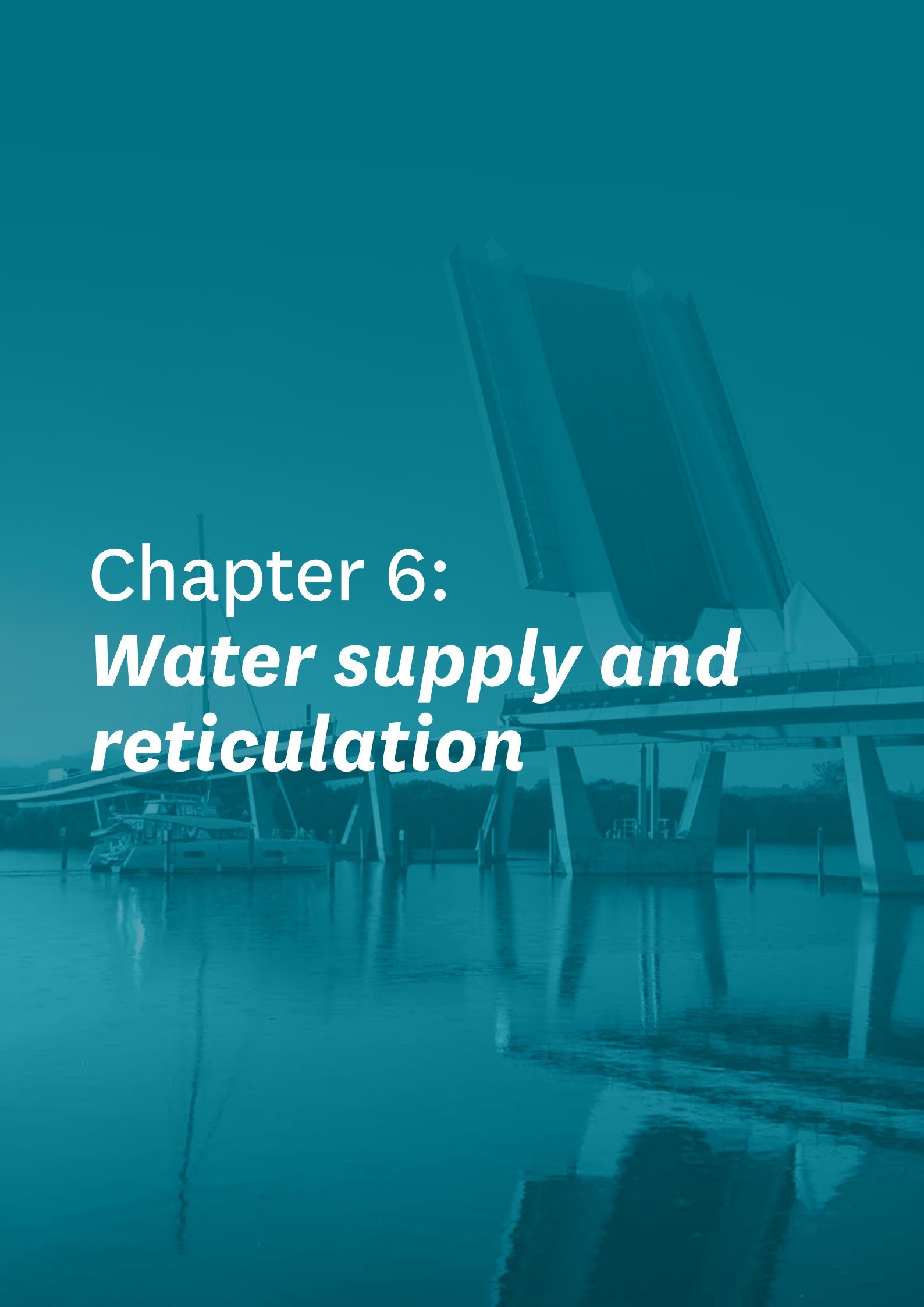

Chapter 6:
Water supply and reticulation

6.1. Introduction

6.1.1. Water Supply System Description and Expectations

This section covers the requirements for design and construction of all extensions and connections to the WDC's water reticulation system. A connection to WDC system shall be provided to all lots within Living and Business Zones unless WDC confirms in writing that a connection is unwarranted, unavailable or unsuitable.

Connections in other Zones will be subject to the availability of a water supply. The WDC may however require that a water supply be provided to a development, regardless of the Zone, if WDC considers that the connection would be a logical extension of an existing supply.

6.1.2. Objectives

The objectives of the water reticulation system are:

a. To supply the required quality and quantity of water to all properties as required by legislation and to meet or exceed the WDC's performance standards.

b. To control the design and construction of water networks in order to ensure an acceptable water supply is available for each property, including fire flows, by providing:

   i. A watermain allowing an appropriate supply to each property, and

   ii. Service connections from the main to the point of supply to each residential property.

c. To ensure that water networks meet the minimum design life requirement, taking into account structural strength, design loadings, soil conditions and water conditions (internal and external corrosion).

d. To ensure that water networks are cost efficient over their design life while accounting for environmental and community impacts through integrated three waters management and water conservation.

e. To ensure that where properties or household units are not within a water supply area or an extension of such an area, water is collected, treated and supplied in a way that is consistent with relevant building code and other national standards.

f. To ensure that where properties connect to a water supply network, that network shall meet the WDC's performance standards.

6.1.3. Performance Standards

New water supply works connected to a Water Supply Area shall be designed and constructed to achieve the following minimum standards:

a. Minimum pressure of 250 kPa at the point of supply for existing residential lots and for new connections at the building platform.

b. Minimum flow rate of 15 litres per minute at the point of supply for existing residential lots and 20 litres per minute for new connections.

c. Be designed and installed to ensure that the works will meet the Drinking Water Standards for New Zealand 2005 (Revised 2018) and the relevant water safety plan.

d. Provide firefighting pressure and flow in conformance with the SNZ PAS 4509:2008.

e. Achieve the specified minimum design life for systems/assets to vest with the WDC.

f. All pipelines and fittings fixed by accurate positioning and the coordinates of those positions specified in terms of the WDC's coordinate specifications in Section 1.7.2 As-Built Plans, Asset Information Schedules, Operation and Maintenance Manuals and Appendix F Drawing Standards:

g. Comply with all relevant structure plan requirements and pipe sizes set by WDC in order to provide an integrated approach to development.

h. The supply shall be capable of serving the entire development and any undeveloped land beyond, when that land is developed to the ultimate development intensity.

6.1.4. Reference Documents

The following documents are referenced in this Chapter:

Note it is the responsibility of the Developer to ensure the most up to date referenced document is sourced.

6.1.4.1 Statutory

NRC Regional Plans

Resource Management Act 1991

Water Services Act 2021

Water Supply Bylaw 2012

6.1.4.2 New Zealand Standards

AS 1831:2007 - Ductile cast iron

AS 3996:2019 - Access covers and grates

AS/NZS 2033:2008 - Installation of polyethylene pipe systems

AS/NZS 2280:2020 - Ductile iron pipes and fittings

AS/NZS 2638.2:2011 - Gate valves for waterworks purposes - Part 2: Resilient seated

AS/NZS 4087:2011 - Metallic flanges for waterworks purposes

AS/NZS 4129:2020 - Fittings for polyethylene (PE) pipes for pressure applications

AS/NZS 4130:2018 - Polyethylene (PE) pipes for pressure applications

AS/NZS 4158:2003 - Thermal-bonded polymeric coatings on valves and fittings for water industry purposes

AS/NZS 4673:2001 - Cold-formed stainless steel structures

NZS 4404:2010 - Land development and subdivision infrastructure

NZS 4442:1988 - Welded steel pipes and fittings for water, sewage and medium pressure gas

NZS 4522:2010 - Underground fire hydrants

NZS 7643:1979 - Code of practice for the installation of unplasticized PVC pipe systems

SNZ PAS 4509:2008 - New Zealand Fire Service firefighting water supplies code of practice

6.1.4.3 WDC Documents

Approved Materials List - Water Services (*To be provided by WDC on request*)

Briefing Document – EES 1: Waste Water Pump Stations Electrical Engineering Standards (*To be provided by WDC on request*)

