

PART E. WATER SUPPLY DESIGN AND CONSTRUCTION

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OBJECTIVES

The objective of this chapter of the Code is to ensure that a high quality and reliable potable and fire fighting water supply service is provided.

Wellington City Council owns and operates water supply infrastructure which provides a high quality and reliable water supply to its residents and businesses. Council has the overall responsibility for the water supply in Wellington City. This includes setting policy, service standards, and ensuring the required outcomes are achieved.

Council endeavours to ensure that public health is maintained, risks are managed, and levels of service are achieved with a continuous, reliable and safe potable water supply through the provision of water supply systems.

Accordingly Council requires all new development connecting to the water supply system and where the existing water supply system is upgraded or replaced to be constructed in accordance with Council's requirements and comply with relevant legislation, codes of practice, performance standards and established minimum levels of service.

The standards set out in the Code can be regarded as a means of compliance, are based to a large extent on established practice and shall be read as the minimum standards required that meet the levels of service to customers connected to the water supply system. These standards are particular to the Wellington City environs and may differ from practices elsewhere due to the geographical nature and constraints particular to Wellington.

The Code does not specifically address private water reticulation beyond the point of supply used in private and community title developments that are connected to the Council reticulation network. However where this private reticulation is likely to be maintained by the Council or the facility is likely to service a community, then the requirements of the Code should be adopted.

GENERAL REQUIREMENTS

Water supply requirements will be determined by Council in accordance with this Code, current Council policy, current Council Annual Plan outcomes and performance measures, current Council design data and the exercise of engineering judgement. The consumption and flows given are for ordinary residential development. Other types of development will need special consideration.

Any special requirements, including a financial contribution from the subdivider, will usually be made known at the time the development is considered to assist an applicant in assessing the economics of a development.

In the case of larger subdivisions and/or areas difficult to supply, the developer or their representative is recommended to discuss the scheme with Wellington City Council before submitting the proposal.

Information regarding submission of construction plans, construction, testing, etc., is contained in this Code and in the current issue of the Wellington City Council Water Supply Specification.

The topography and earthquake susceptibility of Wellington City requires the careful and considered development of water supply schemes and the application of water supply standards that may seem more onerous than those applicable in other centres. There is a particular need to ensure minimum standards are met to avoid compromising levels of service to customers connected to the network. Levels of service are often taken for granted and the achievement of minimum service levels in Wellington City has dictated the need for policies and practices not necessarily implemented or required in other towns and cities.

For the above reasons Council has adopted water supply policies that require all new developments to be fed from publicly owned community service reservoirs in dedicated water supply zones, and for minimum and maximum pressures to be achieved at the point of supply to all newly created sections. This is to ensure all sections can be serviced on a sustainable basis with at least the minimum level of pressure and flow set by Council. This provides for the normal water needs of customers as well as minimising the risk of contamination of the supply by maintaining minimum pressures in the supply network.

Publicly owned service reservoirs serve several roles. It ensures minimum pressures are available to all connected households. It provides a body of water to buffer daily supply demands to ensure consistency and continuity of supply to customers. It provides fire fighting storage reserves, in accordance with the requirements of the New Zealand Fire Service Fire Fighting Water Supplies Code of Practice, which requires minimum quantities of water to be held for fire fighting purposes. Most importantly it provides a reserve volume of water to enable an ongoing availability of water in the event of an emergency, such as burst pipes in the network or an earthquake event.

Council has an established policy in which consent to new subdivisions will only be given where the proposed sections can be serviced from a new or existing publicly owned community service reservoir and a minimum pressure of 25m (250Kpa) and flow of 25L/min is available at the point of supply.

GENERAL PERFORMANCE CRITERIA

The design shall ensure an acceptable water supply to each property including fire flows. Functional requirements to achieve the above objective are:

- An adequate, reliable, safe and efficient supply of potable and wholesome water, sufficient to accommodate anticipated growth.
- Provision of a reticulated water supply and water supply systems meeting at Least the minimum design standards provided for in this Code.
- A reticulation system with a functional design life of at least 100 years.
- The provision of water supply systems and facilities sufficient to ensure an adequate and uninterrupted supply of water for potable and fire fighting use designed to accommodate the anticipated flows, loads and pressures, whilst minimising adverse effects on the environment.
- Supply from a community storage reservoir.
- System compatibility with the existing water reticulation network.
- Being constructed from materials suitable for the intended use.
- Provision for adequate servicing of all sections in the development.
- Allowance for sufficient access for fire fighting appliances and equipment.
- Providing adequate safeguards against water contamination.
- Providing a watertight system.

All water supply schemes shall be designed and constructed in accordance with the provisions of the following documents;

- | | |
|---|---|
| • Resource Management Act 1991 | • Civil Defence Emergency Management Act 2002 |
| • Local Government Act 2002 | |
| • Building Act 1991 | • New Zealand Fire Service Fire Fighting Water Supplies Code of Practice SNZ PAS 4509: 2008 |
| • Health Act 1956 | |
| • Drinking Water Standards for NZ 2005 (Revised 2008) | • Local Government (Rating) Act 2002 |
| • Health and Safety in Employment Act 1992 | • Health (Drinking Water) Amendment Act 2007 |

E.1 WATER SUPPLY SPECIFICATION

To assist with design and construction the Wellington City Council Water Supply Specification, has been developed.

The specification sets out technical and quality standards for the design, materials and construction practices to be used in any water supply schemes

and water system and network construction within the Wellington City water supply area.

The Code is to be read in conjunction with this specification and all water supply technical and construction requirements relating to the provision of water supply facilities shall be in accordance with the requirements of the Water Supply Specification, except where amended or specifically deviated by Council in writing. Should ambiguities arise, the clauses in this Specification shall take precedence over other documentation.

E.2 WATER SUPPLY REQUIREMENTS

E.2.1 Standard of supply

All water supply systems shall be designed for a functional design life of at least 100 years without rehabilitation. Some components such as pumps, metering, control valves and control equipments may require earlier renovation or replacement.

Council water supply systems must be designed to cater for existing and future demand and be constructed to at least a minimum standard adequate for fire fighting purposes and for estimated domestic, commercial and industrial demand.

Developments without access to a public supply or in non-reticulated or rural areas must be served by a privately owned water supply which satisfies all legislation and guidelines including, but not limited to, those listed above.

Unless otherwise approved, all allotments shall be provided with a water supply connection which shall be not less than 20mm internal diameter.

The system shall be designed to provide an uninterrupted supply of water at all times with a minimum pressure of 25m (250kpa) measured from the bottom water level (BWL) of the servicing reservoir and a minimum flow rate of 25 litres/minute at the point of supply for maximum probable development.

E.2.2 Provision by the developer

A public water supply will be required:

- (a) Where new sections are created or a section is subdivided;
- (b) Where a fire hydrant is required to comply with the requirements of the New Zealand Fire Service Fire Fighting Water Supplies Code of Practice;
- (c) Where it will upgrade or improve an existing water supply in an area (or can be later extended to achieve this);

(d) Where Council can maintain such a system.

There may be situations where a reservoir and/or pumping station, designed and constructed to Council standards is required, to serve new sections.

E.2.3 Extensions and alterations to existing infrastructure

Extensions and upgrades to the public water supply system may be required as part of a development. All proposed public water main extensions require consultation with Council prior to approval by Council. All extensions must be designed and constructed to the requirements of this code and the Wellington City Council Water Supply Specification.

Any new connections off an existing main, extensions to, or alteration of the existing water supply reticulation or water supply infrastructure (upgrading, relocation and lowering of water mains and other water supply element(s) etc.) required to facilitate the development or for compliance of the new development with Council's standards shall be at developer's cost.

E.2.4 Consultation with Council

It is advised the developer of multi-lot developments (including infill development that may require network upgrade) that will connect to the Council's supply, to consult with Council in regard to the design, layout and operation of the proposed system prior to submitting any consent application.

Approval of the Council shall be obtained for any proposed development that requires a connection to a piped water supply under Council control. Approval shall be obtained in writing before work commences.

Prior to works starting, plans, calculations and design statement for the design of the proposed water supply system shall be prepared by an appropriately qualified and experienced person, and submitted to the Council for approval. The calculations shall include all design assumptions and any specific structural design as appropriate.

The Developer shall, for multi-lot developments (including infill development that may require network upgrading) that will connect to the Council's supply, consult with Council in regard to the design, layout and operation of the proposed system prior to submitting any proposal for consent approval.

The requirement for water meters, pressure reducing valves, flow control devices, etc will be advised by Council at the time of scheme plan approval.

Concept plans

In some cases the Council may be able to provide a concept plan setting out certain information to be used in the design. Unless the ability of existing water infrastructure to service the development proposal has been verified by Council, the designer will be required to undertake an assessment of the existing infrastructure and the impact of the proposed development on that infrastructure.

Council may provide the designer with some or all of the following information:

1. Details of acceptable connection point(s);
2. Details of available flow at the connection point;
3. Details of available pressure/head at the connection point;
4. Minimum and maximum operating pressure at the connection point
5. Requirement of any upgrade to the existing water supply system to accommodate the new development
6. Details of any larger mains required for future expansion; and
7. A concept plan which would identify any other special requirements of the Council including provision for future expansion of the system.

Pre application meetings

If the Council does not provide a concept plan, the designer shall liaise with Council, prior to the commencement of the design, to ensure that sufficient prerequisite information is available to undertake the design.

In the case of larger subdivisions, and/or areas difficult to supply, the proposal should be discussed at an early stage with Council who will advise of any special requirements or conditions. This may help the developer to assess the financial viability of the development.

Information provided by Council will be supplied in good faith and Council will not accept responsibility for the accuracy or correctness of the information supplied.

E.2.5 Consultation with other parties

Where applicable the developer shall consult with other parties likely to be affected by the proposed development, these include but are not limited to:

1. Property owners served or affected by the works, including absentee owners
2. NZ Fire Service
3. Wellington City Council
4. Greater Wellington Regional Council
5. Insurance Brokers Association of New Zealand (for development of commercial properties and where fire connections are required for fire fighting purposes)
6. Other utility operators
7. Developers of adjacent works

E.2.6 Application and payment for water connections

An application is to be made to Council for all water connections using Council's Water Connection application form available from Council offices and service centres, or downloaded from the Council's website.

In the case of Greenfield development or the development involved connecting a water main to the existing water supply system there is no application fee. For all other types of water connection an application fee and application deposit applies.

Once the application has been processed the applicant will be advised of the applications approval or non-approval by Council. The applicant will be sent a list of approved water supply contractors with the approval letter. The applicant can then select a contractor to negotiate directly with regarding the connection cost.

E.2.7 Developer Contributions

All new developments will attract developer contributions. Developers are advised to refer to the current Developer Contributions Policy to assess the development contribution that will be applicable to their development so that they can determine the financial viability of the proposed development.

E.2.8 Financial contributions

Where the developer is not required to meet the full cost of any upgrading, extension or alteration then financial contributions, as assessed by Council, will be required from the developer towards the cost of extending or upgrading existing water supply system, such as water mains, reservoirs and pumping stations, to service the proposed development.

Contributions will generally be determined on a per section or dwelling basis calculated on the estimated construction costs for the provision of the required facilities.

In some cases it may be appropriate for Council to contribute to jointly funded improvement schemes on behalf of existing properties in a zone where there is a deficiency when compared with the Code requirements. Any decisions on joint funding will be at the sole discretion of the Council.

