

Engineering Design Specification D12 Water Supply – Reticulation, Pumping Station (Design)

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Water Supply - Reticulation & Pumping Station (Design)


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1 General

1.1 Responsibilities

1.1.1 General

Requirement: Provide design and documentation for the construction of a reticulated water supply system (either drinking or dual drinking/non-drinking) conforming to the requirements of WSA 03 and the Water Agency, as documented.

Requirement: Provide design and documentation for the construction of an in-line pressure booster pump station(s) and ancillaries for a reticulated water supply system (either drinking or dual drinking/non-drinking) conforming to the requirements of WSA 03 and the Water Agency, as documented.

1.1.2 Performance

The objective of a water supply system is to provide to the consumer a reticulated (either potable or dual potable/raw) water supply to meet the demands imposed upon it by both the consumers and fire fighting requirements. Consumer requirements shall be met by providing a water main and allowing an appropriate point of connection for each individual property.

1.2 Cross references

1.2.1 General

Requirement: This is not a self-contained design document, conform to the following worksection(s):
D02 Quality requirements for Design

1.3 Standards

1.3.1 General

Standard: To WSA 03 Part 1.

All water works intended for handover to Wingecarribee Shire Council shall be designed in accordance with Council's Engineering Design Specifications, Standard Drawings plus WSA 03 Part 1.

WSC standards take precedence over WSA requirements. In the situation where WSC standards do not cover the requirements, WSA requirements will apply.

1.4 Interpretations

1.4.1 Abbreviations

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

GRP: Glass Reinforced Plastic.

CT: Current transformers.

LV: Low voltage.

HV: High voltage.

PVC: Polyvinyl chloride.

SCADA: Supervisory control and data acquisition system.

SCR: Silicon controlled rectifiers.

SPD: Surge protection device.

VSD: Variable speed drive.

WHS: Work health and safety.

XLPE: Cross-linked polyethylene (or vulcanized polyethylene).

1.4.2 Definitions

General: For the purposes of this worksection the definitions given in WSA 03 Part 0 and the following apply:

- **Booster:** In-line pressure booster pumping station used to increase the hydraulic gradient.
- **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.
- **Document:** Record of information in written or graphical form.

2 Pre design planning

2.1 General

The following factors are to be taken into account in the pre-design planning phase:

- Environmental impact assessment
- Concept plan – Refer to WSA Clause 1.2.2
- Critical infrastructure protection
- Commissioning plan
- Council policies

2.2 System planning

The following factors are to be taken into account in the pre-design planning phase:

- Demands
 - Typical peak hour demand rate – Refer to WSA Clause 2.3.1
 - Peak day factor (PDF):
 - Peak hour factor (PHF):
 - Water Modelling design standards, refer to Council's website for latest version
- System Configuration
 - Acceptable connection points:
 - Water supply zone boundaries
 - Continuity or alternative supply requirements
 - Network layout requirements
 - Duplicate mains
 - Water quality requirements
 - Backflow prevention
- System Hydraulics
 - Available flow (Q) at connection points
 - Available pressure at the connection point
 - Maximum allowable service pressure
 - Minimum allowable service pressure
 - Maximum average service pressure
 - Desirable minimum static pressure
 - Limiting ground level
 - Surge analysis
 - Diurnal pressure variation restrictions

Additional information is provided in section 3

2.3 Consultation

2.3.1 Council and other authorities

Requirements: Consult with the Council and other relevant authorities during the preparation of the design. In addition to the requirements of this worksection, identify the specific design requirements of these authorities.

2.3.2 Utilities services plans

Existing services: Obtain service plans from all relevant utilities and other organisations whose services exist within the area of the proposed development. Plot these services on the relevant drawings including the plan and cross-sectional views.

3 Design criteria

3.1 General

- The Designer is responsible for providing a detailed network/system design including drawings and specifications to service the proposed Development.
- The Designer shall take into account the location and type of pipes and fittings required considering future maintenance and repair requirements.
- The Designer shall determine if water modelling is required to be completed for the development and refer to the modelling factsheet on Council's website.

