The Auckland Code of Practice for Land Development and Subdivision

Water and Wastewater Code of Practice for Land Development and Subdivision

Chapter 5: Wastewater

Watercare
An Auckland Council Organisation

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Based on Section 5 of NZS 4404: 2010 this document is part of the Auckland Code of Practice for Land Development and Subdivision.

Chapter 5 – WASTEWATER

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Revision	Description	Released By	Date
Draft 1.0	Initial document for internal consultation	J Hodges	11/02/2011
Draft 2.2	Amended from feedback for external consultation	J Hodges	12/04/2011
1.0	Amended after external consultation	M Lind	15/06/2011
1.1	General re-formatting for website release	M Lind	30/06/2011
1.2	Text expanded, errors corrected, more linked docs	M Lind	06/12/2011
1.3	Text and linked docs updated, more linked docs	M Lind	16/11/2012
1.4	Detailed updates to specifications and drawings	J de Villiers	08/12/2014
1.5	Amended drawings and content	Chief Executive	28/05/2015
2	Contents updated and inclusion of new sections for pressure wastewater systems and network capacity assessment. Document format and leading section to Wastewater chapter replaced to accommodate Auckland Council chapter changes	J de Villiers	05/12/2017
2.1	Updates following public consultation	J de Villiers	27/07/2018
2.2	Minor updates. Added capacity check chart for process clarification. Sewer system selection tree.	J de Villiers	01/11/2019

The latest version of this standard takes effect on the date of release on all new work and supersedes all prior versions or formats of this document.

Where design work has been completed or where construction work commenced, immediate adoption may be delayed unless the change is required within a timeframe provided by legislation, or is an immediate health and safety concern. Under these circumstances Watercare will review any work in progress and provide specific notice for adoption.

Summary of changes

Version	Section	Description of revision
2	Entire document	Formatting and font
	Introduction (section 1)	Foreword and introduction reworded. Sections numbered and rearranged. Legislative -, standards – and other document reference have been updated. Referenced standards moved to section 3. Deleted “Document hierarchy” diagram Deleted “Water supply mains” process flowchart
	Chapter 1	Removed. Referred to Auckland Code of Practice for Land development and Subdivision that now includes Chapter 1. Referenced made in section 3.
	Chapter 8	Removed. Referred to Auckland Code of Practice for Land development and Subdivision that now includes Chapter 1. Referenced made in section 3.
	2	New section describing relationship of Watercare standards and how this code of practice fits into the overall set.
	3	Updated referenced standards and documents
	4	Reproduction of deliverables that is removed from the previous version of Chapter 1 – this section identifies Watercare’s specific requirements to allow engineering plan evaluation.
	5.3.4.5	New section added for testing contaminated soils in relation to wastewater assets
	5.3.5.1	Complete update of the Design flow section, extending the design scenarios for various types of developments with worked examples and capacity assessment methods for brownfield areas. Adjusted peaking factors and reduced average daily discharge per person
	5.3.5.3	Rewording to remove duplication. C5.3.5.3 deleted. In conflict with Watercare point of supply policy
	5.3.5.4	Section updated to include written consent for reducing downstream pipe sizes. It is recognised that in some instances certain construction technologies may determine upstream size, causing an on-rolling affect, or instances where grade increase could justify the change.
	Table 5.1	Amended table to distinguish of commercial and trade waste flows. Relocated table to corresponding text.
	Table 5.2	Updated friction values based on real allowances for debris, joints and slime build-up and flow through manholes.
	Table 5.4	Amended table to align with design specific thresholds
	5.3.5.6	Minor rewording and inclusion of possible solution to reduce high velocity scenarios
	5.3.6.1	Minor text change. No change in meaning. Second paragraph for bridge design considerations moved to new section 5.3.6.3A
	5.3.6.2	Included option for base isolation of close spaced structures

	C5.3.6.2	New explanatory comment for seismic design. Replaces C5.3.6.3
	C5.3.6.3	Deleted. Replaced by C5.3.6.2
	5.3.6.3A	New clause. Reworded second paragraph from previous section 5.3.6.1 to clarify pipe bridge requirements
	5.3.6.6	Minor text change and update to geology maps reference. Section 5.8 replaced with new section
	5.3.6.8	Text amendment to refer to Watercare construction requirements and acceptable trenchless technologies
	5.3.7.2	Reworded to assert Watercare material requirements
	5.3.7.4	Reworded to assert Watercare requirements
	5.3.7.4.b	Numbering convention corrected to 5.3.7.4A Minor text changes. No change in meaning
	5.3.7.6	Reworded to state Watercare position on allowing horizontal curved pipe
	5.3.7.7	Amended to conform with 5.3.7.6
	Table 5.6	Updated table to clarify clearances from drains – base on intercepting pipe sizes to allow suitable working space and trench structural support
	5.3.7.10	Reworded to assert Watercare requirements and remove ambiguity for minimum clearance form structures
	5.3.7.12	Reworded to clarify Watercare requirements when considering structures over pipelines
	5.3.7.13	Included requirements for shared services trenching. Consistency with Water chapter
	5.3.8.1	Reworded to assert Watercare requirements and remove ambiguity and acceptable maintenance structures
	5.3.8.3	Reformat and changed last paragraph to commentary note
	5.3.8.4.2	Reworded to be consistent with drawings. Clarify base and clearance requirements
	5.3.8.4.5	Additional options for drop structures and clarification on considerations when designing a drop structure
	5.3.8.4.6	Consideration of future climate change affecting water table
	5.3.8.4.7	Reworded. Clarify requirements for manhole covers and lids
	5.3.8.7	Section replaces previous version of section 5.3.8.6. Reworded with terminal shafts excluded.
	5.3.9	Venting included for drop structures
	5.3.10.1A	Reworded section to clarify requirements and limitations for connecting stormwater to the wastewater network
	5.3.10.1B	New section added for proposed connections in soakage areas
	5.3.11	Reworded to direct to Watercare pumping station standard for local wastewater system
	5.3.12	Re-written to specify pressure wastewater design requirements. Reference to vacuum systems removed

	5.4.2	Update references to information that must be provided for design assessment
	5.5	Reworded to clarify construction requirements and appropriate construction standard references. Sub-sections have been deleted.
	5.6	Section updated with new schematics
	5.8	Section deleted. Reference updated in section 5.3.6.6
	Appendix A	New application assessment form added
	Drawing set DW01 (previous appendix B)	Appendix B removed and referenced drawing set in section 3. Drawings updated to reflect document changes. Emphasis placed on reducing infiltration.
2.1	Definitions	Change “drains” to “drain lines” to distinguish from stormwater drains.
	5.3.7.9 table 5.6	Change “drains” to “drain lines” to distinguish from stormwater drains.
	Definitions – “Infill”	Correct grammar “Development within”.
	Abbreviations	Correct grammar “M” to “m”.
	1.2	Update reference to Health and Safety at Work Act 2015.
	3.1.1	Update references to asset data capturing requirements standards.
	3.1.2	Added reference to AS/NZS 2865 for safe working in confined spaces.
	5.3.5.1.1	Example 1 updated with occupancy of 3.
	5.3.5.1.2 B	Updated text to clarify thresholds for capacity checks.
	5.3.5.2 table 5.2	Change note 2 to “and including DN300”.
	5.3.7.1	Changed “depth” to “cover”. Changed “typical” to “possible” Removed scale.
	5.3.7.1 e)	Reword to include both pipe and manholes.
	5.3.7.4	Last paragraph – delete prescription of possible scenarios for easements.
	5.3.7.10	Grammar correction. No change to meaning.
	5.3.8.4	Change step rungs to “1200mm diameter and under”.
	5.3.8.4.2 b)	Reworded to clarify that clear zone can overlay the step-iron / ladder zone.
	5.3.8.4.2 c)	Updated pipe bend radius to 3x pipe diameter.
	5.3.8.4.5	Clarify statement and intent of b). Clarify that droppers are an option to reduce velocity.
	5.3.8.4.7A	Remove reference to “stainless steel”
	5.3.10.1B	First paragraph, delete “Watercare”. Determination is by Auckland Council.
	5.3.10.4 f)	Replaced f) as an advice note to show that an inspection point is a requirement of the Building code.
	5.3.12	Defined Watercare’s pressure sewer ownership model and point of supply reference.
2.2	4	Added section 4.1 and 4.2 on climate change and carbon footprint considerations as part of design deliverables

	5.3.4.1	Updated to refer new Appendix B for system option selection
	Table 5.1.3	Updated table to add guidance for larger areas. Clarification on floor area assessment added to notes. Updated table to add guidance for larger areas with unknown commercial areas
	Table 5.1.4	Updated table to add guidance for larger areas with unknown industry
	5.3.5.1.2 B	Minor re-wording to remove double-negatives
	5.3.5.3	Clarification added for pipe sizing to allow airflow capacity in gravity wastewater.
	Table 5.4	Corrected grades to meet min. flow requirement
	5.3.7.6	Update justification for curved pipe
	5.3.8.2	Amended manhole use for end-of-line arrangements
	Table 5.7	Update on end-of line MH requirements. Deleted use of rodding eye as end-of-pipe
	C5.3.8.2 (h)	Advice note on extending public lines and manhole access arrangements
	5.3.8.4.5	Updated detail for dropper. Advice note added
	5.3.10.1	Clarification on connection junctions using wye versus lunden.
	5.3.12	Updated text to reflect Watercare policy on pump ownership
	C5.3.12.2 (m)	Added practice note to consider connecting pressure sewer monitoring to SCADA
	C5.3.12.3.1	Practice note added to clarify limitation of low pressure sewer system considerations.
	5.6.2 f)	New consideration to use of end-of line access and need for type of MH, and when to be completely omitted.
	Appendix A (new)	Added swim-lane chart to clarify wastewater capacity check process
	Appendix B (new)	Selection tree to assist with wastewater system type decision making

Foreword

This code of practice (CoP) has been developed to guide and govern subdivision, development and re-development of wastewater local network areas. It is applicable within the territory of the Auckland Council and parts of Waikato, where these utility services are provided by, or are to be vested in, or connected to assets owned by Watercare Services Limited (Watercare).

The code of practice is based on NZS 4404:2010 Land Development and Subdivision Infrastructure. Various parts have been reproduced pursuant to Licence 000805 granted to Watercare by Standards New Zealand.

The purpose of NZS 4404 is to deliver good urban design and infrastructure of good quality that is consistent with industry best practices.

NZS 4404 is a national standard developed to accommodate local variations to suit different conditions and circumstances. Accordingly there are numerous inserts by Watercare to deliver local requirements, many of which have been embedded in the local industry for some time.

The clause numbering of the original standard has been retained for section 5 to facilitate cross-referencing. To assist practitioners used to, or wishing to draw comparison to NZS 4404, altered text or additions are presented in Italic font. Deleted text or sections are not shown.

Sections highlighted in grey are intended as comments and guidance notes. These clauses are not mandatory.

Table of contents

Definitions

Term	Definition
Annual exceedance probability (AEP)	The probability of exceedance of a given occurrence, generally a storm, in a period of 1 year (1% AEP is equal to 1 in 100 year storm).
Average Dry Weather Flow (ADWF)	The average sanitary flow in the wastewater sewer over a 24-hour period during Dry Weather.
Assets	Water and wastewater infrastructure owned and operated by Watercare.
Brownfield	A land area that has existing or legacy infrastructure, or land that has been contaminated.
Combined system	A drainage network that collects wastewater and stormwater in a single pipe system or network.
Developer	An individual or organisation having the financial responsibility for the development project. Developer includes the owner.
Designer	The developer's professional advisor, appointed by the developer to complete the investigation, design, contract administration, construction supervision, and certification of the works on completion.
Domestic wastewater	Liquid wastes including matters in suspension discharged from premises used solely for domestic purposes, or wastes of the same character, but does not include any soils, liquids, gases or materials which may not be legally discharged to public sewers
Drain lines	Wastewater lateral connections, or sub-soil groundwater drains, wastewater mains, or stormwater run-off pipes that are less than 300mm in diameter.
Dry weather	A consecutive period of seven days or longer with total rainfall less than or equal to 1mm.
Dwelling	Any building or group of buildings, or part thereof used, or intended to be used principally for residential purposes and occupied, or intended to be occupied by not more than one household.
Greenfield	A land area that has no prior infrastructure development and is not contaminated.
Infill	Development within a previously developed area.
Lateral	The domestic wastewater drain connecting to the wastewater main.
Wastewater	Domestic wastewater with or without trade-waste

Tradewaste	As defined by the Auckland Council trade waste bylaw 2013: means any liquid, with or without matter in suspension or solution, that is, or may be discharged, from trade premises to a wastewater system in the course of any business, industrial or trade process or operation, or in the course of any activity or operation of a like nature.
Wastewater local network	The wastewater collection system used to convey wastewater from a drain line to the wastewater main. The peak dry weather flow is generally less than 78 litres per second and pipe sizes are typically less than 300mm nominal diameter.
Wastewater main	The wastewater conveyance from a wastewater local network to the treatment plant. The peak dry weather flow is generally greater than 78 litres per second.
Point of supply	A 'point of supply' is the point where Watercare's network connects with a private network. At this point, the responsibility for ownership and maintenance of assets and equipment transfers from Watercare to the customer.
Structure	A piece of infrastructure (excluding pipework), that may be constructed from various types of materials that includes something built or arranged such as underground chambers or pits, a building or building components such as foundations, piles or retaining walls.
System (wastewater/network reticulation)	The interconnected hydrological engineered layout and hydraulic components such as pipes, valves and pumps.

Abbreviations

AEP	Annual exceedance probability
BPO	Best practicable option
CCO	Council controlled organisation
CoP	Code of practice
DN	Nominal diameter
DWF	Dry weather flow
EOP	Engineered overflow point
ESF	Engineering standards framework
ha	hectare
L/d	Litres per day
$L/m^2/d$	Litres per square meter area per day

L/p/d	Litres per person per day
L/s	Litres per second
m	metre
m^2	square metre (area)
MH	Manhole or maintenance hole
mm	millimetres
MPa	megapascal
m/s	metres per second
PF	Peaking factor
PDWF	Peak dry weather flow. See DWF
PN	Pressure nominal. Maximum rated operating pressure
PWWF	Peak wet weather flow
WW	Wastewater

1. Introduction

This code of practice applies to the design of local network systems in greenfields (urban expansion), infill and brownfield (urban renewal) redevelopment projects. These projects must demonstrate compliance with the requirements of this code of practice for design, and Watercare's material supply and construction standards before being able to be connected to the Watercare local network system and then vested. This document is not an urban design policy or method of master planning.

Watercare is a Council Controlled Organisation (CCO) of the Auckland Council with specific legislative rights and obligations set out in the Local Government (Auckland Council) Act 2009 No 32 and the Local Government (Auckland Transitional Provisions) Act 2010 No 37. Watercare is responsible for the bulk and retail (local network) water and wastewater services throughout the Auckland region. In the former Papakura District Council, Veolia Water is under contract with Watercare to deliver local network services. Veolia Water applies this code of practice.

The applicable legislation, this document and other Watercare standards, plans and by-laws are to ensure that:

- Wastewater networks, including new and existing private connections to the networks allow the minimum practicable seepage into and out of the networks
- Illegal entry of roof water, overland flow and other stormwater is prevented
- Overflows from the networks during both dry and wet weather are minimised as far as practicable
- Waste materials entering the networks are controlled to avoid or minimise adverse effects on physical assets, wastewater treatment processes and the environment
- Watercare's and other publicly owned assets are not damaged and future access is not compromised by the actions of third parties
- Infrastructure that is created, is of good quality, meets health requirements and minimises ongoing maintenance costs
- Meets future demands on maintainability and access as infrastructure age and the natural environment change

Developing, setting and monitoring subdivision and development standards for greenfield (urban expansion), brownfield (urban renewal) or other development (e.g. intensification) is an important part of ensuring the above requirements are met.

Sub-divisional, development and redevelopment proposals are approved and authorised by the Auckland Council. Watercare's contribution to this process is the examination and acceptance of the design, construction and commissioning of elements of water and wastewater infrastructure, which will ultimately become part of Watercare's infrastructure. This includes works on private property where developments proposing changed land use or intensification may result in a significant alteration to the local demand pattern.

1.1 Outcome statement

This code of practice provides developers and their engineering professionals with the standard for design of local network systems that is consistent across the Auckland region and encourages innovation whilst maintaining basic requirements and sustainable development. This performance outcome requirement allows Watercare to manage the infrastructure in an economical and safe manner over the life of the assets.

1.2 New Zealand legislation

The requirements of this Code of Practice (CoP) shall be read subject to the provisions of the latest versions and amendments of the Auckland Unitary Plan, and to any applicable statutes, regulations, bylaws, including (but not limited to):

- Building Act 2004, Building Regulations, and New Zealand Building Code (NZBC) 1992
- Civil Defence Emergency Management Act 2002
- Conservation Act 1987
- Government Roading Powers Act 1989
- Health and Safety at Work Act 2015
- Health (Drinking Water) Amendment Act 2007
- Historic Places Act 1993
- Infrastructure (Amendments Relating to Utilities Access) Act 2010
- Land Transfer Act 1952
- Local Government Act 1974 and Local Government Act 2002, and related by-laws
- Reserves Act 1977
- Resource Management Act 1991, including all applicable regional and territorial planning documents
- Local Government (Auckland Council) Act 2009
- Local Government (Auckland Transitional Provisions) Act 2010
- Utilities Access Act 2010, National Code of Practice for Utility Operators' Access to Transport Corridors

1.3 Websites

- Auckland Council www.aucklandcouncil.govt.nz
- Auckland Design Manual www.aucklanddesignmanual.co.nz
- Auckland Transport https://at.govt.nz/
- Ministry for the Environment http://www.mfe.govt.nz
- Heritage New Zealand http://www.historic.org.nz
- New Zealand Legislation http://www.legislation.govt.nz
- New Zealand Transport Agency http://www.nzta.govt.nz/

1.4 'Must' versus 'Shall' versus 'Will'

Where the verbs must, shall and will (or its past tense forms) are used, they describe a requirement for compliance with the statement in which it is used.

'Shall' and 'must' expresses a mandatory condition or action. 'Will' is used to prescribe a performance outcome or intent.

1.5 Review of standards

Section 1.5 is provided for information only.

Watercare updates its standards and codes of practices from time to time. Users of this document should ensure that the latest published version is used. Suggestions for improvement of this standard are welcome. They should be sent to: **Principal Engineer - Standards, Watercare Services Limited, Private Bag 92521, Wellesley Street, Auckland 1141.**

Alternatively place feedback electronically at www.Watercare.co.nz

1.5.1 Watercare's engineering standards framework

The Watercare standards are provided in the online engineering standards framework (ESF). The system provides guidance to the end user to find the applicable standards for the operational area in which design, construction or maintenance is performed. The system ensures that the latest versions of standards are available. The standards are uncontrolled when copied or printed.

1.5.2 Governance of standards

Changes to standards are made under a governance structure to evaluate any change or improvements against factors such as Health and Safety, legislative compliance, standards, best practice and asset reliability.

2. Standard documents overview

2.1 Relationship of Watercare standards

Watercare standards comprise of codes of practices, design standards, standard design drawings, construction standards, and asset and material standards.

The Watercare standards are requirements additional to nominated national standards, international standards and industry best practice to meet, and in some cases exceed legislative requirements, to accomplish long term operability and good asset management practices to benefit our customers. The interface of these standards with each other and the project specifications are as follows:

2.1.1 Design standards

Design standards set a level of design for particular types of infrastructure based on operational area and associated risk. The design standards provide the minimum criteria for establishing baseline standard design drawings, interface design between standardised components, establishing the correct sizing of components to complement the baseline parameters of standard drawings and the basis for developing bespoke designs. This document falls within the design standards category and must be read with the relevant drawings and standards for asset capture, materials supply and construction.

2.1.2 Design drawings

The standard design drawings support the requirements of the design standard. Minimum and maximum criteria are set, and specific standard details are shown.

2.1.3 Asset and material standards

The asset standards describe the requirements for asset creation, asset numbering, asset capture, production of manuals and operational documentation. Material standards describe the minimum compliance requirements of materials supplied for asset acceptance. Often selected materials will have limitations of use and requirements specific to the operating environment and infrastructure classification.

2.1.4 Construction standards

Construction standards prescribe the methods and requirements for workmanship to be employed when constructing works in accordance with the design requirements, standard drawings and bespoke designs. To achieve the best outcome the construction requirements focusses on proven methods and best practice to ensure quality is maintained to achieve the design life of infrastructure, maintainability, health and safety and environmental requirements are met. Where construction standards are used or referred to in contracts they form part of the specification of the contract.

