gauge dial: 100 mm diameter face, calibrated in head (m) of water, indicating the pump operating head and the pump no-flow head.
Fittings: Provide each gauge with sized metric equivalent of 3 bronze fittings including gate valve, union, nipple and reducing nipple.
Installation: Conform to the following:

- Pipework ≥ 150 mm: Screw gauges and fittings into the pipe wall of ductile iron pipes, or pipe fittings, 150 mm and larger. Install a ball valve to allow removal of the gauge where required.
- Pipework < 150 mm: Screw gauges and fittings into a tapping band.

Gauge range: For single or parallel pumps duty 0 to 1.7 times the closed valve head of the pumps.
Protective case: Stainless steel to ASTM A240/A240M, bronze or polycarbonate which can be dismantled for cleaning without affecting the accuracy of the gauge.

5.5.3 Bolts and flanges

Maximum protrusion: 10 mm past the nut when tightened.
Anti-galling, anti-seize: Apply either of the following to threads of all stainless steel fasteners to WSA 109 Appendix E:

- PTFE tape: To BS 7786
- Molybdenum disulfide.

Concrete anchor bolts, nuts, locking nuts and large series washers: 16 mm minimum diameter to the equipment manufacturer's recommendations.
Concrete anchor bolts: Chemical masonry type, set to full depth.

5.6 Commissioning

5.6.1 General

The applicant is to submit a pre-commissioning and a commissioning schedule for Council's approval.
Gravity sewerage: To WSA 04 clause 37 and to **Pre-commissioning schedule** and **Commissioning schedule** to certify conformance to documented requirements.
Pressure sewerage: To WSA 07 clause 13.2 and to **Pre-commissioning schedule** and **Commissioning schedule** to certify conformance to documented requirements.
Vacuum sewerage: To WSA 06 clause 42 and to **Pre-commissioning schedule** and **Commissioning schedule** to certify conformance to documented requirements.

5.6.2 Odour control system

Requirement: Carry out commissioning and verification testing in conformance with WSA 04 clause 37.3 and WSA 121.

5.7 Work-as-executed details

5.7.1 General

Requirement: Provide details of work-as-executed to WSA 04 clause 39, and the work as executed including the following:

- Work-as-executed drawings: Same format as the design drawings and certified by a registered surveyor.
- Refer to information in *Design Specification D13 – Sewerage Systems – Reticulation & Pumping Stations (Design).*
- Pump station: Show location, alignment and details, including the size and type of pipes, valve and chamber types, pump details, switchboard equipment details and station structural details.
- Asset register data, as required.

5.7.2 Operation and maintenance manuals

Requirement: Include the following information in the manuals:

- Contractor's name, address and telephone number.
- Client's contract number, job name.
- Circuit diagrams.
- Electrical and mechanical layout.
- Workshop fabrication drawings.
- Commissioning manual.
- Pump station general arrangement drawing showing pumps, motors, valves, pipework, switchboard and electrical installation.
- Safe working procedures: For switching and isolating the supply and distribution system.
- Description of operation.
- Maintenance procedures: Recommended maintenance periods and procedures.
- Tools: Details of maintenance equipment and tools provided, with instructions for their use.
- Equipment: A technical description of the equipment supplied, with diagrams and illustrations, as appropriate.
- Spare parts: A list of the spare parts provided.
- Trouble shooting instructions for pumps, motors, valves and SCA.
- Assembly/disassembly procedures: Step-by-step procedures for dismantling and reassembly of pumps, motors and valves using any special tools.
- Replacement procedures: Step-by-step procedures for replacement of wearing parts, including bearing, seals and wear rings.

Pump and motor curves: Include the following test curves in the manuals:

- Pump witnessed test curves marked with the normal operating point or range.
- Motor test curves and motor current.
- Motor torque/speed/efficiency characteristic curves.

Pumps: Include the following information in the manuals for pumps:

- Manufacture.
- Type and model number.
- Serial number.
- Dimensioned general arrangement drawing of pump and motor.
- Sectional arrangement drawing with parts and list.
- Dimensioned sectional arrangements detailing:

  Maximum and minimum shaft/bearing clearance (radial).

