MACKAY CITY COUNCIL

WATER SUPPLY DESIGN

Planning Scheme Policy No. 15.12

DATE POLICY TOOK EFFECT:
31 March 2008

ENGINEERING DESIGN GUIDELINE - WATER SUPPLY DESIGN PSP 15.12

ABBREVIATIONS

ABBREVIATION	INTERPRETATION
ABS	Acrylonitrile Butadiene Styrene
AHD	Australian Height Datum
AOP	Allowable Operating Pressure
AS/NZS	Australian / New Zealand Standard
DA	Development Approval
DICL	Ductile Iron Cement Lined
DIEL	Ductile Iron Epoxy Lined
DN	Nominal Diameter
EN	European Standard
EMP	Environmental Management Plan
FBPE	Fusion Bonded Polyethylene (“Sintakote”)
GRP	Glass Reinforced Plastic
IDAS	Integrated Development Assessment System
IPA	Integrated Planning Act 1997
ITP	Inspection and Test Plan
KL	kilolitre
KPA	kilopascal
KW	kilowatt
L/S	Litres per second
MA	milliamps
MAOP	Maximum Allowable Operating Pressure
MEN	Multiple Earthed Neutral
MGA	Map Grid of Australia
MH	Maintenance Hole
MPA	megapascal
NPSHA	Net Positive Suction Head Available
NPSHR	Net Positive Suction Head Required
P&ID	Process and Instrumentation Diagram
PLC	Programmable Logic Controller
PN	Nominal Pressure Class
PVC	Polyvinylchloride
PVC-M	Polyvinylchloride modified
PVC-O	Polyvinylchloride orientated

PVC-U	Polyvinylchloride unplasticised
RPEQ	Registered Professional Engineer Queensland
RPZD	Reduced Pressure Zone Device
RRJ	Rubber Ring Joint
SCA	Switchgear and Control gear Assembly
SCADA	Supervisory Control and Data Acquisition
SCL	Steel Cement Lined
SEL	Steel Epoxy Lined
WSAA	Water Services Association of Australia
WS-SPEC	Water Services Specification

DEVELOPMENT DESIGN GUIDELINE
WATER SUPPLY PSP 15.12

1 SCOPE

Scope

This Guideline sets out the requirements to be used in the design of water supply facilities within Mackay City to met the required service standards, design life, environmental requirements and adherence to Council's preferred plant and equipment needs.

This Guideline includes the design of a water supply system as either a stand-alone project or part of a development and its integration into the existing water supply system.

The design shall be undertaken under Council's Asset Creation process (as outlined in this Guideline) and shall comply in all respects with relevant Legislation, Codes of Practice, Australian Standards and with Council's local laws, policies and Guidelines.

The Designer shall ensure that all assets to be procured in the Asset Creation process shall comply in all respects with the requirements of and/or intent of this Guideline and referenced documentation.

This Guideline contains procedures for the design of the following elements of a water supply system:

(a) Service Reticulation
(b) Trunk Mains
(c) Pump stations, complete with all ancillary plant and equipment to effect a fully operational pump station.

2 STRUCTURE

Structure

This Guideline is based on the national Water Supply Code of Australia (WSA-03) and is complimented by the strategic product specifications and technical requirements contained within WS-SPEC.

In doing so, the Guideline is structured as follows;

a) To nominate the Water Services Association of Australia (WSAA) Codes and associated documents as the general requirements to be met for the Asset Creation process within the Mackay City Council Area of jurisdiction.
b) To specify parameters, requirements and functions contained within the Codes that the Council is to nominate or to amend.
c) To specify additional technical and/or administrative matters (that are not otherwise specified within Australian Codes or Standards) pertaining to Operational Works applications made in accordance with the Queensland Integrated Planning Act (IPA).
d) To specify any technical requirements not covered by the Codes.
e) To identify materials, solutions and methods permitted by the Codes that are not acceptable to Council.
f) To specify preferred options where the Codes provide for several methods to deal with a particular issue.

WSA-03 is available from the Water Supply Association of Australia

(WSAA), email: info@wsaa.asn.au. WS-SPEC is available from the Saiglobal Webshop at www.saiglobal.com/shop.

3 Consultation

Consultation

The Designer is required to prepare one concept Water Master Plan of the proposed development and indicate how the water supply design for the proposed development relates to the current/proposed road layout, existing utility services, streetscape and water supply infrastructure. These services and infrastructure are to be plotted onto the plan and cross-sectional views.

The Designer is encouraged to consult with the relevant Authorities prior to, and during, the preparation of a design concept to ascertain service plans and specific requirements of the relevant Authority as they relate to the proposed water supply design and installation.

The Designer is strongly encouraged to discuss the Master Plan during initial consultation with Council (Mackay Water) officers to ensure planning and know constraints are considered by the Designer prior to the lodgement of any Operational Works application. The plan may also be required to be prepared and consultation held with Council officers prior to lodgement of a MCU or RoL Development Application. As a minimum, the following aspects of the proposed development should be included on the plan;

- Legend
- All allotments
- Boundary of land
- North Point
- Location and size of existing mains
- Location, size of new mains
- Location of other services which cross the mains
- Details of connection to existing mains
- The location of valves, hydrants, scours and caps, T's, reducers, etc.
- Road crossing conduit locations,
- Water service connection locations
- Preliminary details of any pumping stations which may include electrical switchboard layout, pipe work details and pump details

4 ENVIRONMENTAL RISK ASSESSMENT

Environmental Risk Assessment

The Designer shall ensure that the design of infrastructure shall be planned and executed to minimise risk to the environment. Where a choice of alternative solutions is possible, an objective environmental risk assessment shall be undertaken to give due weight to reducing the risks to the environment resulting from the construction and operation of the

infrastructure.

5 CONNECTIONS TO COUNCIL'S INFRASTRUCTURE

Connections to Existing Infrastructure

The connection of new water supply infrastructure to Council's existing system forms part of the infrastructure realisation to be carried out at the Developer's expense. Generally, Council staff will undertake all connections to Council's water supply infrastructure. The Contractor shall not carry out the connection unless prior approval is given by Council. This will only be given in exceptional circumstances.

When Council makes the connection, an estimate of cost will be provided to the Developer and the connection will not be made until the payment is received.

Where the Contractor is to make a connection, the Designer is to co-ordinate the work and the processes for inspection and payment. Council shall be given 5 working days notice of the work to enable Council to provide staff to operate valves and isolate pumping stations as necessary and to monitor the Contractor's work.

An estimated cost of the monitoring shall be agreed prior to notice being given. The estimated cost and a signed undertaking to pay the actual costs of the work when completed shall accompany the notice.

Contractors are not permitted to operate Council's infrastructure unless written approval has been obtained from Council.

Council reserves the right, on advice of its authorised representative to stop, or take over a connection being undertaken by a Contractor, if in the representative's opinion the Contractor is incapable of completing the connection work in a reasonable time without causing damage to Council's infrastructure or undue inconvenience to the public.

Consumer requirements shall be met by providing a water main and allowing an appropriate point of connection for each individual property.

6 DEFINITIONS

Definitions

Asset Creation means any or all aspects of the planning, design, construction, supervision of construction, testing and commissioning and eventual handover of water supply infrastructure.

Contractor means a private contractor approved by Council to construct water supply infrastructure on behalf of a Developer.

Council means Mackay City Council and its Mackay Water business unit

Designer means an experienced Professional Engineer who is certified as

a Registered Professional Engineer Queensland (RPEQ) and is competent to perform the engineering works required for the Asset Creation process.

Developer means the person who has submitted a planning application for the provision of infrastructure under the Asset Creation process or for the utilisation of existing water supply infrastructure.