2.1.5 Project specific specification

These specifications identify site/project specific requirements that are not covered by the normative construction standards or standard design drawings identified during specific design.

2.2 Design build projects

Design build projects shall follow the minimum requirements set out in the standard documents for design and construction.

3. Referenced standards

3.1 Standards list

This code of practice must be read in conjunction with the Watercare, national and international standards listed below and the relevant chapters of the Auckland Code of Practice for Land Development. Where conflict or ambiguity exists, this standard shall take precedence. Where there is conflict between referenced standards, the higher level of standard shall take precedence.

3.1.1 Watercare standards

CG – General civil construction standard
ME – General mechanical construction standard
WW-08 Odour control biofilter

MS – Material supply standard

7363 – Watercare CAD manual
AI – Data and asset information standard

DW05 - Access structure drawings for wastewater infrastructure
DW07 - Access structures general drawings for public and non-public areas
DW01 - Code of Practice for Land Development and Subdivision – Wastewater drawing set

DP-06 Local Network Wastewater Pumping Stations
DW03 - Wastewater pumping station drawings for networks

DP-09 Electrical design standard
DW18 - Pump station electrical drawing set
EC - General electrical construction standards

COP-03 Code of Practice for commissioning

AI-03 CCTV inspection of sewers and data collection

3.1.2 National and international standards

NZS 4404 Land development and subdivision infrastructure
SNZ HB 44 Subdivision for people and the environment
NZS 1170 Structural design actions
- Part 5 Earthquake actions – New Zealand
- Part 5 Supp 1 Earthquake actions – New Zealand – Commentary

NZS 4219 Seismic performance of engineering systems in buildings
NZS/AS 1657 Fixed platforms, walkways, stairways and ladders. Design, construction and installation
SNZ PAS 4509 New Zealand Fire Service fire fighting water supplies code of practice
AS/NZS 2041 Buried corrugated metal structures
- Part 1 Design Methods
- Part 6 Bolted plate structures

AS/NZS 2566 Buried flexible pipelines
- Part 1 Structural design
- Part 1 Supp 1 Structural design – Commentary

AS/NZS 3725 Design for installation of buried concrete pipes
AS/NZS 2865 Safe working in confined spaces
AS/NZS 3500 Plumbing and drainage
Part 2 Sanitary plumbing and drainage
AS 2200 Design charts for water supply and sewerage

3.1.3 Other publications

Ministry for the Environment. New Zealand urban design protocol. Wellington: Ministry for the Environment, 2005.

Ministry for the Environment. Coastal hazards and climate change – A guidance manual for local government in New Zealand. Wellington: Ministry for the Environment, 2008.

Preparing for climate change – A guide for local government in New Zealand. Wellington: Ministry for the Environment, 2008.

Preparing for coastal change – A guide for local government in New Zealand. Wellington: Ministry for the Environment, 2009.

Preparing for future flooding – A guide for local government in New Zealand. Wellington: Ministry for the Environment, 2010.

Ministry of Health. Drinking-water standards for New Zealand 2005 (Revised 2008). Wellington: Ministry of Health, 2008.

Seismic Guidelines for Water Pipelines, American Lifelines Alliance, 2005

Guidelines for Seismic Design of Buried Pipelines, NICEE, 2007

Underground utilities – Seismic assessment and design guidelines, Water New Zealand

Health and Safety in Design Minimum standard, Watercare, 2017

WSA07-Pressure sewer code of Australia

4. Design deliverables

The design shall be delivered by a person with evaluated competency. Refer to the Watercare compliance statement policy for acceptable levels of qualification and competency registration. The following comprehensive documents shall be provided to Watercare for evaluation of the design:

a) Geotechnical report on the suitability of the land for subdivision
b) Basis of design report describing options and selection of design
c) Final design report that includes:
    - Site information such as location, layout, contours, soil contamination test results
    - Impact assessment on adjacent properties and services
    - Value engineering that includes material selection, constructability analysis, simplification, innovation and life-cycle costing
    - Assumptions and non-compliance - identifying alternative options to meet performance requirements
    - Detailed calculations
    - Drawings showing location, detailed long sections, pipe grades and sectional details

  - Site specific specification for construction
  - Nominated minimum levels of construction supervision

d) Risk analysis
e) Functional descriptions (process and pump stations)
f) O&M manual
g) New assets register
h) Project execution plan that includes the engineering construction plan/approach and Watercare's connection requirements
i) Design compliance statement – See Watercare compliance statement policy

4.1 Climate change

To address the impact of climate change on new infrastructure, the design shall demonstrate the measures taken to address the impact by:

- The considerations of various scenarios to determine the key financial, operational and environmental performance indicators
- Compare adaptation measures and allow prioritisation
- The location of infrastructure and the impact of flooding on infiltration and overflows,
- Addressing water level rise and possible need for asset relocation, floatation of assets, saltwater intrusion and submerged outfalls
- Mitigating energy costs for increased pumping

4.2 Carbon footprint reduction

The infrastructure owned and operated by Watercare has a large influence on new projects, renewals and ongoing maintenance. Watercare policy is to aim for net zero emissions by 2050 and reducing emissions by 40% by the year 2025. To support this policy new infrastructure should demonstrate opportunities for:

- System selection and layout
- Low carbon infrastructure delivery in construction
- Product selection
- Energy efficiencies
- Carbon removals

5. WASTEWATER

5.1 Scope

This section sets out requirements for the design and construction of wastewater systems. Section 5 primarily addresses reticulated systems. *It also guides the assessment and upgrade of existing wastewater systems to service brownfield and infill development.* Reference is also made to on-site wastewater systems, *but the responsibility for specifying and imposing all aspects of an on-site system rests with the Auckland Council and is therefore not covered in this document.*

Watercare's preference is for gravity wastewater systems. Pumped systems will only be accepted by Watercare when there is not a viable gravity wastewater solution. Refer to section 5.3.4.1 for catchment design considerations and Appendix B for assisting in system-type decision making.

The scope of wastewater networks under this Code of Practice (CoP) is limited to pipe sizes of up to 300mm. For pumping stations and risings mains refer to Watercare's local network wastewater pumping station standard, DP-06. This code of practice excludes design requirements for treatment facilities.

If the intended wastewater system exceeds the above limitations, the appropriate standard details from the Watercare transmission standard must be used in consultation with Watercare. These standards can be accessed on Watercare's Engineering Standards Framework.

5.2 General

5.2.1 Objectives

The objectives of the design are to ensure that the wastewater system is functional and complies with the requirements of *Watercare's* wastewater systems.

In principle the wastewater system shall provide:

(a) A single gravity connection for each property;

(aa) No stormwater entry, except in areas defined by Watercare as served by combined systems, refer section 5.3.10.1A;

(b) A level of service to *Watercare's* customers in accordance with the *Watercare's customer contract*;

(c) *Minimum practicable* adverse environmental and community *effects*;

(d) Compliance with *all relevant resource consent and other* environmental requirements;

(e) Compliance with statutory *Health and Safety* requirements;

(f) Adequate hydraulic capacity to service the full catchment;

(g) Long service life with minimal maintenance and least life-cycle cost;

(h) Zero level of infiltration *into pipelines, ancillary structures and manholes* on commissioning of pipes;

(i) Low level of infiltration/exfiltration *into pipelines, ancillary structures and manholes* over the life of the system;

(j) Resistance to entry of tree roots *and avoidance of build-up of fats, oils and grease;*

(k) Resistance to internal and external corrosion and chemical degradation;

(l) Structural strength to resist applied loads;

(m) 'Whole of life' costs that *are* acceptable to *Watercare*

(n) Compatibility with Watercare's site specific requirements for service delivery and maintenance; and

(o) Consider any environmental changes through the life of the asset in terms of sustainability, asset renewal, future access and levels of service.

5.2.2 Referenced documents and relevant guidelines

Wastewater designs shall incorporate all the special requirements of *Watercare* and shall be in accordance with the appropriate Standards, codes, *technical policies* and guidelines including those set out in Referenced Documents. *Refer to section 3.*

5.2.2.1 Networks discharge consent

Watercare's Network Discharge Consent requires Watercare to manage the network to achieve a target level of service of not more than two wet weather spills per year, on average, at each engineered overflow point, or an alternative discharge frequency where justified by a Best Practicable Option (BPO) process. Under the Wastewater Network Strategy Watercare develops a prioritised improvement works programme to cater for growth and address existing level of service (wet weather overflow frequency) issues.

For new wastewater networks, Engineered Overflow Points (EOPs) will only be accepted as a last-resort if required to protect the public and/or private property from what would otherwise become an uncontrolled wastewater overflow. An example would be to cover the possibility of an extended power-outage at a pump-station where the power outage exceeded the design storage requirements; and where backup power could not be provided to the pump station.

5.3 Design

5.3.1 Design life

All wastewater systems shall be designed and constructed for an asset life of at least 100 years. *The Peak Design Flows detailed in this CoP for pipe networks are to ensure that the system has sufficient capacity over its 100 year design life to convey both exceptionally large spikes in dry weather discharge, as well as wet-weather ingress that may start to occur over the life of the asset due to deterioration with age.*

Some components such as pumps, valves, and control equipment may require earlier renovation or replacement. *Watercare lists a number of accepted and standardised materials. The use of components not listed on the material supply standards requires specific approval from Watercare prior to their use.*

5.*3.1.b Network design criteria and evaluation*

<u>*New Networks*</u>

New wastewater systems shall achieve the following minimum standards:

- *Pipelines shall not surcharge at the Peak Design Flow.*

- *Storage shall not be used for buffering purposes unless approved by Watercare for the purpose of protecting the existing network.*
- *The system shall be self-cleansing at the Self-Cleansing Design Flow.*
- *Manholes, access structures and other facilities shall not be placed in floodplains, secondary overland flow areas, within roading kerb and channel areas or any other areas subject to inundation.*
- *New engineered overflow points (EOPs) will be allowed at new pump stations; this may require BPO process for a new discharge location. Refer to Appendix A of the Standard for Local Network Wastewater Pumping Stations.*
- *The impact of environmental changes such as storm intensity and sea-level rise shall be allowed for.*

Impacts on the downstream network will be evaluated as for existing networks described below.

Existing Networks

Development applications to connect to the existing wastewater network will be assessed based upon the performance of the network in the vicinity of the development and the effect that the development will have on the network performance, the environment and any public health risks. Upgrades to existing infrastructure may be required to support the development. Below are the key technical criteria against which the impact of development on existing networks is assessed:

- *Dry weather overflows are not permitted.*
- *Existing uncontrolled (e.g. from a manhole lid) wet-weather overflows shall not be made worse.*
- *No new predicted uncontrolled wet-weather overflow locations shall be created.*
- *Any increase to the wet-weather overflow (volume or frequency) which is predicted to occur due to additional loading from the proposed development must be managed so that the increased overflow volume/frequency only occurs at existing designed EOPs located within the existing network infrastructure. The exception is new EOPs will be allowed at new pump stations; this may require BPO process for a new discharge location. Refer to appendix A of the standard for Local Network Wastewater Pumping Stations.*
- *Storage, if approved by Watercare, shall clear within 24 hours.*

5.3.2 Structure plan

5.3.2.1 Structure plan and live zone

Auckland Council may live zone land or facilitate a structure plan setting out certain information to be used in design, such as population to be served, flows, sizing, upstream controls, recommended pipe layout, or particular requirements of *Watercare*. Where a structure plan is not provided, the designer shall determine this information by investigation using this *code of practice*, engineering principles *and by discussions with Watercare as necessary*.

5.3.2.2 Areas not currently serviced by public wastewater systems

The Auckland Unitary Plan identifies future urban zoned land. The future service areas are located within the Rural-Urban Boundary (RUB). The future urban land zoning does not imply there is available capacity from existing assets to service this area. For servicing of areas not currently serviced by a public wastewater system planning studies are required to investigate servicing options, feasibility and cost effectiveness and will be dependent on the location, nature, scale, and funding agreement of the development.

Areas outside of the RUB currently not serviced by a public wastewater system shall comply with the Auckland Unitary Plan. Refer to Section 5.3.13 of this code for on-site wastewater discharge requirements. Watercare may accept new connections outside of the RUB at its discretion.

5.3.3 Future development

Watercare requires wastewater infrastructure to be constructed to the upper limits of the proposed development site in order to provide for the needs of future development as provided for under the Auckland Unitary Plan or existing upstream development.

Peak flows and cleansing velocities should be taken into account when designing for additional latent capacity.

All infrastructure proposed to service future development *requires* the approval of *Watercare*.

5.3.4 System design

5.3.4.1 Catchment design

Designers shall consider the hydraulic capacity of the network including the network design criteria (see section 5.3.1.b), the ultimate service area of the system and impact on the existing network.

Pipes within any project area shall be designed to be consistent with the optimum design for the entire catchment area and any future extension of the system shall be accommodated. *The design of the system shall provide a gravity wastewater connection as per section 5.3.10.4 for each lot within the development under consideration; unless a specific exemption has been granted by Watercare (Refer 5.3.12 Pressure Sewers).* This may affect the pipe location, diameter, depth, and maintenance structure location and layout. Designers shall adopt best practice to ensure a system with lowest life-cycle cost.

Pipes shall be designed with sufficient depth and capacity to cater for all existing and possible development of the catchment. Where future extension of the pipe is possible, it may be necessary to carry out preliminary designs for large areas of subdivided and un-subdivided land. This design shall use safety factors defined by *Watercare* for hypothetical subdivision and service for layouts to determine the necessary depth and diameter for an extension.

The need for wastewater pumped systems shall be minimized as far as practicable, for both the development under consideration, and any further subdivision, upstream or downstream.

The decision tree in Appendix B provides guidance to system selection:

5.3.4.1.b Hydraulic modelling

Notwithstanding the following assessment options, Watercare requires that a static assessment be provided in the first instance.

Watercare regards hydraulic modelling as the most accurate way to assess the capacity of a sewer and will at its discretion, require hydraulic modelling to be used in the assessment in conjunction with this CoP.

Where detailed catchment models are not available and/or not required by Watercare, the assessment will be based on a static assessment of flow verses network capacity as per this CoP, the available catchment information and Watercare's knowledge of the catchment performance.

5.3.4.2 Extent of infrastructure

Where pipes are to be extended in the future, the ends of pipes shall extend past the far boundary of the development by a distance equivalent to the depth to invert and be capped off, unless otherwise agreed to by *Watercare*. This ensures that a future extension of the pipe does not require unnecessary excavation within lots or streetscapes already developed.

5.3.4.3 Topographical considerations

In steep terrain the location of pipes is governed by topography. Gravity pipelines operating against natural fall create a need for deep installations which may require trenchless installation. This shall be avoided as far as practicable and the pipe layout shall conform to natural fall as far as possible.

5.3.4.4 Geotechnical investigations

The designer shall take into account any geotechnical requirements determined as part of the investigations for the development. *Watercare shall be advised of site geotechnical limitations as part of the design documentation, with statements provided as to how the proposed design avoids or mitigate those issues.*

5.3.4.5 Contaminated sites

Contaminated sites should be avoided. Where a contaminated site has been confirmed, written approval to proceed shall be obtained from the Auckland Council. The following issues shall be addressed in the request for approval:

- *The nature of the contamination;*
- *Compliance with statutory requirements;*
- *Options to de-contaminate the area;*
- *Selection of pipeline materials to achieve the required life expectancy of the wastewater system; and*
- *Safety of construction and maintenance personnel;*

Any contaminants in the soil, including topsoil on the site, shall be at the lesser levels of the health-based or environmental related protection values as described below:

- *Health based protection values:*

  NES Soil contaminant standards (SCS) for residential land use (no produce, if applicable) as derived in accordance with Ministry for the Environment Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health (Chapter 7). In the absence of a derived NES Soil SCS, then a standard following the hierarchy outlined in the Ministry for the Environment, Contaminated Land Management Guidelines No 2 shall be adopted.

- *Environmental related protection values:*

  Auckland Council Air Land and Water (ALW) Plan criteria for discharges as described in Rules 5.5.41.

- *No asbestos containing material or volatile organic compounds in site soils.*

No free (or separate) phase liquid contaminants and groundwater contaminant concentrations, with the exception of volatile organic compounds, which must be below the Australian and New Zealand Guidelines for Fresh and Marine Water Quality at the level of protection for 80% of freshwater species. Concentrations of volatile organic compounds shall be below typical laboratory screening detection limits (0.5 mg/L or lower).

The following table sets out the acceptance criteria for contaminant free sites:

Contaminant	***Acceptance level (mg/kg)***
Arsenic	*<24*
Cadmium	*<7.5*
Chromium	*<400*
Copper	*<325*
Lead	*<250*

Contaminant	*Acceptance level (mg/kg)*
Mercury	*<0.75*
Nickel	*<105 [1]*
Zinc	*<200 [1]*
Benzo(a)pyrene equivalent	*<2.15*
Pyrene	*<1*
ΣDDT	*<0.7*
VOCs	*Below laboratory detection limit*

[1] Can use upper limit background concentration in Auckland region (i.e. 320 for Nickel and 1160 for Zinc) if the soil is volcanic source

A site investigation including soil sampling and testing must be undertaken and a report submitted to Watercare in accordance with the requirements of the Ministry for the Environment, 2011, Contaminated Land Management Guidelines No. 1 - Reporting on Contaminated Sites in New Zealand. Testing shall be conducted by a NATA/IANZ accredited laboratory.

Soil testing data is required at the position for the proposed wastewater infrastructure. Watercare reserves the right to request additional soil testing at the cost of the developer where the data supplied is considered inadequate or not representative of the site.

5.3.5 Design criteria

5.3.5.1 Design flow

Wastewater design flow comprises domestic wastewater, industrial wastewater, infiltration, and direct ingress of stormwater. *The latter three inflows shall be considered as design factors only and minimised by proper material selection and construction techniques.*

Wastewater pipelines shall be designed such that:

a) There is sufficient capacity to convey the Peak Design Flow from the area they service without surcharge. The Peak Design Flow provides an allowance in the pipe network sizing calculations to ensure that the network has capacity for less-frequent, but particularly large spikes, in dry weather flow that can occur from time-to-time.
b) The minimum velocity for solids re-suspension (i.e. Self-Cleansing Velocity, refer Section 5.3.5.3) is achieved at least once per day at the Self-Cleansing Design Flow. The Self-Cleansing Design Flow is lower than the Peak Design Flow to estimate every-day increases in the diurnal flow. The Self-Cleansing Design Flow shall be determined as follows:

i. Where measured flow data is unavailable:

Self-Cleansing Design Flow = (design Average Dry Weather Flow) x (Self-Cleansing Peaking Factor, as outlined in the applicable design-flow tables in section 5.3.5.1.1).

ii. Where measured flow data is available (1):

Self-Cleansing Design Flow = the 1-hour Peak Dry Weather Flow(2), for the day of the week with the lowest peak diurnal dry-weather flow.

Notes:

(1) When assessing the Self-Cleansing Design Flow, measured Dry Weather Flow data (provided it has been determined accurate) is preferred to standard design values and should be used where available.

(2) The dry weather flow period needs to meet the definition of 'Dry Weather' as described in the definition of Average Dry Weather Flow below.

5.3.5.1.1 New infrastructure design flow calculation

The wastewater design flow for new wastewater infrastructure shall be calculated by the method nominated by Watercare. Unless otherwise stated in writing the following design parameters shall be used to calculate design flows.