There may be cases where Council has an intention to construct the proposed improvement within 5-10 years. The proposed improvement will relate to a likely or anticipated number of sections.

E.2.9 servicing of proposed sections

Every residential dwelling unit or individual premise shall have its own separate Wellington City Council service manifold and service pipe. Where individual services larger than 20 mm are proposed these shall be subject to Council's specific approval and shall be installed with an approved back flow preventer and service valve positioned at the point of supply.

All proposed sections shall be provided with water services in accordance with the standards set out in this Code and the Wellington City Council Water supply Specification.

Once approved and paid for all new connections will be installed by Wellington City Council's authorised contractor.

Water supplied to premises other than residential will be metered and the meters shall be positioned at the point of supply.

New water services shall not be laid across proposed boundaries between sections.

Where an existing water service passes through any new section being created by a subdivision, a new service shall be provided at the cost of the developer, so that it will not pass through any section except the one it serves. Any existing water pipe (for example, to a hose tap or detached building) crossing any proposed boundary between sections shall be disconnected.

Private water supply systems are generally systems that service 'private' development or sites. These systems are maintained by the respective property owners, and in most cases connect to Councils water supply system.

Water supply pipes are a private responsibility from the 'point of supply' onwards.

Requirements for materials and performance for these private systems are given in the relevant sections of the Building Code 1992, Building Act 2004, Plumbers and Gasfitters and Drainlayers Act 1976, Local Government Act 1974/2002, and various Bylaws.

Private systems are controlled through the Building Consent approval process and are installed to the satisfaction of the Building Consents and Licensing Services Department of the Council.

Engineering plans approval prior to construction will be necessary if a private main can potentially be vested as a public asset, in which case the main shall be designed in accordance with this Code.

Rural and non-reticulated areas

Where no public or community water supply is available, or expected to be available, all sections in rural subdivisions shall be self-sufficient for water supply and be provided with an individual, secure and potable water supply to each section.

Reticulated public water supplies, in conjunction with reticulated sewage disposal systems, may be considered in cases of rural-residential development with section sizes less than 50 hectares.

Where water is supplied to the section or dwelling at the section boundary an approved service manifold shall be installed at the point of supply.

The design of any non-reticulated rural drinking water supply system shall be carried out by a suitably qualified and experienced person to the satisfaction of Council.

In order to gain approval for the development the developer shall demonstrate that an adequate water supply providing not less than 1000 l/dwelling unit/day, which complies with the Drinking Water Standards for New Zealand 2005 (revised in 2008) is available to every section from either sources within the section or at the section boundary.

Adequate storage shall be available to each section or dwelling as provided for under section E.3.

Storage tanks shall be roofed, watertight, bird and vermin proof, and cleaned and disinfected before use.

All storage tanks greater than 2m³ shall be positioned to allow ready vehicle access in the event of a fire, and fitted with an adaptor as provided in Fire Fighting Supplies Code of Practice SNZ PAS 4509 for fire fighting, positioned between 300mm and 650mm above ground level, but at least 100mm above the invert of the tank to prevent debris entering the fire service pump.

Alternative fire fighting water sources as provided for in Appendix B of the Fire Code may be used for the provision of a fire fighting water supply in rural areas.

In rural developments a lesser standard of water supply provision may be approved. For example, household roof water supply and alternative fire fighting water supply to certain requirements may be acceptable.

Requirements for such matters should be sought for the specific location being developed.

E.2.10 Common mains

Any main servicing more than two sections or premises laid in a private street or right of way shall be classed as a common main. Where a common main is laid by a developer, individual services shall be taken off it to the frontage of each section or premises. The common main is to be vested as a public asset and covered by an easement in favour of Council.

E.2.11 Non-council supply

In order to meet its obligations under the Building Act and Health Act, all developments that do not require connection to the Council supply must provide detail of the source, capacity, quality of the existing and proposed water supply and details of how water quality will be monitored. Developers are advised to discuss their proposals with the Ministry of Health.

E.2.12 Easements

Public water supply on private land

Where Council has agreed to take over a water main located within private land as a public main, a strip of land through which the main is laid shall be vested in Council as water supply land. The width of this strip shall be in accordance with the easement widths outlined below. The developer will pay for all the cost associated with vesting of the land.

Common mains laid in private streets or right of ways shall have easements in favour of Wellington City Council. The appropriately sized easement shall cover the strip of land through which the mains are laid.

Council will consider any application for new public water mains on private driveways and right-of-ways on a case by case basis.

Private water supply on private land

Where private water supply pipes are laid through other sections, the service should be noted and protected with an easement. As-Builts of completed works should be filed on site files for all sites involved.

Whenever possible, the entire length of private pipes should be located in the section that they serve and in the public road reserve where connection is made to the public main.

Private pipes may sometimes need to be run through adjacent private land. In these cases, the easement or other rights over that land must enable access and maintenance of the water pipe and also ensure that the pipe will not be damaged through the use of that land. Permanent or temporary structures shall not be erected within the easement through which pipes are laid.

Council requires privately installed mains feeding fire hydrants to comply with Council water main standards. Should Council decide to adopt any privately installed pipes and these pipes are not located in a public road or public right-of-way, an easement must be registered on the title to protect the water supply service and allow access to Council for maintenance. Any adopted mains must be vested in Council.

Creation of water easements in gross

Council requires that all water pipelines which are to be vested in Council that are located in reserves, other than drainage reserves, are protected by a Water Easement in Gross in favour of Council which is drawn up and registered against the titles of the individual properties by the subdivider at no cost to Council.

Easement widths

Easement widths shall be the larger of:

- a width equal to twice the depth to invert plus the pipe diameter with the main or service laid in the centre, or
- a minimum of 4 metres with the main or service laid in the centre

E.2.13 Impact of consequential damage

For all new developments and upgrades of existing water supply systems an assessment and risk analysis shall be conducted to evaluate and address the impact of environmental and property damage in the event of a major water supply system failure involving components such as water mains, reservoirs, pumps, pressure reducing valves etc. AS/NZS 4360 can be used as a guide for this process.

E.2.14 Acceptance as a public water supply system

Any new water supply system constructed by a subdivider will only be taken over as a public water supply system when the water supply system has been designed and constructed in accordance with the provisions of this Code and Wellington City Council Water Supply Specification.

A Design Statement to cover the design, and a Producer Statement to cover the construction of the works, is required from an appropriately qualified and experienced person. It shall include the statement: "The water mains and services have been laid in accordance with the Wellington City Council Water Supply Specification and the assumptions made in the design¹ have been fulfilled in the construction." This statement shall not be qualified. Where construction of reservoirs, pump stations etc are involved the statement shall incorporate relevant standards and codes to which the facilities are designed and constructed.

The designer should note that where a Statement is required, Council will hold the provider of the Statement responsible for the satisfactory design and construction of the works.

Any inspection of the works by Council may be limited to an audit function only. This will not reduce the provider's responsibility.

E.3 WATER SUPPLY CONSIDERATIONS

E.3.1 Environmental considerations

In selecting the pipeline route, the designer shall evaluate its impact on the environment for both the construction and operational phases. In some instances Council may specify that an environmental impact study should be completed during the investigations stage and presented to the Council for assessment.

Wherever possible, environmentally significant and/or sensitive areas shall be avoided. Where it is not possible to bypass such areas, the following may need to be considered during selection of the route:

¹ For example, if it has been assumed that the pipe will be laid in a trench of no more than 600mm width, then this maximum width requirement has been met in the construction.

- Use of alternative excavation technology such as tunnelling, boring, directional drilling and micro-tunnelling.
- The environmental impact of de-watering and rock excavation
- The type and size of construction equipment
- Steep slopes and unstable areas such as rock falls and slips
- Avoidance of routes through contaminated land

E.3.2 Development outside the current urban zone

Any development outside the water reticulated areas and outside the current urban zones will not be connected to the public water supply reticulation without a careful analysis of the impact on the existing supply system and the specific approval of Council. Developers should not assume that such developments will be permitted to connect to existing systems.

E.3.3 Basis of Design

Each section shall be provided with a water supply having a minimum service pressure of 25 m head of water (250 kPa) measured from the BWL of the servicing reservoir at the point of supply, and a minimum flow rate of 25 litres per minute in all situations. The reticulation shall have a hydraulic gradient line falling at 5 m per 1000 m, commencing at the bottom water level (BWL) of the supply reservoir.

Water supplied to each section shall be provided by a reticulated gravity supply from the nearest suitable publicly owned community service reservoir and the minimum pressure shall be achieved at the point of supply without the assistance of any further pumping between the reservoir and the point of supply.

All sections are to be gravity fed from publicly owned community service reservoirs. Proposals that provide for pumping between the publicly owned service reservoir and the point of supply will not be approved.

Where it is anticipated that dwellings will be constructed above the point of supply on elevated sections and that the minimum incoming supply pressure of 25m, required at the point of supply, will be inadequate to service dwellings on these sections then private on site pumping arrangements may be permitted to boost pressures within individual sections.

Connecting pumps directly to the supply pipes of sections to boost pressure will not be permitted. In such cases the requirement to achieve a minimum pressure at the point of supply of 25m remains.

Water supply developments that do not meet these requirements will not be approved.

Subdividers having difficulty achieving these requirements are advised to discuss the situation with Council to determine whether there are opportunities for subdividers to co-ordinate their development plans with Council and pursue joint strategies that may facilitate the development and meet the requirements of this Code.

E.3.4 Assessment of demand

Water mains shall be designed with sufficient capacity to cater for all existing and predicted development within the area to be served.

The designer shall forecast and make provision for future demand that might occur within the service life of the water supply system for the development and any adjoining future potential developments that would be serviced by the system. The District Plan could be used as guidance in this respect.

The designer shall make allowance for all areas of subdivided or un-subdivided land capable of future development.

Demand rates can vary significantly due to particular circumstances, e.g. industrial requirements, climate, geographical and topographical features, holiday and seasonal area conditions.

Where practical, estimates of demand shall be based on:

- Available consumption records for similar consumer groups in the region;
- Discussion with Council personnel to access local consumption records if available.

The designer shall also take account of:

- Variation of demand according to time of day and the season.
- Typical distribution of demand over a 24 hour period to determine the pattern of water usage under peak conditions.

Residential demand shall be determined by multiplying the relevant demand rate and the number of properties to be serviced, as provided for in E 4.1.

The water demand allowance for large tracts of vacant land should be determined on the basis of either:

- (a) population forecasts and/or targets;

- (b) the area to be serviced; or
- (c) individual properties

Adjustment may be required to cater for the known performance (demand-based flows) of the existing parts of the water system.

Future demands should be estimated on the basis of:

- (i) Growth forecasts;
- (ii) the rate of development in recent years;
- (iii) current town planning zonings; and
- (iv) discussion with Council planning staff on development expectations.

Commercial and industrial demand per property can vary widely. The peak hourly demand for a commercial and industrial zone would generally not occur during residential peak demand except in CBD and Suburban centres. Wherever possible the designer shall establish the type of industry to be serviced and the demand rates applicable for that industry.

Where a property owner requires a flow rate in excess of what can be reasonably supplied from the existing reticulation network Council may require the property owner to:

- provide on property storage to balance out peak demands; or
- meet the cost of upgrading the existing water supply distribution system.