3.2 Reticulation pressure

- Reticulation systems shall be designed to supply peak instantaneous demand by gravity while maintaining a minimum static head of 120 kPa (12m), measured at the water meter. (Refer also WSA 03 Part 1).
- Under no circumstances shall the pressure be able to equal or exceed the safe working pressure of the reticulation pipe material. The effect of water hammer is to be taken into account for the maximum pressure.
- The desirable maximum pressure is 600 kPa. Zoning of the reticulation system by means of pressure reducing valves (PRV's) may be necessary to achieve these pressures across the development.
- Water fire services required for fire-fighting purposes in the development shall be designed in accordance with the Building Code of Australia. Fire services are to have a flow meter installed. WSC will have ownership up to the flow meter.
- The Designer shall provide a network analysis of the reticulation system detailing the pressure and velocity distribution after consultation with the Water Authority. The internal network must be designed to accommodate Council's pressure and flow standards, and must not detrimentally affect Council's network.

3.3 Pipeline

- Where possible, water property service lines not to be connected to trunk mains or transfer mains
- Transfer mains supplying service reservoirs shall be designed in accordance with the Water Authority. If the purpose is the filling of a reservoir, transfer main capacity is to be designed (with pump capacity) to ensure reservoir level is maintained above RSL over the peak demand design period. This should be done taking into account any pump operating restrictions (eg if trying to avoid peak tariff periods) and would need to be supported by hydraulic modelling.

- Reticulation mains shall be looped to eliminate dead ends unless otherwise permitted by the Water Authority.
- Where a dead end is permitted to provide for future extension from staged development, the end shall be fitted with a stop valve, hydrant bend and hydrant.
- Wherever possible, the development shall be serviced from two or more mains to avoid the loss of supply in the event of maintenance or breakage.
- Each dwelling shall have an individual service tapped from the main and extending 300mm inside the lot boundary. Separate connections are required for Industrial, commercial and residential use.
- The Designer shall show on the Drawings the type of cover, access and security of valve chambers for valves proposed to be housed in valve chambers.
- Chamber lids (pits) and regular valve covers shall be manufactured in accordance with AS 3996 and Council's Standard Drawings. Refer to Council standard drawing for valves and markings. The Designer shall ensure that air valve covers have adequate openings for air exchange.
- Stop valves shall be clockwise closing.
- Double air valves with integral isolating valve on mains or single air valve with isolating valve on reticulation mains, and scour points.
- The Designer shall provide for ease of valve maintenance within valve chambers, where provided, and select valve types such that servicing of the valve can be effected without removal from service, wherever possible.
- Minimum Pipe Sizes shall be in accordance with Council's modelling design criteria.
- No building will be permitted over a watermain.

3.4 Location

- In designing the reticulation system, standard locations shall be followed, as detailed below:
 - Reticulation mains shall be laid in compliance with the Water Authority's standard footpath allocation for public utilities, refer to council's drawings. Street trees shall not be planted over watermains.
 - Valves shall be located to avoid conflict with driveways, telephone house service pits and underground electrical boxes. Stop valves shall be located so that approximately 20 dwellings can be isolated for shutdowns.
 - Hydrants shall be located on all reticulation mains. The interval between hydrants shall not exceed 60 metres in urban areas and 140m in rural areas, at all high and low points of the main, and at dead ends.
- Water mains located on private property shall be located in an easement of minimum width three (3) metres. Unless there are compelling reasons to the contrary the water main shall be located in the centre of the easement. A Registered Surveyor shall survey easements and pipelines.

3.5 Mine subsidence areas and areas of slippage

- The Designer shall accommodate the movement associated with the ground strain for the area, as advised by the Mine Subsidence Board for water reticulation jointing systems in proclaimed Mine Subsidence Areas, or in a known or expected area of subsidence or slippage. The design ground strain for the development shall be detailed on the Drawings.
- The pipe jointing system selected shall be capable of accepting ground movements, without impairing the water tightness of the joint, for the ground strain as advised by the Mine Subsidence Board. For areas with high ground strains a pipe jointing system using shorter

effective length pipes and/or deep socket fittings shall be used. The pipe jointing system shall be shown on the Drawings.

- Where the Mines Subsidence Board does not cover an area of known, or suspected, subsidence or slippage, the above requirements shall still apply.