General Specification for Installation of Watermains (*To be provided by WDC on request*)

Hygiene Code of Practice for All Personnel working on the Water Production and Distribution System (*To be provided by WDC on request*)

Public Utility Connection/Disconnection application form

Quality Assurance / Quality Control Manual for Vested Assets - Inspection and Handover Procedures (2010)

Specification for Registered and Licensed Contractors for Water Supply (*To be provided by WDC on request*)

Specification for the Installation of Service Connections (*To be provided by WDC on request*)

WDC Policy 0020 - Backflow Prevention Policy and Code of Practice 2012

WDC Urban Design Guidelines

6.1.4.4 Other Referenced Documents

Drinking Water Standards for New Zealand 2005 (Revised 2018)

ENZ Producer Statement – PS1 Design

PIPA - POP010A – Polyethylene Pressure Pipes Design for Dynamic Stresses

PIPA- POP101 – PVC Pressure Pipes Design for Dynamic Stresses

WIS: 4-24-01 - Specification for Mechanical Fittings and Joints for Polyethylene Pipes of Nominal Sizes 90 to 1000

Waka Kotahi – M/7 Roadmarking Paints (2009)

6.1.5. Private Water Supply Systems

The Water Services Act 2021 provides that all water suppliers have a duty to ensure their water is safe to drink.

All drinking water suppliers and supplies must be registered with Taumata Arowai.

Small isolated developments outside existing water supply areas may be served by private water supply systems. These systems may serve either single or multiple lots.

Private water supply systems shall only be approved as potable water supplies if they comply with the Drinking Water Standards for New Zealand 2005 (Revised 2018), and operation and monitoring systems are implemented to ensure ongoing compliance of the system with the Drinking Water Standards for New Zealand 2005 (Revised 2018), where applicable.

The Developer is advised to consult with and shall obtain any necessary approvals from the WDC, Fire and Emergency New Zealand, Northland Health and the Northland Regional Council.

6.1.6. Upgrading of Existing Water Supply System

Where the existing reticulation or a proposed extension cannot comply with the minimum flow or operating pressure requirements, the Developer may be required to provide and install elevated storage and/or booster pumping systems to the approval of the WDC.

6.1.7. Connection to Existing Water Supply System

6.1.7.1 Work on Existing Watermains

Where work is required on or over existing watermains, the Developer may be required to lower, move or protect the main to ensure cover and separation distances are met.

Only a Licensed Contractor will be permitted to work on existing live watermains (see 6.3.1 Licensed and Registered Contractors).

The Developer shall pay the full cost of this work.

6.1.8. Disconnections

Where an existing water supply connection to a development is no longer required or is not adequate the existing connection shall be permanently disconnected.

WDC approval is required for disconnections from the water supply network to ensure continued network integrity and quality of supply.

Disconnections shall only be undertaken by a WDC Licensed Contractor.

A WDC Public Utility Connection / Disconnection Application shall be submitted to WDC and approved before any work may be undertaken.

A WDC representative shall inspect all disconnections before back-filling takes place. All WDC owned fittings including meter and backflow preventer shall be returned to the WDC.

6.2. Design

6.2.1. Engineering Design Approval

6.2.1.1 Content of Design Submission

In addition to the general requirements in Section 1.5.3 Engineering Design Approval, the information submitted for an EDA of water supply design shall provide, as applicable, the following:

a. Include analysis of the water demand for consumption and firefighting. Firefighting flows for industrial land shall be obtained from SNZ PAS 4509:2008, based on type and size of industry,

b. Include analysis of potential water hammer, surge and fatigue effects and demonstrate appropriate mitigation measures are incorporated into the design,

c. Demonstrate that the existing and proposed water supply reticulation is adequate and identify existing and proposed connection points to serve the proposed development,

d. Where the proposal would use more than 10% of the capacity of the existing water source and/or treatment facilities, demonstrate that the existing water source and/or treatment facilities are adequate to serve the proposed development,

e. Demonstrate that required firefighting pressures and flows can be met from all hydrants and service connections,

f. Submit details of any system components that do not meet the performance standards (Section 6.1.3 Performance Standards), i.e. components with design lives less than 100 years, and

g. Contain Producer Statements forms (refer to PS1 Design) identifying the design standards used, and certifying that the design complies with the ES.

All analysis shall include appropriate supporting information, calculations, reports, etc. to enable an external review to be undertaken without reference back to the design originator.

For industrial uses, the type and size of industry used to establish water use and the Water Supply Classification for firefighting supply shall be identified. This information will be put on the relevant property files by the WDC.

Any departures from the ES shall be noted and fully justified. Such assessment shall be carried out by a SQEP who is working within their competencies in accordance with the requirements of Section 1.5.1.3 Risk Based Assessment Framework. The SQEP shall identify the design standards used and certify that the design complies with the referenced standards.

The SQEP shall certify that the works through all stages until completion are in accordance with the requirements of Section 1.5.1.3 Risk Based Assessment Framework.

Note: Refer to Appendix A Design for Surge and Fatigue for details of designing for surge and fatigue.

6.2.2. Design Criteria and Scope

6.2.2.1 General Requirements

Proposed water supply works shall be designed for connection to a WDC approved location on the existing water supply network.

The WDC may specify the diameters and classes of pipes to be used for all reticulation within the development and specify reticulation alignment.

SQEP shall consider the hydraulic adequacy of the network including the specified levels of service, water quality and impact on the existing network.

For design purposes, and subject to availability, WDC may:

a. Provide details of the working pressure of the existing water supply network, or of pressures at the approved connection point to the existing reticulation, and

b. Provide details of the capacity of existing water supply facilities.

Where this information is not available from WDC records, or further information is required for the design, the Developer shall consult with WDC regarding the completion of any investigations.

The Developer shall cover the cost of investigations required to complete their design to the ES.

6.2.2.2 Scope of Design

The scope of design shall include:

a. Pipe sizes, material, and layout of the reticulation,

b. Hydraulic design,

c. Service connection locations, including multi-connection box locations,

d. Types and locations of valves, hydrants and other similar control devices

e. Thrust blocks and anchors (where applicable),

f. Pipe cover and protection appropriate to expected loading,

g. Bedding and backfill, and any specific installation requirements (e.g. pipe anchors/bulkheads), and

h. Preparation of construction specifications.

Design drawings shall comply with the requirements of Section 1.5.3.3.5 Design Statements and Engineering Drawings and Appendix F Drawing Standards and the following requirements:

a. Infill developments (not exceeding four lots): may be shown on combined services design drawings, and

b. All other developments: water reticulation shall be on separate drawings from other services.

6.2.2.3 Domestic Demand

The design shall provide for annual, seasonal and peak domestic demand, and allow for a minimum domestic demand of 300 litres/person/day.

6.2.2.4 Commercial and Industrial Demand

The water demands for commercial and industrial areas, and for irrigation shall be analysed and specifically allowed for in the design.

6.2.2.5 Peak Flows

Peak Flows (PF) shall be calculated as follows:

Peak Day Demand (over a 12-month period) = Average Day Demand x PF, where;

a. For populations below 2,000 PF = 2,

b. For populations above 2,000 the WDC shall specify PF.

Peak Hourly Demand = Average Hourly Demand (on peak day) x PF (over a 24-hour period) and where:

c. For populations below 2,000 PF = 5,

d. For populations above 2,000, the WDC shall specify PF.

The minimum flow for an individual 20 mm ID residential connection shall be 20 litres per minute at the meter location.

6.2.2.6 Pressure Fluctuations

The design shall ensure that large pressure fluctuations caused by variations in usage are avoided.

Unless otherwise approved by WDC, head losses in existing and new mains at peak flow shall be limited to:

a. DN less than or equal to 150 mm: 5 m per 1000 m of pipeline

b. DN greater than or equal to 200 mm: 3 m per 1000 m of pipeline.

6.2.2.7 Flow Velocities

Pipelines shall be designed for flow velocities within the range of 0.5 – 2.0 m/s.

6.2.2.8 Operating Pressures

The minimum service water pressure, in other than firefighting conditions, shall be 250 kPa at the ground level of each lot.