E.3.5 Provision for future expansion

Where estimated long-term demands greatly exceed short-term requirements, the works may be able to be staged subject to Council's approval. Special consideration shall be given to reservoir storage volumes to ensure adequate water "turnover" occurs where reservoirs of larger volume than initially required are proposed. Consideration of lower initial top water levels may be an option to address this. Discussions should be held with Council to determine an appropriate construction strategy in such cases.

Where the scheme involves the provision of pumping stations any proposed staging of pump installations shall allow for the installation of additional pumps to cater for the long term demands.

Land requirements for future works (e.g. storage tanks) shall also be considered. Where possible suitable sites shall be identified and considered for acquisition and rezoning for water supply purposes, even though construction may not be envisaged for several years. This is to ensure sites that comply with technical,

environmental and other requirements will be available at a later date to accommodate the future works.

E.3.6 Service Storage Volumes

Provision shall be made for the following storage volumes:

<u>Population served</u>	<u>Litres per Head per Day</u>
0-1000 people	700
1001-2000 people	650
Over 2000 people	600

The design population to be used for water storage calculations shall be 3.1 people per dwelling unit.

Special developments, such as schools, hotels, industrial developments, etc., shall be separately assessed to the approval of the Council.

Fire fighting storage reserves as provided in the Fire Code are additional to the above consumptive storage volumes.

E.3.7 System capacity analysis

Where significant development is proposed or where specifically requested by Council for the purposes of resource consent or for a public water main extension, a capacity analysis of a water supply system is required. This involves a comparison of the capacities of the public system (usually based on testing or network model analysis) with the peak demands requirements and fire fighting requirements of the proposed development.

The development system must be designed to deliver the flows specified elsewhere in this Code. The design should provide a demand analysis and Council may be able to assist with information on existing system capacity constraints derived from network modelling or other data.

E.3.8 Extending an existing water supply scheme

In order to extend the water supply into a development adjacent to an existing scheme the designer shall undertake the following actions:

- Determine an appropriate pressure zone(s), or the establishment of a new pressure zone.
- Calculate the hydraulic demands [head (H) and flow (Q)].

- Determine the extent and sizing of new infrastructure required (e.g. trunk mains, reservoirs etc.) to service the proposal
- Perform a network analysis incorporating this new additional infrastructure to:
 - (i) assess the adequacy of the existing infrastructure to deliver the additional hydraulic load arising from the new scheme;
 - (ii) determine the impacts of the new development proposal on the existing infrastructure (both local and associated remote infrastructure);
- Determine augmentation, replacement needs and the full extent of the works.
- Provision of bulk water supply
- Determine the impact of potential future developments on the existing infrastructure, and impact on the current proposal.
- Design the distribution network (layout, hydraulic, structural etc.)
- Design the localised reticulation networks for the development scheme.

E.3.9 Provision for alternative supply route

In order to provide an alternative supply route in the event of a pipe failure or routine maintenance, the required capacity of certain mains may be governed by the need to cater for certain parts of the network being out of service. Allowance for this shall be made by designers in determining network configurations and pipe sizes.

In establishing a reticulation system Council may determine that in certain cases the requirements of the reticulation network override the specific needs of a particular development.

E.4 WATER SUPPLY DESIGN

The design submitted to Council shall be undertaken by an appropriately qualified person, suitably experienced in water supply system design.

The Design Statement shall cover all aspects of the water supply system design, including the hydraulic design and any structural design.

The design shall be compatible with the approved scheme plan and any concept plan provided by the Council and the design parameters included in this Code and the Wellington City Council Water Supply Specification.

E.4.1 Design considerations

E.4.1.1 General design aspects

For water main proposals designers shall ensure the following aspects have been considered and where appropriate included in the design:

- Size(or sizes) of pipe work throughout the proposed reticulation system;
- Selection of appropriate pipeline material type(s) and class;
- Mains layouts and alignments;
- Looping of mains
- Route selection including:
 - (i) Topographical and environmental aspects
 - (ii) Easements and vesting
 - (iii) Foundation and geotechnical aspects
 - (iv) Clearances, shared trenching requirements
 - (v) Provision for future extensions;
- Hydraulic adequacy including:
 - (i) Compliance with the required maximum and minimum operating (working) pressure
 - (ii) Pipe capacity to meet demand
 - (iii) Pipe pressure ratings
 - (iv) Acceptable flow velocities, and
 - (v) Compliance with the estimated water demand, including fire fighting;
- Property service connection locations, fittings and sizes;
- Any storage or pumping requirements;
- Provision of alternative supply route;
- Types and locations of appurtenances, including:

- (i) Stop valves and auto shut off valves
- (ii) Pressure reducing valves (PRV's)
- (iii) Hydrants and fire services
- (iv) Flow meters
- (v) Backflow prevention
- (vi) Scours and pump-out branches
- (vii) Termination details

- Locations and details of thrust blocks and anchors;

Where water supply schemes include reservoirs, pump stations, etc. designers shall consider and include in their design, where appropriate, relevant functional and operational planning aspects, in a similar manner to that for the design of water mains outlined above.

Residential

The mains shall be designed to provide a flow which is the greater of either:

1. the required fire flow plus two thirds of the peak demand on the maximum demand day or;
2. the peak domestic demand on the maximum demand day

Mains 100mm diameter and larger shall be designed for peak flows on maximum demand day using the formula:

$$\text{Peak flow} = \text{population} \times 0.0162 \text{ (litres per second)}$$

This is equivalent to 1400 litres per head per day.

Mains smaller than 100mm diameter. (Minimum size of a smaller main shall be 50mm)

Peak flows on maximum demand day shall be calculated by using the formula:

$$\text{Peak flow} = 0.6 \times (\text{number of houses})^{0.594} \text{ (litres per second)}$$

Flows using this formula are tabulated:

No. of Houses	Litres per Second	No. of Houses	Litres per Second
1	0.6	6	1.7
2	0.9	7	1.9

3	1.2	8	2.1
4	1.4	9	2.2
5	1.6	10	2.4

Commercial and Industrial

Design for commercial and industrial areas shall be the required fire flow plus the peak demand on the maximum demand day as required for the specific users to be served (quantity and pressure) and subject to a design check.

Minimum fire flows shall be in accordance with Table 2 of the Fire Code.

Water demand for commercial and industrial areas shall be analysed and specifically allowed for in the design.

E4.1.2 Network analysis

Network analysis shall be undertaken for all water supply schemes. The system shall be analysed using a mathematical model of the network to ensure adequate water supply is available to all consumers connected to the system for all defined modes of operation. The analysis shall include all elements within the system and shall address all demand periods including peak demand and low demand flows. Water flows and pressures shall be fully investigated to achieve an acceptable design.

Reservoirs shall be assumed to be empty for analysis purposes.

The developer shall demonstrate that the following pressures are achievable:

1. Not less than 250kpa (25m) at the point of supply with a simulated flow of peak domestic demand.
2. A minimum running pressure in of 100kPa (10m) at the highest hydrant while the main is flowing two thirds the peak domestic demand in addition to the required amount of water from the maximum number of fire hydrants as determined by the Fire Code.

Network analysis using a calibrated network model is also required to determine the impact of the proposed scheme on existing networks. Council has a calibrated network model, H₂O Map, available for analysis of the existing network. Council may, at the Developers cost, be prepared to use this model to analyse the impact of the scheme proposal on the existing network.

E.4.1.3 Design drawings

Drawings will be scanned by Council and therefore should be clear black and white drawings only with minimum line widths of 0.25mm. Plans should be clear without colouring or shading. All annotation, symbology and measurements must be clear of lines and of suitable font to be easily read when printed at 1:250 scale.

Three copies of the as-built plan are to be forwarded to Council. The plans are to be to the satisfaction of Council. As-builts shall also be submitted in electronic format, AutoCAD DXF file on CD.

Design drawings shall generally include the following:

Plan type	Scale
A locality plan giving the overall layout and location of the works	1:2000
A detailed plan of the scheme	1:250
Special details where the Standard Drawings are not sufficient	1:100,1:50 or 1:10 as appropriate for clarity

E.4.1.4 Design tolerance

The location and levels of water mains shall be specified:

- In m to one decimal place for horizontal alignment;
- In m to two decimal places for level.

Horizontal alignment should be referenced to NZGD2000 co-ordinates, or, where this is not possible, to local property boundaries. Levels shall be referenced to City Datum.

E.4.1.5 Design

A water supply system shall:

- Be constructed of materials compatible with the chemical properties of the water being conveyed, suitable for the intended duty with a minimum design life of 100 years, and having a proven performance record.
- Be constructed of materials suited to the ground conditions e.g. acidic soils, hydrocarbon presence etc.
- Minimise leakage, eliminate the ingress of contaminants, and the penetration of roots, using current best practice.

- Provide electrical and mechanical equipment with a life span and quality of the best currently available technology.
- Withstand all anticipated superimposed loads and network pressures (including those from transient surges that could reasonably be expected from pump failure, pump starts, and sudden valve closure).
- Minimise adverse affects on, and be compatible with, the existing water reticulation network.
- Minimise disruption to other parts of the network during maintenance; by having adequate interconnections, valves, and separating trunk supplies from local reticulation.

E.4.2 Hydraulic Design

E.4.2.1 General

The diameter of water mains shall be selected to ensure that:

1. the main has sufficient capacity to meet peak demands;
2. all consumers connected to the main receive at all times an adequate water supply; and
3. the appropriate fire demand is met.

E.4.2.2 Flow velocities

Pipelines shall be designed for flow velocities in the range 0.8 to 2.0m/s. in special circumstances, velocities of up to 3.5m/s may be acceptable.

For pumping mains an economic appraisal may be required to determine the most economical diameter of pumping main to minimise the combined capital and discounted pumping cost. The resulting velocity will normally lie in the range 0.8m/s to 1.4m/s.

The following factors shall be considered in determining flow velocity:

1. Stagnation;
2. Turbidity (large fluctuations in flow rates can dislodge the biological slime or stir up settled solids in pipelines);
3. Pressure;
4. Surge;
5. Pumping facilities - Pumping volumes/pump hours
6. Pressure reducing devices;

7. Pipe lining materials;

E.4.3 Pressure

The pressure at the point of supply shall be within the following limits:

- Maximum normally not exceeding 90 m head of water, measured from the top water level of the associated reservoir.
- Minimum 25m head of water, measured from the bottom water level of the associated reservoir.

The source of any significant pressure surges or high-pressure areas in the proposed network should be identified and remedial measures specified. Excessive surges that can reduce the life of materials and increase customer complaints due to noise or air entrainment are to be avoided.

Where plastic pipes are to be used in zones affected by pressure variations or in locations downstream of pressure reducing valves, and where required by Council, a surge analysis shall be undertaken. The network shall be analysed for the full range of anticipated rates of change of flow in order to determine the magnitude of the surge pressure in the system and the amplitude and number of cyclic loadings expected over the design life of the system.

E4.3.1 Pressure zones

Wellington's water supply system comprises of differing pressure zones supplied from various reservoirs. It is intended that each property contained within any pressure zone has available pressure within the permitted range of pressures.

Where the height variation of the proposed system extends beyond the allowable operating pressure range the system should be divided into discrete zones, each with its own service reservoir and reticulation network.

Council prefers supplies to be direct from reservoirs without pressure reduction. However Council understands that there are circumstances where this may not be possible. Council may approve the use of a PRV zone to control the pressure delivered into an area. It should not be taken for granted that the establishment of PRV zones will be permitted.