3.6 Hydraulic design

Refer to council modelling design standards on council's website for design criteria

4 Products and materials

4.1 General (WSA 03 part 2)

- The working pressure of pipes, fittings, valves and hydrants shall be fit for the purpose in accordance with the relevant Australian Standard for the material and shall be at least 1200 kPa (120m).
- For pumped systems, the Designer shall select pipe type, class and standard based on pumping design and in accordance with AS 2200 and site conditions. All pipes shall be a minimum Class 16 unless otherwise determined by the Supply Authority (WSA 03 Part 1).
- Pipes and fittings for water reticulation shall be of modified PVC, ductile iron, steel, High density polyethylene or copper. The material specifications for each pipe type must be considered when determining use.
- Where water pipes are to be located in close proximity to other service pipes and in dual systems, or where there is the likelihood of the pipes not being recognised as water pipes, the Designer shall provide for the pipes to be colour coded and shown on the Drawings accordingly. Blue markings shall be used on all pipework e.g. blue stripe or some other indicator system for all water pipe use
- The Designer shall show on the Drawings the extent of external protection required to be undertaken by the Contractor. External protection shall be shown to comply with Part 3 of Water Supply Code of Australia.
- Piers for any above ground water main shall be in accordance with Part 3 of Water Supply Code of Australia.
- The Designer shall allow for adequate working area, waste removal and transport arrangements where scouring points or pipe inspection locations are nominated (WSA 03 Part 1).
- The Designer shall indicate the location of connections for gauges required on mains.
- The minimum diameter of all pipes shall be 100 mm unless otherwise determined by the Supply Authority. In commercial, industrial or high-rise building areas the minimum shall be 150mm. In all cases pipe sizes and residual pressures shall be designed to cater for fire fighting flows (WSA 03 Part 1).
- The Designer shall take regard of the limits of use for the pipeline system materials under consideration (WSA 03 Parts 1 and 2).
- Where valves are specified and shown on the Drawings, they shall comply with the valve details in the Part 3 of Water Supply Code of Australia.
- The Designer shall design thrust blocks to resist maximum operating pressure of the pipe, not the estimated surge pressure.
- The Designer shall provide for surge control by specifying an appropriate pipe material and class selection.

4.2 Modified PVC (PVC-M) pipe

- Modified PVC (PVC-M) pipes and fittings shall be specified to be manufactured in accordance with AS/NZS 4020, AS/NZS 4765, blue in colour and with rubber ring (elastomeric) spigot and socket joints (WSA 03 Part 2).
- The Designer shall ensure that PVC pipe is compatible with ductile iron (DI) pipe where necessary.
- Fittings for use with PVC pipe shall be elastomeric seal jointed.

4.3 Acrylonitrile butadiene styrene (ABS) pipe and fittings

- ABS pipes and fittings are not approved.

4.4 Ductile iron (DI) pipe and fittings

- Ductile iron pipes and fittings shall be specified for manufacture in accordance with AS/NZS 2280 minimum Class K9 for rubber ring (elastomeric) joints. Where pipes are to be flanged, Class K12 shall be specified (WSA 03 Part 2).
- The Designer shall specify cement mortar lining in accordance with AS 1281, or fusion-bonded medium density polyethylene to AS/NZS 4321. External protection shall be epoxy coating to AS 3862 where not otherwise specified as sleeved or wrapped, taking into account the type of corrosion protection required.
- Generally, pipe and fitting joints shall be specified to be spigot and socket type using a rubber ring (elastomeric) push in seal made of natural rubber, ethylene propylene rubber or nitrile rubber with compounds complying with AS 1646. The seal shall be a single jointing component shaped to provide both groove lock and seal mechanisms. Alternative thrusting solutions will be considered by Council on a case by case basis.
- The Designer shall take account of congested service corridors, poor soil conditions and the need for additional security for strategic mains with regard to the provision of restrained joints.
- Flanges shall be specified for manufacture in accordance with AS 4087 and AS 2129 Table C. The Designer shall specify bolts and nuts for flanged joints in accordance with AS 2129, galvanised in accordance with AS 1214, or stainless steel in accordance with AS 1449 as for pumps specified in Part 3 of Water Supply Code of Australia.