Service Reticulation (including allotment connection) means pipework less than DN300 and for which direct service connections are permissible.

Surveyor means a licensed surveyor, endorsed in the Register of Surveying Associates, Surveying Graduates, Surveyors (Body Corporate) and Surveyors (Individual), who is competent to perform the surveying work required for the Asset Creation process on behalf of a Developer.

Switchgear and Control Gear Assembly means main switchboard, main distribution board, distribution board, control board, electrical kiosk, electrical panel, control panel or similar enclosure

The Code means the Water Supply Code of Australia (WSA-03) published by the Water Supply Association of Australia (WSAA).

Trunk Mains means pipework equal to or greater than DN 300, and for which no direct service connections are permissible.

WS-SPEC means the national standard water industry specifications.

7 ORDER OF PRECEDENCE

Order of Precedence

Where discrepancy or contradiction in documentation may occur, the order of precedence for documents specifying the works to be undertaken (from highest to lowest order of precedence) shall be as follows:

(a) This Guideline
(b) Mackay City Council Standard Policies, Specifications and Drawings
(c) Water Supply Code of Australia (WSA-03)

8 REFERENCE AND SOURCE DOCUMENTS

Reference and Source Documents

Documents referenced in this Guideline are listed below. The Designer shall possess, or have access to, the latest edition of all documents required to comply with this Guideline, including all current amendments and supplements of those documents. The Designer shall include all relevant specifications and requirements of these documents into the design of the works.

(a) Council Construction Specifications

Council Planning Scheme Specifications

Development Construction Specification - Water Supply (C401)

(b) Council Policy Documents

Council

Mackay City Council Policy - MW16 Clearance to Water and Sewerage Assets

Policies

Mackay City Council Policy – D20 Drawings and Documentation Guidelines

WSA-03Code of Practice

(c) WSA 03 - Water Supply Code of Australia

WS-SPEC

(d) WS-SPEC Water Services Specification

(e) Australian Standards

Australian Standards

References in this Guideline or the Drawings to Australian Standards are noted by their prefix AS or AS/NZS.

The Designer shall use the latest edition of the Australian Standards, including amendments, supplements and replacement applicable thereto.

Relevant Australian Standards are listed within WSA-03.

(f) Council Standard Specifications

Council Standard Specifications

Council Standard Specification for Electrical Assets.

(g) Other Documents

Other Documents

Water Resources Guidelines for Planning and Design of Urban Water Supply. Department of Natural Resources TB No. : 3/1997.

Institute of Public Works Engineering Australia (IPWEA) Streets Opening Conference Information Bulletin on Codes and Practices (Sections 3 and 4 detailing locations and depths of other services and preferred location for water reticulation pipes).

ISO 5199- Technical Specifications for Centrifugal Pumps

(h) WSAA WSA-03 Drawings (as amended by Council)

WSA-03 Drawings

WAT	1100	Design Layouts	A3-04266 B
WAT	1101	Design Layouts	A3-04267B
WAT	1102	Typical Mains Construction	A3-04268B
WAT	1103	Typical Mains Construction	A3-04269B
WAT	1104	Typical Mains Construction	A3-04270B
WAT	1105	Typical Mains Construction	A3-04271B
WAT	1106	Property Services	A3-04272B
WAT	1107	Property Services	A3-04273B
WAT	1108	Property Services	A3-04274B
WAT	1109	Property Services	A3-04275B
WAT	1200	Soil Classification Guidelines	A3-04276B
WAT	1201	Embedment & Trenchfill Typical Arrangement	A3-04277B
WAT	1202	Standard Embedment Rigid & Flexible Pipes	A3-04278B
WAT	1203	Special Embedment Inadequate Foundations	A3-04279
WAT	1204	Special Embedment Support Utilising Piles	

			A3-04280B	
WAT	1205	Thrust Block Details	A3-04281B	
WAT	1206	Thrust Block Details	A3-04282B	
WAT	1207	Thrust & Anchor Blocks	A3-04283B	
WAT	1208	Restrained Jointing System	A3-04284B	
WAT	1209	Trench Drainage	A3-04285B	
WAT	1210	Trench Drainage	A3-04286B	
WAT	1211	Buried Crossings	A3-04287B	
WAT	1212	Buried Crossings	A3-04288B	
WAT	1213	Buried Crossings	A3-04289B	
WAT	1214	Buried Crossings	A3-04290B	
WAT	1300	Valves and Hydrants	A3-04291B	
WAT	1301	Valves and Hydrants	A3-04292B	
WAT	1302	Valves and Hydrants	A3-04293B	
WAT	1303	Valves and Hydrants	A3-04294B	
WAT	1304	Valves and Hydrants	A3-04295B	
WAT	1305	Valves and Hydrants	A3-04296B	
WAT	1306	Valves and Hydrants	A3-04297B	
WAT	1307	Typical Appurtenances	A3-04298B	
WAT	1308	Typical Appurtenances	A3-04299B	
WAT	1309	Typical Appurtenances	A3-04300B	
WAT	1310	Aerial Crossings	A3-04301B	
WAT	1311	Aerial Crossings	A3-04302B	
WAT	1312	Aerial Crossings	A3-04303B	
WAT	1313	Flanged Joints	A3-04304B	
WAT	1400	Typical Steel Pipe Jointing	A3-04305B	
WAT	1401	Typical Steel Pipe Jointing	A3-04306B	
WAT	1402	Typical Steel Pipe Jointing	A3-04307B	
WAT	1403	Typical Steel Fabrication	A3-04308B	
WAT	1404	Typical Steel Fabrication	A3-04309B	
WAT	1405	Typical Steel Fabrication	A3-04310B	
WAT	1406	Typical Steel Fabrication	A3-04311B	
WAT	1407	DI Installation	A3-04312B	
WAT	1408	Joint Corrosion Protection	A3-04313B	
WAT	1409	Hydrant Installation	A3-04314B	

(i) Council Standard Drawings

Council Standard Drawings

A3-04321	Location of Assets
WA3-840	Water Service Connections / Meters
WA3-832	Air Valve Pit
WA3-833	Typical Water Reticulation Layout Drawing
WA3-834	Backflow Prevention Device
WA3-835	Bedding & Backfill Details
WA3-836	Thrust Block Details
WA3-837	Hydrant & Valve Installation
WA3-838	CI Hydrant & Valve Boxes
WA3-839	Valve Scour Details
A3-04320	Flowmeter Pit

9 CODE AMENDMENTS	
The Designer shall ensure that the design of water supply system elements shall comply with The Code unless specified otherwise in this Guideline. Amendments made by Council to the Code are included below.	***Amendments to WSA-03***

Amendments to WSA-03 **Note** : The Clause numbers and table numbers given below correspond to the relevant Clause numbers given in the Water Supply Code of Australia (WSA-03)	***Clause No. in WSA-03***
Based on the initial inputs from Council, the Designer shall undertake and provide a network analysis of the water supply system as part of the system planning process and shall incorporate the results of such analysis in the Water Master Plan. The network analysis shall be sufficient to determine the impact of the proposed development on the distribution of system pressures, flows and pipe velocities throughout the existing and proposed water supply system. In addition to the network analysis, the Designer shall provide an electronic copy of a concept development layout detail in DWG format showing road layout, allotment boundaries, land use definition, water infrastructure alignments, contours, land allocations and easements for water infrastructure. Such drawings shall be sufficiently detailed to assess the proposal. All drawings are to be prepared to Australian Height Datum (AHD) and to Map Grid Australia (MGA 55) co-ordinates.	***1.2.1 Planning Overview***
Except where specified otherwise, the division of responsibility between Council and the Designer shall be in accordance with the DEVELOPMENT CONSTRUCTION SPECIFICATION- WATER SUPPLY (C401).	***1.5 Design Responsibilities***
Council shall assess the impacts of the proposed development on the existing water supply system by reviewing the water supply network simulation model developed by the Designer and the concept development layout plan. Assessment of the proposal shall be based on the details provided by the Designer.	***2.1.1 System Upgrade***
The Designer is required to consult with Council regarding industrial and commercial demands. Submit the demand forecasts as part of Water Master Plan. The Designer shall use for residential development the average demand of 400 l/EP/day The Maximum Day, Maximum Month (MDMM) Factor shall be 1.5. The Maximum Day Factor shall be 2.0, with the assumed density (detached dwellings) of 2.7 EP/ET.	***2.2 Demands***