Where a PRV zone is permitted a top entry strainer and an electromagnetic flow meter shall be installed up stream of the PRV valve and the electromagnetic flow meter be connected to Council telemetry system to monitor flows and pressures. There shall be valves and fire hydrants on the up stream and down stream of the PRV valve. The developer shall arrange for power connection to the electromagnetic flow meter. All work shall be in accordance with the Wellington

City Council Water Supply Specification. All cost associated with the PRV zone will be paid for by the developer.

An economic analysis also may be required to substantiate the viability of the PRV zone

Each pressure zone shall be locked off from the other with closed (shut) valves to prevent higher pressure loadings from one zone being accidentally imposed on a lower zone. The ability to vary the interface between zones may be required with the proposed system to optimise the operational performance of adjacent zones.

Developments that will be bridging two or more pressure zones will require to be supplied from different supply points and may need dual reticulation operating at different pressures to ensure flow continuity. A shut valve shall be installed at each zone boundary and marked in accordance with the Wellington City Council Water Supply Specification

E4.3.2 Design Pressure

The maximum design pressure (head) for the mains to be installed shall be based on the following:

Design Pressure, (m) = Static head + Surge allowance + pumping pressure (if any)

The pressure rating of a component in the water network shall not be less than the maximum design pressure. The minimum rating of pipeline components for reticulation system shall be 160m/PN16.

The operating pressure at any location of the pipeline shall not exceed the design pressure.

The design pressure shall be used for:

1. Selection of pipe materials and pressure rating;
2. Selection of pipe fitting types and pressure rating;
3. Design of thrust and anchor blocks.

E4.3.3 Trunk and distribution operating pressures

Selection of pipe material and pipe pressure rating (PN) shall be based on operational requirements giving due consideration to the maximum and minimum allowable operating pressures. These pipelines shall accommodate system operation within the expected range of operating pressures.

E.4.3.4 Surge analysis

A surge analysis shall be undertaken

- for any pipeline within a pumped system or system containing automated valves.
- where valves or fire hydrants may be opened or closed quickly,
- where plastic pipes are specified in zones affected by pressure variations (Note that pumping mains shall be constructed from metallic material).

The source of any significant pressure surges or high pressure areas shall be identified and remedial measures designed and specified. The system shall be analysed for the full range of anticipated rates of change of flow to determine the magnitude of the surge pressure in the system.

Unless a detailed analysis has been carried out to determine the maximum surge pressure, the specified pipe class shall be determined from the maximum allowable operating pressure plus the application of a surge safety factor in accordance with the table below:

SURGE FACTORS FOR PLASTIC PIPES

Pipe material	Surge factor
UPVC	2.0
MPVC	1.3
PE 100	1.25

E.4.3.5 Surge and fatigue re-rating of plastic pipes

Plastic pipes are susceptible to damage from cyclic loads. Whilst plastic pipes may be permitted in zones affected by pressure variations, e.g. downstream of PRV's and in high surge areas, it is essential that the pipe class be re-rated for both surge and fatigue.

E.4.3.6 Pressure creep and diurnal pressure variations

Water distribution systems shall be designed to control pressure creep and diurnal pressure variations. The diurnal pressure variations may need to be reduced by measures such as:

1. Supplying a sufficiently large number of customers from an interlinked network to reduce the effect of demand peaks;
2. Limiting the range of elevations served from each pipeline; and

3. For PRV zones, ensuring a sufficient number of customers to maintain sufficient minimum flow for the PRV to operate effectively.

E.4.3.7 System Upgrade

The existing water supply system or reticulation network may need to be upgraded (size and material) to accommodate the new development. All cost associated with system or network upgrades shall be paid for by the developer.

E.4.4 Fire fighting supply

Fire flows and fire storage shall be determined in accordance with the requirements of the New Zealand Fire Service Fire Fighting Water Supplies Code of Practice SNZ PAS 4509:2008 (the Fire Code)

The minimum running pressure in the main (at the hydrant) shall not be less than 100kPa and the spacing of hydrants shall be as provided for in the Fire Code.

Principal mains shall be fitted with fire hydrants, spaced as specified in the Fire Code, The actual pipe sizes will be determined by demand and the Fire Code requirements.

The design of the reticulation must ensure the fire flow requirements for each risk classification in the Fire Code can be achieved or the fire hazard in the premises must be reduced.

Developments outside a gazetted fire district with access to a public water supply should provide fire fighting protection through on site storage or an alternative supply.

Alternative fire fighting water sources as provided for in Appendix B of the Fire Code shall not be used for the provision of a fire fighting water supply in urban or reticulated areas.

Some commercial and industrial developments may require installation of special fire protection services. Whilst it is the responsibility of the property owner to provide these fire services, the developer shall design the water infrastructure to meet the required demands, where these are known in advance.

In high risk areas the fire flows shall be determined after consultation with the Fire Service Commission, to the approval of Council.

E.4.5 Water quality

A number of factors in a network can adversely affect the quality of water in the system.

The water reticulation network design shall minimise the risks of contamination being introduced into the network.

The pipe material selected should ensure minimal impact on water quality within the system. All parts of the water supply system in contact with drinking water shall be designed using components and materials that comply with AS/NZS 4020.

Drinking water systems are to be designed and equipped to prevent back siphonage. The location and operation of hydrants, overflow pipes, air valves and scours shall ensure no external water enters the system.

Stagnation and water age shall be minimised to ensure no unacceptable deterioration of water quality. The following arrangements shall be considered by the designer to avoid stagnation:

(i) Mains with dead ends shall be avoided by the provision of linked mains or looped mains. Particular care shall be taken at the boundaries between supply zones where dead ends shall be minimised.

(ii) Mains for short runs shall be looped where possible

E.4.6 Pipe work design

E.4.6.1 Sizing of mains

Principal mains shall have a nominal internal diameter of not less than 100mm in residential areas and not less than 150mm in commercial/industrial areas. The actual pipe sizes will be determined by demand and the Fire Code requirements.

The Council shall have the right to specify diameters for principal mains and material within the subdivisions or development areas. All costs associated with any increased sizing and material will be met by the developer unless otherwise agreed by Council.

In commercial/industrial areas the Council may request the subdivider to install a smaller main on one side of the street, with another larger main on the other side of the street.

In the CBD the pipe material shall be either Ductile Iron or Steel, with copper service connections.

Pipe sizes 200mm and above shall either be Ductile Iron or Steel

All pipe sizes and material shall conform to the standards set out in the Wellington City Council Water Supply Specification.

Mains shall be of adequate size necessary to ensure that residual pressures due to peak demands are not less than the minimum specified in this code.

By convention, PVC pressure pipes in New Zealand and Australia are usually referred to by their Nominal Internal size (i.e. DN50, 100, 150 etc., a carryover from their Imperial past) whereas the equivalent ISO dimension PE pipes are usually referred to and specified by their Normal Outside Diameter (i.e. DN63, 125, 180) as used in the ISO system.

Whilst the designer is concerned with the actual internal diameter as an essential part of the design, it is no longer acceptable to simply identify a pipe size as, for example '100mm'. It must be clear what dimension is being used (ID or OD). The pipe sizes shall be standardised as 100, 150, 200, 250, 300, 375, 400, 525 and 575 nominal diameters only.

E.4.6.2 Pipe pressure classes

Pipe pressure rating (PN) is to be established on the basis of design pressure (head) calculated for the various sections of the reticulation network. This may be varied by specific operational requirements specified by Council.

The minimum pipe and fittings pressure rating to be used for reticulation mains and service pipes shall be PN 16, although a higher class shall be used if necessary for the maximum working pressures in the area in which they are to be laid.

Designers shall verify Council's minimum requirements before specifying the required pipe class.

Council may nominate a pipe PN rating for pressure pipes and fittings to allow future operational flexibility within the reticulation network or to standardise on a limited number of pipe PN ratings.

Pipe Working Pressures

Pipe PN rating	Maximum working pressure		
	Metre Head	kPa	Former Pipe Class
16	160	1600	E
18	180	1800	F

E.4.6.3 Pipe standards

The following pipes may be used for principal mains, providing they comply with the relevant New Zealand Standard (refer to Wellington City Council Water Supply Specification)

Steel Pipes	NZS 4442
Ductile Iron Pipes	AS/NZS 2280
mPVC Pipes	AS/NZS 4765 (Series 2 dimensions)
uPVC Pipes	AS/NZS 1477 (Series 2 dimensions)
Oriented PVC (PVC-O) Series 2	AS/NZS 4441
Polythene (PE) Pipes	AS/NZS 4130

Pipe sizes 200 mm and above shall be either Ductile iron or Steel.

The following pipes may be used for rider mains and service connections providing they comply with the relevant New Zealand Standard:

Copper	NZS 3501
Polythene (PE) Pipes	AS/NZS 4130

All rider mains shall have a minimum internal diameter of 50mm.

E.4.6.4 Acceptability of Pipe materials

Asbestos cement and Galvanised steel pipes shall not be used.

All pipe materials and specifications shall comply with the Wellington City Council Water Supply Specification.

Concrete lined steel pipes may be required in potentially unstable ground, for lengths of exposed pipes, for pipe sizes 200 mm and above, where required by Council, or in other special cases, and should be the subject of specific design. Suitable corrosion protection shall be provided.

Ductile iron pipes may be appropriate for lengths of exposed pipe, or in other special cases such as for pipe sizes 200 mm and above.

uPVC, mPVC and PE pipes shall not be used where high concentrations of hydrocarbons are present as it may result in long term weakening of the pipe and reduction of the factor of safety, e.g. they shall not be used in close proximity to petrol stations or potential petrol station sites. They shall also not be used in industrial/commercial locations where there is a likelihood of large amounts of a product being used or produced that may infiltrate through the pipe wall. (E.g. solvents)

E.4.6.5 Head losses

The head loss through pipes and fittings shall be less than:

- 5m/km for DN =150 and less
- 3m/km for DN =200 or greater.

E.4.6.6 Hydraulic roughness values

The hydraulic roughness value considered in the analysis shall take account of the pipe material, all fittings, other losses (if any) and the expected increase in roughness over the life of the pipe.

The developer shall provide the formula and roughness coefficient used with the design calculations.

E.4.6.7 Mains layout and alignment

The layout of water mains shall provide for the efficient provision of the potable supply and fire fighting protection. It shall facilitate the provision of individual water metering to all properties within the city. In determining the general layout of mains, the following factors shall be considered:

The water main location is to allow continued access to fire hydrants and easy access for repairs and maintenance;

The mains layout must ensure system security, maintenance of water quality and the ability to clean mains to meet operational requirements;

Valves for shut-off areas and zone boundaries shall be appropriately located;

The layout of reticulation mains shall, where possible, provide a closed loop or ring main system with through mains so as to avoid termination points or dead ends and prevent poor water quality and provide alternative supply if any section is valved off for servicing. Use of reticulation mains smaller than 100 mm diameter should be considered to avoid dead ends, particularly in cul-de-sacs.

Where dead end mains cannot be avoided the water main shall terminate with a fire hydrant. No service shall be provided on the dead end side of the hydrant.

The location for the water main shall be in the carriageway, 1.4 m from the kerb face, unless special circumstances justify approval of an alternative location;

Water mains shall be located parallel to the kerb and channel and to other services where practicable.

Mains shall extend across the full frontage of all sections.

Under no circumstances shall sewer or stormwater drains or other services be laid in the same trench as water mains or services.