A. Residential (domestic) design flows:

a) Design wastewater flow allowance and wastewater peaking factors for residential dwellings as per Table 5.1.1; and

b) Design wastewater occupancy allowances as per Table 5.1.2

Table 5.1.1 – Design residential design wastewater flow allowance and peaking factors

Residential property type	***Design wastewater flow allowance***	***Design wastewater peaking factors***	
	Litres per person per day (L/p/d)	***Peaking factor: Self-Cleansing Design Flow*** *(Normal PDWF)*	***Peaking factor: Peak Design Flow*** *(PWWF or Exceptional PDWF)*
Up to three storey residential development	*180*	*3.0*	*6.7*
High-rise residential (or mixed-use) buildings four storeys and above	*180*	*3.0*	*5.0*

Table 5.1.2 Design residential occupancy allowances

Number of bedrooms (Notes 1 and 2)	***Occupancy for design purposes (i.e. people)***
1	*2*
2-4	*3*
More than 5	*Specific agreement with Watercare*
Unknown	*For high rise apartments (four floors or more) and other residential assume a design occupancy rate of 5 per dwelling unit.*

Table notes:

1. *Where large dwellings are proposed, which have additional rooms beyond those allocated as dining, lounge and bedroom e.g. family, office, study or sleepouts which have the potential to be used as bedrooms, an additional occupancy allowance should be made on the basis of 1 extra person times the ratio of the total floor area of the additional room(s) to that of the smallest designated bedroom.*
2. *For residential retirement villages without a hospital facility and that have single bedroom units then a design occupancy rate of 1.5 may be considered.*

Residential example 1:

For a new land-subdivision of 50 new dwellings with three bedrooms per dwelling use:

Design Population = 50 dwellings x 3 people = 150 people

Design ADWF (L/s) = 150 people x 180 (L/p/d) ÷ 86400 (seconds/day) = 0.3125 L/s

Self-Cleansing Design Flow (L/s) = ADWF x $PF_{Self\text{-}Cleansing}$ = 0.3125 L/sec x 3.0 = 0.938 L/s

Peak Design Flow (L/s) = ADWF x $PF_{Peak\ Design\ Flow}$ = 0.3125 L/sec x 6.7 = 2.094 L/s

Residential example 2:

For six storey apartment building with 10 x 1 bedroom units and 55 x 2 bedroom units use:

Design Population = (10 units x 2 people) + (55 units x 3 people) = 185 people

Design ADWF (L/s) = 185 people x 180 (L/p/d) ÷ 86400(seconds/day) = 0.39 L/s

Self-Cleansing Design Flow (L/s) = ADWF x $PF_{Self\text{-}Cleansing}$ = 0.39 L/s x 3.0 = 1.16 L/s

Peak Design Flow (L/s) = ADWF x $PF_{Peak\ Design\ Flow}$ = 0.39 L/s x 5.0 = 1.95 L/s

B. Commercial design flows (non-domestic):

a) *Where flows (both average and peak) from a particular commercial activity are known, they shall be used as the basis of design.*

b) *If average flows are available for the commercial activity, but peak discharge factors for the activity are unavailable, the average flow data shall be used in conjunction with the Peaking Factors documented in Table 5.1.3 to estimate the Self-Cleansing and Peak Design Flows.*

c) *Where there is no specific flow information available, Table 5.1.4 shall be used to estimate the Design Flows.*

Table 5.1.3 Commercial - dry retail, office and wet retail design wastewater flow allowance and peaking factors

Commercial activity type	***Design wastewater flow allowance***	***Design wastewater peaking factors***	
		Peaking factor: Self-Cleansing Design Flow *(Normal PDWF)*	***Peaking factor: Peak Design Flow****(PWWF or Exceptional PDWF)*
Dry retail (Note 1) (where kitchen/toilets are *<u>not</u>* *normally made available to customers)*	*1 person per 50m² net floor area at 65 litres per person per day.*	*2.0*	*5.0*
Office buildings and dry retail where toilet facilities, etc. are provided to customers.	*1 person per 15m² net floor area at 65 litres per person per day.*	*2.0*	*5.0*
Wet retail (Note 2): Food and or beverage retail/preparation e.g. coffee shop, restaurant, bar, butcher, fresh fruit and vegetable retail.	*15 litres per day per net m² of floor area (including kitchen and dining areas).*	*2.0*	*6.7*

Commercial activity type	***Design wastewater flow allowance***	***Design wastewater peaking factors***	
		Peaking factor: Self-Cleansing Design Flow *(Normal PDWF)*	***Peaking factor: Peak Design Flow****(PWWF or Exceptional PDWF)*
Unknown and site area >10ha, <100ha	*1 L/s/ha (complete land area)*	*2.0*	*6.7*
Site area >100ha	*Refer to transmission design standards*	*-*	*-*

Table notes:

1. *Dry retail is where water is normally only used by staff for their own personal food preparation / toileting needs. Examples include: clothes shop, hardware retail.*
2. *Wet retail is where water is used to prepare food product for customers. Examples include: café, lunch bar, restaurant, butchery, fresh fruit and vegetable, food court-bar and supermarkets.*

Important:
Net floor area is the total floor area of the building (exclude any open land areas), less non-productive areas, such as:
lobbies; lifts; machine rooms; electrical services; stairwells; fire escapes; corridors and other passages used in common with other occupiers; car parking areas; etc. If net area is unknown, and the type of buildings are unknown, it can be assumed that the Net floor area is = 80% of the gross floor area of the building.

As a guide to how activities will be assessed, commercial washing activities such as car / boat washing activities, etc. would be regarded as a "wet-industry" and not as a commercial - wet retail, as the water is being used as a part of a process (washing). Large-scale food-processing (i.e. for supply to commercial customers, as opposed to on-site retail customers) would be regarded as an industrial type activity. Preparation / manufacture of non-food based products, is also regarded as an industrial activity. Industry design flows are detailed in the section below.

Commercial example:

For multi-tenancy commercial building with 110m^2 café (i.e. wet retail); 50m^2 shoe shop (i.e. dry retail); and three levels of 160m^2 of office space (i.e. office building) per floor (with a total office floor area of 480m^2) use:

Design ADWF (L/s) = (café: 15 L/d/m^2 x 110m^2) + (shoe shop: 65 L/p/d x (50/50m^2) + ...

...(office: 65 L/p/d x 3 floors x (160 / 15m^2)

= (café: 1,650 L/d) + (shoe shop: 65 L/d) + (office: 2,080 L/d)

= 3,795 L/d

= 3,795 L/d ÷ 86400 (seconds/day) = 0.044 L/s

Self-Cleansing Design Flow (L/s) = ADWF x PF$_{Self\text{-}Cleansing}$ = 0.044 L/sec x 2.0 = 0.088 L/s

Peak Design Flow (L/s) = Sum of ADWF x PF$_{Peak\ Design\ Flow}$ for each component of the flow

= (café: 1,650 L/d x 6.7) + (dry retail 65 x 5) + (office: 2,080 x 5)

= (11,055 L/d + 325 L/d + 10,400 L/day) ÷ 86400 (seconds/day)

= 0.252 L/s

C. Dry industry design flows (non-domestic):

Dry industrial flows are those arising from commercial activities that involve a nature similar to, but not limited to:

a) Manufacture / assembly / processing of goods e.g. tool and die; machining.
b) Preparation / packaging / storing / moving products e.g. timber yard.
c) Service centre for machinery / vehicles depot e.g. car mechanic; delivery vehicle depot.

Industrial wastewater flows may vary significantly depending on the industry type, size, and operational techniques. Also, peak flows may be significant because of the method of operation and work shifts. Where actual discharge rates are known, these values should be used. For design purposes, where specific land uses are known, wastewater generation rates can be derived from literature values; references must be included with design assumptions. In the absence of more accurate information, Table 5.1.4 shall be used.

Table 5.1.4 – Dry industry design wastewater flow allowance and peaking factors

Dry industry activity type	Routine Peak Daily Discharge Litres per square metre per day ($L/m^2/d$) (See Note 5)	Design wastewater peaking factors	
		Peaking factor: Self-Cleansing Design Flow (Normal PDWF)	Peaking factor: Peak Design Flow (PWWF or Exceptional PDWF) (See Note 6)
Light water users, or up to 2 storeys (Note 1)	4.5	5.0 x (Routine Instantaneous Peak Discharge)	6.7 x (Routine Peak Daily Discharge)
Medium water users, or 2 to 5 storeys (Note 2)	6.0		
Heavy water users, or 5 to 10 storeys (Note 3)	11.0		
Very heavy water users (Note 4)	> 11.0 Specific design required	Specific design required	Specific design required
Unknown and site area >10ha, <100ha	1 L/s/ha (complete land area)	2.0	6.7
Site area >100ha	Refer to transmission design standards	-	-

Table notes:

1. *A light water usage industry is a relatively dry and clean trade where industrial practices do not include process water usage. Showers provided for personnel's ad-hoc use would still fall into the 'light water usage' category.*
2. *A medium water usage industry in a dirty trade where good industrial practice requires regular water usage and showers are in daily use because of commercial activities that require staff to have washing facilities, but there is no process water usage.*
3. *A heavy water usage industry in a trade that uses water as a part of commercial activities in moderate quantities, but is not a Wet Industry, as defined below. Wherever possible, the design wastewater flow for a heavy water usage industry should be checked against known water consumption and peak discharge rates. The Design Engineer shall submit evidence of these checks as a part of the application.*
4. *A very heavy water usage industry in a trade that may discharge in excess of 11 $L/m^2/d$ on a routine basis.*
5. *The Peak Design Flow is larger than the Routine Instantaneous Peak Flow to ensure that there is sufficient capacity in the network to convey spikes in discharge that may occur on occasion over the design life of the wastewater system. The Peak Design flow also provides an allowance for wet-weather inflow and infiltration*

that may start to occur as the network deteriorates over its 100 year design life.
6. *A 'Routine' discharge event is defined as having a frequency of once or more per year.*

General principle to be applied:
For greenfield development of dry (and wet) industrial land the minimum pipe size shall be a nominal 225mm diameter. See Table 5.3 for further details. This allowance is to provide flexibility for future activity changes within an industrial complex.

Dry industry example:

An industrial zoned land at a greenfield site is being developed and will accommodate a kitchen-cabinetry business. The floor area is 3,000m^2. The kitchen cabinetry activity is classified as an industrial light water-user.

Design Routine Peak Flow (L/s) = 3000 (m^2) x 4.5 (L/m^2/d) ÷ 86400 (seconds/day) = 0.156 L/s

Self-Cleansing Design Flow (L/s) = ADWF x $PF_{Self\text{-}Cleansing}$ = 0.156 L/s x 5.0 = 0.78 L/s

Peak Design Flow (L/s) = ADWF x $PF_{Peak\ Design\ Flow}$ = 0.156 L/sec x 6.7 = 1.05 L/s

D. Wet industry and major industrial users design flows:

A wet industry is defined as an activity which meets any of the following criteria:

a) *Discharges water into the public wastewater network as a part of an industrial process or commercial washing activity / service e.g. laundromat, car-wash.*
b) *Where the Routine Peak Daily Discharge from the activity will routinely exceed 11 L/m^2/d.*

In addition to the information required under the trade-waste consent application, Watercare requires users in the Wet-Industry and Very Heavy Industrial user categories to provide detailed information that clearly and accurately document the minimum, average, and instantaneous-peak discharge flow rate, as well as the volumes from the activity / process under routine, abnormal (i.e. maintenance), and (if applicable) emergency scenarios.

E. Mixed-use design flows:

For mixed-use developments, the design flow for each of the basic uses of the proposed development shall be calculated separately, and then summed to establish the total design flow for the site.

Mixed-use example:

A high-rise residential development (a total of six levels) with a building footprint of 500m^2; two Levels of car-parking and a ground-floor with dry-retail commercial space and three floors of residential apartments comprising three 2-bedroom apartments per floor use:

- *Net Commercial Area = 80% x 500m^2 = 400m^2*
- *ADWF from car parking area = 0 L/m^2/d*
- *Design occupancy for a 2-bedroom apartment = 3 people per apartment*
- *Residential Design Population = Three floors x three 2 bedroom apartments per floor*
  = Nine 2-bedroom units
  = 9 units x 3 people per unit
  = 27 people

Design AWDF (L/s)

- *Dry-retail ADWF = 65 L/p/d x (400m^2 net floor area ÷ 50m^2 per staff member) = 520 L/d*
  = 520 L/d ÷ 86400 (seconds/day) = 0.006 L/s
- *Residential ADWF = 27 people x 180 L/p/d = 4,860 L/d*
  = 4,860 L/d ÷ 86400 (seconds/day) = 0.056 L/s

Self -Cleansing Design Flow (L/s) =

= Dry-retail Design Cleansing Flow + Residential Design Cleansing Flow

$= \{ADWF_{Dry\text{-}Retail} \times PF_{Dry\text{-}Retail – Self\ Cleansing}\} + \{ADWF_{Residential} \times PF_{Residential – Self\ Cleansing}\}$

$= \{0.006 \times 2\} + \{0.056 \times 3\}$

= 0.180 L/s

Peak Design Flow (L/s) =

= Dry-retail Peak Design Flow + Residential Peak Design Flow

$= \{ADWF_{Dry\text{-}Retail} \times PF_{Dry\text{-}Retail – Peak\ Design}\} + \{ADWF_{Residential} \times PF_{High\text{-}Rise\ Residential – Peak\ Design}\}$

$= \{0.006 \times 5\} + \{0.056 \times 5\}$

= 0.310 L/s

F. Other facility design wastewater flows and peaking factors:

Other facility types		***Design wastewater flow allowance***	***Design wastewater peaking factors***	
			Peaking factor: Self-Cleansing Design Flow *(Normal PDWF)*	***Peaking factor: Peak Design Flow*** *(PWWF or Exceptional PDWF)*
Hospitals	*Day facility (treatment facilities, wards)*	*280 Litres per bed per day*	*2.0*	*5.0*
	Night and day facility (24-hour operation)	*570 Litres per bed per day*	*1.5*	*5.0*
	Staff	*45 litres per employee per day*	*2.0*	*5.0*
Child day-care	*Children*	*42 Litres per child per day*	*2.0*	*6.7*
	Staff	*45 Litres per employee per day*		
School (day students)	*Primary school*	*15 Litres per student per day*	*2.0*	*6.7*
	Secondary school	*20 Litres per student per day*	*2.0*	*6.7*
	Staff	*45 Litres per employee per day*	*2.0*	*6.7*
School (boarding)	*Secondary school*	*140 Litres per student per day*	*3.0*	*6.7*
Student accommodation		*140 Litres per person per day*	*3.0*	*6.7*
Hotels and motels	*Guests*	*180 Litres per room per day*	*3.0*	*6.7*
	Staff	*45 Litres per employee per day*	*3.0*	*6.7*
Community halls and churches and/or facilities with intermittent use		*10 Litres per seat per day*	*2.0*	*Peak discharge to be based upon the fixture-unit rating for the facility as defined in NZS 3500.2 (2015).*

General principles to be applied:

1. *For activities that operate 24 hours a day (or close to a 24 hours day) the Self-Cleaning Design Flow Peaking Factor = 1.5 because wastewater is discharged over a 24-hour period.*

2. *For activities where water is consumed and discharged into the sewer at a relatively even rate throughout a typical working day, e.g. over an 8-12 hour period, the Self-Cleaning Design Flow Peaking Factor = 2.0.*
3. *For activities where water is consumed at higher rates at certain periods of day e.g. hotel/motel with morning and evening peaks in usage, the Self-Cleaning Design Flow Peaking Factor = 3.0.*
4. *For facilities with intermittent use, the Self-Cleaning Design Flow Peaking Factor = 2.0.*
5. *For activities where a large number of people can be expected to use multiple water fixtures simultaneously e.g. community halls and conference halls, the Peak Design Flow shall be based on the number of water fixtures / appliances, as per NZS 3500.2 Plumbing and Drainage: Part 2: Sanitary plumbing and drainage.*

5.3.5.1.2 Existing network infrastructure capacity assessment *for gravity systems*

Wastewater capacity checks shall utilise the same design methodology requirements for new wastewater developments, except as noted in this section, or as otherwise provided by written instruction from Watercare*. The designer shall complete the Watercare capacity assessment form provided by Watercare as part of the engineering approval application. The wastewater capacity assessment shall be valid for one year from the date of assessment. Applications received with an expired capacity assessment shall have the capacity re-assessed.*

C 5.3.5.1.2*: With significant time lapse the network may have extended significantly requiring the capacity check to be confirmed to make sure that sizing assumptions are still valid.*

Refer to section 5.3.10 and 5.3.12 for pressure systems.

A. Calculation of net difference of post verses pre- development peak design flow

The impact of the proposed development on the existing network will be assessed based upon the net change in Peak Design Flow from the proposed development. The designer shall assess the net change in flow using the following formula:

Net Change in Peak Design Flow = (Post Development Site Peak Design Flow) – (Pre Development Site Peak Design Flow)

B. Thresholds

Where there are other consented developments in the same hydraulic catchment (to the nearest wastewater main) of the proposed development then additional checks will be required by Watercare regardless of meeting any or all of the threshold criteria.

Threshold criteria for eliminating the need for checks must meet all of the following criteria:

(1) The site is outside Watercare's defined combined network area;
(2) The net change in Peak Design Flow from the site is less than 1.0 L/s, or is for less than 20 new dwellings, or the proposed development reduces the current number of residential dwellings (for commercial/industrial/other users, reducing the current discharge);
(3) There is no future upstream greenfield land that is required to gravitate through the site in order to connect into the existing wastewater network;
(4) Any proposed buildings are less than four storeys high;
(5) The development or area of connection will connect up to a wastewater main which is usually 300mm or larger.

Failing to meet any of the threshold criteria, then a capacity check must be undertaken as prescribed in the sections below. Refer Appendix A for a graphical representation of the process.

The above development threshold criteria are indicative. A wastewater capacity check may be required at Watercare's discretion, depending on the nature and location of the development proposal within the receiving network.

C. Capacity assessment levels

Level 1: Check pipe-full capacity against Peak Design Flow:

Watercare may issue written instruction to be exempt from the Level 1 check, and to undertake a Level 2 or Level 3 assessment when there are known overflows that require assessment.

The purpose of the Level 1 assessment is to provide a relatively quick and simple assessment of the existing network capacity to identify if a more detailed analysis or improved asset data capture is required.

- *Where the proposed development exceeds the thresholds described in Section 5.3.5.1.2 (B), the Level 1 capacity check shall be carried out in the first instance.*

The assessment methodology is detailed below:

A spreadsheet analysis comparing the pipe-full capacity versus the design flow shall be carried out based on the inputs as described in section 5.3.5.1.2 D to G. Any pipes that are identified to have an Existing WW Capacity Assessment Flow greater than the pipe full capacity shall be highlighted within the tabular outputs included in the submission, and clearly marked on a drawing of the pipe network assessment extents.

If a design flow is in excess of the pipe full capacity at an assumed minimum gradient (due to a missing asset data, or unknown pipe diameter); then these pipes shall be identified separately within the tabular outputs and distinguished on a drawing of the pipe network assessment extents.

The results of the Level 1 assessment shall be submitted to Watercare for consideration. Depending on the results of the Level 1 assessment, Watercare may:

a) *Determine that the existing network has sufficient capacity to accept flows from the proposed development;* ***or***
b) *Request the developer to arrange a field-survey / CCTV to measure missing pipe network data, such that the Level 1 calculations can be re-performed using with measured pipe gradients / diameters, rather than assumed gradients / diameters. Field survey / CCTV (if required) will be at the developer's expense.*
   And/or
c) *Request that a more detailed analysis of network capacity is carried out as per the Level 2 (static HGL analysis) or Level 3 (hydraulic model analysis) as described above.*

Level 2: Static hydraulic grade line (i.e. static HGL) analysis:

a) *The Level 2 check will only be required of the developer if a Level 1 assessment highlights potential capacity problems within the existing network, or where Auckland Council or Watercare identifies that an uncontrolled wastewater overflow that already exists, or could result from the development under consideration.*
b) *The Level 2 assessment requires the calculation of a hydraulic grade line based on a static flow analysis. Watercare will provide site-specific details where they are known.*
c) *The static flow assessment shall be based on the Peak Design Flow for the catchment, calculated as described in Section 5.3.5.1.1 of this CoP, except where:*
   - *Watercare provides further written guidance on the existing flow values that are to be used for the assessment. In this instance Watercare will base the design flows on catchment-wide information held by Watercare, Watercare's knowledge of the catchment performance, the unique mix of customers in the catchment, and/or typical performance factors encountered elsewhere in similar catchments.*

Depending on the results of the Level 2 assessment, Watercare may:

a) *Determine that the existing network has sufficient capacity to accept flows from the proposed development;* ***or***
b) *Require existing infrastructure to be upsized/upgraded/installed/modified in a manner which addresses the lack of capacity;* ***or***
c) *Request the designer to arrange additional field-survey / CCTV to measure missing pipe network data, such that the Level 2 calculations can be re-performed using with measured pipe gradients / diameters, rather than assumed gradients / diameters. Field survey / CCTV (if required) will be at the developer's expense.*
   And/or
d) *Request that a more detailed analysis of network capacity is carried out as per the Level 3 (hydraulic model analysis) as described above.*

C5.3.5.1.2 C (1)*: With regards to Infrastructure Upgrades. If Watercare deems that the Level 2 Static HGL analysis has reliably identified asset(s) which have insufficient capacity; Watercare will work with the developer to find solutions to address the lack of capacity.*

Watercare may at its discretion undertake the Level 2 assessment.

<u>Level 3: Hydraulic model analysis:</u>

It is not expected that designers will have to undertake a Level 3 analysis, except on specific instruction from Watercare. Watercare may at its discretion elect to carry out a Level 3 analysis.

