FOREWORD

The Code is a guide on various development standards required by the Council. The Code sets out the technical engineering criteria for approving the design and construction of developments. Whether vested with Council or maintained in private ownership, new or upgraded assets must be constructed to the Council's standards.

This 2022 Code is a revision of the former Code of Practice for Land Development 2012. It has been updated in association with the preparation of the Wellington City Proposed District Plan, July 2022.

The Code also incorporates the Regional Standard for Water Services ensuring a consistent method of design and implementation of water assets across the Wellington region. These standards must be met before the Council will allow a connection to the City's water supply and drainage systems.

Alternatives to the water supply and wastewater design and construction standards set out in this Code will not be permitted.

However, it is not the intention of the Council to stifle innovation and ingenuity of design. Where the outcome will be an overall net benefit, proposed alternative solutions for infrastructure design, other than for water supply and wastewater, should be negotiated with the Council to ensure that the Code's basic requirements are met.

Reference to this Code of Practice is contained in the Council's District Plan. The requirements of this Code of Practice are enforceable under the Resource Management Act 1991, the Building Act 2004 and the Wellington Consolidated Bylaw 1991.

Note: The Council will occasionally update the Code of Practice for Land Development. It is the responsibility of the user to ensure they are referencing the latest version.

CONTENTS

RELATED DOCUMENTS

The following documents are either referred to or have been used to produce this code.

NEW ZEALAND STANDARDS:

- AS1111:2015 – ISO metric hexagon bolts and screws
- AS 1112:2000 - ISO metric hexagon nuts
- AS 1397:2011 - Steel sheet and strip - Hot-dipped zinc-coated or aluminum/zinc-coated
- AS 1418:2002 - Cranes (including hoists and winches)
- AS 1627:2005 - Metal finishing - Preparation and pre-treatment of surfaces
- AS 4089:1993 - Priming paint for steel, single component, general purpose
- AS 3735:2001 - Concrete structures for retaining liquids
- AS NZS 1158: 2020 - Road lighting - Lighting for roads and public spaces
- AS NZS 1664:1997 – Aluminum structures – Limited state design
- AS NZS 1665:2004 - Welding of aluminium structures
- AS NZS 1734:1997 – Aluminum and aluminum alloys – Flat sheets, coiled sheet and plate
- AS NZS 2312:2014 - Guide to the protection of structural steel against atmospheric corrosion by the use of protective coatings
- AS NZS 3725:2007 - Loads on buried concrete pipes.
- AS NZS 3750:2008 - Paints for steel structures
- AS NZS 4455:12008 - Masonry units and segmental pavers
- AS/NZS 4600:2018 - Cold-formed steel structures
- AS NZS 4680:2006 - Hot-dip galvanized (zinc) coatings on fabricated ferrous articles
- AS.NZS 1554:2011 - Structural Steel Welding Set
- NZS 1170:2011 - Structural Design
- NZS 1254:2010 – PVC piles and fittings for stormwater and surface water applications
- NZS 2280:2020 - Ductile iron pipes and fittings
- NZS 3101:2006 - Concrete structures standard - The design of concrete structures
- NZS 3103:1991 - Specification for sands for mortars and plasters
- NZS 3104:2021 - Specification for Concrete Production
- NZS 3105:2014 - Approval and test specification - Electrical portable outlet devices
- NZS 4058:2007 - Specification for precast concrete drainage and pressure pipes

- NZS 3109:1997 - Concrete construction
- NZS 3111:2009 - Methods of test for water and aggregate for concrete
- NZS 3112.2:1986 - Methods of test for concrete - Tests relating to fresh concrete
- NZS 3114:1987 - Specification for concrete surface finishes
- NZS 3121:2015 - Specification for water and aggregate for concrete
- NZS 3122:2009 - Specification for Portland and blended cements (General and special purpose)
- NZS 3404 1 & 2:1997 - Steel Structures Standard
- NZS 3501:1976 - Specification for copper tubes for water, gas, and sanitation
- NZS 3604:2011 - Timber Framed Buildings
- NZS 4158:2003 - Thermal-bonded polymeric coatings on valves and fittings for water industry purposes
- NZS 4210:2001 - Masonry construction: Materials and workmanship
- NZS 4229:2013 - Concrete masonry buildings not requiring specific engineering design
- NZS 4230:2004 - Design of reinforced concrete masonry structures
- NZS 4402:1986 - Methods of testing soils for civil engineering purposes
- NZS 4404:2010 - Land development and subdivision engineering
- NZS 4431:1989 - Code of practice for earth fill for residential development
- NZS 4442:1988 - Welded steel pipes and fittings for water, sewage and medium pressure gas
- AS/NZS 4671:2019 - Steel reinforcing materials
- NZS 4672:2007 - Steel pre-stressing materials
- AS/NZS 1158.6:2004 - Code of practice for road lighting
- NZS 6801:2008 - Acoustics - Measurement of sound
- NZS 6802:2008 - Assessment of environmental sound
- NZS 6803:1999 - Acoustics - Construction noise
- NZS 4522:2010 - Specification for underground fire hydrants and surface box frames and covers
- NZS 7601:1978 - Specification for polyethylene pipe (Type 3) for cold water services
- NZS 8630:2004 - Tracks and outdoor visitor structures
- SNZ HB 44:2001 - Subdivision for people and the environment
- SNZ PAS 4509:2003 - New Zealand Fire Service Fire Fighting Water Supplies Code of Practice
- ISO 14713:2017 - Protection against corrosion of iron and steel in structures

BRITISH STANDARDS:

- BS 10:2009 - Specification for flanges and bolting for pipes, valves, and fittings
- BS EN 1011.1:2009 & .2:2001 - Welding. Recommendations for welding of metallic materials.
- BS 1560-3.2:1989 - Circular flanges for pipes, valves and fittings (Class designated). Steel, cast iron and copper alloy flanges. Specification for cast iron flanges
- BS 5154:1991 - Specification for copper alloy globe, globe stop and check, check and gate valves
- BS 5896:2012 - Specification for high tensile steel wire and strand for the pre-stressing of concrete
- NZS/BS 5163:2004 - Specification for predominantly key-operated cast iron gate valves for waterworks purposes

WAKA KOTAHI/NEW ZEALAND TRANSPORT AGENCY SPECIFICATIONS:

- TNZ Standard Specification F2:2008- Subsoil drain construction
- TNZ Standard Specification M1:2006 - Asphaltic Bitumen's
- TNZ Standard Specification M4:2006 - Basecourse Aggregate.
- TNZ Standard Specification M6:2019- Sealing Chips.
- TNZ Standard Specification M10:2020 - Specification for Asphaltic Concrete
- TNZ Standard Specification P3:1998- First Coat Sealing
- TNZ Standard Specification P4:1998 - Resealing. A guide to Road Design (Austroads 2021)
- Manual of Traffic Signs and Markings; Part 1 Traffic Signs; Waka Kotahi, 2010
- Manual of Traffic Signs and Markings; Part 2 Markings; Wak Kotahi, 2010
- Road Safety Audit Procedures for Projects; Waka Kotahi 2013
- Austroads Guide to Traffic Management, 2020
- Clay Brick and Paver Institute Design Manual 1989

STATUTES:

- The Local Government Act 1974 and 2002
- The Resource Management Act 1991
- The Public Works Act 1981
- The Soil Conservation and Rivers Control Act 1941
- The Construction Contracts Act 2002
- The Plumbers Gasfitters and Drainlayer's Act 2006
- The Telecommunications Act 2001
- The Electricity Act 1992
- The Gas Act 1992
- The Building Act 2004
- The Health and Safety in Employment Act 1992
- The Environment Act 1986
- The Conservation Act 1987
- Climate Change Response Act 2002
- Energy Efficiency and Conservation Act 2000
- The Fencing Act 1978
- Land Drainage Act 1908
- Traffic Control Devices Rules 2004

OTHER DOCUMENTS:

- Wellington City Operative District Plan 27 July 2000
- Wellington City Proposed District Plan 2022
- Wellington Consolidated Bylaw 2008
- Wellington City Council's Code of Practice for Working on the Road August 2006.
- Wellington City Council's Our Natural Capital Plan
- Guide to Geometric Standards for Rural Roads, 1985, prepared by New Zealand
- Counties Association for the National Roads Board New Zealand
- CBPI Design Manual 1, Clay segmental Pavements – A Design and Construction

- Guide for Sites Subjected to Vehicular and Pedestrian Traffic
- GWRC Publication Getting Riparian Planting Right in the Wellington Region, 2014
- GWRC publication Fish-Passage Guide 2021
- Mark Davis & Colin Meurk Protecting and Restoring our natural heritage – a practical guide
- Department of Conservation 2000 Protecting and Restoring our natural heritage a practical guide
- Wellington City Council's Open Space Access Plan (2020)
- Wellington Water’s Regional Standard for the Design of Water Services 2021
- Wellington Water’s Regional Specification for Water Services 2021
- Greater Wellington Regional Council’s Guide for Land Disturbing Activities in the Wellington Region 2021

DEFINITIONS

Unless the context indicates otherwise all definitions are the same as the 2022 District Plan, excepting the following additional definitions:

"ALTERNATIVE SOLUTIONS"	means options that achieve the bottom-line standards Council require. Council will consider alternative solutions that meet these bottom-line standards and are fit for purpose. Previously these standards have been met with traditional techniques.
"APPROVED"	means approved by the respective Council Representative
"CHARTERED PROFESSIONAL ENGINEER"	means a qualified Engineer registered as a current and competent practitioner within a specific field of engineering discipline under the Chartered Professional Engineers Act of New Zealand 2002.
"CONTRACTOR"	means the party undertaking work for Council or the party whose quotation/tender has been accepted by the Council.
"COUNCIL"	means the Wellington City Council.
"COUNCIL REPRESENTATIVE"	means the delegated Council officer for that aspect of the development.
"DISTRICT PLAN"	means the Proposed Wellington District Plan 2022 as defined by the Resource Management Act, 1991.
"EPHERMERAL STREAM"	means a stream that flows only during and after rain events.
"GWRC"	means the Greater Wellington Regional Council
"SUBDIVIDER"	means either the person/s who are the registered proprietors of the land to be subdivided in terms of the Resource Management Act or in the case of development without subdivision means the person/s who are the registered proprietors of the land in respect of which construction works are to be or a being undertaken.
"SUBDIVISION"	means the Subdivision of land as defined in the Resource Management Act, Section 218.
"URBAN LAND"	means any land not defined as Rural Land.

PART A. GENERAL SUBDIVISION PRACTICE

CONTENTS

A.1 GENERAL

This Code provides a guide for development and subdivision in Wellington City. It integrates sustainable principles of land development intending to enhance water quality, minimise land disturbance, preserve native vegetation and minimise impervious surfaces.

The Council is committed to operating safe and efficient infrastructure systems. In line with our three-year priorities, we aim to increase the resilience of these systems to earthquakes and other natural disasters, including adapting to climate change. The Council's Wellington's Towards 2040 Strategy positions Wellington as an internationally competitive city with a strong and diverse economy, high quality of life and healthy communities without compromising the environment. It will achieve the Towards Wellington 2040 Strategy goals through maintaining and developing smart and connected networks and by managing networks and resources prudently to ensure resilient and sustainable use. As such this Code contributes to achieving these goals through requiring engineering standards and best environmental practices for earthworks, open space, roading and stormwater.

This Code also incorporates the Regional Water Standard provisions for water and drainage assets; ensuring a consistent method of design and implementation of water services across the Wellington region.

Through requiring assets to be designed and built to engineering standards the Code provides the cornerstone of public health and safety. The provision of adequate potable water supplies and treatment and disposal of wastewater are not open to alternative solutions as these services must be compliant, as a minimum, with the following legislation;

- Resource Management Act 1991
- Building Act 1991
- Local Government Act 2002
- Land Drainage Act 1908
- Health Act 1956
- Soil Conservation and Rivers Control Act 1941
- Civil Defence Emergency Management Act 2002
- Health and Safety at Work Act 2015
- Water Services Act 2021

This Code has been written to complement the District Plan by providing more detailed technical standards necessary for the construction of subdivisions and land development. **Note that District Plan requirements are not repeated in this document. The subdivider should**

consult both documents to confirm all requirements. Should there be a discrepancy between the District Plan and this Code; the District Plan must take precedence.

The primary purpose of this Code is to provide a standard technical document for all users. It is intended for planners, designers and developers servicing the land development industry and for work done on behalf of the Council for asset construction, relocation, replacement and renewal.

The procedures and standards used for rural subdivisions must be as for urban subdivisions, except as may be modified in the relevant chapters. There may be instances where an objective can be best achieved by a means not anticipated by the Design Guides or this Code. In this situation, a departure from the Design Guides or the Code is justifiable if it can be demonstrated that the proposed design solution better satisfies the associated design objective.

A.2 FEES AND DEPOSITS

The following fees are required in connection with the engineering development of the subdivision.

A.2.1 Inspection Fee

An inspection fee is required to cover the cost of Council inspections of the engineering plans, specifications and the works.

A.2.2 Extra Inspection / Supervision of Works

Where extra inspections may be desirable because of the magnitude of the works and associated supervision required, the Council may appoint and employ an Inspector for this purpose and charge the costs of their services to the Subdivider.

A.2.3 Legal and Associated Costs

Any legal and associated costs in connection with the granting of easements, caveats, the uplifting of same, dedication, laying off of under-width streets, declaration of public drains, etc.

A.2.4 Street Planting Costs

Where the Council are to plant a tree on behalf of the subdivider, the Council will require payment for provision, planting, and maintenance of the street tree and/ or planting described in section C.4.1

A.2.5 Public Drainage Permit Fee

A Public Drainage permit fee is required where work is to be carried out on public drains (work on private drains is to be carried out under the Building Act).

A.2.6 Water Connection Fee

A water connection fee is required where a connection is required to a public water main.

A.2.7 Other Fees that may fall out of these machinations

All other fees that may fall out of these machinations.

A.3 QUALITY OF WORK

Plans and construction must be designed, supervised and certified by suitably qualified persons in the related area of expertise.

The Council requires the design, construction and certification of any development to be overseen by a Chartered Professional Engineer (civil or structural), or Registered Professional Surveyor, or suitably qualified alternative.

All drawings and plans submitted for approval must be in accordance with the current Wellington City Council Drawing and As-built Specification.

A.3.1 Design Fieldwork

Although electronic data relating to Councils networks is available and is useful in the feasibility stage of a design, the final design must be based on information confirmed by carrying out topographical surveys, levelling (in particular accurate manhole inverts) and field checks/investigation (i.e. manhole inspections).

A.4 ENGINEERING APPROVALS AND NOTIFICATIONS

The Approval and Notification of the appropriate Council Representatives is required at various stages of the subdivision.

The appropriate Council Representative and stages of the subdivision are summarised in Table 1.

Where notification is required, work on the next stage must not commence until the Council Representative has been notified and had a 3 working day period to inspect the work.

Where an **approval** is required during the construction work an inspection will be made within 2 days, not including weekends or public holidays, or as soon thereafter as possible. On no account must the next stage of construction commence until the work has been passed as being satisfactory.

Stage	Council Representative for:		
	Roads and Earthworks	***Drainage***	**Water**
Water right consent application		Approval required	
Proposed construction details	Approval required	Approval required	Approval required
Drainage permit		Approval required	
Initial commencement	Notification Required	Notification Required	Notification Required
Re-commencement (after a 6 month lapse of work)	Notification Required	Notification Required	Notification Required
Commencing Silt retention structures	Notification Required	-	-
Commencing Subsoil Drainage	Notification Required	-	-
Commencing earthworks	Notification Required	-	-
Obtain "Street Opening Notice" for trenching in existing road land	Notification Required	-	-
Completion of drains and water mains (prior to backfill)	-	Notification Required	Approval required
Completion of road subgrade	Notification Required	-	-
Completion of kerb and channel subgrade	Notification Required	-	-
Testing of drains / water mains	-	Approval required	Approval required
Connection to existing drains / water mains	-	Notification Required	Notification Required
Benkelman beam testing of basecourse	Approval required	-	-
Completion of footpath subgrade	Notification Required	-	-
Road surface preparation for sealing	Notification Required	-	-
Berm areas prior to soil and sowing	Notification Required	-	-
As Built Plans	Approval required	Approval required	Approval required
Final completion of subdivision	Approval required	Approval required	Approval required

Table 1: Summary of Engineering Approvals and Notifications.

A.5 DETAILS OF DEVELOPMENT

A.5.1 Proposed Construction Details

As a minimum, the details required of any proposed construction are:

a) Specifications for carrying out the work.

b) Detailed calculations for pavement design, water main pipe size, stormwater and wastewater pipe sizes, together with associated supporting information where appropriate.

c) The Name(s) and Employer(s) of the person(s) who will be supervising the construction work.

d) An erosion and sediment control plan identifying sediment and erosion hazards and the proposed management controls during and post-construction.

e) A contact name and telephone number in case any emergencies arise in the course of the subdivision.

f) Sets of construction plans of the work as required.

NOTE: Further construction requirements may be required – refer to each chapter of this document.

For Earthworks, Roading and Open Spaces: plans must be drawn in accordance with the “Basic Plan Standards and Details” in Appendix A and must include the following information:

i) Earthworks – Extent and depth of cut and fill, surface and subsoil drainage, erosion and sediment control prior to, during and after construction.

ii) Roading – Formation, subgrade drainage, metalling, kerb and channelling, sealing, footpath construction, treatment of areas outside the carriageway.

iii) Open space concepts including street tree planting proposal (individual trees or mass planted shrubs and trees) including plant species.

iv) Vegetation and natural features – Any bush or other vegetation, landforms, outcrops, streams or other natural features.

v) Other Services – All power and telecommunication cables, lighting standards, gas mains and any of their ancillary works.

vi) Existing services – All existing services (live and abandoned) not being altered must be clearly shown by their location and depth.

For Drainage and Water: refer sections D and E and the Wellington City Council Drawing and asbuilt Specification – Water and Drainage Networks.

A.5.2 Levels

Levels shall be used in terms of the NZVD2016. Levels shall be taken from an approved benchmark unless written dispensation is granted. Care shall be taken to ensure the origin level used is accurate. This can be critical in terms of water supply pressures and drainage pipe levels. A description of the origin used, and its level shall be given.

Council will require the source of all data used for the design to be documented on submitted plans and documents.

Further level information and conditions relating to drainage works is documented below.

A.6 BASIC CONSTRUCTION PLAN STANDARDS AND DETAILS

A.6.1 Draughting standards: Earthworks and Roading

A.6.1.3 Plan Numbering

Plans must be numbered and dated.

Amendments must be numbered, dated and detailed.

Plans must be clearly legible.

A.6.1.4 Plan Information

The following information is required on all plans:

a) a North point.

b) a legend

c) Existing and proposed boundaries.

c) Positions and levels of control points or survey marks used in surveys must be shown.

d) Contours clearly showing the land formation. The contours must be at appropriate vertical intervals (preferably not more than 2 m) covering all the land affected by the proposed subdivision. On small proposals, which do not involve earthworks, lesser topographic detail is acceptable.

A.6.2 Draughting standards: Drainage and Water

All drawings and plans submitted for approval must be in accordance with the current Wellington Water Regional Asbuilt Specification and Regional Draughting Manual.

A.7 AS-BUILT DETAILS

As-Built drawings are required prior to the issue of a Certificate of Practical Completion or a certificate under section 224(c) of the Resource Management Act.

Upon completion of work Council must receive detailed As-Built drawings of all assets to be vested in Council, for three waters connections to Council mains, cut and fill areas (including depths) and final land contours.

All drawings and plans submitted for approval must be in accordance with the Council's current Drawing and Asbuilt Specification.

The following requirements apply to as-built plans:

a) Council prefers documents to be submitted electronically.

b) Full-sized As-Built drawings can be supplied in AutoCAD (*.dxf or *.dwg), Microstation (*.dgn) or other agreed electronic format.

c) General information to be shown on as-builts includes:

- A north point
- a legend
- Drawing title
- Property boundaries
- Plan scale(s) and date
- Lot numbers and house numbers
- Appropriate legend
- House/building locations - where appropriate
- Kerb lines
- Name of premises served – if known
- Name of company and person who prepared the as-built plans

g) All co-ordinates must be in terms of New Zealand map grid, NZTM (New Zealand Transverse Mercator), to ±0.1m.

i) Construction plans are not acceptable as as-built plans.

j) Long sections must be drawn with the high point of the drain on the right side of the sheet.

k) All horizontal distances from adjacent property boundaries are to be measured to ±0.1m.

l) Each service or feature must be distinguished by a different legend as shown on the Standard Engineering Detail Sheets.

Also to be submitted with the as-built plans are;

- Detailed drawings at an appropriate scale of all structures requiring a drawing for the structure to be built. Examples are: headwalls, overflows structures, pump stations, valve chambers, secondary intakes, retaining walls. These drawings must include reinforcing drawings if appropriate. Detail drawings may be a copy of the construction drawings amended as appropriate.
- All relevant design calculations.
- Comments/information about ground conditions encountered.
- Digital photographs may be submitted with the as-built, cross-referencing the position of the camera, date and photographer's name.
- Date of installation or construction for all assets and their components.
- Maintenance manuals, plans and/or guarantees for assets and their components, particularly street furniture.

Where Roading, Drainage or Water Supply services have been constructed a certificate must be supplied stating the following:

- The New Zealand map grid co-ordinates of all water and drainage service covers and survey marks: these must be also shown on the plans.
- Existing services – All existing services (live and abandoned) must be clearly shown by their location and depth.
- That all services have been constructed in accordance with Council's

Code of Practice for Land Development.

- The plans must be drawn in accordance with the "Basic Plan Standards and Details" in Appendix A.

<u>NOTE:</u> Each section further details as-built requirements for each specific asset, under As-built

Requirements.

A.8 CERTIFICATION

A drainage permit will not be issued until construction plans have been approved. In the case of subdivisions, Section 223, 224(c) will not be given until as-builts have been received and approved.

As-built drawings must be certified as being accurate and within acceptable engineering and survey tolerances by a Chartered Professional Engineer or Registered Professional Surveyor. This certification will be required for all completed work.

The survey work and preparation of as-built plans must be carried out by the subdivider.

The receipt and Council's acceptance of as-built plans does not absolve the subdivider of any responsibility for their accuracy. In the event of an asset detail not being provided or incorrect, or an asset not being in the position shown on the as-built plan, it must be the responsibility of the subdivider to provide or locate the asset for the owner of the property. Any work initiated by Council to rectify problems arising will be at the expense of the subdivider.

For minor works associated with development, the Council will accept as-built plans, of suitable quality, from registered drain layers and /or technically qualified persons.

Other resource consents from GWRC may be required and the responsibility for identifying and obtaining those is entirely the subdivider’s.

A.9 TESTING

All testing must be arranged and paid for by the Subdivider.

All work required to be tested and approved must have been pre-tested by the Subdivider and proved to be satisfactory before the request is made for official testing.

A.10 CONNECTION TO EXISTING ROADS AND SERVICES

Where the underground services extend into the existing road corridor the work must be carried out in accordance with the WCC Code of Practice for Working on the Road. This will require a Corridor Access Request to be obtained and associated fees paid.

A.11 SURVEY MARKS

Survey marks must be provided in the kerb. The distance between them not exceeding 50 metres.

The marks must be galvanized iron bolts with a head diameter of 25 mm, and a minimum length of 100mm.

These survey marks are primarily for reference to underground services and to locate the kerb in terms of the New Zealand map grid co-ordinates; NZTM (New Zealand Transverse Mercator).

Care is to be taken to preserve or relocate all survey marks and height control benchmarks.

A.12 RETICULATION OF UTILITY SERVICES

Underground services must be located to achieve the clearances dictated in the Wellington Water Regional Standard for Design of Water Services.

To ensure the safety of people operating valves and opening manholes these should be located outside the traffic lanes in the road reserve. Where possible services must not cross over lots other than the one served.

For road lighting power reticulation refer below.

A.13 CONFIRMATION OF UTILITY SERVICES

All utility service authorities/owners must be contacted at the start of the design process to establish the location of any / all services within the design area.

If a service authority has services in the design area, copies of their service plans are to be obtained. Any services near the proposed design area are to be shown on the proposal plan.

The accurate position of services that are potentially in conflict with the network must be confirmed as part of the design process; by digging test holes and /or using ground-penetrating radar, depth finding locators, hydro excavating etc.

A.14 CONSULTATION WITH UTILITY AUTHORITIES

Prior to submitting a design to Council; utility authorities/owners, of services within the design area, are to have been consulted to gain their clearance. They may have requirements for working near their service or additional information.

If a conflict has been established there may need to be further consultation to discuss modifying or shifting of service – this must be carried out as part of the design process.

The consultation is to include the option of the service authority amending their utility service during construction.

A.15 DAMAGE

The Subdivider must immediately make good any damage caused by their work whatsoever unless approved otherwise by the Council Representative.

A.16 INSURANCE

Where work is to be carried out on a dedicated road or other land not owned by the Subdivider, the following insurance provisions must apply.

a) The Subdivider must be responsible to ensure that Public Liability insurance is arranged in the joint names of the Subdivider and the Council, for a minimum amount of $2,000,000 indemnifying the parties in respect of any one claim or series of claims arising out of the same occurrence.

b) The policy must be extended to cover all insurable risks normally applicable to subdivision/road work and including vibration and removal of support.

c) The policy must have attached either:

    i) A cross Liabilities/Joint Insured clause or,

    ii) Appropriate wording which states that the policy will be construed as though a separate policy had been issued to each of the joint insurers.

A.17 EMERGENCY PROCEDURES

If during construction works any situation arises where the security of public or private property or the operation of any public facility is endangered, likely injury to persons, or damage to the environment, the Subdivider must take action to rectify the situation immediately and notify the appropriate authority without delay.

A.18 SITE TIDY UP

Upon completion of the work, the Subdivider must leave the site in a clean and tidy condition.

This includes the following:

- Carriageways and footpaths are to be swept of all loose material.
- Kerb and channel and stormwater sumps are to be free from all loose material
- Earthworks stabilized to minimise erosion via overland flowpaths
- Cleaning of oil spills and liquids to limit the likelihood of these entering stormwater networks

- Any loose material on hard surfaces or other incidental rubbish to be removed from the site

A.19 MAINTENANCE PERIOD

The Subdivider must repair any deficiencies that are due to the negligence of the Subdivider or their Contractors.

In addition to the above, the Subdivider must maintain the other aspects of the works for 24 months. Except for street planting, which is subject to a 36-month maintenance period.

A.20 ALTERNATIVE SOLUTIONS

If the Subdivider wishes to propose a solution that sits outside of this Code, the process that will be undertaken is as follows:

- The Subdivider will be required to submit a design package including all relevant design information and stating why the alternative solution is equal to or better than the standard required by this document
- It will be reviewed initially by the relevant Council or Wellington Water staff
- Where it is deemed required by the Council a peer review will be organised by an independent consultant approved by the Council, and the Subdivider asked to request a pause on the processing time for any relevant consent(s).
- The independent consultant will provide a report stating whether or not the proposed solution is of the same or better standard as the outcome obtained by following this Code. The consultant must also provide the reasoning for the decision.
- This report and decision will be taken as final, with no further discussion to be entered into.
- All costs related to this process will be borne by the Subdivider.

PART B. EARTHWORKS DESIGN AND CONSTRUCTION

CONTENTS

OBJECTIVES

OBJECTIVES

Earthworks are the removal, relocation or deposit of earth (which includes any substance constituting the land such as soil, clay, sand and rock) from a natural or constructed land formation. Turf farming, ground cultivation and quarrying are excluded from the definition of earthworks.

The objective of this chapter of the code is to ensure the following criteria are achieved:

- stability of land,
- geotechnical soundness and resilience of any development,
- control of the sediment generated by the works,
- restriction of erosion and run off from the works,
- control of the amount of sediment entering receiving environments,
- control of surface water flows both during and after construction,
- no undue nuisance from silt, dust, noise or disposal of vegetation,

B.1 DESIGN BASIS

The design and construction of mass earthworks must be in accordance with the requirements of NZS 4431:1989, "Code of Practice for Earth Fill for Residential Development" guided by, but not limited to NZS 4404:2010 Land Development and Subdivision Engineering and SNZ HB 44:2001, Subdivision for People and the Environment.

B.2 SILT, SEDIMENT, EROSION AND STORMWATER CONTROL

Erosion and sedimentation are two related processes:

- Erosion is the wearing away of the land surface by running water, wind, ice, or other agents, including processes such as gravitational creep. Any reduction of erosion will reduce the quantity of sediment generated.
- Sedimentation is the settling of sediment out of the water column as a result of sediment entering waterways.

Erosion and sediment control measures are used to minimise the effects of earthworks on receiving environments.

Principles of Erosion and Sediment Control;

1. Appropriately integrate the development into the site.
2. Integrate erosion and sediment control issues into site and construction planning.
3. Develop effective and flexible Erosion and Sediment Control (ESC) Plans based on anticipated soil, weather and construction conditions.
4. Minimise the extent and duration of soil disturbance.
5. Control water movement through the site.
6. Minimise soil erosion.
7. Promptly stabilise disturbed areas.
8. Maximise sediment retention on the site.
9. Maintain all ESC measures in proper working order at all times.
10. Monitor the site and adjust ESC practices to maintain the required performance standard.

A significant reduction in erosion on a site will result in less sediment being generated, requiring treatment and/or lost through the control measures than if reliance is solely placed on sediment control.

The erosion of soil and sediment from vegetation removal and earthworks is a problem throughout the Wellington Region.

All projects involving land disturbance must incorporate erosion and sediment controls as an integral part of land development. Activities in or near waterbodies require a range of control measures and resource consent.

Approved erosion and sediment controls must be in place before earthworks commence, be maintained during the construction and only be removed once the site is fully stabilised to protect it from erosion.

Due to the increased rate of runoff brought about by the removal of vegetation and earthworks particular care must be taken to control surface water including stormwater.

Muddy or dirty water must be captured and treated before it drains into any watercourse or stormwater system.

Silt and sediment entering a waterbody can cause problems several kilometres downstream. The most obvious is a colour change. Sediment can change flow patterns, cause flooding, and also affect the health of aquatic ecosystems by smothering insects and other creatures.

It is required that best management practices are in place during the construction period of the development, including at site entrances and exits, to control all dust, silt and sediment generated by the works as to not discharge and cause nuisance away from the site or enter a water body or to the stormwater network.

To reduce the risk of erosion, the maximum area of vegetation stripped land being earthworked at any one time (including both cut and fill areas) must be kept to a minimum.

Land must be stabilised be it through revegetation or sealed as soon as possible.

All earthworked surfaces must be hydro-seeded as soon as practicably possible. No bare earth must be left exposed longer than necessary.

Appropriate controls must be in place to cope with anticipated runoff when the land is exposed to erosion. This must include suitable controls over any stockpiled topsoil or other fill material.

Adequate measures must be taken during the construction period to prevent excessive water logging of surface materials yet to be worked and to prevent fill material from being eroded and re-deposited at lower levels.

GWRC’s document, “Erosion and Sediment Control Guide for Land Disturbing Activities in the Wellington Region” 2021 must be used as guidelines.

B.3 DUST CONTROL

All areas of major dust sources including roads must be kept damp during dry periods, or hydro-seeded in advance of anticipated dry periods, to minimise public nuisance from dust.

B.4 SITE PREPARATION

Reference must be made to GWRC's Erosion and Sediment Control Guide for Land Disturbing Activities in the Wellington Region before any earthworks are commenced.

Before any earthworks commence Site Management Plans which include plan drawings, timelines and layouts must be produced to the satisfaction of the Council. These are to be updated regularly with the details of the controls that are in place and must be available upon request. All areas of cut and fill should be clearly defined in the Site Management Plans and marked on site.

It is favoured that a combination of control measures are investigated and used for optimum management of erosion and siltation. Adequate provision should be made for the control of erosion, surface water runoff and siltation prior to, during and after construction, as covered in section B.2 “Silt, Sediment, Erosion and Stormwater Control”.

Large projects must be programmed for earthworks in self-contained stages which can be largely completed within one earthworks season.

Adequate fencing or barriers should also be provided around trees or other features that are to be protected.

Earthworks must only commence after permission is granted from Council.

The site is to be adequately fenced/barricaded to safeguard other persons and private (or public) property both above and/or below the site and to prevent sediment from leaving the site.

All rubbish, vegetation, debris etc., must be removed from earthwork areas prior to topsoil stripping.

All earthwork areas must be stripped of all topsoil and any soft or organic material.

Special care should be taken to ensure that organic materials and areas of old uncompacted fill are not overlain by other soils.

Stripping must be carried out as a specific operation with areas being stripped in large enough increments to ensure that there is an adequate margin of stripped ground beyond any current cutting or filling operation.

All stripped material must be deposited in temporary stockpiles or permanent dumps, in locations where there is no possibility of these materials being unintentionally covered over or incorporated into structural fills.

Stockpiles and building materials must not be stored on the footpath or within the road reserve without permission from Council.

All temporary stockpiles must be covered with tarps or similar to minimise losses.

Stockpiles must not be located within an overland flow path.

B.5 SITE WATER MANAGEMENT

Surface water flows can be controlled using swales, ponds, perimeter bunds, pipes or pumps.

Where possible, the permanent stormwater system should be designed so it can be constructed at an early stage in the project and be used to collect runoff from the site during construction in conjunction with silt and sediment control measures. This includes creating ponds for sediment control during construction which are used for on-going stormwater quantity and quality control after development.

Where surface water could erode batters or affect their internal instability through soakage into the soil, open interceptor drains must be constructed in permanent materials. Benches in batter faces must be sloped back and graded longitudinally to reduce spillage of stormwater over the batter.

Water from stormwater systems must not flow into a fill or onto the ground near the toe or sides of fill or cut batters.

To prevent the problems of surface springs, scouring at the toe of fills, and saturated soil stability problems, it is essential that permanent subsoil drains be constructed in the valley floor and to other potential wet areas before fill being placed.

These drains must be constructed as a public drain in accordance with Section D.

B.6 FILL BATTERS

All fill batters must be no steeper than 2 horizontal to 1 vertical with a bench of a minimum width of 2 metres every 8 metres of vertical height, with a fall inwards of 1 in 10 and longitudinally along the bench of 1 in 100 minimum to 1 in 20 maximum discharging to a point clear of the filling in such a manner as to prevent scouring. The top or toe of the batter must be at least 3 metres from a boundary or building. This is in accordance with NZS4431: 1989 Code of Practice For Earth Fill For Residential Development.

Fill batters steeper than this will require specific design, e.g. high strength rockfill, reinforced earth.

The top edge of batters must also be at least 1 metre from the kerb face or back edge of sealed path or 2 metres where it is anticipated that individual paths will be cut down the batter. The total height of fill batters must generally be not higher than 15 metres.

B.7 FILL MATERIAL

The quality of fill material must be checked for suitability before the placing of fill commences.

The majority of soil types, other than organic materials, are potentially suitable for fillings under controlled conditions. However, because some clay soils are likely to undergo shrinkage and swelling when subjected to seasonal or other changes in water content, a special examination of swelling and shrinkage characteristics must be made in the case of highly plastic soils.

B.8 COMPACTION OF FILL

Fill must be placed in a systematic and uniform manner with near horizontal layers of uniform thickness (not greater than 250 mm) of material being deposited and compacted progressively across the fill area.

Before any loose layer of fill is compacted, the water content must be suitable for the compaction required and must be as uniform as possible.

Fill batter faces should be compacted as a separate operation or overfilled and cut back.

Where testing shows that the compaction achieved is below the specified minimum, all material represented by the test must be further compacted or removed as necessary and re-compacted, until the required standard has been met.

Any compacted layer which has deteriorated after an interruption in the earth moving operation must be re-compacted before further material is placed over it.

The minimum acceptable dry densities must be as shown in *Table 2: Minimum Acceptable Dry Densities*.

Position of fill	**Minimum acceptable dry density (As a percentage of the Maximum Dry Density[1])**
Within 0.6 metres (vertical measurement) of the road subgrade and extending to the outer edges of the footpaths	100
Within 1 metre (vertical measurement) of the finished	97

[1] The maximum dry density shall be determined by NZS 4402 Test 4.1.1 except that the soil water content shall be adjusted directly from the material water content to the compaction water content without prior drying.

surface of all fill areas and within 3 metres (horizontal measurement) of all batter faces.	
Elsewhere in the fill	95

Table 2: *Minimum Acceptable Dry Densities*

If cohesion-less soils are encountered and another test method would be more appropriate NZS 4431:1989 must be used as a guide.

B.9 INSPECTION OF FILL

Work is to be signed off by the Council at least at the following times:

a) After any part of the existing ground has been finally stripped and prepared and before the placing of any fill on that ground,

b) After any drain has been installed and before the drain is covered by fill,

c) Such other times as the Engineer considers necessary to enable an assessment of the general standard of earthworks and to be reasonably satisfied that:

i) Fill is not placed over soft or organic material

ii) All areas of existing ground showing seepage or potential seepage emission have relief drains provided

iii) Unsuitable material is not incorporated into the fill

iv) The compaction operations are systemic, the moisture content of the fill material appears on visual inspection to be suitable and the degree of compaction appears to be consistent and satisfactory.

B.10 TESTING OF FILL

Testing must be carried out and documented with respect to the following considerations and in accordance with the following times:

a) During the construction of earth fills some or all of the following quality control tests must be made on the fill material:

i) Tests to determine whether the moisture content is suitable for the type of material being used to achieve optimum density

ii) In-situ density tests to determine whether the degree of compaction is up to the specific minimum

iii) Where appropriate, test to determine the maximum dry density for the soil tested in each in-situ field density test.

b) Once the filling work is progressing as a steady and acceptable operation with uniform construction methods the minimum frequency of control testing must be one in-situ density test (or equivalent) for each 2,000 m^3 or 1.0 m lift of fill.

However, testing must be more frequent under any of the following circumstances:

i) During the first 4,000 m^3 of filling carried out on the project

ii) On the final layer of not less than 1.0 m depth

ii) When soil type or conditions are variable

iv) When there is any doubt about the adequacy of construction methods or soil properties

v) When relatively small quantities of fills are concentrated in localised areas

or placed discontinuously over a long period.

c) The location of tests must be in a random manner to cover the whole area of the fill.

d) All field and laboratory test data must be recorded in a systematic manner that will allow the results to be identified and allow the calculations to be checked at a later date, if necessary. All control tests results must have recorded the time, date, location and reduced level. Test results relating to sections of fill that have been subsequently removed or reworked and recompacted must be noted accordingly.

e) All field and laboratory test data must be provided with the application for Council certification.

B.11 CUTS

Cut batters must be stable except for minor fretting and must generally be not steeper than 1.0 horizontal to 1.5 vertical with a minimum width of 2.0 metres benching every 8 metres of vertical height. Steeper cut batters are generally not acceptable.

An area must be provided at the top of cut batters that are steeper than 1 to 1 for the softer surface material to be cut back to a 1 to 1 batter.

The extent of this area must be as follows:

a) 1 m for batters up to 5 m in height

b) 2 m for batters between 5 and 10 m in height

c) 3 m for batters between 10 and 20 m in height

The top or toe of a cut batter must be at least 2 metres from a boundary or building.

Buildings at the top of a cut batter must be beyond a 45° line from the toe of the batter and buildings at the toe of a cut batter must be beyond a 45° line from the top of the batter or side of the hill unless there is adequate walling or a qualified engineer certifies otherwise. The toe of a cut batter must also be at least 0.3 metres from the kerb face or back edge of a sealed footpath, but an additional allowance may be required for sight distance on a curve.

Cut batters must generally be not higher than 20 metres, but if required, higher batters will be given special consideration and will require geological investigation.

B.12 WALLS

All retaining walls will require specific approval of the Council before construction, whether or not a Building Consent is required for the work.

All wall structures must be designed for a 50 year or indefinite life period. All wall structures must meet the New Zealand Building Code requirements for their design life.

Any sea walls must be designed and constructed with future sea-level rise taken into consideration. Sea level rise should be based on the latest NIWA predictions for 100-year sea-level rise.

B.13 LOADING AND SPILLAGE

All loading must be carried out on the Subdivider’s land.

Special measures must be taken to keep the streets safe and clear of mud and debris.

Adequate washing facilities or properly designed vehicle rumble pads must be provided at all times on the construction site so that all vehicles are free from mud and debris when they pass onto the public streets. Where considered necessary properly formed, sealed or paved exit ways must be constructed from the washing-down facilities to the public streets.

Any wash water, or other muddy water, must not be discharged to the stormwater system or waterbody without effective pre-treatment.

B.14 CONSTRUCTION NOISE

For rules related to construction noise please refer to the District Plan, individual resource consents and NZS6830.

B.15 DURATION OF EARTHWORKS

The work must be programmed so that the duration of earthworks, between commencing and finishing, on any one stage/area must not exceed six months.

B.16 PLANTING

Areas of fill including batters and areas of cut but not including cut batters must be prepared with topsoil. The minimum depth for topsoil is 300mm. This will depend on the soil and species to be planted.

Those areas along with any other areas that have been disturbed, including cut batter faces, must then as a minimum be sown or preferably hydro-seeded with grass as soon as a satisfactory strike is achieved.

Ideally, the site will also be planted with native species. See section F for guidance on this matter.

Specific planting may be required for certain locations e.g. close to or over underground services, riparian planting in drainage situations and adjacent to open space. See section F.1 for guidance on this matter.

B.17 CERTIFICATION OF SUITABILITY OF EARTH FILL

The Council requires certification of the suitability of earth fill for residential development. Certification must be submitted and approved by the Council upon completion of the earthworks – refer to appendix B for a copy of the certificate.

B.18 AS-BUILT REQUIREMENTS

Council requires the following information concerning earthworks construction.

1) Extent and depth of fill in the form of lines joining all points of equal depth of fill at appropriate vertical intervals of 1 metre (or as appropriate).

2) Plans must also show the type of fill material and any areas where buildings or foundations will require a specific design together with any fill areas of low density not complying with this Code.

3) The position, type and size of all subsoil drains and their outlets must also be shown.

4) Where earthworks have been carried out a certificate of land suitability for residential development must be supplied along with a report of the inspections and testing carried out. A recommended form of the certificate, Standard Form A/1, is in Appendix A. The type of residential development that earth fills must be capable of properly supporting are residential buildings of timber or concrete block work conforming with the requirements of NZS 3604 or NZS 4229. Dimensions and other information relating to the earthworks must be provided.

PART C. ROAD DESIGN AND CONSTRUCTION

CONTENTS

OBJECTIVES

The objectives of the Roading chapter of this Code are:

- To achieve a sustainable, effective, safe and appealing roading corridor that provides for the needs of all road users, including cyclists, micro mobility users, pedestrians, vehicles, adjoining property owners, utility companies and other service providers;
- To ensure transport routes are physically resilient to natural and major disasters;
- To increase public amenity through the provision of landscaped street environments; and the provision of street furniture; and
- To support the Council's operative Transport Strategy which aims to provide a highly efficient interconnected road and street system that is easy to use, cyclist and pedestrian-friendly while minimising any adverse environmental effects associated with the activity.

GENERAL PERFORMANCE CRITERIA

Any constructed road needs to:

- be appropriate for its position in the road hierarchy,
- be of sound structure,
- provide a suitable skid-resistant, waterproof running surface for traffic,
- manage surface and subsoil water so that long term pavement performance is assured
- minimise the area of impermeable surfaces associated with roading.

Having regard for the following criteria:

- limit the ongoing maintenance costs of assets,
- provide for stormwater drainage and utility services,
- be durable and robust.

Provided the previous criteria are met, alternative, low impact design solutions, including permeable paving and swale use, may be proposed with appropriate engineering detail that will enable the Council to assess the viability of the proposal.

Any development that links into or impacts on the Council's existing assets (roading, footpath, drainage etc) must not be based on the premise that the Council's assets can be reconfigured to satisfy the requirements of the development. It is essential that the subdivider surveys the lines, levels and other relevant characteristics of the Council's affected assets in the vicinity and determines how the development will best connect with these assets, without requiring alteration to the Council's assets.

Discussions must be held with the Council upfront to identify if there are any proposed future Council works that will affect the development works.

It is unacceptable to expect users of the Council's assets to be compromised in the interests of the new development.

C.1 ROAD DESIGN

C.1.1 Road categories

Roading categories must be as per the Waka Kotahi One Network Framework classifications and as discussed in the District Plan or as per any relevant conditions of consent.

C.1.2 Road Widths

Road widths must either achieve those specified in Table 1-INF: Design of Roads – One Network Framework in the District Plan, or achieve the widths stipulated in any related conditions of resource consent granted by Wellington City Council.

All berms, kerb extensions and traffic islands must have sufficient space to allow positioning of necessary signs and other street furniture for adequate vehicle clearance.

C.1.3 Roading Network Pattern

Roading patterns must conform to the operative District Plan which the Council has for the area and as per relevant conditions of resource consent granted by the Council,

C.1.4 Walking Network

Care should be taken to ensure a street environment is designed for use by pedestrians. (Refer Traffic Calming Measures Section C.1.9).

Development of land in regard to the roading pattern should include a plan showing pedestrian movement related to key features such as bus stops, schools and shopping areas.

Footpath width and number must be provided in accordance with Table 1-INF: Design of Roads – One Network Framework in the District Plan, or achieve the widths stipulated in any relevant conditions of resource consent granted by the Council.

The preferred design of a road crossing location would provide a median island of a minimum of 2.0m width with a maximum crossing distance of 5.0m of carriageway on either side of the road.

In the vicinity of high pedestrian trafficked areas such as schools, commercial centres, bus stops and hospitals, footpaths and crossings should be of a higher standard. In these locations, the minimum footpath width should be 3.5m.

C.1.5 Cycling Network

Cycling networks must be provided as per the District Plan or as per resource consent conditions.

Provision for cyclists must be in accordance with Table 1-INF: Design of Roads – One Network Framework in the District Plan, or achieve the widths stipulated in any relevant conditions of resource consent granted by the Council.

C.1.6 Public Transport

The design of the development of urban land must maximise the convenient access of public transport.

To achieve this requirement, in areas where residential subdivisions have aggregated to 150 household units or more a plan must be produced to demonstrate public transport accessibility.

Elements in this plan will include the following:

1. The provision of a continuous through route classified as a Local Street M5 P4 or higher, for public transport to use.

   This requirement may be varied in the case of the land development being located near a railway line.

2. High transport intensity land uses (such as schools, tertiary institutions, hospitals, medical facilities, shopping areas, retirement villages and community facilities) should be located with frontages along the public transport route.

3. Land development should be otherwise designed to maximise the number of sites within 400m walking distance of a designated public transport stop.

4. Land development that does not have a frontage on the public transport route must be provided with convenient access to that route. Road or suitably designed walkways access must be provided to the public transport route at intervals not exceeding 200m.

C.1.7 Tree Planting (Design)

Trees must be planted as described in the Table 1-INF: Design of Roads – One Network Framework abd Table 2-INF: Street Trees in the District Plan, or as stipulated in any relevant conditions of resource consent granted by the Council.

Where topography and soils permit; permeable surfaces, rain gardens, soak pits or similar vegetated channels are required for street planting and the retention and dissipation of stormwater run-off and enhancement of biodiversity and amenity. These measures must be located in the same berm as Street Trees, as detailed in Table 1: INF: Design of Roads in the District Plan.

C.1.8 Water Quality and Quantity

Runoff from roads contains contaminants from vehicles (zinc, copper and aluminosilicates from tyres and brakes of vehicles and sulphur from the fuel) and PCB's from road materials and maintenance. Contaminants also come from paint, fuel, and other spillages on the road. Road run-off is also heavily influenced by surrounding land use (especially unpainted galvanised iron roofs).and activities more than by variation and loadings in traffic. The sources of contaminants are diffuse.