Where minimum service water pressure cannot be met, a booster pumping system may be required. Provided that the water supply reticulation satisfies firefighting performance standards, private pumps serving up to five lots may be provided. The lot owners shall be jointly responsible for ongoing maintenance of the booster system and this responsibility shall be registered on the affected property titles.

The preferred operating pressure in the reticulation system shall be 400 kPa or the working pressure, whichever is the lesser. The WDC may require that a pressure reducing valve be installed to reduce the pressure in any development to 400 kPa or below.

For the purpose of pipeline design, the maximum static water pressure at ground level for any lot shall be 600 kPa, unless otherwise approved by the WDC. In cases where the static pressure exceeds 600 kPa, a pressure reducing valve may be required.

6.2.2.9 Capacity and Future Expansion

SQEPs shall allow for the effect on existing and potential future development in an area when determining whether there is capacity to serve a subdivision.

The WDC has the discretion to make a final decision on water availability.

Where future development beyond the current development boundaries is practicable, reticulation (sufficient to serve the future development) shall be extended to the boundaries of the current development. Costs of the extensions shall be at the Developer’s expense.

Where applicable, the Developer shall provide a blanked off line to serve future development. WDC may require installation of additional pipelines or fittings in order to prevent stagnant areas occurring in the extended reticulation prior to any future development proceeding.

6.2.3. Piped System Layout

6.2.3.1 Mains and Rider Mains

Mains and rider mains shall in general be located within public road reserves.

A principal main shall be laid on at least one side of all carriageways. The WDC may also require principal mains on both sides of arterial and dual carriageway roads, and also in industrial subdivisions.

A rider main shall be laid along the road frontage of all lots not fronted by a principal main including the circular head of cul-de-sacs. Rider mains shall be designed as ring mains, with a connection to a principal main at both ends as shown in **Sheet 45**. Fire mains may be required in a private way or private road to meet proximity requirements for buildings. See Section 6.2.9.2 Hydrant Locations for hydrant locations.

The order and layout of watermains and other underground services shall be in accordance with **Sheet 29** and **Sheet 30**.

Water mains shall have a minimum clearance, between the outside edges of the water service and any other service, of:

a. 500mm, or

b. three times the water service diameter,

whichever is the greater, or

c. the greater of the required clearances between the relevant services as shown on **Sheet 30**.

Watermains shall always be laid at a higher level than wastewater pipelines to avoid cross contamination.

6.2.3.2 Reticulation on Private Property

Location of WDC owned reticulation within private property, or down right-of-way or private roads, requires specific approval from the WDC.

Approval of public reticulation located in private property or right-of-way will depend upon:

a. the number and length of connections required, and/or

b. the requirement to provide fire cover that complies with SNZ PAS 4509:2008.

If approved, the following shall be provided:

a. An easement in favour of WDC over the private property, right-of-way or private access,

b. The main shall be laid in a duct,

c. The required minimum clearances from other services (refer to **Sheet 30**) shall apply, and

d. Valves and surface boxes shall be located in berms, clear of carriageways where practicable.

The WDC may require the legal width of the access to be greater than the minimum specified in Section 3.2.27 Private Accessways in order to ensure minimum clearances from other services.

Details on points of supply are as stated in the WDC Water Supply Bylaw 2012.

6.2.3.3 Minimum Cover

The minimum cover between the top of the pipe and finished ground level for all reticulation shall be:

a. 600 mm in areas not subjected to traffic loading, or

b. 900 mm under carriageways and trafficked areas.

The WDC may require greater depth of cover in certain circumstances.

Any pipelines that cannot achieve the minimum pipe cover requirements shall:

a. Be specifically designed by a SQEP to support the likely loading in relation to the actual cover to be provided, or,

b. Be provided with pipe protection in accordance with **Sheet 32**.

All pipes with less than 500 mm cover under carriageways shall be laid in a larger protective duct.

Where excavations for entrances to developments encounter existing water supply reticulation, then those pipelines shall be relocated to comply with the cover requirements of this section. The Developer shall cover the cost of relocation of the existing reticulation to provide compliant cover.

The sections of pipe adjacent to a carriageway crossing shall be gradually deepened either side of the carriageway, to allow the required cover to be achieved under the carriageway without provision of vertical bends. Air valves may be required on the resulting crests in the pipe.

Service connections shall not have less than 600 mm cover under footpaths and berms terminating at a meter manifold as per **Sheet 46**. Reduced cover is accepted where the service line connects to the main and as the service line approaches point of supply.

6.2.3.4 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 practicable, a Specific Design shall be undertaken to cover the following:

a. Protection of the pipeline,

b. Long term maintenance access for the pipeline, and

c. Protection of the existing building or structure.

Any such proposals shall be considered an Alternative Design (Section 1.5.1.2 Alternative Designs). Approval shall be at the discretion of the Water Manager.

Sufficient clearance for laying and access for maintenance is also required. Table 6-1 may be used as a guide for minimum clearances for mains laid in public streets.

Table 6-1: Clearances from Structures

Pipe Diameter (DN)	Minimum Clearance to wall or building (mm)
<100	600
100 to 150	1000
200 to 300	1500
375	2000

Note: These clearances shall be increased for mains in private property (even with easements) as access is often more difficult and the risk of damage is greater.

6.2.3.5 Watermains Near Trees

Pipes shall not be installed within the tree dripline.

6.2.3.6 Clearance from Existing Reticulation

Where any pipe or cable is laid alongside existing water reticulation then a separation of at least 1m is to be maintained where practicable so as not to disturb the existing trench.

6.2.3.7 Aerial Pipes and Pipe Bridges

Any such proposals shall be designed by a SQEP and considered an Alternative Design (See Section 1.5.1.2 Alternative Designs) and approval shall be at the discretion of the Water Manager.

If a pipe bridge is approved by WDC for construction, the following Specific Design requirements shall be satisfied:

a. The underside of the pipe bridge structure shall be a minimum of 300 mm above the 1% AEP (+ CC 20%) flood levels.

b. Where pipelines are fixed to road bridges, they shall be installed on the downstream face of the bridge and shall be located above 1% AEP flood levels.

c. Piles shall be concrete unless specifically approved by the WDC

d. Pipe materials shall ductile iron or coated steel and shall be provided with an appropriate Petrolatum wrapping as per clause 3.6 of the WDC General Specification for Installation of Watermains.

e. The Developer shall be responsible for obtaining all necessary building and/or resource consents.

6.2.3.8 Thrust and Anchor Blocks

On all mains exceeding 50 mm diameter where no end restraint is available, concrete anchor blocks shall be provided at all valves, bends, tees, reducers and dead ends. Refer to drawings WS-003, 004 & 005 in NZS 4404:2010 for further detail.

Generally, anchor/thrust blocks are not required on PE mains, except where a connection is made to an unrestrained pipe or fitting.

The size of anchor block bearing surfaces shall be specifically designed. **Sheet 50** gives guidelines for shape and size for a soil with a bearing pressure of 100 kPa and a design pressure of 1500 kPa. These shall be confirmed by a SQEP at the time of design.

Anchor block concrete shall be ordinary grade concrete supplied from a graded plant and have a minimum compressive strength of 17.5 MPa at 28 days. All anchor blocks shall be poured using adequate formwork, with the bearing surface poured against an undisturbed soil surface. A protective wrapping shall be provided between the pipe and concrete.

If reticulation is being extended from the end of an existing pipe with a blank cap and thrust block, the thrust block shall be removed, and the new pipe continued in the same alignment as the original pipe.

6.2.4. Fire Service Requirements

6.2.4.1 Fire Risk Classification

A “normal single family home” will have a classification FW2. Other buildings with a sprinkler system fitted to an approved standard may have a classification of FW2.

All other buildings are classified according to Table 1, SNZ PAS 4509:2008.

6.2.4.2 Fire Fighting Water Requirements

The minimum standard of water supply for firefighting shall be as set out in Table 6-2.

The required flow shall be obtained from the maximum number of fire hydrants as scheduled within an accessible distance of 270 m of any fire risk. The accessible distance is via a route from the fire hydrant to the property, following roads, driveways or rights of way.

For maximum hydrant spacing refer to Section 6.2.9.2 Hydrant Locations.