The Level 3 check will only be required if:

a) *A Level 1 or Level 2 assessment highlights potential capacity problems in the existing network;* ***or:***
b) *Auckland Council or Watercare is aware of an uncontrolled wastewater overflow that already exists or could result from the development under consideration.*
   And:
c) *Watercare considers that the behaviour of flows within the network assessment extents is complex, and cannot be adequately represented by a static flow hydraulic grade line analysis;* ***or:***
d) *Where a hydraulic model of the network assessment extents already exists and where Watercare consider that the availability of the hydraulic model will offer either additional speed or accuracy (or both) to the assessment.*

Watercare will provide instruction when it is necessary for a designer to undertake a Level 3. If a hydraulic model analysis is required, Watercare will make the applicable section of network from an existing hydraulic model available to the designer to aid in the assessment. However, if Watercare does not hold a hydraulic model for the section of network, Watercare may request the designer to develop a model at their expense to model the section of existing network affected by the proposed development. Watercare will provide site-specific details on any hydraulic model analysis that is undertaken by the designer where available.

Depending on the results of the Level 3 assessment, Watercare may:

a) *Determine that the existing network has sufficient capacity to accept flows from the proposed development;* ***or***
b) *Require existing infrastructure to be upsized/upgrade/installed/modified in a manner which addresses the lack of capacity;* ***or***
c) *Request the designer to arrange additional field-survey / CCTV / network flow gauging to measure missing pipe network data, such that the Level 3 calculations can be re-performed using with*

measured pipe gradients / diameters / network flows, rather than assumed gradients / diameters. Flow gauging / Field survey / CCTV (if required) will be at the developer's expense.

And/or

d) *Request that the hydraulic model analysis is further refined to improve the accuracy of outputs.*

C 5.3.5.1.2 C (2): *With regards to Infrastructure Upgrades. If Watercare deems that the Level 3 Static HGL analysis has reliably identified asset(s) which have insufficient capacity; Watercare will work with the developer to find solutions to address the lack of capacity.*

Watercare may at its discretion undertake a Level 3 analysis by itself.

D. Network assessment extents

The designer shall identify the extents for the existing network capacity assessment. The assessment extents shall include the length of network between the development's proposed connection point(s) to the existing network up to the nearest wastewater main which is usually 300mm or larger.

E. Catchment Boundaries for the Network Assessment

Wastewater flows within the Watercare network both upstream and downstream of development's connection point shall be included in the existing network capacity assessment, in addition to the Peak Design Flow from the proposed development. In order to determine the flows from existing customers, the network boundaries have to be determined.

A pipe-reach will typically be regarded as the section of network between points where significant tributaries enter the network.

C 5.3.5.1.2 E. *To aid the developer, catchment boundaries (where available) have been provided in Watercare's GIS Viewer for Asset Data Query and Land Development/Subdivision**.** As a guideline a catchment should be derived for every significant tributary entering the network extent between the development site and the receiving 300 mm asset or pump station.*

F. Pipe gradient, diameter and manhole data assessment

The designer shall download pipe and manhole ground-level and invert information from Watercare's WW Connection GIS Application to determine the gradient and diameter of the existing pipes as necessary to calculate the hydraulic capacity of the existing network. The designer needs to be aware of the data set reliability rating when using information supplied through GIS (field indicated on GIS inquiry).

If the diameter of a pipe is unavailable or assumed, the designer shall assume the missing pipe diameter information based upon the diameter of the nearest confirmed upstream or downstream pipe. If Watercare's asset data is insufficient for gradients for existing pipes to be determined, the pipe gradient shall be assumed as per the minimum pipe grades outlined in Table 5.4.

Pipes with assumed gradient or diameter information shall be clearly documented in the designer's capacity assessment submission and shown spatially on a drawing.

G. Calculation of wastewater flows from existing customers

The existing wastewater capacity assessment flow shall be calculated using the following formula:

Existing WW Capacity Assessment Flow = (Peak Design Flow from Proposed Development) + (Peak Design Flow from Existing Customers)

Peak Flow Design from existing residential customers:

Unless advised otherwise, the Peak Design Flow from Existing Residential Customers shall be based on 0.054 L/s per connection point (i.e. 180 L/p/d x PF 6.7 at an occupancy rate of 3). The developer can use Watercare's GIS Viewer for polygon selection to count the number of connection points upstream of the applicable pipe-reach or if available select the connection points from within catchment boundaries.

C 5.3.5.1.2 G: *There are some instances throughout the city where multiple residential dwellings will be supplied via a single connection point. The developer shall use aerial photos to identify any instances where this might occur within the assessment area. Where identified, the developer must contact Watercare to request water consumption data for the affected pipe-reach.*

Non-residential existing customers:

Unless advised otherwise, consumption data for all non-residential customers within the assessment area shall be estimated using the design flow values documented in this CoP under sections 5.3.5.1.1 (B), (C), D).

H. Infrastructure assessment deliverables

Level 1 and 2 assessment deliverables:

1. *An overview drawing showing:*
   a. *Location and boundary of proposed development;*
   b. *Nearest 300mm sewer or WW pump station;*
   c. *The determined Network Assessment Extent;*
   d. *The determined catchment boundaries.*
2. *A Level 1 Assessment results drawing showing:*
   a. *The determined Network Assessment Extent;*
   b. *Pipes with assumed gradients;*
   c. *Pipes with assumed diameters;*
   d. *Pipes where the Existing WW Capacity Assessment Flow is greater than the pipe full capacity.*
3. *A spreadsheet / tables (pdf and electronic) detailing:*
   a. *The asset data (invert levels, gradients, diameters, depth and ground level, etc.);*
      i. *Assets with Assumed data are to be highlighted in the tabular outputs.*
   b. *The pipe friction parameter used in the calculation;*
   c. *The calculated Existing WW Capacity Assessment Flow for each pipe-reach. The key variables underlying the Existing WW Capacity Assessment Flow are to be outlined in the table:*
      i. *Number of residential (domestic) customer connection data points;*
      ii. *Estimated commercial floor area upstream of the applicable pipe-reach; and the unit-rate flow of the commercial users as above in Section 5.3.5.1.1 (2), (3), (4) e.g. 1,000 m^2 dry retail @ XX L/d/m^2.*
   d. *The calculated Pipe Full Capacity for each pipe-reach of the network. The calculation methodology (e.g. Mannings equation / Colebrook-White) shall be identified in the submission.*
   e. *The Residual Pipe Capacity shall be calculated for each pipe within the Network assessment extent, where:*

      Residual Pipe Capacity = (Pipe Full Capacity) – (Existing WW Capacity Assessment Flow)

f. Pipes with a negative Residual Pipe Capacity (those where the Existing WW Capacity Assessment Flow exceeds the pipe full capacity) shall be highlighted in the tabular deliverables.

Level 3 assessment - required deliverables:

The deliverables required for a Level 3 assessment will be agreed on a case-by-case basis.

5.3.5.2 Hydraulic design of pipelines

The hydraulic design of wastewater pipes should be based on either the Colebrook-White formula or the Manning formula. The coefficients to be applied to the various materials are shown in table 5.2.

Table 5.2 – Guide to roughness coefficients for *wastewater* lines

Material	**Colebrook-White coefficient** k (mm)	**Manning roughness coefficient** (n)
All pipe material and lining types for gravity systems and low pressure collection systems (PWC), flowing full.	*1.5*	*0.013*
All pipe material and lining types for pressure rising mains, flowing full	*0.6*	*0.011*
NOTE – (1) These values take into account possible effects of rubber ring joints, slime, and debris. (2) The n and k values apply for pipes up to *and including* DN 300.		

5.3.5.3 Minimum pipe sizes

When considering the peak dry weather flow (PDWF), the pipe must be less than half full (<50%). This condition shall be used to confirm the self-cleansing velocity. The self-cleansing velocity shall be minimum 0.75m/s for gravity systems. Refer to the local network wastewater pumping station standard (document number DP-06) for the flow velocity range of rising mains.

The depth of flow at peak wet weather flow (PWWF) shall not exceed 75% of the depth of the pipe.

Irrespective of other requirements, the minimum sizes of property connection and reticulation pipes shall be not less than those shown in table 5.3.

C5.3.5.3

For infill situations where upgrading of an existing DN 100 connection is impractical and the pipe is in sound condition and at reasonable grade to provide self-cleansing; then up to six dwelling units may use the existing connection.

Table 5.3 – Minimum pipe sizes for wastewater reticulation and property connections

Pipe	**Minimum size** DN (mm)
Connection servicing 1 dwelling unit	100
Connection servicing more than 1 dwelling unit	150
Connection servicing commercial lots	150
Connection servicing industrial lots	225

NOTE – In practical terms, in a *residential development* not exceeding *20* dwelling units, and where no pumping station is involved, DN 150 pipes laid within the limits of table 5.4 and table 5.5 will be adequate without specific hydraulic design *of the pipe network*.

5.3.5.4 Limitation on pipe size reduction

The pipe size *shall not* be reduced on downstream *sections without prior written approval from Watercare*.

The pipe size reduction request must be submitted with supporting engineering calculations justifying the request.

5.3.5.5 Minimum grades for self-cleaning

Self-cleaning of grit and debris shall be achieved by providing minimum grades specified in tables 5.4 and 5.5 *under the flow conditions as specified in section 5.3.5.3. The minimum grades shall be achieved irrespective of the minimum self-cleansing velocity.*

Table 5.4 – Minimum grades for gravity wastewater *reticulation* pipes

Pipe size (DN)	**Absolute minimum grade** (%)
150	0.75 *where less than 200 dwellings at this minimum gradient and 1.0 where less than 20 dwellings at the minimum gradient*
225	0.45
300	0.3

Table 5.5 – Minimum grades for property connections and permanent ends

Situation	**Minimum grade** (%)
DN 100 property connections	*1.7 (subject to accurate construction)*
DN 150 property connections	*1.2 (subject to accurate construction)*
Permanent upstream ends of DN 150, *225*, and 300 pipes in residential areas with population ≤20 persons	1.00

5.3.5.6 Maximum velocity

The maximum velocity for peak wet weather flow is 3.0 m/s. Where a steep grade that will cause a velocity greater than 3.0 m/s *is encountered, specific design measures must be considered to prevent:*

(a) Hydraulic jump if a steep graded wastewater changes to a flatter grade, similarly where a pressure main discharges into a gravity wastewater;
(b) Turbulence that may block air flow and release gasses;
(c) Increased manhole water levels; and
(d) Resulting vacuum impacting on boundary traps and seals posing a public health risk and odour issues.

Possible solutions may include:

- *Reducing pipe grade*
- *Drop structure*
- *Energy dissipation chamber*

5.3.5.7 Gravity wastewater applications

The pipe shall be designed to:

(a) Have adequate capacity, grades, and diameters;
(b) Have adequate grade for self-cleaning;
(c) Be deep enough to provide gravity service to all lots;
(d) Comply with minimum depth requirements to ensure mechanical protection and safety from excavation;
(e) Avoid all underground services, while maintaining all the necessary clearances
(f) Allow for various drops and losses through MHs*, and*
(g) Be easily accessible for future operation and maintenance

5.3.5.8 Pressure wastewater applications

The use of pressure systems requires specific approval from Watercare after demonstration that a gravity solution is not achievable. Refer to section 5.3.7.4A and section 5.3.12 for pressure wastewater systems and the on-site requirements.

5.3.6 Structural design

5.3.6.1 General

The design shall be in accordance with AS/NZS 2566.1, or AS/NZS 3725 *as appropriate for the material type*, including the structural design commentary AS/NZS 2566.1 Supplement 1. *The pipe structural design shall also consider seismic actions in accordance with NZS 1170.5 and Supplement 1.* Details of the final design requirements shall be shown on the drawings.

5.3.6.2 Seismic design

All pipes and structures shall be designed with adequate flexibility and special provisions to minimise risk of damage during earthquake. Historical experience in New Zealand earthquake events suggests that suitable pipe options, in seismically active areas, may include rubber ring joint PVC, PE pipes *or concrete lined steel pipe*. Specially designed flexible joints shall be provided at all junctions between pipes and rigid structures *where pipe flexibility alone is not adequate to accommodate movement. Where structures are closely spaced such as at pump stations, base isolation of the area may be considered where minor actions are expected. Connecting to the base isolation area requires a flexible connection.*

C5.3.6.2

Guidance for pipe seismic design method and philosophy can found in "Seismic Guidelines for Water Pipelines", American Lifelines Alliance, 2005, or "Guidelines for Seismic Design of Buried Pipelines",NICEE, 2007, or Water NZ Underground utilities – Seismic assessment and design guidelines.

5.3.6.3 Structural consideration

Pipelines shall be designed to withstand all the forces and load combinations to which they may be exposed including internal forces, external forces, temperature effects, settlement, and combined stresses. *The design shall include the selection of the pipeline material, the pipe class, and selection of appropriate bedding material to suit site conditions.*

5.3.6.3A Pipe bridge considerations

The pipe bridge must not be integrated with the bridge support structure. The design must provide for safe and unrestricted access for maintenance, upgrade or replacement. The pipe shall be positioned clear of the 1% AEP flood levels. The pipe and supports shall be structurally designed to meet the following conditions:

(a) Empty and full static loads
(b) Any dynamic loads and vibration

(c) *Expansion and contraction*
(d) *Seismic action. Refer to section 5.3.6.2.*

Timber supports are unacceptable. Provision shall be made for access and clearances to maintain the pipe, connecting structures, drainage, articulation joints, valves and associated fittings as necessary.

Unauthorised bridge access (i.e. onto the pipe) shall be prevented with an adequate barrier structure and if necessary on-bridge railing for fall protection.

The following pipe material options may be considered:

(a) *Polyethylene pipe, however this material must be butt welded and supported inside a full length carrier pipe of suitable rigidity and durability. Cradles are not acceptable. The carrier pipe must be of suitable internal diameter to allow both future pipe size upgrades and thermal expansion and contraction.*
(b) *Steel (Lined mild steel or stainless steel) with welded or flange joints. Pipe hangers or supports should be a fully welded solution to reduce corrosion and simplify maintenance.*
(c) *Ductile iron with flanged joints with hangers or supports that prevent galvanic corrosion and positioned to encourage water run-off.*

A formal agreement with the bridge owner must be established to provide Watercare with the ability to access, operate and maintain the pipe on the bridge. Contact Watercare in this regard.

5.3.6.4 Internal forces

Pipelines shall be designed for the range of expected pressures, including transient conditions (surge and fatigue) and maximum static head conditions. In the case of transient conditions, the amplitude and frequency shall be estimated *by a competent hydraulic engineer supported with results from surge analysis software*. Mains subject to negative pressure shall be designed to withstand a transient pressure of at least 50 kPa below atmospheric pressure.

5.3.6.5 External forces

The external forces to be taken into account shall include:

(a) Trench fill loadings (vertical and horizontal forces due to earth loadings);
(b) Surcharge;
(c) Groundwater*, including the potential for flotation;*
(d) Dead weight of the pipe and the contained water;
(e) Other forces arising during installation;
(f) Traffic loads;
(g) Temperature (expansion/contraction).

The consequences of external forces on local supports of pipelines shall also be considered.

5.3.6.6 Geotechnical investigations

The designer shall take into account any geotechnical requirements determined *during the investigations for the development. All geotechnical log reports shall be uploaded to the New Zealand Geotechnical Database; https://www.nzgd.org.nz.* Where required, standard special foundation conditions shall be referenced on the drawings.

Special design requirements may apply in any area susceptible to land instability or soil liquefaction. For indicative information refer to http://data.gns.cri.nz/geology. Geo-professionals are to satisfy themselves of the correctness of the information and apply current knowledge when meeting any such special requirements.

5.3.6.7 Pipe selection for special conditions

Pipeline materials and jointing systems shall be selected and specified to ensure:

- (a) Structural adequacy for the ground conditions and water temperature;
- (b) Water quality considering the *types of industrial waste present, the potential for hydrogen sulphide generation and the* lining material;
- (c) Compatibility with aggressive or contaminated ground;
- (d) Suitability for the geotechnical conditions;
- (e) Compliance with *Watercare material supply standards* requirements.

5.3.6.8 Trenchless technology

Trenchless technology may be preferable or required by *Watercare* as appropriate for alignments passing through or under:

- (a) Environmentally sensitive areas;
- (b) Built-up or congested areas to minimise disruption and reinstatement;
- (c) Railway and major road crossings;
- (d) Significant vegetation;
- (e) Vehicle crossings.

Wastewater pipes used for trenchless installation shall have suitable mechanically restrained joints, specifically designed for trenchless application, which may include integral restraint, seal systems, or heat fusion welded joints. *Refer to Watercare's General Civil Construction standard for acceptable trenchless installation methods and its specific requirements.*

Any trenchless technology and installation methodology shall be chosen to be compatible with achieving the required gravity pipe gradient. *Construction tolerances for pipelaying are specified in Watercare's General Civil Construction standard.*

The designer's project execution plan shall detail the *pipe structural limitations for the intended construction method,* the location of access pits and exit points *and include a risk assessment to other services,* abutting surface and underground structures.

C5.3.6.8

Further information on trenchless technologies may be found in 'Trenchless technology for installation of cables and pipelines' (Stein), 'Trenchless technology – Pipeline and utility design, construction, and renewal' (Najafi), and 'Guidelines for horizontal directional drilling, pipe bursting, micro-tunnelling and pipe jacking' (Australasian Society for Trenchless Technology)

5.3.6.9 Marking tape or pipe detection tape

Refer to Watercare's General Civil Construction standard (document number CG, section C3.1)

5.3.7 System layout

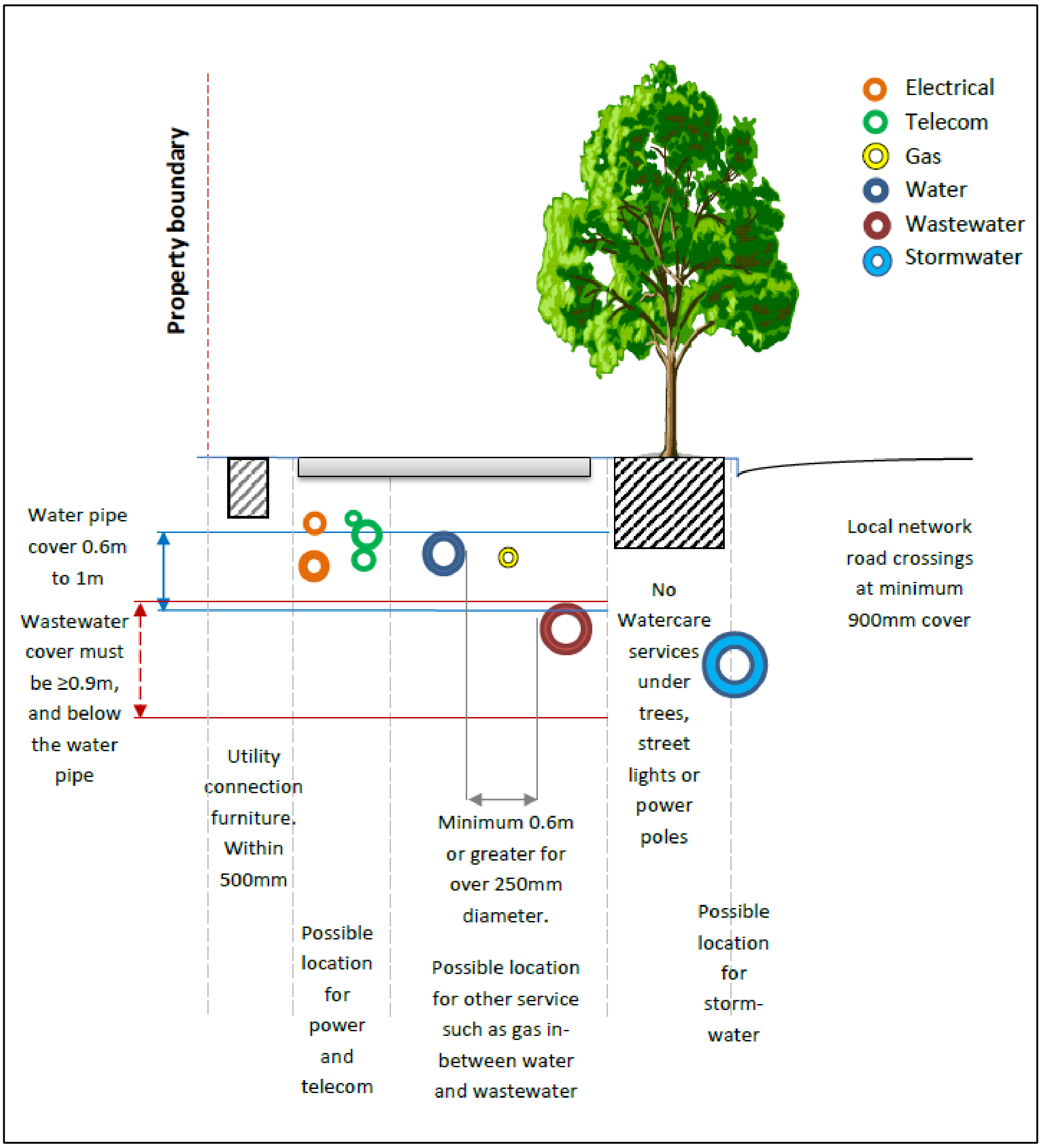
5.3.7.1 Pipe location

The layout/location of pipes within roads, public reserves, and private property shall be to the requirements of *Watercare and where applicable, as agreed with the Road Corridor Manager*.