In Wellington and Porirua Harbours there is data showing ecotoxic contaminants carried by stormwater in bottom sediments at concentrations that exceed guidelines for aquatic life.

Roads are recipients and conveyors of stormwater and contaminants from adjacent and often extensive contributing areas. Roads, whilst not the sole source of contaminants, may be the most appropriate place to treat stormwater.

Sediment and associated contaminants in stormwater can be removed by a range of treatments, including directing runoff to vegetated swales and infiltration trenches along the road corridor, through to interceptor and treatment structures

The Council seeks to promote low impact design to both improve water quality and curb peak runoff volumes.

Permeable or porous paving, and retention and detention devices may be effective means for controlling peak flows of road runoff. Details for the design of these devices can be found in the Wellington Water document Water Sensitive design for Stormwater Treatment Device Design Guideline 2019.

C.1.9 Traffic Calming Measures for Residential Areas

Carriageway and alignment of traffic calming measures must discourage motorists from travelling above the design speed provided in the District Plan

The design speed environment is related to the classification of that street and is a result of the design required under Table 1 – INF: Design of Roads – One Network Framework in the district plan, or any relevant conditions of consent granted by the Council.

All speed control devices must be signposted (including the negotiation speed) and provided with appropriate lane marking.

C.1.9.3 Specific Design Details of Speed Control Parameters

Speed control devices must be designed for their normal use by motor cars, but with provision (such as mountable kerbs) for larger vehicles.

Design of speed control devices must comply with the following parameters:

- The speed at slow points of bends and length of the street between slow points or bends – refer to Table: 3
- Effect of downhill gradient on speed – refer to Table: 4
- The radius of Slow Points (Bend to be 45° deflection or more) – refer to Table: 5
- Deflection Angle for Design Of 20 Km/h Bends – refer to Table:6
- Design of 20/Km/H Street Narrowing – refer to Table: 7
- Design of 20km/H Plateau Or Platform Areas – refer to Table: 8

Speed at slow point	**Length of street (m) to limit maximum speed to (km/h):**					
	25	30	35	40	45	50
20	40	75	100	120	140	155
25		45	60	80	10	135
30			45	65	80	115
35				50	65	100
40					55	80
45						60

Table 3: *Speed at slow points of bends and length of street between slow points or bends.*

Gradient (%)	Increase in speed (km/h)
< 5	0
5 – 10	5
> 10	10

Gradients should not exceed 20%

Table 4: *Effect of downhill gradient on speed*

Design speed (km/h)	Radium of continuous bend (m)	Radius of isolated bend of chicane (m)
20	15	10
25	20	15
30	30	20
35	50	30
40	90	40
45	105	50
50	120	60

Table 5: *Radius of Slow Points (Bend to be 45 deflection° or more)*

Carriageway width	Single Bend	Chicane (two reverse bend)
3.5	60°	30° - 30°
5.0 – 5.5	70°	45° - 45°
6.0 – 6.5	80°	55° - 55°
7.0 – 7.5	90°	60° - 60°

Table 6: *Deflection Angle for Design of 20 Km/h Bends*

Number of Lanes	Carriageway width (m)
Single Lane	2.5
Two Lanes	4.5 (over minimum length of 3m

Table 7: *Design of 20/Km/h Street Narrowing*

Height	Ramp Slope
75mm to 150mm	1 in 15 (6.7%)

Table 8: *Design of 20/Km/h Plateau or Plateau Areas*

C.1.10 Intersections

Intersections within the residential areas should be primarily T-junctions for safety reasons. The design of these must be as per the district plan.

The kerb line radius at intersections should be kept as short as possible consistent with likely vehicle and pedestrian usage, but in any case must not be more than 4.0m. Major intersections such as the junction of secondary collector roads with primary collector roads or greater, must be specifically designed to provide to provide safe provision for walking and cycling and to allow for bus and heavy vehicle usage.

Where practical the gradient within 30m of intersections in local roads should not exceed 1 in 10 (10%) and should preferably be less than 1 in 33 (3%).

Also, where practical, intersections on all other roads should not exceed 1 in 50 (2%) and preferably be less than 1 in 100 (1%).

Grading at intersection approaches must take into account the provisions of *Guide to Road Design – Part 4: Intersections and Crossings – General* (Austroads 2020)

Minimum sight distances must accord with Table 6 – INF: Minimum Sight Distances at New Intersections in the District Plan, or any relevant conditions of resource consent granted by the Council.

Standard wheelchair and pram-friendly kerb ramps must be provided at all road intersections, refer to drawing R-24-727 in Appendix C.

C.1.11 Turning Requirements

A turning facility must be provided at the end of all no exit roads.

Turning circles at the end of residential cul-de-sacs must have a minimum kerb radius of 7.0m, while industrial and commercial cul-de-sacs must have a minimum kerb radius of 12.5m.

Turning areas of other shapes for difficult situations are acceptable if it can be shown they will work satisfactorily.

Examples of turning areas are given in drawings R-9-705, R-9-706 and R-9-707 in Appendix C.

C.1.12 Gradients

Gradients must achieve the requirements in Table 1 _INF: Design of Roads – one Network Framework in the district plan, or as approved under a resource consent issued by Wellington City Council.

Gradients must be minimised at intersections as described above.

Bus route gradients must be not steeper than an average of 1 in 15, (6.7%), measured over 200m; and an instantaneous maximum of 1 in 12, (8.3%). Approval may be considered for steeper gradients in special circumstances.

C.1.13 Horizontal Curves

Horizontal curves must be as per Table 4 _+ INF: Road Vertical and Horizontal Curves in the district plan, or any relevant conditions of resource consent granted by the Council.

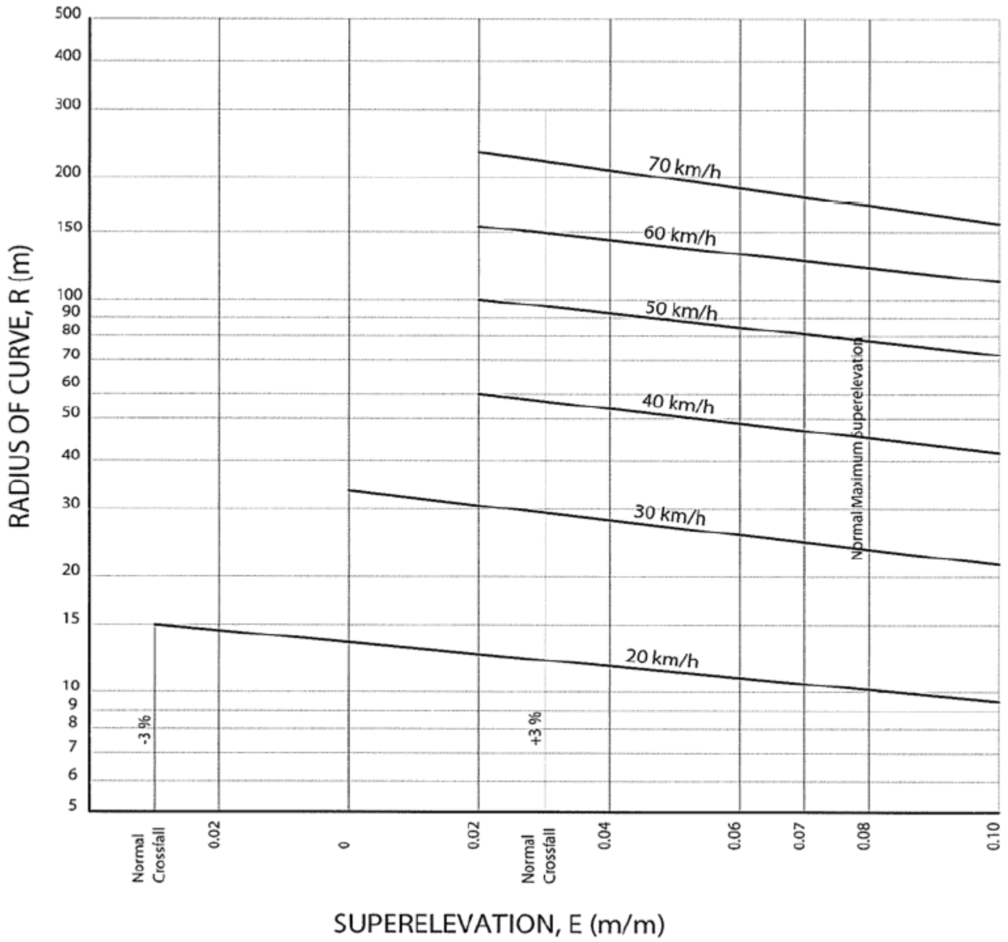
C.1.14 Vertical Curves

Vertical curves must be as per Table 4 _+ INF: Road Vertical and Horizontal Curves in the district plan, or any relevant conditions of resource consent granted by the Council must be as per the district plan.

C.1.15 Superelevation

Superelevation and runoff lengths must be derived from the following:

- Graph 1: Radius of Curve vs. Superelevation
- Equation 2: calculating Radius of Curve
- Table 14: Determining friction factor(f), knowing Speed (V)
- Table 15: Superelevation Table
- Equation 3: Calculating Runoff length
- Table 16: Deriving suitable values of G (%), knowing Speed
- Table 17: Runoff lengths for pavement widths up to 7m



Graph 1: *Radius of Curve vs. Superelevation*

Radius of curve can be calculated using the following formula:

Equation 2:

$$R = \frac{V^2}{127(e+f)}$$

where:

R = Radius of curve (metres)
V = speed (km/h)
e = Superelevation rate *(m/m)* – from table 15
f = friction factor (dimensionless) – from table 14

NOTE: Negative crossfall should not be used where this is avoidable.

Speed – v (Km/h)	10	20	30	40	50	60	70
Friction factor (dimensionless)	0.26	0.24	0.22	0.20	0.18	0.16	0.16

Table 14: *Determining friction factor (f), knowing Speed (V)*

For circular curves used without transitions:

- Use 60% to 66% of the maximum Superelevation at the tangent points
- Use 90% of the maximum Superelevation at the ¼ and ¾ points, and
- The maximum Superelevation at the ½ point.

NOTE: Intended for use in urban roads. For higher speeds use Waka Kotahi guidelines which can be used for any design speed.

Radius	Principal Streets			Collector Streets						Local Streets					
R (m)	*Super (e m/m)*	*Friction (f)*	*Speed (v km/h)*	*Super (e m/m)*		*Friction (f)*		*Speed (v km/h)*		*Super (e m/m)*		*Friction (f)*		*Speed (v km/h)*	
15				0.07	0.12	0.14	0.09	20		0.06	0.12	0.15	0.09	20	
20				0.07	0.12	0.09	0.04	20		0.06	0.12	0.10	0.04	20	
25				0.07	0.12	0.21	0.16	30		0.06	0.12	0.22	0.16	30	
30	0.08	0.16	30	0.07	0.12	0.17	0.12	30		0.05	0.12	0.19	0.12	30	
35	0.08	0.12	30	0.07	0.12	0.13	0.08	30		0.05	0.12	0.15	0.08	30	
40	0.08	0.10	30	0.07	0.12	0.11	0.20	30	40	0.05	0.12	0.13	0.20	30	40
45	0.08	0.20	40	0.06	0.12	0.10	0.16	30	40	0.05	0.10	0.11	0.18	30	40
50	0.07	0.18	40	0.06	0.12	0.19	0.13	40		0.05	0.08	0.20	0.17	40	
60	0.07	0.14	40	0.06	0.12	0.15	0.09	40		0.04	0.06	0.17	0.15	40	
70	0.07	0.11	40	0.06	0.12	0.12	0.16	40	50	0.04	0.05	0.14	0.13	40	
80	0.07	0.18	50	0.05	0.12	0.11	0.13	40	50	0.04		0.12		50	
90	0.06	0.16	50	0.05	0.12	0.17	0.10	50		0.04		0.18		50	
100	0.06	0.14	50	0.05	0.12	0.15	0.16	50	60	0.03		0.17		50	
120	0.06	0.10	50	0.05	0.10	0.11	0.14	50	60	0.03		0.13		50	
140	0.05	0.15	60	0.04	0.10	0.16	0.10	60		0.03		0.11		50	
160	0.05	0.13	60	0.04	0.09	0.14	0.15	60	70	0.03		0.09		50	
180	0.05	0.11	60	0.04	0.06	0.12	0.15	60	70	0.03		0.08		50	
200	0.04	0.15	70	0.04		0.15		70		0.03		0.07		50	
250	0.04	0.12	70	0.03		0.13		70		Normal chamber		0.11 max		50	
300	0.03	0.14	80	0.03		0.10		70							
350	0.03	0.11	80	0.03		0.08		70							
400	0.03	0.10	80	0.03		0.07		70							
500	0.03	0.07	80	Normal Chamber		0.11 max		70							
600	Normal chamber	0.11 max	80					70							

Table 15: *Superelevation*

Note: Use 1st column of lower values of Superelevation in densely built-up areas. Use 2nd column with sharp curves in hilly but more open spaces.

Runoff length can be calculated using the following formula:

Equation 3:

$$L = \frac{100We}{G}$$

where:

L = Runnoff Length (metres)
W = Pavement Width (metres)
e = Superelevation rate *(m/m)* – from Table 15
G = Percentage Difference in Longitudinal Grade between the pavement edges – from Table 16

Speed – (Km/h)	**20**	**30**	**40**	**50**	**60**	**70**	**80**
Suitable Values of G - %	1.95	1.80	1.65	1.50	1.35	1.20	1.10

Table 16: *Deriving suitable values of G (%), knowing Speed*

Or using table 17

Superelevation Rate (e m/m)	**Minimum Runoff Length L metres for Speed (km/h) of:**						
	20	30	40	50	60	70	80
0.06	22	23	25	28	31	35	38
0.07	25	27	30	33	36	41	45
0.08	29	31	34	37	42	47	51
0.09	32	35	38	42	47	53	57
0.10	36	39	42	47	52	58	64
0.12	43	7	51	56	62	70	76
Absolute Minimum	20	20	25	25	30	30	35

Table 17: *Runoff lengths for pavement widths up to 7m*

NOTE: for pavement widths 7m to 10m multiply the above runoff lengths by 1.2
For pavement widths 10m to 14m multiply the above runoff lengths by 1.5

Theoretical superelevation requirements may require adjustments to ensure flowing kerb profiles.

Generally, the best results are obtained from a graphical plot of each kerb profile using a horizontal/vertical scale ratio of the order of 10 to 1. The ruling profile gradient is to be redeveloped along the shortest or inside kerb. Generally, superelevation is added to the inside kerb profile to obtain the profile of the outside kerb, and with the simple horizontal curves. Two-thirds of the maximum superelevation is applied at the tangent points.

For existing situations, superelevation on curves of arterial and principal roads must be designed for the 85th percentile of the actual observed speed at the particular location (refer to the Austroads 'Guide to Road Design Part 3: Geometric Design').

Horizontal and vertical curves in the same direction may be connected with large radius curves in place of straights, with superelevation maintained around the curve combination.

Reverse curves are to be separated by a sufficient length of straight to allow for a satisfactory rate of superelevation reversal.

Alignment and profiles of kerbs at intersecting roads require detailing to permit the accurate location of stormwater sumps, and to check crossfalls.

C.1.16 Pavement Design

Pavement designs must be determined in accordance with the procedures outlined in the Austroads 'Guide to Pavement Technology Part 2: Pavement Structural Design'.

This manual is broadly based, and covers the assessment needed for the design of flexible and rigid pavements as well as overlays and gives guidance to the economic comparisons of alternative pavement designs.

C.1.17 Safety Audit

A safety audit must be carried out for all roads to be vested in the Council, except for service lanes.

A full Waka Kotahi safety audit process must be undertaken for all vested roads.

Members of the proposed safety audit team must be qualified and experienced in safety audit work. The Council may also nominate an additional person as a member of the team.

A copy of the safety audit reports must be supplied to the Council, together with any comments on the report’s recommendations.

The Council will not accept roads for vesting until it is satisfied that all issues raised in the audit have been adequately resolved.

C.2 CARRIAGEWAY CONSTRUCTION

C.2.1 Crossfall

The normal camber or crossfall must be 1 in 33 (3%).

C.2.2 Subgrade

CBR tests must be carried out to confirm whether or not the subgrade is satisfactory.

Subject to correlation by laboratory tests, dynamic cone penetrometer tests (Scala-penetrometer) may be used to determine subgrade CBR values using industry standard correlation charts.

Soft areas must be brought up to strength and retested.

Subsoil drains are required to drain any wet areas and also under the kerb and channel as indicated in C.2.4.

C.2.3 Basecourse Layer

Basecourse must extend 300mm behind the kerb face (or 150mm behind the back of the kerb where a wider kerb profile is used).

All basecourse must be to Waka Kotahi/NZTA Standard Specification, M/04 or M/05 (Wellington 1) 1984.

Material used for choking the surface to obtain a clean stone mosaic surface must be kept to a minimum and must be free of clay.

C.2.4 Kerb and Channel

Kerb and channeling is required on both sides of sealed carriageways in order to achieve the following:

- Collection and control of roading stormwater run-off. **Note:** discharge of stormwater to kerb and channel may require a drainage permit
- Demarcation between trafficked and non-trafficked areas within the road reserve

The Council’s standard 135mm near vertical face kerb profile must be used to achieve these outcomes.

However, there are situations where mountable kerbs may be more appropriate. Situations include:

- Traffic islands that require vehicles to deviate
- Designated turning areas where larger vehicles need additional space
- High speed roads, greater than 70km/h, where a mountable kerb may be safer

For situations in which mountable kerbs are used, the following needs must be satisfied:

- Provision must be made to ensure all adjoining property stormwater is discharged to an approved stormwater system, not to the surface channels within the road reserve
- Street sumps must have overflow capacity equivalent to the overflow capacity of conventional standard kerb sumps
- Critical sumps where overflow may discharge onto a private property must also have the same on-street storage capacity as standard kerb critical sumps
- Carriageway widths must be sufficient to accommodate on-street parking to avoid driver concern that vehicles will be side-swiped
- Footpath pavements alongside mountable kerbs must be constructed to the strength of heavy-duty vehicle crossings to withstand vehicle use.
- Berm areas adjoining mountable kerbs should include trees or other physical features to discourage parking or maneuvering on the berm
- Driveways must be clearly defined, without using carriageway or footpath markings, to allow compliance with parking regulations

RTS 14 (Guidelines for Facilities for Blind and Vision-impaired Pedestrians) highlights the importance of full height kerbs to vision impaired pedestrians.
"*Overseas research has shown that the full vertical upstand of a kerb is the single most reliable cue for blind and vision-impaired people in detecting roads*". Any use of mountable kerbs must take this into consideration.

The standard profiles for both the standard and the mountable kerbs are shown on drawing R-22-700.

Subsoil drains must be placed under kerb and channel for a length of 15m from the sump on the high side. Where the sump is located in the valley position, the subsoil drains must extend 15m on both sides. Refer to drawings R-39-749 and R-39-750, in Appendix C, for details of a subsoil drain.

The kerb and channel foundation must be formed with a basecourse complying with C.2.3 above and must be compacted in layers not exceeding 100mm in loose thickness to achieve a Clegg Impact Value, CIV, of not less than 25. Alternatively, compaction of the basecourse may be assessed using a Scala-Penetrometer and must be considered satisfactory provided there is not less than 4 blows per 50mm of penetration.

Kerb and channeling must be laid in one operation in accordance with the profile in drawing R-22-700, in Appendix C. Construction joints are required at 6.0m intervals maximum and must comprise a tow 20mm cut in the open face of the kerb and channel. Construction joints must align with construction joints in adjacent surfaces (eg concrete footpaths).

Concrete must have a minimum compressive strength of 20MPa at 28 days and must be constructed in accordance with the requirements of NZS 3109: 1997.

In-situ boxed and precast kerb and channeling to the profiles shown on drawing R-22-700, in Appendix C, may be used where it is not practical to slipform or extrude the concrete. Construction joints are required at 6.0m intervals maximum and must comprise a shallow 20mm cut in the open face of the kerb and channel.

All kerbing around traffic islands must be of a mountable type. Refer to drawing R- 22-700, in Appendix C.

Standard disability and wheelchair friendly kerb ramps must be provided at all road intersections. Refer to drawing R-24-727, in Appendix C.

For details on vehicle kerb crossings refer to Section C.5.1.

For new roads and public carparks runoff must be directed from the road surface or car park to water sensitive design treatment devices. When designing these devices consideration shall be given to the Wellington Water document Water Sensitive Design for Stormwater Treatment Devices Design Guidelines, the relevant policies and rules in the Three Waters chapter of the District Plan, any relevant structure plan, stormwater strategies or relevant conditions of resource consent.

Refer to the Drainage section for more detail where porous/semi-porous paving, soak pits or similar vegetated channels may be used.

C.2.5 Sumps

The Wellington City Council standard (single) sump has a design inlet capacity of 25 litres/sec.

The Council’s standard sump grate provides protection for any cyclists while at the same time delivering the design inlet flows.

Sumps, double sumps and half boxes must be constructed in accordance with drawings R-41-740 to R-41-747 inclusive, in Appendix C.

The lead from a private sump will remain a private lead. The length of this lead from the sump to a public main should be as short as practical and must not exceed 5.0m in length.

For maintenance and renewal purposes, the Council requires all sump grates and frames to be to the standard dimensions shown on the drawings.

Sumps must be built so that the grating is 70mm below the line of the entry channel.

C.2.5.1 Sump Location in Carriageway

Sumps must be located in carriageways at:

1) Intervals governed by the design contributory flows but not exceeding 100m

2) Intersections at the upstream tangent point (may have to be positioned further upstream to accommodate a pedestrian ramp)

3) Changes of direction, gradient, or superelevation in the channel where there could be a tendency for the water to leave the channel,

4) Where water would leave a public road and flow onto a private road or property,

5) Any other point required to eliminate surface ponding.

Sumps must not be located in front of a property where the property's frontage is narrow. A minimum 4.0m length of standard kerb must exist in front of every such property to provide for future kerb crossing purposes.

C.2.5.2 Discharge of Sumps

Public sumps must discharge via a minimum 225mm diameter pipe into either:

1) A stormwater manhole, or

2) A clearly defined open watercourse, with adequate erosion control and protection to prevent scour, or

3) Provided that the lead does not exceed 3.0m in length, through a saddle into a pipe of diameter no less than the diameter of the sump lead. or

4) Where conditions allow, sumps may discharge to soak pits or similar vegetated channels as specified in section C1.17.

Note: Connections to a stormwater network (manhole or pipe) require a Public Drainage permit. Work near or in watercourses, or a discharge into a watercourse will require a consent from GWRC and/or the Council.

Any connection other than a minimum 225mm diameter outlet pipe will be at the discretion of the Wellington Water.

C.2.5.3 Connections to Sumps and Sump Leads

Connections into public sumps or public sump leads are not permitted.

C.2.5.4 Types of Sumps

The Council's standard single sump is detailed in drawing R-41-740, in Appendix C. A sump has one chamber, one baffle, one grating and one minimum 225mm diameter sump lead.

High flow areas may require the use of new 'super sumps'. Prior to installing these, discussion with the Council is required.

C.2.5.4.1 Duplicate Sumps

Two independent sumps and leads must be provided in critical situations to provide surplus capacity in the event that one of the sumps (including its lead), becomes blocked. Such situations may include low spots where any concentration of runoff could cause flooding, especially of private property.

Each sump of a duplicate set must have a minimum capacity of 25 litres/sec.

C.2.5.4.2 Double Sumps

A double sump comprises, two single sumps back-to-back connected via a single minimum 225mm lead, with one of the sumps discharging via a 300mm lead to the outfall.

Double sumps (or duplicate sumps and leads) must be provided:

a) Where a single sump has insufficient intake capacity,

b) On grades steeper than 1 in 12 (8.3%),

c) Where two sub-catchments meet.

Attention is drawn to the necessity for providing adequate stormwater disposal at the end of cul-de-sacs where single sumps are frequently inadequate and there are often a large number of kerb crossings within a short distance. Kerb crossings immediately before or over a sump usually prevent the sump from operating as designed. In these situations, double sumps may be more effective and should be provided.

C.2.5.4.3 Deflector Sump Tops

On grades steeper than 1 in 20, a deflector sump top and a vane in the channel, drawing R-41-747, in Appendix C, must be used on:

a) Single sumps,

b) The first sump of duplicate sumps,

c) The first grating of double sumps.

C.2.5.5 Cleaning Eyes

Cleaning eyes are integral to Wellington City Council standard sumps. Cleaning eyes are detailed on drawing R-41-743, in Appendix C.

Any proposed alterations to the sewer and/or stormwater networks, including variations to the above clauses, must be approved by Wellington Water.

C.2.6 Traffic Islands

All kerbing around traffic islands must be of a mountable type. Refer to drawing R- 22-700, in Appendix C.

Traffic islands must be designed in accordance with the '*Guide to Road Design – Part 4: Intersections and Crossings – General'* (Austroads 2009a).

The minimum island widths must be determined using Table 18.

Functional Required	Minimum width (m)
To shelter a crossing vehicle	7.0
Median with turn lane	3.0
Pedestrian refuge	2.5
Signal or lighting poles	2.0
Small sign	1.2

Table 18: *Minimum Traffic Island Widths*

The mountable face must be painted white.

Traffic islands may be:

- Infilled with exposed aggregate,
- Surfaced in permanent materials, such as a concrete footpath type pavement, as specified in section below.

C.2.7 Acceptance of Pavement Prior to Sealing

Before sealing takes place the pavement must be Benkelman Beam tested in accordance with Waka Kotahi/NZTA T/01.

The deflections must not exceed Table 19: Maximum Pavement Deflection.

Roadway	Maximum Deflection (mm)
Principal Roads	0.55 mm
Collector Roads	0.8 mm
Sub-collector Roads	0.8 mm
Local Roads	1.0 mm
Cul-de-sacs	1.0 mm
Service Lanes	1.0 mm
Private Ways	1.0 mm
Private ways on a proposed bus route	0.8 mm

Table 19: *Maximum Pavement Deflection*

A sample Benkelman Beam Test Record report form is included in Appendix C.

C.2.8 Sealing / Paving

C.2.8.1 General

All road surfaces should generally be sealed with a grade 4 chip seal and overlaid with an asphaltic concrete surface unless approved otherwise by the Council's Roading Engineer. Pervious paving may be considered on a case-by-case basis.

C.2.8.2 Chip Seal

The basecourse surface must be inspected and passed by the Council's Roading Engineer prior to any first coat sealing being carried out.

A clean dry stone mosaic surface must exist before the first coat seal is applied and if an adhesion agent is not used the seal should be applied only during warm dry settled weather between 1 October and 15 March. If a suitable adhesion agent is used, sealing may be carried out outside these dates, provided conditions allow.

On no account must sealing or paving or preparatory work be carried out if there is not to be warm (i.e. not less than 10°C) settled weather for the next 48 hours.

A sample Sealing Report is included in Appendix C.

First coat seal must be applied using a bitumen cut-back binder at 1.8 - 2.0 L/m^2 covered with a grade 4 sealing chip.

Sealing must be carried out in accordance with the Waka Kotahi/NZTA specifications M/01, M/06, M/13, P/03, P/04 and Q/1.

Further to clause 26 of the Waka Kotahi/NZTA specification P/03, the subdivider must control traffic such that the full width of new seal is trafficked evenly.

The Polished Stone Value (PSV) must be a minimum of 59 for all sealing chip.

C.2.8.3 Asphaltic Concrete

Asphaltic concrete paving must be carried out in accordance with the Waka Kotahi/NZTA specifications M/01, M/10, M/10D, P/09, and Q/2.

Asphaltic concrete mixes must conform to the following mix type and design as stated in Table 20;

Mix	Application	Specified Marshall Flows	Air Voids %	Minimum Compaction Index	Minimum vMA (voids mineral aggregates)
10	Roads	75	3.0 – 4.0	0.09	16

Table 20: *Roading Asphaltic Concrete Mix type and design*

Immediately prior to the Asphaltic Concrete surface work:

- a strip 600mm wide and adjacent to each channel must be sprayed with
- an approved ground sterilising weed killer at the manufacturer’s recommended rate of application

- the chip seal surface must be clean and have a tack coat of 0.3L/m^2 of
- residual bitumen applied by spraying

Asphaltic concrete must be laid with a paving machine and compacted to a minimum depth of 40mm.

For private ways and residential cul-de-sacs and parking areas, excluding bus stops, the minimum depth of asphalt paving may be reduced to 30mm, using mix 10.

C.2.8.4 Additional Slurry Seal

Existing asphalt and concrete paved surfaces on roads, cul-de-sacs, service lanes and rights-of-way may be maintained by resurfacing with a slurry seal complying with the requirements of ISSA A143 (revised) 2010. Recommended Performance Guidelines for Micro-Surfacing.

The slurry must be an ISSA Type II or III and meet the following additional requirements:

Minimum Final Compacted Depth of Slurry	
Type II	7.5mm +/- 1mm
Type III	3.10.0mm +/- 1mm

Table 21: *Minimum final compacted slurry depths*

- Maximum break time of 30 minutes at air and ground temperature of 10 degrees Celsius,
- The slurry must be designed to allow pedestrian traffic on the surface after a period of 15 minutes,
- Testing must be carried out in accordance with procedures outlined in ISSA A143 (revised) 2010.

C.2.9 Pavers

Interlocking Concrete Block Paving

The use of interlocking block paving may be approved on local roads, service lanes and private rights-of-way.

Paving must be designed and constructed to the manufacturer’s proven specifications and must comply with NZS 3116:2002 ‘Concrete Segmental and Flagstone Paving’.

Blocks must have a thickness not less than 80mm. Blocks must have nominal thickness, strength characteristics, dimensional tolerances and skid resistance which comply with the guidelines in the NZS 3116: 2002 and must be specific to the in-service situation in which they are used.

A water proofing membrane must be applied over the road formation and subsoil drains installed to divert surface water penetration away from the carriageway into adjacent sumps or drainage structures.

Where interlocking block pavements are installed, 24 month maintenance periods must be specified whereby the contractor must be responsible for correcting all defects during this period.

NOTE: The use of clay brick paving for road surfaces will not be approved.

C.2.10 Pervious Paving

As discussed above pervious paving will be considered on a case-by-case basis.

Where pervious paving is approved to be utilised, consideration should be given to the Wellington Water document Water Sensitive Design for Stormwater Treatment Devices Design Guidelines 2019, the relevant policies, and rules in the Three Waters chapter of the District Plan, any relevant Structure Plans, Stormwater Strategies or relevant conditions of resource consent.

C.2.11 Special Surfaces

The roads of the Commercial and Mixed Use Zones and General Industrial Zone, as defined the District Plan, may have specific finishes required. mA

C.2.11 Rural Road Construction

Construction must be as for urban roads except as may be indicated otherwise on the drawing R-9-708, in Appendix C, and as below.

For developments in which water tables, side drains and culverts are used for the collection and management of stormwater runoff, design calculations and a management plan showing how the water will be collected channeled/dissipated and discharged must be submitted for the approval of Wellington Water.

Culvert inlets must be identified with an off-set marker post as shown in drawing R-12-785 in Appendix C.

While generally taking into regard property boundaries, there may be cases where the Council will consider allowing fencing to encroach into road reserve. As a minimum, fences should not be closer than:-

- 5m from the carriageway, or,
- 3m from roadside drains.

C.3 FOOTPATH CONSTRUCTION

C.3.1 General Requirements

Design and construction of all footpaths, pedestrian accessways, steps, footbridges and amenity tracks must meet the following requirements:-

- All pedestrian facilities must be durable and require a minimum of maintenance,
- All surfaces must be adequately drained so as to prevent ponding, and designed and built so they do not cause runoff problems for adjoining properties,
- Lighting must be provided for all walkways except amenity tracks, Security hazards for users must be avoided.
- Accessways must be well lit and where possible should have a clear line- of-sight between streets,
- All walking surfaces must provide minimum in service slip resistance of not less than British Pendulum Value BPN 50 measured on a wet surface,
- Timber on footbridges, boardwalks and steps may be accepted by the Council provided the surfaces have securely fastened wire netting to provide slip resistance or some other approved treatment,
- Gravel surfaces may be accepted on amenity tracks.

C.3.2 Footpath design

Public footpaths must where appropriate, accommodate the access and mobility requirements of AS/NZS 4121, Design for Access and Mobility – Buildings and Associated Facilities.

Footpaths widths are administered by the District Plan, or relevant conditions of resource consent granted by the Council. Footpaths must be at least 100mm higher than the edge of the adjacent carriageway.

Where practical, consideration should be given to pavements sloped in such a way that they drain to a pervious surface to allow the water to infiltrate.

C.3.3 Widths

The minimum public footpath width must be as specified in Table 1 INF in the District Plan and measured from the back of the kerb.

Footpaths are to be widened at shopping areas.

C.3.4 Gradients

Gradients must be no steeper than 1 in 5 (20%) or with intermittent steps and then no steeper than 1 in 6 (16.7%) between flights of steps.

A handrail as per drawing R-19-760 in Appendix C is required on all footpaths steeper than 1 in 7 (14.3%).

C.3.5 Crossfall

The crossfall must be between 1 in 50 (2%) and 1 in 33 (3%) to ensure drainage. As per the above, the preference is that the path drains to a pervious area but if this is not possible it should drain to the kerb.

C.3.6 Concrete Footpaths

Footpaths alongside new roads must be constructed in concrete.

Concrete footpath foundations must be formed with a compacted basecourse material with a minimum depth of 75mm and complying with Waka Kotahi/NZTA Standard Specification, M/04: 1995 (Wellington 1) AP20 basecourse. The sub-base material must be compacted to achieve a Clegg Impact value, CIV, of not less than 25.

Concrete must have a minimum 28-day compressive strength of 20MPa and must be given a light brush surface finish. The concrete must be 150mm thick with 665 mesh in industrial streets, 115mm thick in residential cul-de-sac turning areas, and 100mm thick elsewhere. Transverse construction joints must be formed at spacing not greater than 6.0m.

C.3.7 Other Footpath Materials

New footpaths are to be constructed in concrete however there may be circumstances in which asphalt, pervious pavement or feature pavements are appropriate.

Construction of footpaths in materials other than concrete is subject to the approval of the Council’s Roading Engineer.

In these situations, subject to adequate subgrade strength as approved by the Roading

Engineer, asphalt footpaths must be constructed as follows:

a) For principal, collector and sub-collector roads, local roads and cul-de-sacs asphalt footpath construction consists of a compacted AP20 basecourse depth of 75mm, and compacted asphalt depth of 25mm, finished level with the top of the kerb,

b) Around residential turning areas and in industrial streets, asphalt footpath construction consists of a compacted AP40 basecourse depth of 150mm and 200mm respectively, and compacted asphalt depth of 25mm, finished level with the top of the kerb.

A tack coat of bitumen emulsion must be applied to the compacted basecourse surface and all sloped/vertical faces to be in contact with the asphalt, at a residual bitumen rate of 0.3L/m^2 prior to the asphalt paving.

The asphaltic concrete must be Mix 6.

Asphaltic concrete mixes for footpath construction must comply with the Waka Kotahi/NZTA specification P/09 “Construction of Asphaltic Concrete Paving” and conform to the mix design properties in Table 22:

Mix	Application	Specified Marshall Flows	Air Voids %	Minimum Compaction Index	Minimum vMA (voids mineral aggregates)
6	Footpaths	35	3.0 – 4.0	0.09	17

Table 22: *Footpath Asphaltic Concrete mix and design*

C.3.7.1 Interlocking Concrete Block Paving

Footpaths constructed in interlocking concrete block paving must be designed and constructed to the manufacturer’s proven specifications and must comply with NZS 3116:2002 ‘Concrete Segmental and Flagstone Paving’.

Blocks must:

- have a proven abrasion resistance,
- have a skid resistance not less than a British Pendulum Value of 50 using a RAPRA 4S rubber foot on a wet surface,
- have a thickness not less than 60mm, and not less than 80mm at heavy duty crossings, around residential turning areas and in industrial streets,
- be appropriate for the situation.

Where interlocking block pavements are installed, a 24 month maintenance period must be specified whereby the contractor must be responsible for correcting all defects during this period.

C.3.7.2 Clay Brick Paving

Clay brick paving is not to be used for new subdivision development. The use of clay brick paving will only be approved when upgrading existing clay brick paved footpaths.

C.3.8 Steps

Concrete steps must be constructed in accordance with drawing R-17-763, in Appendix C.

The maximum rise between landings must not exceed 2.5m.

A stormwater channel must be provided alongside steps and landings, which must drain to a sump and thence by pipe to an approved discharge outlet.

C.3.9 Pedestrian Accessways and Amenity Tracks

Pedestrian accessways should be constructed where they would provide pedestrians with a significantly shorter route between different roading locations and where areas of interest are involved such as schools, shops, reserves and bus routes.

Such land is to be vested in the Council as either a pedestrian accessway or, in the case of an Amenity track, as a Reserve.

Pedestrian accessways must be constructed in concrete.

The minimum boundary to boundary width must be 2.1m.

The gradients and construction must be as for footpaths, except that the minimum surface width must be 1.5m.

Where stormwater is likely to flow along the accessways an adjacent stormwater channel must be provided, outside the 1.5m width, which must drain to a sump and thence by pipe to an approved discharge outlet.

Both sides of a pedestrian accessway must be bounded by a fence in accordance with the Council’s standard, see drawing R-19-760 in Appendix C.

C.3.10 HANDRAILING

Handrailing is required on the outer edge of roads or footpaths where there is a:

- drop due to a retaining wall, or,
- drop due to a batter face greater than 2.0m vertical height and steeper than 1.5 horizontal to 1.0 vertical, or,
- footpath gradient steeper than 1 in 7 (14.3%).

Any constructed barrier needs to be compliant with the New Zealand Building Code Clause D1.

Designers should note that in some situations a more substantial barrier will be required to meet the requirements of the Building Act.

Handrailing must be constructed in accordance with drawing R-19-760 in Appendix C.

Handrail posts must be embedded at least 800mm into firm, stable and level ground, and backfilled with 500mm compacted basecourse capped with a 300mm concrete backfill.

Specific design is required where the ground is neither level, stable, nor firm, and for situations in which the handrail may be subjected to higher loads.

C.4 ROAD AMENITY AND BERM CONSTRUCTION

Road design must provide a high standard of visual amenity. The design proposal must include a landscaping plan which provides for vegetation, street furniture and road elements, and which takes into account the following:

- the desirability of a visually attractive and comfortable street environment,
- provision of street trees that will remain healthy and able to mature in the
- space and location provided (note that the district plan outlines acceptable street tree locations, sizes and species)
- safety for road users, with the avoidance of unnecessary visual and physical obstacles,
- security for pedestrians,
- the potential for roadside landscaping treatments to influence vehicle speeds,
- the need to minimise on-going maintenance requirements,
- protection of services.

When an existing street is extended into or through a new subdivision, its streetscape (road width, footpaths, street trees, etc.) should also be continued or improved.

The Centres and Mixed Use Zones (as defined in the District Plan) have special requirements and standards for street furniture. For more information discuss with the Council roading team.

C.4.1 Berm Design

Berms provide a range of ecological and functional services:

- Provides, protects and maintains biodiversity and habitat
- Location for gas, electrical and telecommunication utilities
- Reduces the visual impart of the road as it softens hard surfaces

No utility, including planting, can monopolize the berm space. Preference for some services to be back against the boundary

Infrastructure and utility services should be planned at the same time as the street planting, so tree and a garden planting does not, and is not, compromised by the provision of services.

Planting and utilities provision should be designed to respond to the local road geometry and road reserve design.

Berms must be adequately designed, constructed, and prepared by the subdivider as outlined in Section C1.6 and Table C1.

Layout plans and locations of street planting provisions must be discussed with the Council in the planning stages prior to the lodging of finalised plans.

Appropriate planting must be included in accordance with the District Plan Table 2 – INF Street Trees

Trees and other planting must be positioned to minimise obstruction of vehicular accessways and provide good visibility for the travelling public.

In streets with retaining walls (those below the road in particular) there is likely to be limited space in the berm for utilities and trees. Alternative location and design proposals will be considered at the discretion of the Council.

Berms, tree pits swales and rain gardens will be sufficient width to allow for adequate growth of plants and ease of maintenance. It is important to provide adequate means for tree growth and ongoing tree health, at the same time allowing for the infiltration of water. For guidance on the design of these devices refer to the Wellington Water document Water Sensitive Urban Design

Stormwater Treatment Devices Design Guidelines.

Street planting proposals and considerations will be assessed through the resource consent process.

As-built plans are required for all street planting features, including tree pits, rain gardens and swales.

A 24-month maintenance period must be specified whereby the contractor must be responsible for ensuring an adequate grass strike, maintaining and mowing the berm, and correcting all defects during this period. Where trees or amenity planting is carried out in the berm, a 36-month maintenance period must be specified (refer Tree Planting (Construction) section below).

Street furniture must be robust and durable and meet the Council's standards and specifications where available.

C.4.2 Street Planting (Construction)

Trees must be planted in public roads as per the District Plan Table 2 INF.

All road berm areas must be topsoiled to a lightly compacted minimum depth of 75mm, and sown with grass.

At tree planting locations, suitable topsoil depth will be provided (minimum 600mm, actual determined by tree type, size and soil condition) across the complete berm width and along the berm length twice the distance of the width. (i.e if the berm is 1.5m wide, topsoil to a suitable depth for tree planting will be provided that is 1.5m wide and 3m long).

All street planting must be carried out in the following manner with appropriate detail provided to ensure:

- planting is well planned and integrated into the rest of the street environment in such a way that it can continue to mature without disturbance to other road infrastructure (both above and below ground) and minimum ongoing maintenance
- best practice planting specification are used (for example, the ground is properly prepared, plants are in good health etc)

A complete list of all landscaping in the road reserve (including for example tree species and numbers, irrigation equipment, tree stakes, square metre areas and species/numbers of any planting other than street trees such as amenity type planting or grass) must be provided to enable the Council to plan for ongoing service level requirements and maintenance costs.

C.4.2.1 Tree Sizes

Trees must be between 1.0m and 1.5m in height (planted) and preferably in Pb 40 – Pb 95 containers at the time of planting.

C.4.2.2 Tree Types

Prior to purchase of plants, the District Plan Table 3 INF must be consulted to determine suitable species.

C.4.2.3 Positioning of trees and other vegetation

Positioning will depend on street design detail.

Trees will be located centrally within the berm width and appropriately spaced along the berm length depending on the species of tree used and street character desired.

Other types of planting will be positioned to ensure appropriate space for the plants to mature without interfering with the functioning of the street (i.e maintaining traffic site lines, avoiding pedestrian trip hazards etc) and to minimise ongoing maintenance requirements.

Where possible, trees and underground services should be located away from each other. Where two berms on each side of the road is not possible, then ducts must be provided.

C.4.2.4 Planting

Planting must take place from late autumn (May) – early spring (Sept).

Planting must be carried out by a Council recommended horticultural supplier or contractor.

When planting, holes are to be dug at least twice the diameter and 100mm deeper than the height of the container the plant is supplied in. The plant must be positioned in the hole at the depth it was container grown, and backfilled with topsoil, progressively lightly compacted to surrounding finished soil level.

A proven root guard material for trees must be placed to line the sides of the hole to a depth of 750mm. In areas of tree groups, the root guard material may alternatively extend around the perimeter of the area.

The resident subsoil in the bottom of each hole is to be thoroughly broken up to a depth of 250mm to allow percolation of water.

The planting medium is to be high quality loam, free from roots, weeds, and other rubbish and from gravel and stones greater than 20mm in diameter.

Low vegetation close to walkways or the street edge should be below the level of a driver's eye-line and not interrupt sightlines.

Generally, when a high vegetation tree matures it should be at least 2.0m above ground level to maintain motorist and pedestrian sightlines.

C.4.2.5 Staking

Each tree must have a minimum of two stakes (generally not less than 1.2m) located 50mm away from the base and driven securely into the ground with one on the prevailing windward side of the plant and the other opposite.

The stake must protrude at least 600mm above ground.

An approved cloth tie must be used to attach the stem to the stake. Stakes are to be removed once the tree is established or after three years (whichever is sooner).

C.4.2.6 Weed Control - (in cluster areas)

The entire planted area or tree pit area must be covered with bark mulch to a depth not less than 100mm and across the berm width and length twice the distance of the width

C.4.2.5 Maintenance

A 36 month maintenance period is required for all trees and planting in the road reserve. During this period minimum requirements are:

- Plants must be watered and cared for to ensure they are still healthy during and at the end of the maintenance period. A watering schedule must be provided and implemented.
- Annual mulching
- Check and replace stakes as required
- Weeding if necessary
- If tree fails or dies, record death, replace tree and begin three-year period again.
- Refer also to Section A.18.

C.4.3 Road Lighting

Lighting is required on public roads and pedestrian access ways. The lighting is to meet all requirements of the AS/NZS 1158 "Road Lighting" Standard, including design to an appropriate lighting category.

Street lighting equipment (poles, outreach arms and lanterns) is to be consistent with the types and sizes commonly in use by the Council.

Underground power supply reticulation is to be provided and must meet all the requirements of the network provider.

The Council does not supply power to, and does not maintain, lighting equipment on private ways. The subdivider is to make arrangements directly with an energy retailer for power supplies to lighting on private ways.

Lighting is not normally required for rural situations. However, roadside delineator posts in accordance with the Waka Kotahi/NZTA Manual of Traffic Signs and Markings (MOTSAM) are to be provided.

C.4.4 Road Name Signs

Road name signs must be mounted on 60mm O.D. galvanized steel posts painted or finished in white.

Signs are to be manufactured and erected in accordance with drawing R-44-780 in Appendix C and the Council’s Specification RT 600-010, Signs.

Road name signs must be erected at all road intersections. “No Exit” signs must accompany them if applicable.

For each T intersection, both a double-sided name plate indicating the side road, and a single sided name plate indicating the through road, must be mounted on a single pole in the berm of the through road and opposite the side road.

To minimise future maintenance obligations, entrance signs to subdivisions must not be erected.

C.4.5 Trenching / Services

Trenching work in legal road must be carried out in accordance with the Council’s operative Code of Practice for Working on the Road. This requires a “Road Works Notice” to be obtained and any associated fees paid.

C.4.6 Concrete Mowing Strips

All poles, sign posts, light standards, power transformers, boxes etc. set in the grass berm must be surrounded with a concrete mowing strip.

The mowing strip must be flush with the finished berm level and provide a 150mm wide concrete surround to the base of the item.

C.4.7 Road Markings

Road markings, including reflective raised pavement markers (RRPMs), if required, must be installed in accordance with the following NZTA/Waka Kotahi documents:

- Traffic Control Devices Rules Ministry of Transport 2004,
- Manual of Traffic Signs and Markings (MOTSAM); Part 1 Traffic Signs; NZTA/Ministry of Transport, 2010,
- Manual of Traffic Signs and Markings (MOTSAM)*;* Part 2 Markings; NZTA/Land Transport Safety Authority, 2010,

All lines other than parking markings must be reflectorised.

Road marking paint and its application must be in accordance with the Council's Specification RT 800-003, Road Marking.

C.4.8 Special Items

The following items are considered special items and will require discussion with Council prior to starting design and construction:

- Bollards
- Rubbish Bins
- Bus Stop Shelter
- Seating

C.5 PRIVATE WAYS

Private ways include rights-of-way, access lots and driveways.

The District Plan Table INF 1 provides details on widths and design of private ways.

Note that the construction of private ways with public infrastructure in them is usually not acceptable due to issues with future maintenance access and reinstatement. Maintenance requirements for services in private ways will remain with the private way owners.

C.5.1 Entrance / Exit

The entrances/exits of private ways are to be positioned such that accident problems are not created. In this respect sight distances given in the district plan

All entrances to private ways must be constructed as a footpath crossing facility giving priority to pedestrians. This will require the vehicle crossing to:

- Be at a right angle to the footpath,
- Be as narrow as possible,
- Not affect the grade, crossfall, colour and texture of the footpath.

