PART 7: WATER SUPPLY

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EQUATIONS

REFERENCED DOCUMENTS

Planning and Policy

- Timaru District Council Water Supply Activity Management Plan 2018-2028
- Ministry for the Environment *National Environmental Standard for Sources of Human Drinking Water*
- Water Services Act 2021
- Water Services Regulation (Drinking Water Standards for New Zealand) 2022

Design

- SNZ/PAS 4509:2008 *New Zealand Fire Service Fire Fighting Water Supplies Code of Practice* (*Fire Service Code of Practice)*
- AS/NZS ISO 9001:2016 *Quality Management Systems – Requirements*
- AS/NZS 4020:2005 *Testing of products for use in contact with drinking water*
- AS/NZS 2566.1:1998 *Buried flexible pipelines structural design, supplement 1*
- AS/NZS 2845.1:2010 *Water supply – Backflow prevention devices*
- UKWIR 10/WM/03/21 *Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites*

Where a conflict exists between any Standard and the specific requirements outlined in the Infrastructure Design Standard (IDS), the IDS takes preference (at the discretion of the Council).

7.1 INTRODUCTION

This Part includes:

- the assessment of required infrastructure;
- technical design requirements;
- material requirements.

The Timaru District Consolidated Bylaw 2018 defines the Council's requirements for protecting the water supply.

7.1.1 Description of the water supply system

The statements in this section have been adapted from the Timaru DC Water Asset Management Plan 2018-28

TDC delivers water supply services for residential, commercial, industrial and stockwater purposes. There are 12 water supplies being managed by TDC consisting of:

- Six (6) urban drinking schemes for Geraldine, Peel Forest, Pleasant Point, Temuka, Timaru and Winchester;
- Four (4) rural drinking and stockwater schemes for Downlands, Orari, Seadown and Te Moana; and
- Two (2) stockwater only schemes for Beautiful Valley and Rangitata-Orari

<u>**Urban Water Supply Schemes**</u>

The urban water supply schemes consist of the Geraldine, Peel Forest, Pleasant Point, Temuka, Timaru and Winchester water supplies. They are operated as individual water supplies but funded as a single scheme.

Geraldine Water Supply

The Geraldine Water Supply is predominantly an urban on-demand scheme. Water is supplied for domestic, commercial, industrial and stock drinking water purposes. The Geraldine Scheme also supplies water to parts of the Te Moana Water Supply.

Peel Forest Water Supply

Peel Forest Water Supply is a small scheme supplying drinking water in the residential area of the township. The scheme does not supply the picnic area, campground or all of the properties at Peel Forest.

The Peel Forest water supply is classified as an urban on-site storage scheme. The treatment process in the scheme was upgraded in 2016 to improve water quality and meet the criteria of Drinking Water Standards NZ.

Pleasant Point Water Supply

The Pleasant Point Water Supply is an urban scheme with on-demand and on-site storage supply. The supply is for domestic drinking water purposes only.

Upgrading of the scheme is being undertaken to increase security of supply. A new reservoir became operational November 2020. Pump station upgrades, remediation of the raw water reservoir, and network renewals are also planned. The scheme upgrade will result in a greater ability to allow on-demand connections within the scheme and the removal of on-site storage tanks as an option to property owners.

Temuka Water Supply
Temuka Water Supply Scheme is an urban on-demand scheme that supplies domestic drinking water only. The Scheme supplies treated water to three distinct networks, namely: the Temuka Water Supply, the Orari Water Supply, and the Winchester Water Supply.

Security of supply is a major issue being addressed in the implementation of the 30-year Temuka Water Supply Strategy. Part of the Strategy was the renewal of the Temuka trunk main in 2016 which addressed a leakage issue. Other works identified in the Strategy which are being considered include investigation of a new source and construction of a new storage.

Timaru Water Supply
Timaru Water Supply Scheme is an urban on-demand scheme that supplies domestic drinking water only. Customers in the Timaru water scheme are domestic and industrial users, with each accounting for approximately half of the total volume of water consumption.

The Timaru Scheme also supplies treated water to the Hadlow Subzone of the Downlands Water Scheme.

Security of supply is a major issue within the scheme. A long-term strategy is being developed to address water use efficiency issues and enable the scheme to sustainably meet current and future demand. Options investigated relate to water take provisions within resource consents, developing a new source, improving existing sources, and reducing demand.

Winchester Water Supply
The Winchester water supply is a small on-demand scheme supplying the Winchester township. Customers of the Winchester Scheme are predominantly domestic or related to a domestic and farming population.
The scheme's source and treatment plant were decommissioned in September 2016. Winchester is now supplied treated water from the Temuka Water Supply.

<u>Rural Water Supply Schemes</u>

Downlands Water Supply
The Downlands Water Supply Scheme is jointly owned by the District Councils of Timaru, Waimate and Mackenzie. The proportions within each territorial jurisdiction are Timaru District (82%), Waimate District (14%) and Mackenzie District (4%). There is a Downlands Joint Standing Committee, with representation from the three

Councils, who acts as the policy governing body for the scheme. The Committee has appointed TDC as Downlands Scheme Manager responsible for the management and operation of the scheme.

The Downlands Water Supply Scheme is primarily a stock water scheme which also supplies domestic drinking water to rural properties within the scheme boundaries. It is a restricted supply which requires on-site storage. Increasing supply to meet increased demand, security of supply and meeting drinking water standards are the priority focus for the Downlands Scheme in the next 10 years. Major programmed capital works include upgrading of the Te Ngawai trunk main and intake, upgrading of the treatment plant, and increasing storage capacity (raw and treated water).

Orari Water Supply
The Orari water supply is restricted for domestic and stock water use. The scheme does not produce its own water; it is entirely supplied from the Temuka Water Supply with water that is already treated. Customers of the Orari Scheme are predominantly domestic or lifestyle property owners. The scheme has minimal stock water demand.

Seadown Water Supply
The Seadown scheme supplies both stock and drinking water. Connections to troughs are on demand while domestic connections are generally restricted. Seadown has issues with supply to farm properties with connections directly to troughs instead of reticulated tanks. Water wastage from troughs is very high and could reduce the LOS during high demand. This gives issues with water conservation and quantity.