Pipes *shall* be positioned as follows:

(a) Within the street according to the locally applicable utilities allocation code;
(b) Within public land with the permission of the controlling authority;
(c) Within reserves;
(d) Within private property parallel to front, rear, or side boundaries;
(e) Outside of the 1 in 100 year flood overland flow paths. This includes manholes;
(f) At a lower level than the water supply;
(g) Not within the root zones of trees.

A typical cross section layout for public roads is provided below:



5.3.7.2 Materials

Pipe systems shall be designed for the maximum number of straight full pipe lengths and to minimise the number of joints.

5.3.7.3 Pipes in reserves and public open space

Pipes in reserves and public open space shall be located in accordance with *Watercare*'s requirements *and those of the controlling authority*.

Crossings of roads, railway lines, waterways, and underground services shall be at right angles.

5.3.7.4 *Gravity* pipes in private property

Where *gravity* pipes are designed to traverse any vacant or occupied public or private properties, the design shall as far as practicable allow for possible future building plans, preclude maintenance structures and specify physical protection of the pipe within or adjacent to the normal building areas and all engineering features (existing or likely) on the site, such as retaining walls.

The design shall allow access for all equipment required for construction and future maintenance. Except where obstructions or topography dictate otherwise, pipes shall run parallel to boundaries at minimum offsets of 1.0 m.

Where pipes are designed to traverse properties containing existing structures such as retaining walls, buildings, and swimming pools, the current and future stability of the structure shall be considered. Pipes adjacent to existing buildings and structures shall be located clear of the 'zone of influence' of the foundations. If this is not possible, protection of the pipe and associated structures shall be specified for evaluation and approval by *Watercare*.

Gravity sections of the wastewater reticulation do not require easements, unless specifically requested by Watercare.

5.3.7.4A Pressure pipes in private property

Watercare pressure pipe shall only be installed in the public road reserve. The point of supply shall be at the road boundary, see definitions in section 5.6. Watercare has ownership of the complete boundary kit. Figure 5.1 below illustrates a typical scenario. Refer to section 5.3.12.3.2 for layout requirements.

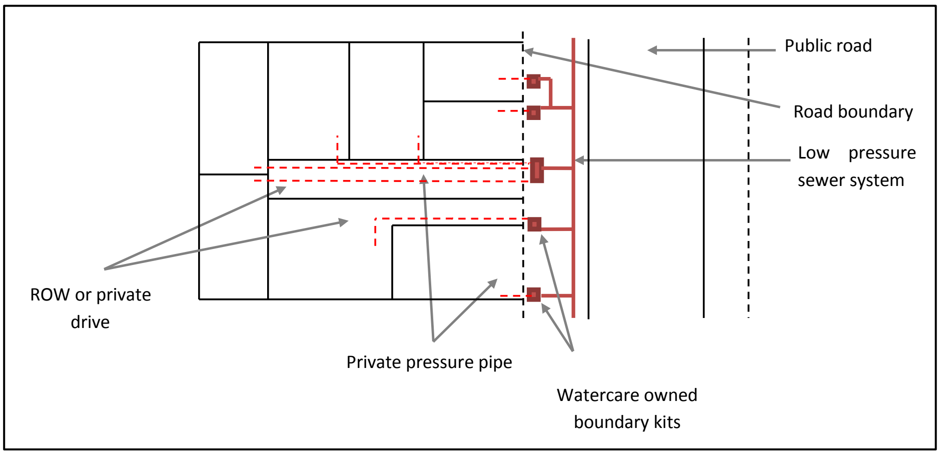


Figure 5.1 Example of a low pressure wastewater system

5.3.7.5 Minimum cover

All wastewater pipelines, *except property lateral connections that grades towards a connection point,* shall have *a* minimum cover *of 900mm*. *A graded connection in the public road reserve must have a minimum cover of 450mm at the highest point.*

5.3.7.6 Horizontal curves

Horizontal curves shall only be used *with flexible pipe material and where it is demonstrated as a best option* in curved streets to negotiate obstructions. *Bends shall be long curvatures and not cause turbulent flow. The design must* be justified to *maintain suitable access for maintenance and repair but not increase total life-cycle cost*.

5.3.7.7 Vertical curves

The curvature limitations for vertical curves are the same as those for horizontal curves in 5.3.7.6. *Vertical curves have the added complication of the potential for hydraulic jump which must be demonstrated will not occur.*

5.3.7.8 Underground services

The location of underground services affecting the proposed pipe alignment shall be determined. Where pipes will cross other services, the depth of those services shall be investigated, and exposed where necessary. Services upstream of the project area may affect the design. A future extension of the pipe that will cross existing and proposed upstream services may determine the level for the current project infrastructure.

5.3.7.9 Clearance from underground services

For *all* trenching and trenchless technology installation, clearance from other service utility assets shall not be less than the minimum vertical and horizontal clearances shown in table 5.6. *For crossing larger diameter pipes than those listed in the table, refer to Watercare's General Civil Construction Standard, section C3.1.5.*

Table 5.6 – Clearances between wastewater pipes and other underground services

Utility (Existing service)	**Minimum horizontal *('X' Fig. 5.2)* clearance for new pipe size ≤ DN 300** (mm)	**Minimum vertical clearance**$^{(1)}$ (mm) *('Y' Fig. 5.2)*
Gas mains	300$^{(2)}$	150
Telecommunication conduits and cables	300$^{(2)}$	150
Electricity conduits and cables	500	225
Drain lines <300mm	300$^{(2)}$	150
Water mains *and Storm water >300mm and ≤ 800mm*	1000$^{(3)}$/600	500

NOTE –
All clearances are measured as the inside open spacing between the external walls of services
For larger wastewater pipe sizes refer to Watercare's general civil construction standards. Watercare may consider specific clearances for larger mains due to operational reasons.
(1) Vertical clearances apply when wastewater pipes and other underground services cross one another, except in the case of water mains when a vertical separation shall always be maintained, even when the wastewater pipe and water main are parallel. The wastewater pipe *shall* always be located below the water main to minimise the possibility of backflow contamination in the event of a main break.
(2) Clearances can be further reduced to 150 mm for distances up to 2 m when passing installations such as poles, pits, and small structures, providing the structure is not destabilised in the process.
(3) When the wastewater pipe is at the minimum vertical clearance below the water main or storm water (500 mm) maintain a minimum horizontal clearance of 1000 mm. This minimum horizontal clearance can be progressively reduced to 600 mm as the vertical clearance increases to 750 mm.

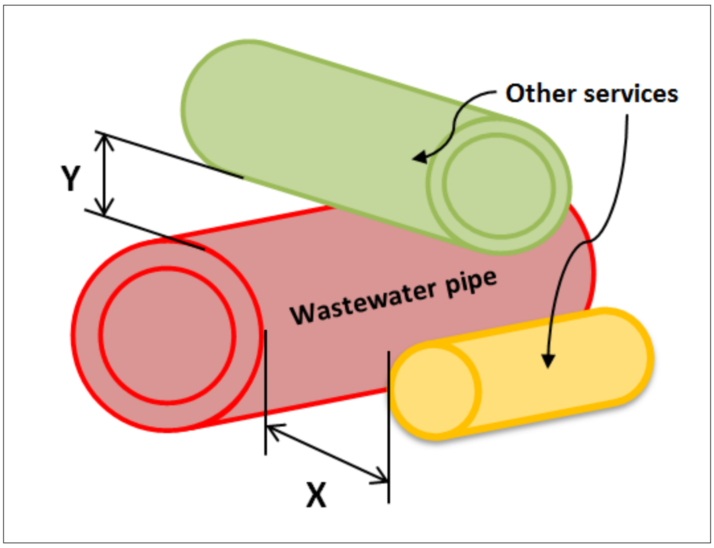


Figure 5.2 Service clearance measurements

5.3.7.10 Clearance from structures

Pipes adjacent to buildings and structures shall be located clear of the 'zone of influence' of the building foundations. *The design shall take into account the:*

(a) Protection of the pipeline;
(b) Long term maintenance access for the pipeline;
(c) Protection of the existing structure or building*; and*
(d) *Sufficient clearance for future maintenance and upgrades.*

Refer to table 5.6A for minimum clearances from structures.

Table 5.6A – Minimum clearance from structures

Pipe diameter DN	***Clearance to wall or building (mm)***
<100	*600*
100 – 150	*1000*
200 – 300	*1500*
NOTE – All clearances are measured from the outer pipe wall closest to the structure. These clearances should be increased for mains in private property (even with easements) as access is often more difficult and the risk of damage greater; consultation is required with Watercare under these circumstances.	

For the process to construct close to Watercare's networks please refer to the 'Works Over' page under on Watercare's website.

5.3.7.11 Bulkheads for pipes on steep grades

Pipe trench bulkheads for wastewater pipes shall be designed for:

(a) At grades ≥10% the pipe bedding shall be minimum 7 MPa scoria concrete, and
(b) Grades ≥20% anchor blocks located at every pipe joint and minimum 6m spacing.

Bulkheads shall extend minimum 200mm into the trench walls.

5.3.7.12 Construction of structures over pipelines

The basis of design must satisfy Watercare that all alternative options have been investigated to avoid the pipeline from passing under the structure. The design of structures over gravity pipelines are subject to:

(a) The structure does not pass any additional loading onto the pipe;
(b) The pipe is accessible for regular maintenance and inspection;
(c) Replacement or future upgrade of any section of the pipe shall not pass any cost burden onto Watercare, or increased structural risk; and
(d) The position of the pipeline must not pose a potential for public health risk

Structures shall not be constructed over any pressurised system.

5.3.7.13 Shared trench construction

Where shared trenching is approved *the pipe structural calculations shall consider the pipe structural impact and minimum clearances from other services. See section 5.3.7.9.*

5.3.8 Maintenance structures

5.3.8.1 General

This describes the requirements for structures which permit access to the wastewater system for maintenance*. All maintenance structures shall be accessible and allow CCTV inspection of the line to be carried out.*

Maintenance structures include:

(a) Manholes (or maintenance holes) (MHs);
(b) Maintenance shafts (MSs); and
(c) Terminal maintenance shafts (TMSs).

MSs and TMSs shall not be typically considered on Watercare local wastewater networks and require written approval.

5.3.8.2 Location of maintenance structures

The selection of a suitable location for maintenance structures may influence the pipe alignment. A minimum clearance of 1.0 m *shall* be provided around maintenance structures *and the* opening *clear* to facilitate *Watercare activities*. *Maintenance structures shall not be located in state highway carriageways and preferably 1.0 m back from the front of the berm in the road reserve. Watercare* may determine other specific requirements subject to the individual site characteristics.

The design shall include maintenance structures at the following locations:

(a) Intersection of pipes except for junctions between mains and property connections;
(b) Changes of pipe size;
(c) Changes of pipe direction, except where horizontal curves are used;
(d) Changes of pipe grade, except where vertical curves are used;
(e) Combined changes of pipe direction and grade, except where compound curves are used;
(f) Changes of pipe invert level;
(g) Changes of pipe material, except for repair/maintenance locations;
(h) Permanent or temporary ends of a pipe when:
- The distance is in excess of 55m length from the connecting mains (connected with a MH), and
- Installed with a terminating MH of 600mm diameter if the depth to invert is ≤900mm, or

- Installed with a full-size manhole of 1050mm or greater if the depth to invert is >900mm;

C5.3.8.2 (h)

Where a public wastewater line is extended across private property boundaries to less than 55m from the manhole on the main line, no additional manholes are required. When the extended line is in excess of 55m meters we usually require an additional access point such as a terminating manhole or full-size manhole to access the line for operational reasons.

(i) Discharge of a pressure main into a gravity pipe.

Table 5.7 summarises maintenance structure options for wastewater reticulation.

Table 5.7 – Acceptable MH options for wastewater reticulation

Application	Acceptable options(1)
Intersection of pipes(2)	YES
Change of pipe grade at same level	YES
Change of grade at different level	YES MH with internal drops
Change in pipe size	YES MH is the only option
Change in horizontal direction	YES within permissible deflection at MH
Change of pipe material	YES
Permanent end of a pipe	YES, where the pipe end is in excess of 55m from the connecting manhole on the mains and over 900mm deep.
Pressure main discharge point	YES MH is the only option and shall include a vent
NOTE – (1) Where person entry is required down to the level of the pipe, a MH is the only option. (2) This table refers to *local network* mains.	

5.3.8.3 Maintenance structure spacing

For reticulation pipes, the maximum distance between any two consecutive maintenance structures shall be *100m*. *Watercare may increase this distance at its discretion where maintainability and function is not compromised.*

C5.3.8.3

Where Watercare has approved the use of either MSs or TMSs between manholes these shall be spaced at 100m intervals and the distance from manhole to manhole shall not exceed 400m.

5.3.8.4 Manholes

5.3.8.4.1 Manhole materials

Refer to Watercare's material supply standards for suitable materials.

MH materials selected shall be suitable for the level of aggressiveness of the wastewater and surrounding groundwater.

The design shall consider the site specific geotechnical conditions and future environmental changes to prevent hydraulic uplift (see section 5.3.8.4.6), ensure vertical stability and prevent infiltration. The number of vertical joints in manholes shall be minimised.

Manholes deeper than 3 metres shall be minimum 1200mm in internal diameter.

Accepted step rungs shall be used for manholes 1200mm diameter and under. Over this size galvanised ladders shall be used. Where manholes are deeper than 6m depth landing platforms shall be designed such that a clear vertical access is maintained. Watercare's standard design requires a 1500mm diameter manhole for platforms to allow the minimum clearance for safe access.

5.3.8.4.2 Base layout

Each MH base shall have:

(a) One minimum standing area of 350 mm x 350 mm or of 350 mm diameter (where the ladder or step irons are located), and a second minimum width standing area of 250 mm x 250 mm or of 250 mm in diameter;
(b) A minimum *clear* working space of *1000mm that may overlap with the step-rung or ladder*;
(c) Channels with a minimum inside channel wall radius of *3x pipe diameter* (in plan); *and*
(d) *Regardless of the clearance areas specified in a), the manhole diameter shall be increased to minimum 1200mm for manholes that are 3.0m deep, and to minimum 1500mm for manholes that are deeper than 6.0m (See section 5.3.8.4.1).*

5.3.8.4.3 Allowable deflection through MHs

A maximum allowable deflection through a MH shall comply with table 5.8.

Table 5.8 – Maximum allowable deflections through MHs

Pipe size DN	**Maximum deflection** (Degrees (°)
150 – 300	Up to 120º for internal fall along the MH channel – see table 5.9 Up to 150º where there is a large fall at MH using an internal drop structure

5.3.8.4.4 Internal falls through MHs

The minimum internal fall through a MH shall comply with table 5.9.

Where the outlet diameter at a MH is greater than the inlet diameter, the minimum fall through the MH shall be not less than the difference in diameter of the two pipes, in which case the pipes shall be aligned soffit to soffit.

On pipes where the internal fall across the base of the MH is not achievable due to a large difference between the levels of incoming and outgoing pipes then internal drops shall be provided.

Table 5.9 – Minimum internal fall through MH joining pipes of same diameter

Deflection angle at MH Degrees (°)	**Minimum internal fall** (mm)
0 to 30	30
>30 to 60	50

Deflection angle at MH Degrees (°)	**Minimum internal fall** (mm)
>60 to 120	80

5.3.8.4.5 Effect of steep grades on MHs

Where a pipe of grade >7% drains to a MH, the following precautions shall be taken if the topography and the connection pipes allow for:

(a) No change of grade is permitted at inlet to a MH;
(b) Steep grades are to be continuous through the MH at the same grade;
(c) Depth of MH is to exceed 1.5 m to invert for DN 150 and DN 225 pipes;
(d) Depth of MH is to exceed 2.0 m deep for DN 300 pipes;
(e) Change of direction at the MH is not to exceed 45°;
(f) No drop junctions or verticals are to be incorporated in the MH;
(g) Inside radius of channel inside the MH *shall* greater than 6 times the pipe diameter; and
(h) Benching *shall* be taken *to* 150 mm above the top of the inlet pipe.

To avoid excessively deep channels within MHs, steep grades (>7%) shall be 'graded-out' at the design phase where practicable.

Where the depth of the channel within the MH would be greater than 2 x pipe diameter, *or the inlet to outlet fall difference is greater than 150mm, and the steep grade cannot be 'graded-out',* then an internal drop structure *or energy dissipation device of specific design* shall be provided *as stated below*.

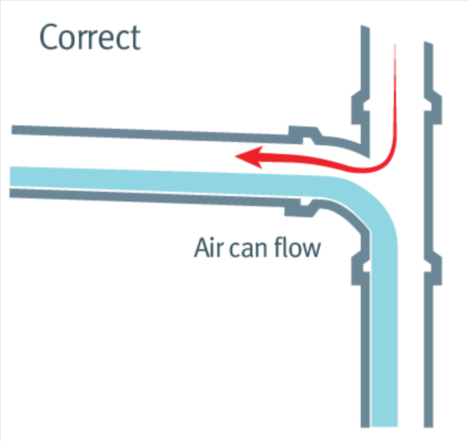
Where internal droppers are provided at a grade greater than 7%, a long radius bend shall be provided to facilitate installation of the drop assembly through the manhole.

The Watercare standard plunge-drop dropper detail is suitable for incoming pipeline of up to 7% grade only. A specific design is required at steeper grades, high drops or high flow velocities that address:

(a) Suitability of drop structure type for terminal velocity, noise, cavitation, erosion, self-cleansing, vibration and impact loads
(b) Suitability of alternative drop structures such as cascade drop, vortex drop, helicoidal ramp or energy compensating chambers.

C5.3.8.4.5

Plunge dropper top inlet shall be designed with a lunden-junction such as not to trap air. Y (wye) - junctions are not allowed.



5.3.8.4.6 Flotation

In areas of high water table, *or areas that are susceptible to future climate changes affecting the water table during the asset life;* MHs shall be designed to provide a factor of safety against flotation of at least 1.25.

5.3.8.4.7 Covers

Manholes covers shall comply with Watercare's material supply standards. All manhole lids shall be HN-HO-72 with a minimum 600mm clear opening.

Covers shall be flush with the adjacent ground level.

5.3.8.4.7A Safety of people

Manholes and chambers shall be fitted with an accepted safety grille. Refer to Watercare's material supply standards.

5.3.8.4.8 Bolt-down covers

Bolt-down metal access covers (watertight type) shall be specified on MHs:

(a) In systems where the possibility of surcharge exists; and
(b) Along creeks subject to flooding above the level of the cover, in tidal areas, or in any location where surface waters could inundate the top of a MH.

Sealed entry holes with restricted access *shall* be used in geothermal conditions and for deep manholes.

MHs should be located on ground that is at least 300 mm above the 1 in 100-year flood level. Where this is not practicable, bolt-down access covers *are required*. MH components *located in 1 in 100-year flood levels must be tied together as a complete unit*.

5.3.8.5 Maintenance shafts

This section has been removed. Maintenance shafts should not be typically used.

5.3.8.6 Terminal maintenance shafts

This section has been removed. Terminal shafts should not be typically used.

5.3.8.7 Dead ends

Pipes ends must terminate at a manhole unless the pipe is expected to be extended within 5 years.