There are two types of vehicle crossing:

1. **Light duty vehicle crossing**: for up to one single residential property or three dwelling units

2. **Heavy duty vehicle crossing**: for two or more residential properties or seven or more dwelling units and any urban non-residential use property

Vehicle crossings may be constructed either in conjunction with the original kerb and channel installation, or at a later stage once vehicle access locations have been determined, or as and when crossings require modifications.

Construction details for both light and heavy-duty crossings are shown on plan number R-24-721. This plan allows for a number of options, depending on the extent of the works required, and whether the crossing is light duty or heavy duty. Where a grass berm separates the footpath from the kerb, the crossing ramp must extend from the kerbline to the edge of the adjacent footpath, or 500mm, whichever is the greater.

The splay length along the kerbline, either side of the crossing, must be 500mm.

In situations where excessive road camber, kerb height, or footpath crossfall exist, approval may be given for more extensive work to modify the surrounding

features to achieve a functional vehicle crossing. Drawing R-24-720 “Vehicle scraping Mitigation” must be used to identify such situations.

Modifications may include:

- Raising the channel (refer drawing R-24-722)
- Lowering the footpath (refer drawing R-24-723)

Note - Both these situations require detailed design and the approval of the Council's Roading Engineer.

C.5.2 Minimum Widths

The minimum widths must be as per the District Plan Table 1 INF.

All trafficable surfaces must comply with the ground clearance template in AS/NZS 2890.1 :2004 Parking Facilities Part 1: Off-street car parking Appendix C.

C.5.3 Crossfall

The crossfall must be 1 in 33 (3%) to provide sufficient slope for stormwater discharge into the adjacent kerb and channel without ponding.

C.5.4 Kerb and Channel & Stormwater

Kerb and channel is used to confine stormwater runoff to the private way, and to protect the edge of the private way.

Standard kerb and channel must be constructed on both sides (where stormwater outlets are on both sides) or standard kerb and channel on one side and standard kerb (or similar support edging) only on the other.

Suitable provision must be made for the disposal of stormwater from the private way.

Stormwater may be directed across a public footpath only where the paved area of the private way is less than 30 square metres, and the public footpath has an impervious surface. Private way stormwater control is required where the paved area exceeds 30 square metres ($30m^2$).

No stormwater must discharge onto neighbouring property (including legal road and other Council land), except as noted above.

In rural situations where the access to a private way crosses the street drainage channel a minimum 300mm internal diameter reinforced concrete pipe culvert must be installed.

The culvert must be laid with the invert level aligned with the design invert level of the drainage channel.

C.5.5 Aggregate Depths

As a general guide for residential use:

- Serving up to two properties – compacted basecourse depth of 100mm.

- Serving three or more properties – compacted basecourse depth of 150mm.

These depths are based on the subgrade having a minimum soaked CBR strength of 7. Subgrade improvement may be necessary to achieve this strength These values shall be used as guide only and specific design may be required.

Basecourse depths for non-residential use must be determined by specific design.

C.5.6 Sealing / Paving

Rights-of-way and shared accessways must be sealed or paved for their entire lengths.

The carriageway may be surfaced with one of the following methods except that where a private way has a gradient steeper than 1 in 8 (12.5%) the carriageway must not be surfaced in sealing chips:

a) A suitable bitumen cut-back binder covered with Grade 4 sealing chip followed by a second coat seal, consisting of a suitable bitumen cut-back binder covered with grade 3 sealing chip. Both grades are to be in accordance with Waka Kotahi/NZTA specification M/06.

b) A minimum thickness of 25mm of asphaltic concrete on a basecourse primed with bitumen at a residual rate of 0.3L/m2. The asphaltic concrete must comply with Waka Kotahi/NZTA specification M/10, Mix 10.

c) An interlocking block paving designed and laid to manufacturer's specifications and in accordance with NZS 3116: 2002.

d) Porous/semi-porous paving may be used where drainage is provided for and soils and slope allow. The successful implementation of porous paving depends on individual circumstances; the final decision rests with the Council's Roading Engineer.

e) Residential private ways may be constructed in 100mm of reinforced concrete with a 28 day compressive strength of 20MPa. The reinforced concrete must be placed on a 75mm compacted basecourse layer, or 150mm of unreinforced concrete on the same base.

f) Non-residential private ways constructed in concrete must be specifically designed.

g) Residential private ways carrying more than an estimated 100 vehicle movements/day constructed in concrete must be specifically designed.

In rural situations only, where the street carriageway is not sealed and is unlikely to be sealed in the near future, the private way may remain unsealed. Otherwise, the first 15m of the private way must be sealed.

In rural situations where the grade is greater than 1 in 8 (12.5%) the private way must be sealed for its entire length.

Sealing should be carried out only during warm dry settled weather between 1 October and 15 March. If a suitable adhesion or emulsion agent is used, sealing may be carried out outside these dates. On no account must sealing or paving or preparatory work be carried out if there is not to be warm (i.e. not less than 10°C) settled weather for the next 48 hours. A report must be provided for each day's sealing activity. Refer sample proforma Sealing Report in Appendix C.

C.5.7 Guard Rail or Fence

A guard rail and / or fence is required where a danger or hazard would otherwise be presented for neighbours or to the public.

The barrier must be designed and of sufficient strength to resist the vehicle loads as indicated in standard AS/NZS1170:2002 Part 1 "Structural Design Actions" for vehicles for direct impact.

C.5.8 Parking Areas

The gradient of the parking surface must not exceed 1 in 20 (5%) in any one direction. Where practical, the use of pervious materials for parking areas is encouraged, provided the strength of the underlying pavement is not compromised by the high water table and saturated foundation.

Where soils, topography and slope permit, runoff must be directed from the parking area to rain gardens, soak pits or similar vegetated channels.

C.6 AS-BUILT REQUIREMENTS

Council requires the following information concerning new road construction.

- Benkelman Beam test report prior to sealing the road pavement, refer to clause above.
- Road pavement Sealing report, refer to clause above
- Certificates of the concrete strength of all concrete used in the footpaths.

Dimensions and other information relating to Transportation must be provided for all assets within the road reserve, accessway or service lane

All information is required to be entered into the council RAMs database. A proforma for this information can be obtained from council.

PART D. WASTEWATER AND STORMWATER NETWORK DESIGN

For all water services (water supply, stormwater and wastewater) refer to the following documents:

- Wellington Water Regional Standard minimum standards regarding building over pipes. This is now a last resort and will likely be declined in most cases
- This can be deleted WSUD is now required by GWRC for all areas of roading and parking that require GWRC consent. Early engagement with GWRC and Wellington Water is encouraged to ensure that this is allowed for in initial designs
- Shared services are a last resort. Individual services are preferred due to ongoing maintenance issues for council/Wellington Water.
- The previously acceptable practice of making roads and services private where they don't meet this code will not be acceptable. Private roads and services of a lesser standard will likely be declined.

PART E. WATER SUPPLY DESIGN AND CONSTRUCTION

For all water services requirements (water supply, stormwater and wastewater) refer to the following documents:

- Wellington Water Regional Standard for Water Services December 2021
- Wellington Water Regional Specification for Water Services December 2021
- Wellington Water Sensitive Design for Stormwater Treatment Device Design Guideline 2019
- Wellington Water Managing Stormwater Runoff Version 3

Special Areas to note:

- WCC has adopted the Wellington Water minimum requirements regarding building over pipes. This is now a last resort and will likely be declined in most cases
- WSUD is now required by GWRC for all areas of roading and parking that require GWRC consent. Early engagement with GWRC is recommended to ensure that this is allowed for in initial designs
- Shared services are a last resort. Individual services are preferred due to ongoing maintenance issues for council/Wellington Water.
- The previously acceptable practice of making roads and services private where they don’t meet this code will not be acceptable. Private roads and services of a lesser standard will likely be declined.

PART F. OPEN SPACES

CONTENTS

OBJECTIVES

Communities are enhanced through access to open spaces. Refer to *Capital Spaces, Open Space Strategy for Wellington* (2013 and currently under review) for comprehensive information, values and management direction for Wellingtons open spaces.

Please see below for further references to current operative Council policy, standards and documents that must be considered.

F.1 PLANTING

All planting must take place from late autumn (May) – early spring (Sept).

Minimum depth for topsoil is 300mm. This will depend on soil and species to be planted.

Minimum depth for mulch is 100mm. Mulch is to be of organic material and of composition that is unlikely to be blown away.

Plant stakes may be required depending on size, type and location of plants.

Any planting next to existing mown grass areas must be marked to avoid damage while it establishes.

All planting must be a minimum of 1m from existing track edges.

Any development near (i.e. within the drip line), or involving, an existing public tree

must adhere to the Council's draft Working Around Trees document and must not be carried out without prior approval from councils Parks, Sports and Recreation business unit.

Failure to observe any of the rules will result in a substantial financial penalty that increases with each occurrence as per Tree Preservation Guidelines/ District Plan.

Weed control will be required for the first 36 months or until a closed canopy is established as per clause Maintenance Period clause in Section A.

Dead plants must be replaced throughout the maintenance period to maintain vegetation density and achieve canopy closure.

All planting must be supplied and carried out in accordance with horticultural best practice.

Plants must be eco-sourced from the Wellington area and species appropriate to the area being planted. Professional advice must be taken where necessary.

F.1.3 Revegetation

Wellington native plants must be used for all revegetation. These must come from a Council approved source.

Species will depend on the location and a species list will be approved as part of the landscape plan.

In-fill planting may be required throughout the maintenance period.

The Department of Conservation guide Protecting and Restoring our natural heritage – a practical guide, must be referenced.

Guidance and approval on ground preparation and mulching must be sought from Council.

F.1.4 Turf

The type of grass planted will depend on the use of the area, soil or sand type, irrigated or not and shaded or not.

Guidance and approval on the varieties and situations in which to be used must be sought from Council.

F.1.5 Maintenance

In addition to the above the Subdivider must maintain the following aspects of the works (as a minimum requirement) for a period of 36 months:

a) Grassed areas are to be attended to obtain a good strike,

b) Street trees and street planting – refer to Section C above,

c) Any massed areas of shrubs and trees are to be kept in a healthy state, which is weed free and the mulch is to be topped up to maintain the specified depth. Irrigation (temporary and/or permanent) may be required.

d) Any planting is maintained as required by the conditions of a resource consent or any other agreement with Council.

e) Any areas of revegetation or riparian buffer planting are to be kept weed free and the mulch is to be topped up to maintain the specified depth,

f) Any plant failures/deaths must be replaced throughout the three-year maintenance period. Only established vegetation will be considered compliant

at the end of the three-year period and a bond may be taken for newly planted 'replacement planting' to ensure establishment.

The above aspects will be inspected for compliance at the end of the three-year period.

F.2 NATIVE FOREST AND SHRUBLAND PROTECTION

Fencing, with approval and guidance from Council, should be constructed to exclude domestic stock. For small forest remnants, this fencing should be placed 5-6 m away from the forest edge and a protective buffer zone planted.

Pest animal control such as possum, rodent, mustelid, goat or pig control may be required. Seek advice from Council's Parks and Gardens unit about the best methods of control.

Weed control may be required if there is a substantial weed problem in the forest remnant and should be carried out prior to fencing and/or further planting.

Weeds must be carefully identified, and advice sought from Council for the best methods of control.

F.3 STREAMS

Subdividers should consider the 'day lighting' of streams that are now piped to enhance amenity values and improve water quality.

A riparian native vegetated buffer system must be created along all perennial and intermittent streams. The buffer should be clearly marked on plans.

Limits of disturbance of the buffer will be established during application, construction and post development stages.

Reference should be made to the relevant direction and requirements of the National Policy Statement for Freshwater Management 2020, the National Environmental Standards for Freshwater 2020 and GWRC's Natural Resources Plan.

F.3.1 Riparian Buffers

Although reduction of contaminants is a widely recognised function of riparian buffers, they also contribute significantly to other aspects of water quality and physical habitat. Habitat alterations, especially channel straightening and removal of riparian vegetation, continue to impair the ecological health of streams more often and for longer time periods than contaminants.

Generally, the provision of a 10m minimum buffer width is recommended, with narrower or wider options being considered appropriate as indicated by site constraints or opportunities.

For small waterways (or where wider planting is not obtainable) a 5-6 m buffer is recommended.

- For small streams (3 m max width), low stature shrubs and grasses will be sufficient.
- For medium sized streams (6 m max width), small trees (2-4m) are required
- For large streams/rivers (12 m max width) large trees (>4m) large trees are required.

Species planted must be Wellington eco-sourced natives or appropriate species from a Council approved source.

Riparian planting must occur from late autumn (May) to early spring (Sept).

When choosing plants, consideration must be given to the stream bank substrate and topography, as well as to the different parts of the stream bank e.g. *stream edge* (frequently damp, prone to erosion), *flood area* (stream flat and lower slop prone to regular flooding), *back wetland or spring* (areas wet for much of the year), *slope* (drier conditions).

Larger plants must be planted away from the stream edge. Shrubs, like manuka and hebe are suited to the mid bank area, and plants that can cope with wet soils and occasional flooding, like cabbage trees and toetoe, can be planted near the stream edge.

Plants should be spaced 0.9 m apart and be at least size PB3 or PB5 for planting next to stream edge.

Appropriate stream edge and flood plain plants (those that are able to lie flat when flood waters flow over them) include:

- Toetoe (*Cortaderia fulvida*)
- Pukio, sedge (*Carex secta*)
- Small swamp sedge (*Carex virgata*)
- Mahoe (*Melicytus ramiflorus*)
- Cabbage tree (*Cordyline australis*)

Appropriate species to plant for wetland edges or spring areas and slope areas are:

- Manuka (Leptospermum scoparium)
- Karamu (Coprosma robusta)
- Harakeke (Phormium tenax)
- Makomako/wineberry (Aristotelia serrata)
- Kohuhu (Pittosporum tenuifolium)
- Akiraho (Olearia paniculata)
- Ngaio (Myoporum laetum)
- Toetoe (Cortaderia fulvida)
- Cabbage tree (Cordyline australis

Weed control will be required for the first 24 months or until a closed canopy is established as per the Maintenance Period clause in Section A. Weed control will be carried out in accordance with GWRC's document "Getting Riparian Planting Right in the Wellington Region" 2014.

Land disturbance, vegetation removal and establishment in riparian margins may require consent from GWRC under the Natural Resources Plan.

F.4 RESERVE TRACKS

These are pedestrian accessways that are predominantly for access to reserve areas, e.g., Town Belt and to create "green networks" for pedestrian connectivity (refer e.g., to Northern Growth Management Framework). The track network throughout Council's Parks and Open Spaces is extensive and varies in style dependent on use and park type, character, and location.

The Wellington city council Open Space Access Plan (2016) should be referenced in all track proposals. Councils Capital Spaces Open Space Strategy for Wellington (2013) and various the Reserve Management Plans (e.g the Town Belt Management Plan and the Northern Reserves Management Plan) also refer to reserve tracks networks.

Tracks must be designed and laid out in accordance with the Council Requirements specified in Councils tracks standards and NZ HB 8630:2004 Tracks and Outdoor Visitor Structures.

Any services in reserves must be buried and follow walking or access tracks except where otherwise agreed with Councils Parks, Sport and Recreation.

Open spaces including playing fields and reserves must allow for access for future maintenance.

Lighting will not normally be necessary.

The minimum boundary to boundary width for reserve entrances must be 10m.

F.5 CAR PARKING

Car parks provided in parks and reserves are to be compliant with Council's Roading Specification.

Where soils, topography and slope permit, run off must drain through permeable or porous paving or be directed from the car park to rain gardens, swales or similar vegetated channels. These channels with provisions for infiltration or detention can either:

- Percolate to the ground where capability is available and is satisfactory to Wellington Water
- Temporarily store run off and release at a slower rate to the public stormwater system

However, overflows from the channel must drain to an approved outfall.

F.6 FENCING

Fencing must be installed in accordance with approval and guidance from Council with regard to the Fencing Act 1978.

When adjacent to private property both sides of a pedestrian access track to a reserve must be bounded by a fence in a way that retains visual permeability and to maintain overlook from residential properties. Where there is existing native vegetation at the boundary fencing may not be required and if required must be designed and installed to minimise disturbance and enable vegetation survival and growth.

Gates and bollards will be required where there is vehicle access to reserves. Design and installation specifications can be obtained from Council Parks, Sports and Recreation.

F.7 PLAYGROUNDS

Playgrounds for public use must be to the requirements of:

- NZS 5828:2015 Playground equipment and surfacing
- SNZ HB 5828.1:2006 General Playground Equipment and Surfacing Handbook
- SNZ HB 5828.2:2006 Supervised Early Childhood Facilities playground
- Equipment and Surfacing Handbook

All facilities, such as types and sizes of playground fittings, and associated equipment, are to be consistent with materials used by the Council and in accordance with the Council requirements detailed in the Parks and Gardens Specification and Council's Playground Policy (2002).

F.8 RESERVE FURNITURE

Reserves furniture must be robust, durable and functional.

All furniture location, design and installation must be consistent with the Council's Public Space Design Manual and be approved by the Council's Parks, Sports and Recreation unit.

The following items are considered special items and will require discussion with Council prior to starting design and construction:

- Seats
- Reserves signs
- Picnic Tables
- Seating

F.8.1 Parks Bins

Bins in Council Parks and Gardens are to be AE Tilley Ltd Horizon Tilting Litter Bin.

Bins in inner-city parks are to be WCC eye-bins. Details of supplier are available from Council's Parks, Sports and Recreation unit.

The bins must:

- Be lockable to prevent loss of inner sleeve
- Be galvanised for longevity – expectation that these assets will last 10 years.
- All parts of the bins are to be replaceable ensuring low-cost maintenance
- be no greater than 50 litre capacity.

F.9 UTILITY SERVICES

All utility services, including reservoirs, must be placed underground, except where it is not practicable to do so. Where buildings or above-ground cabinets are proposed these shall be placed at the edges of road frontage to minimse effects to the park access and amenity.

Utility services must be located so as not to restrict areas useable for outdoor activities or required for future facilities or tree planting.

Any disturbance of the existing site during installation of a utility must be made good immediately after completion.

Requirements of the Reserve Act 1977 and any relevant Wellington City Council Reserve Management Plan must be met when proposing or installing utilities and infrastructure services in a reserve. Reference should also be made to relevant chapters of the Energy, Infrastructure and Transport Section of the District Plan for additional requirements for network utilities and other infrastructure services.

APPENDIX A. EARTHWORKS DESIGN AND CONSTRUCTION

CONTENTS

FORM 1 Certificate of Suitability of Earthworks for Residential Development

CERTIFICATE OF SUITABILITY
OF EARTH FILL FOR RESIDENTIAL DEVELOPMENT

SUBDIVISION: ………………………..……………………………………………………………………….
(Description of land development/subdivision)

SUBDIVIDER: …………………………...……………………………………………………………..
(Owner / Developer)

LOCATION: ……………………………………………………………………………………………….
(Address)

ISSUED BY: …………..……………………………………………………………………………..
(Approved suitably qualified design professional)

COMPANY/FIRM: …………...………………………………………………………………...............

………

(Name and address of firm)

Hereby confirm that:

1. I am a Charted Professional Engineer or Engineering Geologist – Specialising in Geotech Engineering; and was retained by the Subdivider to supervise the earthworks on the above subdivision.

2. The attached plan/s No(s):………………………………………………..show/s the extent of the fill and shows the Lot numbers:………………..………………… affected by the fill.

3. The earth fills shown have been placed in accordance with the Wellington City Council Code of Practice for Land Development, including NZS 4431:1989. The extent of my inspections during construction, and the results of all tests carried out are described in my report dated ………………………… copy attached.

4. the filled ground is suitable for the erection thereon of residential buildings not requiring specific design in terms of NZS 3604 and NZS 4229 providing that:

   1) ……………………………………………………………………………..

   2) ……………………………………………………………………………..

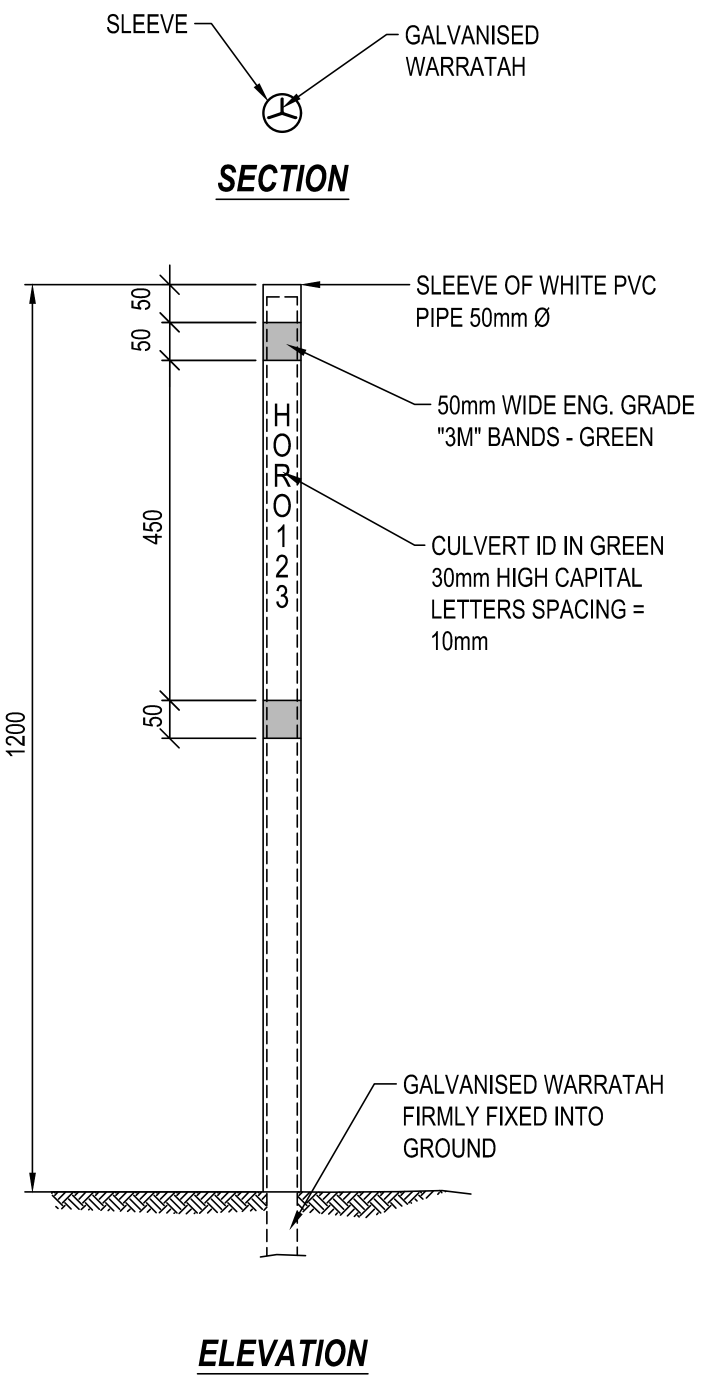
   3) ……………………………………………………………………………..

   This certification does not remove the necessity for the normal inspection and design of foundations as would be made in natural ground.

SIGNATURE: ………………………………… DATE: ……………………….

APPENDIX B. ROAD DESIGN AND CONSTRUCTION

CONTENTS



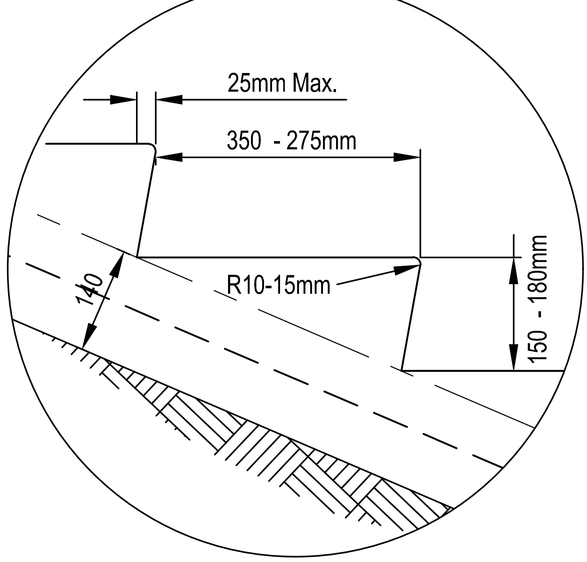
SCALE 1:10

Absolutely Positively **Wellington** City Council
Me Heke Ki Pōneke

STANDARD CULVERT MARKER

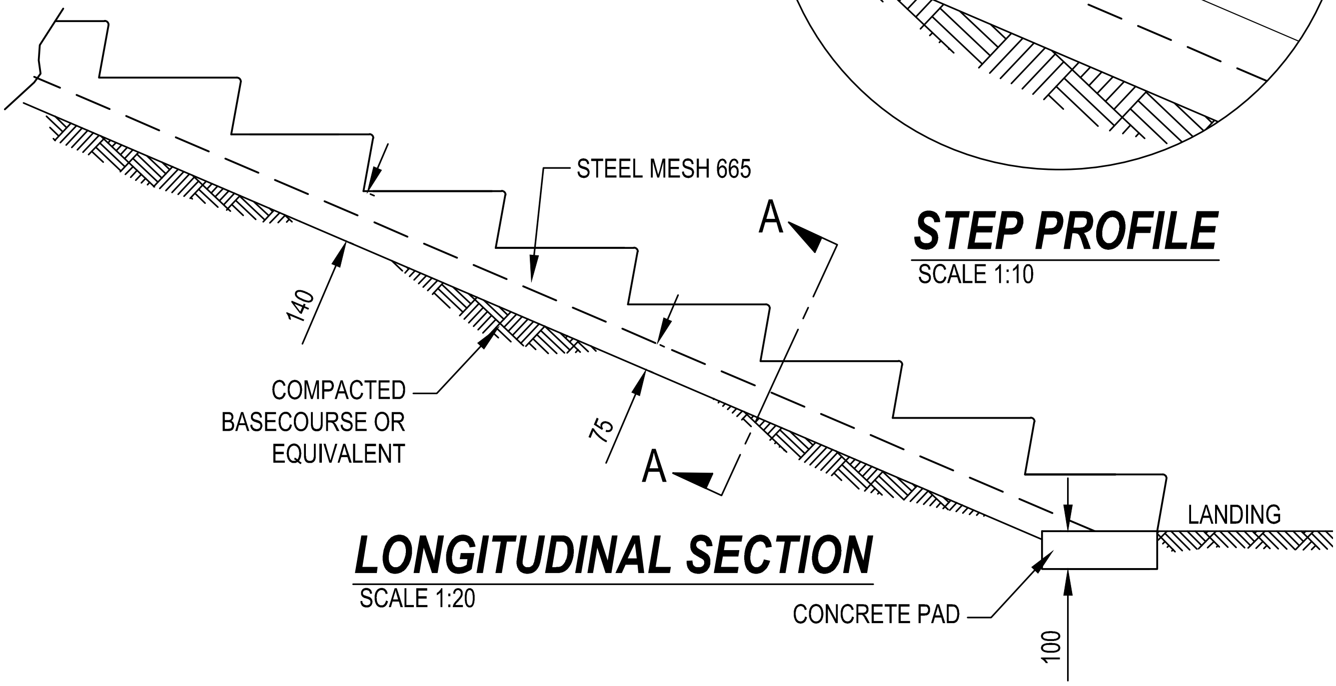
PLAN NO.	R-12-785
ASSET CATEGORY:	CULVERTS
APPROVED BY:	D. SINGH
DATE:	14 DEC. 2007

RISE	GOING
150	350 (STANDARD)
160	325
170	300
180 (Max.)	275 (Min.)



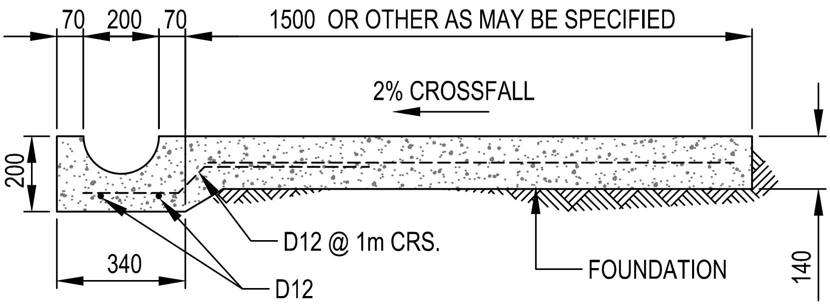
STEP PROFILE

SCALE 1:10



LONGITUDINAL SECTION

SCALE 1:20



CROSS SECTION A-A

SCALE 1:20

NOTES:

1. VERTICAL HEIGHT BETWEEN LANDINGS SHALL NOT EXCEED 2.5m. LANDING LENGTH SHALL NOT BE LESS THAN 900mm.
2. WHERE THE FOUNDATION AS SHOWN IS NOT SOLID GROUND CONCRETE FOOTINGS DOWN TO SOLID ARE REQUIRED WITH ADDITIONAL REINFORCING TO SUIT.

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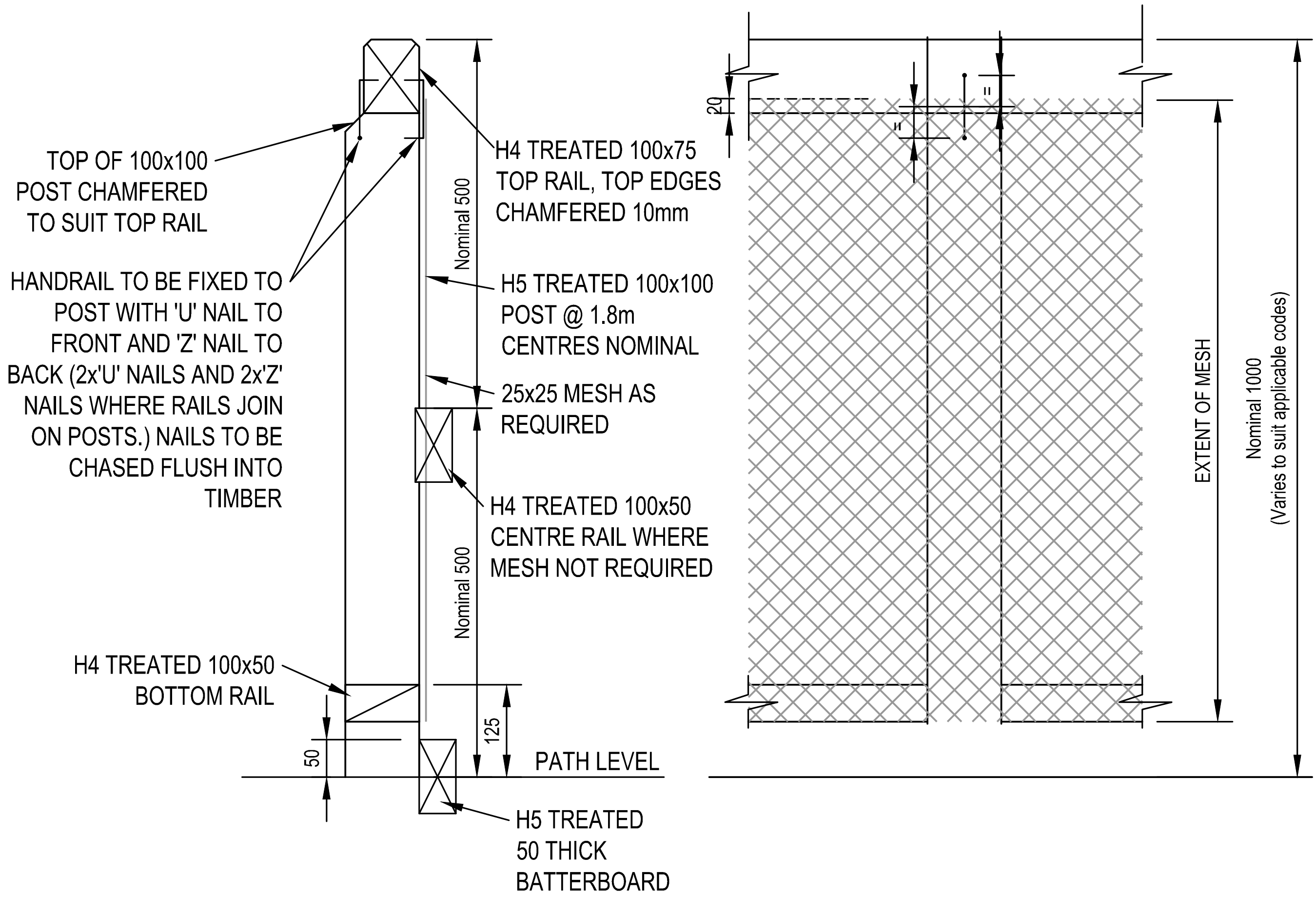
CONCRETE STEPS

PLAN NO. R-17-763

ASSET CATEGORY: FOOTPATHS/ STEPS

APPROVED BY: D. SINGH

DATE: 18 OCT. 2010



NOTE:

ALL POSTS TO BE VERTICAL.

SCALE 1:10

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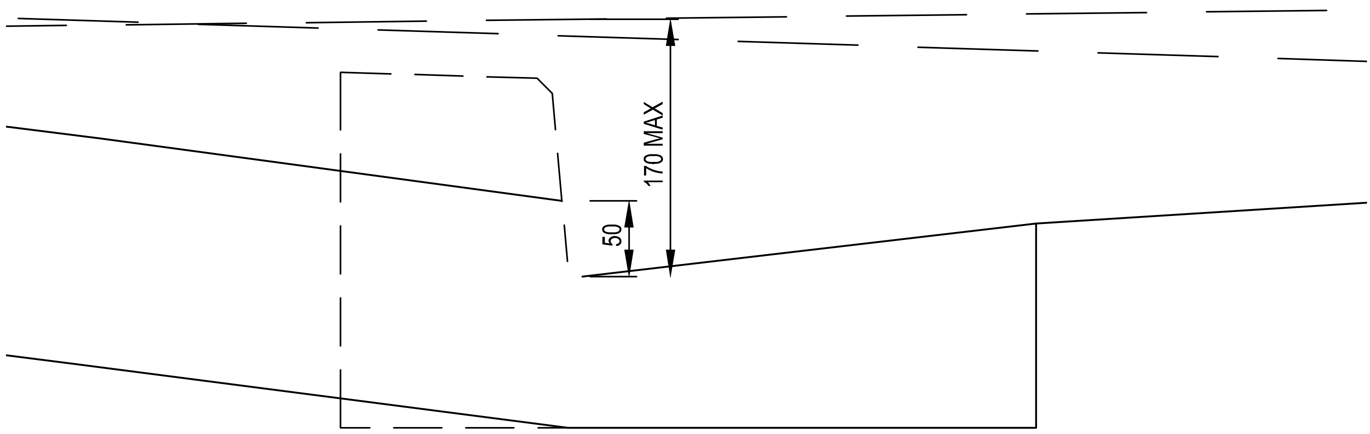
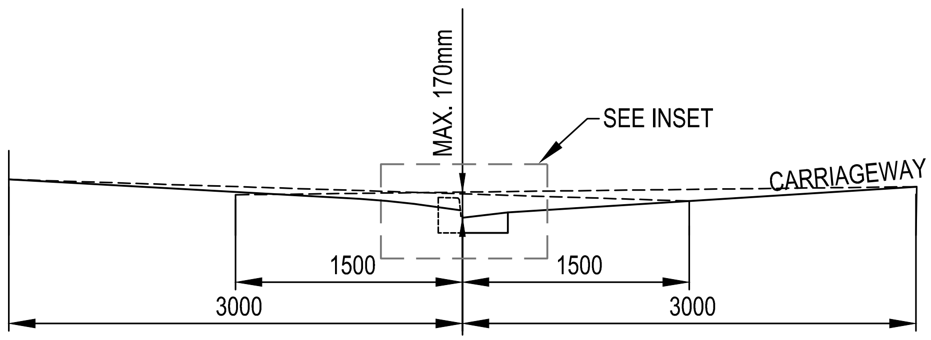
Me Heke Ki Pōneke

STANDARD HANDRAIL

PLAN NO.	R-19-760
ASSET CATEGORY:	HAND RAILS/ SAFETY FENCES
APPROVED BY:	D. SINGH
DATE:	15 FEB. 2008



INSET
SCALE 1:5



VEHICLE SCRAPING MITIGATION
SCALE 1:50

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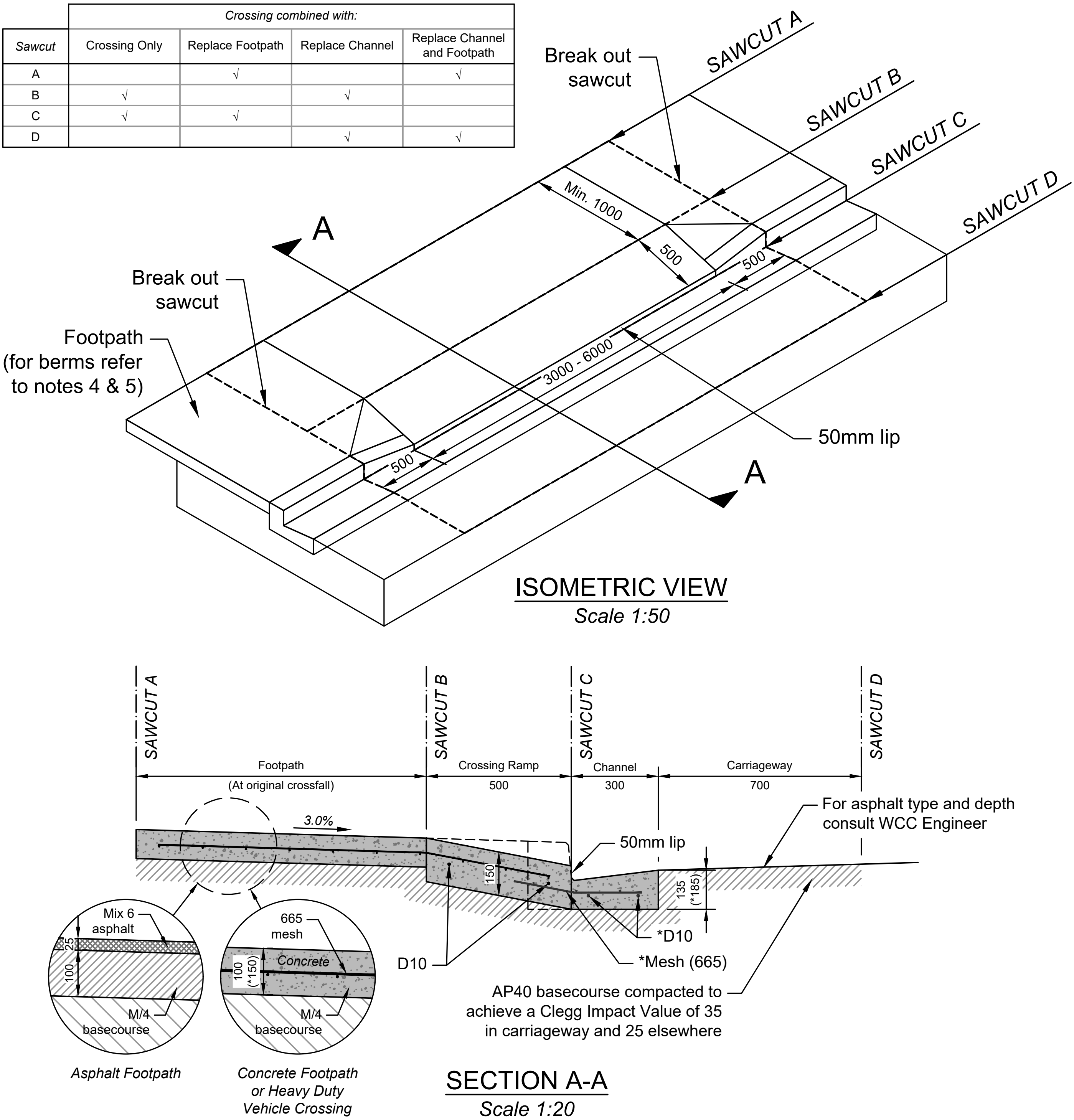
Wellington City Council
Me Heke Ki Pōneke

VEHICLE SCRAPING MITIGATION

PLAN NO.	R-24-720
ASSET CATEGORY:	LIGHT DUTY KERB CROSSINGS
APPROVED BY:	D. SINGH
DATE:	18 OCT. 2010

SAWCUTS

Sawcut	Crossing combined with: Crossing Only	Replace Footpath	Replace Channel	Replace Channel and Footpath
A		√		√
B	√		√	
C	√	√		
D			√	√



SECTION A-A
Scale 1:20

NOTES:

1) WHERE KERB HEIGHT EXCEEDS 135mm REFER TO ENGINEER.
2) 20 MPa (80 -120 SLUMP) CONCRETE WITH LIGHTLY BROOMED FINISHED.
3) SOFT SUBSOILS TO BE UNDERCUT BY 200mm AND FILLED WITH COMPACTED BASECOURSE.
4) CROSSING DETAILS SHOWN ALSO APPLY WHERE NO PUBLIC FOOTHPATH EXISTS.
5) WHERE A GRASS BERM SEPARATES THE FOOTPATH FROM THE KERB, THE CROSSING RAMP SHALL EXTEND FROM THE KERBLINE TO THE EDGE OF THE ADJACENT FOOTPATH, OR 500mm, WHICHEVER THE GREATER. THE SPLAY LENGTH ALONG THE KERBLINE EITHER SIDE OF THE CROSSING SHALL BE 500mm.
6) * REFERS TO HEAVY DUTY VEHICLE CROSSINGS

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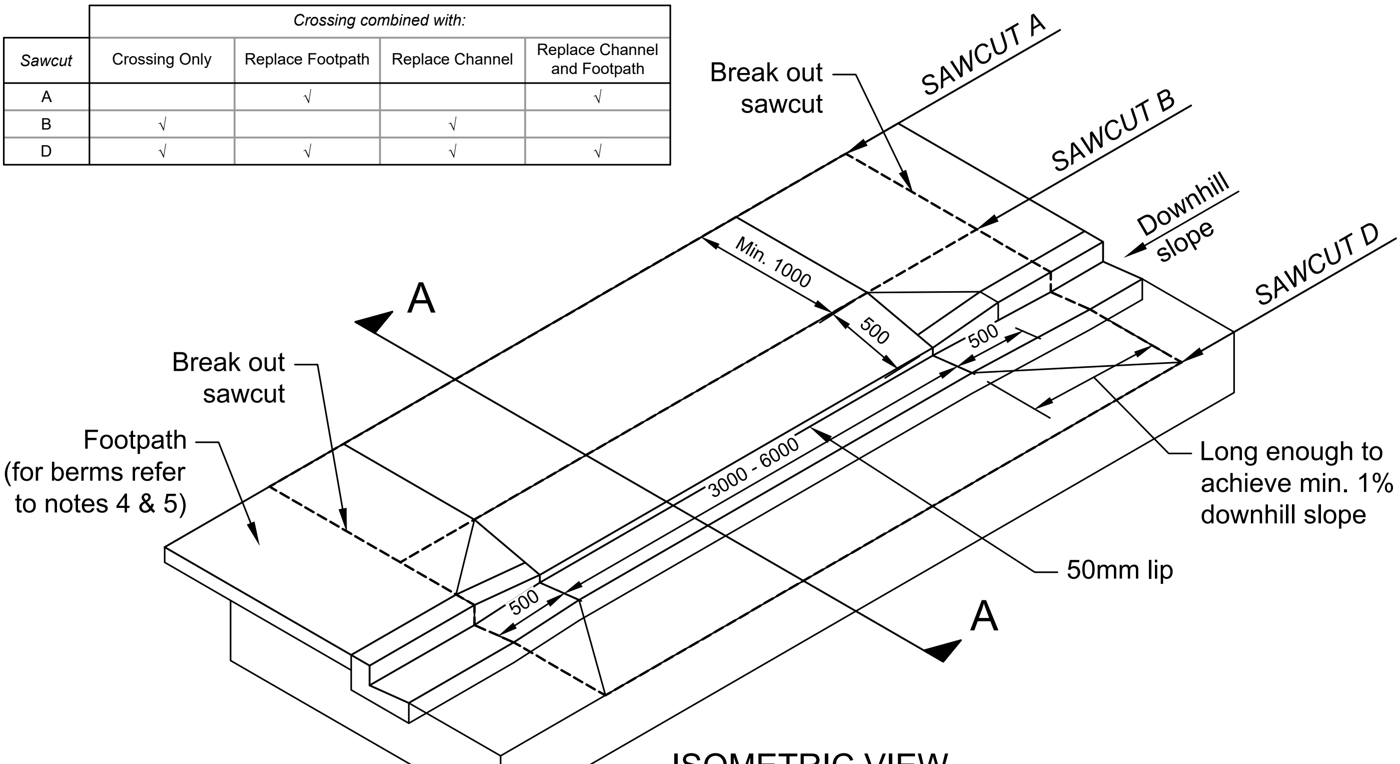
KERB / FOOTPATH / BERM VEHICLE CROSSING

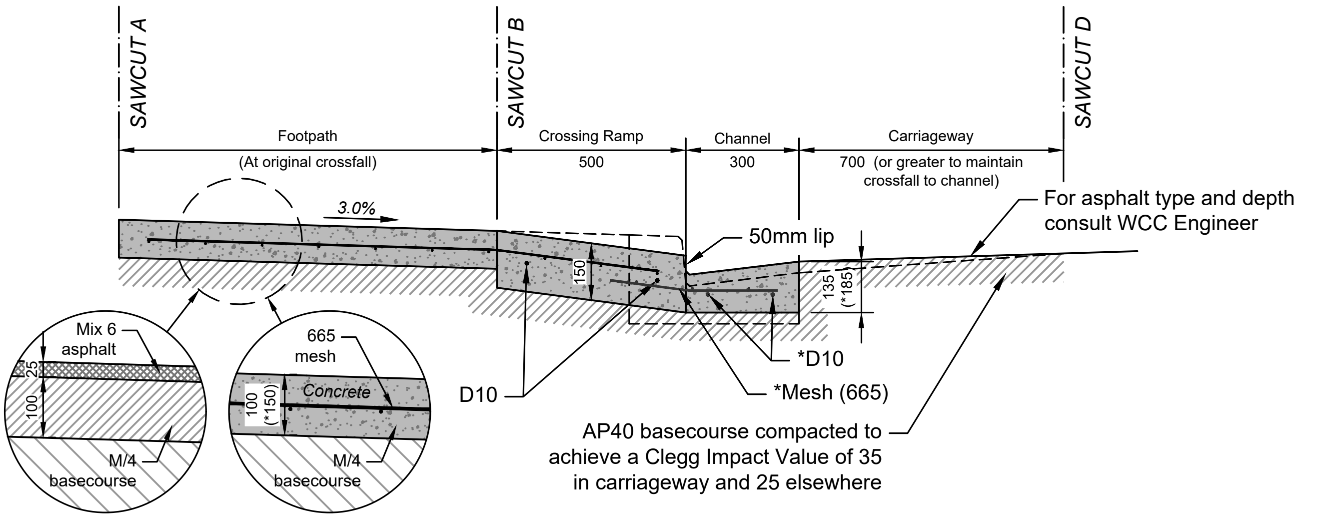
PLAN NO.	R-24-721
ASSET CATEGORY:	KERB CROSSINGS
APPROVED BY:	D. SINGH
DATE:	18 OCT. 2010

SAWCUTS

Sawcut	Crossing combined with: Crossing Only	Replace Footpath	Replace Channel	Replace Channel and Footpath
A		√		√
B	√		√	
D	√	√	√	√