TDC is carrying out sustainable water management strategy to this scheme. Seadown Rural Water Supply Model Review and Analysis is being undertaken to identify feasible options to be assessed and approved by the Council. TDC will be assessing whether to keep the current set-up of the scheme or to convert to a restricted supply.

Te Moana Water Supply
The Te Moana supply is a restricted water supply based on units of supply of 1,000 L/day. Customers of the Te Moana Scheme are predominantly domestic or farming. The Te Moana scheme has reached its original capacity so additional water is being purchased from Geraldine to supplement the main intake.

The security of water supply in the scheme is being addressed through the programmed works which include the establishment of a new source, a new treatment plant, pump station upgrade and watermain upgrade.

<u>Stock Water Only Schemes</u>

Beautiful Valley Stockwater Scheme
The Beautiful Valley Stockwater Scheme is a piped stockwater supply. It also caters for garden and shed use but not for domestic use. Therefore there is no treatment provided.

The scheme is very small (41 rating units and 1800 hectares design area) and no additional water is available at the source. The scheme has no expansion capacity and there are no plans to cater for additional demand.

Rangitata-Orari Stockwater Races
The Rangitata-Orari (RO) water race is a stock water supply. The water flows from the Orari River and is fed into a network of open water races some 170 km long. Some significant modifications to the water race network have occurred as a result of the establishment of the Rangitata South Irrigation (RSI) Scheme in the area which is upgrading then utilizing parts of the races for conveying irrigation water. A large number of RO ratepayers are also shareholders in the RSI. There are also a number of RO ratepayers who are not irrigation shareholders and who wish to remain on the RO stockwater scheme, and a number of ratepayers who wish to permanently withdraw from the scheme. The final scope of the Scheme is still to be established through the on-going discussions between Council and RSI. This will determine the future demand in the scheme.

7.2 QUALITY ASSURANCE REQUIREMENTS AND RECORDS

Provide quality assurance records that comply with the requirements in Part 3: Quality Assurance, during design and throughout construction.

7.2.1 The designer
The designer of all water supply systems that are to be taken over by Timaru District Council must be suitably experienced. This experience must be to a level to permit membership in the relevant professional body. Refer to clause 2.7.1 – Investigation and design (General Requirements) for further information.

The design peer reviewer must have at least equivalent experience to the designer.

7.2.2 Design records
Provide the following information, to support the Design Report:

- hydraulic calculations, preferably presented in electronic form;
- all assumptions used as a basis for calculations, including pipe friction factors;
- calculations carried out for the surge analysis of pressure pipes, where appropriate;
- design checklists or process records;
- design flow rates;
- system review documentation as detailed in clause 7.5.5 – System review;

- thrust block design calculations, including soil bearing capacity;
- trenchless technology details.

7.2.3 Construction records

Provide the information detailed in Part 3: Quality Assurance and the Timaru DC '*Timaru District Council Construction Standard Specifications" TDC CSS* including:

- pressure test results;
- chlorination test results;
- bacteriological test results;
- material specification compliance test results;
- compaction test results;
- subgrade test results;
- confirmation of thrust block ground conditions and design;
- site photographs.

The developer must provide the Council with a certificate for each pipeline pressure tested, including the date, time and pressure of the test. Provide details of the pipes in a form complying with the requirements of Part 12: As-Builts, including manufacturer, diameter, type, class, date of manufacture, serial number, jointing and contractor who laid the pipe.

7.2.4 Acceptance criteria

All pipelines must be tested before acceptance by Council. Provide confirmation in accordance with the Contract Quality Plan that they have been tested, inspected and signed off by the engineer.

All pump stations must be commissioned before acceptance by Council. Provide the following pre-commissioning documentation before requesting Council witness commissioning:

- confirmation that Hazard and Operability (HAZOP) items are closed out
- completed Health and Safety audit of constructed works
- construction and safety audit defect record using Appendix XIX – Pump Station Outstanding Work/Defect List (Part 3 – Quality Assurance)
- draft Operations and Maintenance Manuals
- draft of Final Management Plan (if required)

7.3 WATER SUPPLY DESIGN

All pipe diameters are internal unless otherwise noted.

7.3.1 Design considerations

Consider the:

- hydraulic adequacy of the system;
- ability of the water system to maintain acceptable water quality, including consideration of materials and their disinfection demand, and prevention of back siphonage and stagnation;
- structural strength of water system components to resist applied loads, including ground bearing capacity;
- seismic design - all structures must be designed with adequate flexibility and special provisions to minimise risk of damage during earthquake. Provide flexible joints and isolation valves at all junctions between rigid structures (e.g. reservoirs, pump stations, bridges, buildings, manholes) and natural or made ground;
- pipeline's ability to withstand both internal and external forces, taking into account any transient temperature changes;
- Poisson's effect and end restraint designs to compensate where necessary;
- requirements of the Fire Service Code of Practice;
- impact of the works on the environment and community;
- "fit-for-purpose" service life of the system;
- best way to minimise the "whole-of-life" cost;
- resistance of each component to internal and external corrosion or degradation. Refer to clause 6.13.3 – Corrosion prevention (Wastewater Drainage) for further information;
- installation requirements expressed in *TDC CSS;*
- capacity and ability to service future extensions and development;
- location of major reticulation and its potential for significant traffic disruption. Discuss at an early stage with Council.
- networking, redundancy and security of supply.

Design all parts of the water supply system that are in contact with drinking water using components and materials that comply with AS/NZS 4020. Select the pipe material to ensure a minimal impact on water quality within the system.

7.3.2 Design life

All water supply distribution systems are expected to last for an asset life of at least 100 years with appropriate maintenance, and must be designed accordingly to minimise life cycle costs for the whole period.

7.3.3 Future system expansion

Design watermains with sufficient capacity to cater for all existing and predicted development within the area to be served. Make allowance for areas of subdivided or un-subdivided land capable of future development, as specified by the Council in the design parameters.