The water supply requirements for fire protection systems shall be considered in addition to firefighting water supplies. All firefighting water requirements are additional to the expected daily demand.

The minimum firefighting residual running water pressure shall be 100 kPa at any fire hydrant. For industrial subdivisions, the water supply classification to which the system has been designed shall be stated. Following approval, this classification shall be registered against all property titles as a consent notice, noting that the design does not necessarily account for future consumption from other large users.

For large industrial sites, the requirements of SNZ PAS 4509:2008 may not be able to be met from existing Water Services infrastructure. In such cases, the Developer shall provide a supplementary supply. The Developer shall establish requirements and obtain approval for such a supply from the Fire Service and provide evidence of this approval with the consent application.

Where any development is of such a nature that the required flows cannot be achieved without serious negative effects on the system, the Developer shall install sprinklers or provide an alternative means of firefighting to the satisfaction of the NZ Fire Service.

For non-reticulated firefighting water requirements refer to SNZ PAS 4509:2008.

Table 6-2: Simplified Method for Determining Fire Fighting Supplies

Water Supply Classification	Water flow within an accessible distance of 135m (l/s)	Additional water flow required within an accessible distance of 270m (l/s)	Water storage time (min)	Water storage volume (m^3)	Maximum number of fire hydrants to provide flow
FW1	7.5		15	7	1
FW2	12.5	12.5	30	45	2
FW3	25	25	60	180	3
FW4	50	50	90	540	4
FW5	75	75	120	1080	6
FW6	100	100	180	2160	8
FW7	As calculated (see note 7 below)				

Refer to Table 1 SNZ PAS 4509:2008 for Water Supply Classification.

Notes – (from SNZ PAS 4509:2008)

(1) Table 1 lists the minimum requirements for firefighting water supplies. In developing towns' main reticulation systems, a water supply authority needs to cater for domestic/industrial water usage in addition to the above. This procedure is outlined in Appendix K. of the Standard

(2) Special or isolated fire hazards which have higher requirements in an area of lower water supply classification shall determine measures to mitigate the hazard or increase the water supply (see 4.4).

(3) Where houses have a sprinkler system installed to an approved Standard, the distance to a fire hydrant or alternative water supply may be negotiated by agreement with the Fire Region Manager.

(4) The water requirements for fire protection systems shall be considered in addition to the firefighting water supplies, as detailed in table 1 (FW2), the fire protection system demand plus 1500 L/min (25 L/s) at 1 bar residual pressure.

(5) The minimum flow from a single hydrant shall exceed 750 L/min (12.5 L/s), except for those cases where a home sprinkler is installed, in which case the minimum is 450 L/min

(7.5 L/s) while the maximum design flow, for safety reasons, is limited to 2100 L/min (35 L/s).

(6) If the minimum water storage requirement as listed in the above table is not available from the reticulated system (reservoir), water can be sourced from an 'alternative supply' as approved by the Fire Region Manager. This water supply shall always be within 90 m of the fire risk.

(7) FW7 is for either special or isolated hazards or where the fire hazard due to the size of the largest firecell and its fire hazard category make specific fire engineering assessment necessary. Appendix H and J [SNZ PAS 4509:2008] shall be used as the basis for calculating this required firefighting water supply.

(8) See Appendix B [of SNZ PAS 4509:2008].

6.2.4.3 Dedicated Sprinkler and Fire Fighting Watermains

Dedicated sprinkler and firefighting watermains require specific approval from the WDC.

Design of sprinkler systems shall demonstrate that the minimum operating pressure of 250 kPa is available.

All dedicated watermains for sprinkler systems shall have a WDC approved testable double check (or RPZ) detector backflow prevention device together with isolation valves for testing, located within, but as close as practicable to the property boundary. The owner shall be responsible for the ongoing maintenance of the sprinkler system.

All dedicated private firefighting watermains with hydrants connected to them shall have an RPZ backflow prevention device together with isolation valves for testing located within, but as close as practicable to the property boundary together with an electromagnetic water meter, or NZ Insurance WDC approved meter. The backflow prevention device shall be mounted above ground level and be protected by a cage to avoid damage. The hydrants shall not be used for any purpose other than firefighting.

6.2.4.4 Domestic Sprinkler Systems

Domestic sprinkler systems shall be designed to run at a pressure of no more than 250 kPa, which is the target minimum operating pressure at customer meters.

If the sprinkler system is a dead-end system and not linked to the internal plumbing, then a backflow preventer shall be installed.

All sprinkler systems shall be metered.

6.2.5. Design Life

All elements of water supply networks shall be designed and constructed for a design life expectancy of at least 100 years.

Where components of the water supply network, such as pumps, metering, control valves, and control equipment require earlier renovation or replacement, it shall be considered an Alternative Design (see Section 1.5.1.2 Alternative Designs) and assessed as a departure from the ES, requiring specific approval by the Water Manager. The proposed water works shall document the asset renewal requirements for each

component in the Operations and Maintenance Requirements, which shall be provided with EDA.

6.2.6. Approved Materials

Materials and products used on water networks shall comply with the relevant NZ standards and be from the WDC Approved Materials List - Water Services.

The use of material not described in the WDC Approved Materials List - Water Services shall be considered an Alternative design (see Section 1.5.1.2 Alternative Designs) and shall require specific approval from the Water Manager.

The WDC Approved Materials List - Water Services will be updated from time to time at the discretion of the WDC.

Materials and pressure ratings for pipelines greater than DN 150 shall be determined by Specific Design and in consultation with the WDC.

6.2.7. Pipe Selection

6.2.7.1 General Requirements

The size, class and material of water supply mains shall be selected to achieve the objectives and meet the performance standards set out in Section 6.1.2 Objectives and Section 6.1.3 Performance Standards.

Pipeline sizes shall allow for future growth, both infill and extension.

6.2.7.2 Standard Pipe Sizes

Pipelines shall be standardised as DN 50, 100, 150, 200, 250, 300, 375, 450, 525 and 600 mm nominal internal diameter only. The WDC shall specify the diameter of larger pipes.

Design documentation and drawings shall clearly indicate whether diameters of pipes are specified as inside (ID) or outside (OD) diameters.

Principal Main sizing shall be in accordance with Table 6-3. Rider Main sizing shall be in accordance with Table 6-4.

Table 6-3: Empirical Guide for Principal Main Sizing

Nominal diameter of main DN	Capacity of main (single direction feed only)			
	Residential (lots)	Rural residential (lots	General/light industrial (ha)	High usage industrial (ha)
100	40	10	-	-
150	160	125	23	-
200	400	290	52	10
225	550	370	66	18

Nominal diameter of main DN	Capacity of main (single direction feed only)			
	Residential (lots)	Rural residential (lots	General/light industrial (ha)	High usage industrial (ha)
250	650	470	84	24
300	1000	670	120	35
375	1600	1070	195	55

Table 6-4: Empirical Guide for Rider Main Sizing DN 50 Rider mains

Pressure	Maximum number of household units	
	One end supply	Two end supply
High> 600kPa	20	40
Medium 400 to 600kPa	1530	30
Low <400 kPa	715	15

6.2.7.3 Minimum Pipe Sizes

Minimum pipe sizes shall be as set out in Table 6-5.

Table 6-5: Minimum Water Supply Pipe Sizes

Reticulation Hierarchy	Minimum ID (mm)
Industrial Area Main (Business 4)	150
Industrial Rider mains	100
Principal Main (other Zones)	100
Residential Rider main	50
Residential Service Connection	20

6.2.7.4 Pipe Class

Standard approved pipe classes are given in Table 6-6. Other classes shall not be used, except with WDC's specific approval.

Table 6-6: Pipe Classes

Class of Pipe and Fittings	Maximum Working Pressure	
	Head (m)	kPa
Class 12 (PN12.5)	120	1200
Class 16 (PN16)	160	1600

6.2.7.5 Pipe Materials

The following pipe materials are approved for use:

a. PE80/PE100 to AS/NZS 4130:2018,

b. Ductile Iron to AS/NZS 2280:2020, and

c. Steel to NZS 4442:1988.

Watermains shall be constructed using PE80 or PE100 unless otherwise approved or required by the WDC.