ISOMETRIC VIEW
Scale 1:50



SECTION A-A
Scale 1:20

NOTES:
1) WHERE KERB HEIGHT EXCEEDS 135mm REFER TO ENGINEER.
2) 20 MPa (80 -120 SLUMP) CONCRETE WITH LIGHTLY BROOMED FINISHED.
3) SOFT SUBSOILS TO BE UNDERCUT BY 200mm AND FILLED WITH COMPACTED BASECOURSE.
4) CROSSING DETAILS SHOWN ALSO APPLY WHERE NO PUBLIC FOOTHPATH EXISTS.
5) WHERE A GRASS BERM SEPARATES THE FOOTPATH FROM THE KERB, THE CROSSING RAMP SHALL EXTEND FROM THE KERBLINE TO THE EDGE OF THE ADJACENT FOOTPATH, OR 500mm, WHICHEVER THE GREATER. THE SPLAY LENGTH ALONG THE KERBLINE EITHER SIDE OF THE CROSSING SHALL BE 500mm.
6) * REFERS TO HEAVY DUTY VEHICLE CROSSINGS

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RAISED CHANNEL VEHICLE CROSSING

SPECIAL APPROVAL REQUIRED TO INSTALL THIS TYPE OF CROSSING

PLAN NO. R-24-722

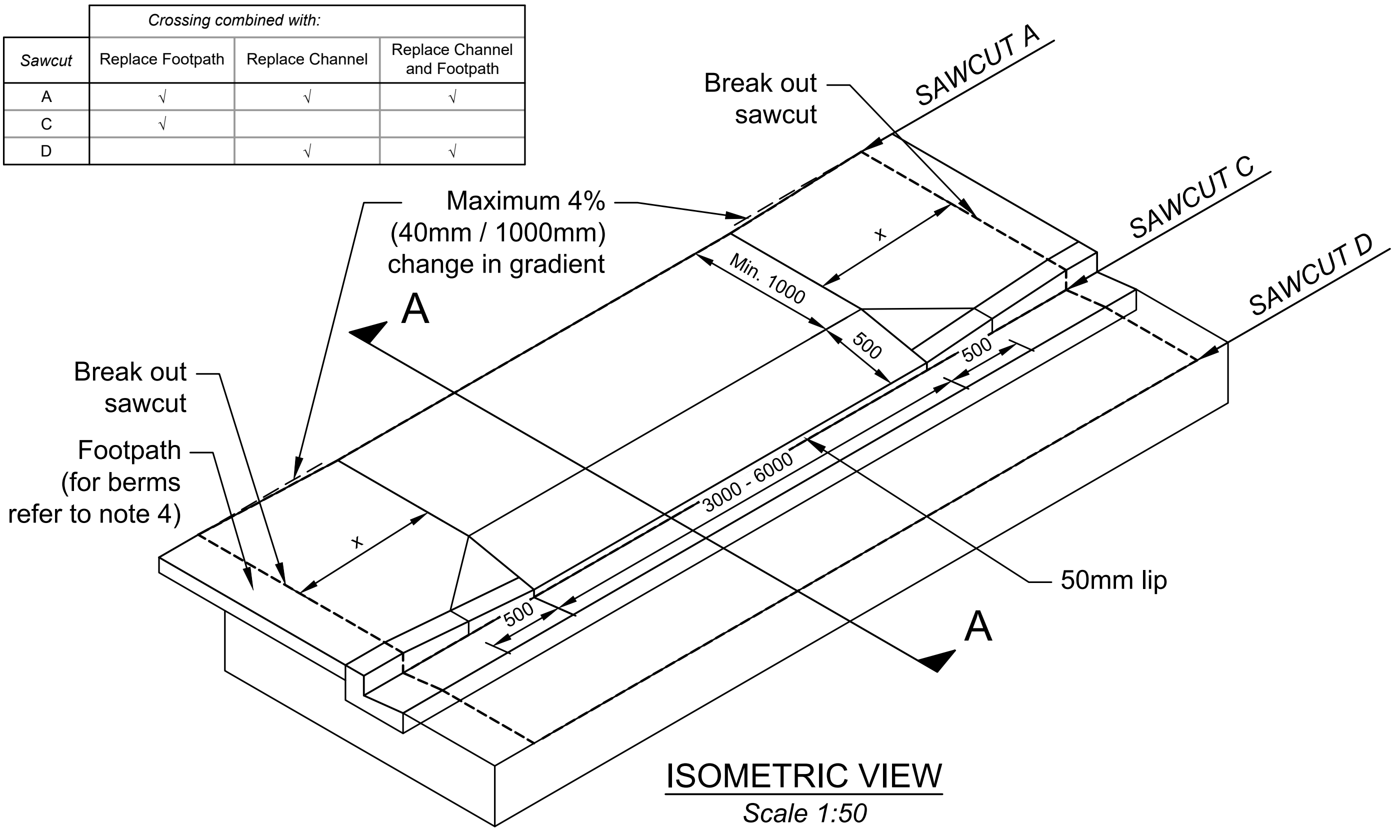
ASSET CATEGORY: KERB CROSSINGS

APPROVED BY: D. SINGH

DATE: 18 OCT. 2010

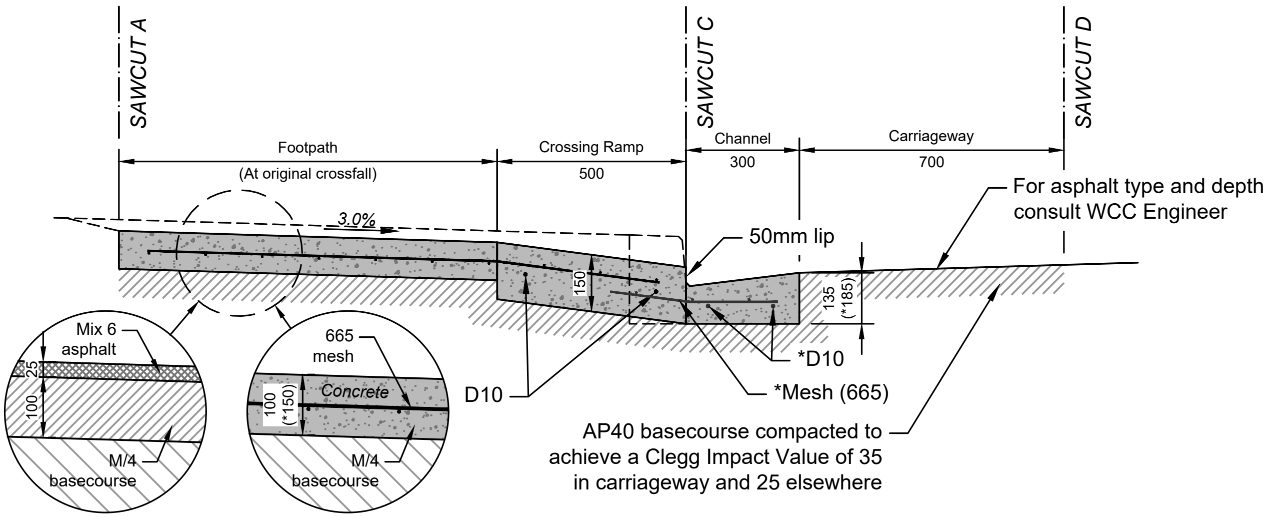
SAWCUTS

	Crossing combined with:		
Sawcut	Replace Footpath	Replace Channel	Replace Channel and Footpath
A	√	√	√
C	√		
D		√	√



ISOMETRIC VIEW

Scale 1:50



Asphalt Footpath

Concrete Footpath or Heavy Duty Vehicle Crossing

SECTION A-A

Scale 1:20

NOTES:

1) WHERE KERB HEIGHT EXCEEDS 135mm REFER TO ENGINEER.
2) 20 MPa (80 -120 SLUMP) CONCRETE WITH LIGHTLY BROOMED FINISHED.
3) SOFT SUBSOILS TO BE UNDERCUT BY 200mm AND FILLED WITH COMPACTED BASECOURSE.
4) WHERE A GRASS BERM SEPARATES THE FOOTPATH FROM THE KERB, THE CROSSING RAMP SHALL EXTEND FROM THE KERBLINE TO THE EDGE OF THE ADJACENT FOOTPATH, OR 500mm, WHICHEVER THE GREATER. THE SPLAY LENGTH ALONG THE KERBLINE EITHER SIDE OF THE CROSSING SHALL BE 500mm.
5) * REFERS TO HEAVY DUTY VEHICLE CROSSINGS

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LOWERED FOOTPATH VEHICLE CROSSING

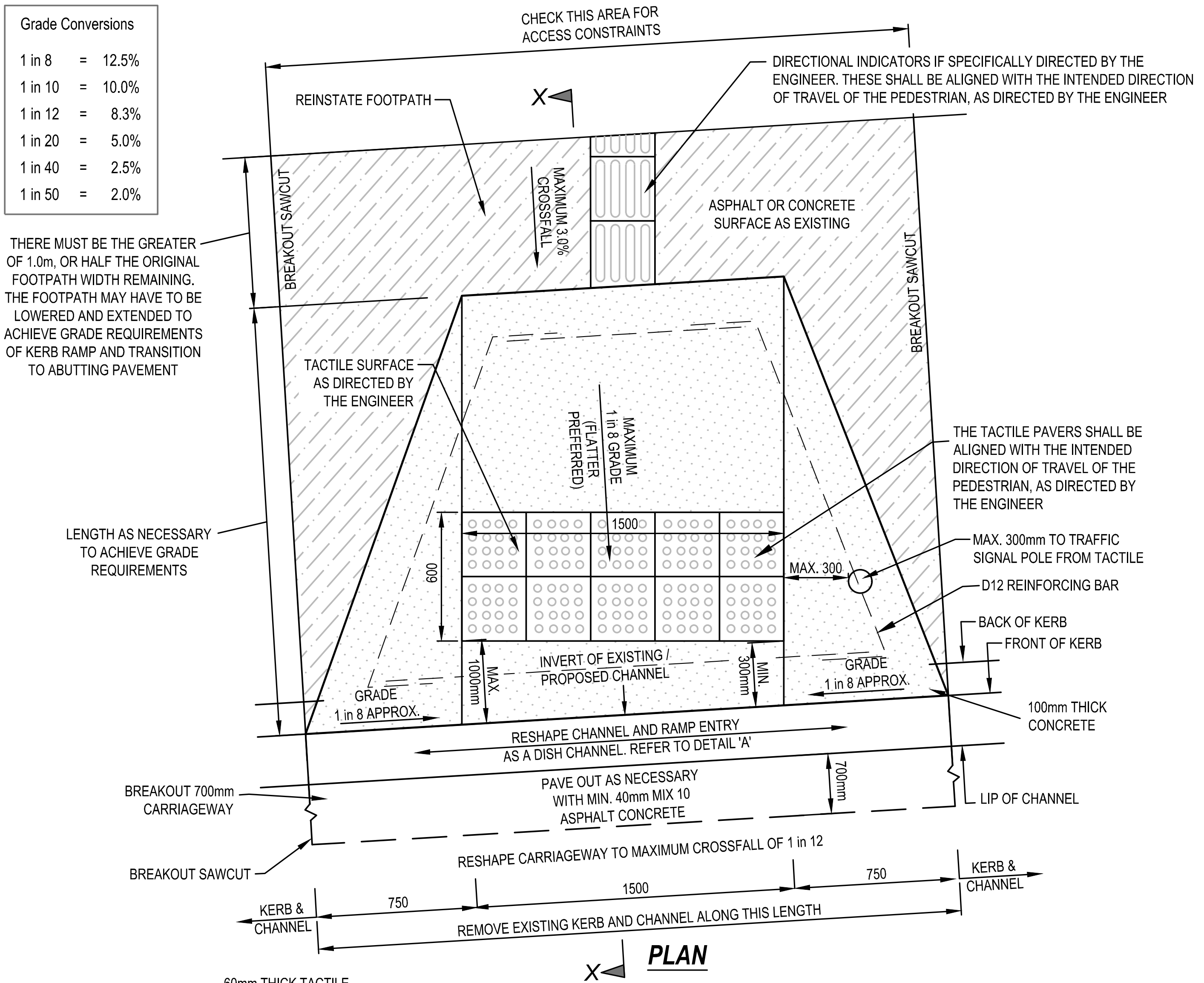
SPECIAL APPROVAL REQUIRED TO INSTALL THIS TYPE OF CROSSING

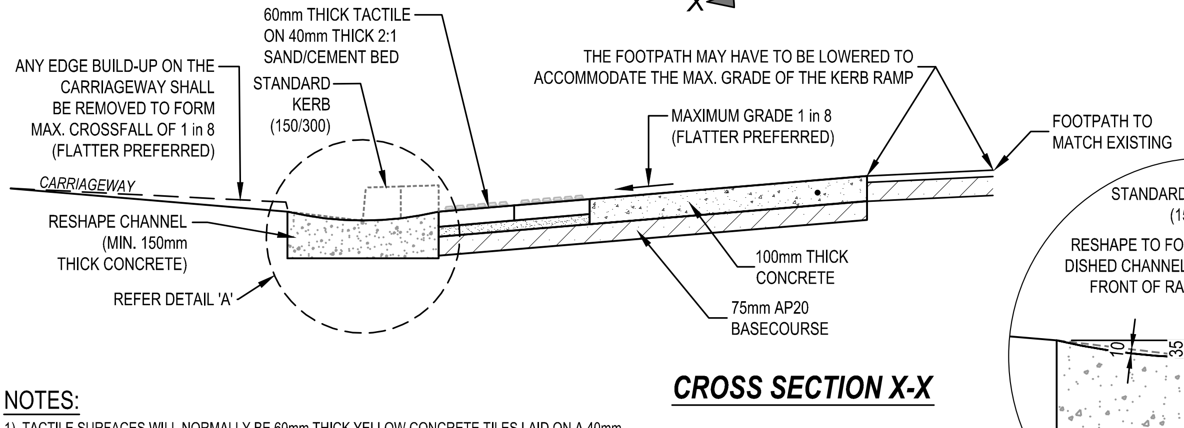
PLAN NO. R-24-723

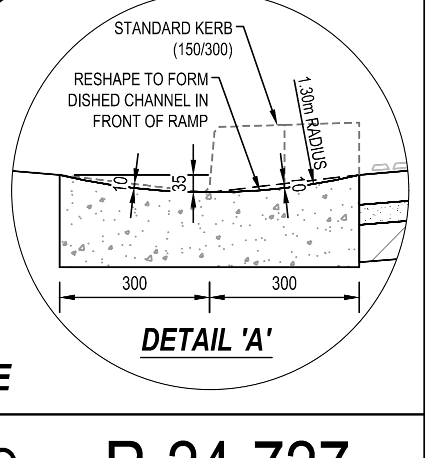
ASSET CATEGORY: KERB CROSSINGS

APPROVED BY: D. SINGH

DATE: 18 OCT. 2010







NOTES:

1) TACTILE SURFACES WILL NORMALLY BE 60mm THICK YELLOW CONCRETE TILES LAID ON A 40mm THICK 2:1 SAND/CEMENT BED.
2) THE TACTILE PAVERS SHOULD NOT BE STEPPED.
3) TACTILE SURFACE TO COMPLY WITH LTSA RTS-14.
4) DIRECTIONAL INDICATORS MAY BE REQUIRED IN SHOPPING AND COMMERCIAL AREAS AND WHERE THE FOOTPATH IS LOCATED AWAY FROM THE KERB AND CHANNEL OR INTERSECTION.
5) THE RAMP SHOULD BE LOCATED PERPENDICULAR TO THE CROSSING DIRECTION WHERE POSSIBLE.

NOT TO SCALE

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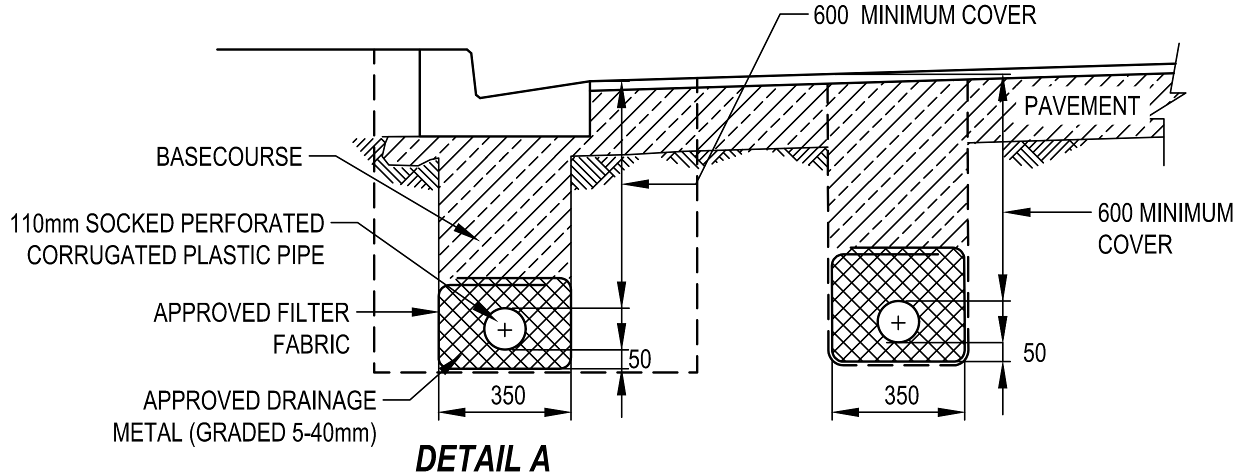
PEDESTRIAN RAMP WITH TACTILE PAVERS

PLAN NO.	R-24-727
ASSET CATEGORY:	LIGHT DUTY KERB CROSSINGS
APPROVED BY:	D. SINGH
DATE:	16 JAN. 2015

NOTE:

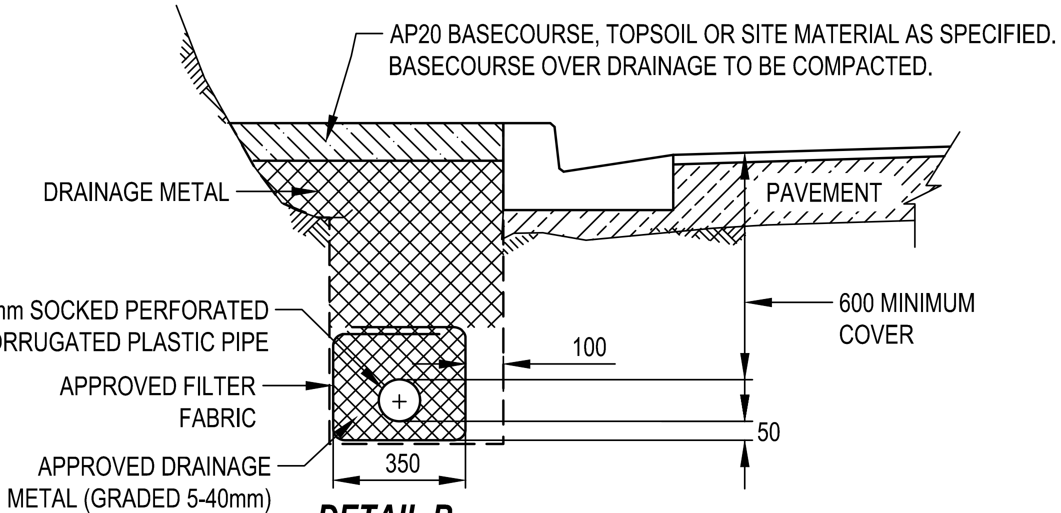
1. UNDER KERB SUBSOIL AND CARRIAGEWAY SUBSOIL DRAINS ARE NOT TO BE LAID IN THE SAME TRENCH.
2. STRIP DRAIN EQUIVALENT APPROVED BY THE ENGINEER MAY BE USED (REFER TO R-39-750).



DETAIL A

UNDERCHANNEL / CARRIAGEWAY SUBSOIL DRAINAGE

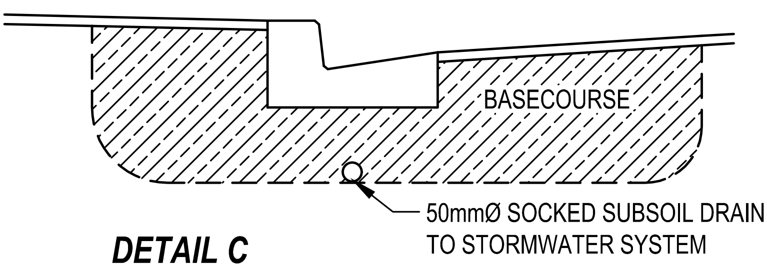
USING SOCKED SUBSOIL PIPE AND FILTER FABRIC



DETAIL B

TOE OF BATTER SUBSOIL DRAINAGE

USING SOCKED SUBSOIL PIPE AND FILTER FABRIC



DETAIL C

50mmØ SUBSOIL DRAINAGE UNDER RECONSTRUCTED KERB AND CHANNEL

SCALE 1:20

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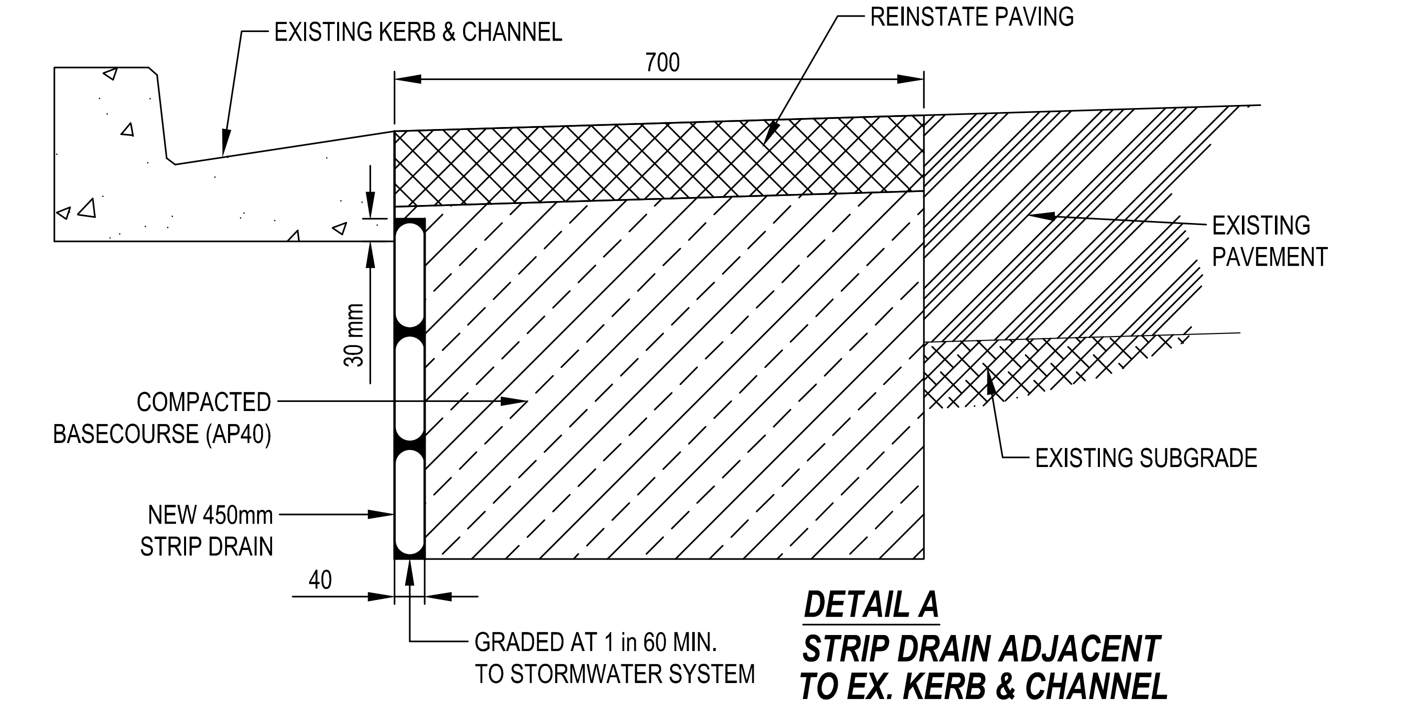
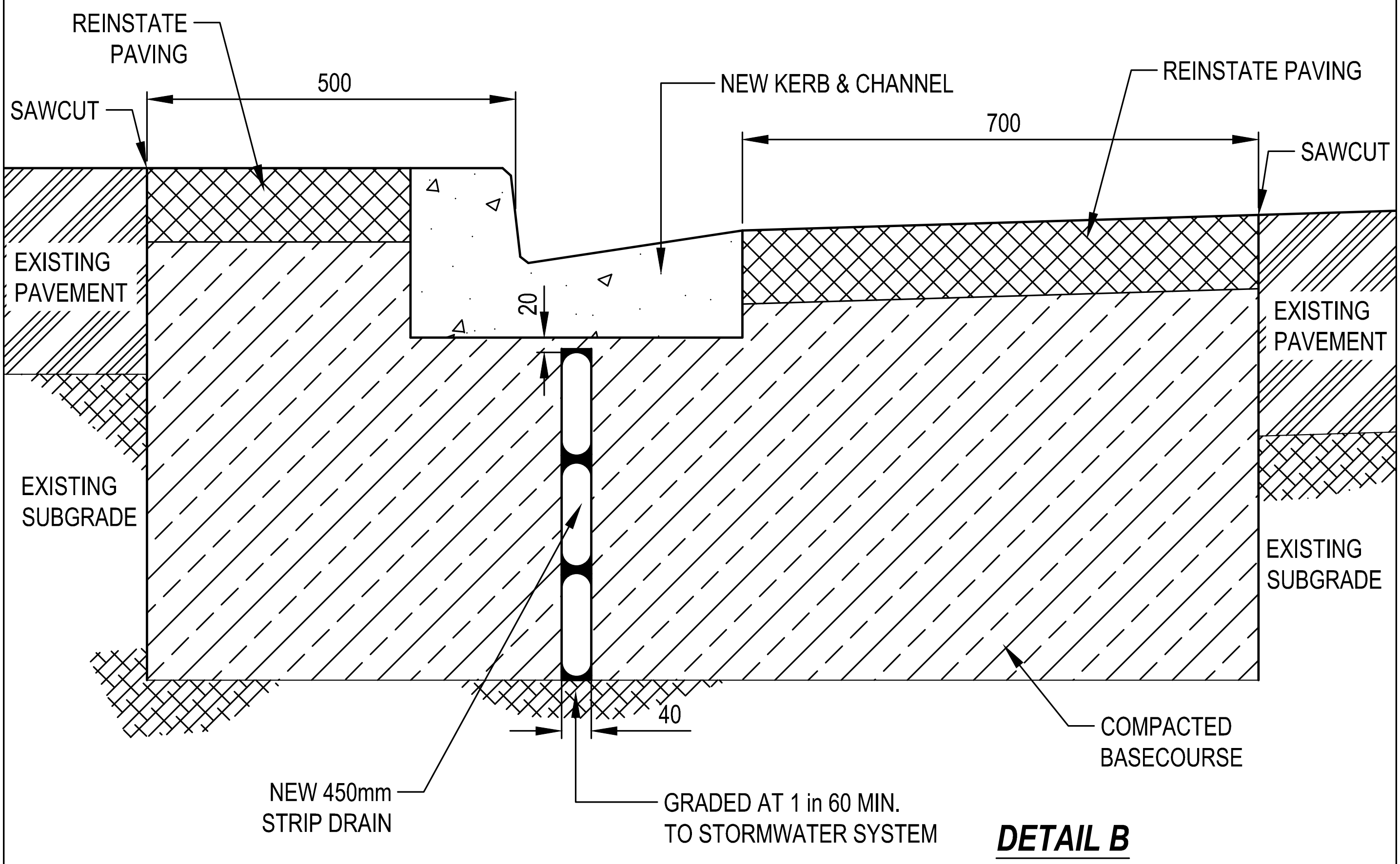
Me Heke Ki Pōneke

PAVEMENT SUBSOIL DRAINS

PLAN NO.	R-39-749
ASSET CATEGORY:	SUBSOIL DRAINS
APPROVED BY:	D. SINGH
DATE:	18 OCT. 2010



DETAIL A
STRIP DRAIN ADJACENT TO EX. KERB & CHANNEL



DETAIL B
STRIP DRAIN UNDER NEW KERB & CHANNEL

SCALE 1:10

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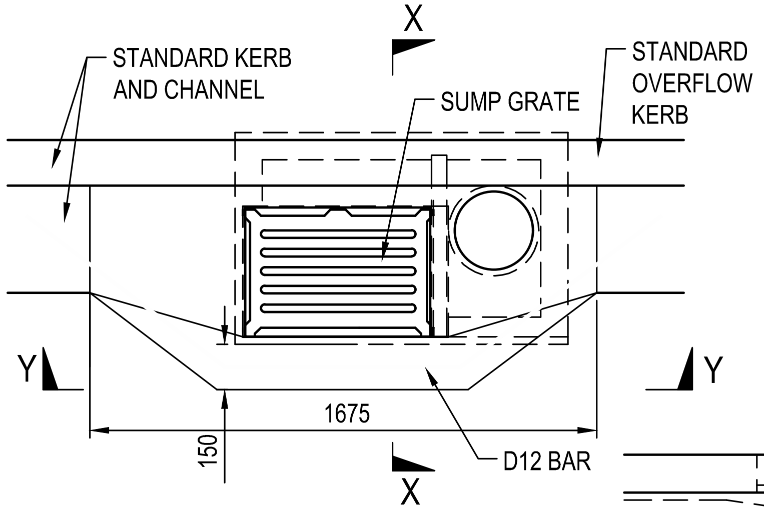
STRIP DRAIN

PLAN NO. R-39-750

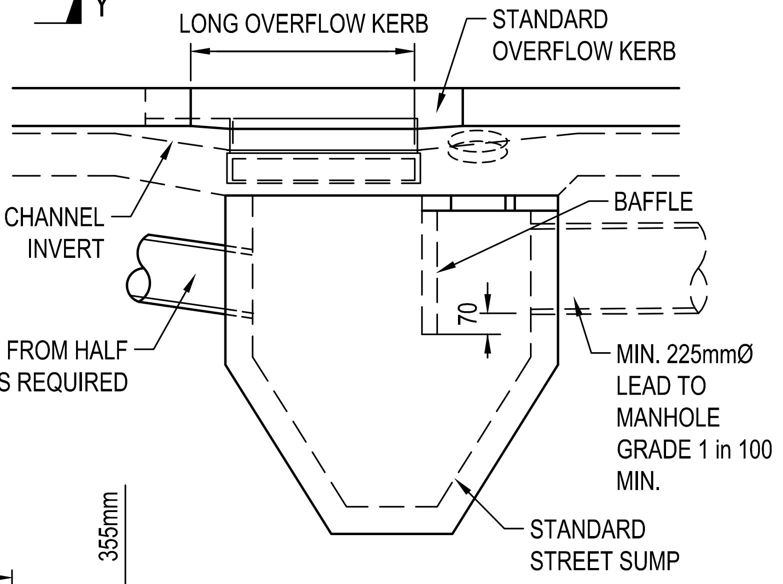
ASSET CATEGORY: SUBSOIL DRAINS

APPROVED BY: D. SINGH

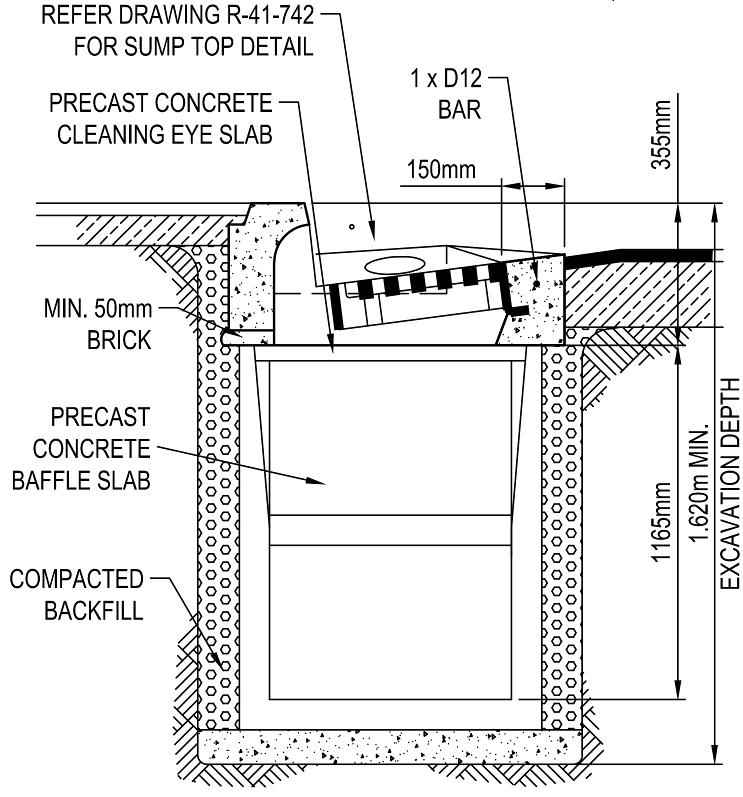
DATE: 14 DEC. 2007



PLAN VIEW



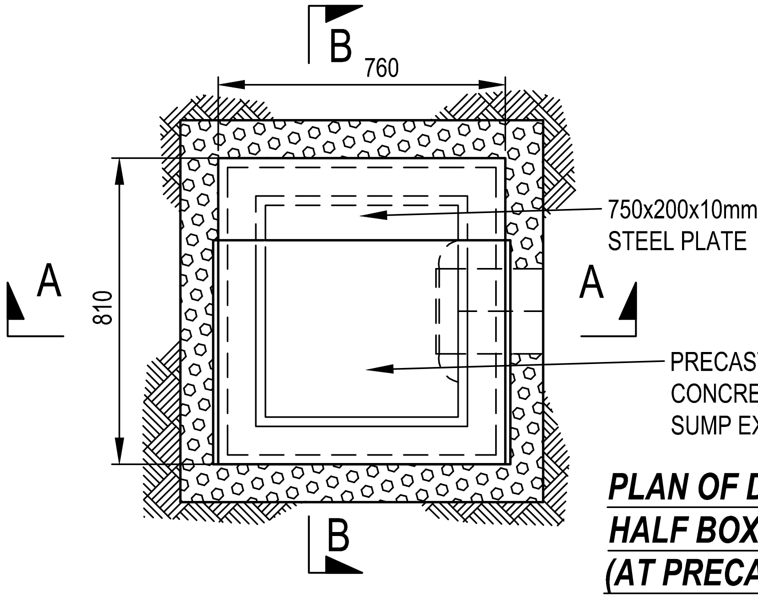
SECTION Y-Y



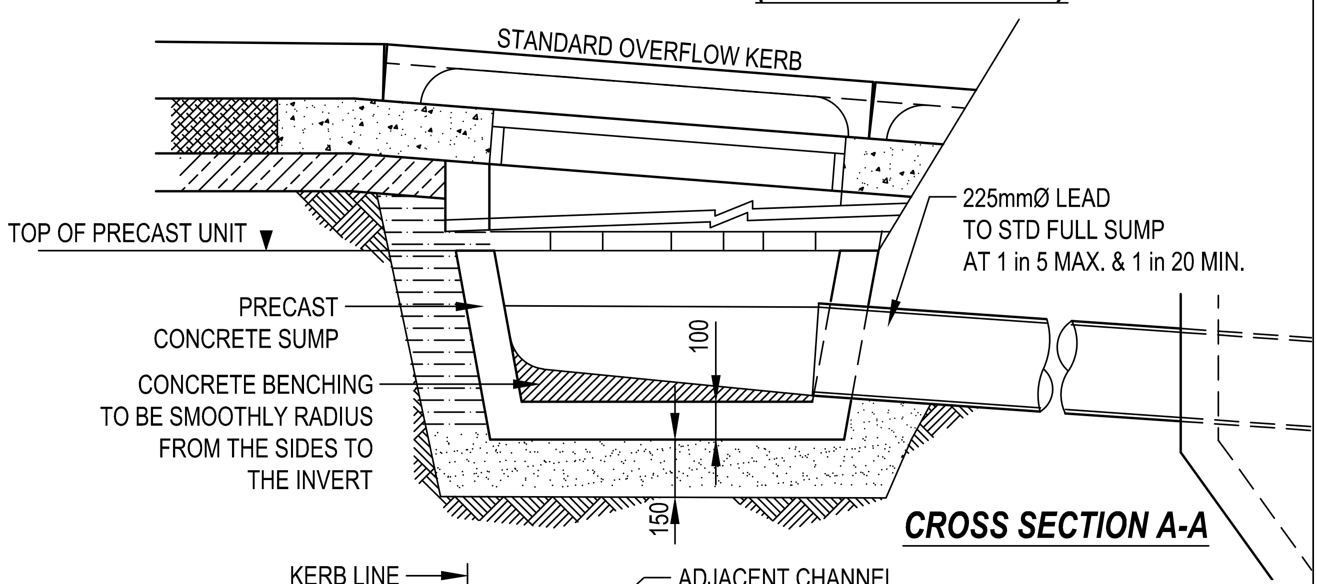
SECTION X-X

SCALE 1:25

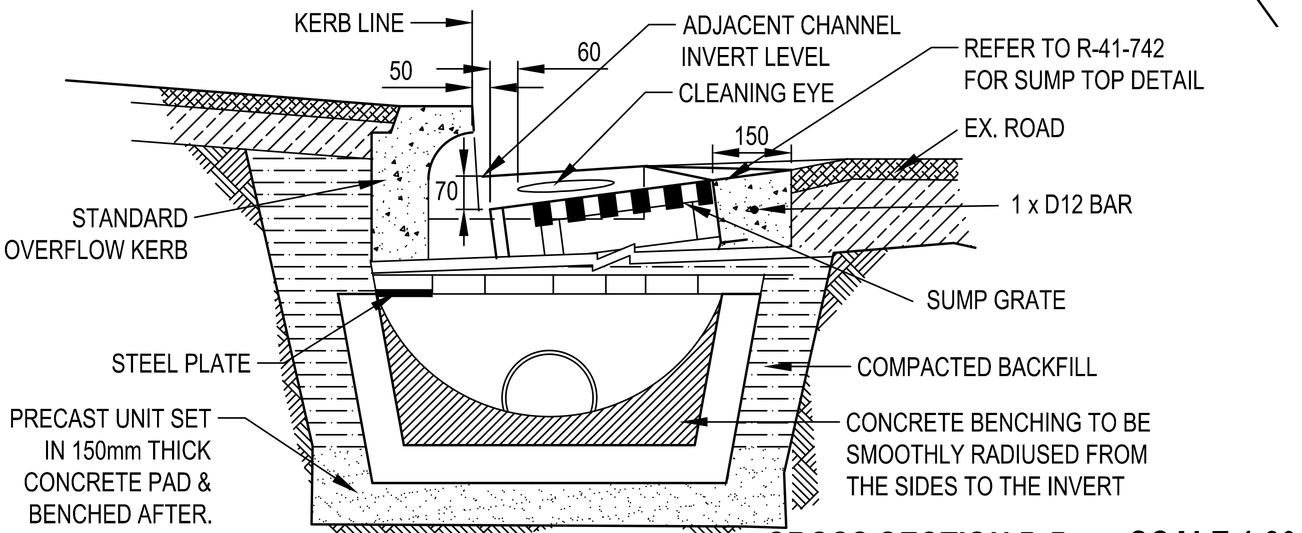
Absolutely Positively **Wellington** City Council Me Heke Ki Pōneke	FULL SUMP AND SECTIONS	PLAN NO. R-41-740
		ASSET CATEGORY: SUMPS AND LEADS
		APPROVED BY: D. SINGH
		DATE: 18 OCT. 2010



PLAN OF DOUBLE SUMP
HALF BOX EXTENSION
(AT PRECAST LEVEL)



CROSS SECTION A-A



CROSS SECTION B-B ***SCALE 1:20***

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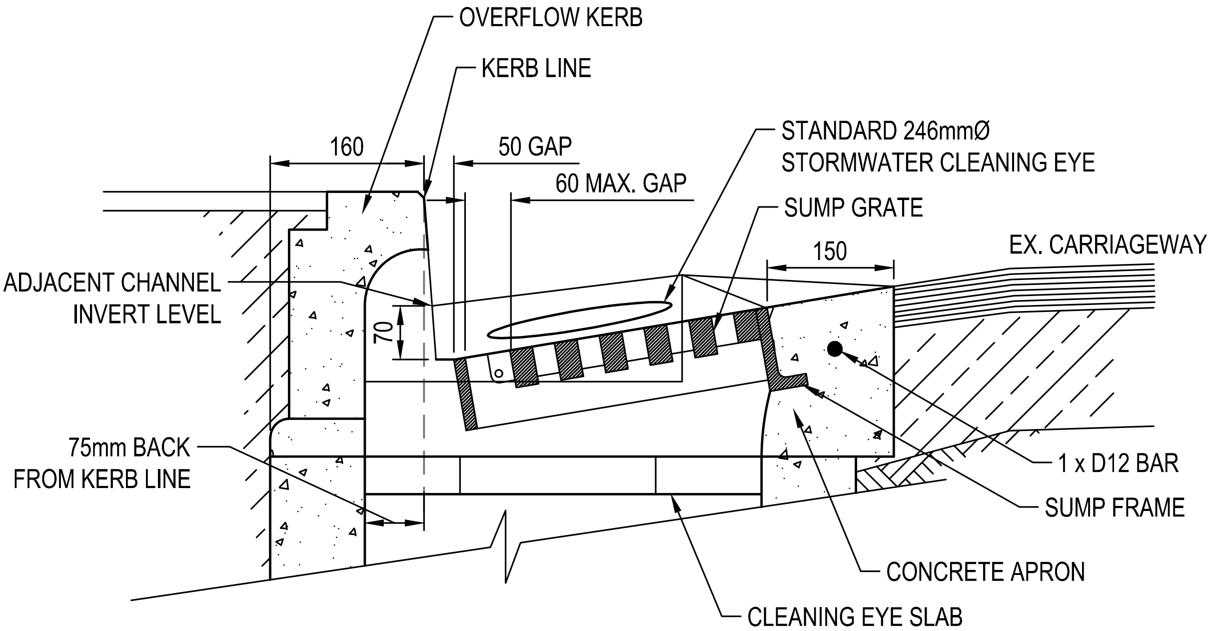
Me Heke Ki Pōneke

HALF BOX EXTENSION AND SECTIONS

PLAN NO.	R-41-741
ASSET CATEGORY:	SUMPS AND LEADS
APPROVED BY:	D. SINGH
DATE:	18 OCT. 2010



SCALE 1:10

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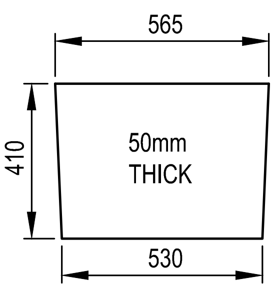
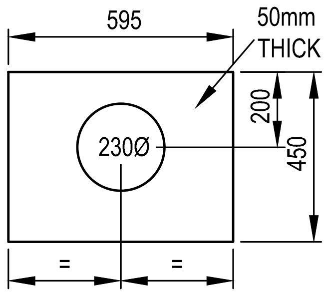
Me Heke Ki Pōneke

DETAILS OF TOP OF SUMP AND HALF BOX

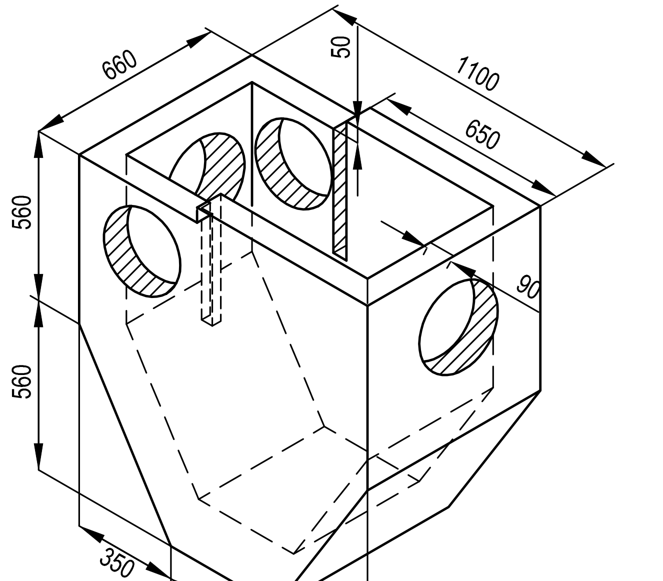
PLAN NO.	R-41-742
ASSET CATEGORY:	SUMPS AND LEADS
APPROVED BY:	D. SINGH
DATE:	18 OCT. 2010



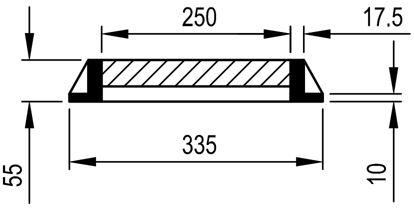
BAFFLE SLAB
SCALE 1:20



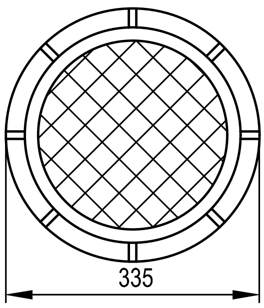
CLEANING EYE SLAB
SCALE 1:20



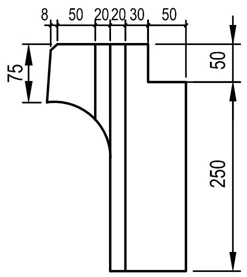
STREET SUMP
SCALE 1:25



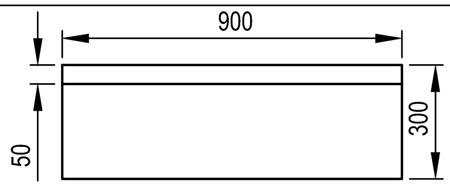
SECTION OF CLEANING EYE COVER
SCALE 1:10



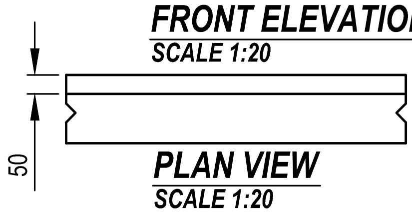
PLAN OF CLEANING EYE COVER
SCALE 1:10



END ELEVATION
SCALE 1:10

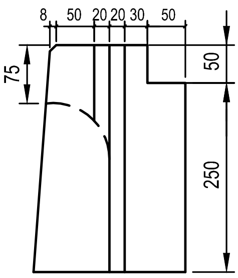


FRONT ELEVATION
SCALE 1:20

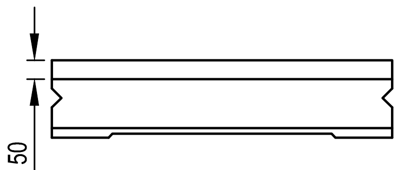


PLAN VIEW
SCALE 1:20

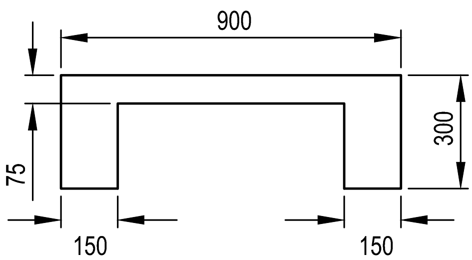
LONG OVERFLOW KERB
(FOR BETTER ENTRY SHAPING & FLOW CAPACITY)



END ELEVATION
SCALE 1:10



PLAN VIEW
SCALE 1:20



FRONT ELEVATION
SCALE 1:20

STANDARD OVERFLOW KERB

NOTE: ALL CONCRETE UNITS TO BE MADE WITH 20 MPa AT 28 DAYS STRENGTH CONCRETE.