7.3.4 Contaminated sites

Avoid contaminated sites wherever possible. If a contaminated site cannot be avoided, provide details about the following issues with the Design Report:

- compliance with statutory requirements;
- options for decontaminating the area;
- selection of ductile iron or galvanised submains, wrapped in accordance with *TDC CSS*- Fittings, and jointing techniques that will maintain the water quality (in accordance with the approved materials set out in the *TDC CSS* and *Appendix A – Acceptable Pipe and Fitting Materials – NZS4404:2010*);
- safety of construction and maintenance personnel;
- any special pipeline maintenance considerations.

Consult with Council Drainage and Water staff if any further information is required.

7.3.5 Specific structural design

Design pipelines being installed at depths greater than detailed in *TDC CSS* to resist static and dynamic loads. The design must comply with AS/NZS 2566.1 including Supplement 1. Provide details of the final design requirements in the Design Report.

Any ground that has an allowable bearing capacity less than 50 kPa is unsatisfactory for watermain construction. In such environments, engage a geotechnical specialist to investigate the site and to design and supervise the construction of an appropriate support or foundation remediation system for the watermain. Refer to clause 4.6.3 – Peat (Geotechnical Requirements) for further information.

Wherever it is necessary to fill an area before laying a watermain across it, or to build an embankment in which to lay the watermain, seek advice from a geotechnical specialist, to ensure that the weight of the fill will not cause failure or leakage of the pipe joints, after the main is laid.

7.3.6 Reducing waste

When designing the development, consider ways in which waste can be reduced.

- Plan to reduce waste during demolition e.g. minimise earthworks, reuse excavated material elsewhere.
- Design to reduce waste during construction e.g. prescribe waste reduction as a condition of contract.
- Select materials and products that reduce installation waste.
- Use materials with a high recycled content e.g. recycled concrete subbase.

See the Resource Efficiency in the Building and Related Industries (REBRI) website for guidelines on incorporating waste reduction in your project www.rebri.org.nz/.

7.4 DESIGN PARAMETERS

In developments where adequate system pressure and coverage from hydrants already exists, the Council will advise the point of supply and the minimum pipe size for the supply pipe. The developer is responsible for the full cost of the supply pipe from the point of supply to the individual connection points.

When the developer is providing water reticulation for vesting in the Council, the Council will provide the following parameters, after receipt of the application plan:

- point of supply;
- mains size at the point of supply;
- supply type (e.g. on-demand or restricted);
- design number of connections, as provided by the developer;
- additional development to be allowed for in the design;
- static pressure;
- residual pressure at peak system demand in the network;
- residual fire pressure during fire demand at point of supply;
- fire water classification at point of supply;
- the minimum residual pressure at house site at peak system demand;
- networking requirements;
- other requirements (e.g. minimum mains size).

7.4.1 Flow and pressure for urban on-demand water supply areas

Develop residential zones to comply with the definitions in the *District Plan*. The minimum residual pressure at the point of supply shall be 200 kPa. Provide the design flow rates, for developments other than standard residential zones (e.g. multi-unit developments or older persons' housing), with the Design Report.

7.4.2 Design for restricted water supply areas

Restricted water supply areas apply to:

- Downlands,
- Te Moana,
- Seadown,
- Beautiful Valley,
- Orari Township

Design any rural restricted supply to meet requirements of the scheme for each property.

The minimum storage capacity per connection must be 3 days allocation or 10,000L whichever is greater. The supply must be installed as per Council's standard drawings. Any other sources of water on any property must not be connected to the Scheme reticulation.

Individual sites may provide their own water bores for domestic purposes. These bores must be established in accordance with the consent requirements of Environment Canterbury. The water must be tested to show that the water quality is potable in accordance with the *Drinking Water Standards*.

Rural restricted supplies are not designed for firefighting purposes.

7.4.3 Fire service requirements

Design the water supply reticulation to comply with the *Fire Service Code of Practice*. In particular, the reticulation must meet the requirements for firefighting flows, residual fire pressure and the spacing of hydrants.

7.4.4 Fire services

Many industrial and commercial sites require the installation of fire services. The site owner is responsible for providing these fire services, which must be designed to meet the requirements of the New Zealand Building Code.

All fire service connections to the Council reticulation will have a meter fitted to detect any unlawful water use and shall be backflow protected in accordance with their level of risk.

Do not assume that current pressure and flow will be available in the future when designing private fire services. Pressure and flow available is likely to reduce in the future, due to demand growth and pressure management.

7.5 RETICULATION DESIGN

7.5.1 Standard main sizes

Acceptable standard nominal bore (DN) main diameters are 100, 150, 200, 300, 375, 450 and 600mm. Acceptable standard nominal outside (OD) submain diameters are 50 and 63mm. Polyethylene pressure pipe only is specified by a nominal outside diameter (OD).

Rural reticulation may be designed to a nominal OD at a minimum of 20mm. Sizing rural reticulation will be dependent on network modelling to determine the required size to supply the required level of service.

7.5.2 Minimum pipe and fitting class

The minimum pipe class for reticulation mains is PN 12 in urban and PN 16 in rural. The minimum class for fittings is PN 15. Utilize the *TDC CSS* or *Appendix A – Acceptable Pipe and Fitting Materials – NZS4404:2010* before specifying the required pipe class. Some parts of Downlands Rural Scheme operate up to 2200 kPa.

7.5.3 Pipe hydraulic losses

Take differences in elevation across the subdivision or development into account.

Calculate pipe friction losses from the pipe supplier's technical information or from representations of the Darcy-Weisbach/Colebrook-White formula. Use friction factors from Table 1 that take into account the effects of pipe aging.

Table 1 Friction factors

Pipe material	K_s (mm)
PVC-U, PE	0.015
Ductile Iron	0.06

Note:
1) These friction factors are extracted from NZS 4404, Table 6.1.
2) Manufacturers' design charts may be based on smoother pipe assumptions than these (e.g. K_s = 0.003) but such charts usually assume 'as new' laboratory conditions and ignore effects such as fittings and pipe ageing.

7.5.4 Surge and fatigue re-rating of plastic pipes

Although plastic pipes may be permitted in zones affected by dynamic pressure variations (e.g. pump zones), in locations downstream of pressure reducing valves, and in high surge areas, it is essential that the pipe class be reclassified (rerated) for both surge and fatigue (cyclic dynamic pressure variations) in accordance with the criteria set out in *Polyethylene Pressure Pipes Design for Dynamic Stresses* or *PVC Pressure Pipes Design for Dynamic Stresses*.