The Designer shall take into account the special requirements for dual water supplies where required by Council, including but not limited to, demand, size and location for each pipe system. Dual services shall not be installed unless part of a dual supply.	***2.3 System Configuration***
The Designer shall ensure that the design provides for a minimum allowable service pressure shall be 22 metres of water head at the customer's meter at peak instantaneous demand. Reticulation systems shall be designed to supply peak instantaneous demand by gravity while maintaining this minimum allowable service pressure. The maximum allowable operating pressure at any point in the system is 80m of water head.	***2.4.3 Operating Pressures***
NEW PUMPING STATIONS where the Designer cannot provide 22m of head. **General Requirements** The Designer shall take into account site access, site maintenance and restoration, easement requirements, power supply and construction laydown working areas when locating pump stations. Council shall advise following lodgement by the Designer whether the option to confer on the locations and land allocations is required. Small booster pumping units may be housed in underground pits or aboveground buildings. Underground pumping installations shall be provided with watertight covers, approved access arrangements, adequate provision for maintenance and provision of drainage. Where required, larger pump units shall be secured within an aboveground purpose-designed building. Aboveground buildings and structures shall be subject to Development Approval (DA) by Council. The building shall match the aesthetics of the surrounding land use and shall accommodate any need for climate and/or acoustic control. For all pump stations structures and buildings, Occupational Health and Safety requirements shall be met, especially with regard to ease of access, clearances for maintenance, lifting equipment, and avoidance of trip hazards. The Designer shall provide lifting equipment, including gantry cranes; monorails or permanently installed davits, as necessary, to comply with operational health and safety requirements. Structural steelwork in pumping stations for ladders and access platforms, and brackets shall be SS316 or marine grade aluminium. For above ground buildings, preformed components or system may be used in lieu of in-situ concrete, providing: (a) Preformed concrete wall units are to be manufactured to AS 4058. The Designer shall take into account the cover requirements for the reinforcing steel. (b) Joints shall be internal flush (c) The Designer shall ensure components make a watertight system and have a satisfactory surface finish. The Designer shall provide for the floor of the pump station or, in the case of underground booster pump stations, the roof of the pit to be a minimum of 300mm above the 1 in 100 year flood level or to such other level as	***2.6 Pumping Stations*** ***Land Requirement*** ***Pump Station Building*** ***Preformed Components*** ***Flooding***

provided by Council's planning instruments . All electrical equipment shall also be located one metre above the 1 in 100 flood level or higher if required by Council or Ergon Energy.	
The Designer shall provide for alarms and signals systems in consultation with Council and compatible with Council's existing control system.	***Alarms & signals***
The design shall provide for dismantling joints in the pipework to facilitate removal of the pumps and valves for maintenance.	***Dismantling joints***
The Designer shall ensure that the design of belowground water structures are capable of resisting floatation both during the construction/installation stage and whilst operating under flood conditions. The minimum factor of safety against uplift shall be 1.5 excluding any frictional resistance between the soil and the structure.	***Flotation***
The Designer shall undertake surge analysis as part of the pumping station design and shall provide surge control equipment as required by the analysis to maintain maximum transient operating pressures (positive and negative) within an allowable range, compatible with the design of the associated rising main.	***Surge Analysis and Control***
The Designer shall consult with Council with respect to the provision of suitable arrangement for access into underground structures and statutory requirements for the entry of personnel into confined spaces.	***Confined Spaces***
Sizing of Pump Station The pumping station, power supply and control cubicle shall be designed for ultimate projected requirements as advised by Council.	***Sizing***
Hydraulic Design The pumps shall be designed to deliver the required transfer capacity over a period of 20 hours per day, assuming the level in the receiving reservoir is midway between the top and bottom operating water levels.	***Hydraulic Design***
The hydraulic design of the pumping machinery and the pressure main shall be considered together. System curves shall be developed to calculate the pump duty point for the capacity requirement. System characteristics shall be based on analysis using the Darcy Weisbach formula for friction loss. The friction factor (f) within this formula shall be based on an absolute pipe roughness value (k) of 0.3mm. Form losses due to pipe fittings, valving and other pipeline equipment shall also be taken into account in determining the system characteristic curves.	
Pump data and selection criteria shall be documented in **Appendix B Pump Asset Registration Data.**	
PUMPING SYSTEMS	
Pumping equipment For standardization of equipment, Council's preferred suppliers of pumping equipment are ; (a) Grundfos (b) KSB Ajax	***Pumping Equipment***
(This is to minimize Council's maintenance costs in regard to provision and storage of spare parts).	

Notwithstanding, pumping equipment shall be:
(a) Subject to Council approval.
(b) Readily available in the market place servicing the Council.
(c) Interchangeable with other Council approved makes/models.

Final selection of the pump model and size shall be subject to Council approval.

Pump Selection
The Designer shall select a pump to be consistent with the minimum whole-of-life (NPV) cost of the pumping station based on the calculated mean system curve. Each pump and its drive unit shall be suitable throughout the specified range of station requirements such as flow rates, heads and duty points.

Pump Selection

Pumps shall be End Suction Centrifugal or Split Casing Axial type. All end suction pumps shall be arranged for back pull out. If either of these pump types is not suitable for the application, other pumps may be considered with Council Approval.

NPV

Pump Types

Pumps shall be designed to meet the following requirements:

(a) To give prolonged running at the required output under site conditions.
(b) To have a stable 'head-quantity' characteristic and show sufficient rise from the duty point to closed valve to avoid large changes of output with small changes of head.
(c) To be suitable for use with a modified impeller that will give the required output against 110% of the specified head.

The selected pump H-Q performance curve shall extend to intersect all system curves. The pump motor shall be rated for the maximum power required at the H-Q system curve intersection point.

Selection of the pumps shall be based on:

(a) system head for ultimate flow requirements;
(b) capable of operating near optimal efficiency within the range of operating conditions;
(c) continuous operation;
(d) having non-overloading characteristics beyond the duty point close to zero head;
(e) having starting characteristics acceptable to the electricity supply company and the Council;
(f) having a minimum of 4 pole unless approved otherwise by Council.

Pump Selection

Waterways through pumps shall be smooth in finish and free from recesses and obstructions.

Pumps up to and including 80mm branch diameter will be single shaft with flange mounted drive motors. Pumps over 80mm branch diameter shall be close coupled with spacer coupling to enable pump rotating element removal with minimum disturbance of the drive motor. The pump casing shall be supported independent of the pipework.

The direction of pump rotation shall be clearly and permanently marked on the pump casing.

STANDBY:
Standby pumping capacity shall be provided such that if one pump is out of

service, the pump station will remain able to supply the required transfer capacity.

ELECTRICAL STANDBY:
Unless otherwise approved by Council the Designer shall provide for a permanent on-site generator for each site and shall provide for connection of same.. Also refer to Section D11.13 Electrical Works of this Guideline.