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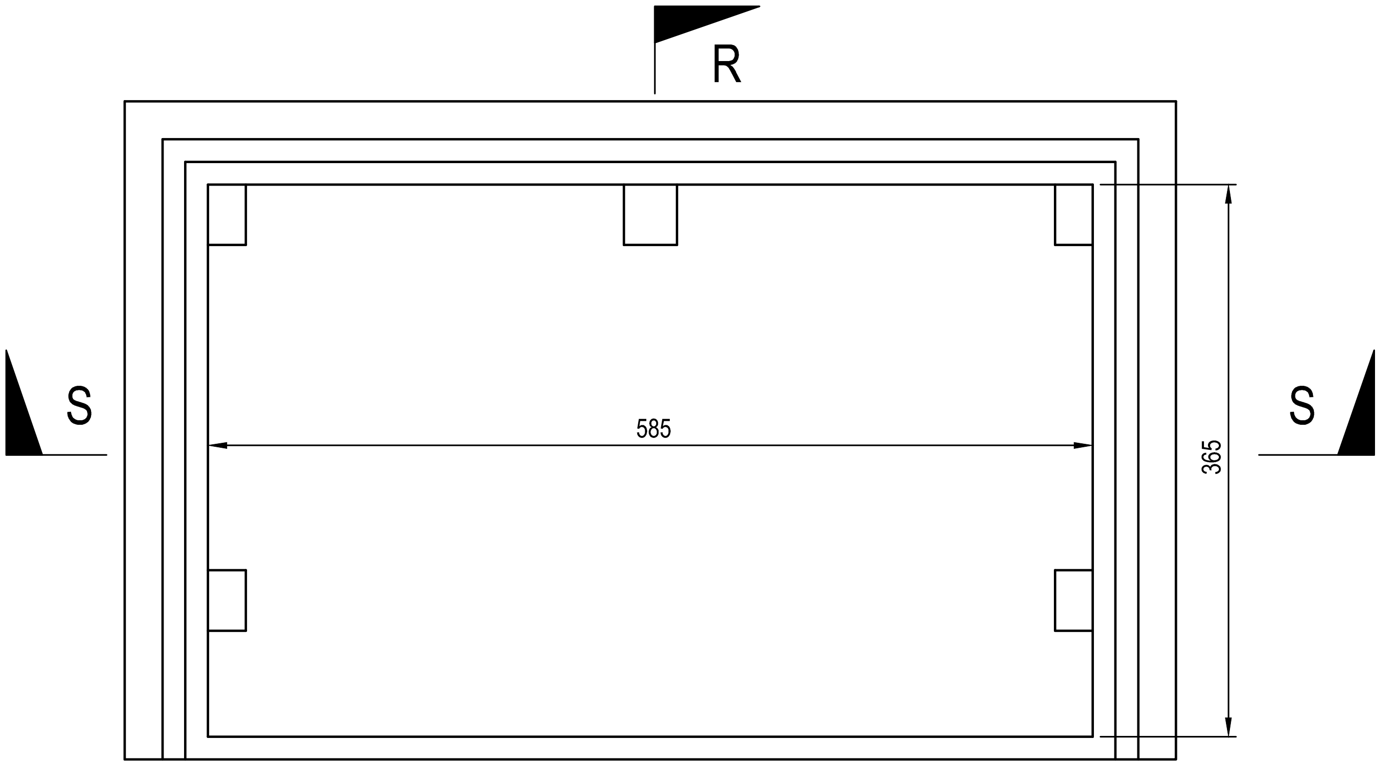
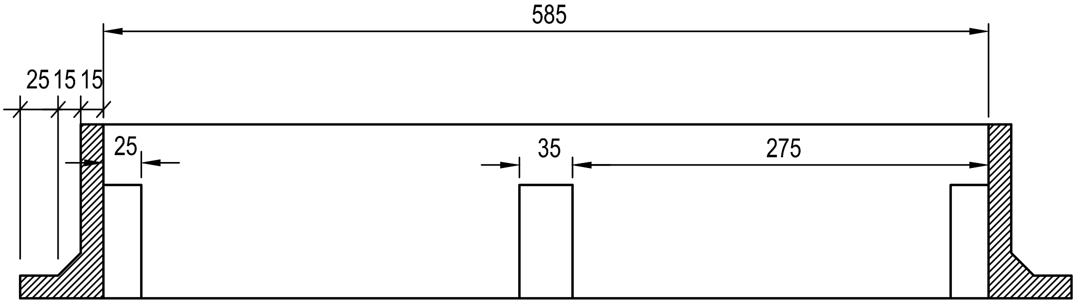
Me Heke Ki Pōneke

OVERFLOW KERB AND STREET SUMP DETAILS

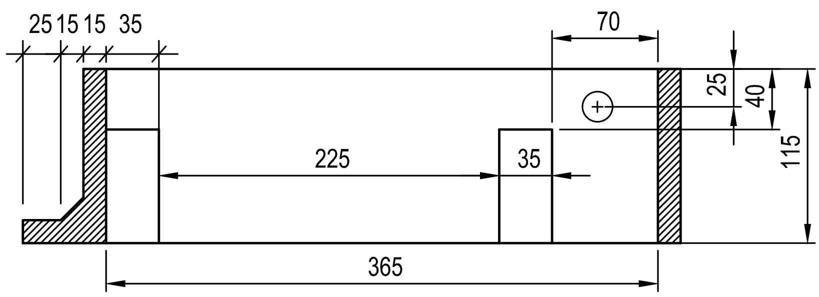
PLAN NO.	R-41-743
ASSET CATEGORY:	SUMPS AND LEADS
APPROVED BY:	D. SINGH
DATE:	18 OCT. 2010



SUMP FRAME



SECTION S - S



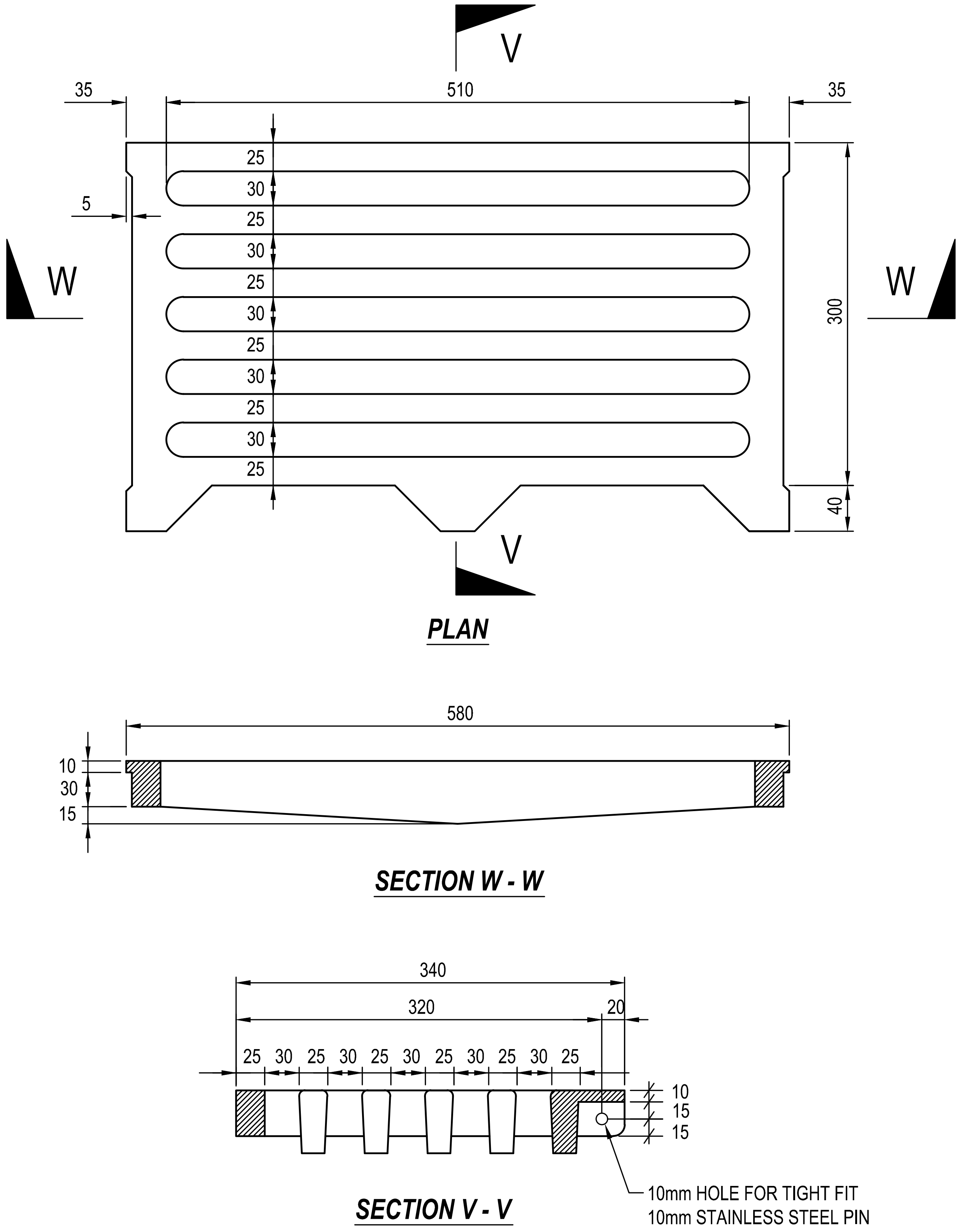
SECTION R - R

SCALE 1:5

Absolutely Positively **Wellington** City Council
Me Heke Ki Pōneke

STANDARD
STREET SUMP
GRATE FRAME

PLAN NO.	R-41-744
ASSET CATEGORY:	SUMPS AND LEADS
APPROVED BY:	D. SINGH
DATE:	14 DEC. 2007



SCALE 1:5

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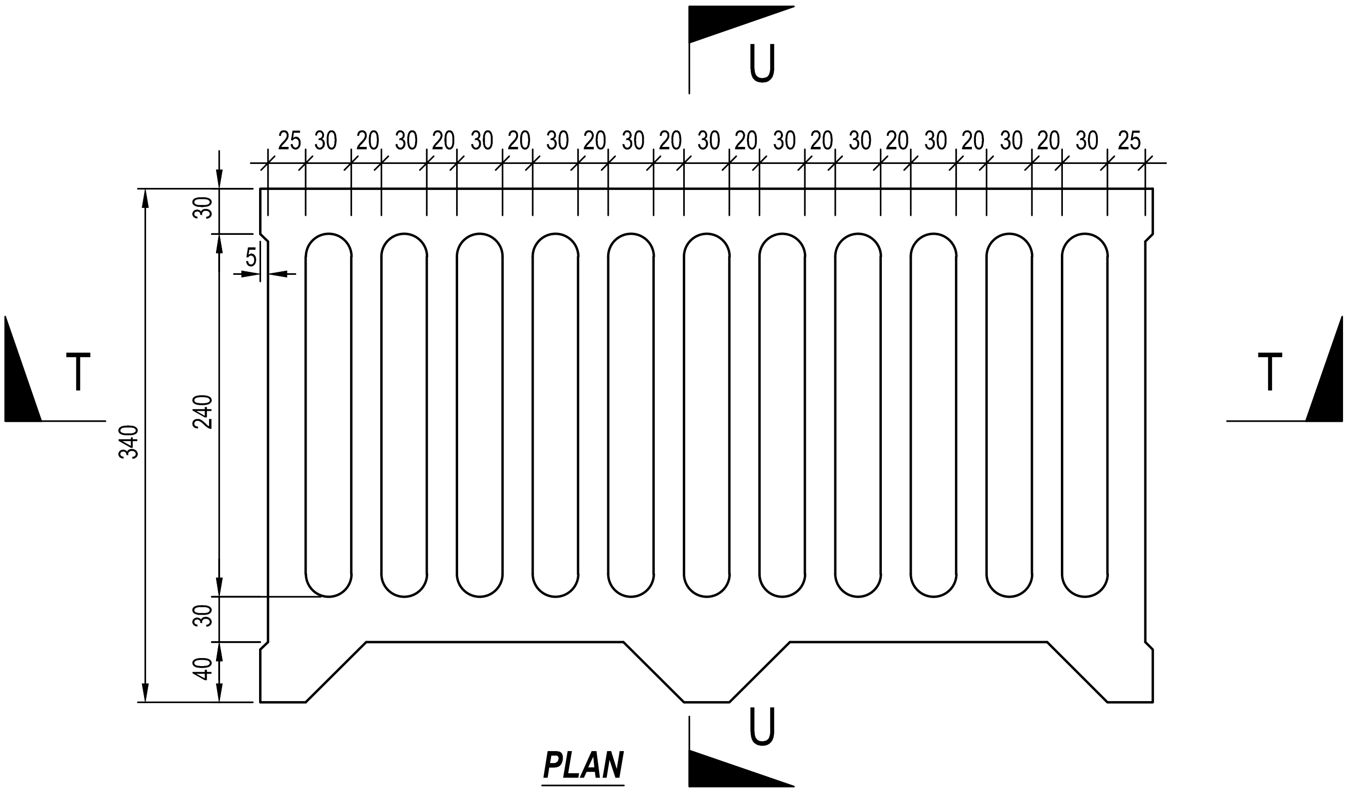
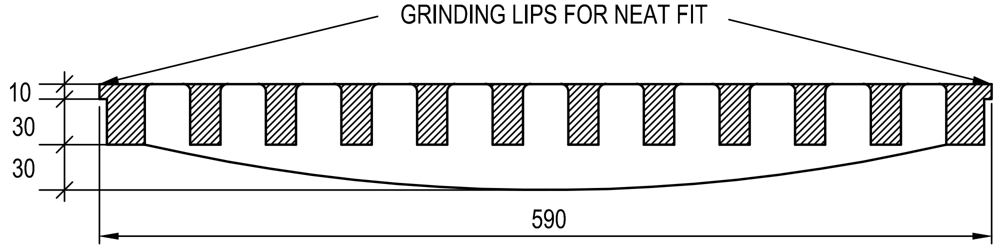
Wellington City Council
Me Heke Ki Pōneke

STANDARD
GRATE
(MEDIUM FLOW CAPACITY)

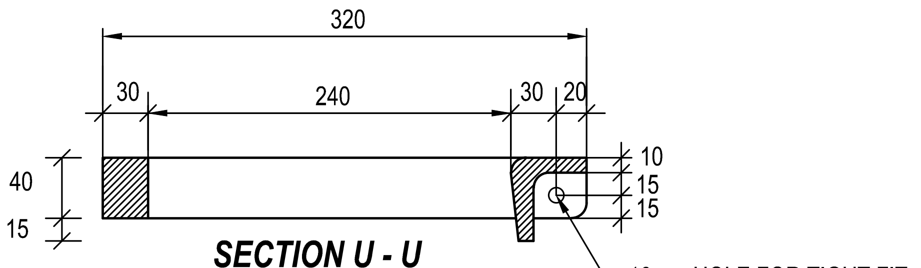
PLAN NO.	R-41-745
ASSET CATEGORY:	SUMPS AND LEADS
APPROVED BY:	D. SINGH
DATE:	18 OCT. 2010



PLAN



SECTION T - T



SECTION U - U

NOTE:

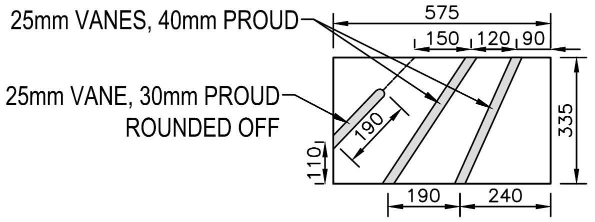
LOW FLOW CAPACITY AT ENGINEER'S PERMISSION ONLY.

SCALE 1:5

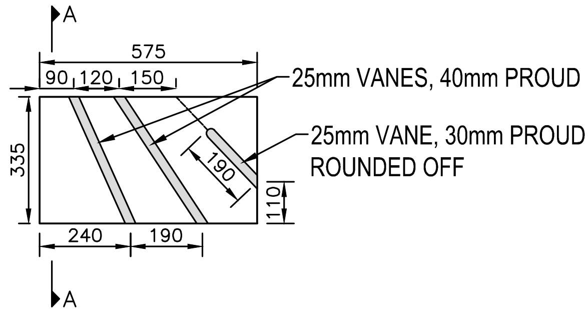
Absolutely Positively Wellington City Council
Me Heke Ki Pōneke

CYCLE SAFE GRATE (LOW FLOW CAPACITY)

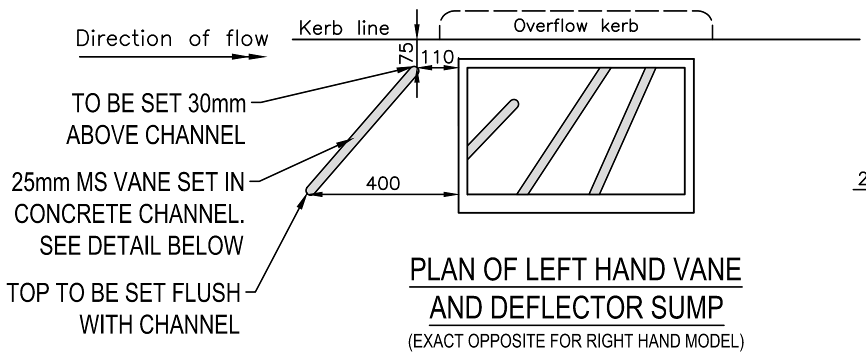
PLAN NO.	R-41-746
ASSET CATEGORY:	SUMPS AND LEADS
APPROVED BY:	D. SINGH
DATE:	14 DEC. 2007



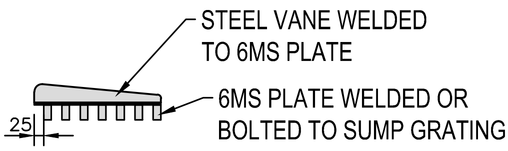
DEFLECTOR SUMP TOP
(LEFT HAND MODEL)



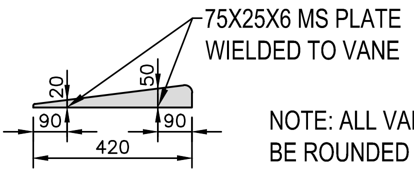
DEFLECTOR SUMP TOP
(RIGHT HAND MODEL)



PLAN OF LEFT HAND VANE
AND DEFLECTOR SUMP
(EXACT OPPOSITE FOR RIGHT HAND MODEL)



TYPICAL CROSS
SECTION A-A



NOTE: ALL VANES TO
BE ROUNDED OFF

DETAIL OF VANE

SUMP DEFLECTORS AND VANES

SCALE 1:20

Absolutely Positively **Wellington** City Council
Me Heke Ki Pōneke

STANDARD DEFLECTOR SUMP TOP

PLAN NO. R-41-747

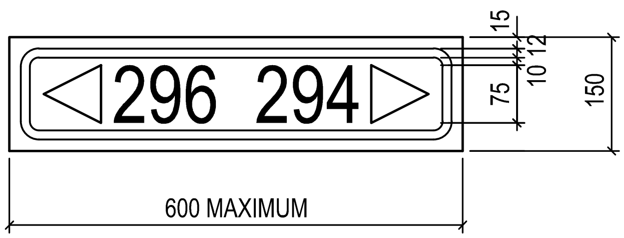
ASSET CATEGORY: SUMPS AND LEADS

APPROVED BY: D. SINGH

DATE: 14 DEC. 2007

* TO BE USED FOR MAJOR ARTERIAL ROUTES ONLY

STANDARD STREET NAME BLADE DESIGN



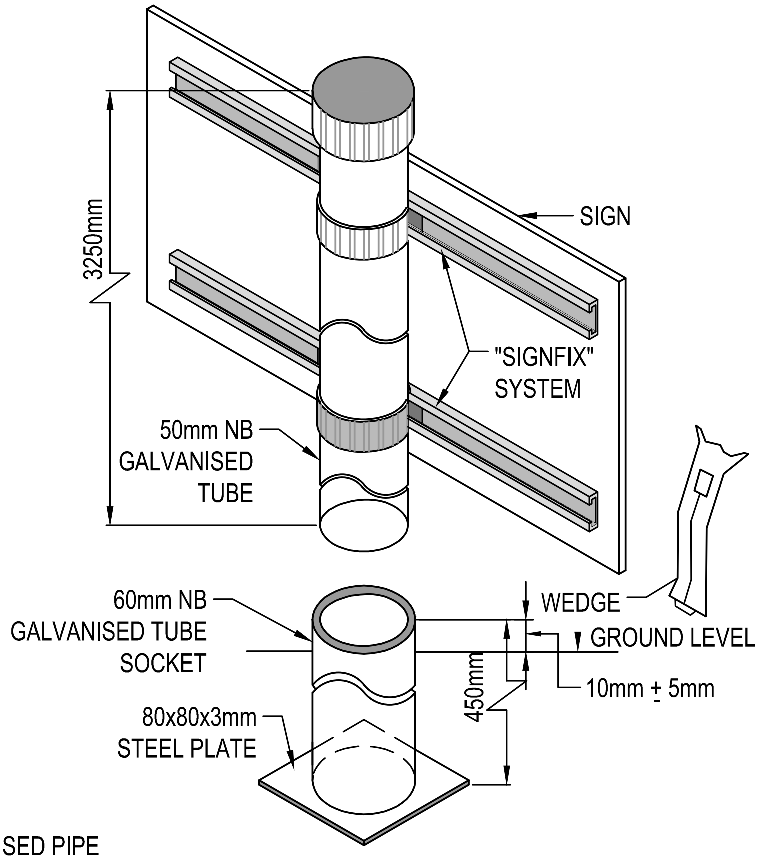
STANDARD STREET NUMBER SUPPLEMENTARY DESIGN

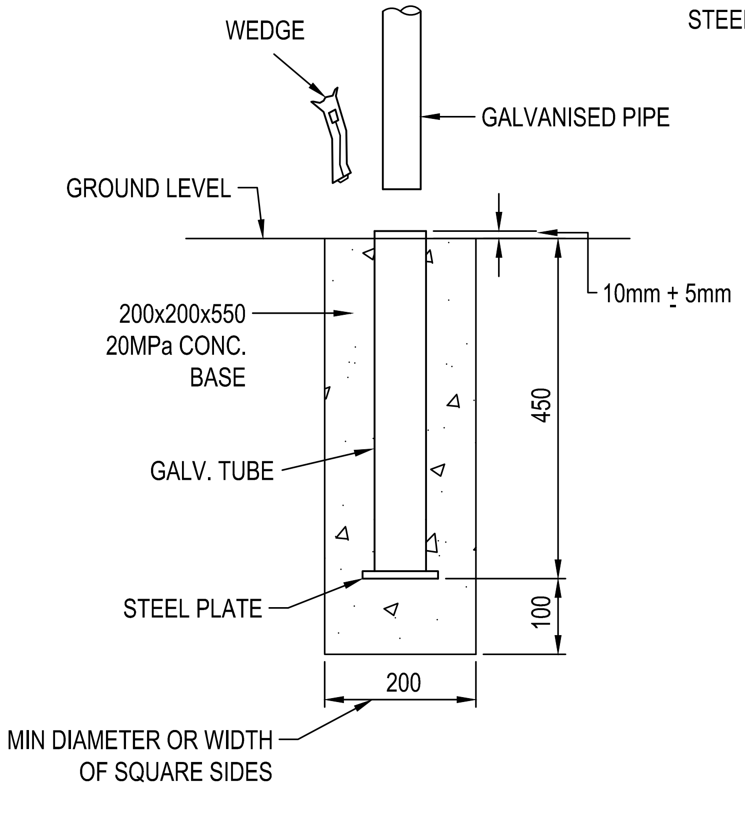
STANDARD NO EXIT SUPPLEMENTARY DESIGN

SCALE 1:10

Absolutely Positively **Wellington** City Council Me Heke Ki Pōneke STANDARD STREET NAMES, NUMBERS AND NO EXIT SIGNS	PLAN NO. R-44-780 ASSET CATEGORY: TRAFFIC AND PARKING SIGNS APPROVED BY: D. SINGH DATE: 14 DEC. 2007

NOTE:
SET IN 20MPa CONCRETE BASE.





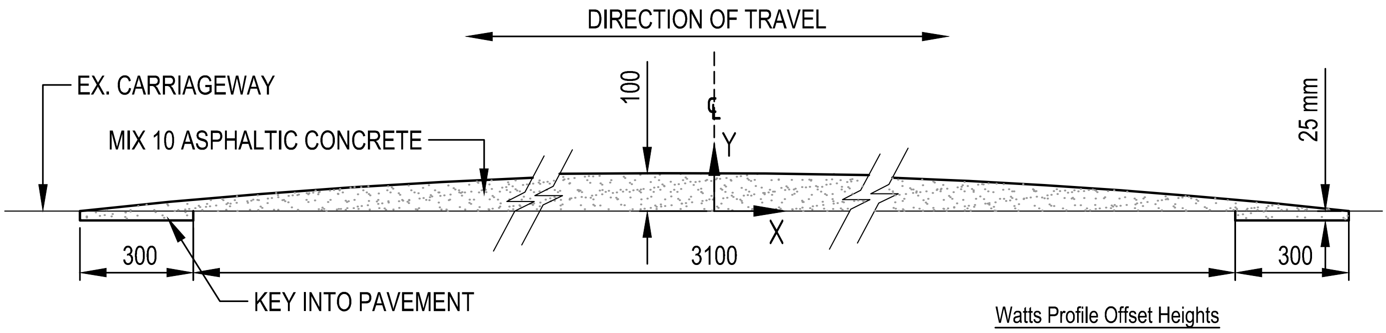
FIXING DETAILS
SCALE 1:10

SCALE 1:2.5

Absolutely Positively **Wellington** City Council
Me Heke Ki Pōneke

TRAFFIC SIGN SUPPORT SYSTEM

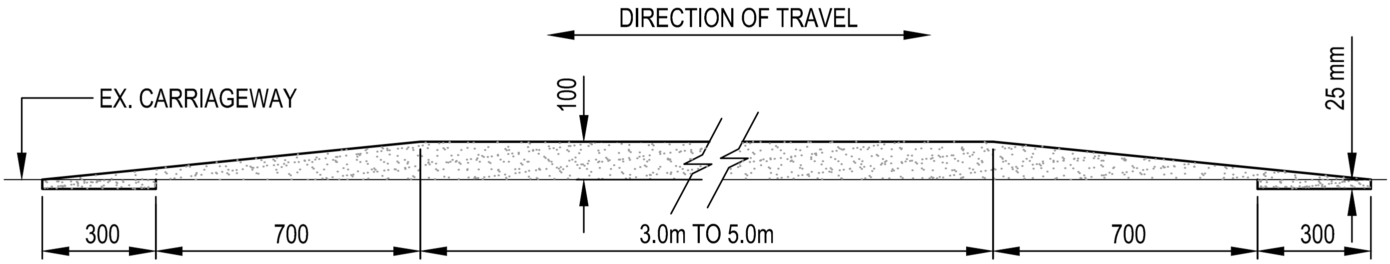
PLAN NO.	R-44-782
ASSET CATEGORY:	TRAFFIC AND PARKING SIGNS
APPROVED BY:	D. SINGH
DATE:	14 DEC. 2007



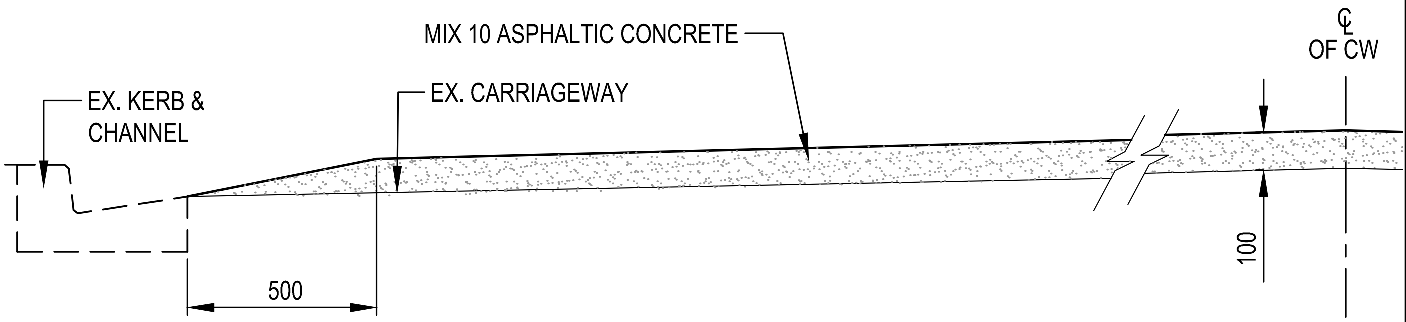
Watts Profile Offset Heights

X (m)	Y (mm)	X (m)	Y (mm)	X (m)	Y (mm)
0.0	100	0.7	86	1.4	43
0.1	100	0.8	81	1.5	34
0.2	99	0.9	76	1.6	24
0.3	97	1.0	71	1.7	16
0.4	95	1.1	65	1.8	5
0.5	93	1.2	58		
0.6	90	1.3	51		

WATTS PROFILE



MODIFIED WATTS PROFILE



TYPICAL SECTION

SCALE 1:20

Absolutely Positively
Wellington City Council
Me Heke Ki Pōneke

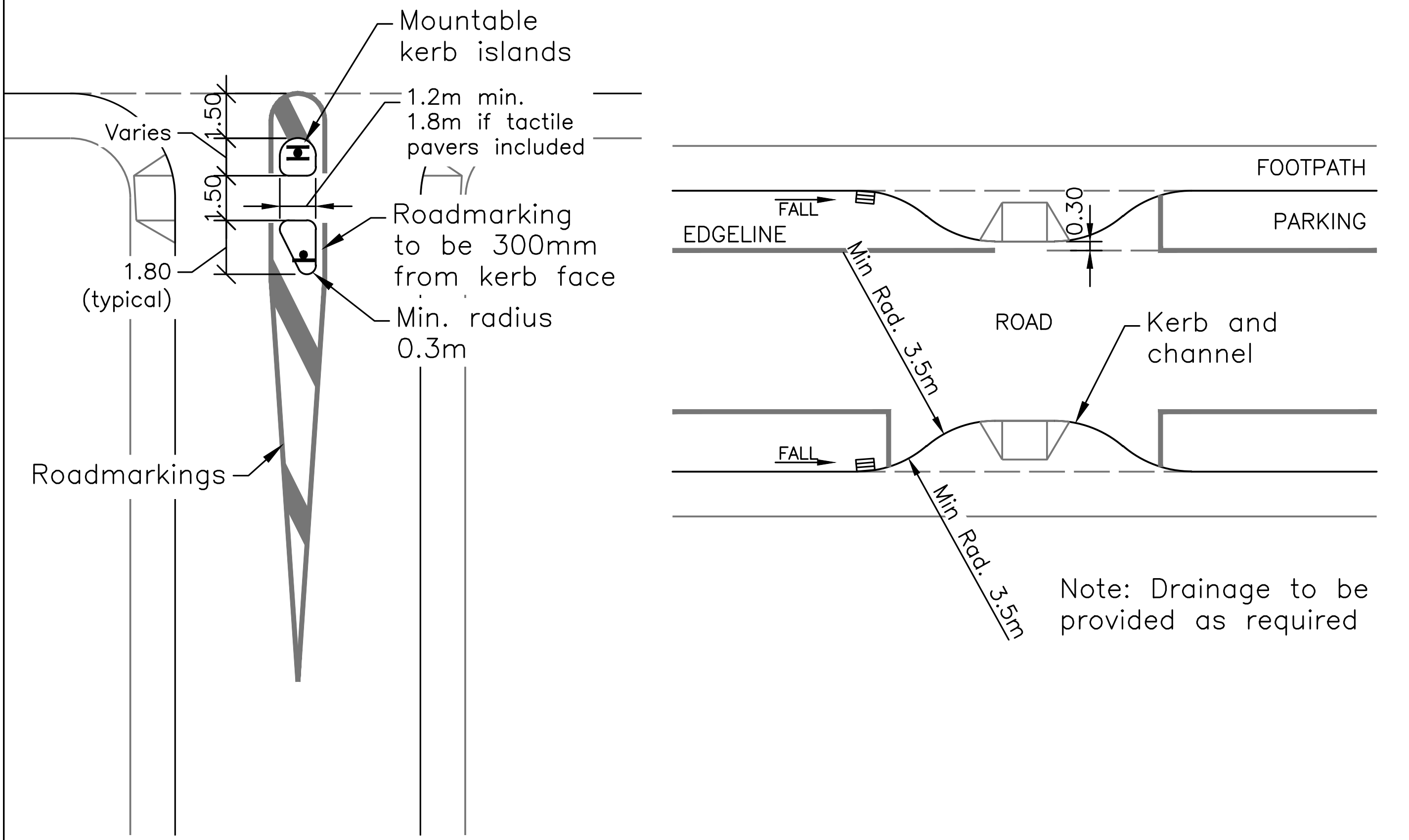
STANDARD SPEED HUMP DETAILS

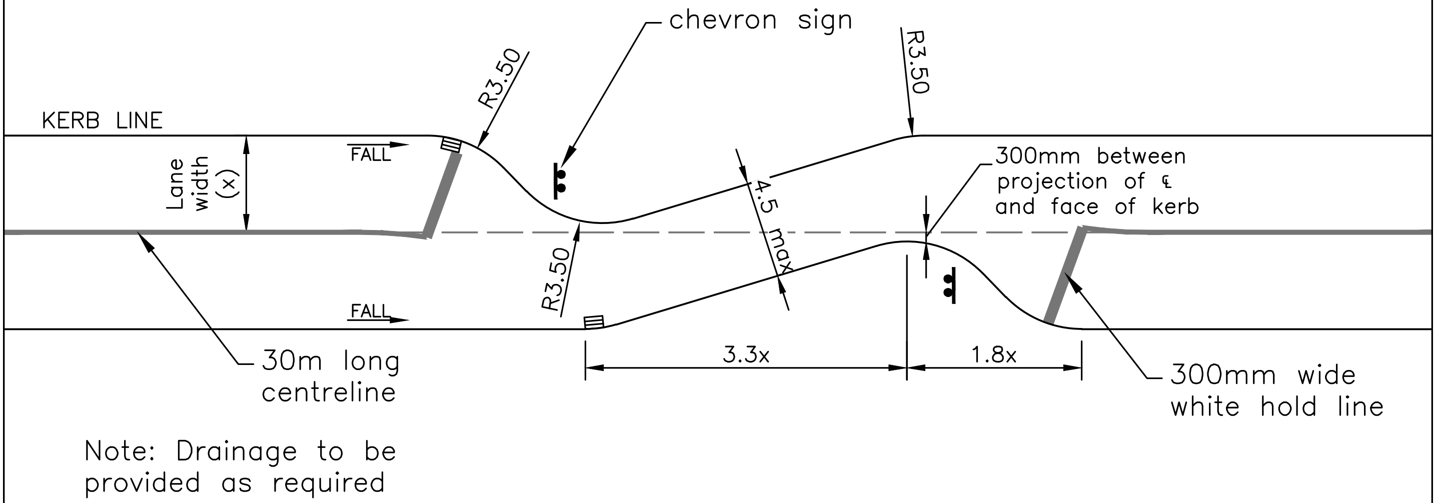
PLAN NO. R-45-702

ASSET CATEGORY: TRAFFIC ISLANDS AND HUMPS

APPROVED BY: D. SINGH

DATE: 14 DEC. 2007





NOTE:
THESE ARE EXAMPLE LAYOUTS ONLY.
SPECIFIC DESIGNS REQUIRE WCC APROVAL.

SCALE 1:250

Absolutely Positively Wellington City Council Me Heke Ki Pōneke CENTRAL ISLANDS, KERB EXTENSIONS AND CHICANES	PLAN NO. R-45-703
	ASSET CATEGORY: TRAFFIC ISLANDS AND HUMPS
	APPROVED BY: D. SINGH DATE: 18 OCT. 2010

Sealing Report

Road and Location____Date__________

Air Temperature Start__________Finish__________Surface Condition__________________

Starting Time________________________Finishing Time________________________

Weather____

Binder Type__________AGO(%)__________KERO(%)__________Precoating: Yes/No

Additives__________Chip Size__________Source__________________________

Rolling Equipment____

Details of Samples____

Tank No	Distance			Width	Area	Tank Dip			Spray Rate		Spray Temp	Binder at 15°C
	From	***To***	***Metres***			***Start***	***Finish***	***Total***	***Actual***	***Target***		

Total Chips Used:____________________Comments ________________________________

____

____

Benkelman Beam Test Record

Street and Location:____

Date:________________Test Load:_____________________Tested By: ______________________

Pavement Temperature/Tyre Pressure:____

(Details of location of test points and general information about the street are to be noted on the basis of this form).

Test Point	**Lane**	**Distance from Kerb**	**Deflection Readings**			**Description of Test Point**
			Intermediate	***Final***	***Difference***	

Regional Standard for Water Services

December 2021 Version 3.0

Our water, our future.

This document was developed for Porirua, Hutt, Upper Hutt and Wellington city councils, South Wairarapa District Council, Greater Wellington Regional Council and Wellington Water Limited.

Document Control

Rev No	Revision description	Date
1.0	Final	November 2012
2.0	Minor revision	May 2019
3.0	Major revision	December 2021

Description	Name	Date	Signature
Prepared by	Emily Greenberg Anna McDonald	09/12/2021	
Document Owner	Gary Cullen	09/12/2021	G. Cullen
Reviewer	Gary Cullen	09/12/2021	G. Cullen
Approver	Julie Alexander	09/12/2021	J Alexander

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Sean de Roo	*Marlene Roberts-Saidy*	*Sarah Zhou*	*Andrew Stevenson*	*Paul Gardiner*
Nadia Nitsche	*Charles Puha*	*Steve Hutchison*	*Laurence Edwards*	*Jonathan Eweg*
Francis Leniston	*Kevin Brown*	*Tony Jaegers*	*Steven Mann*	*Zac Jordan*
Graeme Dick	*Clive Welling*	*Brittany Challis*	*Kat Dever-Tod*	*Susmitha Suresh*
Chad Johnson	*Kama Sliepen*			

Thanks also to Kelly Davenport for the massive reformatting, Andrew Lim for the drawings and Dylan Hopkins, Wade Gosper and Adrian Stockill.

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1 INTRODUCTION

Wellington Water Limited is a shared service, council-controlled organisation, which is jointly owned by Hutt, Porirua, Upper Hutt and Wellington City Councils, South Wairarapa District Council and Greater Wellington Regional Council. On behalf of these councils, the three waters network (stormwater, wastewater and water supply) is managed under a trusted advisor model.

The Regional Standard for Water Services (version 3.0) serves as an updated version of three waters infrastructure standards, to ensure a regionally consistent method of design and implementation of water services to meet outcomes of:

- Safe and healthy water,
- Respectful of the environment, and
- Resilient networks support our economy.

In July 2020, the Government launched the Three Waters Reform Programme – a three-year programme to reform local government three waters service delivery arrangements. From July 2024, New Zealand's three waters services will be managed by four, publicly-owned water service entities. After water reform, it is expected that a new Regional Standard will be produced, reflective of geographic arrangements.

This document promotes consistency within the local industry for the benefit of developers, designers, suppliers, and councils. There are a few clauses particular to each city, but it is expected these differences will reduce over time as design philosophies consolidate through collaborative consideration.

The document provides minimum standards for the design and construction of proposed three waters infrastructure that will be vested in council, and to the maintenance, renewal, upgrade or decommissioning of existing public infrastructure. It is also expected that developers may seek innovative solutions to design issues, in particular carbon emissions, wherever possible in the achievement of a higher standard.

The Regional Standard for Water Services (RSWS) is to be used in conjunction with the Regional Specification for Water Services (R.Spec) (available at www.wellingtonwater.co.nz). The Regional Specification for Water Services contains the minimum technical specifications for the materials, construction, installation, testing and commissioning of the stormwater, wastewater, and water supply networks.

1.1 Review of standard

The Regional Standard for Water Services will be reviewed and revised as needed, particularly as policy and technology evolves. Users of this document should ensure that the latest published version is used.

Feedback on the standard can be made to:

Wellington Water Limited
Private Bag 39-804
Wellington Mail Centre 5045
Lower Hutt

c/- Standards

Alternatively, feedback can be sent to the following email: standards@wellingtonwater.co.nz.

2 USING THE REGIONAL STANDARD FOR WATER SERVICES

The Regional Standard for Water Services provides minimum standards that must be applied to the design and construction of proposed stormwater, wastewater and water supply infrastructure that will be vested in council, and to the maintenance, renewal, upgrade or decommissioning of existing public three waters infrastructure.

This standard supersedes the Regional Standard for Water Services May 2019. Departures from this standard require the written permission of Wellington Water.

2.1 Document structure

This document is structured such that provisions specific to stormwater, wastewater and water supply are divided into four sections:

1. **Objectives:** The objectives outline the broad, overarching objective of the network.
2. **Performance Criteria:** The performance criteria outline the minimum operational and functional levels of service expected from proposed developments and/or upgrades.
3. **Design Methods:** Design methods describe the design methodology that is considered acceptable for the purposes of establishing the effectiveness of proposed solutions.
4. **General Specifications:** General specifications describe acceptable engineering methods that constitute a standard acceptable method of compliance with the objectives and performance criteria. This section should be read in conjunction with Wellington Water's Regional Specification for Water Services.

2.2 Definitions

For the purposes of this document, the following definitions and abbreviations shall apply.

2.2.1 Nominal pipe diameter

All pipe diameters referred to in this document are in millimetres (mm) and are nominal internal diameters unless specifically noted otherwise. Only polyethylene (PE) pipes are denoted with a nominal outside diameter and this should be post-fixed with the letters OD. For example:

63 OD	is 63 mm nominal outside diameter; and
100 mm	is 100 mm nominal internal diameter.

2.2.2 Definitions

Table 2-1 provides the terms used in this document:

Table 2-1 – Definitions

Term	Description
Annual exceedance probability	The probability of an event happening in any one year, typically expressed as a percentage (10%) as opposed to a ratio (1 in 10 years).
Aquatic receiving environment	Waters, including wetlands, which serve as a habitat for interrelated and interacting communities and populations of plants and animals.

Term	Description
Average dry weather flow (ADWF)	The average sanitary flow in the wastewater sewer over a 24-hour period during Dry Weather.
Building line restriction (BLR)	An angled line projecting up to the surface from below the pipeline.
Building in close proximity	Building works near new or existing public pipelines, and/or laying new or upgraded public pipelines near an existing structure or retaining wall.
Building near	Building in close proximity within a horizontal distance of 3 m measured from the outside of pipe, or within 5 m for pile driving (see **Figure 3-2**).
Building over	Building in close proximity within a vertical height above the finished ground over a pipe that equals the depth to pipe invert plus 1 m, with a minimum height of 2.4 m, and a vertical depth of 300mm below the pipe invert (see **Figure 3-2**).
Building over and near	Building works within a zone around a pipe bounded horizontally by the lateral distance defined as building near, and the vertical height and depth defined as building over (see **Figure 3-2**).
Building works	Structures, retaining walls, or any other works which may compromise the integrity, durability or accessibility of a pipe, or be compromised by a pipe. This includes new buildings and structures, modification of existing structures, demolition, temporary works including heavy machinery, excavation works and any work that changes the current form and shape of the ground.
Bulk water pipeline	Water supply pipeline from the water treatment plants to the network. The pipes are usually larger than 375 mm and can be as large as 1400 mm in diameter. Also referred to as “bulk main”.
Commissioning	In regard to water supply, a process by which agreement is reached that the installed system meets the design performance specification.
Council	The participating territorial authority within which the boundaries of the proposed scheme or renewal is located; or a delegated representative thereof (e.g., Wellington Water).
Culvert	A pipe, typically passing under a road or embankment, which links two open watercourses.
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.
Developer	An individual or organisation having the financial responsibility for the project and includes the owner, contractor and constructor.
Drainage	Wastewater or stormwater pipework, channel or stream, and drain has a corresponding meaning.

Term	Description
Grey water	The wastewater from sinks, basins, baths, showers and similar appliances but not including any toilet waste.
Household unit or dwelling unit	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.
Hydraulic neutrality	Land development, including increased imperviousness, does not increase the peak design discharge (post development) to greater than the peak design discharge (pre-development) for all events up to and including the 1% AEP rainfall including the predicted impacts of climate change.
Lateral	The private, domestic drain connecting to the public wastewater or stormwater network.
Local/minor roads	All other roads which are not primary or secondary arterial roads.
Network	All pipes, pumping stations, fittings, reservoirs, structures, treatment facilities and any other appurtenant components or facilities directly associated with water supply, wastewater or stormwater.
Maximum day	Shall be a day where the water demand is greatest and the hydraulic grade line of the network is drawn down to its lowest operating level. A Maximum Day would typically be a hot, dry day in the February – March period of summer.
On-site disposal	The treatment and disposal of wastewater or stormwater within the boundaries of a private lot, typically residential.
Overland flow	See 'secondary flow'.
Potable water	Drinking water as defined in the Health (Drinking Water) Amendment Act 2007.
Point of supply	The legal boundary between private and public water supply as defined in each councils' water supply by-law.
Primary flow	The estimated stormwater flow resulting from the event outlined by the primary level of service, and is typically fully contained within the Primary Network.
Primary network	The stormwater network designed to collect and dispose of the primary flow without surcharging/overflowing.
Primary arterial	Roads providing interconnections between major sectors of a large area linked with external areas, and that distribute traffic from major intercity links. Defined by the roading and traffic department, but typically has traffic volumes of 7,000 to 10,000 vehicles per day with a significant number of heavy vehicles. Includes state highways.

Term	Description
Principal main	A water main, typically 100 to 200 mm in diameter, that provides the firefighting and majority of supply in a street. Sometimes called a distribution or secondary main.
Pumping station (in water supply)	A facility for mechanically increasing pressures in a pipeline. Typically used to fill reservoirs or increase pressures in a distribution zone.
Pumping station (in wastewater)	A facility for mechanically increasing pressure in a pipeline, or to lift effluent to a higher elevation in an adjacent manhole (lifting station). Typically used to convey collected effluent to an adjacent catchment or large sewer.
Pumping station (in stormwater)	Similar to pumping station (wastewater) but designed to convey the stormwater to a safe discharge point.
Regional plan	Planning document developed to assist a regional council to carry out any of its functions in order to achieve the purpose of the Resource Management Act 1991.
Reticulation main	A water main that distributes water to customer connections. Could be either a principal main or rider main.
Rider main	A water main, typically less than 100 mm in diameter, and secondary to any principal main in a street.
Rising main	A dedicated pipeline running between a pump's discharge and a nominated discharge point; typically a reservoir in water supply systems, or a manhole on a gravity drain for wastewater systems.
Supervisory control and data acquisition (SCADA)	The council owned and operated telemetry and control systems used to remotely monitor and control facilities such as pumping stations, reservoirs, large-scale metering installations etc.
Secondary arterial	Roads providing access to primary arterial roads. They have a dominant through vehicular movement and carry the major public transport routes. Defined by the roading and traffic department.
Secondary flow	The excess stormwater flow that cannot be contained by the primary network, typically due to extraordinary design storm or network blockage. Also referred to as overland flow or secondary overland flow.
Serviceability limit state (SLS)	In relation to seismic resilience, is defined in **Section 3.7.3.1 Definition of limit states**.
Service valve	An isolation (water shut off) valve where a potable water connection is made between the public water supply (in the street) and the private dwelling or commercial building. Sometimes referred to as a "toby".
Sewer	A pipe that conveys wastewater/sewage, typically using gravity. Could also be called a sewer drain.