7.5.5 System review

When the pipe selection and layout have been completed, perform a system review, to ensure that the design complies with both the parameters specified by the Council and detailed in the IDS. The documentation of this review must include a full hydraulic system analysis. Compliance records must cover at least the following requirements:

- minimum residual pressure can be maintained at all property connections;
- maximum operating pressure will not be exceeded anywhere in the system;
- pipe class is suitable for the pipeline application (including operating temperature, surge and fatigue);
- pipe and fittings materials are suitable for the particular application and environment;
- pipe and fittings materials are approved materials;
- minimal likelihood of water quality problems or water stagnation;
- valve spacing and positioning allows isolation of required areas;
- mains layout and alignment meets the Council's requirements;
- meets minimum firefighting demands;
- control valves, where required, are positioned to provide the required control of system;
- watermains are extended to boundaries;
- connections, to existing or future subdivisions, form a cohesive network and provide security of supply;
- capacity provided for future adjacent development.

7.6 RETICULATION LAYOUT

Lay watermains in public roadways unless there is no practicable alternative. Remove any existing reticulation between new lots.

7.6.1 Mains layout

Consider the following factors when deciding on the general layout of the mains:

- the need for mains to be replaced due to their physical condition and/or inadequate capacity or whether new mains are required to provide additional capacity;
- providing easy access to the main for repairs and maintenance;
- whether system security, disinfectant residual maintenance and mains cleaning meet operational requirements;
- the location of valves for shut off areas and zone boundaries. Note the ‘50 property’ constraint in clause 7.8.1 – Sluice valves, for shutting off sections of the network;
- provision for scour and air valves;
- required clearances to other utilities. Refer to clause 9.5.3 – Typical services layout and clearances (Utilities);
- topographical and environmental considerations;
- avoidance of dead ends;
- providing dual or alternate feeds to minimise customer disruptions.

Generally, the connection of reticulation to trunk mains is not permitted, as these mains may be shut down for servicing over extended periods, disrupting supply to reticulation where alternate feeds have not been provided.

Identify obstructions along the pipeline route and specify clearances. Specify clearances from other utility services, such as electricity, telecommunication cables, gas mains, stormwater drains and sewers. Where bending pipes, comply with the requirements of clause 7.7.7 – Working around structures.

7.6.2 Duplicate mains

Provide duplicate mains to provide adequate fire protection in the situations set out in Table 2:

Table 2 Duplicate mains

Situation	Duplicate main
Parallel to large distribution/trunk mains that are not available for service connections	Required
Industrial/commercial areas	May be required
Arterial and dual carriageway streets	May be required

7.6.3 Reticulation in legal road

Evaluate and incorporate the following design considerations when locating reticulation in legal roads:

- Situate the pipeline in the least costly location, such as on the side of the legal road that serves the most properties;
- Wherever roads are cut into the hillside, situate pipes on the cut or high side, to make best use of road drainage and limit the risk of consequential damage;
- Excavate for the pipeline in undisturbed ground;
- Consider the balance between initial capital cost versus ongoing operational and maintenance costs, for factors such as access and soil type;
- Consider special cover requirements when renewing or laying new pipes in streets with a high crown and dish channels (refer to clause 7.7.5 – Cover over pipes);
- Allow for known future utility services and road widening.

Lay principal mains on one side of all residential streets to within 65m of the end of the cul-de-sac. In commercial and industrial streets, lay principal mains to within 20m of the end of the cul-de-sac. Measure the distance to the terminal hydrant from the road boundary at the end of the cul-de-sac. If the cul-de-sac is short enough to provide adequate fire protection from the intersecting road, locate the fire hydrant at the intersection.

The preferred location for principal mains is within berm and footpath outside of the carriageway, set a minimum of 0.7m from the back of the kerb. Lay principal mains in new subdivisions only after the kerb and channel has been laid, unless the Council has given prior approval. Principal mains must not be less than 100mm diameter and must be fitted with fire hydrants in accordance with the *Fire Service Code of Practice*.

The preferred position of surface boxes, e.g. sluice valves and fire hydrants, is in line with either side of property entranceways. Locate surface boxes clear of feature paving such as cobblestones, and within roundabout islands where possible.

7.6.4 Watermains in easements

The preferred solution for water reticulation is to avoid easements over private property. This is generally only used as a temporary solution to landlocked developments, pending the future provision of a permanent supply within a legal road.

Typical situations where the Council may approve mains in easements include those where there is the need for a link main to provide continuity of supply or to maximise water quality, or where fire protection is required for multiple properties within a private right-of-way. Easements may be located over private property, public reserves, crown reserves, other government-owned land, private roads or accessways in both conventional and community title subdivisions.

Equation 1 below is to be utilized to calculate easement width when mains are required to be located through private properties.

Equation 1 Easement width

The easement width is the greater of:
- $2 \times (\text{depth to invert}) + \text{OD}$
- 3.0m

where $\text{OD} =$ outside diameter of pipe laid in easement

The easement registration must provide the Council with rights of occupation and access and ensure suitable conditions for watermain operation and maintenance.

Construct principal mains, which are in any easements excluding over private rights of way, of steel, ductile iron, PE 80 or PE 100. Install valves in order to isolate that section of pipe.

7.6.5 Submains

In industrial areas and/or commercial zones all submains must be 100ID PVC or PE. In residential zones, submains shall be 63OD PE 100 PN12.5 pipe.

Lay the submain at least one metre along the allotment's street frontage, including corner properties. Serve corner properties from one side only unless future subdivision is expected.

Install submains approximately 150mm from boundaries to serve all allotments. In category V roads (as defined in Appendix I – Lighting categories – Chapter 11: Lighting), amend the submain's design location to allow for the location of the lighting poles on the road boundary.

Locate 50ID diameter valves next to the submain on the crossover. Wherever a crossover serves both directions and more than ten properties each way, locate valves on the submain on either side of the crossover.

Submains on straight roads shall loop back to the main with cross overs at a minimum spacing of every two hydrants

7.6.6 Termination points and hydrants at the end of mains

Avoid termination points or dead ends, in order to prevent poor water quality. Consider alternative configurations such as a continuous network, link mains and use of submains to serve properties off the end of mains.