PE pipes shall conform to the following requirements:

a. Rider mains and service connections of 50 mm ID and under shall use solid blue PE 80 pipe or black internally with a blue outer skin,

b. PE 80 and PE 100 watermains with a nominal ID of 100 mm or greater shall be black internally with a blue outer skin, and

c. The blue outer skin shall be co-extruded with the internal material and have a thickness equivalent to 10% of the pipe wall thickness unless otherwise approved by the WDC. The Developer shall provide evidence of the blue outer skin thickness.

Note: Blue, or black with blue stripe pipes or ducts shall not be used for any application other than potable water supply within the Whangārei District.

Note: PVC is not an acceptable pipe material for new installations, it shall only be used for repair work carried out by the WDC.

Note: Steel or ductile iron will only be approved where the use of PE is not appropriate, e.g. in above ground applications.

Note: Use of steel or ductile iron is subject to specific WDC approval, which will require evidence of tight quality control of fabrication and construction.

Note: Steel and ductile iron pipes shall have a spun concrete lining not less than 6 mm thick, and an external coating of extruded blue HDPE as detailed in the WDC Approved Materials List - Water Services. Care shall be taken not to damage the coating during handling and installation. No welding is permitted after the protective coatings have been installed on the pipes.

6.2.8. Valves, Fittings and Marking

6.2.8.1 General

All valves and fittings shall be in accordance with WDC Approved Materials List - Water Services (See also Section 6.2.6 Approved Materials).

6.2.8.2 Sluice Valves and Peet Valves

6.2.8.2.1. Types

Sluice valves used on principal mains shall be ductile iron Resilient Seated valves to AS/NZS 2638.2:2011 and fully nylon coated to AS/NZS 4158:2003. They shall be bi-

directional, anti-clockwise closing, have raised flange faces to AS/NZS 4087:2011 and shall be provided with cast iron spindle caps.

The depth to the top of the spindle from the finished ground surface shall be, where practicable, between 75 mm and 250 mm and the spindle shall be truly vertical. Where depth to the spindle exceeds 500 mm a spindle extension shall be used to bring the top of the spindle between 75 mm and 250 mm of the surface.

Peet Valves used on rider mains shall be ductile iron Resilient Seated valves to AS/NZS 2638.2:2011 and fully nylon coated to AS/NZS 4158:2003. They shall be clockwise closing with a ductile iron handwheel. They shall have threaded end connections to which a 63 mm PE compression coupling can be screwed.

Use of butterfly valves is subject to Specific Design and approval shall be at the discretion of the Water Manager. If approved they shall meet the following requirements:

a. Be anti-clockwise closing, and

b. Be fitted with travels tops and a special type of spindle or cap dolly, which differs from those for sluice valves.

6.2.8.2.2. Location of Valves and Fittings

Valves shall be arranged so that a shutdown of any section of watermain will affect as small an area as practicable.

Valves located at intersections shall be fixed on all legs of a tee or cross installation and shall, where practicable, be located in berm areas free of the carriageway.

A peet valve is required on rider mains at the connection to the principal main. Where there are more than 15 connections on the rider main, an isolating peet valve shall be provided in the middle of the rider main.

Valve layout on the principal and rider mains shall enable the rider main to be flushed through the nearest hydrant. Where this is not practicable a scour valve may be required.

Where the rider main is a continuation from the end of the principal main in the same direction, the end of the principal main shall be provided with a peet valve immediately after the reducer.

The maximum spacing of valves shall be in accordance with Table 6-7.

Table 6-7: Valve Spacing

Water Main Size DN	No of Property Service Connections (nominal)	Maximum Spacing of Valves (m)
≤ 150	40	300*
200 - 300	100	750
≥ 375	150	1000

Water Main Size DN	No of Property Service Connections (nominal)	Maximum Spacing of Valves (m)
* In rural areas, the maximum spacing may be increased to 500 m		

6.2.8.3 Air Release and Scour Valves

Air Release and Scour Valves shall be located within the network, as required, to provide effective release of entrained air and effective flushing of the system. The WDC may specify the type, number and/or location of air release and scour valves.

Air release valves shall be ductile iron and be a combination type as per the WDC Approved Materials List - Water Services. They shall be installed in a fully draining box as per **Sheet 51**.

A connection to a suitable drainage system shall be provided for all scour points where practicable.

6.2.8.4 Pressure Reducing Valves

Pressure reducing valves may be required by WDC where water pressure is greater than 600 kPa and a significant number of properties are affected or potentially may be affected (typically over a distance of 500 m and affecting more than 40 lots).

Pressure reducing valves shall be installed as per **Sheet 52**. Pressure gauges are required upstream and downstream of the valve. Only valves as specified by the WDC Approved Materials List - Water Services shall be used.

The valve shall be installed in an approved chamber with isolating valves to allow removal.

6.2.8.5 Valve Marking

The position of all valves on watermains shall be indicated by a WDC approved reinforced concrete indicator post bearing with the inscribed letters ‘SV’, ‘AV’, ‘BV’ or ‘PV’ in black to indicate either sluice valves, air valves, butterfly valves or peet valves, respectively and shall be in accordance with **Sheet 48**.

A concrete mowing strip 150 mm wide shall surround the post when it is set in the grassed berm.

The correct main size in millimetres and the distance between marker and valve in metres shall be attached to the post using black adhesive lettering near the top of the post.

There shall also be a rectangle painted on the kerb in a direct line between the valve and the marker post. This rectangle shall be white unless the valve shall be normally closed, in which case it shall be red. In all cases the colour of the valve box lid shall match the rectangle. This rectangle shall be painted using Waka Kotahi M/7 Class B paint or at the discretion of the WDC Water Manager.

6.2.9. Hydrants

6.2.9.1 Hydrant General Requirements

All mains of 100 mm diameter or greater shall be provided with hydrants. Hydrants shall comply with the following requirements:

a. Hydrants shall be ductile iron, clockwise closing, screw down type in accordance with NZS 4522:2010, and shall be tall pattern.

b. Hydrants and risers shall be fully coated inside and out with blue nylon to AS/NZS 4158:2003.

c. Hydrant stoppers shall be resilient seated and encapsulated in nitrile or EPDM rubber.

d. Hydrant spindles shall be non-rising stainless steel or DR brass, stem seals shall be nitrile rubber 'O' rings (gland packing is not acceptable).

e. Hydrant tees shall be ductile iron and coated in Rilsan 11 or an approved alternative complying with AS/NZS 4158:2003**.**

f. Sealing cup washer shall be of nitrite rubber and the gland seal shall be either braided PTFE yarn or a minimum of two captive 'O' sealing rings.

g. Hydrants shall not be self-draining.

6.2.9.2 Hydrant Locations

Hydrants shall be located opposite the common boundaries of lots and spaced at intervals not exceeding 135 m on principal mains.

For developments requiring pipelines greater than or equal to 100 mm ID on both sides of the road, hydrants shall be fitted on the larger pipe as above, and on the smaller pipe at intervals not exceeding 270 m.

Terminal hydrants shall be within 135 m of the furthermost portion of any building site along a route that is fully accessible[1]. In cul-de sacs or other terminal streets the last hydrant shall be as per **Sheet 45** and not be more than 65 m from the end of the street.

Where a private way is more than 65 m long, a hydrant shall be provided at the street end of the private way or on the other side of the street immediately opposite the entrance.

The WDC may require a 100 mm diameter principal main with hydrant to be constructed within a private way or private road to ensure fire coverage. In this instance, adequate turning must be provided within 50 m of the end of the private way. Adequate turning shall mean a turning area of no less than 11.3 m radius, or as per Fire and Emergency NZ requirements. The access shall be designed to take heavy vehicles.

[1] The definition of accessible is a route from the fire hydrant to the building or building site following roads, driveways or right of ways.

Where an isolated risk is identified such as a school or large industrial complex, a private fire main shall be constructed onto that lot. No other reticulation shall be taken off this line. Meter and backflow requirements shall apply as per the ES.

Hydrants shall be readily accessible for fire appliances and should be positioned near street and private way intersections and at least 6 m from any building.

Hydrant risers shall be used where necessary to ensure that the top of the spindle is not less than 75 mm nor greater than 250 mm below finished surface level.