Term	Description
Stormwater	Rainwater that does not soak into the groundwater or evaporate, but flows via overland flow, interflow, channels or pipes into a defined channel, open watercourse or a constructed infiltration facility.
Subdivision	The subdivision of land as defined in the Resource Management Act 1991.
Subsoil drain	A drain that is designed to control groundwater levels. It achieves this through the infiltration of groundwater into the pipe, typically through perforated walls or porous joints. It does not collect and transport surface runoff.
Toby	The water shut-off valve, generally located at the boundary of a property, that sits between the public water main and a private water pipe.
Trunk main (in water supply)	A water main typically 300 mm or greater in diameter designed to transport water between reservoirs, distribution zones, source waters and reticulation mains. Sometimes called a transmission main or primary main.
Ultimate limit state (ULS)	In relation to seismic resilience, is defined in **Section 3.7.3.1 Definition of limit states**.
Wastewater (sewage)	Water that has been used and contains unwanted dissolved and/or suspended substances from communities, including homes and businesses and industries.
Water supply	Water distributed for domestic, commercial, industrial and firefighting purposes.
Wellington Water	Wellington Water (abbreviated from Wellington Water Limited), when referred to as an entity, shall also mean the relevant territorial authority in relation to water services asset ownership and approvals; or the Engineer or Principal in relation to contractual approvals.

2.2.3 Abbreviations

Table 2-2 provides the abbreviations used in this document:

Table 2-2 – Abbreviations

Abbreviation	Description	Unit
ADWF	Average dry weather flow	L/s
AEP	Annual exceedance probability	%
ARI	Average recurrence interval	years
AS	Australian Standard	
AS/NZS	Australian/New Zealand Standard	
BLR	Building line restriction	

Abbreviation	Description	Unit
CBD	Central business district	
DN	Nominal diameter	mm
DICL	Concrete lined ductile iron	
GWRC	Greater Wellington Regional Council	
h_d	Head loss due to change	m
h_f	Head loss	m
h_j	Head loss due to junction	m
h_n	Nominal head loss	m
hr	Hour	hour
H	Head (water column measured in metres)	m
ha	Hectare	ha
HCC	Hutt City Council	
km	Kilometre	km
kPa	Kilopascal	10^3Pa
L	Litre	L
LINZ	Land Information New Zealand	
m	Metre	m
mPa	Megapascal	10^6Pa
m/s	Metres per second	ms^{-1}
m^3/s	Cubic metres per second	m^3s^{-1}
mm	Millimetres	mm
MSL	Mean sea level (1953 Wellington Vertical Datum)*	m
NCD	WCC New City Datum (same datum as MSL)	m
NPV	Net present value	
NZBC	New Zealand Building Code	
NZS	New Zealand Standard	
NZTM	New Zealand Transverse Mercator	
NZVD2016	NZ vertical datum	
OD	Outside diameter	mm
PCC	Porirua City Council	
PDWF	Peak dry weather flow	L/s
PE	Polyethylene (generic)	
PE80b	Medium density PE (MDPE)	

Abbreviation	Description	Unit
PE80c	High density PE (HDPE)	
PE100	High performance PE (HPPE)	
PN	Nominal pressure	bar
PP	Polypropylene	
PRV	Pressure reducing valve	
PVC	Polyvinyl chloride (generic)	
PVC-M	Modified polyvinyl chloride	
PVC-O	Molecularly oriented polyvinyl chloride	
PVC-U	Unplasticised polyvinyl chloride	
PWWF	Peak wet weather flow	L/s
RRJ	Rubber ring joint	
RSWS	Regional Standard of Water Services	
s	second	s
SCADA	Supervisory control and data acquisition	
SDR	Standard dimension ratio	
SLS1	Serviceability limit state 1	
SLS2	Serviceability limit state 2	
STCL	Concrete lined steel	
SWDC	South Wairarapa District Council	
$\mathbf{T_c}$	Time of concentration	T_c
$\mathbf{T_f}$	Time of pipe and channel flow	T_f
$\mathbf{T_g}$	Time of gutter flow	T_g
$\mathbf{T_o}$	Time of overland flow	T_o
UHCC	Upper Hutt City Council	
ULS	Ultimate limit state	
v:h	Vertical to horizontal	v:h
WCC	Wellington City Council	

* Note: Tide levels listed in Tide Tables published by Land Information New Zealand use a Wellington Standard Port zero datum equivalent to -0.929 m MSL or 3.551 m below benchmark K80/2 (LINZ code ABPC – updated Feb 2018). The actual average measured sea level is currently measured at around 1.12 m above Wellington Standard Port datum or 0.191 m MSL (1953 Wellington Vertical Datum).

2.2.4 Pipe gradients

This document generally uses a percentage to represent pipe or channel grades as opposed to a ratio (i.e., 1% instead of 1 in 100 (v:h)). The percentage grade can be calculated by dividing the ratio's vertical component by the horizontal component and multiplying by 100. Conversions are presented in **Table 2-3**.

Table 2-3 – Conversion table

Grade %	Grade ratio
0.33%	1 in 300
0.5%	1 in 200
1%	1 in 100
2%	1 in 50
5%	1 in 20
10%	1 in 10
20%	1 in 5
25%	1 in 4
50%	1 in 2

2.3 References

Various documents and standards including, New Zealand (NZS), Australian (AS) and joint (AS/NZS) standards are referenced in this document. Where a standard's year has been nominated, then that specific issue is to be used. Where no year is nominated, the latest version is to be used. Standards and documents relevant to this document are listed in **Table 2-4.**

Table 2-4 – Referenced documents and standards

Reference	Title
Regional Specification for Water Services (R.Spec)	Wellington Water Regional Specification for Water Services [IMMP-47]
As-Built Specification	Wellington Water Regional As-Built Specification [IMMP-48]
Draughting Manual	Wellington Water Regional Draughting Manual [IMMP-49]
AS/NZS 1170	Structural design actions
C-SP-AE-64322	KiwiRail – Civil specification installation of utility structures on railway land
GD2021/007	Stormwater soakage and groundwater recharge in the Auckland Region
ISO 16134	Earthquake- and subsidence-resistant design of ductile iron pipeline
NZBC	New Zealand Building Code

Reference	Title
NZS 3106	Design of concrete structures for the storage of liquids
NZS 4517	Fire sprinkler systems for houses
NZS 4541	Automatic fire sprinkler systems
SNZ PAS 4509	New Zealand Fire Service Firefighting Water Supplies Code of Practice
SP/M/022	Waka Kotahi NZ Transport Agency Bridge Manual
TR2013/035	Auckland Council Unitary Plan stormwater management provisions: Technical basis of contaminant and volume management requirements

3 GENERAL REQUIREMENTS

This document is governed by the requirements of the Local Government Act 2002 and is given effect through resource consent conditions, regional and district plans and bylaws.

Reference shall be made to this document when planning and designing new stormwater, wastewater and water supply infrastructure and for the renewal, upgrade or decommissioning of existing infrastructure. Where council's subdivision or development codes of practice are inconsistent with this document, the provisions within this document shall take precedence.

3.1 Subdivision requirements

Requirements relating to the overall subdivision process, urban planning and other council utilities and services can be found in each council's subdivision codes and policy documents. Reference shall be made to these documents and their requirements when using this document.

3.2 Legislative and regulatory requirements

The requirements of this Regional Standard of Water Services (RSWS) shall be read subject to the provisions of the latest versions and amendments of any applicable legislation and regulations, including, but not limited to:

(a) Building Act 2004, Building Regulations, and New Zealand Building Code (NZBC) 1992
(b) Civil Defence Emergency Management Act 2002
(c) Climate Change Response (Zero Carbon) Amendment Act 2019
(d) Energy Efficiency and Conservation Act 2000
(e) Fire and Emergency New Zealand Act 2017
(f) Health (Drinking Water) Amendment Act 2007
(g) Health and Safety at Work Act 2015 and related regulations
(h) Land Drainage Act 1908
(i) Local Government Act 1974 and Local Government Act 2002, and related council by-laws and policies
(j) Resource Management Act 1991, including all applicable National Environmental Standards, regulations and regional and territorial planning documents
(k) Soil Conservation and Rivers Control Act 1941
(l) Utilities Access Act 2010, National Code of Practice for Utility Operators' Access to Transport Corridor and the Installation of Utility Structures on Railway Land.

Other documents are referenced throughout this document at the relevant section.

3.3 Alternative solutions

Innovative, alternative solutions are encouraged and will be considered where the proposed scheme can demonstrate compliance with both the objectives and performance criteria as set out in this document. It must be proven that the performance, maintenance and long-term economic outcomes are equivalent, if not better than the 'standard' solutions presented in the Design Methods and General Specifications sections within this document, as well as complying with the urban planning objectives set by the council.

Acceptance of alternative solutions will be at the discretion of Wellington Water. The form of alternative solutions should be discussed with Wellington Water at an early stage of design.

3.3.1 Carbon reduction

The Climate Change Response (Zero Carbon) Amendment Act 2019 sets a domestic greenhouse gas emission target for New Zealand to reduce net emissions of all greenhouse gases (except biogenic methane) to zero by 2050, and to reduce emissions of biogenic methane to 24–47 per cent below 2017 levels by 2050, including to 10 per cent below 2017 levels by 2030. To help achieve this target, Wellington Water will specifically encourage alternative solutions that reduce carbon emissions.

3.4 Health and Safety in Design obligations

The requirements of the Health and Safety at Work Act 2015 and the Health and Safety at Work Regulations shall be observed at all times. Designers shall follow a Safety in Design Process approved by Wellington Water. Wellington Water's Safety in Design process is available online.

All designers so far as reasonably practicable must design all plant, substances or structures without risk to the health and safety of persons who use, handle, store, construct, or who carries out any foreseeable activity for inspection, cleaning, maintenance, or repair for the plant, substance or structure as designed, in accordance with the Health and Safety at Work Act 2015.

Infrastructure shall be designed so that:

(a) No harm shall occur to design staff.

(b) No harm shall occur to workers during its construction.

(c) No harm shall occur to public during its construction.

(d) No harm shall occur to workers and the public during its operation.

(e) No harm shall occur to workers during or following its de-commissioning and removal.

3.5 Application and approvals

Developers are encouraged to discuss their proposed scheme with Wellington Water prior to concept design to ascertain requirements or pertinent considerations relating to their proposal.

This document does not cover the applications and approvals process. Each council has its own subdivision application and approvals process by which the applicant must abide. Compliance with the provisions in this standard does not imply acceptance of the asset for vesting or compliance with the subdivision consent.

3.6 Customer outcomes and service goals

The Regional Standard for Water Services provides developers with the design standards so that Wellington Water can manage the three waters infrastructure to meet Wellington Water's customer outcomes and service goals outlined in **Figure 3-1**.

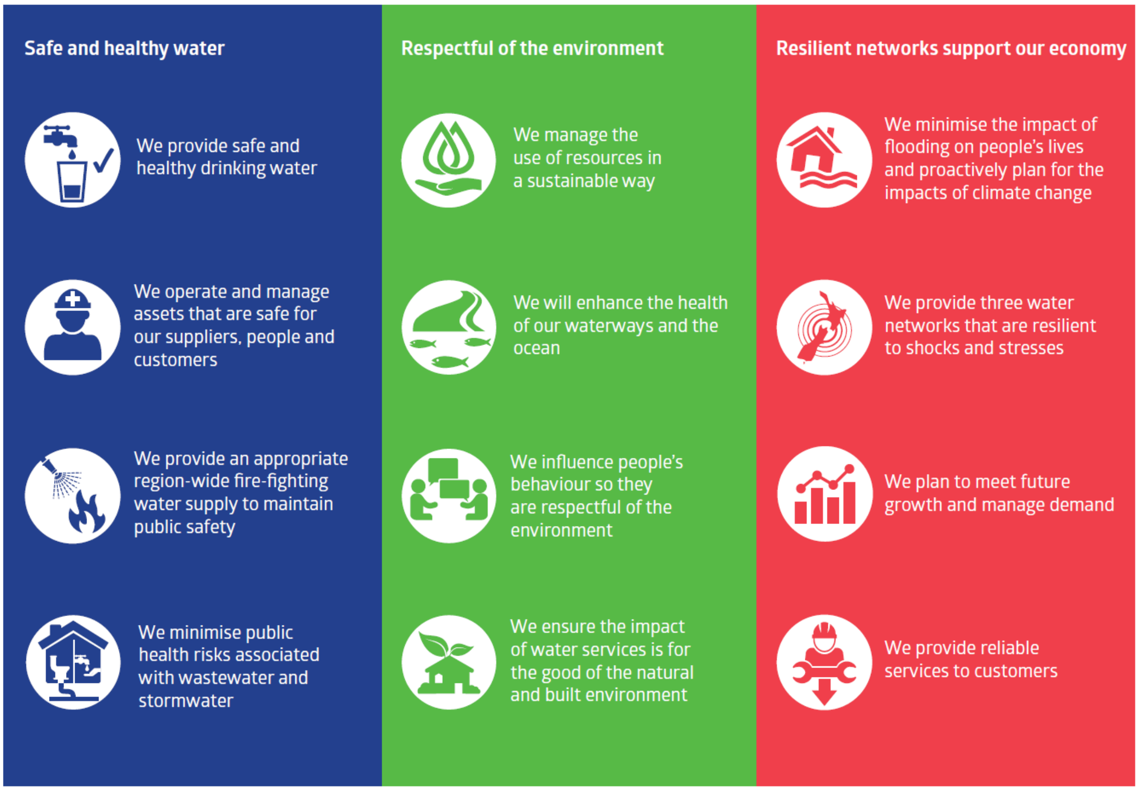

Figure 3-1 – Wellington Water's customer outcomes and service goals

3.7 Seismic resilience

The following applies to seismic resilience:

(a) Seismic resilience is required to be considered for the design of new and upgraded assets.

(b) Seismic resilience extends to pipelines, structures, other facilities and any associated fixtures and fittings.

(c) Design of a seismically resilient asset shall consider:

  (i) Design earthquake (i.e., magnitude);

  (ii) Ground conditions (i.e., risk of liquefaction);

  (iii) Proximity to faults; and

  (iv) Required level of resilience.

(d) The required level of seismic resilience is dictated by the seismic criticality, which is the asset criticality following a seismic event (see **Section 3.7.4 Determination of seismic criticality**).

(e) A seismically critical asset must be afforded greater resilience in design than a seismically non-critical asset.

(f) Seismic criticality is determined by the possible consequences of failure, both immediately after the event and during recovery.

3.7.1 Design earthquake

The design earthquake will be as defined in AS/NZS1170 or the Waka Kotahi NZ Transport Agency Bridge Manual as appropriate. Consideration should also be given to ground displacements.

Known fault zones can be accessed from the Greater Wellington Regional Council open data source[1].

3.7.2 Risk of liquefaction

The risk of liquefaction shall be determined using:

(a) The Greater Wellington Regional Council liquefaction potential mapping, which can be accessed from the Wellington Region Liquefaction Potential open data source[2].
  (i) Ground that has moderate, high, or very high liquefaction risk is considered liquefiable.

(b) Geotechnical analysis for large projects shall be used to determine whether the ground is liquefiable or non-liquefiable.

3.7.3 Design standards

There are two main design standards in New Zealand for design of seismically resilient structures: AS/NZS 1170 and the Waka Kotahi NZ Transport Agency Bridge Manual. In addition, NZS 3106 is relevant for the design of concrete structures holding liquids (such as reservoirs). The NZBC and NZS 4219 are also relevant.

3.7.3.1 Definition of limit states

In addition to the definitions from AS/NZS 1170 for seismic resilience, the following definitions are specific to reservoirs:

(a) The serviceability limit state 2 (SLS2) of a reservoir shall be defined as the reservoir retaining its contents with no leakage following a SLS2 level of shaking.

(b) The ultimate limit state (ULS) of a reservoir (inclusive of roof) shall be defined as limited cracking and leakage, and the structure's stability is not seriously affected by the damage.

3.7.4 Determination of seismic criticality

A pipeline or structure is considered seismically critical if any of the following criteria apply:

(a) Water supply pipes and structures supplying drinking or firefighting water to 500 or more people (or 175,000 L/day if non-residential).

(b) Any pipe or structure specified by Wellington Water as seismically critical.

(c) Note that wastewater and stormwater assets are not generally considered seismically critical unless specifically identified as per (b) above.

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[1] *https://data-gwrc.opendata.arcgis.com/datasets/fault-hazard-zone-for-the-wellington-fault-wellington-nz-1*

[2] *http://data-gwrc.opendata.arcgis.com/datasets/wellington-region-liquefaction-potential*

Refer to **Section 3.7.6 Seismically resilient structures** for examples of what is considered a structure.

3.7.5 Seismically resilient pipelines

A pipeline is a linear asset intended to convey a fluid such as water. Wellington Water pipeline assets are typically buried underground. For the purposes of this clause, above ground pipelines are considered structures.

The following applies when designing new pipelines:

(a) Designers shall consider ground conditions and choose a seismically resilient solution appropriate to the ground conditions (refer to **Table 3-1**).

(b) The behaviour of pipelines laid in liquefiable ground is significantly different to pipelines laid in non-liquefiable ground. Experience during previous earthquakes is that approximately 80% of pipe failures occurred in liquefiable ground.

(c) For seismic resilience, pipelines shall be designed to resist the effects of:

- (i) Ground shaking
- (ii) Liquefaction
- (iii) Lateral spreading
- (iv) Slope failure (including under-slip and over-slip)
- (v) Tsunami (including inundation by the advancing wave and scour due to the receding wave)
- (vi) Settlement (including differential settlement).

(d) For the purposes of seismic resilience design, above-ground pipes are to be considered structures (see **Section 3.7.6 Seismically resilient structures**).

3.7.5.1 Definition of a seismically resilient pipeline

A 'seismically resilient pipeline' refers to a pipeline that can:

(a) Reasonably expected to achieve a minimum level of service specified for the type of pipeline following a severe movement of the Wellington Fault, or another relevant fault, where:

- (i) The minimum level of service for a pressure pipeline is specified as: the pipeline shall remain in full operation without significant deformation or leakage.
- (ii) The minimum level of service for a gravity sewer pipeline is specified as: the pipeline shall remain in partial operation and be resilient to significant infiltration.
  1. Where partial operation is defined as: being able to continue to transport limited flows, even where loss of grade results in some back-up. Such a pipeline may require regular jetting to remain operational, but will contribute to the removal of sewage flows from secondary (overland) flow paths.
  2. Where resilient to significant infiltration is defined as: where pipes are constructed in liquefiable ground that may cause unrestrained pipe joints to open, the pipe is continuous, has restrained joints or is

protected from inflow of liquefied soils which may temporarily, or permanently block the pipeline.

(iii) A severe movement of the Wellington Fault is defined as: An event where ground displacements of at least 4-5 m in the horizontal direction and 1 m in the vertical direction occur at one or more locations along the fault.

(b) Be easily and quickly repaired with limited materials and plant that can reasonably be expected to be readily available following a severe seismic event.

(c) Be easily maintained during the normal operational life of the pipeline.

(d) Have manholes designed in accordance with Wellington Water's Regional Specification for Water Services.

This definition:

(e) Acknowledges that pipelines in the following locations will require significant specialist design to create a seismically resilient pipeline:

(i) Immediately adjacent to any fault (considered to be within 75 m of the fault)[3]

(ii) Laid across any active fault[4]

(iii) Laid along any active fault[5]

(iv) Installed on a structure such as a bridge

(v) Installed inside host, encasement or carrier pipes[6].

(f) Focuses on the structural resilience of the pipeline rather than the configuration of the network. For example, redundancy loops and location of valves are not relevant to this definition.

(g) Applies to the pipelines and their embedment rather than ancillary structures such as pump stations and large valve chambers, which constitute transitions between mobile and fixed elements. Bedding types can result in specific vulnerabilities. These must be assessed individually.

3.7.5.2 Design of seismically resilient pipelines

The following applies to the design of seismically resilient pipelines:

(a) Design is dependent on two factors:

(i) Seismic criticality of the pipeline (see **Section 3.7.4 Determination of seismic criticality**)

(ii) Seismic hazard of the ground surrounding the pipeline.

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[3] *These pipelines are expected to experience ground shear and shall be assessed individually. Refer to **Section 3.7.1 Design earthquake.***

[4] *These pipelines are expected to experience ground shear and shall be assessed individually. Refer to **Section 3.7.1 Design earthquake.***

[5] *These pipelines are expected to experience ground shear and shall be assessed individually. Refer to **Section 3.7.1 Design earthquake.***

[6] *These pipelines are expected to experience ground shear and shall be assessed individually. The shear conditions entering and exiting are uncontrolled.*

(b) As part of post-disaster planning, Wellington Water has determined that all water supply and wastewater pipes are to be resilient, irrespective of seismic criticality. For these pipes, the seismic hazard of the ground is the determining factor.

(c) Pipe materials are to be selected as outlined in **Table 3-1**.

Table 3-1 – Selection of resilient pipe materials

<table>
<tr><th></th><th>Seismic criticality</th><th>In liquefiable ground</th><th>Non-liquefiable ground</th></tr>
<tr><td rowspan="3">Water supply</td><td>Distribution network</td><td>• Steel with fully restrained joints[1]
• Welded PE
• DI with seismically resilient joints (refer to Section 3.7.5.3 Ductile iron pipe joints)</td><td>As per Approved Products Register</td></tr>
<tr><td>Bulk water network ≤ DN 300</td><td>• Steel with fully restrained joints[1]
• Welded PE (including 355 mm OD)
• DI with seismically resilient joints (refer to Section 3.7.5.3 Ductile iron pipe joints)</td><td>• Steel with fully restrained joints[1]
• Steel with unrestrained joints
• Welded PE (including 355 mm OD)
• DI with fully restrained joints</td></tr>
<tr><td>Bulk water network > DN 300</td><td colspan="2">• Steel with fully restrained joints[1]
• DI with seismically resilient joints (refer to Section 3.7.5.3 Ductile iron pipe joints)
• Welded PE (refer to Table 6-3 for allowable nominal pipe diameters)</td></tr>
<tr><td>Wastewater</td><td>All pipes</td><td>Welded PE</td><td>As per Approved Products Register</td></tr>
<tr><td>Stormwater</td><td>All pipes</td><td>As per Approved Products Register[2]</td><td>As per Approved Products Register</td></tr>
</table>

[1] Steel pipe with fully restrained joints (butt weld, lap joint with internal and external welds, welding band with internal and external welds, flange joint)

[2] In areas subject to liquefaction where the ground containing the pipeline could suffer from lateral spread, the designer should give consideration to use of welded PE or end restraints.

Note: Pipes under or near buildings are to have special consideration of materials, installation, and future repair (see **Section 3.8 Building in close proximity to public pipelines**).

(d) For drainage pipes where the embedment of the pipe is wrapped, it is not a requirement to wrap joints with filter fabric to prevent the ingress of material due to joint separation. If embedment wrap is not specified, unrestrained joints shall be wrapped where pipes are constructed in liquefiable ground.

(e) In addition, the designer shall provide consideration of:

(i) Where possible, minimising the depth of services to facilitate repair.

(ii) Specification of inserts for mechanical joints in PE pipes. The inserts achieve fully end load resistant joints so that displacement can be transferred from the joint or fitting into the barrel of the pipe. The pipe barrel can accommodate greater deformation so this reduces the risk of failure.

(iii) Alternative technologies where they would significantly increase resilience or reduce time to repair (e.g., pressure sewer systems).

(iv) Network resilience (e.g., additional isolation valves for pressure systems at the transition between high and low hazard areas to enable quick isolation of damaged sections and continued functionality of undamaged sections).

(f) Where pipe lining for wastewater pipes is determined to be the preferred renewal methodology, pipes that are rehabilitated with a fully structural liner will be considered to comply with the seismic resilience requirements in this clause and will not require a deviation from the standard.

(g) Pipe lining of water supply pipes as a preferred renewal method will be considered on a case-by-case basis in relation to seismic resilience requirements.

3.7.5.3 Ductile iron pipe joints

The following applies to seismically resilient ductile iron pipe joints:

(a) Seismically resilient ductile iron pipe joints shall comply with ISO 16134 *Earthquake- and subsidence-resistant design of ductile iron pipelines* and the class of pull-out resistance, rotation and elongation identified.

(b) In liquefiable ground, ductile iron pipe joints should be able to meet:

(i) The highest classification of ISO 16134 at Class S-1 for expansion/contraction performance

(ii) Class A for pull out resistance

(iii) A minimum joint deflection angle of 3 degrees.

3.7.5.4 Pipes at fault crossings or in areas with lateral spread

The following applies to pipes at fault crossings or with lateral spread:

(a) Standard design approaches may not be appropriate, and a more considered review of the design is required to assess pipe seismic resilience, where pipes are laid:

(i) Across, along, or within 75 m of an active fault line or

(ii) In an area where significant slope failure, ground settlement or lateral spread is expected.

(b) If these pipes are seismically critical (see **Section 3.7.4 Determination of seismic criticality**), the designer shall undertake a specific design to allow for the expected ground movement. This design shall be undertaken in consultation with Wellington Water.

(c) Where a pressure pipe is expected to fail due to significant ground movement, the designer should specify isolation valves spaced at least 75 m either side of the fault to allow for isolation of the damaged pipe.

3.7.6 Seismically resilient structures

A structure is typically a non-linear asset. Structures that form part of the three waters network include pumping stations, reservoirs, telemetry buildings, treatment plants, pipe bridges, valve chambers, above-ground pipes and emergency stores. For the purposes of this clause, standard manholes are not considered to be structures.

For assets that are comprised of more than one structure, such as wastewater and water supply treatment plants, the designer shall undertake an assessment of individual buildings and determine the seismic criticality of each building in consultation with Wellington Water.

3.7.6.1 Definition of seismically resilient structures

Structures are considered seismically resilient if they meet the requirements of AS/NZS 1170 for serviceability limit states (SLS1 and SLS2) and ULS relating to earthquake loading. Note that Wellington Water has modified the SLS2 return period for reservoirs in **Table 3-2**.

3.7.6.2 Design of new resilient structures

The following applies when designing new resilient structures:

(a) New structures are to be designed in accordance with **Table 3-2,** based on the requirements of AS/NZS 1170. Refer to **Section 3.7.3.1 Definition of limit states** for definitions of SLS1, SLS2 and ULS.

Table 3-2 – Design criteria for new structures

	Seismic criticality	IL	Design working life	SLS1	SLS2	ULS	Durability requirements
Water supply	Seismically critical	IL4	100 years	1/25	1/1000	1/2500	100 years
	Seismically non-critical	IL3	100 years	1/25	-	1/2500	100 years
	Ancillary structures[1]	IL2	50 years	1/25	-	1/500	50 years
Wastewater/ Stormwater	Seismically critical[2]	IL4	100 years	1/25	1/500	1/2500	100 years
	Seismically non-critical	IL3	100 years	1/25	-	1/2500	100 years
	Ancillary structures[1]	IL2	50 years	1/25	-	1/500	50 years

[1] Ancillary structures shall be defined as any structures which are not required for the operation of the network, either during normal operation or following a seismic event. The designer must have agreement in writing with Wellington Water prior to designating any structures as ancillary for seismic design.

[2] As determined on a case-by-case basis under **Section 3.7.4 Determination of seismic criticality.**

(b) When designing for SLS2 limit states, it should be noted that all permanent internal fixtures (switchboards, HVAC systems, etc.) which are required for the operation of the structure must also meet the SLS2 requirements.

(c) Where possible, the designer shall avoid placing structures within 75 m of a known fault (refer to **Section 3.7.5.1**(e) **Definition of a seismically resilient pipeline**).

(d) When designing structures in tsunami-prone areas, the effects of a tsunami should also be considered.

   (i) Specifically, pipe bridges may be high risk due to their location.

   (ii) Where required, specialist design of structures for tsunami resilience is to be agreed with Wellington Water.

3.7.6.3 Site-specific seismic hazard analysis

The following applies to site-specific seismic hazard analysis:

(a) For in-ground (earth retaining) structures and retaining walls, a site-specific seismic hazard analysis shall be undertaken where required by the Waka Kotahi NZ Transport Agency Bridge Manual based on the value of the structure.

(b) For all other structures, a site-specific hazard analysis shall be undertaken where required by AS/NZS 1170. For IL4 structures with a design working life of 100 years or more, the design events are determined by a hazard analysis but need to have probabilities less than or equal to those for IL3 (return periods greater than or equal to those for IL3).

(c) If the designer considers that a site-specific seismic hazard analysis is recommended for a project where not required by the applicable standard, they should make this recommendation to Wellington Water and a project-specific decision can be made.

3.7.6.4 Upgrade of existing structures

The retrospective strengthening of existing seismically critical structures to IL4 will be subject to a value assessment. Wellington Water will determine the design standard for upgrading existing structures on a case-by-case basis, taking into account remaining life expectancy and seismic criticality.

In general, the following guidance will apply:

(a) Where the remaining useful life is less than ten years, the asset should be replaced with a new structure, either immediately or as part of the long-term planning.

(b) Where the remaining useful life is more than 25 years, the asset should be strengthened to the standard required for new builds.

(c) Where the remaining useful life is between ten and 25 years, the design standard is to be assessed and brought to Wellington Water for approval, taking into account the following factors:

   (i) Can the required level of service be met if this structure fails?

   (ii) Time to repair following a seismic event.

   (iii) Seismically critical facilities served by the structure.

3.7.7 Connections from pipes to structures

It is intended that pipelines connected to structures such as valve chambers, scour chambers, pump stations, manholes and reservoirs shall be able to accommodate differential settlement and differential lateral movement without failing at the connection point.

3.7.7.1 Geotechnical input

In non-liquefiable ground, structures are expected to have a much lower level of differential settlement due to ground shaking. Standard designs are typically sufficient to allow for this movement.

Geotechnical analysis is required for the following situations:

(a) In liquefiable ground, structures require site-specific geotechnical analysis to determine the differential settlement expected from a seismic event. In some cases, ground improvements may be suitable to reduce the differential settlement, however this is to be agreed with Wellington Water.

(b) Dewatering during construction may also cause ground settlement and geotechnical input is required on ground settlement due to dewatering so that it can be considered in the design.

3.7.7.2 Design of connection points

The design of connection points between pipes and structures must take into account the expected level of movement along with the seismic criticality of the structure. Connection details are to be designed as described in **Table 3-3**.

Table 3-3 – Design criteria for connection points to structures

	Liquefiable ground	Non-liquefiable ground
Seismically Critical	• Specialist design of the connection points is required to ensure sufficient flexibility for the expected differential settlement. • Flanged flexible joints detailed as suitable for seismic flexibility in the Approved Products Register such as “Flex-tend” or “GeoFlex” flexible joints may be suitable for these connections. A cost-benefit analysis will be required for these joints, especially for large gravity pipes. • Designs are to be agreed with Wellington Water. Note that the backfill must also be designed to allow for the expected movement.	• Rocker pipe assemblies* are to be specified at connection points. • For critical structures with pressure pipe connections, tie rods are required on the rocker pipe assembly.
Seismically Non-critical	• Rocker pipe assemblies* are to be specified at connection points. • In addition, the risk of failure shall be mitigated by a ‘fuse’ joint (an easily repairable weak spot in the system, designed to be the point of failure) or other means so that breaks in the main	• Rocker pipe assemblies* are to be specified at connection points.

	Liquefiable ground	Non-liquefiable ground
	can be easily isolated and repaired. • Designs are to be agreed with Wellington Water.	
Standard manholes	• For gravity systems with standard manholes, flexible connections are required as shown in the **Standard Detail DR01 – Manhole Details** in the Regional Specification for Water Services. • Rigid pipelines shall have a flexible connection within the lesser of 650 mm or twice the pipe diameter of the manhole wall. Manhole connectors shall be used for PVC pipes.	

* Rocker pipe assemblies are not typically required for PE pipes. Note: Typical details for flexible connections between structures and pipes are available from Wellington Water on request.

3.7.7.3 Power and communications supply to structures

The following applies to power and communications supply to structures:

(a) For structures that require power and/or communications to operate, the designer shall provide consideration of how these connections will be maintained following a seismic event. This could include:

- (i) Leaving an expansion loop at the connection to provide flexibility
- (ii) Permanent back-up generators
- (iii) Back-up batteries
- (iv) Redundant connections
- (v) Provision for the connection of a generator in the event of a power failure.

(b) Care shall be taken where cable ducts enter buildings to ensure ducting is not at risk of shear due to differential movement between the structure and surrounding soils. Additional slack in the cable is to be provided to accommodate movement during a seismic event.

3.8 Building in close proximity to public pipelines

This section applies to what is commonly referred to as “building over or near a public pipe”. This section also applies to laying new or upgraded pipelines near existing structures and retaining walls. This section should be read in conjunction with the relevant sections in the Regional Specification for Water Services.

Several specific terms used in this section are defined in **Section 2.2.2 Definitions**, including:

- Building in close proximity
- Building over (shown in **Figure 3-2**)
- Building near (shown in **Figure 3-2**)
- Building over and near (shown in **Figure 3-2**)
- Building works

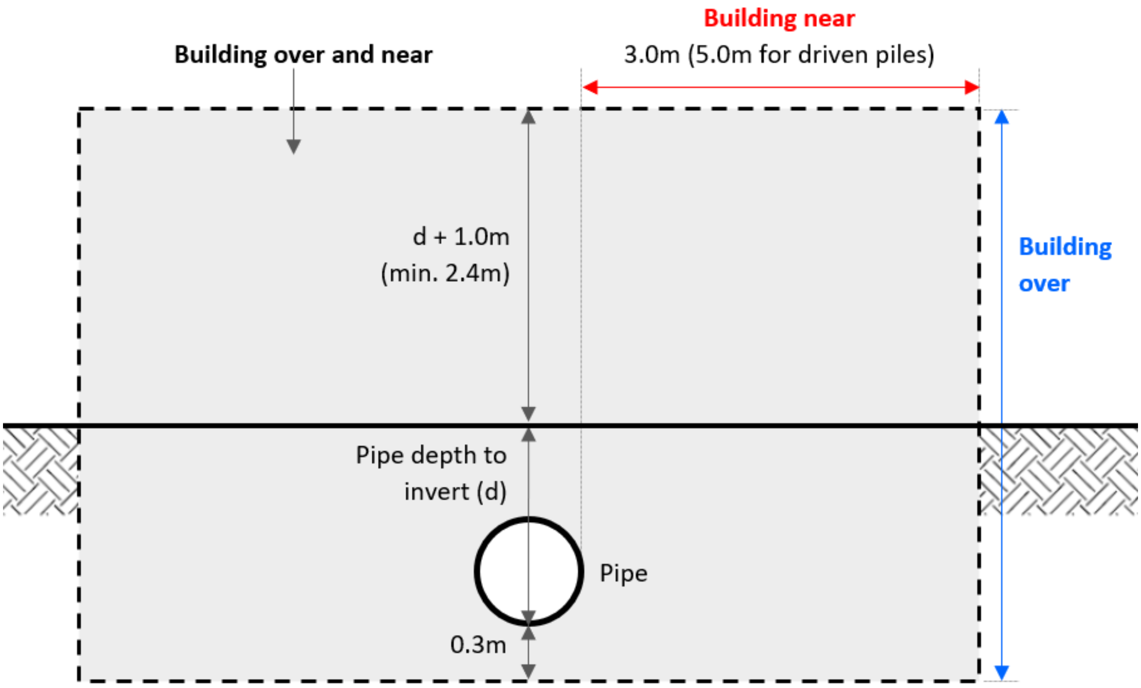


Figure 3-2 – Illustration of zones used in definitions of "Building over and/or near"

(a) This section applies to building in close proximity to live, abandoned and decommissioned public:

  (i) Wastewater pipes

  (ii) Stormwater pipes

  (iii) Water supply pipes.

(b) This section **does not** apply to:

  (i) Small buildings that:

    1. Do not exceed 1 storey or 10 square metres in floor area; and
    2. Do not contain sleeping accommodation, sanitary facilities, or facilities for the storage of potable water; and
    3. Do not have a permanent foundation; and
    4. Can be easily relocated by the owner when work is required on the pipeline underneath the building; and
    5. Are not positioned over access chambers or service connections.

  (ii) Private pipes, such as wastewater or stormwater laterals.

  (iii) Private or common (shared) wastewater or water supply pipes.

  (iv) Abandoned or decommissioned pipes that have been grout filled along the entire length that is in close proximity, to a minimum of 3 m longitudinally from any building works, and 5 m longitudinally from any pile driving.

  (v) Building works outside the building over and near zone (**Figure 3-2**) except for the requirements in **Section 3.8.1**(d) **General requirements** and **Section 3.8.1.1 Building line restriction.**

3.8.1 General requirements

The following are general requirements for building in close proximity:

(a) Building in close proximity **should be avoided where possible.** This is to prevent the possibility of:

(i) Compromising the durability of the pipe.

(ii) Interfering with future maintenance, including the ability of the network to meet future demands or levels of service.

(iii) Compromising the long-term integrity of the proposed building should the pipe fail or when work is carried out on the pipe.

(b) Where building in close proximity cannot be avoided, proposals will be assessed by Wellington Water based on council policy and consideration of the possible adverse outcomes listed in (a) above and all relevant requirements in the Regional Standard for Water Services and Regional Specification for Water Services. A proposal must address the following:

(i) All practicable alternatives to relocate the pipe or relocate the structure/retaining wall must be considered at the developer's expense.

(ii) Relaying with or without sleeving of the pipe at the developer's expense is generally required as detailed in the Regional Specification for Water Services. Geotechnical investigation or confirmation of the soil type may be required at the discretion of Wellington Water.

(iii) Prior to any works, all pipes and easements must be identified, including manholes and connections in the area. The property may also have services that Wellington Water does not manage and which need to be protected, such as utilities and easements for electricity, gas and broadband.

(iv) For pipe installations under roads or rail embankments, design and construction shall comply with the latest revisions of the NCOPUATTC and the Kiwirail Civil Specification for Installation of Utility Structures on Railway Land. In the event of any ambiguity or contradictions between this specification and the specifications named above, the more stringent requirements shall take precedence.

(v) Design of the works:

1. Shall include consideration of seismic resilience of both the pipeline and building works, in accordance with **Section 3.7 Seismic resilience**.
2. Should provide for a secondary flow path if needed and as far as practicable, in accordance with **Section 4.4.12 Easements**.
3. Should maximise the ease with which the pipe can be maintained and replaced.
4. Must take into account network structures such as chambers and manholes, maintenance access for machinery at a future date, and access to manholes.

In addition, the following restrictions apply:

(c) It is **not permitted** under any circumstances to "build over" a service connection, change in grade or change in direction within the following distances (see **Figure 3-3**):

(i) (Perpendicular to pipe alignment) 1 m horizontally from the outside of the pipe.

(ii) (Longitudinally along the pipe alignment) The greater of:

1. 1.0 m
2. Half the pipe depth to invert.

(d) Building works will generally not be permitted:

(i) from any height above a depth of 300 mm below the pipe invert and:

1. Within a horizontal distance of 1 m, measured from the outside of pipe perpendicular to the pipe alignment (see **Figure 3-4**), from:
   A. Pipelines that normally operate under pressure, such as water mains or drainage rising mains.
   B. Gravity pipes with diameters of 300 mm or greater.
2. Within a radius of 1.5 m along the horizontal plane from the centre of a manhole cover to provide access to the manhole (see **Figure 3-5**).

(ii) Where foundations are located within 1 m to 1.5 m from the outside of a pipeline (perpendicular to the pipe alignment).

1. Approval will require foundations to terminate at a depth of at least 300 mm below the invert of the pipe.

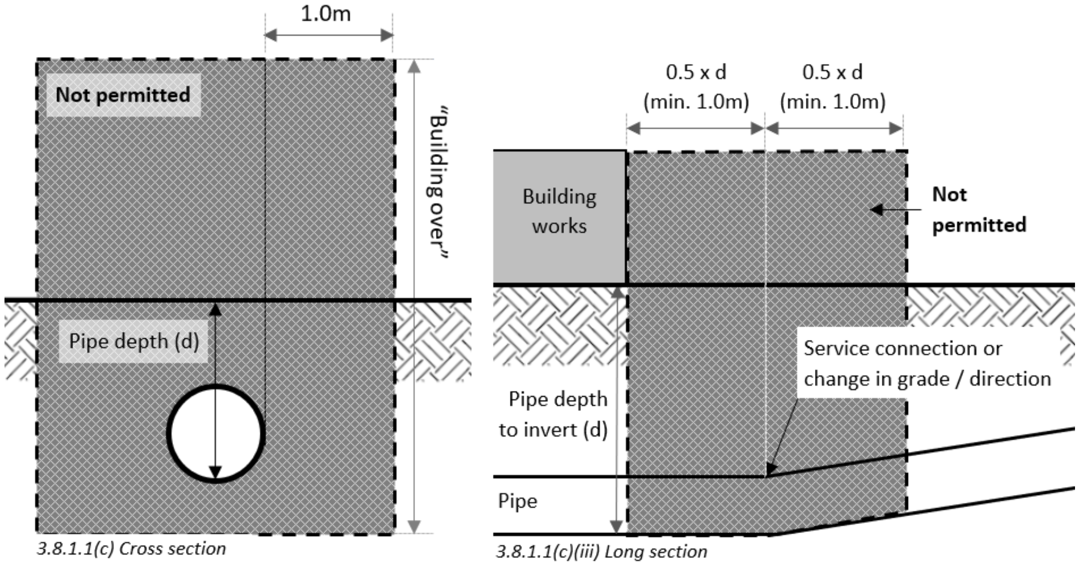
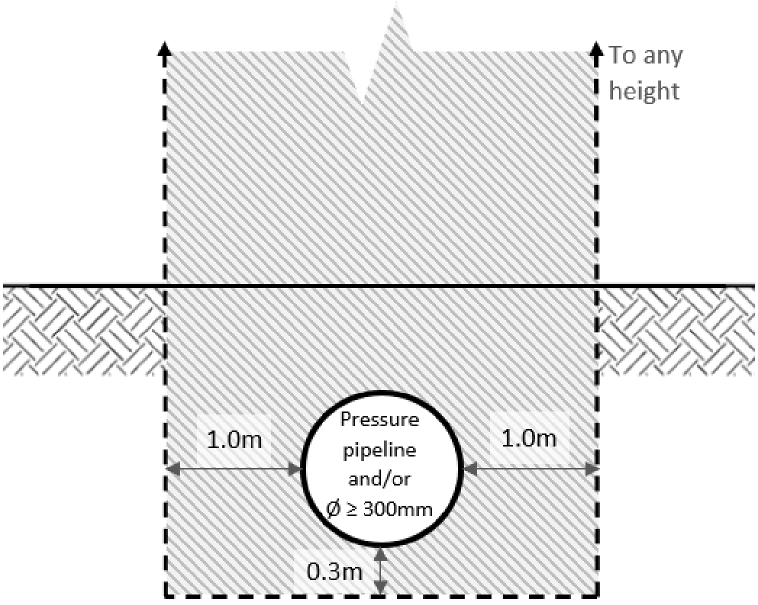
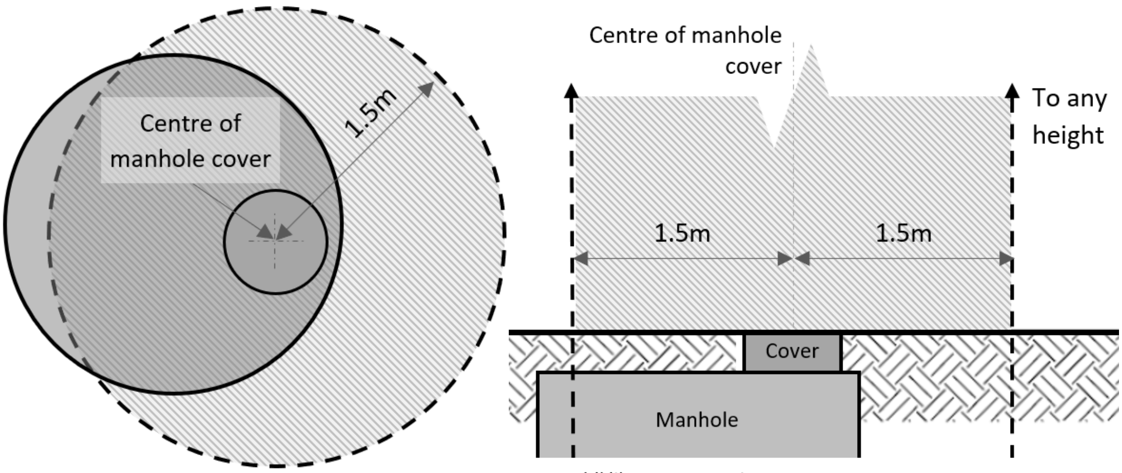


Figure 3-3 – Restrictions for building over service connections, changes in grade/direction



3.8.1.1(d)(i)1. Cross section

Figure 3-4 – Restrictions for building over pressure pipelines and gravity pipes ≥ 300 mm



3.8.1.1(d)(i)2. Plan view

3.8.1.1(d)(i)2. Cross section

Figure 3-5 – Restrictions for building over service connections and changes in grade/direction

3.8.1.1 Building line restriction

For all building works and pipelines:

(a) Where the trench will be open less than 48 hours:

(i) The origin of the building line restriction (BLR) shall be located at a point 300 mm below the invert of the pipeline and offset 0.5 x pipe OD from the pipe centreline.

(ii) From the origin, the BLR shall extend to the surface as determined by geotechnical testing or at the following typical angles:

1. Cohesive soils: 45 degrees (1 horizontal:1 vertical)
2. Non-cohesive soils: 2 horizontal:1 vertical

(b) Where a trench is likely to be open for longer than 48 hours:

(i) The origin of the BLR shall be located:

1. Vertically, at a depth of 300mm below the invert of the pipeline or at the trench base, whichever is deeper
2. Horizontally, at the edge of excavation of the trench.

(ii) The clearance required by the BLR shall be increased to comply with NZBC Clause E1/AS1. This shall be applied to all structures and retaining walls.

(c) Load bearing foundations and piles shall terminate below the BLR of any nearby public pipelines (refer to **Standard Detail DR09 – Building in Close Proximity** in the Regional Specification for Water Services and **Section 3.8.2 Laying new or upgraded pipelines near existing structures or retaining walls**).

(d) The design shall ensure no additional surcharge load is imposed on an existing or new pipe and an excavation could be made to maintain or replace a pipe without undermining the foundations of any structure.

(e) Skin friction on any segments of piles above the BLR line shall be excluded from any calculations.

(f) No horizontally orientated structural elements that apply tensile loading into the ground (e.g., tie-backs, deadmen) shall be installed where a drainage or water supply main would be within the zone of influence of the structural element.

3.8.2 Laying new or upgraded pipelines near existing structures or retaining walls

(a) Public pipes shall not be laid within 1 m of the structure or retaining wall (see **Section 4.4.5.4 Location**).

(i) When both the pipe and structure / retaining wall are existing, an exception to this requirement may be granted at the discretion of Wellington Water. To obtain this approval, the developer must meet the following conditions:

1. All practicable alternatives to relocate the pipe or relocate the structure/retaining wall must be considered at the developer's expense.
2. The reasons necessitating an exception and all alternative options considered shall be detailed in the proposal submitted to Wellington Water (**Section 3.8.1 General requirements**).

(b) Where a pipe is laid deeper than 1 m, it shall be located so all existing load bearing foundations and piles terminate below the BLR (refer to **Standard Detail DR09 – Building in Close Proximity** in the Regional Specification for Water Services).

4 STORMWATER

4.1 Objectives

To safeguard people, property, infrastructure and the environment from the adverse effects of stormwater, contaminated or otherwise, comply with goals outlined in **Section 3.6 Customer outcomes and service goals** and meet the performance criteria outlined within this document.

4.2 Performance criteria

Any scheme must demonstrate consideration and compliance with the criteria listed below.

4.2.1 Functionality

The following shall be designed for stormwater functionality:

(a) All new stormwater systems, or existing systems modified to accommodate new works, shall be designed to protect property and infrastructure from inundation or damage to the Minimum Level of Service specified in **Section 4.2.7 Secondary system level of service** and **Section 4.2.8 Freeboard**.