A hydrant must be placed within 1.5m of the end of all permanent and temporary sections of dead end mains greater than or equal to 100mm diameter. Apart from the firefighting function, this also allows the section of dead end main to be flushed regularly to ensure acceptable ongoing water quality. This is particularly important in new subdivisions, where only a small number of properties may be connected initially.

7.6.7 Temporary ends of watermains

Lay watermains to within 1.0m of a subdivision boundary, where it is intended that the road will extend into other land at some future time.

In new development areas, construct mains to terminate approximately 2.0m beyond finished road works, with a hydrant within 1.5m of the temporary end, as detailed in clause 7.6.6 - Termination points and hydrants at the end of mains. The hydrant must be suitably anchored, to ensure that future works do not cause disruption to finished installations.

7.6.8 Connecting new mains to existing mains

When specifying the connection details, consider the:

- pipe materials, especially capacity for galvanic and other corrosion;
- relative depth of mains;
- standard fittings;
- pipe restraint and anchorage;
- limitations on shutting down major mains to enable connections;
- existing cathodic protection systems.

Anchor valves unless they are secured by restrained joint pipes.

Where connecting to mains that are deeper than the standard cover, obtain the correct cover on the proposed reticulation main by utilising joint deflection of the reticulation pipes downstream of the valve that is attached to the branch connection.

Design connections from the end of an existing main to address any differing requirements for the pipes being connected, particularly restraint, spigot/socket joint limitations and corrosion protection. Use standard fittings and pipework to connect to non-metallic mains. Confirm all sluice valves near the connection are restrained.

Any alterations or connections to the existing reticulation system must be done at the developer’s expense.

7.6.9 Temporary works

The Council may, at its discretion, approve a delay in providing the total infrastructure requirements for large developments that will be developed over a period of several years. Such approval is conditional on the provision of a temporary infrastructure of sufficient capacity for the immediate development and a bond to ensure construction of the remaining infrastructure when necessary.

7.7 RETICULATION DETAILING

7.7.1 Proposed method of installation

There are a number of methods of installing underground services. These include open trenching, directional drilling, pipe bursting or slip lining. Factors that may influence the selection of installation method include the ground conditions, disruption to traffic, need to work around trees, topographical and environmental aspects, site safety and the availability of ducts or redundant services, e.g. old gas mains or their offsets.

Wherever the intention is to lay a number of utilities with a submain in a common trench, pay particular attention to obtaining the required minimum cover and clearances for each utility in the trench cross-section. Mains must always be laid in a separate trench. These clearances are summarised in clause 9.5.3 – Typical services layout and clearances (Utilities).

Where a polyethylene watermain is installed within a duct, detail flanges at each end.

7.7.2 Hillsides

Give special consideration to the design and installation of pipelines on hillsides, as defined in clause 6.14.3 – Scour (Wastewater Drainage). Refer to clause 6.14.3 - Scour (Wastewater Drainage) for lime stabilisation specifications.

7.7.3 Backfill and bedding

Specify backfill materials for the specific installation location. The material used must be capable of achieving the backfill compaction requirements set out in *TDC CSS* and *BRRG*.

Bedding materials should comply with *TDC CSS* and the pipe manufacturer's specifications. Highlight in the Design Report wherever there is a conflict in bedding specifications between the requirements of the *TDC CSS* and the pipe manufacturer and state what was specified for the design.

7.7.4 Trenchless technology

Trenchless technology can be used for alignments passing through:

- environmentally sensitive areas.
- built-up or congested areas.
- areas not suitable for trenching (e.g. railway and main road crossings).
- difficult hill crossings.
- private land.

Installation by methods such as directional-boring, thrust-boring, micro-tunnelling and pipe-jacking may be used in order to lessen the impact of the works on pavements and trees. Pipe bursting is not permitted for water supply infrastructure.

Submit the following, with the Design Report:

- Plans and long sections showing the design vertical and horizontal alignment, how the required clearances from other services and obstructions will be achieved and the expected construction tolerances (including annulus dimensions);
- The location and site space requirements of launch and exit pits and their impacts on traffic and existing services;
- How the alignment will be tracked and as-built records provided over the whole length, including joint locations;
- Reticulation details, including structural pipe design, jointing methods, connections, inline structures and excavation treatments to prevent groundwater movement;
- Geotechnical investigation results and how these have affected the choice of trenchless installation method;
- The method of spoil removal;
- A risk management and assessment study including environmental management, to mitigate potential constructed, installed and operational issues.

Refer to *Guidelines for Horizontal Directional Drilling, Pipe Bursting, Microtunnelling and Pipe Jacking*.

Specify hold points for, for acceptance and for inclusion in the Contract Quality Plan and required material or performance tests to be included in the Contractors Inspection and Test Plan including:

- Presentation of drilling contractor details, including experience with method, pipe diameter and expected ground conditions, to Council for acceptance of trenchless installation.
- Presentation of installation methodology to Council for acceptance, including location tracking.
- Determination of design tensile forces/stresses on the pipe and auditing against these values during pipe pull.
- Determination of design slurry pressure rates and auditing against these values during directional drilling.
- Relaxation period for polyethylene pipe post installation.

7.7.5 Cover over pipes

All Pressure Watermains must have not less than 0.8m cover at all times. Large fittings may require increased cover to allow the correct installation. The maximum cover must not exceed 1.5m. Where the design cover exceeds this, present a non-conformance report for Council consideration. See Timaru District Council Standard Drawings 5301-2 for specific cover depths and details for various situations. If the proposed situation is not covered by the standard drawing, PS1 Design Certification must be provided with the proposal.

7.7.6 Clearances to other services or obstructions

Become familiar with the required clearances from existing and proposed overhead and underground utilities. Identify all underground and surface obstructions, or utility assets that may be hazardous, on the engineering drawings. Refer to clause 9.5.3 – Typical services layout and clearances (Utilities) for clearances for utility services.

When using a trenchless technology installation method, apply the clearances required for watermains laid in an open trench.

New parallel water reticulation services must cross as close as practicable to 45°.