Hydrants are also required at all dead-end lines, high points (for the purpose of air release), and low points to enable mains flushing if a normal washout cannot be fitted.

6.2.9.3 Hydrant Marking

Location marking of fire hydrants shall be to Appendix L of SNZ PAS 4509:2008.

Markings in carriageways and berm areas shall by in accordance with **Sheet 48**. Final triangular hydrant markings should not be placed until near the end of the Defects Liability Period. Marking around hydrant boxes in parking bays shall be yellow retroflective paint.

Yellow painted, WDC approved reinforced concrete marker posts shall be fixed 225mm from the street boundary at the closest point to and facing the hydrant, with the top of the post 600mm above finished ground level.

A concrete mowing strip 150 mm wide shall surround the hydrant marker post when it is set in the grassed berm.

The correct main size in millimetres and the distance between marker and hydrant in metres shall be attached to the post using black adhesive lettering near the top of the post.

6.2.10. Surface Boxes

All valves and hydrants shall be accessible via surface boxes as shown on **Sheet 45** and **Sheet 49**.

Surface boxes shall be heavy duty cast iron or ductile iron and be directly above the valve or hydrant. Hydrant boxes in “Arterial” roads and State Highways shall be Motorway Grade. All other hydrant boxes in road carriageways shall be manufactured to AS 3996:2019. All hydrant boxes to be installed to NZS 4522:2010.

The long side of the surface box shall run parallel to the watermain. The box shall be supported on concrete risers sized to provide unobstructed access to the valve or hydrant. For hydrants, this shall include easy access for standpipes and installation of data logging equipment.

The design shall ensure that surface loading (traffic, etc.) is not transmitted via the box and supports to the pipe or fittings.

Where a valve is particularly deep, a length of 200 mm diameter PN9 PVC pipe shall be used to direct the valve key to the spindle (in addition to the requirement for concrete surrounds).

All surface boxes shall be marked in accordance with **Sheet 45** and **Sheet 48.**

6.2.11. Bulk Water Meters

WDC may require a bulk water meter to be provided at the connection point of the reticulation.

Bulk water meters will normally only be required where there are more than 20 industrial connections, 40 commercial or 150 residential connections.

Bulk water meters shall be a full bore magnetic flow meter in accordance with the WDC Approved Materials List - Water Services and include an approved data logger.

6.2.12. Service Connections

6.2.12.1 Layout and Location

A service connection shall be provided for each single lot or residential unit with individual street or right of way access. The connection shall:

a. Be perpendicular to the main or rider main,

b. Be centralised on the road frontage for front lots,

c. Be located as to avoid existing or proposed vehicle crossings,

d. Terminate 100 mm from the boundary,

e. Include a Water Services approved manifold with diaphragm isolation valve and dual check valve and blue meter box with base (see **Sheet 46**), and

f. Be located with respect to the main by a 12 mm wide cut in the kerb and a 250 mm wide blue strip painted on the kerb

Manifolds shall be in accordance with **Sheet 46** and be blanked off with a brass plug and cross-cut into cap of the manifold.

Where there are three or more service connections provided along a private access road or right of way, the following shall apply:

a. A single connection feed sized as a rider main (as per **Sheet 47**), shall be provided within the legal road,

b. The single connection feed shall extend from the public watermain to a point no closer than 500 mm to the road boundary,

c. A peet valve shall be installed at the junction with the main,

d. At the road boundary end, a multiple meter box shall be provided in accordance with **Sheet 47**,

e. Separate individual connections shall then extend from the meter box to each lot, and

f. The lot number of each connection shall be clearly marked within the box.

Where lots are situated on either side of a private access road or right of way, service pipes shall be split either side to avoid passing under the carriageway. The multiple meter box requirements above shall apply to each side. Where this is not practicable, service connections crossing under carriageways shall be laid in a larger protective duct.

Subject to restrictions in Section 6.2.9.2 Hydrant Locations, where a WDC maintained watermain is provided along a private access or road, connections may be provided from this main to each property.

Connections to single residential units at the point of supply pipe shall be 20 mm ID. For multiple units, the points of supply pipe shall be sized to match the expected demand.

Where private water lines are required to cross other private property, then suitable easements shall be created protecting the water line.

Service connections are not required to be installed for commercial/industrial business lots.

6.2.12.2 Meters

Meters shall not be installed during development.

For water supplies to public assets that will be maintained by WDC in the future (e.g. a sewer pumping station or irrigation system for a reserve), the following shall apply:

a. The Developer shall submit an application to WDC for the connection,

b. The Developer shall pay for all costs and fees, including any Development Contributions for the connections,

c. A utility as-built form shall be submitted to WDC as per WDC Specification for the Installation of Service Connections, and

d. Meters and backflow preventers shall be installed at the time of the physical works for the development.

In all other cases:

a. A WDC Public Utility Connection / Disconnection Application to install a meter shall be submitted and approved before any work may be undertaken.

Connection sizes up to and including 25 mm diameter, meters shall be in accordance with the WDC Approved Materials List - Water Services.

For connections larger than 25 mm diameter, WDC shall specify the type of meter and backflow preventer.

6.2.12.3 Materials and Fittings

Service connections and fittings shall be in accordance with WDC Approved Materials List - Water Services (See Section 6.2.6 Approved Materials).

Mechanical fittings may be used for connections up to 50mm and shall comply with WIS 4-24-01.

Electrofusion fittings shall be used for service connections greater than 50mm and shall comply with Section 3 of AS/NZS 4129:2020.

6.2.12.4 Backflow Prevention

All connections shall be provided with a dual check valve Backflow Preventer, unless:

a. The potential risk requires a greater level of protection, in which case the Developer shall provide protection appropriate to the level of contamination risk, or,

b. The WDC specifies an alternative backflow prevention.

For sewer pumping stations a reduced pressure zone backflow preventer, in accordance with **Sheet 44**, shall be provided above ground in a protective cage.

All backflow preventers shall be installed between isolating valves and be fully testable.

Note: Guidance on where backflow preventers are required can be found in the WDC Policy 0020 – backflow Prevention Policy and Code of Practice 2012 and the WDC Water Supply Bylaw 2012.

6.2.13. Pump Stations and Reservoirs

The design of pump stations and components require specific approval from the WDC Water Manager and shall be designed by a SQEP.

The following requirements for pump stations shall be met:

a. The pump station shall be a ‘package’ type pump-station which incorporates the pumps, valves, pipework, and electrical control panel all mounted on a plinth or frame.

b. Where a pump station is required to provide compliant pressure and/or flow then it shall, where practicable, be linked to an appropriate sized reservoir. Where no reservoir site is available, or provision of a reservoir is not practicable, then a pressure sustaining system may be used.

c. Pump Stations shall be designed in accordance with **Sheet 53** and WDC Briefing Document – EES 1.

d. Pumps shall be capable of maintaining the pressures and flows required, including firefighting flows, with reserve capacity. A standby pump shall be provided.

Reservoirs, where provided, shall be of concrete or timber (with liner) construction and sized to provide:

a. A firefighting supply as specified in the SNZ PAS 4509:2008, with a minimum of one hour’s supply, and

b. Sufficient storage for two day's supply at peak daily demand, plus additional future demand as assessed by the WDC.

A WDC approved SCADA and telemetry link shall be provided for control of pumps and reservoir levels. Details of the equipment requirement will be provided by WDC upon enquiry

The reservoir and pump station site shall be vested in the WDC.

Access and water supply easements shall be provided in favour of WDC where the supply pipeline is within private property.

6.3. Construction

6.3.1. Licensed and Registered Contractors

Only contractors who are a Licensed Contractor or Registered Contractor may install water assets that will be vested in WDC. Only a Licensed Contractor may undertake work on existing water assets or on live watermains.

Licensed Contractor's and Registered Contractor's shall satisfy the requirements of and only undertake work that is specifically listed as being within the scope of their approval, as specified in the WDC Specification for Registered and Licensed contractors for Water Supply.

Contractors who produce workmanship of a substandard quality or fail to comply with the ES will have their approved status revoked.

6.3.2. Pipeline Installation

6.3.2.1 Watermains

Watermains shall be installed in accordance with this section, the WDC General Specification for Installation of Watermains and with the bedding and backfill details on **Sheet 31**.