Standby Capacity

OPERATING RANGE:
The pumping units selected by the Designer shall have steadily falling Head/Quantity curves from no-flow to maximum flow. The selected pump shall have an upper limit of the operating range (where stated) not exceeding 90% of the shut-off head for that pump/impeller combination. The duty point head should not exceed 85% of the shut-off head.

Electrical Standby

Where there is negative suction head at the pump inlet, provision shall be made to facilitate priming of each pump.

Operating Range

The net positive suction head available (NPSHA), shall exceed the net positive suction head required (NPSHR) by the pump for satisfactory operation over the full range of operation by a minimum of one metre.

The Designer shall select the best efficiency point for each pump to be as close as possible to the specified duty point.

IMPELLER :
Pump impellers shall be keyed to the shaft. Pumps shall be fitted with substantial renewable impeller and/or casing eye rings. Impellers, greater than 200 mm diameter, shall be provided with substantial eyes to permit the future fitting of wear rings.

With the exception of single vane impellers, the impeller shall be dynamically balanced in two planes to prevent the pumpset exceeding the maximum vibration levels specified. Balancing shall be achieved by machining, not by addition of weights.

Impeller

The impeller shall be fitted with a replaceable inlet wear ring.

CASING :
The casing (and bearings) shall be capable of withstanding the closed valve system pressure. The pump casing shall be provided with lifting lugs or eyebolts for lifting purposes.

SHAFT:
Pump shafts shall be fitted with sleeves, where they pass through stuffing boxes. The rotating element shall be statically and dynamically balanced before final assembly. The shaft seals shall effectively prevent the ingress of the pumped liquid to the bearings or the motor.

Casing

GLANDS:
Glands shall be fitted with conventional water lubricated soft packing. The water shall be taken from the pump discharge.

Shaft

BEARINGS:
The shaft shall be fitted with grease lubricated ball and roller bearings, no thrust shall be transmitted to the drive unit on close coupled pumpsets.

Glands

BOLTS AND NUTS:
All nuts and bolts shall be manufactured in accordance with AS/NZS 1111

and AS/NZS 1112 IS0 metric series and fitted with washers beneath bolts heads and nuts.

Bearings

(a) All bolts shall be stainless steel Grade 316 and all nuts and washers shall be stainless steel Grade 304.
(b) All threads are to be rolled.
(c) All bolt heads and nuts shall be hexagonal.
(d) All bolts, studs, set screws and nuts for bolting flanges and other pressure containing purposes shall conform to AS 2528.
(e) All nuts and bolts subjected to vibration shall be fitted with lock washers or lock nuts.
(f) All concrete anchor bolts, nuts, locking nuts and large series washers required for the bolting down of pump set discharge bends shall be provided. These anchor bolts shall be as recommended by the equipment Designer with a minimum diameter of 16mm.
(g) Concrete anchor bolts shall be chemical masonry anchor type, set to their full depth, suitable for the required duty.

Bolts and Nuts

Bolts shall not protrude less than 0mm nor more than 10mm past the face of the nut when tightened.

PROTECTIVE COATINGS:

The pumps, motors and guards shall be supplied with painted finish to the pump manufacturers' standard specifications. The base plate, where applicable, is to be hot dipped galvanised.

Protective Coatings

INSTALLATION:

Pumps shall be fitted with air release cocks at the highest point of the casing and with a drain cock at the lowest point. Copper or suitable plastic drain pipes shall be provided from the air release cock and the glands to a common tundish. Horizontal close coupled pumps and their drive motors shall be mounted on a common cast iron or fabricated steel baseplate.

Installation

PRESSURE GAUGES AND TRANSDUCERS

The Designer shall provide one direct mounted bottom connected pressure gauge, minimum gauge face 100mm diameter, complying with AS 1349, per pump installation.

Pressure Gauges and Transducers

Gauges and fittings shall be screwed into the pipe wall of steel and ductile iron pipes of DN150mm and larger. In steel and ductile iron pipework less than DN150mm, gauges and fittings shall be screwed into a tapping band. In pipes other than steel or ductile iron, tapping bands shall be used.

The Designer shall provide a pipe tee on the main to install the pressure gauge. An isolating ball valve shall also be provided to allow release of pressure prior to removal of the gauge.
The pressure gauge range for single or parallel pumps duty shall be 0 to 1.7 times the closed valve head of the pumps.

A minimum of two (2) pressure transducers shall be provided at each pump station. One (1) pressure transducer shall be provided on the suction side of the pump station and one (1) pressure transducer shall be provided on the discharge side of the pump station. The signals from both pressure transducers shall be connected to the site telemetry system.

For pressure gauges and transducer details refer to Council Standard Specification for Electrical Assets.

ELECTROMAGNETIC FLOWMETER AND FLOW SWITCHES: An electromagnetic flowmeter must be provided at each pumping station. The flowmeter shall be housed within the pumping station or in a separate dedicated concrete structure. The flowmeter converter shall be housed in the pump station electrical switchboard and shall provide an input into the site telemetry system. For the flowmeter details refer to Council Standard Specification for Electrical Assets. Each pump shall be provided with IFM Effector flow switch for the flow detection. For details refer to Council Standard Specification for Electrical Assets. **ELECTRICAL DESIGN:** Electrical equipment design and telemetry shall comply with the requirements of Council Standard Specification for Electrical Assets. **UPGRADES TO EXISTING PUMPING STATIONS** The provisions of this Guideline for new pumping stations as detailed above shall also be applicable to the upgrade of any existing pumping stations that may be required to be undertaken as a result of the development works.	***Flow meters*** ***Electrical Design*** ***Upgrades to Existing Pumping Stations***
Service reservoirs are not within the scope of this Guideline.	***2.7 Service Reservoirs***
Trunk mains directly supplying reticulation system shall be designed as part of the reticulation system to carry peak instantaneous demands. Trunk mains feeding service reservoirs shall be designed to carry mean day maximum month demands over 24 hours in the case of gravity mains and 20 hours in the case of rising mains. Generally (or unless not possible), a development shall be serviced from two or more mains as a looped main system to avoid the loss of supply in the event of maintenance or breakage. The minimum diameter of all pipes shall be DN100mm unless otherwise approved by Council. In commercial, industrial or high-rise building areas as zoned in Council's Planning Scheme, the minimum pipe size shall be DN150mm. Duplicate mains are required for all industrial / commercial uses. In all cases, sizes and residual pressures shall be designed to cater for fire fighting flows.	***3.2 Sizing of Trunk Mains*** **Trunk Mains** **MDMM Demand** **Minimum Diameters**
Allowance for fire flows shall be in accordance with the DNR&M Guidelines for Planning and Design of Urban Water Supply Schemes Chapter 21A – Fire Fighting, as released in Technical Bulletin TB No.3/1997 September 1997. Council does not allow the direct connection of pump systems to water mains for the purpose of fire fighting. Maximum hour flow shall be used as the base demand for fire flows.	***3.2.4 Fire Flows***
The Designer shall provide for surge control by specifying appropriate pipe material and class / wall thickness selections. The pipe wall thickness shall accommodate the maximum anticipated surge pressure against pipe burst	***3.5 Surge and Fatigue***