7.7.7 Working around structures

Watermains that are located close to structures, such as foundations for walls and buildings, must be clear of the "zone of influence" of the structure's foundations, to ensure that the stability of the structure is maintained and that excessive loads are not imposed on the watermain. Refer to Table 3 below for guidance on minimum clearances from structures.

Table 3 Minimum clearance from structures

Pipe Diameter (mm)	Clearance to Wall or Building (mm)
<100	300
100-150	1000
200-300	1500
375	2000

Watermains that are constructed from metallic materials must not be located within 30m, measured horizontally, of overhead electricity transmission towers having a voltage 66kV or higher, especially if cathodic protection will be provided. Galvanic anodes for cathodic protection should be located away from the transmission lines or approximately midway between the transmission towers.

Deviate a mains pipeline around an obstruction by deflection at the pipe joints and with bends. If plastic pipes are used, restrict radii to greater than 100 x the pipe OD for tapped bends and to 75 x OD otherwise. The deflection angle permitted at a flexible joint must comply with the manufacturer's recommendation. Provide a detailed design, showing the route of the watermain around the obstructions.

7.7.8 Crossings

Wherever watermains cross under roads, railway lines, waterways, drainage reserves or underground services, make the crossing, as far as practicable, at right angles. Design and locate the main to minimise maintenance and crossing restoration work. Make all crossings of natural waterways below the invert level of the waterway.

Wherever pipelines are located under major infrastructure assets, carriageways, intersections or waterways, determine whether the pipeline may require mechanical protection, or if different pipeline materials are needed for the crossing. Consider seismic loading and its potential to cause abutment movement or bridge approach slumping when detailing pipes traversing bridges.

7.7.9 Above-ground watermains

Include the design of pipeline supports and loading protection with the design of above-ground watermains. Address any exposure conditions such as corrosion protection, UV protection and temperature re-rating. Provide details of mechanical protection to prevent vandalism and rockfall.

7.7.10 Redundant infrastructure

Redundant watermains are generally left in the ground. Specify removal of hydrants, valves and surface boxes and detail that the ends of redundant pipework, including at these fittings, are capped.

7.7.11 Tracer wire

Specify the installation of tracer wire or tape directly above watermains in rural areas or within easements, including where the watermain is installed by trenchless methods. Detail connections to fittings, overlaps and jointing that comply with the manufacturer's instructions. Confirm the effectiveness of the tracer wire and record in the Contract Quality Plan.

7.8 RETICULATION FITTINGS

Detail jointing of PE pipes and fittings with diameters greater than 125mm OD using only electrofusion couplers or butt welds.

7.8.1 Sluice valves

Sluice valves specified in Timaru are defined as clockwise opening valves with diameters greater than or equal to 100mm and gate valves are defined as clockwise opening valves with diameters below 100mm.

Sluice valves are required next to the branch of any tee. Other valves must also be provided to ensure that turning off a maximum of five valves can isolate the network in any area. The maximum five-valve shut off must not isolate more than 50 properties.

Locate sluice valves at street intersections and also along the line of the main as required. Consider the following when deciding on the location of sluice valves:

- the operational needs of the system so that continuity of supply is maximised;
- operation and maintenance requirements;
- the safety of maintenance personnel.

Keep the number of valves to a minimum, without compromising the ability to easily identify and isolate a section of the network.

Attach sluice valves to flanged fittings at junctions rather than plain-ended fittings.

The force required to open or shut a manually operated valve, using a standard valve key, with pressure on one side of the valve only, must not exceed 15kg on the extremity of the key. Specify geared operation, motorised valves or a valve bypass arrangement, to reduce pressure across the valve, if the allowable force cannot be met.

7.8.2 Backflow

Design and equip drinking water supply systems to prevent back siphonage. Locate air valves and scours to avoid water entering the system during operation. Backflow prevention devices must meet the requirements of AS/NZS 2845.1.

7.8.3 Scour valves

Scours are required on mains of 300mm diameter and larger. Generally, valves must be 150mm diameter in size. Scours are required on mains less than 300mm diameter where there are no fire hydrants. Install scour valves at the lowest point between isolating valves, and discharge to an approved outfall.

7.8.4 Air valves

Air can accumulate at high points when it is drawn into the system at reservoirs and pumps. Mains should be laid evenly to grade between peaks to ensure all possible locations of potential air pockets are known. Investigate the need for air valves at all high points, particularly those more than 2.0m higher than the lower end of the section of watermain, or if the main has a steep downward slope on the downstream side.

Air may also come out of solution in the water due to a reduction in pressure, such as when water in a main flows uphill or at pressure reducing valves. Air valves may be required to allow continuous air removal at these locations.

The number and location of air valves required is governed by the configuration of the distribution network, in terms of both the change in elevation and the slope of the watermains. Install air valves in a secure enclosure above the ground, with an isolating valve to permit servicing or replacement without needing to shut down the main.

Air valves are not normally required on reticulation mains in residential areas, as the service connections usually eliminate air during operation. Where the need is primarily for admission and exhaust of air during dewatering and filling operations, a high-point hydrant usually adequately serves reticulation networks.

On hillsides, locate a fire hydrant adjacent to and downhill from any sluice valve where the main descends from that location to release air.

300mm and 375mm diameter reticulation mains, with only a few service connections, may require dual-acting air valves, to automatically remove accumulated air that may otherwise cause operational problems in the water system.

Dual-acting air valves, incorporating an air valve (large orifice) and an air release valve (small orifice) in a single unit, are generally preferred for distribution and trunk mains, and where required on reticulation mains. The nominal diameter of the large orifice of air valves must be 50mm, for installation on mains less than or equal to 300mm diameter.

7.8.5 Additional hydrants and scour valves for maintenance activities

Hydrants, additional to those required by the *Fire Service Code of Practice*, may be needed to facilitate maintenance activities, such as flushing the watermains. Ensure that these are approved and there are adequate drainage facilities to cope with the contents of the watermain from dewatering and flushing operations.

Where automatic dual-acting air valves are not installed at high points on the watermains, install a hydrant to release air during charging, to allow air to enter the main when dewatering and for manual release of any build-up of air as required. Install a fire hydrant at the top section of a hillside main, to act as an air intake and prevent the creation of a vacuum.