Pipes shall be laid so that the identification code is uppermost, where practicable, and shall be evenly supported along their length.

Mains and rider mains installed by trenching shall be thoroughly bedded and protected by a well hand-compacted granular material. The bedding material shall be placed as per requirements of AS/NZS 2033:2008 for PE pipe or in layers of less than 100 mm and shall surround the pipe by at least 100 mm in all directions.

The particle size range of bedding material shall be in accordance with **Sheet 31**, and shall be compacted in accordance with Appendix B of NZS 7643:1979 regardless of pipe material.

When reinstating trenches in existing carriageways the Contractor shall:

a. Comply with clause 4.15 of the WDC General Specification for Installation of Watermains,

b. Lodge a Corridor Access Request to the Road Control Authority,

c. Meet any further specific requirements regards reinstatement of the Road Control Activity

6.3.2.2 Service Connections

Service connections onto a principal main or rider main shall be made with an electro-fusion tapping saddle.

Tapping saddles on PE80/PE100 pipes shall be with ball valves or self-tapping ferrules at the point of connection, installed in accordance with the manufacturer's instructions. Connection between the tapping saddle and the service connection shall be made using an approved compression fitting or electro-fusion coupling.

Use of alternative LG2 gun metal tapping bands requires specific approval from the WDC Water Manager prior to installation.

All materials and fittings shall comply with the WDC Approved Materials List - Water Services, and be installed in accordance with the WDC Specification for the Installation of Service Connections and the manufacturer's recommendations.

The tapping saddle for each service connection shall be sited at the central point of the front boundary or house site, and clear of any driveways or accessways. The position shall be marked on the kerb with a 125 mm square of blue paint: in addition, a notch 12 mm wide and 12 mm deep shall be cut in the top of the kerb before painting.

Service connections shall be a minimum of 1 m apart at the point of connection to the main.

All connections shall be provided with backflow prevention in accordance with Section 6.2.12.4 Backflow Prevention.

6.3.2.3 Jointing

Pipe laying and jointing shall be as recommended by the manufacturer and as required by the applicable standard for the type and class of pipe.

Joints in PE pipes of greater than 50 mm ID shall be welded joints unless mechanical fittings have been specifically approved by the WDC.

100 mm ID pipes (125 mm OD) may be supplied in coils and joined using electrofusion couplers. Where pipe is supplied in 6 m or 12 m lengths and the pipeline length is greater than 50 m, joints shall be butt welded.

Pipes from different suppliers or different batches shall not be butt welded.

Welding (butt or electrofusion) of PE pipes shall be undertaken by a WDC Approved Contractor (See WDC Specification for Registered and Licensed contractors for Water Supply), using calibrated data logged welding machines. Only employees of an Approved Contractor who have successfully completed a Water New Zealand approved welding

course for polyethylene pipe, or re-fresher in the past two years, shall be permitted to physically undertake welding.

An initial (Practice) test weld shall be done on site using the equipment, personal and materials (pipe) that will be used for the welding works. The weld shall be tested and approved **before** work starts. If there is any change to the above factors, (i.e. materials, personnel) another test weld shall be done, tested and approved before continuing.

Prior to commencing work, the following shall be provided to WDC:

a. A copy of the current calibration certificate(s) of the welding machine (not more than 12 months old),

b. Registration number of welder, and current certification (not more than 24 months old).

All welding of PE pipe shall be data logged.

Welding shall take place in a covered environment to avoid contamination of weld faces and prepared pipe.

For all electrofusion welds, including tapping saddles, a mechanical scraper with a winding mechanism shall be used to ensure even finishing. Hand scraping of pipe ends, with the appropriate tools, will only be permitted if mechanical scraping is not practicable and with prior permission from the Distribution Engineer. Electrofusion welds shall be undertaken using clamps and the equipment correctly calibrated.

The jointing of flanged fittings to PE pipe shall be with stub flanges and backing rings. Backing rings shall be mild steel and plastic coated with Rilsan 11 or approved alternative to AS/NZS 4158:2003**.** Where Ductile Iron flanges backing rings are used they shall be to B5 of AS/NZS 4087:2011

The thickness of the backing rings shall be as shown in Table 6-8.

Table 6-8: Thickness of Mild Steel Backing Rings on PE Water Pipe Joints

Pipe Outside Diameter (mm)	Backing Ring Thickness (mm)
125	16
180	16
250	16
315	20

For pipes greater than 180 mm OD, slim flanges with reinforced faces shall be used. Gaskets shall be used for all flanged connections. All bolted flanges shall be tightened in accordance with the manufacturer's specification using a torque wrench.

During transportation and on-site storage temporary capping of all pipes as per WDC Hygiene Code of Practice is required. The pipes shall be inspected externally immediately prior to laying to check for damage in accordance with the manufacturer's specifications. An internal inspection shall also be carried out and adequate protection against the

ingress of debris shall be made as laying proceeds. Temporary caps shall be placed over all open ends during construction.

6.3.2.4 Detection Tape and Tracer Cable

A metallic detection tape and tracer cable shall be laid directly above all new non-metallic watermains including rider mains.

Detection tape shall have 'water' written on it in blue, be located at a depth of between 200 and 250 mm below the finished surface level and contain sufficient metal to be detectable from the surface by a standard metal detector.

Tracer cable shall also be attached to all principal mains and rider mains. This wire shall take the form of a continuous 2.5 mm^2 multi strand (polythene sleeved) cable, strapped to the pipe wall by means of a minimum of two complete wraps of heavy-duty adhesive tape, at a maximum of 3.0 m intervals.

The tracer cable shall be connected to all surface boxes, and electrically tested for continuity by a Registered Electrician following installation and backfilling. Records of the electrical continuity test shall be provided by the contractor.

6.3.2.5 Aggressive Ground Conditions

Where aggressive soil conditions are likely to be encountered, only materials specifically approved by WDC shall be used.

For metal components, the approved materials are Grade 316 stainless steel complying with AS/NZS 4673:2001, Ductile Iron coated to AS/NZS 4158:2003**,** or aluminium-bronze. Metal components shall have a molybond coating corrosion protected with an approved Petrolatum system primer paste covered with Petrolatum mastic (for moulding around irregular profiles such as flanges, valves etc. to provide a suitable profile for wrapping), followed by Petrolatum tape and 'Greensleeve' over wrap.

Alternative corrosion protection requires specific approval from the WDC.

6.3.3. Testing and Inspections for Pipelines

6.3.3.1 Testing of Welds

For welded pipelines, one or more welded joints shall be removed for tensile or peel de-cohesion testing. For further details on testing refer to WDC General Specification for Installation of Watermains. The test sample(s) shall be sent to an approved laboratory for testing at the contractor's expense.

Should a weld fail to pass the test, two further welds shall be tested. If one or more of these welds fail in a brittle manner the pipeline may be condemned and the Contractor/ Developer may be asked to remove all welds up to this point and re-lay the pipe at their expense. Should the machine, welder, pipe supplier or the raw material batch change, then new tests shall be undertaken at the expense of the Contractor/ Developer.

WDC staff shall be present when the welded section is being removed.

Test results shall be forwarded to the WDC.

6.3.3.2 Pipeline Pressure Testing

On completion of the pipe laying and jointing, sufficient backfill materials shall be placed over the pipes to prevent movement during pressure testing, leaving joints, fittings and anchor blocks visible. No connections of a permanent nature between existing mains and the new work will be allowed at this stage. PE 80 rider mains shall not to be connected to the mains before testing but shall be tested separately. Service connections shall be included within the test.

To complete the preliminary test, the new reticulation system shall be swabbed, and any air eliminated using a temporary supply. All valves on the new main shall be fully opened and all hydrants, stop taps and valves on the consumer end of the service pipes shall be shut. Water for tests may be obtained from the existing system provided prior WDC approval is obtained and a metered standpipe with a check valve is used. Standpipes are available from the WDC.

A visual inspection of the line including joints and fittings shall be made and any apparent flaws and leaks shall be remedied. The pipe shall be left full overnight before pressure testing.