Maximum and minimum impeller/bowl clearance (radial).

Maximum and minimum impeller/bowl clearance (axial).

Impeller/bowl wear rings.

Motor/pump coupling-type, make and model number.

Mechanical seals where applicable.

Motors: Include the following information in the manual for motors:

- Manufacture.
- Type and model number.
- Serial number.
- Dimensioned general arrangement drawing.
- Sectional arrangement drawing for submersible motor power cabling where applicable.
- Gland sealing arrangement drawing for submersible motor power cabling where applicable.
- Cables where applicable.
- Terminal block arrangement drawing where applicable.

Valves: Include the following information in the manuals for valves:

- Dimensioned sectional arrangement drawing with parts and material list for all valves.

5.8 Testing

5.8.1 Quality

Requirement: Test for all characteristics in conformance with WSA requirements.

6 Annexure

6.1 Annexure - Summary of hold and witness points

6.1.1 Reticulation

Reference No:	Clause and description	Type*	Submission/Inspection details	Submission/Notice times	Process held
C31-WP01	SUBMISSIONS, Authority approvals Drainage and dewatering	W	Approval to discharge to sewers, stormwater drains or watercourses	2 weeks	
C31-HP02	SUBMISSIONS Products and materials Authorised products and materials	H	Certification that all products and materials used are authorised by the Water Authority	10 days	Delivery to the site
C31-WP03	SUBMISSIONS, Authority approvals PE weld pre-qualification	W	Evidence of approval of proposed elocrofusion and butt welding	5 days	-
C31-HP04	SUBMISSIONS, Variations Alignment	H	Proposals to adjust alignment or position	10 days before excavating trenches	Trench excavation
C31-HP05	INSPECTIONS, Notice Underground services	H	Location and marking of existing underground services.	3 days before excavating trenches	Trench excavation, For development inspections book through “MyInspect”.
C31-HP06	INSPECTIONS, Notice Protection of property and environment	H	Proposed work method statement for any interference to the works caused by an existing service	5 days before relevant action	Relevant action. For development inspections book through “MyInspect”.
C31-WP07	INSPECTIONS, Notice Foundations and foundation stabilisation	W	Additional excavation of rock, backfill and compaction	5 days	-

Reference No:	Clause and description	Type*	Submission/Inspection details	Submission/Notice times	Process held
C31-HP08	SUBMISSIONS, Variations Soil conditions	H	Details of unexpected soil conditions	5 days before preparing trench floor	Preparation of trench floor
C31-HP09	SUBMISSIONS, Execution details Excavation support	H	Permanent stability proposals	5 days before installing permanent stability measures	Installation of permanent stability measures
C31-WP10	INSPECTIONS, Notice Foundations and foundation stabilisation	W	Any area that may contain material inadequate for support	5 days before preparing trench floor	-
C31-HP11	SUBMISSIONS, Execution details Inadequate foundation material	H	Details for providing adequate foundation	3 days before preparing trench floor	Preparation of trench floor
C31-WP12	INSPECTIONS, Notice Trench floor preparation	W	Completed trench excavation	5 days before placement of bedding	-
C31-HP13	INSPECTIONS, Notice Pipe embedment and support	H	Completed pipe laying, jointing and corrosion protection	2 days before trench backfilling	Trench backfilling, For development inspections book through “MyInspect”.
C31-WP14	INSPECTIONS, Notice Restoration of surfaces	W	Carriageway pavements, pathways, lawns, fencing and other improved areas progressively restored to pre-construction condition	Progressive	-
C31-HP15	INSPECTIONS, Notice Acceptance testing	H	Intention to perform acceptance testing	3 days before starting acceptance testing	For development inspections book through “MyInspect”.
C31-HP16	INSPECTIONS,	H	Intention to connect to	10 days before	For