4.5 Steel pipe and fittings

- Steel pipes and fittings shall be specified for manufacture in accordance with AS 1579 and AS/NZS 1594 and designed to AS/NZS 2566.1. (WSA 03 Part 2).
- The Designer shall specify the jointing system where long-term corrosion resistance, ease of construction or special circumstances dictate the need. The pipe jointing shall be either:
 - Rubber ring (elastomeric) jointed to conform to AS 1646, or
 - Welded with butt welding or by using a welding collar with the application of a polyethylene heat shrunk sleeve over the weld, or wrapped, or
 - Flanged to comply with AS 4087 to the table specified on the Drawings. Bolts and nuts for flanged joints shall be in accordance with AS 2129 and galvanised in accordance with AS 1214, or stainless steel in accordance with AS 2837 as for pumps specified in Part 3 of Water Supply Code of Australia
- The Designer shall avoid the positioning of continuously welded steel pipelines in parallel with high voltage power lines (WSA 03 Part 1).

4.6 High density polyethylene pipe and fittings

- High Density polyethylene pipe shall be specified for manufacture in accordance with AS/NZS 4130 and designed to AS/NZS 2566.1 (WSA 03 Part 2).
- Fittings shall comply with AS/NZS 4129 with compounds to AS/NZS 4131.

4.7 Glass Reinforced Plastic (GRP) and fittings

- Glass filament reinforced thermosetting plastics (GRP) pipes are not approved.

4.8 Copper pipe and fittings

- Copper tube shall be specified for manufacture in accordance with AS 1432 in the range of DN6 to DN200 for Type A or Type B. The Designer shall take into account the requirements of AS 3500 (WSA 03 Part 2).
- Capillary and compression fittings shall be specified to comply with AS 3688 and de-zincification resistant. Capillary fittings shall have silver brazed joints or solder insert capillary joints.

5 Pump Station

5.1 General

- The Designer shall take into account site access, site maintenance and restoration, easements, power supply and working area when locating pump stations in road reserves or on private property. This action constitutes a HOLD POINT. The design shall be consistent with the function of the pump station, eg: booster or transfer.
- Pump units shall be secured under a purpose-designed building, which shall be subject to the Development Approval (DA) of the Council. The building shall match the aesthetics of the surrounding land use and shall accommodate any need for climate and/or acoustic control. Occupational Health and Safety requirements shall be met especially with regard to clearance for maintenance, and avoidance of trip hazards.
- Where pumps are to be installed below ground level, the Designer shall provide for the pumps to be mounted on plinths and housed in a single pump well.
- The Designer shall provide for the construction of the pump well after taking into consideration the ground and site conditions.
- Preformed components or systems, complying with the Drawings, if any, may be used in lieu of in-situ construction, provided:
 - Preformed concrete wall units are manufactured to AS 4058. The Designer shall take into account the cover requirements for the reinforcing steel.
 - Joints shall be internal flush
 - The Designer shall ensure components make a watertight system and have a satisfactory surface finish.
- Where the pump station site is exposed to possible flooding, the Designer shall provide for the floor of the pump station or top of pump well, as appropriate, to be the higher of one (1) metre above the 1 in 100 year flood level or to such other level as provided by Council's planning instruments.

- The Designer shall provide for the design of pump wells against flotation both during the construction/installation stage and whilst operating under flood conditions.
- Capacities of the pump unit shall be calculated from the intersection of the pump performance curve and the pipeline characteristic curve calculated at mid water level of the service reservoir involved with this duty point. Standby pumping capacity shall be provided such that if one (1) pump is out of service, the pump station will remain able to supply the required transfer capacity. The pump unit shall be capable of operating near optimal efficiency within the range of operating conditions.
- All pipework and fittings shall be in accordance with this Specification. In addition, all steel bolts, nuts and washers shall comply with AS/NZS 1111 and AS/NZS 1112 and shall be galvanised in accordance with AS 1214 or stainless steel complying with AS 1449 grade 316.
- Negative suction head is to be avoided.
- The Designer shall provide for alarms and signals systems with the concurrence of the Water Authority and compatible with Council's SCADA.