Water mains shall not be placed under footpaths, beneath verandas in the CBD or Suburban Centres

Mains are required on both sides of the road in the following cases:

- Major roads or roads with central dividing islands.
- Dual lane carriageways
- Roads with split elevation
- CBD and suburban shopping centres
- Parallel to Primary, Transmission or Distribution mains that are not available for service connections
- Industrial/commercial areas nominated by the Council
- Where required by New Zealand Fire Service Fire Fighting Water Supplies Code of Practice (SNZ PAS 4509)

In roads that may be extended in the future, mains shall be extended to within 6 meters (one pipe length) of the end of the legal road and terminated with a valve and the valve blank plated.

If a water main crosses under the carriageway, it shall be laid at right angles to the carriageway.

Water mains shall be laid continually from one street intersection to the next, being supplied with water at each end without cross connections to mains on the other side of the street between these points.

All water mains shall generally be laid in straight lines. Where water mains are laid on curves, the degree of deflection at joints shall not exceed the manufacturer's recommendation. Where the pipeline cannot be laid within the curvature deflection criteria, bends not sharper than 45° shall be used.

Any water main laid on a slope steeper than 1 in 5 shall be steel or ductile iron pipe suitably tied and anchored with headwalls. Any exposed sections of the water main may be required to be concreted in place.

The minimum cover to water supply pipes as set out in the Wellington City Council Water Supply Specification shall be achieved.

E.4.6.8 Grade Line

In any street, water mains shall be laid below a gradient line falling at 5 m per 1000 m of pipeline length, commencing from a point 10 m below the bottom water level of the supply reservoir

E.4.6.9 Level of hydrants

Notwithstanding the requirements for size of water mains, the maximum allowable ground level at hydrant locations shall be such that:

1. The level of the highest hydrant shall be 10 m below a hydraulic grade line falling at 6 m per 1000 m of pipeline length, commencing from the floor level of the supply reservoir.
2. The level of hydrants other than the highest shall be 10 m below a hydraulic grade line falling at 8 m per 1000 m of pipeline length, commencing from the floor level of the supply reservoir.

E.4.6.10 Rider Mains

The size of rider main shall be 50mm internal diameter

A 50mm rider main shall be laid to the road frontage of all sections not fronted by a principal main. Individual road crossings for a service connection will not be accepted.

Rider mains shall be supplied from a principal main at both ends, except for private ways or right-of-ways. Intermediate connections to a principal main will be required for rider mains longer than 100 meters in urban areas.

Rider mains shall where possible be connected to an independent principal main so that continuity of supply can be maintained when one of the mains is shut down.

All rider mains shall have at least one flushing point.

E.4.6.1 1 Mains in Cul-de-sacs

A water main of not less than 100mm internal diameter fitted with fire hydrants (hereinafter referred to as the principal main) shall be laid on one side of all through streets and on one side of every cul-de-sac to the cul-de-sac head. A 50mm rider main shall be laid around the cul-de-sac head from the end of the principal main and be looped back to the principal main. There shall be isolation valves at each end of the rider main and a flushing point.

E.4.6.12 Above-ground water mains

Flanged metallic pipes shall be used for all above ground water mains. The pipes shall be internally and externally protected for corrosion. The external protective material used to protect the pipe should be able to withstand UV radiation.

Attention should be taken when designing above ground water mains close to power lines.

The design shall include the design of pipeline supports, loading protection, stainless steel flanged, EPDM rubber bellow joint connections at each end of the pipe, protection of bellow joints and access requirements for maintenance.

Any exposed sections of the water main shall be concreted in place.

E.4.6.13 Maximum length of small mains

For level streets with 90 m initial pressure the maximum length of 100mm diameter main without other cross connections:

100 mm fed one end only	270m
100 mm fed both ends	540m

E.4.6.14 Service pipes

The service pipe off the principle main or rider main shall be laid at right angles to the main.

The minimum size of a service pipe shall be 20mm.

E.4.6.15 Pipe depth and minimum and maximum cover

The minimum and maximum cover for water mains shall be as set out in the Wellington City Council Water Supply Specification.

There may be situations where these requirements are not able to be met. In such situations special protection of the pipe is to be provided, subject to Council approval. The Council may specify a greater depth if required.

E.4.6.16 Pipeline tracer tape

The location of all non-metallic (e.g. PE and PVC) water mains and rider mains shall be marked with a foil tape/wire buried in the trench according to the Wellington City Council Water Supply Specification.

E.4.6.17 Bulk heads and trenchstops

Where pipelines are to be laid on steep grades construction of bulkheads and trenchstops shall be incorporated in the pipeline design and constructed across

the pipeline trench to prevent or impede the migratory flow of surface or ground water through the pipe bedding material.

The installation criteria for bulkheads and trenchstops for all pipe materials at various grades are set below.

Requirement for Bulkheads and Trenchstops		
Grade (%)	Requirement	Spacing (m)
5-14	Trenchstop	100/Grade
15-29	Concrete bulkhead	$S=L/Grade(\%)$, where $L_p=80 \times \text{Pipe length, m (450m max)}$ Where $L_p > 100$ – use intermediate Trenchstops at spacing $< 100/Grade(\%)$
30-50	Concrete encasement (continuous) and concrete bulkheads	$S= 100/Grade(\%)$
>50	Special design	

Bulkheads shall be in the form of a wall constructed from 20mpa concrete, not less than 150mm thick poured around the pipe and spanning the trench. The bulkhead is to be keyed into the trench walls and floor minimum 150mm, to form a pipe anchor and extend to within 150 mm of the finished surface level. Drainage holes should be placed in the lower part of the pipe bedding zone to control the flow of water past the bulkhead.

Trenchstops in the form of a wall of woven, 025mm minimum thickness, polyethylene bags filled with sand or cement stabilised sand packed around the pipe and spanning the trench shall be used for flatter grades, with the bags being stacked around the pipe and extending to within 150 mm of the finished surface level.

Where the natural transfer of water from the trench into the surrounding ground will not provided sufficient drainage, trench drainage shall be provided to divert the water to a suitable watercourse.

E.4.6.1 8 Anchor blocks

Cast in situ anchor blocks shall be designed to resist the unbalanced thrust due to greater of the design pressure or test pressure imposed at the anchorage location. They shall be designed to prevent movement of pipe bends in a vertical direction and based on a soil bearing value of 75kPa or on the actual bearing capacity of the site soils whichever is the lesser. A safety factor of 2 shall be used in the design. Construction requirements are set out in the Wellington City Council Water Supply Specification.

E.4.6.1.9 Thrust blocks

Cast insitu thrust blocks are to be designed to resist the total unbalanced thrust and transmit all loads to the adjacent ground. Calculation of the unbalanced thrust shall be based on the water main design pressure with an allowance for pressure up to the maximum water main test pressure

E.4.6.19 Swab inlets

Where required by the Council Swab inlets in conjunction with flush out points are to be installed in water mains of DN 100 or greater.

Specific designs will be required depending on the size of pipe, network configuration, location of discharge facility etc.

Swab inlets shall be located within a standard 600mm precast MH chamber and CI lid with the word "WATER" and painted blue.

The developer will be advised if swab inlets are required at the scheme plan stage or at the initial consultation stage with the Council.

E.4.6.20 Sampling points

Where required by Council 15 mm sampling points shall be set up at nominated points within the reticulation.

The sampling points shall be housed in a lockable steel cabinet.

The foundation, steel cabinet and drainage facility from the cabinet shall be approved by the Council.

The size, shape, appearance and the location of installation of the cabinets shall comply with the Wellington City Council Code of Practice for Working on the Road

E.4.6.21 Pipe fittings

Pipe fittings shall be of ductile or cast iron, or concrete lined steel and fabricated to withstand a working pressure of 160m and a test pressure of 180m.

All fittings shall be in accordance with the Wellington City Council Water Supply Specification.

uPVC fittings shall not be used.

Adjacent fittings and 'specials' shall be flanged and bolted together to form a single unit.

Stand alone fittings shall be, where possible, socket jointed to avoid the use of mechanical joint coupling.

Where dissimilar metals are used purpose made delrin thermoplastic inserts shall be installed in the flanges to prevent electrolytic action.

Subsequent to successful pressure testing of the pipeline the joints and couplings shall be wrapped with a double layer of Denso tape extending 150mm either side of the coupling.

E.4.6.22 Excavation and Trenching

Wherever possible, and where practicable, trenchless technology methods shall be used for constructing new services and water mains;

Trenchless technology may be utilised, particularly for alignments passing through:

1. environmentally sensitive areas
2. built-up or congested areas to minimise disruption and reinstatement; and
3. other areas not suitable for trenching e.g. railway and motorway crossings.

Excavation methods such as directional-boring (Guided boring), thrust-boring (Impact moling), micro-tunnelling and pipe-jacking may be used in order to lessen the impact of works on existing pavements and trees. The Council may require a ground penetrating radar survey be carried out along the proposed alignment for identification of other services. All process details including the location of access pits and exit points shall be submitted to Council for approval. The submission shall include how:

- (i) The required clearances from services and obstructions are to be attained.
- (ii) The depth at which the pipeline is to be laid to ensure minimum cover is maintained.
- (iii) The pipe support and ground compaction must be addressed.

E.4.6.23 Subsoil drainage of service trenches

Adequate provision for draining all service trenches, including water trenches on all hillsides shall be specified in the drawings.

Similar requirements in conjunction with more extensive subsoil drains may be necessary on flatter ground in wet areas.

E.4.6.24 Pipe bedding, laying and backfilling

All water mains installed by trenching shall be thoroughly bedded, laid, haunched, surrounded and backfilled in accordance with the Wellington City Council Water Supply Specification.

Water mains under existing vehicle crossings, footpaths, carriageways and in the vicinity of tree roots shall be thrust or bored wherever possible to keep the disruption of access to properties and damage to surfaces and vegetation to a minimum.

Where pipe thrusting and boring is proposed, the depth of thrusts/bore shall be the same as for general pipe laying. The pipes shall be installed in a straight line in accordance with the Wellington City Council Water Supply Specification. The alignment deviation (both vertical and horizontal) shall not exceed 150mm.

Where the new pipe crosses other services the required clearances shall be maintained.

E.4.7 Service Connections

E.4.7.1 Service Connections

All sections shall be supplied by separate service connections fed by individual service pipes or common water mains laid from the principal or rider main and constructed to the requirements of the Water Supply Specification. This applies to all land developments, including fee simple, cross lease and unit title subdivisions.

A separate service connection including a service manifold and service pipe is required to each separate residential dwelling unit.

The service pipe shall be laid at right angles to the main and the service shall terminate at the point of supply with an approved service manifold in an approved manifold/meter box.

The minimum size of any residential service connection shall be 20 mm nominal inside diameter.

Where individual services larger than 20 mm are proposed these shall be subject to Council's approval

If approved they shall be installed with an approved back flow preventer and service valve positioned at the point of supply.

The location of the service pipe and manifolds/valves shall be shown on the construction drawings.

Where information on flows and pressure at the connection point are not available, the developer shall engage a Council approved contractor to undertake tests at the nearest hydrant(s) to the point of connection.

Service connections to commercial and industrial properties is subject to specific design and approval.

E.4.7.2 Point of supply

The point of supply is the point on the service pipe which marks the boundary of responsibility between the customer and the water supply authority, irrespective of property boundaries.

The point of supply to an individual customer is the customer's side of the tail piece of the service manifold or service valve if there is no manifold installed.