(allowing for cyclic fatigue derating for plastic pipes) and a minimum possible surge pressure of -100kPa (buckling collapse under full vacuum) Other means of surge control are only acceptable with prior approval of Council.	
The Designer shall ensure that the minimum pipes and fittings pressure class shall be Class 16 (PN16). Under no circumstances shall the maximum operating pressure (including surge) exceed the safe working pressure / pressure class rating of the pipe material used (accounting for derating of the safe working pressure for cyclic fatigue where plastic pipes are used). All pipes shall be capable of resisting a minimum operating pressure of -100 kPa (vacuum). The factor of safety against buckling failure under vacuum shall be 2.5 in accordance with the provisions of AS2566.1.	***3.7.2 Minimum Pressure Class*** ***Vacuum***
Council's minimum requirements for pipe materials are as follows: (a) mPVC, uPVC or oPVC: rubber ring jointed, minimum Class 16 Series 2, blue in colour, fittings for all pvc pipes shall be DI. (b) PE: electrofusion or butt fusion or compression fittings, minimum PN16 pressure class. (c) DI: rubber ring jointed or flanged, polyethylene sleeved, cement or epoxy lined, minimum Class 21. (d) Steel: rubber ring jointed, flanged or welded, FBPE or epoxy coated, cement or epoxy lined, minimum steel barrel wall thickness of 6mm or diameter/120 whichever is the greater. (e) GRP : rubber ring jointed couplings, minimum SN10000 stiffness, PN16 pressure class. (f) ABS : pipes and fittings to AS3518, solvent welded to AS3691, minimum PN16 pressure class. (g) Cu : copper pipes shall be to AS1432 in the range of DN6 to DN200 Type A. Compliance with AS3500. All products and materials used for the creation of infrastructure shall comply with the relevant sections of WS-SPEC as applicable for the respective pipe materials.	***3.8 Pipeline Materials***
The location and alignment of water mains shall be generally in accordance with Council Standard Drawing All mains and reticulation pipes shall be located on alignments shown on Drawing The mains and reticulation pipes shall be located on the side of the road as prior approved by Council. Trunk mains and reticulation pipes shall be laid in compliance with the Council's standard footpath allocation. Pipes are to be colour coded or otherwise identifiable as water supply pipes for maintenance purposes.	***4.3.1 Location of Water Mains*** ***Footpath allocation*** ***Colour coding of pipes***
Water mains that are to be constructed in roads shall be in accordance with Mackay City Council Standard Drawings and C401**.**	***4.3.2 Water Mains in Road Reserves***
All watermains that are not sited within a road reserve or on Council owned land shall be located within a dedicated easement of minimum 5m width.	***4.3.3 Water Mains in Easements***

Easements shall be located centrally over the pipeline, or in the case where a pipeline is laid on standard alignment near a property boundary, the boundary of the lot and one boundary of the easement may be coincident. Where it is necessary for water mains to be located on private property outside of the proposed development, the Local Government Act 1983 requires the Designer to obtain written approval from the affected property owner or tenants to enter and/or undertake any construction work on such private property. The Designer shall provide satisfactory evidence of the land owners approval with the design. The Designer shall obtain easements over any works to be constructed within private property at no cost to Council prior to commencement of works. A Registered Surveyor shall survey easement reserves for pumping stations and pipelines.	***Width of Easements*** ***Consent of Owner*** ***Survey***
Shared trenching for utility services is not permitted without prior written approval from Council.	***4.4 Shared Trenching***
Minimum DN150 duplicate mains are required for all industrial and commercial areas.	***4.5 Duplicate Mains***
The Designer shall ensure that dead end reticulation shall only be permitted to provide for future extension from staged development, in which case the end shall be fitted with a stop valve, hydrant bend and hydrant. Otherwise, reticulation pipework shall be looped to eliminate dead ends.	***4.8 Termination Points***
For residential properties a maximum of two can be serviced by an individual service, of minimum 32mm, from the service reticulation pipe and extending 300mm inside the lot boundary. For industrial and commercial properties, the minimum service size is 100mm.	***4.9 Property Services***
The Designer, shall all ensure all reasonable care is taken during the design and construction of the works to ensure that existing utility services are protected against damage or interference whatsoever. If existing utility services are damaged by the Developer and/or its contractors during the course of the works, through any cause whatsoever, the Developer and/or its contractors shall be fully responsible for all costs associated with rectification of the utility services, to the satisfaction of the Council or the utility service owner as appropriate, regardless of the accuracy of any prior location advice given by Council, the utility service owner or its agent. Where it is necessary to relocate or alter existing utility services, the Designer shall make all necessary arrangements with the appropriate authorities concerned at no cost to council.	***4.10.5.1 Utility Services*** ***Damage*** ***Relocations and / or Alterations***

The Designer shall ensure that all known utility services are detailed on the engineering drawings by Dial Before You Dig (DBYD) investigations and accurately located by non-destructive field location, and it is the Contractor's responsibility to have such services confirmed in the field prior to any excavation or underbore commencing in their vicinity of the works.	***Field Locating of services***
This clause within WSA-03 is superseded by the provisions of Council Policy MW16 - Clearance to Water and Sewerage Assets	***4.10.5.2 Clearance Requirements***
Notwithstanding compliance with all other design requirements and specifications, deviate above structures wherever possible Where the minimum clearances over structures cannot be achieved, the main shall be 100mm flanged DICL.	***4.10.7 Deviations of Mains around Structures***
Ductile iron pipework shall be provided with protective polyethylene sleeving installed in accordance with the pipeline manufacturer's instructions or epoxy coating. Steel pipe work shall be protected by fusion bonded polyethylene (FBPE, known commercially as Sintakote) or epoxy coating. At welded joints, the pipeline shall be protected from corrosion by the application of either polyethylene heat shrink sleeves or by a suitable tape wrap system in accordance with the manufacturer's installation requirements. The Designer shall assess the need for cathodic protection (sacrificial anode or impressed current) for metallic piping systems based on the aggressivity of the soil and groundwater characteristics along the alignment of a proposed pipeline and with particular reference to construction through old landfill sites, low lying anaerobic wetlands and coastal/tidal areas. The assessment of the aggressivity of the soil will be part of the geotechnical investigations for the work and the Designer will assess the geotechnical advice to determine whether cathodic protection is required.	***4.12.2 Corrosion protection against aggressive environments*** ***DI & Steel pipes*** ***Cathodic protection***
The minimum depth of cover to be provided for water supply pipework measured vertically from the finished ground level to the top of any socket shall be in accordance with Council Drawings. Lesser cover may be permitted only withCouncil approval and special protection of the pipelines is provided for in the approved design as. Greater cover may be provided where special situations occur, such as where there is conflict with other services or to meet grading requirements, provided that the provisions of AS2566 Buried Flexible Pipe Part 1 Structural Design are met.	***5.4.2 Pipe Cover*** ***Minimum Cover*** ***Deep excavation***
The minimum clear width of trench (inside internal faces of timbering or sheet piling, if used) to a height of 150mm above the top of the pipe shall be as shown below. **NOMINAL** | **MINIMUM CLEAR WIDTH OF TRENCH**	***5.4.2 Trench Width***

SIZE OF PIPE (DN) (mm)	(mm) (inside timbering or sheet piling, if any)	
100	450	
150	450	
200	600	
225	600	
250	600	
300	900	
375	900	
400	900	
450	950	
500	1200	
525	1200	
600	1200	