5.2 Pump

- Pumps shall comply with the WS-SPEC. The Designer shall take account of dismantling joints and valves provided in the pipework to facilitate removal of the pumps for maintenance and the need for surge control devices.
- Pump sets are to be interchangeable within each pump station where standby pumps are installed.
- The Designer shall design structural steelwork in accordance with HB 48.

5.3 Electrical

- Notwithstanding other clauses mentioned herein, the Designer shall be responsible for the design of the equipment as suitable for the purpose. Equipment design shall comply with the requirements of the relevant standard specification.
- The Designer shall provide for Switchgear Control Assembly (SCA), SCA housing and electrical requirements as detailed in Part 3 of Water Supply Code of Australia.
- Where more than one (1) item of equipment is designed to form a particular function, all such items of equipment shall be identical and completely interchangeable (eg pilot lights, pushbuttons, relays, etc).
- The switchboard shall be installed visibly and physically accessible above all areas at risk of flooding.
- Ambient conditions shall be within the normally accepted limits of 00C to 450C.
- The switchboard shall be connected to the local electricity supply system.
- Normal system parameters:
 - 415 volt, 3-phase, 4-wire, 50 Hz, solidly earthed neutral system.
 - Prospective Fault Current: As specified by the Local Supply Authority.
- The works shall be designed in accordance with and subject to the provisions of MEW E101, except where modified by this Specification.
- The pump station shall be designed for fully automatic operation in the unmanned condition.

5.4 Electrical power supply

- The consumer electrical mains shall be run underground where possible and commence at the point of attachment on a steel consumers pole (if applicable) installed near the property boundary and run in conduit to the switchboard.
- The minimum size of the consumers mains shall be sized to satisfy the following requirements:
 - Current carrying capacity to suit the maximum demand with an excess current carrying capacity of 30 per cent minimum.
 - Be sized for a voltage drop less than 1.5 per cent of the maximum demand as calculated.
 - Be single core PVC/PVC cables. XLPE insulated cable may also be used.
 - Comply with the requirements of the Local Supply Authority.
 - Pole termination method shall be determined in consultation with the Local Supply Authority.

5.5 Telemetry

- The Designer shall provide for telemetry requirements in accordance with the schedule supplied by the Water Authority.
- The telemetry system is to be compatible with the existing system, if any, in use.

5.6 Ladders

- Ladders shall comply with AS 1657 and applicable Occupational Health and Safety legislation.
- If required, the Designer shall set intermediate landings in wells to achieve the minimum headroom clearance. Wherever possible, the landing shall be located adjacent to fittings and machinery requiring maintenance.
- Ladder cages shall not be used on ladders in pump station wells.

5.7 Other appurtenances

- The Designer shall provide for machinery lifting equipment including pump chains as necessary.
- The Designer shall provide pressure tapping and gauges for all valves, including isolation and non-return valves as detailed in the Construction Specification-C30 Water Supply.
- The Designer shall take account of the possibility of site flooding ingress and overflow, and Occupational Health and Safety requirements in providing for access and inspection covers.

6 Documentation

6.1 Reticulation

- The Developer shall submit, to the Water Authority for approval, 1 x A3 and 1 x electronic PDF copy the proposed water main design, including calculations and network analysis if appropriate, prior to issue of a Section 68 Consent. This action constitutes a HOLD POINT.
- The Drawings shall show to scale:
 - Plan showing:
 - Lot boundaries and lot numbers
 - Location and size of all mains, appurtenances and pump stations