Where water meters are installed separately and not as part of a manifold then the point of supply shall be customer's side of the tail piece of the meter.

E.4.7.3 Location of the point of supply

For single dwelling units the centre of the service manifold shall be located 450 mm from the boundary, in the berm wherever possible, or as close as possible where fences, walls or other permanent structures make it difficult to locate it at the required position. Other positions shall require specific approval.

For front sections (or dwelling units with individual street frontage) the point of supply shall be at the service manifold adjacent to the street boundary.

Back sections (or dwelling units without individual street frontage) of up to two dwelling units shall have separate service connections at the street frontage as for front sections. The terminal ends shall be clearly pegged.

In rights-of-way or private streets the service valve shall be in common land.

Where more than two sections are serviced by a Right of Way a 50mm ID rider main shall be laid in the Right of Way with separate service pipes and manifolds off that rider main for each section. The point of supply for each section is to be within the Right of Way, adjacent to the section served.

There shall be an easement in favour of the Council over the land the rider main, service pipes, and the manifolds are installed

If a subdivision of a section for two dwelling units is anticipated, a separate 20mm service pipe and manifold for each unit should be installed at the subdivision construction stage.

The position of the service manifold should be in front of the expected dwelling or at the side of the expected driveway. If the positions are not known the two manifolds shall be at one quarter and three-quarters section width across the frontage.

E.4.7.4 Tapping bands

All service connections from a principal main and rider main up to 40/50mm shall be made via a tapping band and a Talbot swivel ferrule, in accordance with the Wellington City Council Water Supply Specification.

Large service connections shall be made via a Tee.

E.4.7.5 Service valve boxes

New service valves (manifolds) shall have a HDPE valve box at the point of supply. The valve box shall have a black lid having the wording "WELLINGTON CITY COUNCIL WATER SUPPLY".

New manifolds with a manifold meter shall have a HDPE valve box at the point of supply. The valve box shall have a blue lid having the wording "WELLINGTON CITY COUNCIL WATER METER".

All valve boxes are to be installed with HDPE bottoms.

All gate valves shall have cast iron 200mm x 200mm valve boxes and concrete surrounded.

E.4.7.6 Backflow Prevention

Backflow prevention shall be incorporated into the water reticulation design, to protect the potable water supply at the point of supply.

For industrial and commercial properties backflow prevention shall be installed on the owner's side as close as practicable to the point of supply at the point of supply.

The backflow prevention shall be specifically designed according to the flow requirements, the hazard of the particular premises, and to the approval of Council.

The type and location of backflow preventers shall comply with all relevant legislation and standards including but not limited to the Building Act 1991 and the Health Act (Drinking Water) Amendment Act 2007.

The premises owner is responsible for arranging annual testing and forwarding compliance certificate to the Council.

E.4.8 Fire service (fire prevention or fire fighting) connections

Developers are advised to consult NZS 4541 prior to applying for fire connections. The Council may only be able to supply water from mains supplied from one source as therefore Developers are advised to consult the appropriate authorities to satisfy the classification of their fire fighting systems. Dual fire connections may be given with a valve in between the connections to a building from a water main that is being fed from both directions.

Where a fire service connection is required to service a property this connection shall typically consist of a connection off the serving main via a tee and sluice valve immediately adjacent to the tee.

All fire connections shall be subject to Council approval.

Fire connections shall be separate from the domestic connection to the section supplied, although a single metered domestic connection may be taken off the fire connection where Council approval is given; except that no more than one domestic connection shall be provided to any one building, irrespective of how it is configured.

Where adjacent separate fire and domestic connections are taken from the same main their connection points on the main must be separated by a distance of at least 2 metres.

The minimum nominal size for fire service connections is 50mm, with commercial and industrial connections having a minimum size of 100mm.

Metallic pipes shall be used in all fire service connections.

The point of supply for fire connections is the upstream face of the valve. Council owns and maintains fire connections up to the upstream face of the valve adjacent to the connection Tee (the point of supply). The valve, connecting pipe from the valve through to the property boundary and beyond is the responsibility of the property owner.

Only Council approved contractors can install fire connections.

Fire service connections and supplies shall not be used for any other purposes.

Council is under no obligation to provide a fire service supply at any particular flow or pressure.

Council may require metering of the fire service connection.

Prior to the physical installation of the fire service connection, an approved backflow prevention device must be fitted (by the customer), in the fire service control room or closest other approved practical point.

E.4.9. Public fire mains on private property

Council may require, for the purpose of fire protection, a public fire main to be laid within large privately owned residential, commercial or industrial complexes. Where this is required an easement shall be provided in favour of Council to allow access and repairs to the main at all times.

E.4.10. Hydrants

Hydrants complying with the Wellington City Council Water Supply Specification shall be fitted at intervals of not more than 90 m in commercial and industrial areas and 135 m in residential areas on mains 100 mm and over as per the New Zealand Fire Service Firefighting Water Supplies Code Of Practice.

Only hydrants for scouring and for special fire risks are required on mains 250 mm and over where these mains are without service connections and there are adequate hydrants on parallel mains.

Hydrants shall be provided on water mains at high points and downstream of valves for releasing air and at low points and upstream of valves for scouring mains.

Hydrants associated with main line valves are needed only every two or three intersections. See Drawings A4-8929/1- WC and A4-8929/2- WC.

Hydrants shall be provided at intersections and in the vicinity of special fire risks.

Terminal hydrants shall be located in the carriageway.

There shall be a hydrant at the end of any main 100 mm diameter or larger, and at any reduction in diameter below 100 mm, whether temporary or permanent.

The location of terminal hydrants in cul-de-sacs shall be as shown on Drawings A4-8929/3- WC and A4-8929/4- WC.

Services on dead end mains shall be connected upstream of the terminal hydrant to the arrangement shown on Drawings A4-8929/3- WC and A4-8929/4- WC.

Every dwelling shall be within the hose lay distance as provided in the NZ Fire Service Firefighting Water Supplies Code of Practice.

Hydrants shall be marked on the road by the subdivider with a yellow lid, yellow triangle and where required with a circle as provided in the NZ Fire Service Firefighting Water Supplies Code of Practice.

E.4.11 Valves

E.4.11.1 General

All valves shall be supplied and installed in accordance with the Wellington City Council Water Supply Specification.

A holistic view of the existing supply network and the proposed additions shall be taken in determining the location of new valves.

Valves shall be sited to provide the required control (flow, pressure, isolation, diversion, etc.)

The number and location of valves shall be optimised to enable their safe operation.

Valve layout shall minimise the effect of a shutdown on Council's customers.

Account shall be taken of traffic and other site peculiarities. Access to valves shall be readily available. The design shall avoid clustering of valves at intersections.

Valves sizes 450mm and above shall have a bypass valve. The minimum size of the bypass valve shall be 100mm.

E.4.11.2 Sluice valves

Sluice valves shall be used on principal mains.

They shall be resilient seated valves, anticlockwise closing and with non- rising spindle. Cast iron spindle caps shall be attached. Generally valve operation will be by valve key but in some cases the Council may require a handwheel to be installed.

The maximum distance between valves on water mains with services shall not exceed 450 m.

The maximum distance between valves on mains without services shall not exceed 900 m.

Valves are required at every intersection as shown on Drawings A4-8929/2-WC.

Valves are required adjacent to the principal main at branches so as to isolate a secondary or rider main from the principal main (refer to Drawings A4-8929/1-WC and A4-8929/2-WC).

Valves shall be rated to match pipe pressures with higher rated seatings etc. to accommodate expected pressures.

E.4.11.3 Gate valves

Gate valves used on rider mains shall be resilience seated and clockwise closing with a ductile or cast iron handwheel.

E.4.11.4 Butterfly valves

Butterfly valves shall only be used with the specific approval of Council.

Note the use of butterfly valves will generally be limited to motorised valves and unburied pump station installations, and shall not be used in reticulation mains as they hinder swabbing operations.

E.4.11.5 Stop valves or Line valves

Stop valves are used to limit the size of shut off area when a main is taken out of service. In line stop valves shall be the same diameter as the reticulation main.

Stop valves shall be positioned so that in general not more than 40 dwelling units shall be isolated together in any shutdown. This requirement may dictate the maximum spacing requirements outlined above.

Stop valves will generally be sluice valves and shall be located at street intersections and along the line of the main as required.

The location of stop valves shall take into consideration the operational and maintenance needs of the system so that continuity of supply can be maximised as well as the safety of personnel.

E.4.11.6 Air valves (AV) and Air Release valves

Appropriately sized air and vacuum valves shall be installed where appropriate. The valve shall be able to automatically exhaust large quantities of air during

filling of the main and allow air to re-enter the main during draining or when a negative pressure occurs.

Use of Air release valve may be permitted only in special cases

Where there is low hydraulic head special consideration shall be given to the type of AV to prevent water leakage from the valve.

AV's shall be installed with an isolating valve to permit servicing or replacement without having to shut down the main.

AV's shall not be located in major roadways or areas subject to flooding.

Investigation into the need for AV shall be made, and when required, air valves shall be located:

- At summits (high points) particularly at points more than 2m higher than the lower end of the section of water main and particularly if the main has a steep downward slope on the downstream side.
- At intervals of not more than 800m on long horizontal , ascending and descending sectors;
- At every increase in downward slope;
- On the downstream side of Pros;
- On the downstream side of major isolating valves;
- At blank ends where installation of a fire hydrant is not suitable.

Where the AV is in a valve chamber, the design shall ensure adequate venting for effective operation and drainage to prevent backflow contamination.

E.4.11.7 Pressure reducing valves

The use of pressure reducing valves (Pry's) is to be avoided where possible in proposed water supply schemes. Council approval is required for any proposals that call for the installation of Pry's.

Where the use of a PRV is approved the design and installation is to be in accordance with the Wellington City Council Water Supply Specification.

E.4.11.8 Pressure zone dividing valves

Pressure zone dividing valves and hydrants shall be installed in one of the following arrangements;

1. Valves in a paired configuration with a standard fire hydrant located between them. Installation in this manner permits the valves to be checked for leakage. The valve on the low side of the pair will normally be closed in order for the fire hydrant to be used for fire fighting purposes with the supply from the higher pressure zone.
2. A valve with a standard fire hydrant on each side.

E.4.12 Water Meters

E.4.12.1 General

All non-residential connections must be individually metered. In the case of combined residential/non-residential usage on the property the combined supply shall be metered.

Residential properties with commercial usage and those with spa and swimming pools in excess of 10m³ capacity shall be metered.

Properties considered to be supplied with an extraordinary supply shall be metered.

Water meters may be required to be installed in new developments for monitoring or charging purposes.

Water meter installations may be requested by Council or by the customer through Council's voluntary metering scheme.

Council retains the sole ownership rights of all water meters and is responsible for their ongoing maintenance.

Meters shall normally be installed as part of the service manifold. Where this is not suitable the meter shall be located in the road reserve within the berm area on down stream side of the point of supply (out of any vehicle paths) and must be accessible at all times for reading and maintenance.

All meters are to be provided with a Council approved HDPE meter box as provided for in the section on service valve boxes above.

All cost associated with meters, valves and strainers shall be paid by the subdivider/developer or applicant.

E.4.12.2 Multi-unit and multi-level developments

Multi-units are non-freestanding individual buildings.

Multi-level units are buildings with separate titles on more than one floor.

Water meter connections to all multi-unit developments shall be assessable from the street level at the point of supply.