Pressure tests shall be carried out using an approved pressure pump at a steady rate without shock loading. Pressure gauges used shall be accurate and read to a minimum of 10kPa intervals.

Note: Gauges shall be calibrated on an annual basis, with test certificates available for all equipment on request

The contractor shall give WDC at least 24 hours' notice before carrying out testing. The test shall be carried out in the presence of a WDC representative and a data logger shall be used to verify the results.

The test pressure shall be 1.25 x the rated pressure of the pipe (1500 kPa for PN 12 and 2000 kPa for PN 16). Test sections shall not exceed 500 m in length. The specified test pressure is the pressure to be applied at the lowest point in the section.

If the pressure gauge is not located at the lowest point a correction shall be made for the difference in levels. Pressure testing against valves will not be permitted.

For PE 80 or PE 100 pipe the type of test will depend on the length and diameter of pipe to be tested. The 'small diameter' pipeline test shall be limited to 50 mm ID pipes and to 100 mm ID pipes where the length to be tested does not exceed 135 m.

The contractor shall supply a graph or data logger printout of the pressure test and show calculations n_1 and n_2 where applicable.

The Developer, SQEPs and contractors are reminded of their obligations under the Resource Management Act 1991 in terms of the discharge of testing water into natural water courses. It will only be acceptable to discharge the water into a WDC-managed stormwater system if it is of a quality that would comply with the requirements of the relevant catchment drainage plan or the rules in the NRC Regional Plans. Otherwise, testing water shall be discharged into a WDC-managed sewerage system.

6.3.3.3 Hydrant Flow Test

Following completion of the pipe test and connection to the main, the Developer shall provide certification from the fire service or other WDC approved independent certifier, of the static pressure, the maximum flow and the residual pressure at maximum flow for each hydrant.

6.3.4. Disinfection

After backfilling, pressure testing and flushing and no more than 10 days before being put into service, all pipes, valves service pipes and connected fittings shall be disinfected. All disinfection testing will be at the contractor's cost.

Disinfection testing shall be carried out by persons who have successfully completed NZQA Unit Standard 19209 - Water Reticulation - Demonstrate knowledge of water reticulation system cleaning and disinfection.

The main shall firstly be swabbed with a suitable swab, if not already done prior to pressure testing. The main shall then be drained and slowly filled with potable water to which sufficient free chlorine is added to produce a concentration of 50 parts per million (ppm) in the main. It is recommended this be done via a water tanker of known volume.

Chlorine may be added to the pipe in one of the following ways:

a. Chloride of lime solution,

b. Calcium hypochlorite solution,

c. Sodium hypochlorite solution, or

d. HTH dry chlorine granules dissolved in water before put into the main.

The chlorinated water solution shall be introduced at the lowest point of the section of main to be disinfected to ensure no air is trapped. The main shall be left full of the chlorinated water for 24 hours, during which time all valves, hydrants and other fittings on the section shall be operated to ensure all part of the main are disinfected.

The residual chloride concentration shall not be less than 20 ppm after 24 hours.

After 24 hours contact time, the pH of the water shall be recorded. The effectiveness of hypochlorite as a disinfectant is greatly reduced above pH 8.0. A pH level greater than 9.0 will not be accepted as compliance with the disinfectant requirements and shall be repeated using a solution with a pH less than 8.0.

The main shall then be flushed out until the chlorine concentration of the issuing water is between 2.0 and 0.2 ppm.

The chlorine solution shall not be discharged into the stormwater system. Instead it shall be discharged to the sewer system. The rate of discharge to the sewer shall be limited to a maximum of 10 litres per second. If this is not practicable, then the solution shall be dechlorinated to acceptable levels before being disposed to ground or a stormwater system.

If the chlorination is found to be unsatisfactory, the contractor shall repeat the procedure until the water is of acceptable quality.

The testing for chlorine, pH and bacteria (total coliforms and E.coli). shall be carried out by the WDC's Water Testing Laboratory or another approved laboratory. It is the contractor's responsibility to engage the laboratory and to pay for all the necessary testing. At least 24 hours' notice is required for the initial chlorine application. The laboratory representative shall return 24 hours later for the second residual chlorine test and will stay on site while the line is flushed until the chlorine concentration is between 2 & 0.2 ppm.

The laboratory will then issue WDC with a written report confirming the tests.

6.3.5. Connection

Following a successful chlorination procedure and flushing, the following steps shall be undertaken

a. The main shall be charged with fresh mains water with a chlorine concentration of less than 1.0 mg/litre.

b. The water shall then be tested for the presence of E.coli at a minimum of two locations. One bacteriological test shall be carried out for a minimum of every 300 m of pipe disinfected, including the extremity of any branches.

c. The contractor shall provide WDC with a site plan showing the location of the new main as well as the sampling points.

The tests will take approximately 24 hours. A satisfactory result is E.coli <1/100 ml or an "E.coli Absent" result.

If this requirement is not achieved, the disinfection procedure shall be repeated and a further bacteriological test done until a satisfactory result is achieved. A satisfactory pH result is pH<9.

If the newly chlorinated main has not been connected to the existing reticulation within 10 days, the main shall be retested for E.coli as per the initial testing.

If any of the new samples fail the E.coli test the disinfection procedure shall be repeated. All sample results shall be received before approval for the main to be connected can be given.

Following approval by WDC, an ES-W1 (in Appendix D) shall be completed by a WDC representative.

Upon completion of ES-W1 the Developer shall keep the new reticulation continuously charged with water under pressure and obtain WDC approval to connect to the existing reticulation. This approval is requested by notifying WDC in writing and providing a copy of ES-W1, the test results and a drawing of the connection detail.

The connection shall only be made by the Licensed Contractor shown in the application.

Upon connection, the new reticulation shall be flushed to the satisfaction of WDC and left operational.

If WDC considers that the main being connected is critical, then only the WDC's Reticulation Maintenance Contractor may undertake the connection.

All costs associated with connection to the existing system shall be met by the Developer.

6.3.6. Pump Station Commissioning

Commissioning shall be undertaken in accordance the WDC QA/QC Manual 2010. Particular reference should be made to the requirement to produce and complete:

a. Inspection and Test Plan – Pump Stations

b. Pre-Commissioning Checklist for New Pump Stations

c. Procedure for Performance Testing of Pumps

d. Commissioning of Civil Works

6.4. Completion of Works

6.4.1. Completion

Following completion of all works the water supply network serving the development shall be isolated until the 224c certificate has been issued for the development and the first lot connection has been authorised.

6.4.2. As-Built Drawings and Schedule of Asset Information

As-built drawings, a schedule of asset information and Operation and Maintenance Manuals shall be submitted in accordance with Section 1.7.2 As-Built Plans, Asset Information Schedules, Operation and Maintenance Manuals and Appendix F Drawing Standards.

In addition to the requirements in Section 1.7.2 As-Built Plans, Asset Information Schedules, Operation and Maintenance Manuals and Appendix F Drawing Standards, as-built drawings shall clearly and accurately show:

a. The constructed locations and details of all water infrastructure provided as part of the work, including any modifications made to the existing system.

b. Any existing connections (metered or otherwise) to a property that is being subdivided or re-developed, meter details must be included.

c. Weld data logging information for all welds, including welders name and company, shall be submitted with as-built drawings.

d. Directional drilling log if that method of installation was used.

Additional information to be included in the asset information schedule, is required for all hydrants, valves and meter box locations as follows:

e. Location diagram, including offset distance from the lot boundary and distances from corners of the lot,

f. Location coordinates (X,Y,Z) in accordance with datum requirements in Appendix F Drawing Standards,

g. Item type (hydrant, sluice valve, peet valve, pressure reducing valve),

h. Make, model and manufacturer,

i. Depth to spindle/handle,

j. Date installed, contract or PU number (if relevant) and installing contractor's name,

k. For Hydrants, test results as per Section 6.3.3.3 Hydrant Flow Test showing:

   i. static pressure,

   ii. residual pressure, and

   iii. maximum flow rate

l. For valves, number of turns to fully open from off position.

The WDC may audit as-built information on site upon completion of the works, development.

An EDA Certificate of Completion for the works will not be issued until as-built information fully complies with the requirements of the ES and is to the satisfaction of the WDC.

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