- Existing mains
- Existing and proposed features and services
- North point and scale bar
- Easement locations
- Arrangement of other utilities
- Longitudinal section for trunk mains or smaller mains when deemed necessary by Council showing:
 - Reduced levels for natural surface and design surfaces at all changes in grade
 - Mains, appurtenances and pump stations
 - Appurtenances numbered in accordance with Water Authority's Asset Register
 - Invert levels where necessary
 - Size, type, class and grade of pipe
 - Location, invert level and size of all drainage lines, sewer mains, and other utility services crossing the main
 - Notation regarding all joining lines
 - Property ownership
 - Note "In road" trench conditions
- General arrangement of pump stations with site plan; concrete outlines; number, make, model and details of pumps; inlet and outlet pipework details and levels; pump cut in; cut out and alarm levels; switchboard location; pump station access details; design starts per hour.
- Details of corrosion protection required for pipes and fittings.
- Areas designated for trenchless pipe installation.
- Detail plans shall be drawn to a scale of 1:500 and longitudinal sections to a horizontal scale of 1:1000 and a vertical scale of 1:100. The Designer shall show locations of hydrants, stop valves, non-return valves, air valves and scour valves, tees, tapers, creek crossings, trench dimensions and backfill, thrust blocks, and other existing and proposed services and installations including chambers and covers and items of construction which are project specific.
- Drawings shall be 'A3' and/or 'A1' size after consultation with the Water Authority.
- Drawings shall also be provided in electronic form after consultation with the Water Authority.

6.2 Pump station

- The Principal shall submit, to the Water Authority for approval, prior to commencement of the manufacture of any pumps and control equipment, 1 x A3 and 1 x electronic PDF copy of the following:
 - Switch and Control Gear Assemblies (SCA) - Proposed fully dimensioned manufacturing details, general arrangement (showing internal/external details) and foundation/gland plate details.
 - Common Control - Complete circuit diagram and description of operation.
 - Schedule of Equipment - Completed as to the equipment to be provided.
 - Other Engineering drawings as required fully describing the proposed equipment.

The submission of the documents constitutes a **HOLD POINT**.

- The Designer shall take into consideration the technical requirements to minimise all risks associated with chlorination, and entry into confined space.
- Drawings shall be on 'A3' and/or 'A1' size after consultation with the Water Authority. All symbols used shall conform to AS 1102 and all wires and terminals shall be numbered.
- Drawings shall also be provided in electronic form after consultation with the Water Authority.

6.3 Asset Register

- The Designer shall provide asset schedules and Drawings in a form consistent with the existing or proposed Asset Register after consultation with the Water Authority (WSA 03 Part 1).

6.3.1 Work-as-executed documents

Work-as-executed drawings: Provide an additional set of final construction drawings for the purpose of recording the work completed by the Contractor.

Provide all required data and electronic files as outlined in WSC "Work as Executed plans specification and attribute requirements" located on Councils website.

6.3.2 Final certification of completed works

Requirement: Council requires the designer or its representative to carry out sufficient site inspections to validate the final certification of the proposed works.

Completed works: The designer to provide evidence of the inspections undertaken during construction works and a copy of the final certification that the completed works is consistent with the approved design.

7 Annexure

7.1 Annexure – Referenced documents

The following documents are incorporated into this worksection by reference:

WSA 03.1	2011	Water Supply Code of Australia
AS 1657	2018	Fixed platforms, walkways, stairways and ladders - Design, construction and installation
AS/NZS 3000	2018	Electrical installations (known as the Australian/New Zealand Wiring Rules)
AS/NZS 3111	2009	Approval and test specification - Miniature overcurrent circuit-breakers
AS/NZS 3439		Low-voltage switchgear and controlgear assemblies
AS/NZS 3439.1	2002	Type-tested and partially type-tested assemblies
AS/NZS IEC 60947		Low voltage switchgear and controlgear
AS/NZS IEC 60947.4.1	2015	Contactors and motor-starters - Electromechanical contactors and motor-starters
AS/NZS IEC 60947.4.2	2015	Contactors and motor-starters - A.C. semiconductor motor controllers and starters
AS/NZS 61439		Low-voltage switchgear and controlgear assemblies
AS/NZS 61439.1	2016	General rules (IEC 61439-1, Ed,2.0(2011),MOD)
AS 61800		Adjustable speed electrical power drive systems
AS 61800.2	2004	General requirements - Rating specifications for low voltage adjustable frequency a.c. power drive systems
AS 61800.3	2005	EMC requirements and specific test methods
WSA 03	2011	Water Supply Code of Australia
IEC 61643		Low voltage surge protective devices
IEC 61643-11	2011	Surge protective devices connected to low voltage power distribution systems – requirements and test methods
IEC 61643-12	2008	Surge protective devices connected to low voltage power distribution systems – selection and application principles