Provide hydrants at low points on watermains, to drain the pipeline when scours are not installed. As a general rule, place a hydrant or scour at the lowest point of elevation where the volume of water unable to be drained exceeds $15m^3$. This normally applies to mains greater than or equal to 200mm diameter.

7.8.6 Pressure reducing valves and check valves

Pressure reducing valves are preferred over break pressure tanks, and must be sized for minimum and maximum demand. The pressure reducing valves must have V-porting and relief valves, capable of taking full flow to an approved outfall, which is visible to the public.

Consider and allow for increased pressures as a result of pressure reducing valve failure.

Pressure reducing valves and check valves that are 100mm diameter and larger must have bypass pipe work and shutoff valve arrangements. This allows the valve to be isolated for maintenance or to reverse the flow if necessary.

7.8.7 Thrust and anchor blocks on mains

Design thrust blocks for all fittings and valves, to withstand the greater of:

- maximum operating pressure and test pressure, including transient and pump shut off head;
- adjacent pipeline class rating;
- a minimum pressure of 1200kPa.

The precast thrust block detailed in *TDC CSS* may be used if all of the following criteria are met:

- the fitting or valve is up to and including 200mm diameter;

- the maximum operating pressure is up to and including 700 kPa;
- the trench ground conditions can sustain an allowable bearing capacity greater than 150 kPa, as established by testing;
- the thrust block will not experience up-thrust.

The thrust block must have a minimum surface area of 0.18m^2 in contact with an undisturbed trench wall.

If the above criteria are not all complied with, design and detail thrust blocks individually for the site bearing capacity. Consider the buoyancy effect of any alteration in the watertable.

Confirm the bearing capacity of the in-situ soil and the installed thrust or anchor block design and record in the Contract Quality Plan prior to installation.

Consider the Poisson's effect in flexible pipes and design end restraints to compensate for this, where necessary. Also detail anchorage for in-line valves on pipelines that are not capable of resisting end bearing loads.

7.8.8 Restrained joint watermains

Restrained joint watermain systems can be used in place of thrust and anchor blocks to prevent the separation of elastomeric seal-jointed pipelines.

Restrained joint systems include welded steel joints, flanged pipes and fittings and factory made mechanical restrained joint systems. Polyethylene pipe fabricated joints are not acceptable. Specify details of factory made mechanical restrained joint systems in the Design Report, including the:

- length of restrained pipeline and adjacent fittings required to ensure the transfer of thrust forces to the ground strata;
- requirement for placing suitably worded marking tape in the trench over the pipeline to define the limits of the restrained joint system;
- requirement for details of the commercial restrained jointing systems to be shown on the as-built records, including the location of restrained portions of pipelines.

7.8.9 Provision for sterilisation

The fittings and reticulation layout must provide for chlorination. At the point of connection, provide a 20mm diameter tapping band for chlorination. The connection to the existing main must be capable of 500 litres/minute capacity from the reticulation. Provide an outlet (normally 50mm diameter, or a fire hydrant) to flush the chlorinated water out of the reticulation, at the end of each section of main and specify the outfall in the Design Report.

7.8.10 Connections

For design purposes, assume a minimum 20mm diameter connection, unless Council consent has been granted for other sizes.

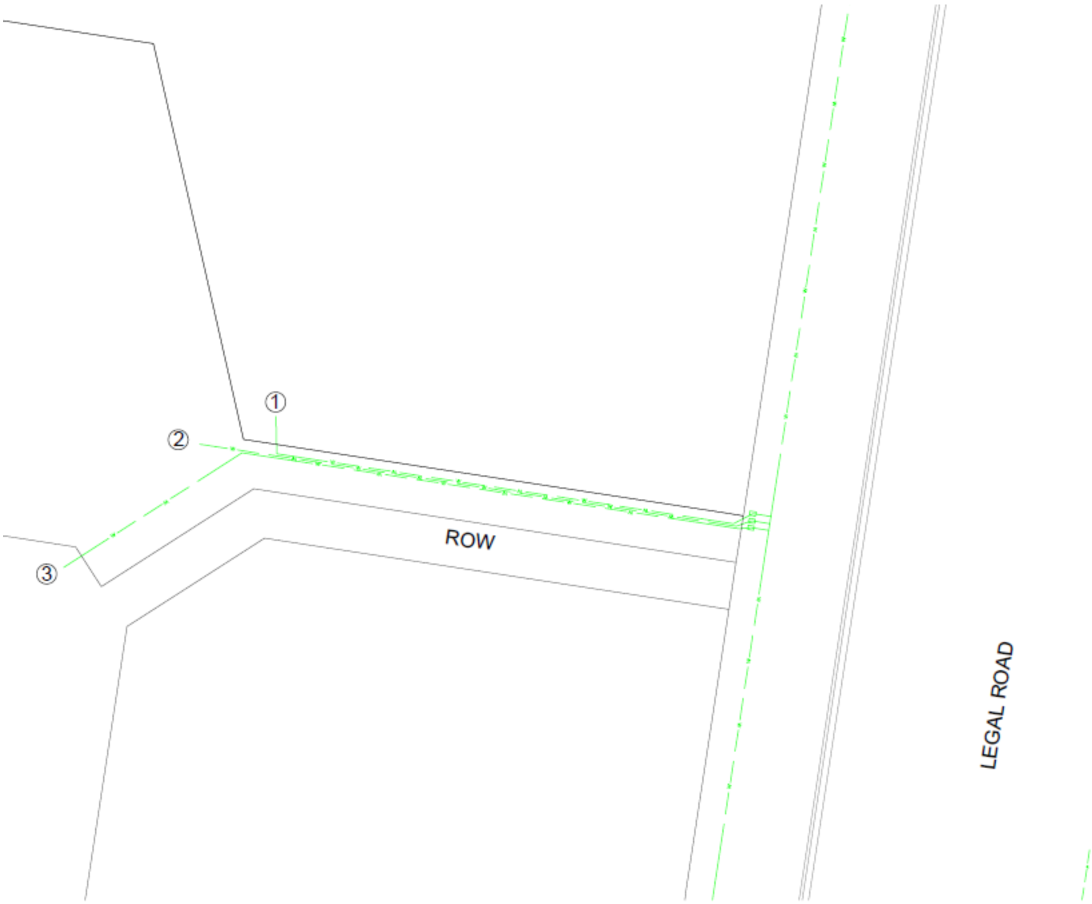
Individual connections may be installed at the time of Engineering Acceptance by the developer. Lateral connections (including isolation valve and meters) will become the property of, and be maintained by, the Council, up to the point of supply to the individual property.