Reference No:	Clause and description	Type*	Submission/Inspection details	Submission/Notice times	Process held
	Notice Connections		existing main and charge new main by Council crew	connecting to existing main	development inspections book through "MyInspect".
C31-HP17	SUBMISSIONS, Work as Executed Drawings and Sewer Attribute Schedules	H	Submit certified drawings and schedules	2 weeks after completion of the works	Prior to Subdivision Certificate / Occupation Certificate
C31-HP18	INSPECTIONS, Concrete formwork/reinforcement	H	Formwork/reinforcement prior to concrete pour	1 day before concrete pour	Pouring of concrete. For development inspections book through "MyInspect".
	*H = Hold Point, W = Witness Point				

6.1.2 Pumping Stations

Reference No:	Clause and description	Type*	Submission/Inspection details	Submission/Notice times	Process held
C31-HP19	SUBMISSIONS Products and materials Electrical and pump equipment	H	Submit proposal for all products and materials	4 weeks before ordering	Ordering
C31-HP20	SUBMISSIONS, Certification Electrical safety and earthing to sewer services	H	Test for defects and submit a certificate of safety declaration	1 week before starting works	Commencement of works
C31-HP21	INSPECTION, Notice Commissioning	H	Give notice of the intention to undertake commissioning	10 days before commissioning	For development inspections book through "MyInspect".
C31-HP22	INSPECTIONS, Notice Acceptance testing	H	Give notice of the intention to undertake acceptance testing	10 days before starting acceptance testing	For development inspections book through "MyInspect".
C31-HP23	SUBMISSIONS, Work as Executed Drawings and Sewer Attribute Schedules	H	Submit certified drawings and schedules	2 weeks after completion of works	Prior to Subdivision Certificate / Occupation Certificate
C31-HP24	SUBMISSIONS, Structural certification from professional engineer	H	Submit certification letter	With subdivision/occupation certificate submission	Prior to Subdivision Certificate / Occupation Certificate
	*H = Hold Point, W = Witness Point				

6.2 Annexure - Maximum lot sizes and minimum test frequencies

6.2.1 Sewerage system - Reticulation (Construction)

Activity	Key quality verification requirements	Test method
Materials supply	Material quality – Supplier's documentary evidence and certification of:	
	DI pipes	AS/NZS 2280 or EN 545
	PVC-U pipes	AS/NZS 1477
	PVC-M pipes	AS/NZS 4765
	PVC-O pipes	AS/NZS 4441
	PE pipes	AS/NZS 4130
	PP pipes	AS/NZS 5065
	GRP pipes	AS 3571.1
	Reinforced concrete pipe	AS/NZS 4058
	Vitrified clay pipes	EN 295-1
	Steel pipes	AS 1579
	ABS pipes	AS/NZS 3518
	Precast concrete access chambers	AS 4198
	Precast PVC-U maintenance structure	AS/NZS 4999
	PVC-U, PE and PP shafts and chambers	To WSA 137 Appendix A
	Gate valves	AS/NZS 2638.1 or AS/NZS 2638.2
	Knife gate valves	AS 6401
	Air valves	AS 4883
	Non-return valves	AS 4794
	Vacuum interface valves	AS 4310
	Bedding and embedment grading	Relevant WSAA product spec.
Siting and excavation	Geometry	Survey
Thrust blocks, anchor blocks and concrete encasement	Consistency – slump	AS 1012.3.1
	Compressive strength (7 and 28 day)	AS 1012.1 AS 1012.8.1 AS 1012.9
Embedment trench/ embankment fill	Compaction testing for gravity sewers	
	Granular material	AS 1289.5.6.1
	Non granular material	AS 1289.5.7.1 or AS 1289.5.4.1
	Compaction testing for	