The Designer shall undertake geotechnical investigations to determine any considerations which will impact upon the design and / or construction of the works. In particular, the geotechnical investigations will include, where appropriate, any necessary consideration of soil conditions relating to: (a) The presence, impact and management of Acid Sulphate Soils; (b) The presence, impact and management of soil or other material at any contaminated sites; (c) The presence and impact of reactive soils; (d) The impact of soil and groundwater aggressivity on the durability of underground concrete structures and pipework; (e) The impact of saline / marine environments or tidal flats on the design of structures and pipelines; (f) Chemical analysis to determine the need for protective coatings of concrete structures or cathodic protection of pipelines. All geotechnical investigations shall be undertaken by a suitably qualified geotechnical engineer (RPEQ, Geotechnical) and shall be documented in a geotechnical report submitted to Council by the Designer a copy provided to the Contractor.	***5.5 Geotechnical Considerations***
The Designer shall accommodate the movement in pipe jointing systems associated with the ground strain in proclaimed Mine Subsidence Areas, as advised by the Mine Subsidence Board, 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. Where the Mines Subsidence Board does not cover an area of known, or suspected, subsidence or slippage, the above requirements shall still apply, unless stipulated otherwise by Council.	***5.5.4 Mine Subsidence***
Piers shall be designed to WSA-03 Drawings WAT-1310 and WAT-1311.	***5.7 Above ground***

	water mains
Trenchless installations, including an enveloper, shall be provided at existing roads unless otherwise approved by Council. Where such construction is required, the Designer shall document the design of each trenchless construction installation on the project drawings compliant with requirements of WSA-03.	***5.8 Trenchless Installation***
The Designer shall design thrust blocks to resist the force resulting from the maximum pressure commensurate with the pressure class of the pipe, not the estimated maximum pressure due to surge.	***5.9.2 Thrust blocks***
The Designer shall take into account the location and type of valve required considering maintenance and repair requirements. Valves equal to or greater than DN375 shall be housed in valve chambers and shall be provided with bypasses. Metal access covers to valve chambers shall be manufactured in accordance with AS 3996. The Designer shall ensure that air valve covers have adequate openings for air exchange. The Designer shall show on the Drawings the type of cover and how the covers shall be seated. The Designer shall provide for ease of maintenance within valve chambers. Valve types shall be selected such that servicing of the valve can be effected without removal from service, wherever possible. A minimum clearance of 600mm shall be provided from the edge of valving or pipework to the wall of a valve chamber. Pipework adjacent to valves shall be fitted with dismantling joints to facilitate valve removal when required.	***6.1 Valves General*** ***Direct buried or chambers*** ***Covers*** ***Ease of maintenance***
Valves shall be provided complete with bypass pipework, actuators, positioners, pilot valves, solenoid valves, internal piping, strainers and the like, so that they are complete and operable units. The number of different types and makes of valves used shall be kept to a minimum. All valves of the same size, duty and type supplied shall be identical. The Designer shall select such valve materials as are best suited for the service conditions and resistant to corrosion. All ferrous alloy (cast iron, spheroidal graphite cast iron, plain carbon and alloy steel) valves shall have protective epoxy coatings complying with WS-SPEC Section SP-30 Protective Coatings for Valves. All valves shall have a minimum pressure class rating of PN16. Flanges to valves shall be to AS4087, drilled off centre. Fasteners for valves shall be SS316 for bolts and SS304 for nuts and washers. All valves shall be anti-clockwise closing.	***6.1.3 Valve Selection*** ***Standardisation*** ***Corrosion Protection*** ***Pressure Rating*** ***Fasteners*** ***Closing Direction***

Sluice valves shall be resilient seated compliant with WS-SPEC Section SP-21.	***6.2.1.2 Sluice/Gate Valves***
Knife Gate valves shall comply with WS-SPEC Section SP-23.	***6.2.1 2 Knife-Gate Valve***
Butterfly valves shall only be used with prior written approval of Council. If approved, butterfly valves shall comply with WS-SPEC Section SP-24.	***6.2.1.3 Butterfly Valves***
Valves shall be connected on the branch line directly to the straight water main tee using a flanged connection. Valves shall be located to avoid conflict with driveways, telephone house service pits, underground electrical boxes and any other street side furniture. Stop valves shall be located so that a maximum of 40 properties can be isolated for shutdowns on DN100 and DN150mm reticulation pipes and 50 properties can be isolated for shutdowns on DN200mm reticulation pipes and larger. Hydrants shall be located on all reticulation mains at all high and low points of the main and at intervals between hydrants not exceeding 80 metres. (Guidelines for Planning and Design of Urban Water Supply Schemes Chapter 21A -Fire Fighting Clause 9.02). Location of valves and hydrants shall be marked with a Council approved marking post or alternatively a stainless steel kerb marker. The location of pipes crossing roads shall be indicated by a stainless steel kerb marker as detailed in standard drawing.	***6.2.5.2 Location of valves and hydrants***
Pressure reducing valves shall comply with AS/NZS 4020 at a scaling factor of 0.1. Valves shall be lined and coated with a fusion bonded polymer in accordance with AS/NZS 4158. Pressure reducing valves shall be of the type as shown on Council Drawing. Pressure reducing valves shall be installed with isolating valves upstream.	***6.3.2 Pressure Reducing Valve***
Air valves shall comply with WS-SPEC Section SP-27. All air valves shall be Ventomat brand or Council approved equivalent.	***6.4 Air Valves***
Reflux valves shall comply with WS-SPEC Section SP-25. Reflux valves shall be Flexichek Resilient Sealed Non-Return Valves without level arm and without counterweight. Council's nominated brand of reflux valves is Crevet.. For vendor supply pumping packages, the vendor nominated reflux valves system shall be acceptable.	***6.5 Reflux Valves***

The Designer shall allow for adequate working area, waste removal and transport arrangements where scouring points or pipe inspection locations are nominated. Scour valve assemblies shall be as shown on the Drawings. Scour valves shall comply with the requirements for sluice valves as above.	***6.6 Scours & Pump Outs***
Swabbing points shall be provided where specified by Council.	***6.7 Swabbing Point***s
Hydrants shall be DN100 flanged spring type (SWASH) hydrants without isolating valves. Pillar type hydrants shall be installed where directed by Council. Hydrants shall be epoxy coated. Spring hydrant valves shall be compliant with SP28 of WS-SPEC.	***6.8.3 Hydrant type***
The top of spring hydrants shall be between 100mm and 200mm below finished surface level as detailed in WSA 03 Part 4, WAT-1302. If necessary, this shall be achieved by the use of hydrant risers of various heights.	***6.8.4 Hydrant Installation***
Maximum spacing between hydrants shall be 80m.	***6.8.7 Hydrant Spacing***
Hydrants shall be located at the boundaries between adjacent properties and at the end of all mains. Hydrants shall be located such that existing or future development lots are, or will be, within 40m of the nearest hydrant. Bi-directional blue fire hydrant raised reflective pavement markers (otherwise known as blue "cats eyes") complying with the Guidelines provided by the Queensland Department of Main Roads shall be provided to indicate the location of fire hydrants.	***6.8.8 Hydrant Location***
PIPELINES AND PUMPING STATIONS In addition to the requirements of WSA-03, the Design Drawings shall show to scale: (a) Plan showing: (i) Lot boundaries and lot numbers (ii) Location and size of all mains, appurtenances and pump stations (iii) Existing mains (iv) Existing and proposed features and services (v) North point and scale bar (vi) Easement locations (vii) Arrangement of or for other utilities. (b) Longitudinal section, for all pipelines of DN150 or larger, showing: (i) Reduced levels for natural surface and design surfaces at all changes of grade (ii) Mains, appurtenances and pump stations.	***7 Design Review and Drawings***