7.8.11 Multiple Configurations for PRIVATE PROPERTY

Supply pipes in private property and mutually owned right-of-ways are considered to be privately owned and must be protected by easements in favour of the dominant tenants.

One service connection per property title, with manifolds located within the Road Reserve. Figure 1 provides an outline for multiple supplies servicing units down a right of way.

Figure 1 Multiple supplies at boundary



For up to two dwellings, a single connection can be made to the main via a DN25 lateral, and then be split into individual isolation valves. For more than two dwellings, lateral must be sized sufficiently to provide 200 kPa capacity to the point of supply.

7.9 MATERIALS

All materials must comply with those listed in the *TDC CSS* which provides a guide when specifying materials.

7.9.1 Material selection

Water reticulation materials have specific design and installation issues, as identified in the manufacturers' design manuals, specifications and other literature. Consider these issues, as tabulated below, when specifying materials.

Table 4 Material design issues

Mains Pipeline Material	**Issues to be Considered**
Ductile iron and steel	• Internal lining and external coatings must be undamaged or fully restored after repairs or fabrication work. • Potential problems with stray electric currents and bimetallic corrosion.
PVC-U	• Tests pressure not to exceed 1.25 times the rated pressure of the lowest rated component but to be at least 1.25 times the maximum operating pressure. • UV degradation. • Scratching, gouging and impact damage. • Proper bedding and installation required. • Permeation by contaminants possible.
PE 80, PE 100	• Susceptible to permeation by some hydrocarbon contaminants. • Sophisticated equipment and highly skilled workers required. • UV degradation (Blue pipe). • Bedding support to prevent excessive deformation. • Pulling forces for PE are not to exceed the manufacturer's recommendations. • Minimum radii. • Poisson's effect and end restraint.

All plastic pipes used in the Timaru public supply must have a nominal pressure rating (PN) of not less than 12 bar or PN 12 (1200 kPa). PVC-M and PVC-O pipe will not be accepted.

Submains must be made from polyethylene pipe of resin type PE 100 or PE 80, with a minimum pressure rating of PN 12.5. Contaminated sites will require careful material selection. Refer to clause 7.4.4 – Contaminated sites.

7.9.2 Material specifications

All materials must comply with those listed in the *TDC CSS* which provides a guide when specifying materials.

The specific requirements for reticulation materials that are to be incorporated within the supply network are listed in the *TDC CSS*. Bedding and backfill materials must comply with the requirements of the *TDC CSS*.

The Council has an asset service life requirement of 100 years. Pipes and fittings must have a minimum required design life of 100 years and a minimum warranty period of 50 years. All products must be fit for their respective purpose and comply in all respects with the Council's current specification for the supply of that material and the standards referenced.

Manufacturers of any pipes and fittings intended for use in the Timaru District distribution system must have a certified quality management system in place that complies with AS/NZS ISO 9001. This system must apply to all aspects of the manufacturing processes, including product handling, administration and stock control.

The Council requires the right to verify that any and all contracted and subcontracted products conform to the specified requirements (clause 7.5.2 of AS/NZS ISO 9001). Full product identification and traceability is required (clause 7.5.3 of AS/NZS ISO 9001). Protection of the quality of the pipe and fittings includes transportation and off-loading at the delivery point (clause 7.5.5 of AS/NZS ISO 9001). Full quality records (as per the manufacturer's Quality Assurance manual) must be available on request for evaluation by the Council and be kept for a minimum period of 10 years.

Both the developer and the contractor are responsible for ensuring the appropriate handling, storage, transportation and installation of pipes and fittings to avoid damage and to preserve their dimensions and physical properties. The total exposed storage period from the date of manufacture to the date of installation for all PVC pipe must not exceed 12 months. Store fittings under cover at all times.

The Council reserves the right to require full details of the manufacturer's means for demonstrating compliance. Irrespective of the means of demonstrating compliance and the supplier's and manufacturer's quality assurance systems, responsibility remains with the developer to ensure the installation of products that conform with the requirements of the IDS and the appropriate standards. The Council may arrange for independent testing to be carried out on randomly selected samples or assembled joints.

Positive verification inspections or testing results obtained by the Council shall not limit the supplier's responsibility to provide an acceptable product, nor shall it preclude subsequent claims made under warranty due to manufacturing defects, faulty design, formulation or processing.

7.10 INFRASTRUCTURE APPROVED CONTRACTORS

Only Timaru District Council Infrastructure Approved Contractors are permitted to install pipework that will be vested into the Council and any pipework that is located within legal roads. A full list of authorised drainlayers and conditions of approval may be found on the Council webpage.

7.11 CONNECTION AND STERILISATION

Design a sterilisation point in the new reticulation.

Construction of the water supply system must not start until approval in writing has been given by the Council.

Wherever works are installed within existing legal roads, obtain a Works Access Permit (WAP) for that work. Apply for a Corridor Access Request (CAR) at www.beforeudig.co.nz. The works must comply with requirements as set out in the *TDC CSS* for this type of work.

7.11.1 Connecting into existing system

New pipe work must not be connected to the Council reticulation until after the mains have been sterilised and passed a pressure test. The pressure test must be carried out as specified in *TDC CSS* – Performance Testing, in the presence of the Council.

7.11.2 Sterilisation

The approved contractor will organise sterilisation of the new reticulation or infrastructure, which may include bacteriological testing of the water to confirm compliance with the *Drinking Water Standards*, prior to commissioning. Bacteriological testing takes 24 hours. Further details are set out in *TDC CSS.* Sterilisation report shall be provided as part of final engineering clearance documentation.

7.12 AS-BUILT INFORMATION

Present as-built information which complies with Part 12: As-Builts and this Part.