Activity	Key quality verification requirements			Test method
	pressure sewers			
	Granular material			AS 1289.5.6.1
	Non granular material			AS 1289.5.7.1 or AS 1289.5.4.1
	Compaction testing for vacuum sewers			
	Granular material			AS 1289.5.6.1
	Non granular material			AS 1289.5.7.1 or AS 1289.5.4.1
Acceptance testing: Gravity sewers	Air pressure or vacuum testing			WSA 02 clause 21.4
	Infiltration testing			WSA 02 clause 21.5
Pressure sewers	Pressure testing			WSA 07 clause 21.4
Flexible sewers	Deflection testing			WSA 02 clause 21.6
Internal inspection	CCTV inspection			To WSA requirements
Thermoplastics lined concrete sewers and MH's	Spark testing			AS 3894.1
	Locking key pull out testing			WSA 02 clause 21.9.3
Inverted syphons	Hydrostatic pressure test			AS/NZS 2566.2 WSA 02 clause 21.10
Vacuum sewers and service connections	Air pressure or vacuum testing			Refer to Testing of vacuum sewers and service connections
	Hydrostatic testing			WSA 06 clause 41.6

6.2.2 Sewerage systems - pump stations (Construction)

Activity	Key quality verification requirements			Test method
Equipment supply	**Equipment quality – Supplier's documentary evidence and certification of:**			
	Submersible pumps: Independent witness testing			To WSA 04 clause 20.9.2 and WSA 101
	Motors			To IEC 60034-30-1 and WSA 04 clause 20.9.3 or WSA 06 clause 24.10.4
	Vacuum generators			To WSA 06 clause 24.10.2
	Vacuum sewage pumps			To AS 2417 Grade 2 and WSA 06 clause 24.10.3
	Switchboards			To WSA 04 clause 20.9.1
Electrical works	Acceptance testing			To WSA 04 clause 36.9
Switchgear and controlgear assembly	Electrical function			AS/NZS 61439.1

6.3 Annexure - Referenced documents

6.3.1 Reticulation

The following documents are incorporated into this worksection by reference:

AS 1012		Methods of testing concrete
AS 1012.1	2014	Sampling of concrete
AS 1012.3.1	2014	Determination of properties related to the consistency of concrete - Slump test
AS 1012.8.1	2014	Method for making and curing concrete - Compression and indirect tensile test specimens
AS 1012.9	2014	Compressive strength tests - Concrete, mortar and grout specimens
AS C08		Methods for sampling and testing aggregates
AS C08.22	2008	Wet/dry strength variation
AS C08.32	2008	Weak particles (including clay lumps, soft and friable particles) in coarse aggregates
AS 1210	2010	Pressure vessels
AS/NZS 1214	2016	Hot-dip galvanized coatings on threaded fasteners (ISO metric coarse thread series)
AS/NZS 1260	2017	PVC-U pipes and fittings for drain, waste and vent application
AS 1289		Methods of testing soils for engineering purposes
AS 1289.4.3.1	1997	Soil chemical tests - Determination of the pH value of a soil - Electrometric method
AS 1289.4.4.1	2017	Soil chemical tests - Determination of the electrical resistivity of a soil - Method for sands and granular materials
AS 1289.5.4.1	2007	Soil compaction and density tests - Compaction control test - Dry density ratio, moisture variation and moisture ratio
AS 1289.5.6.1	1998	Soil compaction and density tests - Compaction control test - Density index method for a cohesionless material
AS 1289.5.7.1	2006	Soil compaction and density tests- Compaction control test - Hilf density ratio and Hilf moisture variation (rapid method)
AS/NZS 1477	2017	PVC pipes and fittings for pressure applications
AS/NZS 1554		Structural steel welding
AS/NZS 1554.1	2014	Welding of steel structures
AS 1579	2001	Arc welded steel pipes and fittings for water and waste water
AS 1627		Metal finishing - Preparation and pretreatment of surfaces
AS 1627.4	2005	Abrasive blast cleaning of steel
AS 1657	2018	Fixed platforms, walkways, stairways and ladders - Design, construction and installation
AS/NZS 2032	2006	Installation of PVC pipe systems
AS/NZS 2033	2008	Installation of polyethylene pipe systems
AS 2129	2000	Flanges for pipes, valves and fittings
AS 2187		Explosives - Storage, transport and use
AS/NZS 2280	2014	Ductile iron pipes and fittings
AS/NZS 2566		Buried flexible pipelines
AS/NZS 2566.1	1998	Structural design
AS/NZS 2566.2	2002	Installation