5.3.9 Venting

In urban developments, pipes will normally be adequately ventilated within private property. However, there are some situations where vent shafts will be required such as:

(a) At pumping stations;
(b) At MHs where pumping stations discharge to a gravity pipe;
(c) At entrances and exits to inverted siphons; and
(d) *Drop structures*

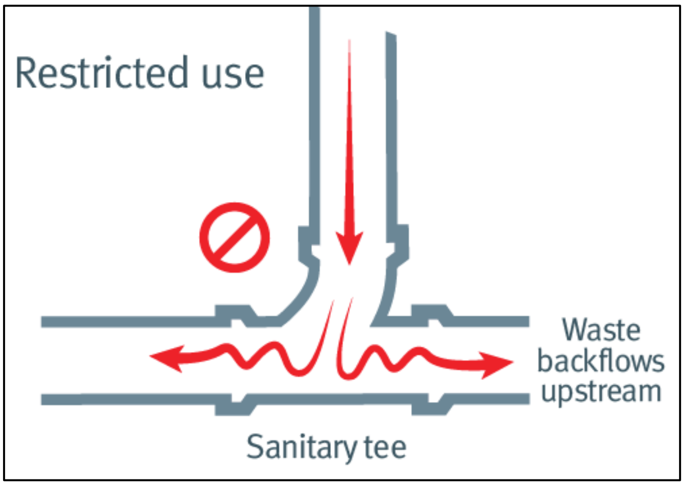
5.3.10 Connections

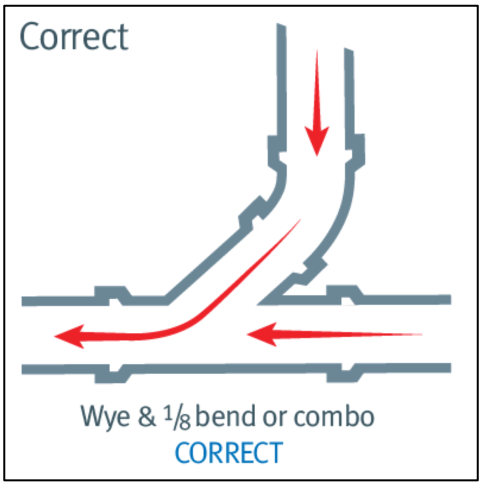
Connections link private systems to the public system or other approved outlet point. Private systems extend through to the public system, except where *Watercare* accepts responsibility for that part of the pipe outside private property.

5.3.10.1 General considerations

The property connection *shall* be designed to suit the existing situation and any future development. Each connection shall be capable of serving the entire building area of the property.

Property connections shall be constructed using a single length of pipe with a minimum number of joints. The connection shall be made at an angle between 30 to 60 degrees from the horizontal with either a y- or lunden-junction in the direction of the flow. Lunden junctions are only suitable where the mains grade and size is such as to reduce hydraulic resistance and a connection angle not exceeding 30 degrees from the horizontal. A Y (wye)-junction shall be used ordinarily. Tee junctions are not allowed.





5.3.10.1A Connections in combined stormwater and wastewater network areas

Developments in areas defined by Watercare as combined service areas, is where stormwater and wastewater are serviced by the wastewater network. New stormwater connections to these areas will only be accepted where:

(a) There is no public stormwater network within a direct line of 55m to the nearest point of the property boundary, not considering super lots that are yet to be subdivided; and

(b) Auckland Council confirms that there is no potential for stormwater to discharge to the road, watercourse or private soakage system (refer to section 5.3.10.1B for connections to soakage areas).

(c) The wastewater and stormwater systems shall have separate internal reticulation. The private stormwater and wastewater pipes shall only join at the point of supply (refer section 5.6) to allow for future separation. The stormwater shall discharge via a detention tank with an orifice plate to attenuate stormwater flow to the combined system. The detention tank size and stormwater flow attenuation must be approved by Auckland Council.

(d) Development of a site with an existing combined reticulation is required to be separated on site as per (c) above.

C5.3.10.1A

The combined service area is subject to change. Contact Watercare for confirmation of the current defined areas. Unauthorised stormwater connections to the wastewater system will be issued with a Notice of Defective Drainage and pursued for corrective action.

5.3.10.1B Connections in soakage areas

In soakage areas defined by Auckland Council, Watercare will not approve new connections of private stormwater systems to the wastewater system.

Development in a defined soakage area may be subject to the removal of exiting private stormwater connections from the wastewater system and required to be replaced with more appropriate stormwater disposal measures as approved by Auckland Council.

C5.3.10.1B

Compliance monitoring will be undertaken across the region, including in soakage areas, to identify any unauthorised stormwater connections to the wastewater network. Unauthorised stormwater connections to the wastewater system will be issued with a Notice of Defective Drainage and pursued for corrective action.

5.3.10.2 Requirements of design

The design shall specify the requirements for the property connections including:

(a) Plan location and lot contours;
(b) Invert level at property boundary or junction with the main as applicable.
(c) *Location of inspection point at property boundary*

5.3.10.3 Number of connections

Each lot shall be provided with one point of connection to Watercare's system up to the point of supply as defined in section 5.6.

For multiple occupancies (unit title, cross lease, or company lease), service of the whole property is achieved by providing a single point of connection to *Watercare's* system. Connection of the individual units is by joint service pipes owned and maintained by the body corporate, tenants in common or the company as the case may require. In this instance the whole of the multiple occupancy shall be regarded as a single lot.

5.3.10.4 Location of connection

The location of the connection is at the point of supply. See section 5.6 for a representation of the point of supply.

The connection shall be located to service the lowest practical point on the property and:

(a) Be clear of obstructions, such as trees, tree roots, paved areas;
(b) Be easily accessible for future maintenance;
(c) Be clear of any known future developments, such as swimming pools or driveways;
(d) Avoid unnecessarily deep excavation >1.5 m;
(e) Be within or on the property boundary;

C5.3.10.4

The Building Code requires that an inspection point be installed at the property boundary. This allows checks to be made of inflow and infiltration and access for maintenance in some instances.

5.3.10.5 Connection depth

Connection depths shall be set to drain the whole serviced area recognising the following factors:

(a) Surface level at plumbing fixtures of buildings (existing or proposed);
(b) Depth to invert of pipe at plumbing fixture or intermediate points;
(c) Minimum depth of cover over connection for mechanical protection;
(d) Invert of public main at junction point;
(e) Allowance for crossing other services (for clearances see table 5.6);
(f) Provision for basements;
(g) Allowance for head loss in traps and fittings;
(h) Allowance for *1200mm minimum between building floor level and soffit of Watercare pipe.*

The designed invert level at the end of the connection shall be not higher than the lowest calculated level consistent with these factors.

5.3.11 Pumping stations and pressure *rising* mains

Pumping stations and pressure mains shall be designed and installed in accordance with *Watercare's Local Network Wastewater Pumping Stations standard (document number DP-06). Watercare will only accept pumping stations where the system services typically 50 or more dwelling unit equivalents. Temporary pumping stations may be considered on a case-by-case basis. Telemetry requirements are area specific and will be clarified during the process of assessing the design.*

5.3.12 Pressure sewers

This section covers the requirements for on-site pressure wastewater discharging into Watercare gravity local network and for low pressure wastewater collection systems.

Watercare's ownership model for pressure sewer systems are:

(a) On-site pressure systems are owned, operated and maintained by the property owner and includes the discharge manhole that shall be situated inside the private property. Watercare ownership starts at the gravity discharge manhole situated within the public road boundary.
(b) Low pressure wastewater collection systems (LPS, also referred to as PWC):
   i. The on-site pump unit, control system, storage, discharge pipework shall be owned, operated and maintained by the property owner.
   ii. Watercare will own and operate the pressure system at the "point of supply" as defined by sections 5.3.12.3.2 (e), (g), (h) and 5.6.3.

5.3.12.1 Equipment

The pumping system that includes all connection fittings, tanks and controllers shall comply with Watercare's Material Supply standards.

The pump selection shall consider:

(a) The hydraulic basis for the design in both pressure network and/or on-site gravity application.
(b) Flows and pressure from pumps are compatible with existing hydraulic conditions, and other pumps and pressure wastewater equipment contributing flows into reticulation.
(c) Efficient and reliable operations of the Watercare wastewater reticulation.

5.3.12.2 On-site direct pumping to a gravity network

On-site pumping to a Watercare gravity network shall be designed to:

(a) Integrate hydraulically with the gravity system to meet the meet the parameters in section 5.3.5.
(b) Connect to the gravity network through a shallow private discharge chamber. Up to 6 equivalent dwelling units can be connected to a single private discharge manhole.
(c) The connection into the Watercare network shall be made with a manhole. See section 5.3.8.
(d) The gravity section between the private and public manholes shall be minimum 150mm NB.
(e) Allow Watercare access to maintain the gravity system and interrupt discharge to the gravity system to perform maintenance.

5.3.12.3 Low pressure sewer system

5.3.12.3.1 General requirements

A low pressure sewer (LPS) system (also referred to as a pressure wastewater collection (PWC) system), may only be considered where the designer can provide evidence that a gravity system is not feasible. These systems must be generally designed in accordance with WSA07-Pressure sewer code of Australia and as otherwise required in this Code of Practice.

C5.3.12.3.1

A low pressure sewer system should in general be considered as limited for up to 50 dwelling units due to system risk to customer service under power failure. A combination of systems or a gravity system with pump station may be more practical.

An LPS system places an increased cost responsibility on property owners and maintenance complications that must be demonstrated to provide:

(a) Equivalent or lower life cycle cost to Watercare than other options.
(b) Costs passed onto homeowners are reasonable.
(c) A reliable service in accordance with Watercare's customer charter so that failure of a component does not cause total system failure.
(d) Which site specific problems it will overcome and how.
(e) How the system will impact on the environment from events arising from system failures such as spills, power outage or pipe breaks and how the system mitigate these issues.
(f) A discharge point that can be integrated into the existing wastewater network. See section 5.3.12.2.

5.3.12.3.2 System layout

The pressure wastewater system layout shall consist of:

(a) One pumping unit per dwelling on the property. Pumping units shall not be shared between properties or housing units. For larger pumping units or multiple dwellings connecting to a single pumping unit (50 or more dwelling unit equivalents), Watercare's Local Network Wastewater Pumping Stations standard (document number DP-06) shall be followed.

(b) The system shall be dendritic (tree-like) structured, loops must be avoided and backflow prevented with non-return valves at key junctions.

(c) A pumping unit with storage tank located in the private property. The pumping unit is separated from the property gravity collection system so as to prevent any backflow.

(d) A control panel with alarm system. The controller is programmed in accordance with the system design point.

(e) Private pressure mains that connect onto a boundary kit to the pressure network system at a maximum depth of 250mm. Refer to section 5.3.7.4A for the point of supply definition and section 5.6.3.

(f) The pressure reticulation network shall be located in public road reserve, parallel to the property boundaries and connected in accordance with section 5.3.7.

(g) Connection lines where approved to cross the public road, shall be the same size as the collection main.

(h) Multiple private connections to dwellings on a single property, or where a subdivision does not provide a dwelling with direct public road frontage, shall be supplied through a bulk boundary kit arrangement or with a multi-kit box arrangement associated with the property. Private connections are made from the bulk point or multi-kit box.

(i) A multi-kit box shall not house more than six individual boundary kits. Where more than six individual boundary kits are required for dwellings not fronted by a public road, a bulk point installation shall be used with individual private boundary kits located inside the property.

(j) Connection lines shall be perpendicular to the collection main.

(k) Connection points to vacant lots shall be a fixed point and the boundary kit pre-installed unless the connection is likely to further subdivided, commercial or an industrial development.

(l) System isolation points shall be installed on pipe branches and the main to create strategic zoning for flexibility in operation and maintenance. Isolation intervals shall not exceed 500m.

(m) Flow meters and pressure monitoring points shall be installed at strategic positions along the length of the collection main. As a minimum a flowmeter shall be installed just prior to the main discharge point.

C5.3.12.3.2 (m)

Depending on the size and complexity of the system it may be required that the pressure and flow monitoring be connected to the SCADA system.

(n) The reticulation network maximum pipe cover shall be no greater than 1200mm and not less than 900mm.

(o) Peaks and low points shall be minimised with the layout providing continual rise to air valve locations and gradual fall to flushing points.

(p) The system termination point shall include a discharge structure to the gravity network, or pumping station.

(q) The design solution shall provide for future connections and any staging requirements.

The design shall provide the layout and location for easy access and maintenance of:

(a) Flushing points for adding water or draining the system

(b) Air/vacuum valves and odour management

(c) System isolation points
(d) Flow and pressure metering points
(e) Integration into the discharge point

5.3.12.3.3 Design flow and pressure

The design flows shall be calculated in accordance with section 5.3.5 and as revised below:

(a) Peak flows will be based on average daily flow (ADWF) with an added capacity safety factor of 1.2 per dwelling unit.
(b) Wet weather flows shall be excluded.
(c) The maximum dynamic head of any new the system shall be 40m. Extensions to existing systems shall not exceed the maximum dynamic head of the original system design to the detriment of existing customers.
(d) Discharge pipe shall be minimum 32mm internal diameter for one pump and reticulation pipe shall be minimum 50mm internal diameter.
(e) Flow velocity in the reticulated networks shall be a minimum of 0.9m/s and a maximum of 2m/s.
(f) The maximum wastewater detention time in the pressure network is 8 hours. Chemical dosing options shall not be considered as a substitute to mitigate detention time constraints.
(g) Turbulent flow shall be avoided.
(h) Depending on the system pump selection the design flows shall be based on the probability method, or rationale method, or dynamic hydraulic modelling.
(i) The wastewater pressure system design model and design reports shall be supplied to Watercare as part of the design deliverables for the purpose of ongoing operation and maintenance of the system.

C5.3.12.3.3

The probability method will limit the selection of suitable pumps and is only suitable for vertical head-discharge pump curves such as progressive cavity pump types. Dynamic hydraulic modelling is preferred and allows greater options for pump selection at design and end of life replacement.

5.3.12.3.4 Structural design of pumping mains

In addition to section 5.3.6 all the pressure reticulation system pipework and componentry shall be minimum PN16 rated.

5.3.12.3.5 Pressure system extensions

For larger developments or subdivisions divided into a number of stages, such staging may be designed as a single system provided that the extension proceeds within 12 months. The connecting stages shall spread outwards from the discharge point.

Extensions to existing systems may not be possible due to the nature of specific system design for pressure systems. The developer must contact Watercare to determine if spare capacity is available. Other solutions such as collection main upgrade or main duplication may be required. The extension must be designed to accommodate the existing system design philosophies and not impact on existing customers and must be identified in the design report.

Any staging or extension shall prevent peak overload or detrimental increase in wastewater detention time. System flushing shall only be allowed on Watercare's approval and must not be a permanent solution. Refer to section 5.3.12.3.6.

5.3.12.3.6 System flushing

A flushing programme must be provided for the systems at the subdivision staged occupancy rates of 30 %, 50%, 80% and greater.

The developer must provide the expected development occupancy fill rate. Based on the expected speed of development and flushing requirements the developer will be responsible for the flushing costs until an occupancy rate is achieved that will provide adequate self-cleansing flowrates in the pressure main. The developer shall afford these costs before connecting to the Watercare system.

5.3.13 On-site wastewater treatment and disposal

Watercare is not responsible for on-site wastewater treatment and disposal. Such systems require the approval of the Auckland Council.

5.4 Approval of proposed infrastructure

5.4.1 Approval process

Wastewater infrastructure, *including all private connections,* require approval from *Watercare, the Auckland Council and where any of the work falls within state highway road reserve, also requires prior approval of NZTA.*

5.4.2 Information to be provided

Applications for design approval shall include the information outlined in *section 4* of this *CoP and* the *information as required by Chapter 1 of the Auckland Code of Practice for Land Development and Subdivision.*

5.5 Construction

A pre-construction meeting shall be arranged with Watercare prior to construction starting. Watercare may at its discretion waive the requirement for a meeting. Construction work shall comply with Watercare's construction standards, refer to section 3.

The designer shall recommend the minimum level of professional supervision required for the various aspects of construction and review their recommendation with Watercare. Watercare may require a higher level of supervision based on a risk assessment that includes contractor competence, asset risk and specific methodology. For more information refer to Watercare's compliance statement guidelines.

The construction deliverables shall include but are not limited to:

a) Construction and environmental management plan that includes a schedule of activities and a quality management plan - to be provided prior to construction starting
b) Current type test certification of material, maintenance information and transfer of warrantees
c) Completed quality control records
d) Completed test certificates
e) As-built information and drawings
f) Operation and maintenance manuals
g) Construction compliance statement
h) Commissioning records and completion report

Connecting a network extension or property to the existing wastewater system requires Watercare authorisation. In some cases the connection must be completed by a Watercare authorised contractor or Watercare, depending on the site specific wastewater pipe being connected to. Watercare has legal and health *and safety responsibility for works undertaken on its systems and therefore must protect access of contractors to the network.*

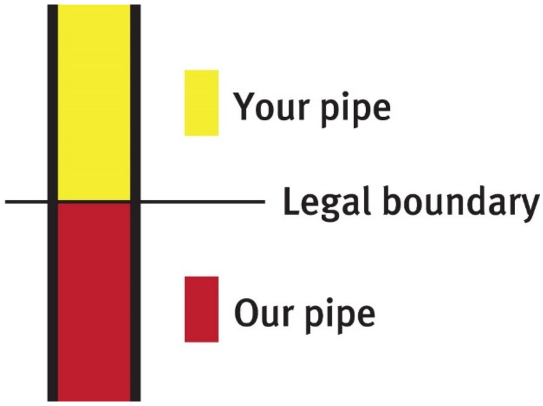
5.6 Point of Supply – Wastewater

All equipment and fittings downstream of the point of supply are owned by Watercare and are considered part of the Watercare network.

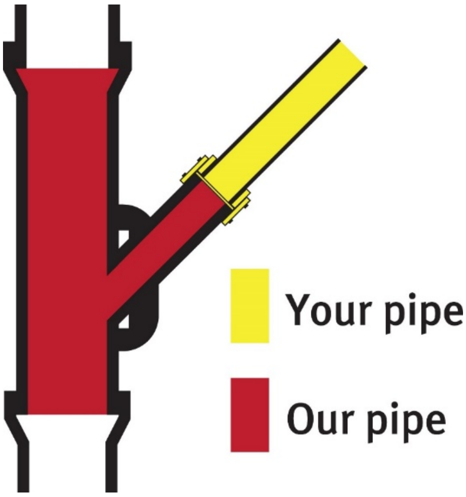
5.6.1 Pipe joint and boundary location explanations

The point of supply locations are depicted by either boundary transition or pipe joint.

a) The boundary locations are the point of legal property boundary, regardless of pipe material, size or any fittings in close proximity as shown below.

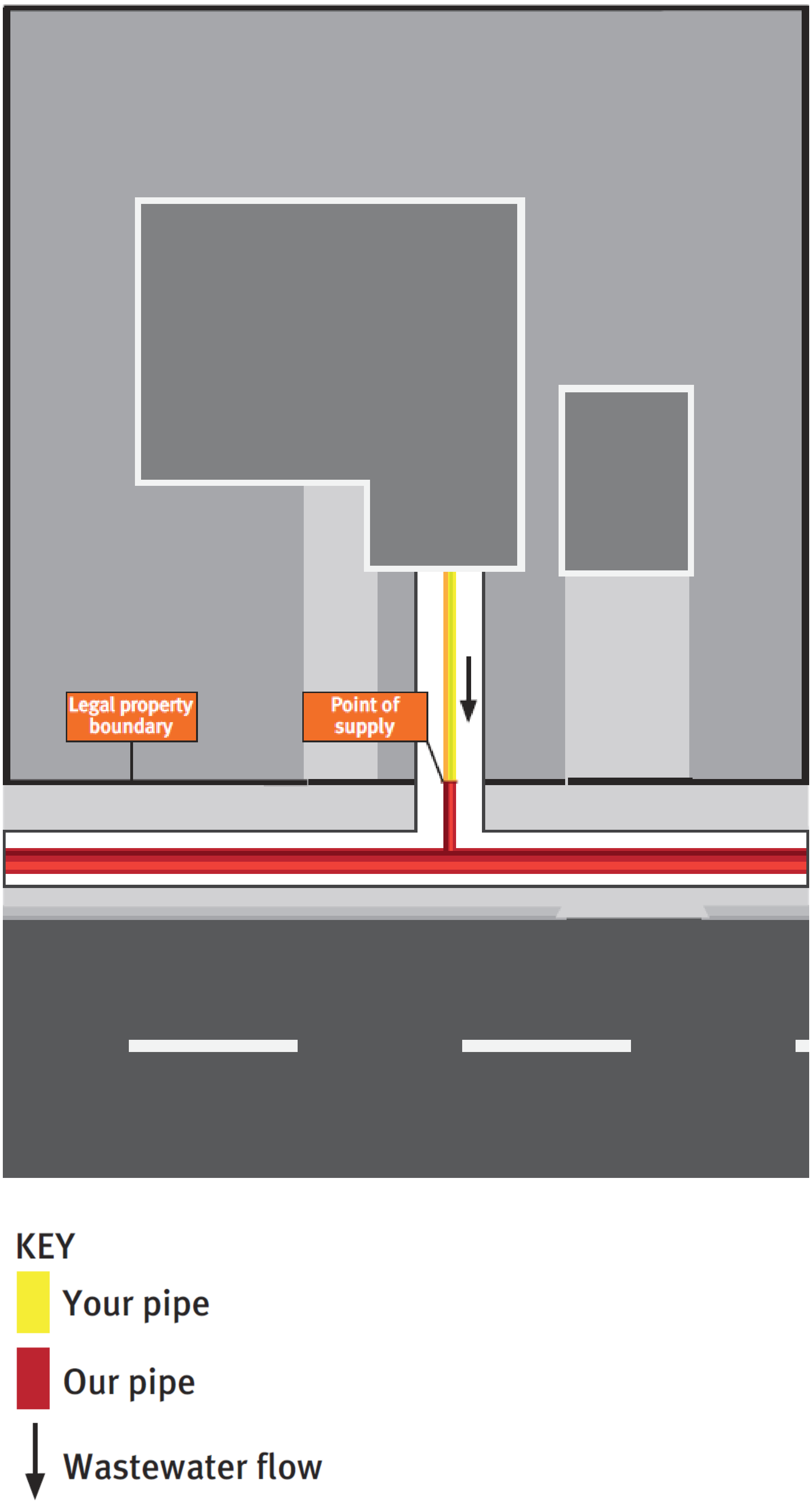


b) Where the point of supply is defined by a first pipe joint from the public wastewater local network pipe it means the stub-pipe connected onto the local network is in Watercare's ownership up to the first pipe joint. The joint and fitting that constitute the joint is in private ownership as shown below.