Multi-units shall be serviced by individual meters. Meter banks fed from a single connection may be used with specific approval of Council.

Multi-level units shall use water meter bank(s) or bulk meters fed from a single connection may be used where a Body Corporate will be responsible for all water meter charges covering individual units. Council approval will be required for the type of meter installation proposed.

Fire and rider mains may have to be extended into privately owned sites to service multi-unit developments.

E.4.12.3 Bodies corporate

Body Corporates are set up under the Unit Titles Act 1972 to administer 'common' property, particularly where individually-owned land or buildings are inherently connected.

Where meters are associated with the development:

1. The sharing of existing water meters or payments is at Councils discretion;
2. Body Corporate rules are to include clauses regarding payment of water charges that are to Councils satisfaction;
3. New shared meters are not permitted for new unit title developments;
4. For both single-meters and multi-meters, the Body Corporate will determine each unit-owners water usage and will levy each unit-owner;
5. The Body Corporate must attend to the prompt payment of water charges in respect of the levy determined by Council's single water meter on the property.

E.4.12.4 Area meters

Where appropriate in new multi-lot developments and greenfield developments, Council may require the Developer to install area meters at nominated locations.

Electromagnetic flow meters are to be installed as Area meters. The Council will specify the location where electromagnetic flow meters are to be installed. The meters are to be housed in manholes with adequate drainage.

The electromagnetic flow meters are to be connected to Council telemetry system.

The developer is to arrange power supply for meter operation.

E4.13 Obstructions and clearances

E.4.13.1 Underground services

The location of underground services affecting the proposed pipe alignment shall be determined. Where pipes cross other services, the depth of those services shall be investigated, and exposed where necessary.

E.4.13.2 Clearance from high voltage transmission facilities

Water mains constructed from metallic materials shall generally not be located close to high voltage transmission lines and other facilities.

Special design shall be undertaken if it is necessary to locate metallic mains close to such facilities. Such design is subject to approval Council and the utility operator.

E.4.13.3 Water supply pipes crossing other utilities

The water supply pipe may be laid crossing another utility service as per the Wellington City Council Water Supply Specification

E.4.13.4 Clearance from underground services

For normal trenching and trenchless technology installation, clearance from other service utility assets shall not be less than the minimum vertical and horizontal clearances as detailed in Wellington City Council Water Supply Specification. Written agreement on reduced clearances and clearances for shared trenching shall be obtained from Council and the relevant service owner prior to the commencement of any work.

E.4.13.5 Clearance from structures

Pipes adjacent to existing buildings and structures shall be located clear of the 'zone of influence' of the building foundations.

If this is not possible, a specific design shall be undertaken to ensure protection of the pipeline and the existing structure or building.

The protection shall be specified by the designer for evaluation and acceptance by Council.

Sufficient clearance for laying and long term access for maintenance is also required.

E.4.13.6 Building alongside a public water main

Structures are to be located no closer than 1.5 metre measured horizontally from the barrel of any public water main where the pipe is less than or equal to 50mm in diameter.

Structures must be located no closer than 2.0 metre measured horizontally from the barrel of any public water main where the pipe is greater than 50mm in diameter.

Structures which are located within 3 meters measured horizontally from the barrel of the pipe must have the base of the foundation deeper than a line drawn at 30 degrees from the horizontal from the invert of the pipe.

Balconies may overhang the line of the pipe provided the balcony is cantilevered and its height above ground level is not less than 1.8m.

E.4.13.8 Deviation of mains around structures

Deviation of a pipeline around an obstacle can be achieved by deflection at pipe joints and with bends in accordance with the Wellington City Council water supply specification.

E.4.13.9 Corrosive soils

Special measures shall be taken to protect the main and fittings in areas of corrosive soils in accordance with the Wellington City Council Water Supply Specification.

E.4.13.10 Contaminated sites

Pipes used in contaminated sites shall be metal and either butt welded or flanged.

The pipes shall be internally and externally protected to protect the pipe from the contaminant. The protective material selected should be able to protect the pipe line from the contaminant for the design life of the pipe.

Information on protective coating material, material data sheet and performance test data of the protective material shall be submitted to the Council.

E.4.14 Reservoirs

E.4.14.1 General

All newly created sections are to be fed from publicly owned reservoirs in dedicated water supply zones, for minimum and maximum pressures to be achieved at the point of supply. This is to ensure all sections can be serviced on a sustainable basis with at least the minimum level of pressure and flow set by

Council, as well as minimising the risk of contamination of the supply by maintaining minimum pressures in the supply network.

The reservoir is to be located at a location where telemetry signals could be received and transmitted to Council telemetry system.

The size of the reservoir shall be able supply all newly created sections, future growth (available developable land) and fire fighting requirement. Subdividers/Developers are advised to consult the District Plan

The design shall show details of wall fittings, pipe penetration details through the wall and floor and details of pipe support and restrain. It shall be the responsible of the designer to ensure that the proposed reservoir location is capable of receiving and transmitting uninterrupted telemetry signals from the Council's telemetry network

It is recommended that the design and construction plans be discussed with Council before these are formally submitted.

Council aims to avoid small individual reservoirs, associated with new developments, in favour of larger reservoirs providing greater community benefit, especially for contingency storage.

The setting up of a new reservoir to supply less than 100 sections will not be considered.

Publicly owned community service reservoirs must provide water to meet daily supply demands to ensure consistency and continuity of supply to customers.

Publicly owned community service reservoirs must provide fire fighting storage reserves, in accordance with the requirements of the New Zealand Fire Service Firefighting Water Supplies Code of Practice, which requires minimum quantities of water to be held for fire fighting purposes.

The capacity of the reservoir is such that it should hold 24hrs storage to enable an ongoing availability of water in the event of an emergency or burst pipes required taking into consideration future growth potential.

E.4.14.2 Storage

The minimum storage required is 600 litres per person (please refer to E3.6), in addition to the fire storage provision required by the Fire Code. A minimum reservoir size of 250 m³ shall be provided where storage is required.

The proposed storage volume shall be approved by Council.

Council reserves the right to provide the storage and charge the developer the cost of providing it.

Depth of reservoirs shall not exceed 6 m but in exceptional circumstances depth up to 7.5 m deep may be considered.

The reservoir shall have an inside dividing wall or circular compartment to hold at least 20% of the volume of the reservoir to supply the zone while the balance volume is emptied for carrying out maintenance work.

E.4.14.3 Technical requirements

The reservoir shall be located at an appropriate height so that properties at the highest location receive a pressure of 25 metres at the point of supply measured from the bottom water level of the reservoir and properties at the lowest location receive a pressure not more than 90metres from the top water level of the reservoir at the point of supply without the use of a PRV valve.

Reservoirs shall have appropriately sized valve chamber to house inlet and outlet control valves, cross connection valve between inlet and out let, auto shut off valves, flow meters, control and monitoring equipments etc.

All reservoirs shall be supplied by their own dedicated, appropriately sized pumping main.

Supplying the reservoir through the city's reticulated network will not be permitted.

Council may permit one pumping main to supply more than one reservoir provided all the reservoirs supplied by a pumping main is kept 95% full at all times and the risk associated with this arrangement is minimum.

The outlet main from the reservoir shall be appropriately sized to supply the proposed zone during peak demand plus fire fighting supply without the need to supplement the zone from another zone.

Reservoirs of capacity less than 500m³ may be freestanding depending on the location, future plans, community and interest groups preference, maintenance cost and Council's policies at the time of the proposal.

Reservoirs of capacity 500m³ and above shall be buried and graded to facilitate natural drainage. The area on top of buried reservoir shall be grassed and landscaped to the requirement of Council

The reservoir shall have all weather access road and parking space for a large truck and a small vehicle. The road and parking space shall be built in accordance with Section "C" of this Code.

The land around reservoirs shall be fenced with lockable gates and vested in Council as Water supply land.

Reservoir depth monitoring equipment shall be fitted to all reservoirs as provided for in the Wellington City Council Water Supply Specification.

Depth monitoring and telemetry equipment shall be to the approval of Council.

E.4.14.4 Reservoir Design

The design and construction shall be to the latest codes and standards.

The structure shall be designed for a minimum service life of 100 years to all relevant standards and Codes.

The reservoir structure shall be a Category 1 structure as defined in table 2.3.1 of NZS 4203 and designed for all Code loading requirement to withstand a water level at least 450mm higher than the overflow crest level, independent of surges due to earthquake.

The roof shall be designed to withstand surges or surcharge within the reservoir.

The reservoir must also be designed for rapid changes in its water level and be suitable for excavation for repairs at any point around outside of the reservoir and to operate at 95% full under normal supply conditions.

Circular reservoirs are preferred although site requirements may dictate alternative shapes.

Only concrete reservoirs will be permitted.

Reservoir walls shall be cast insitu reinforced or prestressed concrete or precast concrete.

Precast column, beam and roof units are acceptable.

The dimensions and shape of the reservoirs shall provide structural efficiencies, resist earthquake movements and be economical to maintain.

The subdivider/developer will carry out appropriate geotechnical investigation to design the foundation for the reservoir. A summary report of the geotechnical investigation shall be attached to the construction drawings.

Where the ground condition is incongruous, foundations shall be designed to overcome the situation.

The reservoir design must ensure adequate circulation at all times (to prevent short circuiting and uneven chlorine distribution).

An external sampling point must be provided to give access to a representative water sample.

Reservoirs shall have scour and overflow connections with sumps in the floor positioned opposite to the inlet. Fall shall be provided in the floor to the sumps and the sumps connected to the scour.

Under floor drain system shall be placed below the reservoir floor. The trench for under floor drains shall be excavated to a true line and grade.

Under floor drains are to be laid in grade and with smooth curves so that upon completion of the floor and after completion of the reservoir the drains can be inspected with a CCTV camera.

The under floor drains are to be wrapped with durable geotextile and stone wrapped with clean durable stone,

Perforated high density polyethylene pipe with 6.5mm diameter perforations, at 76mm centres shall be used for under floor drains.

Up stream end of all under floor drains are to be capped to prevent ingress foreign material.

The under floor drain system shall discharge into the valve chamber and be pumped into the reservoir overflow system, but prevented from surcharging the floor under overflow conditions.

The under floor drain system discharge points shall be clearly marked by means of permanent engraved signs to allow the source of any leakage through the floor to be identified.

Pipe penetration in the floor and wall shall be waterproofed.

The design shall minimise the risk of contamination and for buried reservoirs, be strong enough to take the required amount of fill and any other activities that are envisaged.

The outside walls of the reservoir shall be leak tested and water proofed before placing backfill against it. Leak testing and waterproofing shall be in accordance with the Wellington City Council Water Supply Specification.

E.4.14.5 Pipework

Inlet, outlet mains, scour mains and vents shall be provided in accordance with the Wellington City Council Water Supply specification.

E.4.14.6 Valve Chamber

A valve chamber shall be constructed at the side of the reservoir in the best location with regard to pipework alignment and landscaping requirements.

Valve chambers shall be above ground wherever practicable.

Access into the valve chamber shall be through a side door, or roof hatch for buried chambers, with internal platform and stair access to the pipework and valves at a lower level.

Where a tunnel/gallery arrangement is proposed two levels may not be necessary.

E.4.14.7 Landscaping

The reservoir and associated landscaping shall be designed so that the completed work compliments the surrounding environment. The landscape plan shall be approved by the Council.