AS/NZS 2638		Gate valves for water works purposes
AS/NZS 2638.1	2011	Metal seated
AS/NZS 2638.2	2011	Resilient seated
AS/NZS 2648		Underground marking tape
AS/NZS 2648.1	1995	Non-detectable tape
AS/NZS 3518	2013	Acrylonitrile butadiene styrene (ABS) compounds, pipes and fittings for pressure applications
AS 3571		Plastics piping systems - Glass-reinforced thermoplastics (GRP) systems based on unsaturated polyester (UP) resin
AS 3571.1	2009	Pressure and non-pressure drainage and sewerage (ISO 10467:2004, MOD)
AS 3681	2008	Application of polyethylene sleeving for ductile iron piping
AS/NZS 3690	2009	Installation of ABS pipe systems
AS 3705	2012	Geotextiles - Identification, marking, and general data
AS/NZS 3879	2011	Solvent cements and priming fluids for PVC (PVC-U and PVC-M) and ABS and ASA pipes and fittings
AS 3894		Site testing of protective coatings
AS 3894.1	2002	Non-conductive coatings - Continuity testing - High voltage ('brush') method
AS 3996	2006	Access covers and grates
AS/NZS 4058	2007	Precast concrete pipes (pressure and non-pressure)
AS/NZS 4087	2011	Metallic flanges for waterworks purposes
AS/NZS 4130	2009	Polyethylene (PE) pipes for pressure applications
AS 4198	1994	Precast concrete chambers for sewerage applications
AS 4310	2004	DN80 piston type vacuum interface valves for municipal sewer systems
AS/NZS 4441	2017	Oriented PVC (PVC-O) pipes for pressure applications
AS/NZS 4680	2006	Hot-dip galvanized (zinc) coatings on fabricated ferrous articles
AS/NZS 4765	2017	Modified PVC (PVC-M) pipes for pressure applications
AS 4794	2001	Non-return valves - Swing check and tilting disc
AS 4883	2017	Air valves for sewerage
AS/NZS 4999	2006	PVC-U maintenance shafts
AS/NZS 5065	2005	Polyethylene and polypropylene pipes and fittings for drainage and sewerage applications
AS 6401	2003	Knife gate valves for waterworks purposes
PIPA POP001	2017	Electrofusion jointing of PE pipe and fittings for pressure applications
PIPA POP003	2017	Butt fusion jointing of PE pipes and fittings - recommended parameters
PIPA POP007	2015	Metal backing flanges for use with polyethylene (PE) pipe flange adaptors
PIPA POP102	2014	Solvent cement welding of PVC pipe
WSA 01	2004	Polyethylene Pipeline Code 2004 3rd edition Version 3.1
WSA 02	2014	Gravity Sewerage Code of Australia
WSA 06	2008	Vacuum Sewerage Code of Australia
WSA 07	2007	Pressure Sewerage Code of Australia
WSA 109	2011	Industry standard for flange gaskets and O-rings
WSA 113	2002	Industry standard for reinforced concrete pipes with flexible thermoplastic linings
WSA 114	2002	Industry standard for concrete special class 2002