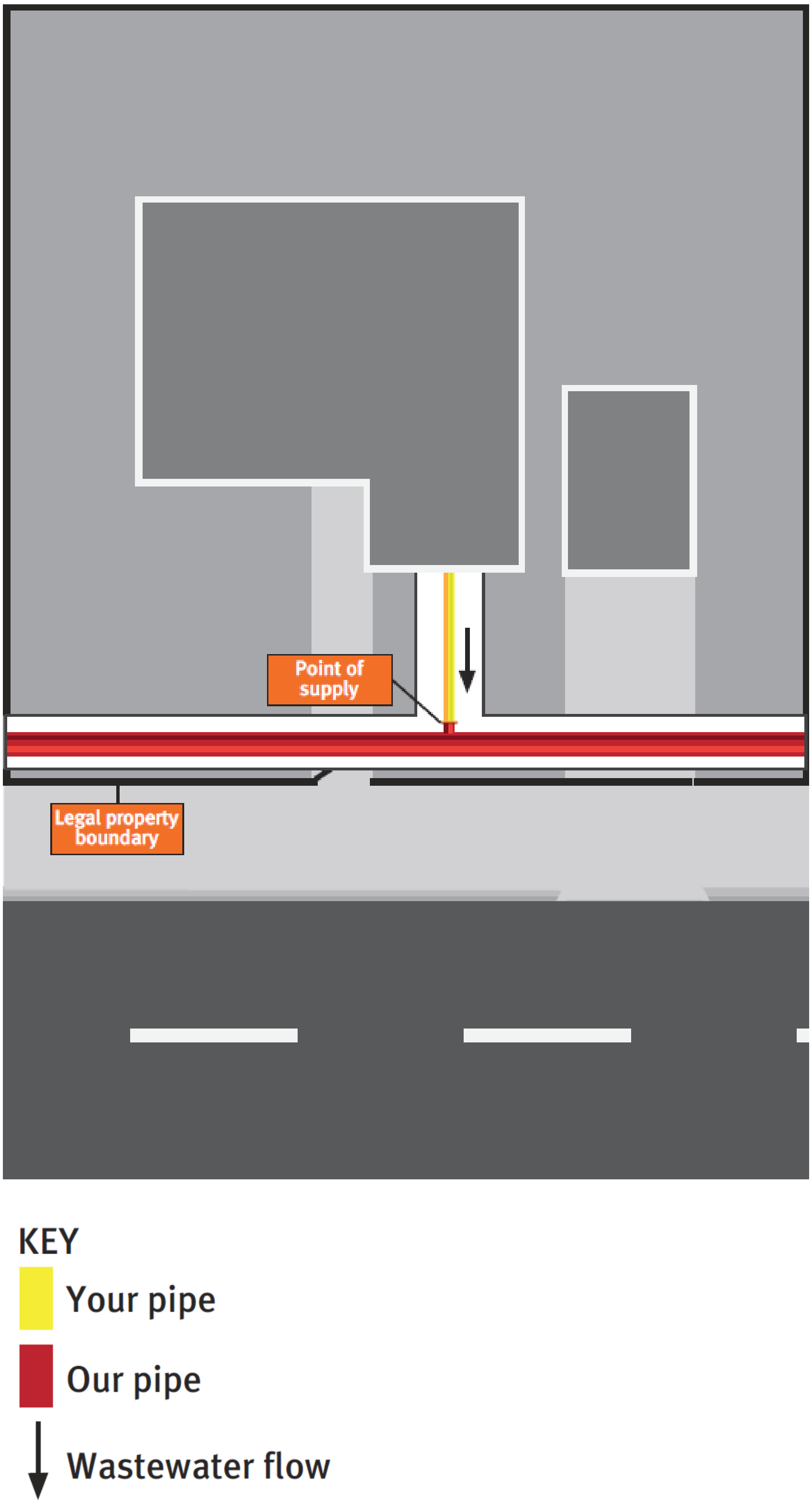


5.6.2 Gravity systems

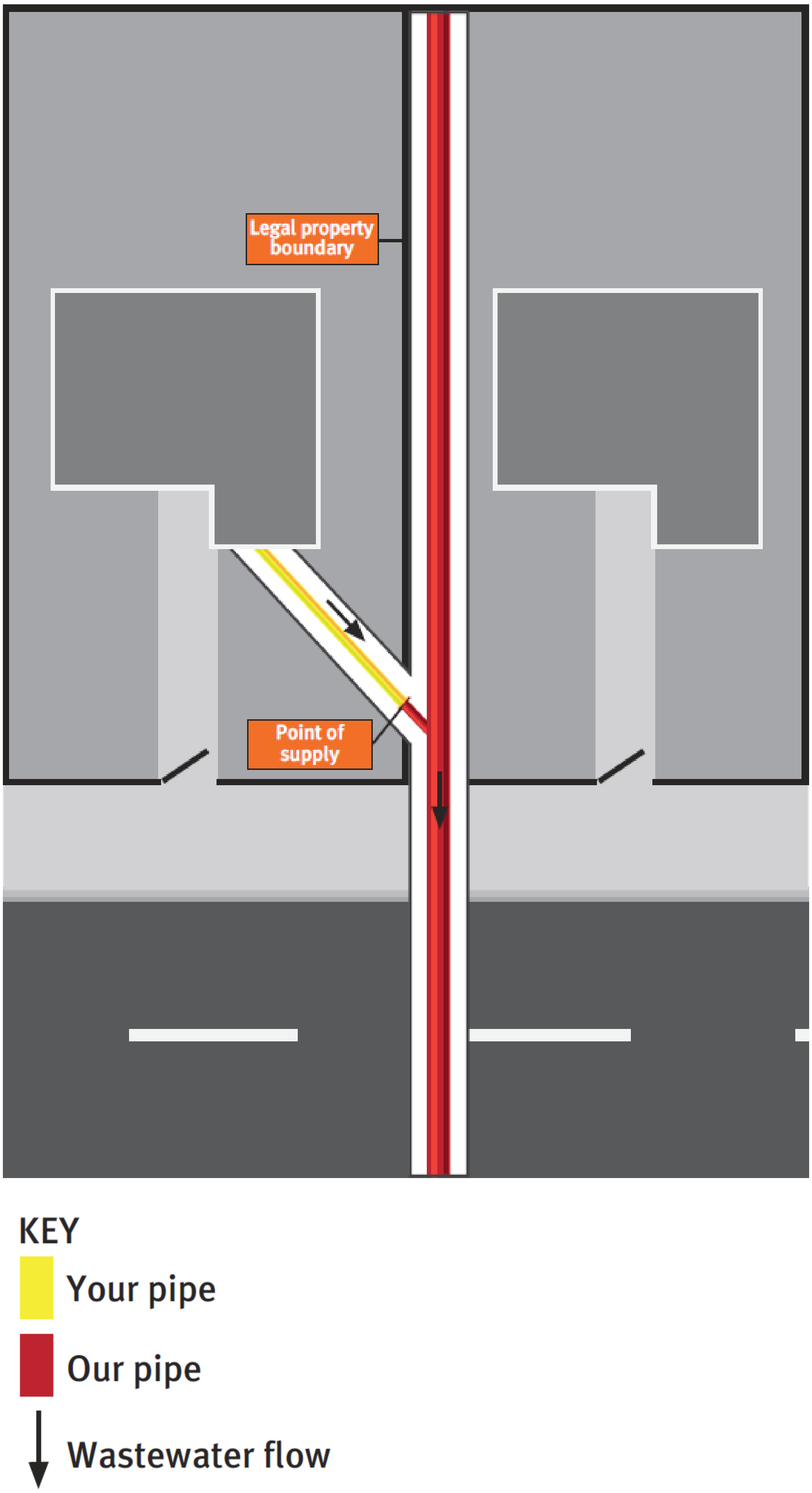
a) *Connection to public wastewater in public land. The point of supply is where the wastewater pipe enters public land.*



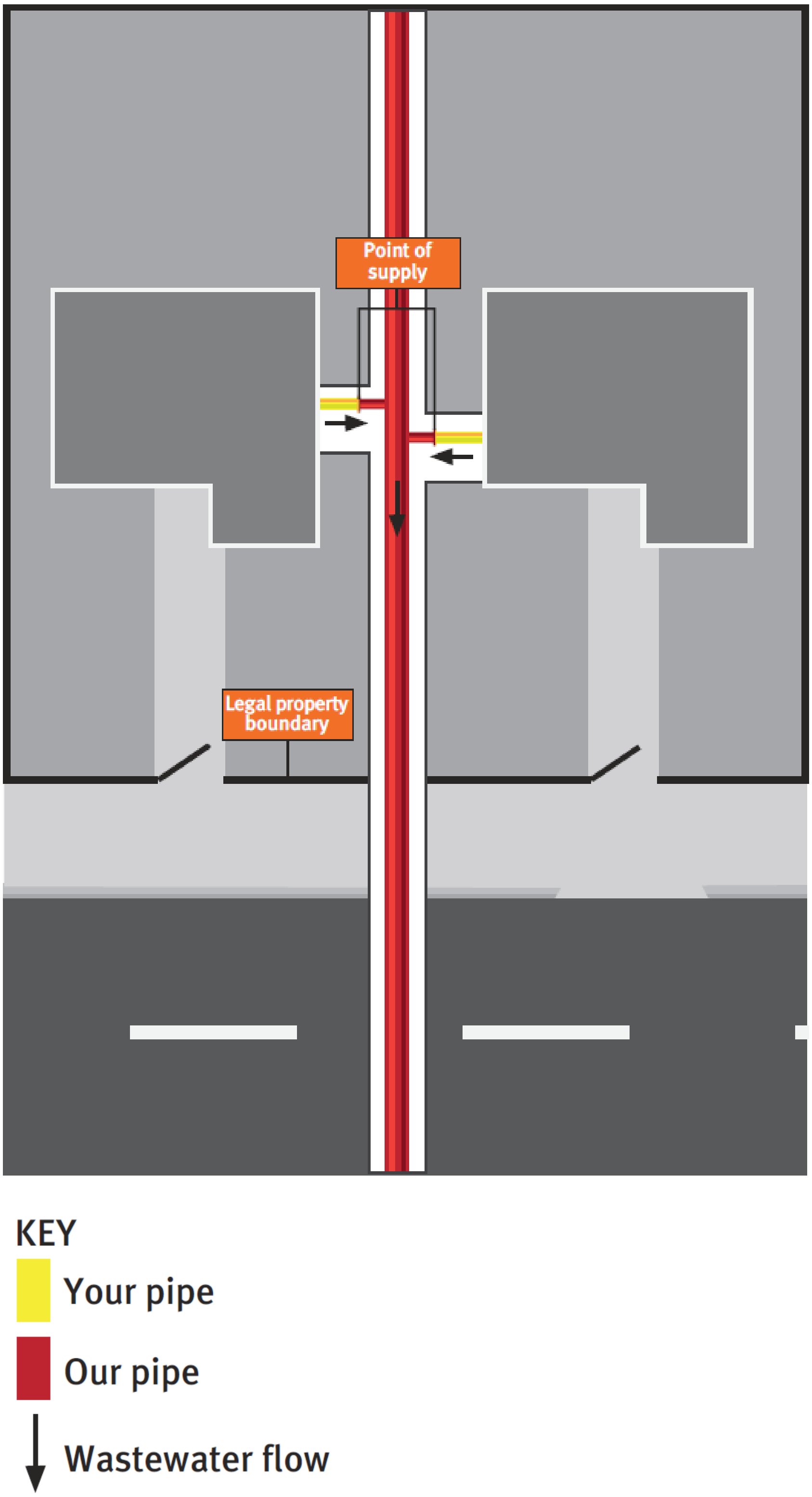
b) Connection to public wastewater within own property. The point of supply is the first pipe joint from the public local wastewater network pipe.



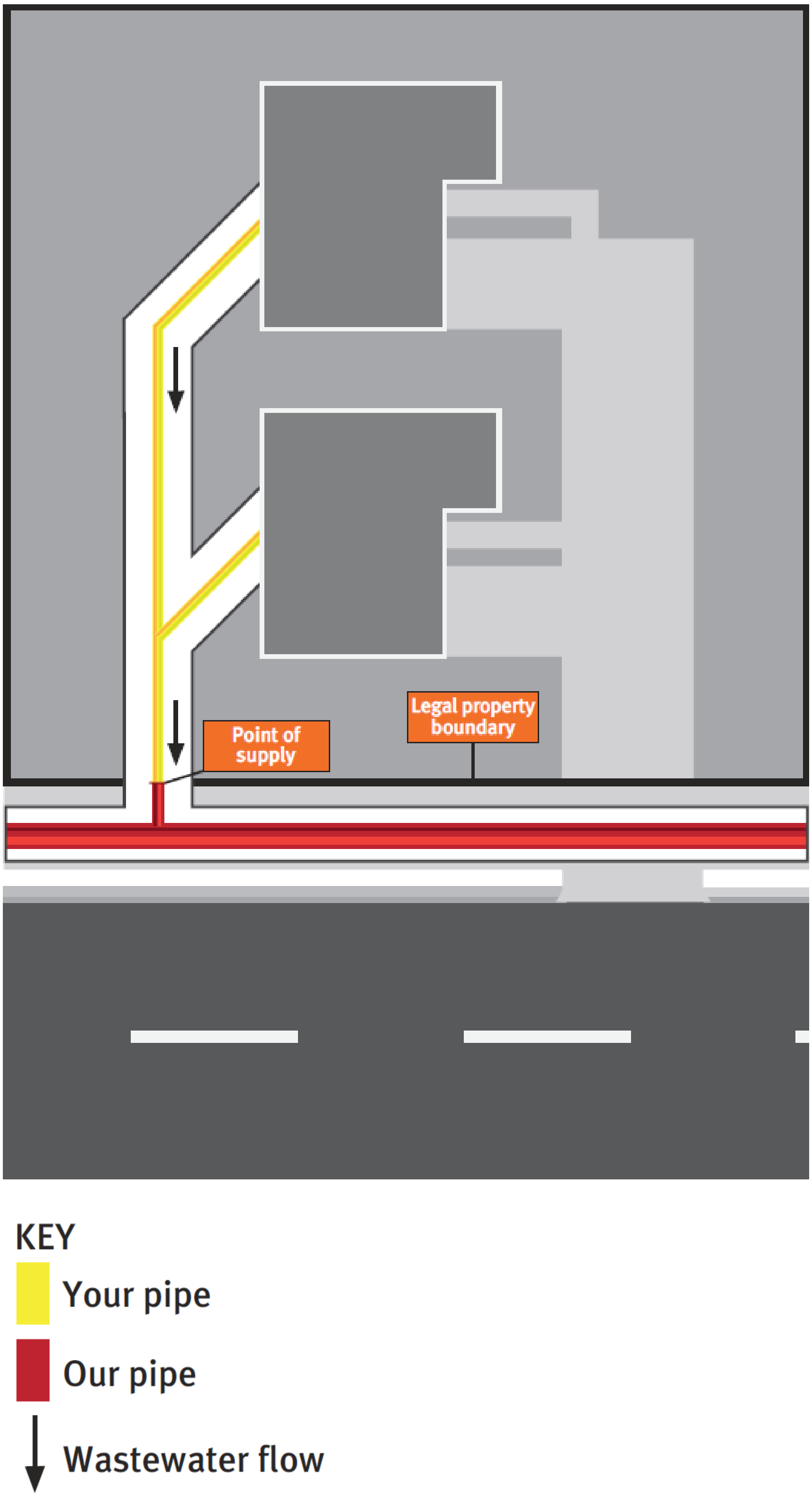
c) Connection to public wastewater within neighbouring property. The point of supply is where the pipe cross the property boundary.



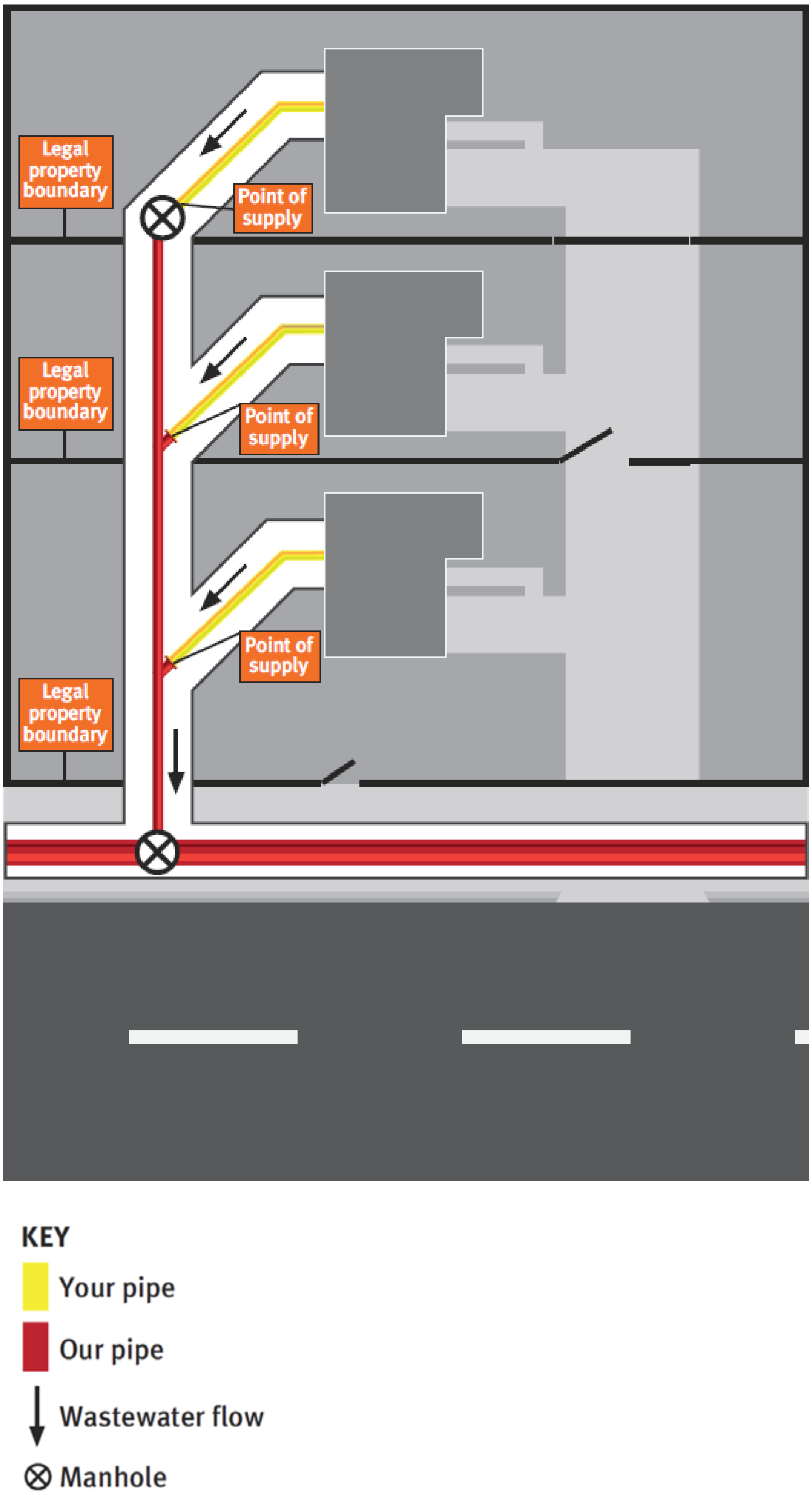
d) *Connection to public wastewater within cross-lease property where the public wastewater pipe is within the property boundary. The point of supply is the first pipe joint from the public wastewater.*



e) Connection to public wastewater within cross-lease property where the public wastewater pipe is outside the property boundary. The point of supply is where the wastewater pipe enters public land.