(iii) Appurtenances numbered in accordance with Council's Asset Register (iv) Invert levels where necessary (v) Size, type, class and grade of pipe (vi) Location, invert level and size of all drainage lines, water mains, and other utility services crossing the main (vii) Notation regarding all joining lines (viii) Property ownership (ix) Note "In road" trench conditions (c) General arrangement of pump stations with site plan; concrete and/or building outlines; number, make, model and details of pumps; inlet and outlet pipework details and levels; pump control levels and/or pressures; switchboard location; pump station access details. (d) Details of corrosion protection required for pipes and fittings. (e) Areas designated for trench less 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 Council. One (1) copy of A1 size and three (3) copies of A3 size drawings shall be provided. Drawings shall also be provided in electronic form compatible with Council's systems. All drawings and documentation to be submitted to Council for approval shall conform to the requirements of Council's *Drawings and Documentation Guidelines*. A copy of these Guidelines will be made available upon request. Failure to comply with Council's *Drawings and Documentation Guidelines* may result in the drawings and/or documentation being returned to the Designer without comment. **ELECTRICAL AND CONTROL DOCUMENTATION** The Designer shall submit, to the Council for approval, prior to commencement of the manufacture of any switchboards and control equipment, three copies of all drawings as required in Council Standard Specification for Electrical Assets	
ASSET REGISTER When provided the Designer shall provide asset schedules and Drawings in a form consistent with Council's Asset Data Register. "As constructed" information shall be incorporated onto the design drawings at the completion of the constructed works. Submission of the "As constructed" information is a pre-requisite of works completion as per the	***7.3 Recording of works as constructed Information***

Asset Creation process outlined in the Clause D11.03 to this Guideline.	
All products and materials used for the creation of infrastructure shall comply with the relevant sections of WS-SPEC as applicable for the respective pipe materials.	***8 Products and Materials Overview***
STEEL PIPES AND FITTINGS Steel pipes and fittings shall be compliant with WS-SPEC Section SP1. Steel pipes shall be provided with cathodic protection if required in accordance with geotechnical recommendations. 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. The Designer shall avoid the positioning of continuously welded steel pipelines in parallel with high voltage power lines.	***Steel Pipes and Fittings***
DUCTILE IRON PIPE AND FITTINGS Ductile iron pipes and fittings shall be compliant with WS-SPEC Section SP2.	***Ductile Iron Pipes and Fittings***
PVC PIPES AND FITTINGS PVC Pipes and Fittings shall be compliant with WS-SPEC Section SP4 and the following specific details: The Designer shall ensure that PVC pressure pipe specified is compatible with ductile iron pipe where necessary. Pipes and fittings are to be handled and stored protected from sunlight. The contractor shall provide protection for the pipes and fittings from ultraviolet light and damage. The contractor shall take account of the time for storage and type of shelter. All exposed uPVC pipework shall be painted to protect it from UV light using a water based acrylic paint. Selection of pipe class shall take into account cyclic loading and fatigue.	***PVC Pipes and Fittings***
GRP PIPES AND FITTINGS GRP pipes and fittings shall only be used with prior written approval of Council. If approved, GRP pipes and fittings shall be compliant with Section SP5. Pipes and fittings shall be handled and stored protected from sunlight. The Contractor shall provide protection for the pipes and fittings from ultra violet light and damage. The Contractor shall take account of the time for storage and type of cover. All exposed GRP pipework shall be painted to protect it from UV light using water based acrylic paint.	***GRP Pipes and Fittings***
POLYETHYLENE PIPES AND FITTINGS PE Pipes and Fittings shall be compliant with Section SP6.	***PE Pipes and Fittings***

PE pipes shall be manufactured in either PE80B or PE100 polymer material.

Selection of pipe class shall take into account cyclic loading and fatigue.

ABS Pipes and Fittings

ABS PIPE AND FITTINGS

ABS pipes and fittings shall be specified to be manufactured in accordance with AS 3518.1 and AS 3518.2 and joined in accordance with the manufacturer's instructions using solvent cement to AS 3691. Selection of pipe class shall take into account cyclic loading and fatigue

Copper Pipe and Fittings

COPPER PIPE AND FITTINGS

Copper tube shall be specified to be manufactured 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.

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.

CONCRETE WORKS

Concrete Works

All concrete work shall be compliant with WS SPEC Sections SP43, 44 & 45 and TR10. Classes of concrete used for the construction of the works shall be as follows:

Application	**Grade (F'c at 28 days)**	**Min cement content (kg/m3)**	**Max w/c ratio**
Blinding concrete, mass concrete	N15	-	-
Surface footpaths and driveways	N25	-	-
Unreinforced thrust blocks, anchor blocks, bulkheads, and conc. encasement in all environments	N25	-	-
Reinforced thrust blocks, anchor blocks, bulkheads, and conc. encasement in all environments	N32	-	-
Valve chambers and flowmeter pits in non–aggressive environments	N32	-	-
Valve chambers and flowmeter pits in aggressive soil and groundwater environments	S40	380	0.50
Underground booster pump stations, building foundations, in non-aggressive environments.	N32	-	-
Underground booster pump stations, building foundations, in aggressive soil and groundwater environments.	S40	380	0.50

Aggressive environments are defined as exposure to :

1. seawater, anaerobic waters, swampwater, tidal flats and the like, including exposure to intermittent saturation.
2. relatively high levels of chlorides and /or sulphates, relatively high

or low pH levels, as defined within Appendix B of SW-SPEC Section SP-43, exposure classification 3 (moderate) and above. Cementitious materials for concrete shall comply with Appendix B of WS-SPEC SP-43. Cover to reinforcement shall comply with the relevant Exposure Classifications within AS3600 but shall not be less than B1, or C for aggressive conditions. Concrete surfaces exposed to aggressive environments shall be provided with a protective coating compliant with WS-SPEC Section TR-20. The protective coating applied shall be in addition to the concrete cover requirements.	
All amendments to WSA-03 Drawings are detailed on Council's standard drawings.	***Amendments to WSA-03 Std Drawings***

10 ELECTRICALLY OPERATED ACTUATORS

The Designer shall be responsible for the design, manufacture, supply, and performance of the actuators.	***Electrically Operated Actuators Design***
Electric motor actuators shall be 3 phase with a rated voltage 415, 50 Hz and shall be suitable for operation over a phase voltage range of 400 to 440 V. Phase rotation protection shall be provided integral with 3 phase actuators.	***Power***
The actuators shall be suitable for indoor and outdoor installation. The actuator enclosures, including all auxiliary enclosures, shall be a minimum of IP56 to AS 60529	***IP Rating***
Actuator motors for penstocks and valves shall be specifically designed for penstock or valve actuator service and winding insulation shall be Class F. It shall be the Contractor's responsibility to determine the rated output (kW) of the motor, in conjunction with the gear reduction unit used, to suit the operational requirements of the respective penstock or valve.	***Motor Sizing***
The rated speed and the direction of rotation of the motor, in conjunction with the gear reduction unit used, shall suit the operational requirements of the penstock or valve. The time to operate the penstock from fully closed to fully open and visa versa shall range between 2 to 3 minutes. The time to operate a valve from fully closed to fully open and visa versa shall range between 4 to 6 minutes.	***Operating Times***
Where possible, actuators shall be selected to be interchangeable with existing actuators at the plant.	***Interchange-ability***
The Designer shall have the valve and penstock suppliers prepare calculations of the maximum opening and closing torques for each penstock and valve. These calculations shall be submitted to the Council as verified design for acceptance. Actuators shall be sized for non-overload operation at these loadings.	***Design Calculations***