WSA 117	2004	ABS compounds, pipes and fittings for water supply and sewerage
WSA 132	2011	Industry standard for ductile iron access covers for water supply and sewerage
WSA 137	2013	Industry Standard for maintenance shafts and maintenance chambers for sewerage
WSAA WSA PS	2017	Product specifications for products and materials
WSA PS-231	2018	Vitrified clay (VC) pipes and fittings for non-pressure applications - Sewerage
WSA PS-233	2018	Reinforced concrete (RC) plastics-lined pipes for non-pressure applications - Sewerage
WSA PS-240	2018	Polypropylene (PP), ribbed construction, pipes and fittings for non-pressure applications - Sewerage
WSA PS-264	2018	Non-return (reflux) valves for pressure applications - Water supply and sewerage
WSA PS-318	2018	Marking tape, detectable
WSA PS-319	2018	Marking tape, non-detectable
WSA PS-355	2018	Geotextile filter fabric
WSA PS-357	2018	Concrete, pre-mixed, normal class
WSA PS-358	2018	Concrete, pre-mixed, special class
WSA PS-364	2018	Graded recycled materials for pipe embedment
WSA PS-367	2018	Steel reinforcing materials for concrete
WSA PS-368	2018	Recycled glass sand for pipe embedment
WSA PS-369	2018	Bottom ash sand for pipe embedment
WSA TN-08	2017	Technical note Product conformity assessment requirements
ASTM A276/A276M	2017	Standard Specification for Stainless Steel Bars and Shapes
EN 295		Vitrified clay pipe systems for drains and sewers
EN 295-1	2013	Requirements for pipes, fittings and joints
EN 295-6	2013	Requirements for components of manholes and inspection chambers
EN 545	2010	Ductile iron pipes, fittings, accessories and their joints for water pipelines - Requirements and test methods

Pumping Stations

The following documents are incorporated into this worksection by reference:

AS 1349	1986	Bourdon tube pressure and vacuum gauges
AS/NZS 1680		Interior and workplace lighting
AS/NZS 1680.2.4	2017	Industrial tasks and processes
AS 2417	2001	Rotodynamic pumps - Hydraulic performance acceptance tests - Grades 1 and 2
AS 2528	1982	Bolts, studbolts and nuts for flanges and other high and low temperature applications
AS/NZS 3000	2018	Electrical installations (known as the Australian/New Zealand Wiring Rules)
AS/NZS 3008		Electrical installations - Selection of cables
AS/NZS 3008.1.1	2017	Cables for alternating voltages up to and including 0.6/1 kV - Typical Australian installation conditions
AS/NZS 3518	2013	Acrylonitrile butadiene styrene (ABS) compounds, pipes and fittings for pressure applications

AS 3571		Plastics piping systems - Glass-reinforced thermoplastics (GRP) systems based on unsaturated polyester (UP) resin
AS 3571.1	2009	Pressure and non-pressure drainage and sewerage (ISO 10467:2004, MOD)
AS 3600	2009	Concrete structures
AS/NZS 4058	2007	Precast concrete pipes (pressure and non-pressure)
AS 4100	1998	Steel structures
AS 4198	1994	Precast concrete chambers for sewerage applications
AS/NZS 4961	2003	Electric cables - Polymeric insulated - For distribution and service applications
AS 60529	2004	Degrees of protection provided by enclosures (IP Code)
AS/NZS IEC 60947		Low voltage switchgear and controlgear
AS/NZS IEC 60947.5.1	2015	Control circuit devices and switching elements - Electromechanical control circuit devices
AS/NZS IEC 60947.8	2015	Control units for built-in thermal protection (PTC) for rotating electrical machines
AS/NZS 61386		Conduits systems for cable management
AS/NZS 61386.21	2015	Particular requirements - Rigid conduit systems
AS/NZS 61439		Low-voltage switchgear and controlgear assemblies
AS/NZS 61439.1	2016	General rules (IEC 61439-1, Ed,2.0(2011),MOD)
WSA 04	2005	Sewage Pumping Station Code of Australia
WSA 06	2008	Vacuum Sewerage Code of Australia
WSA 07	2007	Pressure Sewerage Code of Australia
WSA 101	2008	Industry standard for submersible pumps for sewage pumping stations
WSA 109	2011	Industry standard for flange gaskets and O-rings
WSA 121	2004	Industry standard for biofilters for odour control
BS 7786	2006	Specification for unsintered PTFE tapes for general use
ASTM A240/A240M	2017	Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
IEC 60034-30-1	2014	Rotating electrical machines - Efficiency classes of line operated AC motors (IE code)