(b) The stormwater system shall be designed to allow for all reasonably predictable development within the upstream catchment to the level of development allowed for within the council's district plan.

(c) The network shall be a gravity network formed of pipes, channels and defined watercourses to approved discharge points within, as far as practicable, the catchment as it exists at the time of development.

(d) The system shall be designed such that there is no direct cross-contamination between the wastewater and stormwater systems or any other source of hazardous substances.

(e) No development or new drain shall cause water to be diverted from one catchment to another, either directly or indirectly and pre-application advice should be sought from Greater Wellington Regional Council.

(f) Retention or attenuation/detention facilities are required for all new development connecting to existing infrastructure and shall be designed to limit the design peak discharge from the development (post-construction) to not greater than the existing design peak discharge (pre-development) from the site for all events up to a 1% annual exceedance probability (AEP) event which shall include the predicted impacts of climate change.

  (i) Wellington Water has the right to nominate an alternative design event and event duration to mitigate specific downstream risks.

(g) The stormwater system shall be designed with adequate flexibility and special provisions to minimise the risk of damage during an earthquake or from differential settlement (see **Section 3.7.5 Seismically resilient pipelines** and **Section 3.7.6 Seismically resilient structures**).

  (i) Flexible joints are required at all junctions between rigid structures (wet wells, manholes, drywells, pumping stations, stream and bridge crossings etc.) and natural or engineered ground.

(ii) Rigid pipelines shall have a flexible connection within the lesser of 650 mm or twice the pipe diameter of the structure wall.

(iii) Manhole connectors shall be used for polyvinyl chloride (PVC) pipes.

4.2.2 Access

The following applies to access:

(a) Any proposed system shall not unduly restrict the location of any potential building or development or restrict potential development elsewhere in the catchment.

(b) Where practicable, stormwater assets shall be placed in land that is public (see **Section 4.4.5.4 Location**) or proposed to be vested. Where this is not practicable, Wellington Water may require the public stormwater asset to be protected by an easement (see **Section 4.4.12 Easements**). This criterion also applies to watercourses and secondary flow paths.

(i) Open watercourses and secondary flow paths shall also be located on public land where practicable or protected by an easement in favour of the council.

(c) Systems shall be designed such that reasonable access for regular maintenance can be made without significant damage or disruption to other utilities, land use activities and landscape values.

(d) Secondary flow paths shall be clearly defined as no-building zones.

4.2.3 Maintenance and operation

The network shall be designed such that:

(a) It is compatible with the council's existing systems, materials and maintenance practices.

(b) Gravel/debris obstructions, scouring and land instability are minimised.

4.2.4 Durability

The proposed scheme must be designed:

(a) With an asset life of 100 years, although it is accepted that mechanical components such as pumps and valves, and electrical equipment are likely to have lesser durability, nominally 20 years.

(b) In a way that minimises the life-cycle costs, inclusive of capital, maintenance, and rehabilitation costs and on the following basis:

(i) The life cycle shall be taken as 100 years for the purpose of this assessment.

(ii) Wellington Water may not necessarily accept the lowest cost option if it has a poor or limited track record for performance.

4.2.5 Climate change

All systems shall be designed to accommodate the predicted impacts of climate change (refer to the Wellington Water *Reference Guide for Design Storm Hydrology*, which is available online).

4.2.6 Primary system level of service

The primary system typically comprises piped drainage systems, formed drainage channels and soakage systems. Each system is to be designed:

(a) To accommodate the design storm to a set level of service as defined by the annual exceedance probabilities (AEPs) listed in **Table 4-1**.

(b) To the General Catchment Level of Service, and then demonstrate that the roads, sections and other considerations internal to the catchment are not inundated when the general catchment is subjected to the assigned internal event for each consideration.

(c) The catchment is the entire drainage area above the design point of concentration.

Table 4-1 – Primary level of service (AEP)

	HCC	PCC	UHCC	WCC
General catchment level of service				
Residential	10%	10%	4%	10%
Commercial/industrial	10%	10%*	4%	10%
Rural/rural residential	10%	10%	10%	10%
Internal level of service for roads				
Primary arterial	5%	1%	1%	1%
Secondary arterial	5%	5%	5%	5%
Local/minor	10%	10%	20%	20%
Bridges	2%	1%	2%	2%
Internal level of service for sections				
Open space/reserve	50%	N/A**	50%	50%
Private yards	20%	10%	20%	50%
Car parks	20%	10%	20%	20%
Internal level of service for others				
Where no secondary path is available	1%	1%	1%	1%
Key public facilities, hospitals, substations etc.	1%	1%*	1%	1%
Wastewater disposal fields	**5%**	**5%**	**20%**	**5%**

* The minimum level of service may be specified differently in the building consent depending on the buildings intended purpose. Consent requirements supersede those listed here.

** Refer to PCC parks and reserves department for required levels of service.

4.2.7 Secondary system level of service

The secondary system comprises secondary flow paths typically overland and along carriageway surfaces. The secondary systems shall:

(a) Only be required should the primary system become blocked or its capacity exceeded.

(b) Be conveyed through a combination of the primary system and secondary flow paths.

(c) Follow the required level of service for secondary systems as outlined in **Table 4-2**.

(d) Follow the maximum stormwater flow depths and velocities for access roads as outlined in **Table 4-3**.

Table 4-2 – Secondary system level of service (AEP)

	HCC	PCC	UHCC	WCC
Building floors (also see Section 4.2.9 Building floor levels to be identified)				
Housing and communal residential and communal non-residential	1%	1%	1%	1%
Commercial	1%	1%	1%	1%
Industrial	1%	1%	1%	1%
Rural residential	1%	1%	1%	1%
Roads				
Primary arterial*	2%	1%	1%	1%
Secondary arterial*	2%	1%	1%	5%
Local/minor*	5%	1%	1%	20%
Bridges and major culverts	1%	1%	1%	1%

* Flooding is allowed at these levels of service, but the road must be passable by light vehicles. The table below indicates acceptable depths and flow velocities as measured at the road centreline.

Table 4-3 – Maximum stormwater flow depths and velocities

	Max depth	Max velocity
Primary/secondary arterial road	0.1 m	2 m/s
Local/minor road	0.2 m	2 m/s
Steep local/minor roads	0.1 m	3 m/s
Walkways only	0.4 m	1 m/s

4.2.7.1 Secondary flow path

A secondary flow path is the path the stormwater would take if the primary drain was rendered inoperable or is overwhelmed by a flow exceeding the drain's design capacity. The secondary flow path shall:

(a) Be shown on the submitted design and subsequent as-built plans, including demonstrating that existing and proposed dwellings are not affected by the secondary flow during the design secondary storm event.

(b) Include a secondary inlet (if required by Wellington Water) where the primary drain's capacity is large and the consequence of overflow is great (primary flow is greater than secondary flow path capacity).

(c) Convey the secondary system level of service event, less the design capacity of the primary system, regardless of secondary intakes.

4.2.8 Freeboard

The minimum freeboard shall be measured from the top of the peak water level resulting from the design storm event, to the building platform level or underside of the floor joists or structural concrete slab of the building (see also **Table 4-2)**.

Unless Wellington Water has undertaken a formal assessment of an appropriate freeboard allowance based on sensitivity testing in a validated hydraulic model:

(a) Habitable building floors shall have a freeboard of 500 mm above the surface water of the secondary level of protection event.

(b) Commercial and industrial buildings shall have a freeboard of 300 mm.

(c) All other building freeboards shall be 200 mm.

(d) Open channels and streams shall have a minimum freeboard of 500 mm for the primary level of protection flow.

(e) Vehicle bridges shall have a freeboard of 600 mm to the underside of the bridge structure, or 1200 mm where there is a possibility of large trees in the waterway.

4.2.9 Building floor levels to be identified

The building platform and building floor levels that are required to meet the above secondary levels of protection and freeboard shall be identified on the subdivision plans for each lot within the subdivision. The floor levels shall be expressed in terms of mean sea level (MSL) or NZVD2016. Datums for MSL are outlined in **Section 2.2.3 Abbreviations**.

4.2.10 Water sensitive design

Water sensitive design, including the provision of stormwater treatment devices, is the recommended design approach for stormwater management to avoid adverse effects on receiving waterbodies. **Table 4-4** provides recommended guidance at each design phase.

Table 4-4 – Recommended guidance for water sensitive design by phase

Design phase	Recommended guidance*
Project scoping	Early engagement with the Wellington Water Land Development Team
Site assessment	Auckland City Council GD04[7]
Concept, preliminary and detailed design	Water Sensitive Design: Treatment Device Design Guideline

* Recommended guidance materials are subject to version updates and may be superseded by the development of new guidelines.

Other treatment methods and devices will be considered on a case-by-case basis. Contact the Wellington Water Land Development Team to confirm specific design criteria.

4.2.11 Environmental quality

The following applies to stormwater environmental quality design:

(a) For all land development work (including urban and rural subdivisions and land use change), the design shall include an evaluation of the post-development stormwater effects on the upstream and downstream existing and potential properties.

  (i) Upstream increases shall be negligible or shown to have no detrimental impact.

  (ii) Downstream impacts to be managed and mitigated against shall include, but are not limited to, changes in peak flow and flooding, erosion, sedimentation and contamination.

  (iii) Works will be required to address any adverse effects.

(b) In general, stormwater design should be commensurate with the intended character of the area and the environmental context. Environmental quality must be taken into account in the location and design of stormwater systems.

(c) Where practicable, and unless directed otherwise by Wellington Water, water sensitive design (see **Section 4.2.10 Water sensitive design**) should be employed to minimise the potential adverse effects of development. The following should be taken into account when considering environmental quality:

  (i) Avoid adverse effects on cultural and heritage sites.

  (ii) Preserve or protect areas of ecological significance, areas of significant habitat for indigenous flora and fauna and outstanding natural features.

  (iii) Avoid, remedy or mitigate adverse effects on freshwater ecosystems, streams and watercourses, esplanade strips, harbours and coastal maritime areas.

  (iv) Avoid, remedy or mitigate adverse effects on visual amenity.

  (v) Provide for on-site silt and sediment management, erosion control and dust control during construction.

  (vi) Provide passage for fish through or past proposed or existing infrastructure.

[7] *Auckland City Council GD04 – Water Sensitive Design for Stormwater*

(d) Pre-application advice should be sought from Greater Wellington Regional Council (GWRC) if the proposed works involve the discharge of contaminants, including sediments, into an aquatic receiving environment.

(e) Stormwater must not be discharged to the ground in a manner that may cause or contribute to ground instability.

(f) Consideration shall be given to pre-treatment of stormwater discharges to aquatic receiving environments, including harbours and inlets, to minimise potential adverse effects.

4.3 Design methods

The design methods presented here are considered 'acceptable solutions' for the purposes of developing solutions compliant with the objectives and performance criteria of this standard. Deviation from these methods will be considered with suitable evidence that the alternative method is equivalent in performance, cost and application to those presented here.

Stormwater design is presented in two parts in this document:

- Hydrological design - collection and transportation of rainfall runoff overland to a nominated point in the network.
- Hydraulic design - calculating the behaviour of the flow once inside a network.

Where the council has a stormwater management plan:

(a) The proposed scheme shall be designed in line with the objectives and philosophies of the stormwater management plan, as well as the design methods and specifications outlined in this document.

(b) The council should be contacted during the early stages of design to ascertain if an operative stormwater management plan applies in the area of interest.

(c) Certified calculations shall be made available to the council as part of any application.

4.3.1 Hydrological design

The hydrological and hydraulic assessment outlined here relates to determining the peak flow and volume for a catchment for the rainfall events required to achieve the required level of service.

For storage assessments:

(a) For all catchments the hydrologic assessment method as per the Wellington Water *Reference Guide for Design Storm Hydrology* (available online) shall be used.

(b) For larger urban catchments, or where significant storage elements (e.g. ponds) are incorporated, surface water runoff can be determined using:

  (i) Wellington Water models that cover the majority of the Wellington region (WCC, PCC, HCC, UHCC and SWDC) and can be made available upon request

  (ii) An appropriate hydrological and hydraulic model with Wellington Water's approval of the method and the proposed software to be used.

For development impact assessments or flood mitigation assessments:

(c) Wellington Water may request the modelling to be carried out as below, with (i) being the preferred method:

(i) Wellington Water models that cover the majority of the Wellington region (WCC, PCC, HCC, UHCC and SWDC) and can be made available upon request

1. The developer is to discuss requirements with Wellington Water prior to carrying out any modelling to confirm process and requirements if Wellington water models are used.
2. Wellington Water may be able to provide modelling services to the developer (depending on resource availability).

The developer may carry out their own modelling using particular software or format, but the developer is to discuss modelling requirements and software with Wellington Water prior to carrying out any modelling to confirm process and requirements.

4.3.2 Hydraulic design

*(Parts of the hydraulic design presented here are also applicable to wastewater hydraulic design in conjunction with the provisions outlined in **Section 5.3.2 Hydraulic design)***

The designer may use the Manning's Formula for hydraulic calculations as outlined in **Appendix 1**. The Colebrook-White method is not suitable for free-surface or open channel flow, but is not specifically excluded from use where a suitable situation is presented.

The hydraulic design must consider:

(a) An allowance for air entrainment.

(b) Losses at bends and changes in direction.

(c) Losses at pipe entries, junctions and exits.

(d) Losses through manholes and structures.

(e) Changes in grade, invert level or pipe size.

(f) The water level at the outlet due to:

  (i) Design high tide

  (ii) Flood levels

  (iii) Peak channel flow

  (iv) Other hydraulic influences.

4.3.2.1 Air entrainment

Where the pipe exceeds grades of 1 in 10:

(a) Allowances shall be made for bulking of the flow due to air entrainment.

(b) Special precautions shall be made to release the air and surplus energy. See **Appendix 1** for calculation methods.

(c) Special precautions may be required to release air in subsequent tranquil drain sections.

4.3.2.2 Losses through structures

Losses through a structure shall be compensated for through a drop in the invert level through the manhole. The drop shall be additional to the entry and exit slopes and shall be introduced gradually across the manhole.

The losses to be accounted for are:

(a) Head loss due to change in direction (h_d)

(b) Head loss due to junction (if applicable) (h_j)

(c) Nominal head loss across structure (h_n)

Therefore, the total drop (h_f) through the manhole to be accommodated shall follow:

Equation 1 $$h_f = h_d + h_j + h_n \quad \text{(m)}$$

See **Appendix 1** for acceptable methods for determining components of h_f.

4.3.2.3 Pipe inlets

The following applies to pipe inlets:

(a) Where an open stream or channel transitions to a pipe through a headwall or similar structure, the designer shall consider the hydraulic head required to ensure full pipe capacity is achieved in the receiving pipe.

(b) Many pipe entries will require additional energy, with a subsequent increase in the backwater curve, to transition the flow from a channel cross section to a pipe cross section.

(c) The TR2013/035 and NZBC Clause E1/VM1 details appropriate methods for determining the inlet and outlet hydraulics.

4.3.2.4 Culvert hydraulics

The hydraulic evaluation of stormwater culverts is outlined in the NZBC Clause E1/VM1. This method shall be used to evaluate the hydraulic performance of culverts. The following also applies to culvert hydraulics:

(a) Culverts under fills shall be of a suitable capacity to cope with the design storm with no surcharge at the inlet.

(b) Where the design storm is less than the 1% AEP flow, design checks shall be carried out under the 1% AEP design flow to assess the extent of the surcharge and to show that it will not present a risk to the stability of the adjacent embankments or increase the flooding risk to upstream properties, noting that:

   (i) If either of these situations applies, then the culvert size shall be increased to eliminate the risks.

4.3.2.5 Backflow effects and downstream level conditions

Backflow effects shall be considered in the design. Outlet design and water level conditions shall be considered in the design of discharges to existing stormwater systems and waterways and incorporate backflow prevention if necessary.

Where the proposed drain discharges:

(a) To the coast, assumed sea levels shall be the sum of (shown in **Table 4-5**):

   (i) Mean high water springs

   (ii) Projected sea level rise through to 2110 and

   (iii) Allowance for barometric rise from storms.

Table 4-5 – Design sea levels allowing for climate change

	Wellington Harbour[8]	Porirua Harbour
Mean high water springs (MSL)	0.921	0.916
+ Projected sea level rise (m)*	1.0	1.0
+ Barometric allowance (m)	0.25	0.25
= Design sea level (MSL)	2.17	2.17

* An additional 1.0 m for sea level rise has been added to the design sea level to account for an increased sea level rise due to climate change[9] through to 2110.

(b) To the public system:

(i) The peak flows of both the proposed and public drains are unlikely to coincide due to the difference in times of concentration.

(ii) The designer is required to determine the receiving waters level during the design event to facilitate backwater curve calculations.

(iii) A conservative alternative is to assume both systems peak at the same time.

(c) To the Hutt River, discussions with GWRC shall be held to establish the downstream level of the river during the design event. GWRC has a floodplain management plan and/or flood maps for, but not limited to, the following water courses:

(i) Hutt River

(ii) Waiwhetū Stream

(iii) Pinehaven Stream.

4.3.2.6 Minimum stormwater velocity

Pipes shall be laid at a grade that reduces the potential for sediment build-up. Where gradients are less than 0.5%:

(a) For trapped drains, the minimum velocity shall be 0.75 m/s at half the 50% AEP design event flow, and noting:

(i) That a trapped drain is considered as one where influent passes through a sump or sediment trap before entering the drain.

(b) For non-trapped drains, the minimum velocity shall be 0.9 m/s.

(c) Velocities as low as 0.6 m/s may be considered in areas with flat terrain on special application.

4.4 General specifications for stormwater

The following minimum specifications are designed to meet the objectives and criteria of this standard. Deviations from these specifications may be approved by Wellington Water if provided with suitable cause; however, Wellington Water reserves the right to decline alternatives if they are inconsistent with the objectives and performance criteria of this standard.

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8 *Based on LINZ's Dec 2017 revision of Standard Port Datums*

9 *From "Preparing for Coastal Change: A summary of coastal hazards and climate change guidance for local government" Dec 2017. Scenario D.*

These specifications may change as technology and legislation evolve and changes may be unpublished at the time of design and application. Wellington Water reserves the right to vary these specifications to suit the application and contemporary industry practice.

All materials used for stormwater drainage works shall be new, or in as new condition when placed.

4.4.1 Information to be provided

In addition to the council's normal subdivision application requirements, the developer shall provide evidence demonstrating compliance with the objectives and performance criteria of this document.

Operations and maintenance guidelines for any water quality and/or control structures shall be submitted to Wellington Water for approval along with other required documentation.

4.4.1.1 Calculations

The design details and calculations shall be prepared by a suitably qualified person and demonstrate that required levels of service will be achieved and sustained.

(a) Calculations presented as part of any application shall include, but not limited to:
   (i) Catchment and sub-catchment attributes and details
   (ii) Rainfall intensity
   (iii) Time of Concentration
   (iv) Catchment runoff coefficients
   (v) Flood routing
   (vi) Peak discharge
   (vii) Pipe capacities
   (viii) Consideration of the receiving environment
   (ix) Structure losses
   (x) Pipe losses
   (xi) Backwater calculations.

(b) All assumptions regarding the design and calculations shall be clearly listed.

(c) Structural calculations shall be provided to support the proposed pipe class based on:
   (i) Min/max cover
   (ii) Traffic/construction loadings
   (iii) Surcharge conditions
   (iv) Bedding and surrounds.

(d) The developer shall provide calculations where scour may occur. The NZBC Clause E1/VM1 can provide guidance on this.

(e) All applications to build within a floodplain must be supported by detailed calculations and plans that outline the floodplain boundaries and levels relative to building floor levels.

(f) Any impact that the proposed works may have on adjacent areas or catchments shall be clearly indicated on the drawings and supported by detailed calculations prepared by a suitably qualified person.

4.4.1.2 Design and construction drawings

The following items shall be included in any design and construction drawings:

(a) A scale plan of the catchment and sub-catchments.

(b) A legend

(c) Details of all structures, including:

- (i) Culvert entrances and exits
- (ii) Secondary intakes
- (iii) Energy dissipating structures.

(d) The location and alignment of any:

- (i) Open channels
- (ii) Natural waterways
- (iii) River or coastal floodplains
- (iv) Secondary (overland) flow paths
- (v) Wetlands within the site or within close proximity to a boundary.

(e) The location, in plan, and the level of the water's edge and shoulder of the bank shall be indicated.

(f) Representative "typical" pre-existing and post development cross sections and long sections through any natural waterways or wetlands.

(g) The proposed proximity of buildings to the water's edge and/or shoulder of the banks.

(h) The level datum.

(i) A plan showing the proposed location of existing and proposed stormwater drains in terms of datum.

(j) Long-sections shall be drawn with the chainage starting at the downstream end of the drain and the upstream point of the drain to the right of the drawing. This represents the way the drain would normally be constructed.

(k) Long-sections shall include:

- (i) Details of all proposed and existing depths
- (ii) Diameters and levels of manholes
- (iii) Pipe materials, diameters and grades.

(l) Secondary flow paths and calculated flow depths during the design event.

Proposed works shall not begin until construction plans have been approved.

4.4.1.3 Asset operations and maintenance plan

New assets, such as water quality and/or control structures, will be accompanied by an asset operations and maintenance plan, as part of the completion documentation, which shall detail how the asset is to be operated and maintained over the life of the asset. A replacement schedule should also be included to show what works needs to be carried to ensure the asset is operable in perpetuity. The plan shall include, as a minimum:

(a) Required inspection and condition assessment schedule.

(b) Required maintenance, both regular and occasional to ensure continued operation.

(c) Required replacement schedule for components with a limited lifespan, or life span shorter than the nominal life expectancy of the asset as a whole.

(d) How the asset is to be operated or is intended to work, including:

  (i) Stages where operator input is required should be highlighted.

(e) Health and safety and operational risks intrinsic to the asset, operators and public and either:

  (i) How they have been mitigated (through design), ***or***

  (ii) How they should be mitigated (through operation).

4.4.2 Stormwater detention

Detention may take the form of oversized pipes, defined ponds, large channels/swales or ponding areas. Detention ponds or areas require specific design in conjunction with Wellington Water. The following applies to the design of stormwater detentions:

(a) The Wellington Water *Reference Guide for Design Storm Hydrology* shall be considered an acceptable method for use in flood routing.

(b) Detention areas/ponds must be provided with safe access for maintenance to at least the standard for intakes.

(c) Where an open detention pond is proposed, detention depths shall not exceed 1.2 m unless access to the pond edge is restricted.

(d) The detention structure is to be adequately designed to have a controlled discharge for an event larger than the design event.

(e) Where detention structures are to be vested to the council as part of the public stormwater network, the designer shall liaise with Wellington Water to confirm the requirements for access, control, monitoring, alarm and telemetry systems specification.

4.4.2.1 On-site stormwater management and disposal

The following paragraphs relate to on-site stormwater management and disposal:

(a) On-site stormwater management and disposal systems are required for all developments unless the developer can demonstrate that there is no increased upstream or downstream flooding.

(b) The proposed system shall be designed to achieve hydraulic neutrality by limiting the design peak discharge from the development (post-construction) to not greater than the existing design peak discharge (pre-development) in all flood events up to and including the 1% AEP rainfall event. Please refer to **Section 4.3.1 Hydrological design** and the Wellington Water *Reference Guide for Design Storm Hydrology* .

(c) Systems shall be privately owned and operated.

(d) Systems servicing single lots shall be located completely within the serviced lot.

(e) A suitable maintenance manual is required before the system is approved.

4.4.2.2 Soak pits

Typically, soak pits will only be considered acceptable on the elevated river terraces in Upper Hutt (see **Standard Detail DR06 – Possible Location for Stormwater Soakage in Upper Hutt** in the Regional Specification for Water Services). All other areas within Hutt, Upper Hutt, Wellington or Porirua cities are unlikely to be suitable for soakage.

The standard acceptable methods of on-site disposal are soak pits and soak trenches, include the following guidelines:

(a) These may only be used to dispose of runoff generated on the site.

(b) They are not to accept flows from adjacent lots.

(c) Suitably designed and constructed soak pits will be considered acceptable for residential applications and will be privately owned and maintained.

(d) GD2021/007 can be used for guidance in the site suitability assessment, soakage testing and the design of soakage systems.

(e) Larger installations for commercial, industrial or communal use will be at the discretion of Wellington Water.

(f) A geotechnical assessment may be requested by Wellington Water if the proposed soakage has the potential to affect land stability, but not withstanding that:

  (i) Care must be taken to ensure the stability of the adjacent ground is not compromised by the soakage.

(g) The soakage facility must be sited on private property and have adequate clearance from boundaries, dwellings, buildings, retaining walls and sanitary sewers. **Table 4-6** provides clearance distances for small installations.

Table 4-6 – Clearance distances between soak pits and structures

Proximity to:	Required clearance
Dwellings	2.0 m
Small out-buildings	1.5 m
Boundaries	1.5 m
Retaining walls	Height of wall + 1.5 m
Sewers	1.0 m

(h) The top level of the soak pit is to be above the ponding level of a 20% AEP rainfall-runoff event, and the base of the soakage facility is to be a minimum of 500 mm above the winter groundwater table level.

(i) The soakage facility will be approved upon submission of results of a suitable soakage test and design. Suitable tests are outlined in Appendix A of GD2021/007. A suitable design must achieve the following outcomes:

  (i) Soakage devices that are the sole management device shall be designed to achieve a primary level of service as defined in **Section 4.2.6 Primary system level of service**. The design shall consider all storms between 10 minutes and 24 hours in duration.

  (ii) All soak pits must completely drain within 24 hours of a rainfall event to ensure they are ready for the next event.

(iii) Additional retention devices to achieve hydraulic neutrality may also be required.

(j) A discharge permit may be required from the regional council for discharge to ground[10] and this shall be confirmed with GWRC.

(k) Soakage pit entries or systems should be trapped to limit the amount of debris entering the soakage interface to extend the long-term viability of the system.

4.4.2.3 On-site detention and attenuation

Attenuation, using on-site detention facilities, can be used to limit the discharge from the property to mitigate adverse effects on the downstream system.

These can take the form of an above-ground tank or buried tank and may be combined with soakage. The following applies to these structures:

(a) The proposed system shall be designed to achieve hydraulic neutrality by limiting the design peak discharge from the development (post-construction) to not greater than the existing design peak discharge (pre-development) in all flood events up to and including the 1% AEP rainfall event.

(b) Storage for larger, multiple lot developments requires special design, as outlined in **Section 4.4.2 Stormwater detention**.

(c) For residential detention structures, a 10% and 1% AEP event using the Wellington Water *Reference Guide for Design Storm Hydrology*, shall be used to determine runoff and detention volumes.

  (i) Wellington Water has developed a set of Approved Solutions for Hydraulic Neutrality. These approved solutions focus on stormwater detention are suitable for developments of one to ten residential buildings. The approved solutions are available online or on request.

(d) Consideration shall be made to providing suitable access for regular maintenance of the outlet and storage volume.

(e) The attenuation facility shall generally be privately owned and maintained and placed on private property, and:

  (i) The facility shall be protected by private easement where required.

(f) The secondary flow path due to outlet blockage *shall not* be a buried overflow pipe connection, but by an appropriate and visible overland flow to an approved outfall or public system. This is to provide a visible indicator to the owner for the requirement for maintenance.

4.4.3 Open watercourses

Open watercourses shall be designed to the following guidelines:

(a) Open watercourses shall be designed with a minimum freeboard of 500 mm above the design flow. Consideration shall be given to wave action and heading up at bends in the watercourse.

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[10] *Discharge into or onto land, including stormwater collected from any road, roof, yard, paved surface, grassed surface or other structure, and discharged into a pipe which discharges into surface water.*

(b) Watercourses and their natural character shall be retained wherever possible and located in public reserves.

(c) There shall be no modification of an existing stream system unless it is for flood mitigation purposes, there are no viable alternative flood management methods available, and:

   (i) All development work should be located away from the riparian buffer where possible.

   (ii) Impediments to the natural flow with barriers to fauna should be avoided[11].

(d) Any work in a stream bed is likely to require resource consent and contact shall be made with Greater Wellington to confirm. Consent may also be required from the territorial authority as well.

(e) The extent of any stream improvement work shall be agreed with Wellington Water to achieve a satisfactory result maintaining the natural topography and vegetation, along with maintenance, hydraulic and safety considerations, including the downstream effects of the work.

(f) Ephemeral streams should be retained as secondary flow paths.

(g) Further piping of streams is not a preferred approach; however, if approved, an approved secondary flow path must be available.

(h) For watercourses with the equivalent 10% AEP event design capacity as that of a 600 mm pipe, the watercourse is required to be in an easement in favour of the council.

   (i) The easement is to include sufficient space on at least one side of the stream and flood berm (for mean annual flood) for a 4.5 m wide strip practical for maintenance access to the stream, unless otherwise specified by Wellington Water.

   (ii) The cross section of any open watercourse shall be constructed to comply with Wellington Water specific requirements.

4.4.3.1 Bridges

Where bridges or structures cross an open watercourse, the design shall:

(a) Include advice from GWRC on potential regional consent requirements.

(b) Allow for a freeboard of 600 mm between the design peak water level (see **Section 4.2.7 Secondary system level of service** and **Section 4.2.8 Freeboard**) and the underside of the bridge or structure.

   (i) The freeboard shall be increased to 1200 mm where there is a possibility of large trees being carried down the waterway (from the Waka Kotahi NZ Transport Agency Bridge Manual).

[11] *Users of the standard should be aware of their responsibilities for maintaining fish passage under the Freshwater Fisheries Regulations 1983 (Part 6) and Resource Management Act 1991.*

4.4.4 Lateral connections to the public stormwater network

The following applies to lateral connections to public mains, watercourses and kerbs:

(a) Private connections may be required to provide stormwater treatment to reduce contaminant loading to meet bylaw or resource consent requirements.

(b) Private connections shall be a minimum size of 100 mm nominal diameter.

(c) Each proposed dwelling on a lot shall be serviced by a separate connection to the public system at a location approved by Wellington Water, except that:

  (i) Unit titled developments are exempt from this criterion and may be serviced by a single, suitably sized connection.

(d) Each connection shall be capable, as a minimum, of conveying the design level of service.

(e) Industrial and commercial lots shall have a minimum nominal diameter of 150 mm and shall connect to a stormwater pipe, swale or, where permitted under the Regional Plan, open watercourse.

(f) Connections provided to lots must be at sufficient depth that they can be extended to the building platform in a manner compliant with the NZBC.

(g) Where the connection is to an empty lot (see **Standard Detail DR07 – Lateral Connections to Public Stormwater or Wastewater Mains** in the Regional Specification for Water Services), the terminal connection shall be:

  (i) Laid at least 1 m inside and within the boundary of the property.

  (ii) End in a method that can accept an approved spigot.

  (iii) Pipe colour-coded green, ensuring that if paint is used any rubber ring gap is taped over to protect it from the paint.

  (iv) Be blanked off or sealed with a removable cap colour-coded green.

  (v) Be marked with a securely embedded H4 treated timber post, with at least 600 mm protruding above ground, and the top 100 mm painted green.

(h) Connections larger than 150 mm shall be connected to the public system via a manhole only. Connections shall be made at angles 90 degrees or less to the direction of the flow.

(i) Connections 150 mm or less can be made directly to a stormwater main using one of the methods listed in **Table 4-7**.

Table 4-7 – Acceptable methods for lateral connection to public stormwater pipe

Public main material	Acceptable method
PVC	PVC Y-junction with rubber ring joint slip couplers
PE100	Electrofusion PE100 Y-saddle or Y-junction
Earthenware or concrete (see **Section 4.4.4.2 Earthenware saddle connections to earthenware or concrete mains**)	1. Proprietary Y-junction with mechanical elastomeric metal banded couplers 2. Earthenware saddle installed in accordance with **Section 4.4.4.2**.
Twin wall polypropylene	Proprietary T-junction

Public main material	Acceptable method
AC and other pipe materials	Proprietary Y-junction with mechanical elastomeric metal banded couplers

(j) Connections shall not be made to a public pipe deeper than 3.5 m to the crown. A shallower public drain shall be provided to collect private connections before joining the deeper main.

(k) A private connection cannot cross an adjacent property without the permission of Wellington Water and the adjacent property owner. Where permission is obtained, in writing, an easement shall be obtained in favour of the connection's lot.

4.4.4.1 Connections to kerb and channel

The following applies to kerb and channel connections:

(a) In an existing developed area, kerb and channel connections are approved on a case-by-case basis and are limited to 100 mm diameter pipes.

(b) All greenfield developments and other connections must be to a watercourse, swale or a public stormwater pipe.

(c) The pipe between the back of the footpath and the boundary may be made from an approved plastic, but beneath the footpath and to the kerb and channel must be galvanised steel or cast iron with approved steel kerb adaptors.

4.4.4.2 Earthenware saddle connections to earthenware or concrete mains

(This section also applies to wastewater design.)

The following applies to earthenware saddle connections to gravity earthenware and concrete wastewater and stormwater pipes:

(d) Wellington Water reserves the right to require proprietary Y-junctions in any circumstance.

(e) For saddles to be used, the main must be at least one size larger than the saddle connection.

(f) The saddle shall be installed as follows:

   (i) Hole in existing public main to be drilled out and finished with epoxy mortar on inside.

      1. For stormwater connections, the earthenware saddle should be a minimum of 150 mm to allow better entry for inside finishing. Where required, reducers shall be installed on the incoming pipe.

   (ii) Earthenware saddle to be secured using epoxy mortar.

   (iii) Joint to be backfilled with low strength 2 MPa cement stabilised flowable fill material.

(g) Connection between the saddle and lateral pipe shall use an elastomeric metal banded coupler.

4.4.4.3 Decommissioning and reuse of existing laterals

Where an existing building is demolished or replaced:

(a) The end of the lateral is to be capped at the main, relined or re-laid for future use.

(b) Wellington Water shall be advised of the final treatment.

(c) The reuse, without relining, of an existing lateral is not permitted, unless the lateral (from the building to the public main) is free from cracks and other defects as verified with the use of CCTV and is made of a resilient pipe material such as PVC, concrete or PE.

(d) The reuse of laterals made of earthenware or AC pipe is never permitted, regardless of condition, without relining.

4.4.5 Public stormwater pipes

The stormwater system shall be designed as a separate system with no cross-connections to the wastewater system.

4.4.5.1 Minimum size

The minimum nominal diameter for a public stormwater pipe is:

(a) 300 mm for stormwater mains and double sump leads

(b) 225 mm for single sump leads.

4.4.5.2 Minimum cover

The following applies to the minimum cover of stormwater pipes:

(a) Stormwater pipes shall generally be laid with a minimum cover of 600 mm where practicable.

(b) The designer is required to demonstrate suitable pipe class selection and structural trench design at all depths.

(c) Wellington Water may require additional load mitigations, such as concrete slabs, when considering a request from a designer for a lesser cover.

4.4.5.3 Materials

The permitted materials for use in the stormwater network are detailed in the Regional Specification for Water Services and supporting documents.

4.4.5.4 Location

The following applies to the location of pipelines:

(a) Public pipelines shall be laid in accordance with all requirements in **Section 3.8 Building in close proximity to public pipelines**.

(b) Where practicable, pipes shall be located in public land, preferably within carriageways, footpaths and berms.

(c) Pipes are to be located where surface access for machinery and maintenance is possible at all times and at reasonable cost and least possible disruption to the public.

(d) Where public pipes must be located in private property, they shall be protected by an easement (see **Section 4.4.12 Easements**) and subject to the criteria outlined in **Section 4.2.2 Access** regarding easements and avoidance of existing and potential building sites.

(e) Public pipes (including manholes) shall not be located directly on a boundary line or on the alignment of a proposed fence or retaining wall.

4.4.5.5 Changes in pipe diameter

(This section applies to wastewater design also.)

The following applies to changes in the pipe diameter:

(a) Where the downstream pipe diameter increases, the pipe shall, as a minimum, be designed as soffit-to-soffit such that the hydraulic grade line through the structure is constantly falling (i.e., no heading up).

(b) A downstream reduction in pipe diameter will generally not be accepted, but if approved:

 (i) The reduction shall be made in an appropriately smooth transition structure (a manhole as a minimum).

 (ii) Specific engineering is required to eliminate heading up in the manhole, and to avoid detrimental backwater effects in the upstream pipe.

 (iii) Reductions to less than a 300 mm diameter pipe will not be considered.

4.4.5.6 Pipes at steep grade

(This section applies to wastewater design also)

Pipes laid at a steep grade shall be designed:

(a) To allow for air entrainment (see **Section 4.3.2.1 Air entrainment**)

(b) With sufficient protection to protect the drain from UV light, erosion and physical damage; with the protection of a form that is be visually acceptable within the context of the surrounds.

(c) With appropriate downstream energy dissipation that will protect the receiving structure from erosion and damage, including:

 (i) If the design velocity exceeds 3 m/s and the flow undergoes a sudden reduction in grade

 (ii) Where hydraulic design suggests significant turbulence will occur.

(d) For water stops (see **Section 4.4.5.7 Water stops**).

4.4.5.7 Water stops (Bulkheads)

(This section applies to wastewater design also.)

Water stops shall be designed as follows:

(a) Water stops are required to reduce movement of groundwater along trenches and minimise the potential for trench scour.

(b) Manholes can be considered as water stops if constructed in a manner that restricts the passage of water past the structure.

(c) Water stops shall be constructed of 150 mm thick 17.5 megapascal (MPa) concrete, keyed 150 mm minimum into the trench walls and base and extending 300 mm above the pipe (see **Standard Detail DR03 – Typical Trench and Waterstop Details** in the Regional Specification for Water Services), with spacings as per **Table 4-8**.

Table 4-8 – Water stop spacing

Pipe grade	Spacing
> 20%	5 m
20% to 12.5%	7.5 m
12.51% to 6.7%	15 m
6.71% to 1%	90 m

(d) Subsoil drains (see **Section 4.4.6 Subsoil drains**) may be required where a high groundwater table or excessive infiltration is expected. These drains shall discharge to an appropriate facility, typically a downstream manhole and above nominal design flow levels. Where the subsoil drain passes through a water stop or similar, it shall be sealed to restrict bypass flow through the water stop.

4.4.5.8 Pipe junctions

(This section applies to wastewater design also.)

All public pipe junctions shall be made using a manhole. This does not necessarily include laterals, which are subject to provisions in **Section 4.4.4 Lateral connections to the public stormwater network**. Junctions shall be appropriately benched as outlined in the Regional Specification for Water Services.

4.4.6 Subsoil drains

The following applies to subsoil drains in fill areas:

(a) Permanent subsoil drains shall be installed in earthfills except where all of the following criteria can be demonstrated:

- (i) There are no natural springs that will discharge at the base of the fill.
- (ii) Positive provisions (e.g., cut-off subsoil drain) are made to prevent surface runoff entering the fill at the exposed fill/natural ground contact.
- (iii) The natural ground on which the fill is to be placed is contoured and scarified prior to the placement of fill to ensure that, over the whole base of the fill, the fill can be fully compacted to specification and continuity achieved between the fill and natural ground.
- (iv) The fill material is uniform, of relatively low permeability and is not erodible.

(b) Private subsoil drains servicing earthfills (excepting those behind retaining walls) shall be laid to the same standard as if they were public drains.

- (i) A Building Consent shall be obtained.
- (ii) The requirements for a public drain will in general apply, though access requirements may be eased.

Subsoil drains shall be constructed as follows:

(c) They shall connect to a manhole structure at both ends. The upstream manhole can be a maintenance shaft.

(d) They should be laid in a narrow trench, though if the loading permits, they may be laid in the cleaned out bed of the old watercourse with gentle horizontal and vertical curves.

(e) There shall be no abrupt changes in grade.

(f) The drains in the main gullies shall be established through design and shall be at least one pipe size larger than any connecting branch drain.

(g) Branch drains shall be laid in all adjacent gullies and adjacent to any wet areas, such as a spring, and in accordance with the following:

 (i) Branch drains shall be a minimum of 100 mm diameter.

 (ii) They shall be connected to the main by means of Y junctions only.

 (iii) Open butt joints will not be permitted.

(h) Where the design load allows, perforated concrete, high density polyethylene (HDPE) or ceramic pipes may be used:

 (i) These pipes must all be bedded and surrounded with a minimum of 150 mm of suitable graded filter material.

 (ii) Alternatively, a suitable permanent filter fabric may be placed around granular pipe bedding in lieu of the graded filter material.

(i) Where the design load precludes the use of these pipes or where significant localised inflows or ground water are to be intercepted then the drain shall be laid as a sealed drain of adequate strength and may have multiple branches with multiple inlets to collect ground water.

(j) Where perforated pipes cannot be used, stones larger than the pipe diameter shall be hand placed over the inlets:

 (i) The larger stones are to be covered with 50 mm of ballast.

 (ii) A suitable graded filter material shall be placed over this ballast.

(k) Where perforated pipes are used, the ends of the branch drains shall be sealed off and the drain backfilled as normal.

(l) Subsoil drains shall be clearly identified on as-built plans.

(m) There shall be no direct stormwater connection or opening to a subsoil drain.

4.4.7 Manholes and maintenance shafts

(This section also applies to wastewater design.)

4.4.7.1 Manholes

Manholes are required to allow physical entry of a person and equipment to the pipe for purposes of maintenance, investigation or connection. The following applies to the use of manholes:

(a) Manholes shall be constructed in pre-cast reinforced concrete with minimum number of risers to minimise risk of infiltration. Other materials may be accepted by Wellington Water upon application and with suitable reason.

(b) Manholes should generally be used on all public drains at:

 (i) Junctions of public drains

 (ii) Changes in grade

 (iii) Changes in direction.

(c) Branch pipelines 300 mm or smaller may be saddled onto pipes 1200 mm diameter or larger without the requirement for a manhole (see **Section 4.4.4.2 Earthenware**

saddle connections to earthenware or concrete mains), provided a manhole is constructed on the branch line within 50 m of the junction.

4.4.7.2 Maintenance shafts

Maintenance shafts are designed to provide access to rod or jet obstructions clear of the pipe. They are also known as cleaning eyes, rodding points or lamp hole cleaning eyes.

Maintenance shafts shall:

(a) Not be used on the public main unless dispensation has been granted by Wellington Water.

(b) Be considered at the upstream termination of a short section of 150 mm drain section, typically 50 m or less.

(c) In some circumstances, be used at the top of a steep change of grade where a manhole is likely to be in an unsafe or precarious position.

(d) Be considered for approval by Wellington Water at subdivision terminal staging points or where the developer can justify their use for a special circumstance.

(e) Have no customer connections to the maintenance shaft.

4.4.7.3 Design to prevent floatation

Manholes shall be designed to prevent floatation according to the following guidelines:

(a) Manholes shall be designed to prevent floatation using a factor of safety of 1.25. The design must include consideration of groundwater table and liquefaction potential.

(b) The weight of the manhole risers, lid, slab and base shall be used for calculating the resistance against floatation, and the manhole shall be assumed to be empty.

(c) The weight and effects of the surrounding soil shall be ignored except where integrated flanged manhole bases are used, whereupon the volume and net density of the soil (density of dry soil minus the density of water) above the flange can be used to calculate additional resisting force.

The following applies to design against liquefaction:

(d) Shallow structures (less than 3 m deep) are less likely to uplift due to liquefaction than deeper structures (greater than 3 m deep), although this is still dependant on the level of the groundwater table and the potential for the material to liquefy.

(e) Areas with potential for liquefaction are published by Greater Wellington Regional Council. Reference to the latest hazard maps shall be made prior to design.

(f) The manhole excavation shall be lined with filter fabric prior to the manhole base being placed. The filter fabric shall encase the manhole and the backfill of the excavation. The calculated up-thrust from liquefied in-situ material acting against the full area of the manhole flange, shall be countered by the downward force from:

   (i) The buoyant downward force of the backfill below ground level, e.g.

   $$\left(wet\ density_{backfill} - wet\ density_{in-situ\ material}\right) * volume * g$$

   (ii) The weight of the manhole.

(g) The backfill shall be a compacted, non-cohesive, gap graded material (i.e. AP40 or similar). Alternatively, where this is not practical due to method of installation or retro-fitting, approved pore-pressure releasing mechanisms may be employed (float-less manhole system) or similar.

(h) The manhole shall be constructed in accordance with the Regional Specification for Water Services.

(i) As design against liquefaction is continuously evolving, other methods will be considered on application. All other requirements for manhole design and construction outlined within **Section 4.4.7 Manholes and maintenance shafts** still apply.

4.4.7.4 Manhole size

The following clauses apply to manhole size:

(a) Manholes shall be a minimum of 1050 mm diameter (refer to clause (h)).

(b) Manholes with a depth to invert between 2 m and 4 m shall be 1200 mm minimum diameter.

(c) Manholes with a depth to invert greater than 4 m shall be 1500 mm minimum diameter.

(d) Manholes shall be the same diameter for the full depth of the manhole.

(e) Notwithstanding the above minimum requirements, the manhole shall also be sized to accommodate the minimum dimensions outlined in **Figure 4-1**, where the dimension X is the greater of:

  (i) 0.75 x OD of inlet/outlet pipe where pipes are same diameter

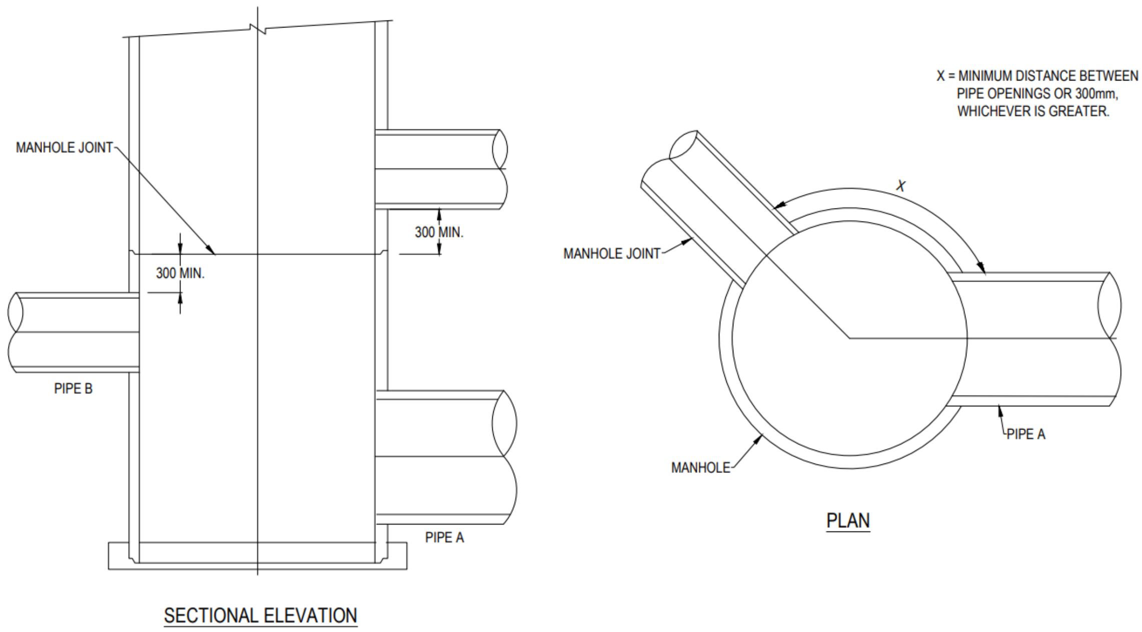
  (ii) 0.65 x OD of largest inlet/outlet pipe where pipes are different diameter

  (iii) 300 mm.

(f) Manholes shall be large enough to appropriately admit connecting pipelines and any required change in direction.

(g) Manholes shall also be large enough to accommodate landings with room for manoeuvring and equipment if required (refer to **Section 4.4.7.6 Deep manholes).**

(h) 600 mm diameter manholes may be considered where the pipe invert is less than 1 m from the finished ground level, the manhole is not located in the carriageway, there are less than two connections per manhole, and there are other special circumstances.