Electric actuators shall be mounted directly on the valve or penstock capstan so that all forces are confined to the valve or penstock. All electric actuators shall be suitable for remote operation from the PLC. All electrical connections, controls, and the like shall be accessible from platforms or walkways.	***Mounting***
The actuators shall be fitted with integral adjustable position and torque switches which shall be arranged to stop the actuator at the extremes of travel.	***Switches***
All actuators shall be provided with a manual override which shall be a handwheel. Hand wheels shall be located not more than 1000 mm or less than 700 mm above the operating floor level and shall not exceed 600 mm diameter. The hand wheels must be of a diameter which shall require a force of no more than 130 Newtons at the rim to operate the penstock or valve from fully open to fully closed under all operating conditions. Where this cannot be achieved due to the limit on the hand wheel diameter, a gear reduction unit shall be used. Minimum handwheel size shall be 500 mm and minimum clearance 150 mm for penstocks Hand wheels shall be rotated clockwise to close the valve, and shall be clearly marked with the words “OPEN " and " CLOSE " and arrows in the appropriate directions. The rims of the hand wheels shall be machined to a smooth finish. CONTACTORS: Each actuator shall have integral open and close contactors, local open/close/emergency stop control pushbuttons and Local/Remote control selector switch together with all ancillary equipment such as control transformers, relays etc. Contactors for modulating duty actuators shall be solid state type.	***Handwheel***
Each actuator shall be supplied with an integral reversing DOL starter and associated control equipment. It shall be possible to control electrically actuated valves and penstocks either locally manually or remotely.	***Remote & Local Operation***
Operation of the emergency stop push button shall stop the valve or penstock regardless of selector switch position.	***Emergency Stop***
The actuators shall be fitted with open, close and stop interposing relays which shall enable the actuators to be opened and closed by the control system when remote is selected.	***Interposing Relays***
The actuators shall be provided with voltage free contacts for remote connection of monitoring signals including the following: • Open and close status; • Actuator available (ie. voltage present and remote selected); • Actuator fault – e.g overtorque, motor overload/over temperature fault	***Signals***
Actuators shall have a local mechanical position indicator. Where specified the actuators shall have a position signal transmitter with an isolated 4 to 20 mA output suitable for connection to the PLC.	***Indicator***
Each actuator shall be fitted with a Grade 316 stainless steel nameplate,	***Nameplate***
Actuators shall be fitted with temperature sensing devices which shall be embedded in the motor phase windings and shall be arranged to prevent motor overload. Non-modulating actuators shall be rated for 60	***Sensors***

starts(reversals) per hour. Actuators shall be fitted with 240 V ac anti-condensation heaters.	***Anti-Condensation***

11 ELECTRICAL WORKS

Compliance

COMPLIANCE WITH AUTHORITIES, STATUES, REGULATIONS AND STANDARDS

All electrical works shall be carried out in accordance with the requirements of:

a) AS/NZS 3000 and other relevant Australian Standards;

b) Power Supply Authority Service Rules and Regulations;

c) Other relevant Statutory Authorities;

d) Council Standard Specification for Electrical Assets

SCOPE OF WORK

Scope

The scope of electrical work shall include but shall not be limited to the following:

a) Negotiations with Power Supply Authority unless another power supply Authority is nominated in the project specification. The name and the phone number of the Power Supply Authority contact shall be as indicated in the project specification. The Contractor must fill all relevant application forms and pay all relevant fees.

b) Supply and installation of consumer mains;

c) Supply and installation of electrical switchboard;

d) Supply and installation of all instrumentation and field mounted control equipment;

e) Supply, installation and termination of all cabling;

f) Supply and installation of all telemetry equipment including aerial and aerial mast;

g) Supply and installation of all junction boxes, conduits, cable trays, cable ladders and fittings;

h) Supply and installation of a standby diesel generator set for backup power to ensure continuity of service, or provision of connection facilities for same, as required by Council at the development approval stage;

i) Carry out factory testing of the switchboard;

j) Carry out site testing and commissioning;

k) Provide “As Constructed” design documentation and also Operation

and Maintenance Manuals; l) Provision of Defects Liability Period; m) Liaison with Council; n) Any other work as required in the project specification. **INCOMING POWER SUPPLY** The Contractor must carry out all works as required by Power Supply Authority to provide 3 phase 415V, 50 Hz power supply to site; The Contractor must upgrade or provide new metering facilities at each site as required by Power Supply Authority. The Contractor must ensure the minimum power factor of 0.9 at each site. The prospective fault level of each electrical installation shall be as nominated by Power Supply Authority but in any case the minimum fault level shall be as follows: • Not less than 15kA for 1 second for the Main Switchboards rated 100 Amp or less, and • Not not be less than 25kA for 1 second for the Main Switchboards rated over 100 Amp. If VSD drives are used the level of total harmonics distortion (THD) at the point of common coupling (PCC) must be as required by Power Supply Authority; The consumer mains with a cross section greater than 120 mm^2 shall consist of single core XLPE/PVC cables; The current carrying capacity of the consumer mains shall suit the maximum demand plus 30% spare capacity; The consumer mains shall be sized to ensure the voltage drop at the incoming terminals of the switchboard does not exceed 2.5% under maximum demand conditions plus 30% spare capacity; Power supply metering must be provided as required by Power Supply Authority. **STANDBY DIESEL GENERATOR** For the diesel generator details refer to Council Standard Specification for Electrical Assets. Where provisions only are required for the standby diesel generator these provisions must be in a form of external weather and vandal proof socket inlet or a junction box rated for the full load of the relevant switchboard and as required in the Project Specification. Sufficient space shall be allowed for the mobile diesel generator installation. **POWER SUPPLY CHANGE-OVER ARRANGEMENT** Where a permanent diesel generator is required to be provided on site, the	***Power Supply*** ***Standby Diesel Generator***

main switchboard shall be fitted with an automatic transfer switch (ATS) to facilitate an automatic transfer between the power grid and the generator supplies. For all other sites where only provisions for connection of mobile diesel generators are required the changeover switch shall be manual switch. For details of ATS refer to Council Standard Specification for Electrical Assets.	***Power Supply Changeover Arranagement***
EARTHING	
The Contractor must provide M.E.N. earthing system at each site. The earthing system must comply with requirements of AS/NZS3000 and Power Supply Authority Service Rules.	***Earthing***
Each earthing rod must be a minimum 16 mm stainless steel copper clad rod with a minimum length of 3 metres. Each earthing cable must be provided with a PVC sleeve. Bare earthing conductors must not be used. All earthing cable connections to earthing rods must be by means of approved earthing clamps	
The Contractor must provide an earth inspection pit at each rod. Each pit must be marked for easy identification.	
LIGHTNING AND SURGE PROTECTION	
The need for lightning protection shall be assessed for each site and shall comply with the requirements of AS1768.	***Lightning and Surge Protection***
Suitable surge protection must be provided at each site to protect equipment against lightning strikes, motor starting and stopping or sudden loss or application of power supply. Surge protection devices must be provided as follows: • Inside each Main SCA or Switchboard/Panel/Distribution Board across incoming power supply • Across power supply to all instrumentation loops mounted outside in the field • All signal lines run to and from outside. Instrument surge diverters must be provided on both ends of each loop. • On all data and cable communication lines.	
Minimum size surge protection earth cable must comprise stranded, 16 mm^2 or as recommended by the manufacturer, green/yellow PVC insulated cable installed such that it is segregated from all other cables.	
For details of surge protective devices refer to Council Standard Specification for Electrical Assets.	
STARTING OF PUMPS	
DOL starting of the pump motors shall be with Ergon Energy approval only. Otherwise, all motor starters must be either soft starter or VSD (Variable Speed Drive) as required by the process.	
The maximum number of starts per hour shall be 12 starts.	
Where electronic starters are used the disturbance to the electrical supply system shall not exceed limits set down in AS61000.3.6 and AS61000.3.7. Radio interference external to the electronic starters shall not exceed limits set down in AS/NZS CISPR 11:2004. A suitable R.F.I. filter shall be	***Starting of Pumps***

provided to ensure compliance with AS/NZS CISPR 11:2004. The level of total harmonic distortions at the point of common coupling (PCC) must be limited to planning levels as set by Power Supply Authority. Appropriate harmonic filters shall be provided on each VSD unit to comply with Power Supply Authority requirements. **NOMINATED SUBCONTRACTORS** Refer to Council Standard Specification for Electrical Assets for the details of nominated equipment suppliers and service providers**.**	***Nominated Subcontractors***