E.4.15 Pump stations

E.4.15.1 Provision of pumping stations

A pumping station will be required where the development requires water to be supplied to the development from a new storage reservoir.

It is recommended that location of the pump station, construction details and power supply be discussed with Wellington City Council before these are formally submitted for approval.

It shall be the responsible of the designer to ensure that the proposed pumping station location is capable of receiving and transmitting uninterrupted telemetry signals from the Council's telemetry network

The pump station building shall be designed and built to the relevant codes and standards including the appropriate Building Code to resist earthquake induced loads.

The pump station shall be sound proofed and adequately sized to house stand-by pump/s, electrical, mechanical and control equipment required for the functionality of the pumping station.

Pump control equipment shall be provided as necessary and shall be installed in a monitoring hut or pumping station to the approval of the Council.

Council will take over the suction main, pump station and the rising main upon completion.

Where water supply schemes include pump stations, etc. designs shall include, where appropriate, relevant functional and operational planning aspects.

E.4.15.2 Design of pumping stations

The pump station shall be designed to have sufficient flow capacity to deliver the total maximum day volume requirement within a pumping period not exceeding a total of 12 to 15 hours per day, without using standby units.

All pump stations shall have 100% stand-by capacity.

Water is to be supplied to the pump station from the following sources:

1. The bulk water supply network, (The bulk water supply network is owned and operated by Greater Wellington Regional Council).
2. Trunk mains (Major distributor mains that do not have service connections off them)

The pump station shall be supplied from these mains via a primary or suction main (The dedicated suction mains supplying bulk water to pump stations, these mains do not have service or fire connections or connections to distribution mains)

Council may require some mains in the water supply network to be upsized to satisfy the above condition for which the full cost of upsizing the mains are to be paid for by the subdivider/developer.

The subdivider/developer shall pay for the connection to the bulk water network or Council main, suction main, pump station and pumping main.

E.4.15.3 Suction main

The suction main shall be of metal pipe, internally and externally protected, appropriately sized to deliver the required amount of flow, velocity and have a net positive suction head (NPSH) greater than the NPSH required for the selected pump, at the pump.

The velocity in the suction main shall be greater than 0.80 metres per second and not exceeding 1.4 meters per second at all times.

The connection of the suction main to the source main shall be off a tee and have an isolation valve to isolate the suction main.

E.4.15.4 Pumping Mains (Rising mains)

The pumping main from the pump station to the reservoir shall be constructed of metallic material, internally and externally protected, and appropriately sized to supply the maximum flow that the pump could supply.

The velocity of flow shall be greater than 0.85 metre per second and shall not exceed 2 metre per second in all cases. The preferred velocity is approximately 1.5 meters per second.

The pumping main shall be sized on the basis of least total cost including capitalised power costs over 30 years.

Thrust blocks and anchor blocks shall be constructed at bends and required locations to transmit loads to the adjacent ground and prevent pipe movement

Pumping mains supplying storage reservoirs shall be dedicated mains used solely for the purpose of delivering water to the reservoir. Delivery to storage reservoirs shall not be via the reticulation network.

E.4.15.5 Valves

Isolation, scour and air valves shall be provided in conjunction with pump stations in accordance with the Wellington City Council Water Supply Specification.

An emergency supply point connection may be made between the rising main and the delivery main. The ideal location to make this connection is within the valve chamber with a closed valve. The connection shall be isolated with two valves.

E.4.15.6 Pump and Motors

Pumps and motors shall be in accordance with the Wellington City Council Water Supply Specification.

E.4.15.7 Pump station buildings

Buildings shall be designed to blend into the existing streetscape or environment. This may be achieved through landscaping and suitable planting.

Building construction, including earthworks, shall comply with relevant codes and standards.

E.4.15.8 Mechanical and Electrical Installation and Structural Steel Fabrication

All mechanical and electrical Installation and structural steel fabrication shall be in accordance with the Wellington City Council Water Supply Specification.

E.4.15.9 Continuous monitoring and telemetry

Continuous pump station monitoring be provided via the WCC telemetry system. The subdivider/developer shall liaise and arrange this with Council.

E.4.15.10 Antenna

Antenna selection and installation will be determined by Council.

E.4.15.11 Automatic control

The pumping station shall be designed for automatic control with protective devices fitted in accordance with the Wellington City Council Water Supply Specification.

E.4.15.12 Security of Water Supply Facilities

Hand access lock box type locks shall be provided on all doors, lids and chamber covers that require limited access for operational or security purpose. All newly constructed facilities shall be keyed to Council's security system prior to the hand over.

E.4.15.13 Site Access

Site Access is to be via a sealed surface and allow maintenance vehicles access up to doorway of pump station for unloading and loading of pump sets.

E.4.15.14 Landscaping

The pump station and associated landscaping shall be designed so that the completed work compliments the surrounding environment.

Council requirements in relation to the finished appearance of the structures, landscaping and planting shall be met.

The landscaping shall be designed to minimise covers to pipework and any proposed planting should not interfere with underground pipework.

E.5 WATER SUPPLY CONSTRUCTION

E.5.1 Construction requirements

E.5.1.1 General

All water supply technical and construction requirements relating to materials, excavation, pipe laying & jointing, backfilling, pipeline testing & disinfection,

reservoir & pumping station construction, electrical works and commissioning of water supply facilities shall be in accordance with the requirements of the Wellington City Council Water Supply Specification.

E.5.1.2 Approval of drawings

Construction of water supply facilities shall not commence unless Council has given written approval for the construction plans. Four copies of approved construction plans shall be provided prior to the commencement of construction.

E.5.1.3 Commencement of work

The preferred sequence for water main laying is after the kerb and channel construction. Alternatively the proposed kerb and channel location may be clearly pegged out and the water main then laid. If for any reason where the location of the pegged out kerb and channel is altered after the water main laying, then the laid water main also **must be moved** in relation to the altered location of the kerb and channel. This is to ensure that the water main is at a suitable line and level in relation to the finished road surface and also to allow time for the survey to be made of permanent marks in the kerb upon which the pickup of the water main is based.

E.5.1.4 Access to Council's water supply system

Council's maintenance contractor and Council approved New Connections Contractors have exclusive access to Council's water mains. These contractors install all new connections on behalf of Council.

The maintenance contractor performs shutdowns and associated cut-in works on Council's water supply system.

Where a development is planned involving extensions to the public water supply system, subject to Engineering Plan Approval issued by Council, these works may be undertaken by the developer's contractor. It is recommended however, that an approved Council contractor be used for such works. As above, all cut-in works must be carried out by a Council's approved contractor.

E.5.1.5 Testing and acceptance

On completion of the pipe laying and jointing and installation of thrust and anchor blocks, sufficient backfill materials shall be placed over the pipes to prevent movement during pressure testing, leaving joints, fittings and anchor blocks visible.

Before joints and fittings are covered each section of the reticulation, together with all specials and fittings connected thereto shall be tested by the Designer in the presence of the appropriate Council officer.

The test shall be carried out, and all necessary apparatus supplied, by the Designer/Contractor in accordance with the requirements of the Wellington City Council Water Supply Specification.

Provision shall be made for the installation of the Council officer's test apparatus in the test set up if required. The Council shall be notified in advance of the test date and time as Council officers may witness the test.

All testing work shall be at the developers cost.

E.6 TESTING AND COMMISSIONING

E.6.1 Approval of water supply system

Subsequent to the receipt of a request for clearance by the developer Council will inspect the site to check for achievement of the Code and Wellington City Council Water Supply Specification requirements, including the following:

1. That all pipes, valves, fittings, etc., have been installed as shown on the as-built/construction drawings, unless written approval has been given by Council for any variation from the construction drawings.
2. That all surface boxes for service valves, manifolds, valves and hydrants are correctly positioned to line and level.
3. That all valves, hydrants and service valves can be satisfactorily operated.
4. That reservoirs, associated pipe works, mechanical and electrical works have been constructed to design, tested and test certificates submitted
5. That pumping stations, pumps, mechanical and electrical works have been constructed to design, tested and test certificates submitted

Clearance will not be given until satisfactory "As Built" plans have been provided and all outstanding matters have been satisfactorily addressed, including that all required easements have been registered, and where required land has been vested in Council as Water Supply land.

A Producer Statement to cover the construction of the works from an appropriately qualified and experienced person shall be provided. It shall include the statement: "The water supply facility has been constructed in accordance with the Wellington City Council Water Supply Specification and the assumptions made in the design have been fulfilled in the construction." This statement shall not be qualified.

Upon being given clearance the assets will become the responsibility of the Wellington City Council as part of the water supply system.

E.6.2 Connection to existing reticulation

Before any new water main is connected to the existing reticulation, the Contractor shall arrange for Council to witness the pressure test and disinfection of the main. Council's certification of both the successful pressure test and the satisfactory disinfection of mains is required before connections can be undertaken.

The physical work of connecting new facilities to the existing water supply reticulation shall be undertaken by a Council approved contractor after the new facilities have been tested and passed as satisfactory. The cost of the connection work shall be met by the developer.

E.6.3 Disinfection

The new water supply facilities shall be disinfected and bacterial tests undertaken before being put into service in accordance with the Wellington City Council Water Supply Specification. Zero E.Coli and Total Coliforms counts shall be achieved in the bacterial testing before the facilities are commissioned.

All disinfection activities shall be at the developers cost.

E.6.4 Water mains to be kept charged

After any water main has been laid and tested and disinfected, it shall be kept charged with water, and under pressure. If the permanent connection to the existing reticulation is delayed, a temporary small diameter connection shall be made from the existing reticulation. The Fire Service shall be notified accordingly and it shall be the developer's responsibility to notify the Fire services.

Pressure must be maintained in the watermain while electric power and other underground services are being laid in the vicinity.

E.6.5 Commissioning of Pump Stations

The suction main, pumps and the pumping main shall be disinfected and tested prior to commissioning.

Following the receipt of a request for clearance by the developer Council will inspect the pump station to carry out a range of operational checks.

Where water is supplied to the pump station from the bulk water net work, the suction main, pump station and the pumping main up to the inlet vale of the storage reservoir, upon completion will be taken over by the Greater Wellington Regional Council.

Where water is supplied to the pump station from a Wellington City council owned primary or trunk main, the suction main, pump station and the pumping main, upon completion will be taken over by Wellington City council.

Council will take over the facility upon passing of all tests and receipt of the following documentation:

- Three sets of pump station operation manuals shall be provided. The content shall include information on all components within the pump station including pump set maintenance, pump performance tests.
- Any software related to the pump station shall be provided to the Council.
- All electrical, mechanical and civil drawings are to be provided in both hard copy and electronic form.

E.6.5.1 RTU Commissioning

All electrical and mechanical components shall also be tested as provided in the Wellington City Council Water Supply Specification.

Commissioning of RTU communications shall be carried out by Council Telemetry engineers.

E.6.6 RESERVOIRS

E.6.6.1 Testing of reservoirs

The reservoir and pipes are to be sterilised, pressure tested and leak tested as provided for in the Wellington City Council Water Supply Specification

Water for testing and sterilising may be provided by the Council. The developer shall pay for all water used.

E.6.6.2 Reservoir Commissioning

The reservoir shall be commissioned as provided for in the Wellington City Council Water Supply Specification.

Approval certifying that the reservoir is satisfactory for water supply use is required from the Ministry of Health. It is the developer's responsibility to liaise with Regional Public Health Services up to the time the reservoir is put into service.