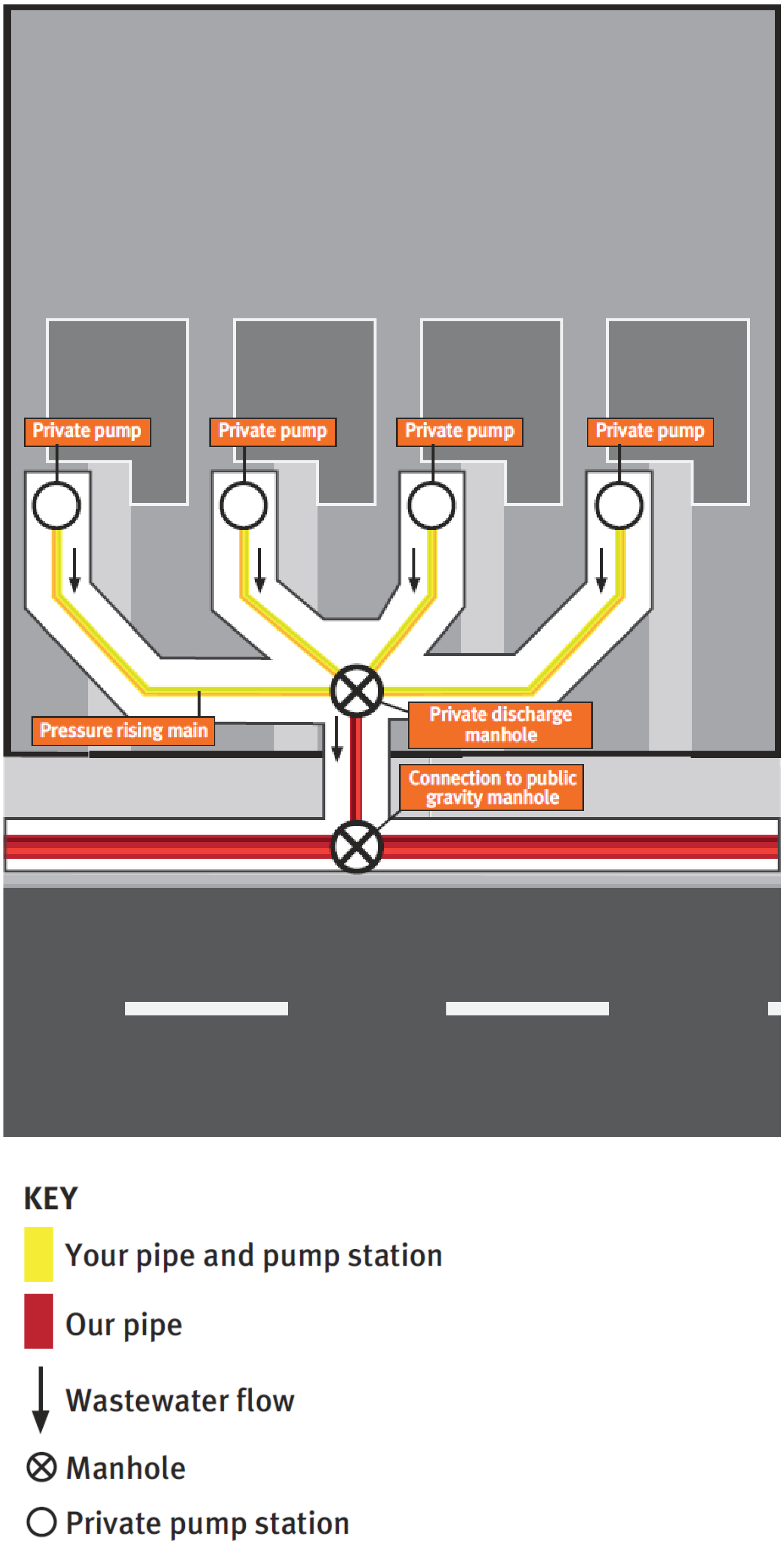


f) *Connection to public pipe crossing multiple boundaries not fronted by a public road. The pipe is vested to public ownership up to the last boundary crossing. The point of supply is the first pipe joint from the public wastewater, or if the public main extension is in excess of 55m a public terminating manhole of 600mm diameter, or manhole (for over 900m depth) is installed that becomes the point of connection.*

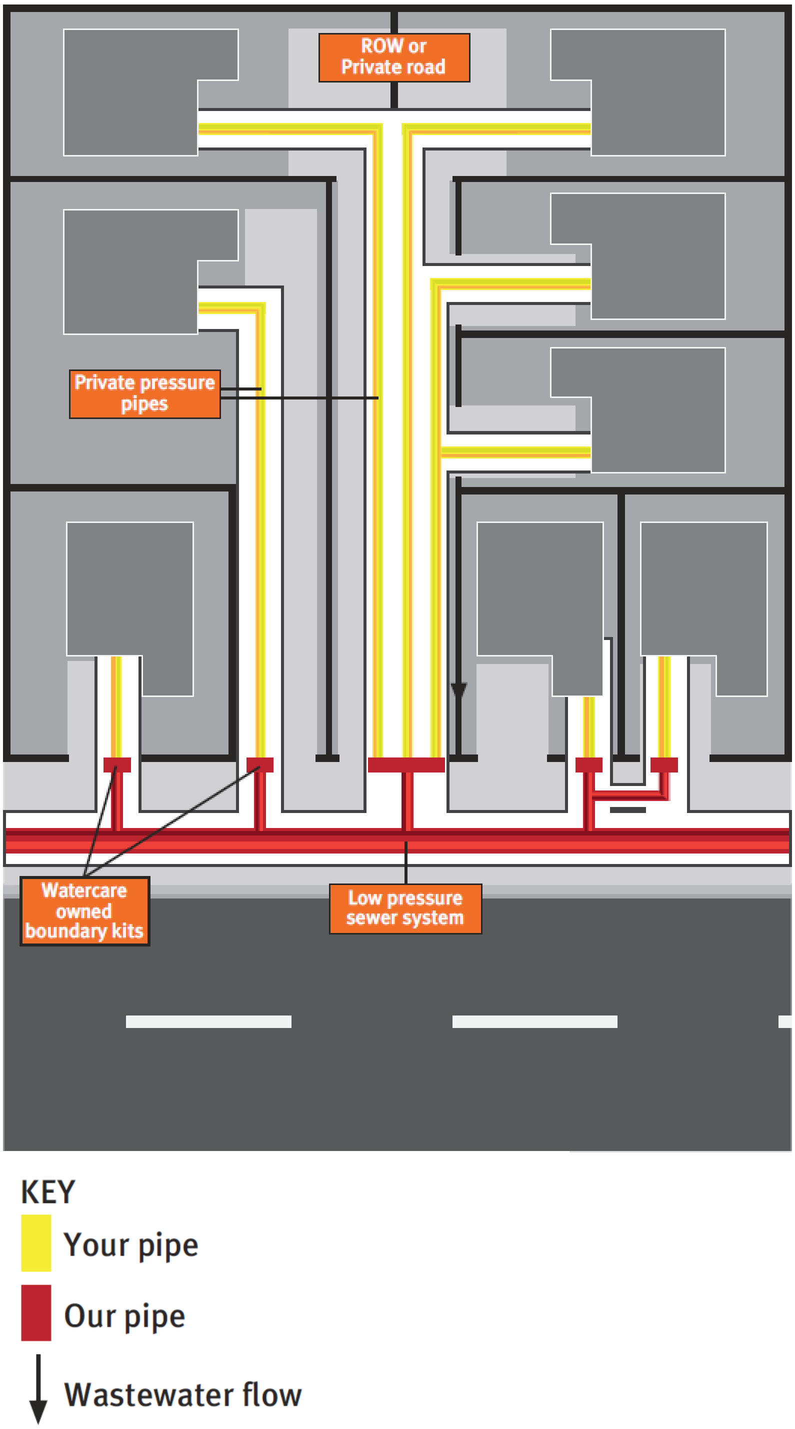


5.6.3 Pressure systems

a) Private on-property wastewater pump connected to public gravity system. Typical for low laying properties within a gravity system pumping up to a gravity system with individual rising mains. Up to 6 properties connecting to a private manhole before discharging to the public system.

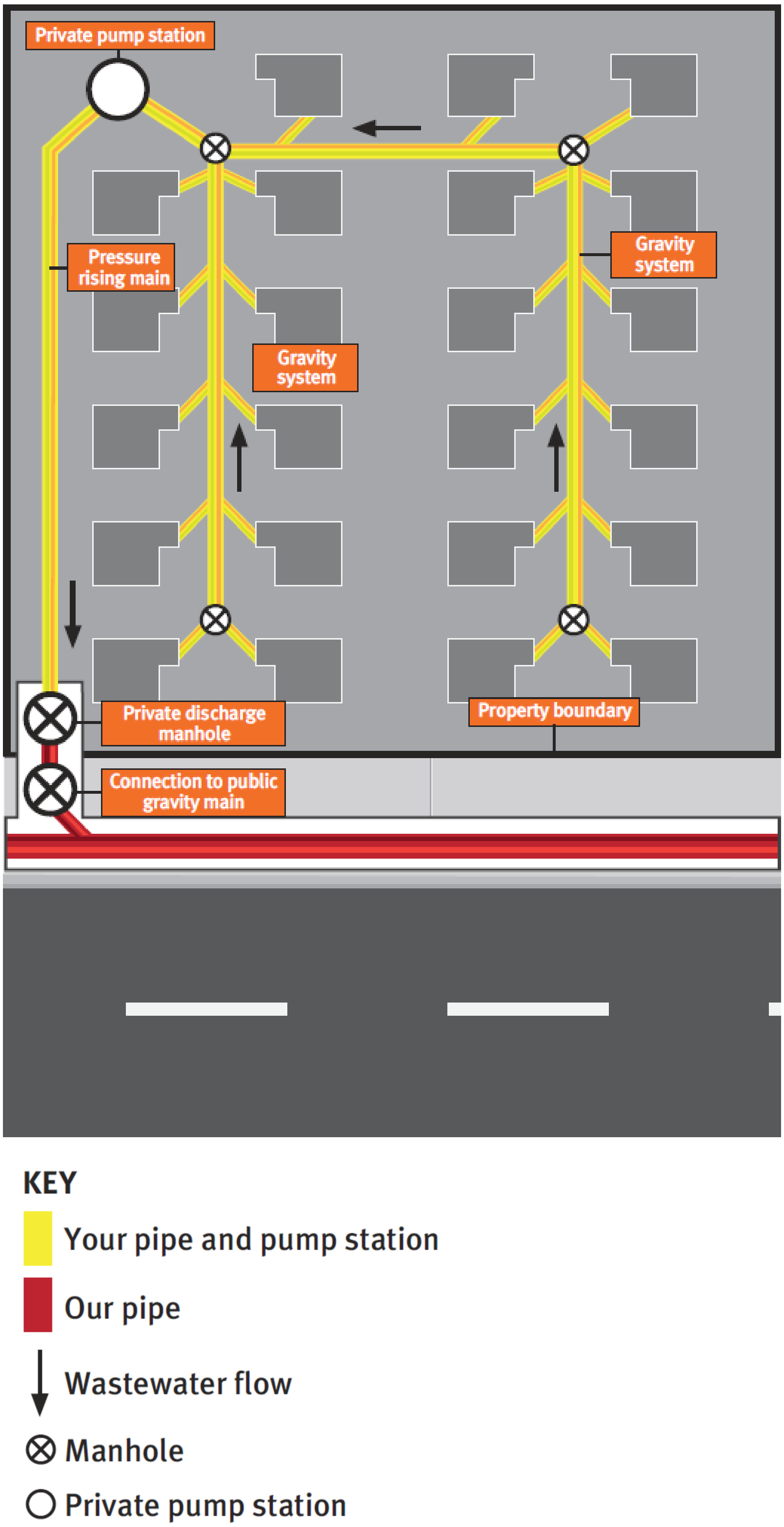


b) *Low pressure sewer (LPS) or pressure wastewater collection (PWC) systems are constructed in public roads. Ownership transfers at the public road boundary on the last connection of the boundary kit. The boundary kit is owned by Watercare.*

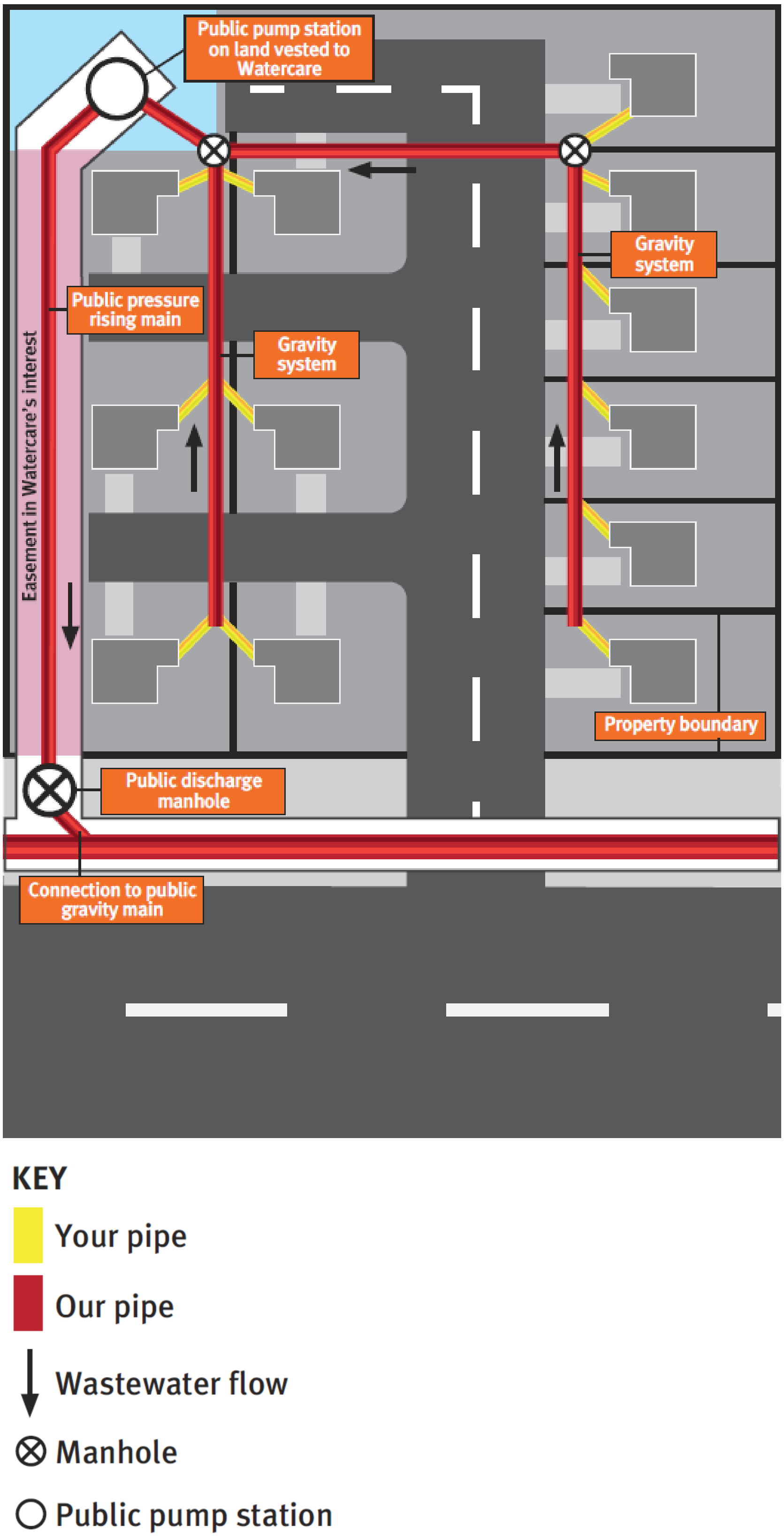


5.6.4 Pumping systems

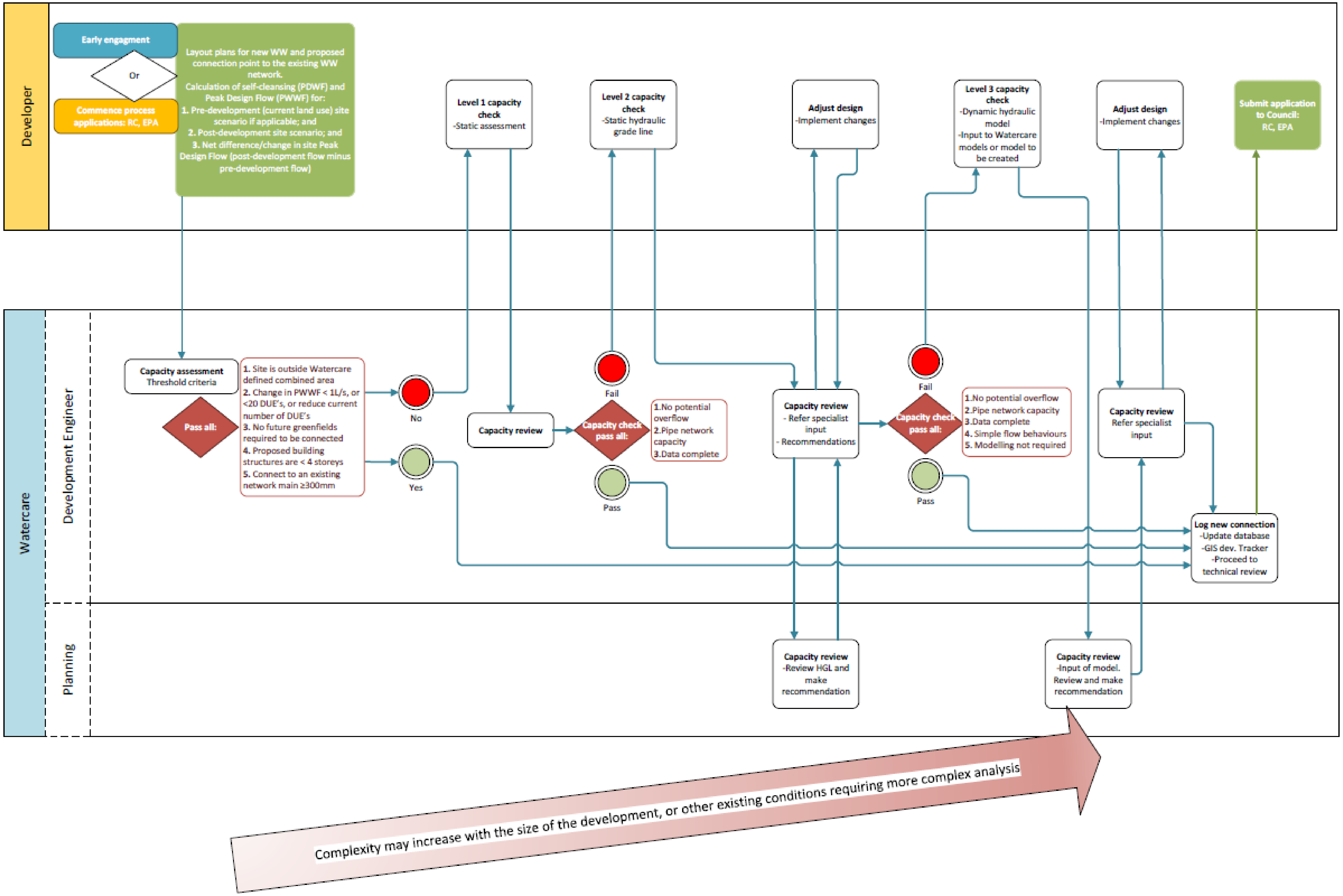
a) *Private pumping stations, such as for retirement villages, are managed under a private legal instrument such as a body corporate. The wastewater system connected to the private pumping station, the pumping station and rising main are in private ownership and situated within the private property boundary. The point of supply into the public system is at the private discharge manhole situated inside the property boundary.*



b) Connection to public pumping stations can be from a gravity system or LPS/PWC system as in the preceding scenarios where properties are subdivided. Where a rising main from the public pumping station crosses private boundaries or are situated within a private road, an easement is provided in Watercare's interest.



Appendix A: Capacity assessment flow diagram



Appendix B: Wastewater system selection tree