Source: CPAA Guidance Note: Loads on Circular Precast Concrete Manholes and Access Chambers: March 2016

Figure 4-1 – Manhole layout

4.4.7.5 Manhole safety grilles

Manhole safety grilles shall be fitted into manhole access lid frames for all new manholes deeper than 3 m and for any manhole where a specific safety risk is identified. The safety grilles are intended to prevent the risk of falls greater than 3 m and to act as a signal that access to the manhole will require additional safety equipment such as a winch and safety harness.

4.4.7.6 Deep manholes

Deep manholes:

(a) Are greater than 3 m in depth and shall be specifically designed to take into consideration access, health and safety, maintenance, and rehabilitation.

(b) Do not require landings as they may interfere with safety equipment and rescue operations in confined spaces. If the designer chooses to specify a landing in a manhole for a specific purpose, this shall first be agreed in writing by Wellington Water.

4.4.7.7 Connections to manholes

The following applies to manhole connections:

(a) A 600 mm manhole can accept a maximum of two incoming pipes.

(b) A 1050 mm manhole shall have no more than 3 incoming pipes and 1 outgoing pipe. This includes sump leads, private connections and main pipelines.

(c) Where more connections are required, a larger manhole may be required to comply with the manufacturer’s recommendations for connection spacings.

4.4.7.8 Drops at manholes

The following applies to manholes drops:

(a) All pipe entries shall be haunched to the manhole invert to avoid cascades; except that:

  (i) Sump leads, or normally dry stormwater laterals 300 mm in diameter or less, may enter above the benching as a cascade.

(b) Haunched drops are not to exceed 500 mm. Consideration shall be given to the hydraulic grade line and surcharging where super-critical flows transition to tranquil sub-critical flows.

(c) For wastewater pipes, drops greater than 500 mm may be made using an internal drop structure.

4.4.7.9 Internal drop structures

The following applies to drop structures:

(a) External drop structures are not permitted within either the stormwater or wastewater network.

(b) Internal drop structures will not normally be considered for stormwater applications but are acceptable within wastewater systems.

(c) Drop structures shall be avoided where possible, by laying the approaching drain at a shallow grade, then descending to the manhole invert through a steep section of pipe at the final approach and:

  (i) A manhole is required at either end of the steep approaching inlet drain.

(d) For wastewater systems (see **Standard Detail DR02 – Internal Drop Details** in the Regional Specification for Water Services):

  (i) Internal drop structures are required where the approaching inlet grade is greater than 45 degrees.

  (ii) Internal drop pipework shall be designed to be clear of the design flow and the discharge shall be to a haunched channel.

  (iii) Internal drop pipes shall not be larger than 225 mm nominal diameter.

  (iv) The minimum size for a manhole with an internal drop structure is the nominal manhole diameter plus the drop pipe outside diameter.

4.4.7.10 Spacing

Manholes shall be spaced at intervals of:

(a) Not more than 90 m in road reserve for pipe less than 1050 mm in diameter.

(b) 90 times the pipe diameter for pipes 1050 mm in diameter or greater.

(c) 60 m in private property.

4.4.7.11 Changes in grade

Notwithstanding the provisions in **Section 4.4.7.2 Maintenance shafts** regarding manholes at the top of steep banks, changes of grade shall be made at a manhole.

4.4.7.12 Changes in direction

Any change in direction or bend shall be completely contained within the interior of the manhole. The maximum change of direction shall be 90 degrees.

An exception to this may be made where a manufactured mitred bend is required, generally on large pipes, typically 750 mm in diameter or larger, provided:

(a) There is a compelling reason not to form the bend within a manhole.

(b) There is a downstream manhole within 5 m of the bend.

(c) There are no proposed or potential connections to the bend.

(d) The location of the bend is shown, accurate to ±100 mm in the required co-ordinate system, on the drain's as-built plan.

Maintenance structures shall not be used for changes in direction.

4.4.8 Stormwater pipe intakes

The following applies to stormwater pipe intakes:

(a) Intakes shall be designed to accept the design flow without scour or erosion of the pipe surrounds. Wing walls are a minimum requirement for stormwater intakes directly into a pipe.

(b) Suitable barriers/fences shall be required above an intake where a fall of 1 m or greater is possible from above the intake headwall, and where public access is possible.

(c) An all-weather access track must be provided to the entrance of all intakes, as follows:

- (i) The access shall be at least 4 m wide and no steeper than 1:5 (v:h) and suitable for use by trucks.
- (ii) There must also be room for machinery to work at the intake.
- (iii) The access shall be in public land or protected by an easement.
- (iv) Provision shall be made so that no water can bypass the inlet structure and flow into compacted fill or areas where damage may occur. See also **Section 4.3.2.3 Pipe inlets** for hydraulic design requirements.

4.4.8.1 Stormwater intake grilles

The following applies to stormwater intake grilles:

(a) For culverts:

- (i) Grilles are not typically required unless a specific safety risk is identified.
- (ii) Wellington Water may request an intake grille to be installed in some locations.
- (iii) Culverts are required to have access provisions for clearing similar to those of pipe intakes (see **Section 4.4.8 Stormwater pipe intakes**), and debris arrestors may be required as noted in **Section 4.4.8.2 Debris traps.**
- (iv) Provisions to protect the structure against scour and erosion at the inlet and outlet shall be provided and supported by calculations where requested.

(b) For stormwater pipe intakes:

(i) A grille is to be installed unless it can be demonstrated through the Safety in Design process that the potential for pipe or valve blockage due to debris accumulation is low and there is no risk to safety (for people, especially children entering the intake).

(c) To determine the appropriate grille, the designer shall consider:

(i) The potential effects of seawater on the durability of the grille.

(ii) The public use of the area surrounding the intake.

(iii) The diameter of the intake.

(iv) The likelihood of people (especially children) entering the water course upstream of the intake.

(v) The accessibility of the water course (extent of vegetation, fencing and ground slopes).

(vi) The quantity and type of debris.

(vii) Maintenance requirements.

(viii) The consequences of blockage (safety and economic).

(ix) The use of a grille with a top-hinge for ease of maintenance (where practical).

(d) Stormwater intake grilles shall (see **Figure 4-2**):

(i) Consist of a vertical front face of a height at least equal to the pipe diameter, and a sloping top.

1. The angle of the top shall be greater than 1 to 4 (v:h).
2. The total open area of the grille shall be no less than two times the cross-sectional area of the intake pipe.
3. An alternative acceptable design would be to exclude the vertical front face and have a uniform slope surface with the angle greater than 1 to 4 (v:h).

(ii) Be made of galvanised steel flat bars and follow the below guidelines:

1. The length of the bars shall run top to bottom (as opposed to across the intake).
2. Each flat bar shall be positioned on its edge so that the thickness of the bar forms the face of the grille, with the flat side of the bar standing vertical.
3. The minimum bar thickness shall be 10 mm, and the depth of bars (flat side) to be determined by the designer.
4. The bars shall be spaced to maintain 140 mm clear opening (i.e., bars at 150 mm centres where bar thickness is 10 mm). Larger (even) bar spacing may be considered on a case-by-case basis.
5. The edges of the bars are to be bevelled prior to galvanising

(iii) Be bolted to the wall with either hot dipped galvanised or stainless steel bolts in a fashion that will allow the grille to be readily replaced;

(iv) Be sufficiently strong to resist the impact of any debris that may come down the watercourse.

(v) Be sufficiently designed to withstand cleaning with an excavator bucket (where appropriate).

(vi) Not allow the top grille to protrude beyond the vertical grille (to avoid excavator buckets from catching on the top grille).

(vii) Be shaped and located to make clearing as easy as practical prior to or following storm events.

(viii) Maintain fish passage.

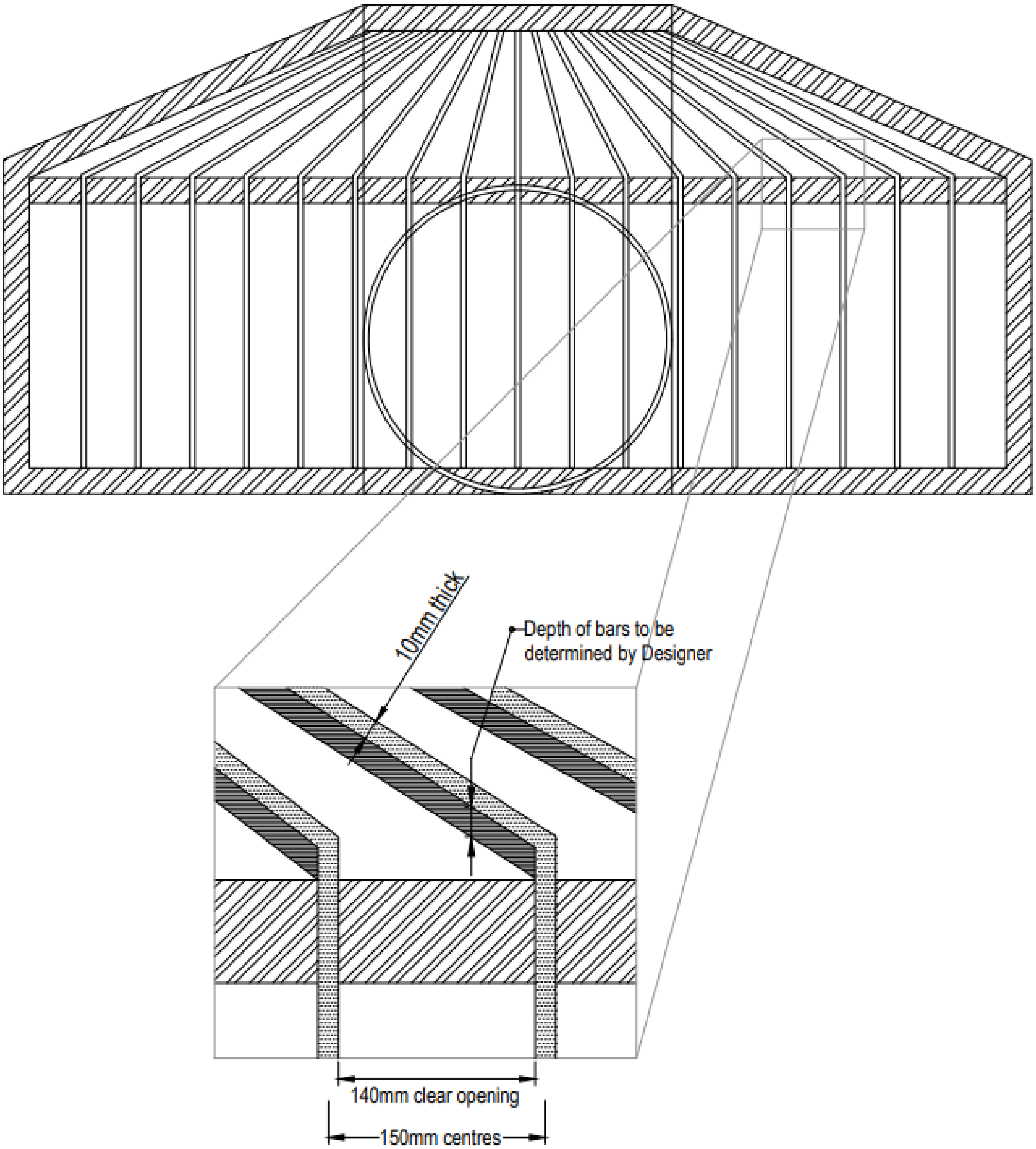


Figure 4-2 – Stormwater intake grille

4.4.8.2 Debris traps

Debris traps (or arrestors) may be required upstream of the intake at the request of Wellington Water. The debris trap shall:

(a) Be a coarse screen designed to restrict the entry of large objects into the intake structure.

(b) Typically be constructed from vertically set steel railway sections or similar, with bars spaced approximately 0.75 times the diameter of the intake pipe.

(c) Have a catch-pit immediately upstream of the debris arrestor to arrest sediments and heavier debris, if required. The dimensions of this trench or pit shall be based on catchment characteristics, approaching flow velocity and maintenance restrictions.

4.4.8.3 Secondary intakes/paths

The following applies to secondary intakes and secondary (overland) flow paths:

(a) Secondary intakes shall be considered in all cases where there is serious consequence of damage should the primary intake be overtopped.

(b) The preferred form of a secondary intake in a confined ponding area is a mushroom intake where entry of floating debris into the intake is minimised.

(c) The design of the secondary intake should be based around the assumption that the primary intake is blocked.

(d) Provision shall be made for flows greater than the design capacity of the intake and pipe to overflow to an secondary flow path that meets the minimum AEP, as described in **Section 4.2.7 Secondary system level of service**.

4.4.9 Outlets

The outlet or outfall from a public or private drain shall be to the public stormwater network or an approved alternative[12]:

(a) Discharging to land sloping down to receiving waters is to be avoided where possible. It may be considered where the designer can demonstrate that the flows can be controlled, there are no adverse environmental effects, and secondary (overland) flow is contained to within the developer's property before reaching a receiving body of water.

(b) Discharging to land shall not be considered where scouring is likely.

(c) Where significant turbulence is likely, such as at a large change in cross-sectional area, specific measures shall be taken to eliminate scour and erosion of the receiving drain and surrounds:

  (i) This may take the form of protective aprons and linings of the receiving channel or flow calming or energy dissipating structures.

  (ii) As a general rule, exit velocities in drains of up to 1.8 m/s may be tolerated without specific energy dissipation structures.

  (iii) Short duration flows up to 3 m/s may be tolerated if it can be shown that the channel is in stable and strong ground, potential maintenance has been considered and addressed and the consequences of erosion are small.

(d) Where the outlet discharges to a natural stream or channel, the outlet shall, as a minimum, be protected by a proprietary wing wall structure, concrete apron and concrete embedded downstream riprap with the intention of reducing scouring velocities.

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[12] *See Auckland Council Hydraulic Energy Management: Inlet and Outlet Design for Treatment Devices July 2013 Tech Report 2013/018 for assessing outlet structures.*

(e) Any structure should be designed to minimise the collection of debris. Where collection of debris is likely, access considerations equivalent to those of an intake (see **Section 4.4.8 Stormwater pipe intakes**) shall be incorporated into the design to allow for removal of the debris.

(f) Direct outfall to specific rivers, streams or the sea may require permission from Greater Wellington Regional Council.

4.4.10 Sumps

High capacity sumps may be required in some instances. The intake capacity of these sumps shall be determined from first principles and in consultation with the manufacturer. Specific approval should be obtained from the roading authority if the sumps are not compliant with the relevant code of practice.

Sumps shall:

(a) Connect to a manhole, or to an open watercourse where no stormwater reticulation is available.

(b) Use a rear entry and cycle friendly grate.

(c) Be double sumps at the end of cul-de-sacs, at low points in the road or where slopes are steeper than 5%.

(d) Be clear of vehicle crossings and access ways.

(e) Be placed where there is the potential for water to leave the road and enter a private property, typically upstream from vehicle crossings, or sudden changes in grade or direction.

(f) Be placed in areas where ponding of water is possible.

(g) Be spaced no greater than 90 m apart, but close enough to adequately accept the contributing flows.

(h) Have a flexible connection within 300 mm of the sump.

(i) Standard single sumps shall be serviced by a 225 mm nominal diameter lead, while double sumps shall be serviced by a single 300 mm nominal diameter lead.

(j) Sump leads shall be specifically designed where a lead is proposed to discharge to a pipe running full to ensure the sump lead is of a suitable size.

(k) Have a baffle on all sump outlets to mitigate the conveyance of litter and gross pollutants (see **Standard Detail DR04 – Baffled Sump Plan and Sections** in the Regional Specification for Water Services).

4.4.11 Stormwater pumping stations

The following applies to stormwater pumping stations:

(a) Publicly owned stormwater pumping stations will be considered only at the discretion of Wellington Water and only where, in the opinion of Wellington Water, there are no practicable alternatives.

(b) Wellington Water shall be contacted prior to design to establish any materials or design conventions that have been established in addition to those outlined in the Regional Specification for Water Services.

(c) Pumping systems shall be designed using a multi-pump system to best balance the need for regular pump operation against the relative infrequency of major storm events.

(d) The peak storm frequency (AEP) shall be set to match the upstream and downstream stormwater system, but shall be not less than:

 (i) The AEP specified in the Performance Criteria (see **Section 4.2.7.1 Secondary flow path**) when an overland secondary flow path can be identified that will ensure the minimum level of service is achieved

 (ii) 1% AEP when no overland secondary flow path is available.

(e) If the pumping station building covers less than two thirds of the lot, the lot shall have permanent fencing or other methods to prevent access by the public and livestock.

4.4.12 Easements

(This section also applies to wastewater design.)

The following applies to easements:

(a) Where a drainage easement is required, the easement shall be a minimum 3 m wide or the outside diameter of the pipe plus 2 times the depth to invert, whichever is greater.

(b) Drainage easements for stormwater are also required to provide for the unobstructed passage of secondary flow paths (refer to **Section 4.2.7.1 Secondary flow path** and removal of materials that may result in blockages downstream.

(c) Where the drainage easement is for the underground pipe and the secondary overland flow path, the easement shall be the width required to cater for clause (a) or (b) above, whichever is greater.

(d) Where more than one public main is laid in an easement, the easement shall extend 1.35 m from the outside edge of each outside drain.

(e) The cross section of the drainage easement shall, wherever possible, be designed and constructed as an access for maintenance (including mowing if appropriate). The easement may also be used for secondary overland stormwater flow if required.

(f) Unless otherwise approved, easements shall be within one lot and shall not straddle a boundary line. The pipe centreline shall not be laid less than 1.0 m from the boundary.

(g) The council will at all times retain a 24-hour access right to all services contained within the easement without impediment, and without prior notice to the property owner.

(h) No building works or obstruction to access shall be constructed within a drainage easement without written approval from Wellington Water (refer to **Section 3.8 Building in close proximity to public pipelines**).

(i) The easement shall be secured over all public services crossing private property at development stage whether services are existing or new.

4.4.13 Testing

(This section also applies to wastewater design.)

The following applies to testing:

(a) Unless otherwise stated, if records of testing and inspections are required, these records shall be provided to Wellington Water as part of the project completion and as-built documentation.

(b) For subdivisions all wastewater and stormwater drains will be tested upon completion of construction at the developer's expense and as part of the council's approval process.

(c) Wellington Water shall be present during the test and will sign the appropriate documentation provided by the council to verify the test if successful.

(d) A minimum of 48 hours of notice is required to be given to Wellington Water prior to the test being carried out.

(e) The developer shall provide all fittings and materials to carry out the test.

(f) For subdivisions, the developer is required to have met the following requirements prior to pipe testing and Wellington Water arriving on site:

 (i) Trenched and pipes laid.

 (ii) Bedding and surround material, top and bottom shall have been laid over the pipe. Minimum 100mm top and bottom of pipe.

 (iii) All pipe junctions exposed including laterals and inspection eyes.

 (iv) Lines flushed and all residual debris cleaned out.

 (v) All fittings and connection to have been installed prior to pressure test.

 (vi) Lines to have been pressurised overnight to the required pressure prior to the test commencing.

(g) All mains and branch pipelines, including manholes and connections shall be tested after backfilling. The test shall be either the Water Test or Low Pressure Air Test as outlined in the Regional Specification for Water Services.

4.4.13.1 CCTV inspection

Wellington Water may require the drain to be inspected with a colour CCTV camera.

(a) This inspection shall be additional to the water or air test.

(b) Any defects detected by the camera inspection shall be made good and the relevant section of pipeline tested again.

(c) Contractors are advised to carry out their own test before backfilling the trench.

(d) Acceptance of the drain will not be given until it has passed the water or air test and any CCTV inspection required.

5 WASTEWATER

5.1 Objectives

To provide a system for the safe treatment and disposal of wastewater that safeguards people and communities from injury or illness caused by infection or contamination resulting from exposure to wastewater; while at all times avoiding, remedying or mitigating adverse effects on the environment.

5.2 Performance criteria

Any scheme must demonstrate consideration and compliance with the criteria listed below.

5.2.1 Durability

The wastewater network shall:

(a) Be designed and constructed with materials suitable for the intended use, with a proven performance record, and commensurate with a nominal structural and operational life of 100 years; notwithstanding that:

  (i) Items with a lesser expected operational life, such as mechanical and electrical equipment, shall be selected and installed with consideration to maximising longevity, compatibility with existing systems and economic replacement.

(b) Be designed in a way that minimises the overall renewal and maintenance life-cycle costs. For the purposes of calculation, the lifecycle costs shall be determined using a life of no less than 100 years.

5.2.2 Maintenance and operation

The wastewater network shall:

(a) Minimise the risk of flood water ingress without unduly restricting maintenance access.

(b) Be compatible with the existing wastewater drainage network.

(c) Be laid out in such a way as to minimise the potential for blockage and facilitate on-going maintenance or development.

(d) Minimise the likelihood of leakage, inflow and infiltration and the penetration of tree roots.

(e) Minimise the likelihood of blockage.

(f) Withstand all anticipated superimposed loads.

5.2.3 Level of service

The wastewater network shall:

(a) Minimise adverse environmental effects and comply with all consent conditions set under the Resource Management Act 1991.

(b) Adequately service the catchment including all current and future lots ultimately possible under the operative district plan. This includes potential expansion of the network beyond the developer's initial development.

(c) Consist of an underground piped reticulation system where an adjacent public reticulation is available.

(d) Be of capacity suitable for carrying peak flows anticipated during the lifetime, without surcharge and with due allowance for ground and surface water infiltration and inflow.

(e) Be designed to minimise blockage and sediment deposition.

(f) Maintain adequate self-cleansing velocities to ensure a daily flush at dry weather flow at both existing and fully developed stages, and:

  (i) Where inadequate flows are expected, such as within some industrial areas, or during initial stages of development, special flushing facilities shall be required at the discretion of Wellington Water.

(g) Adequately convey wastewater to an approved discharge point.

(h) Use gravity drainage wherever practicable. Where gravity drainage is not practicable, smart pressure sewer systems should be considered (see **Section 5.4.9 Pressure sewer systems**).

(i) Where using mechanical or electrical equipment, have adequate emergency provisions and alarm systems to minimise the possibility of discharge to land or water.

(j) Be adequately vented to reduce the build-up of hazardous gases and prevent siphoning of private drainage or gully traps. Ventilation should be provided in such a manner that it does not cause a hazard to property owners or members of the public.

(k) Provide alarm and telemetry systems that are compatible with those being used by Wellington Water at the time of project implementation.

(l) Not be connected to the stormwater network. Wastewater systems shall be designed and constructed to minimise the risk and extent of stormwater inflow and infiltration.

(m) Be designed to prevent floodwaters entering the network where the wastewater network is within a flood plain, or secondary flow path.

(n) Gully traps should be installed at a level that:

  (i) prevents unwanted wastewater discharge by being a minimum of 150 mm above the nearest opening (e.g. manhole) in the wastewater network

  (ii) prevents stormwater inflow by being above the 1% AEP flood event level, or at the minimum clearance allowable by the NZBC based on the overflow level of the lowest plumbing fixture.

(o) Ensure maintenance storage is provided at pumping stations (see **Section 5.4.8 Wastewater pumping stations**) to provide overflow protection in case of pumping failure.

  (i) For new build public systems, 8 hours ADWF maintenance storage volume in addition to 12 hours detention volume shall be the target level of service where it can be achieved cost effectively and particularly where traffic management is required to access the station, as shown in **Table 5-5**.

  (ii) Emergency relief overflows and venting shall be provided for extreme events in addition to any maintenance storage provisions.

Where the existing network is affected by development, system upgrades shall meet the following minimum standards (which may need to be assessed in the hydraulic wastewater model):

(p) Overflows at unconstructed locations shall not be made worse (volume or frequency).

(q) Detention, if required by Wellington Water, should provide storage for 12 hours average dry weather flow (ADWF) in addition to storage volume requirements for maintenance purposes, as shown in **Table 5-5**. In general, gravity detention systems will not be accepted unless the design can clearly provide for effective avoidance of blockages and flushing of settle material. For private pumping stations, also see **Section 5.4.8.1 Private wastewater pumping stations**.

5.2.4 Access

The wastewater network shall:

(a) Be located within the road reserve except where special difficulties preclude this.

(b) Be protected by easement where special difficulties necessitate the placing of reticulation pipes on private property.

(c) Not unduly restrict the location of any future buildings or development.

(d) Be located and designed to provide reasonable access for maintenance without significant damage or disruption to other network utility services, land use activities and landscape values.

(e) Covers, barricades, fences and sign-posting shall be provided as appropriate to provide for public safety and prevent public access to hazardous areas.

5.2.5 Environmental quality

The developer shall ensure that environmental quality is considered in the location, design and construction of all components of wastewater systems. The following should be considered for environmental quality:

(a) Avoid adverse effects on cultural and heritage sites and respect cultural values, particularly the cultural values of tangata whenua relating to wastewater treatment and disposal.

(b) Preserve or protect areas of ecological significance, areas of significant habitat for indigenous flora and fauna and outstanding natural features.

(c) Avoid, remedy, or mitigate adverse effects on freshwater ecosystems, watercourse margins, esplanade strips, harbours and the coastal marine area.

(d) Avoid, remedy, or mitigate adverse effects on visual amenity.

(e) Provide for on-site silt and sediment management, erosion control and dust control during construction.

5.2.6 On-site disposal of grey water and wastewater

The following applies to on-site disposal:

(a) Grey-water reuse schemes in urban areas are considered an alternative solution and will be considered under special application (refer to **Section 3.5 Application and approvals**).

(b) On-site disposal of wastewater by surface or subsurface land disposal must not result in adverse environmental impact outside the bounds of the lot.

(c) A resource consent for on-site disposal of grey water or wastewater may be required under the regional plan.

5.3 Design methods

The design methods presented here are acceptable for the purposes of developing solutions compliant with the objectives and performance criteria of this standard. Deviation from these methods will be considered with suitable evidence that the method is equivalent in function and outcome to the standard solutions presented in this document.

Wastewater design is presented in two parts in this document:

- Wastewater design flows – determining the hypothetical design parameters for the collection system.
- Hydraulic design – calculating the behaviour of the flow within the system.

Certified calculations shall be made available to Wellington Water as part of any application.

5.3.1 Wastewater design flow

The design flows determined in this section are to be used in the hydraulic design of the wastewater collection network. Reference to the council's current district plan will be required to ensure all potential development upstream, downstream and within the development is accommodated in any proposed works.

5.3.1.1 Wastewater catchment

The following applies to the wastewater catchment:

(a) The catchment used for all wastewater design calculations shall be all the area that drains/discharges wastewater or could physically and legally drain/discharge wastewater to the point under consideration.

(b) When determining the design flow, the catchment shall be, as a minimum, considered to be developed to the full extent permitted by the district plan.

(c) Where future development is possible (i.e., if a district plan change is pending, or flows are possible from an adjacent development), the potential for additional wastewater flow shall be accommodated.

(d) Sewer catchment areas will usually need to be calculated manhole to manhole, so the network pipelines are not unnecessarily oversized.

5.3.1.2 Population

The following applies to the population for wastewater design:

(a) The population to be used for wastewater design in typical residential developments shall be based on a people per dwelling basis.

(b) Where the proposed number of dwellings cannot be determined, the minimum density per hectare (ha), outlined in **Table 5-1**, shall be adopted.

(c) Alternative means of estimating occupation and/or flows will be considered and may be discussed with Wellington Water.

Table 5-1 – Residential development population density

Council	Population per dwelling	Min. density people per ha*
HCC	3.5	60
PCC	3.5	50
UHCC	3.5	45
WCC	3.1	Residential – 140 Inner city – 400 Suburban centre - 1200
WCC CBD	3.1	400/ha of floor area**

* Gross area including streets but excluding reserves.

** Assuming 3 m between floor levels and maximum building height and coverage as per district plan. Ninth floors and above can assume 50% occupancy.

5.3.1.3 Residential design flows

For the design of residential wastewater pipelines, the peak wet weather flow (PWWF) shall be determined by:

PWWF = PDWF + Direct Inflow + Infiltration

Where:

PDWF	=	ADWF x PF
ADWF	=	0.0023 L/s/person (L/s) (equivalent to 200 L/person/day)
Peaking factor PF	=	7.23 x Area$^{-0.2}$ (area in ha)
Direct inflow	=	0.55 L/s/km of pipeline in catchment upstream of point of analysis.
Infiltration (per km pipe length)	=	0.06 L/s/km (low groundwater table)
	=	0.43 L/s/km (high groundwater table)
	=	0.25 L/s/km (unknown groundwater table)

(a) Where the pipe length within a collection area is unknown and in a proposed greenfield development, assume 0.8 km of pipeline per hectare of developed land.

(b) Typically, pipes in rock or clay slopes are anticipated to have low groundwater tables.

(c) Pipes in flat, valley floors or in coastal areas with an invert below 3 m MSL are anticipated to have a high groundwater table.

5.3.1.4 High density / industrial / commercial design flows

The following applies to high density, industrial or commercial design flows:

(a) Flow from large industrial or institutional complexes, wet industries, large residential buildings or commercial developments shall be by specific design and pertinent to the activity. The basis of design for this shall be submitted for approval to Wellington Water and prior to final design.

(b) Consultation with Wellington Water is required when designing flows for the following areas:

(i) Hospitals and nursing homes

(ii) Abattoirs or significant wet industries

(iii) Institutional complexes such as universities

(iv) Commercial port areas

(v) Central business districts.

(c) Where specific activities are *not* known, the following factors from **Table 5-2** may be used:

Table 5-2 – Industrial and commercial design flows

Council		ADWF (L/ha/s)	PDWF (L/ha/s)	PWWF (L/ha/s)
HCC	Industrial/commercial	0.52	1.56	1.56
PCC	Heavy			1.3
	Medium			0.7
	Light			0.4
UHCC	Industrial	1.0		3.0
	Light industrial	0.08		0.23
	Commercial	0.25		1.0
WCC	Apply WCC residential method as outlined in **Section 5.3.1.3 Residential design flows** to obtain ADWF and PWWF.			

5.3.2 Hydraulic design

The following applies to hydraulic design:

(a) Manning's Formula shall be used in the hydraulic design of sanitary sewers.

(b) The method outlined in **Appendix 1** shall be used with the following amendments:

(i) Backflow effects for wastewater pipes should assume downstream pumping station wet well levels are at normal operational maximum (duty pump start level) (see **Section 4.3.2.5 Backflow effects and downstream level conditions**).

(c) Gravity wastewater pipelines shall not be designed to operate at pipe full capacity and pipes shall allow for a 15% air space in the design.

$$\frac{\text{Area of sewage}}{\text{Area of pipe}} = 0.85$$

(i) For circular pipes, this is equivalent to a pipe flowing at a depth of 80% of the pipe diameter.

(ii) This air gap is required to maintain airflow through the sewers and eliminate the discharge of odours at manholes.

(d) Additional design considerations are provided in **Section 4.3.2 Hydraulic design**.

5.3.2.1 Downstream water level

For wastewater design, the terminal downstream level for network design shall be taken as the pumping station's wet well maximum 'duty pump start' level.

5.3.2.2 Self-cleansing velocities

Notice should be taken of the requirement for new sewers to maintain self-cleansing velocities during subdivision staging. The design shall:

(a) Allow for interim measures for self-cleansing where these cannot be achieved during the initial stages of the development.

(b) Provide self-cleansing velocities demonstrated by either:

(i) Calculating the expected peak dry weather flow (PDWF) for the proposed pipe section and ensuring flow velocity exceeds the minimum requirement of 0.75 m/s, ***or***

(ii) Adopting the minimum pipe grades in **Table 5-3**.

Table 5-3 – Minimum grades for wastewater pipes

Pipe DN	Minimum grade	
150	1.11 %	1/90
225	0.69 %	1/145
300	0.44 %	1/230

Note: These values are based on pipes flowing at 52% depth (PDWF) and assuming a peaking factor of 2. Steeper grades may be required for areas with greater peaking factors.

(c) Permit shallower grades at the discretion of Wellington Water provided the applicant can demonstrate cleansing velocities can be achieved or the effects mitigated.

5.3.2.3 Maximum velocity

Maximum velocity guidelines include:

(a) Velocities during PWWF should not exceed 3 m/s.

(b) Where velocities exceed 3 m/s, either:

(i) Special provisions shall be made to reduce the velocity, such as:

1. Drop manholes (see **Section 4.4.7.8 Drops at manholes** and **Section 4.4.7.9 Internal drop structures**) to flatten the approaching grade, *or*
2. Increasing pipe diameter.

(ii) Analysis shall be undertaken to demonstrate that there will be no adverse effects from the high velocity.

5.4 General specifications for wastewater

5.4.1 Information to be provided

In addition to the council's normal requirements for subdivision application, the developer shall, as a minimum, provide the following information with any wastewater design:

(a) Drawings and calculations as outlined below.

(b) Operations and maintenance guidelines for any pressure sewer system, pumping station, odour treatment or effluent treatment facility to be vested to the council.

5.4.1.1 Calculations

Calculations shall be prepared and presented as follows:

(a) The design details and calculations shall be prepared by a person qualified in wastewater design and demonstrate that required levels of service will be maintained.

(b) Calculations presented as part of any application shall include, but are not limited to:

- (i) Peak and daily flows
- (ii) Structure losses
- (iii) Pipe losses
- (iv) Backwater calculations.

(c) All assumptions regarding the design shall be clearly listed. Any deviation should be documented and Wellington Water's written approval for the deviation attached.

(d) Analyses, results, reports and calculations prepared by a suitably qualified person shall be submitted to Wellington Water for approval for pumping stations and on-site disposal fields proposed.

(e) Structural calculations shall be provided to support the proposed pipe class based on:

- (i) Min/max cover
- (ii) Traffic/construction loadings
- (iii) Surcharge conditions
- (iv) Bedding and surrounds.

5.4.1.2 Design and construction drawings

Design and construction drawings shall include:

(a) Details of all structures, including energy dissipating structures, internal/external drops, and typical trench cross sections.

(b) A legend.

(c) The level datum.

(d) Long-sections showing:

- (i) Levels, grades, and material of proposed pipelines in terms of datum.
- (ii) Material, depth and diameter of manholes and maintenance structures.

(iii) Chainage starting at the downstream end of the drain and with the upstream point of the drain on the right of the drawing, representing the way the drain would normally be constructed.

(e) The long-sections and plan drawings shall show proximity to any other existing or proposed services.

(f) Where on-site treatment is proposed, drawings are required outlining:

(i) Effluent treatment areas proposed

(ii) Flood levels in design event

(iii) Proximity of any natural body of water

(iv) Method and layout of irrigation.

Proposed works shall not begin until construction drawings have been approved by Wellington Water.

5.4.1.3 Asset operations and maintenance plan

New assets, such as those listed in **Section 5.4.1**(b) **Information to be provided,** will be accompanied by an asset operations and maintenance plan, as part of the completion documentation, which shall detail how the asset is to be operated and maintained over the life of the asset. A replacement schedule should also be included to show what works needs to be carried to ensure the asset is operable in perpetuity. The plan shall include as a minimum:

(a) Required inspection and condition assessment schedule.

(b) Required maintenance, both regular and occasional, to ensure continued operation.

(c) Required replacement schedule for components with a limited lifespan, or life span shorter than the nominal life expectancy of the asset as a whole.

(d) How the asset is to be operated or is intended to work, including:

(i) Stages where operator input is required should be highlighted.

(e) Health and safety and operational risks intrinsic to the asset, operators and public and either:

(i) How they have been mitigated (through design), ***or***

(ii) How they should be mitigated (through operation).

(f) Compliance, auditing requirements and a renewal schedule for any regulatory permissions.

5.4.2 Lateral connections to the wastewater network

The following applies to lateral connections to the wastewater network:

(a) Each proposed dwelling on a lot shall be serviced by a separate connection to the public main at a location approved by Wellington Water, with the exception of:

(i) Unit titled developments are exempt from this criterion and may be serviced by a single, suitably sized connection.

(b) Connections provided to lots must be at sufficient depth that they can be extended to the building platform in a manner compliant with the NZBC.

(c) Minimum grades for private connections up to the property boundary shall be as outlined in Clause G13 of the NZBC, but with a minimum grade of 1:60 unless otherwise justified.

(d) Connection to the public network shall be carried out by a contractor approved by Wellington Water as specified on the connection application form.

(e) A minimum nominal diameter for a lateral connection shall be 100 mm.

(f) An inspection eye shall be installed at the property boundary, comprised of:

  (i) Proprietary inspection chamber with minimum 150 mm riser and screw-cap fitting within:

    1. Manifold box with red lid marked 'SS' in non-trafficable areas, or

    2. Ductile iron lamp-hole frame and cover on a concrete footing

  (ii) On steep property boundaries with an exposed lateral pipe, the inspection eye may be replaced with a sealed inspection junction point.

(g) Connections shall be made at a manhole in the following situations:

  (i) Where the lateral connection is 225 mm or greater.

  (ii) Where the public main is identified as a trunk main, either on existing GIS network plans or as required by Wellington Water.

(h) Where the connection is not to a manhole, acceptable methods for lateral connections are listed in **Table 5-4.**

Table 5-4 – Acceptable methods for lateral connection to public wastewater main

Public main material	Acceptable method
PVC	PVC Y-junction with rubber ring joint slip couplers
PE100	Electrofusion PE100 Y-saddle or Y-junction
Earthenware or concrete (See **Section 4.4.4.2 Earthenware saddle connections to earthenware or concrete mains**)	1. Proprietary Y-junction with mechanical elastomeric metal banded couplers 2. Earthenware saddle installed in accordance with **Section 4.4.4.2**.
AC and other pipe materials	Proprietary Y-junction with mechanical elastomeric metal banded couplers

(i) The minimum length of a connection shall be 1 m.

(j) Connections, in general, shall not be made to a sewer pipe deeper than 3.5 m to the crown, and instead:

  (i) A shallower public branch sewer shall be provided to collect private connections before joining the deeper main at a manhole.

(k) Where the connection is to an empty lot (see **Standard Detail DR07 – Lateral Connections to Public Stormwater or Wastewater Mains** in the Regional Specification for Water Services), the terminal connection shall be:

  (i) Laid at least 1 m inside and within the boundary of the property.

  (ii) End in a method that can accept an approved spigot.

  (iii) Pipe colour-coded red, ensuring that if paint is used any rubber ring gap is taped over to protect it from the paint.

  (iv) Be blanked off or sealed with a proprietary removable cap colour-coded red.

  (v) Be marked with a securely embedded H4 treated timber post, with at least 600 mm protruding above ground, and the top 100 mm painted red.

(l) A private connection cannot cross an adjacent property without the permission of Wellington Water and the adjacent property owner. Where permission is obtained, in writing, an easement shall be obtained in favour of the connection's lot.

5.4.2.1 Decommissioning and reuse of existing laterals

Where an existing building is demolished or replaced:

(a) The end of the lateral is to be capped at the main, relined or re-laid for future use.

(b) Wellington Water shall be advised of the final treatment.

(c) The reuse, without relining, of an existing lateral is not permitted, unless the lateral (from the building to the public main) is free from cracks and other defects as verified with the use of CCTV and is made of a resilient pipe material such as PVC, concrete or PE.

(d) The reuse of laterals made of earthenware or AC pipe is never permitted without lining.

5.4.2.2 Earthenware saddle connections to earthenware or concrete mains

See **Section 4.4.4.2 Earthenware saddle connections to earthenware or concrete mains**.

5.4.3 Public wastewater pipes

The wastewater system shall be designed as a separate system with no cross-connections to the stormwater system and in accordance with the following clauses:

5.4.3.1 Minimum size

The minimum nominal diameter for a public wastewater gravity pipe is 150 mm.

5.4.3.2 Minimum cover

The following applies to the minimum cover of wastewater pipes:

(a) Main wastewater pipes shall generally be laid with a minimum cover of 900 mm where practicable.

(b) The designer shall take into consideration traffic loading and structural design when asking Wellington Water for a reduction in minimum cover.

(c) Customer laterals shall be no shallower than 600 mm at the boundary.

5.4.3.3 Pipe materials

The permitted materials for use in the wastewater network are detailed in the Regional Specification for Water Services.

Materials for stream crossings, elevated pipelines and pumping station pipework shall be discussed and approved by Wellington Water prior to detail design.

5.4.3.4 Cathodic protection for steel pipes

Refer to **Section 6.4.11 Cathodic protection for steel pipes**.

5.4.3.5 Location

See **Section 4.4.5.4 Location**.

5.4.3.6 Pipeline design

The following sections are to be applied to both wastewater and stormwater designs:

- **Section 4.4.5.5 Changes in pipe diameter**
- **Section 4.4.5.6 Pipes at steep grade**
- **Section 4.4.5.7 Water stops**
- **Section 4.4.5.8 Pipe junctions**

5.4.4 Manholes

See **Section 4.4.7 Manholes**.

5.4.5 Easements

See **Section 4.4.12 Easements**.

5.4.6 Testing

See **Section 4.4.13 Testing**.

5.4.7 Venting

Venting of structures is required to eliminate the collection of noxious gases and corrosive conditions within the structure's air space. The following guidelines apply:

(a) The venting structure must be constructed on public land.

(b) The location must be approved by the relevant council.

(c) Venting shall be required at all:

  (i) Pumping station wet wells.

  (ii) Manholes that receive a rising main discharge.

  (iii) Manholes where inverted siphons enter or discharge.

  (iv) Terminal upstream manholes on any branch line (this is deemed satisfied for pipes in subdivisions if at least one property is connected to the most upstream manhole in the branch).

(d) Odour treatment will be required where vents discharge to urban areas. Odour treatment can be in the form of activated carbon filters or odour beds. Solutions for odour treatment shall be discussed with, and approved by, Wellington Water prior to detailed design.

5.4.8 Wastewater pumping stations

The following applies to wastewater pumping stations:

(a) Pumping stations will only be considered for approval by Wellington Water where gravity drainage is not feasible. Pumping stations serving more than 10 urban lots may be vested to the council.

(b) The Design shall be approved by Wellington Water before construction begins. The designer shall liaise with Wellington Water pumping station engineer prior to detail design to establish acceptable methods and materials.

(c) The developer shall bear all costs of design, construction and commissioning of pumping station, including supervisory control and data acquisition (SCADA), controls, flow metering, power supply and integration of the station into the wastewater network.

(d) Refer to **Section 5.2.3 Level of service** and **Table 5-5** regarding storage and overflow protection.

(e) Wastewater pumping stations shall be wet well or dry well pump installations depending on merit and site-specific conditions. Generally, wastewater pump stations shall be dry-well pump installations:

  (i) In the CBD, wastewater pump stations shall be dry well pump stations due to access and noise constraints.

  (ii) Wet-well pump installations will be acceptable where individual pumps are less than 10 kW in size.

(f) The station site shall be on a separately titled lot on the subdivision with a sealed vehicle access to a formed road. The lot shall be vested to the council. The site shall have permanent fencing or other methods to prevent access by the public and livestock as outlined by Wellington Water.

(g) If the pumping station building covers less than two thirds of the lot, the lot shall have permanent fencing or other methods to prevent access by the public and livestock.

Table 5-5 – Detention, maintenance and total storage volume for wastewater pumping stations

Storage volume	Public	Private
Detention volume	12 hours ADWF	12 hours ADWF
Maintenance volume	8 hours ADWF	24 hours ADWF
Total volume (above highest pump start level)	20 hours ADWF	36 hours ADWF

5.4.8.1 Private wastewater pumping stations

Where connection to Wellington Water network is not possible, and where Wellington Water has given written permission, private wastewater pumping stations may be considered provided they comply with the minimum criteria as set out here, and in the Regional Specification for Water Services:

(a) Wellington Water requires that the design of the station is to be carried out by a suitable professional and be submitted to Wellington Water for approval.

(b) To allow adequate time for maintenance, the wet-well shall be of a size to hold 24 hours of ADWF plus the volume of the rising main, above the pump start level. Where detention is required (see **Section 5.2.3 Level of service**), an additional 12 hours storage for a total of 36 hours is required.

(c) Non-return valves shall not be installed on the private discharge main in a way that prevents the un-discharged effluent to return to the wet well when pumping stops. This avoids septic conditions in the rising main. Notwithstanding this, the rising main discharge shall be placed and designed to eliminate the potential for sewage from the main pipeline to surcharge and backflow down the rising main and overflow the wet well.

(d) The rising main shall discharge to a private manhole, and then discharge to a public manhole by gravity.

(e) The resource consent may require additional emergency storage (over and above that required by **Section 5.2.3 Level of service** and the Regional Specification for Water Services) or an emergency disposal field depending on the surrounding environs and scope of the development.

(f) The developer shall take the responsibility to alert any future owners of the site and the station that:

(i) The site is serviced by a private pumping station.

(ii) The owners are fully responsible for the maintenance and operation of the station.

(iii) The owners are responsible for any fines or consequences from a failure to adequately maintain the station.

(iv) A 24-hour message service, including a high wet level alarm, overflow alarm, and on-going maintenance contract, must be acquired for the station.

(v) The station must be kept to a standard acceptable to Wellington Water, including not causing a nuisance to other property owners or adverse effects to the surrounding environment.

(vi) The pumping station must not discharge any material that may damage or cause negative effects to the Wellington Water sewer network or the environment.

(g) Notices shall be placed on the resource consent outlining the maintenance obligations of the private owner, and equivalent notices shall be placed on the Certificate of Title for the serviced properties.

5.4.9 Pressure sewer systems

Pressure sewer systems may be accepted by Wellington Water where gravity networks are not practicable due to high groundwater tables, flat topography, or areas with a high liquefaction potential. The design of the sewer system shall be carried out by a suitable professional and be submitted to Wellington Water for approval.

Pressure sewer systems shall be designed in conjunction with this document and Water Services Association of Australia WSA 07[13].

The following considerations need to be fully evaluated and presented in any situation where pressure systems are being proposed:

(a) Ownership

(b) Maintenance

(c) Operational

(d) Life-cycle cost.

[13] *Water Services Association of Australia (WSA) WSA 07 – Pressure Sewerage Code of Australia*

6 WATER SUPPLY

6.1 Objectives

To safely and reliably collect and adequately distribute water for domestic, commercial, industrial, and firefighting purposes in a manner that protects public health, promotes sustainability, and complies with the performance criteria outlined in this document.

6.2 Performance criteria

Any scheme must demonstrate consideration and compliance with the criteria listed below.

6.2.1 Durability

The following applies to the durability of the water supply system:

(a) The water supply network shall be designed and constructed with materials suitable for the intended use, with a proven performance record, and commensurate with a nominal structural and operational life of 100 years.

(b) Notwithstanding the nominal operational network life, items with a lesser expected operational life, such as mechanical components, pumps, control valves and electrical equipment, shall be selected and installed with consideration to longevity, compatibility with existing systems, technological and operational upgrading, and economic replacement.

(c) Consideration of the operating conditions shall include, but not be limited to:

  (i) Ground conditions

  (ii) Corrosion conditions

  (iii) Pressure

  (iv) Fatigue.

(d) Operating conditions shall be considered during selection of pipeline materials to provide the specified levels of service required by this standard.

(e) The water supply network and its components shall be designed in a way that minimises the overall life-cycle costs. For the purposes of calculation, the life-cycle costs shall be determined using a life of no less than 100 years.

(f) Designs shall accommodate anticipated demand growth and network expansion ultimately possible under the council's current district plan. This includes potential expansion of the network beyond the developer's initial development.

6.2.2 Maintenance and operation

The following applies to maintenance and operation of the water supply network:

(a) The water supply network shall be designed to be watertight to the required test pressures set out in the Regional Specification for Water Services, which includes allowances for surge and fatigue.

(b) Components shall be compatible with the existing network.

(c) Pipework shall be laid underground at the depths set out in the Regional Specification for Water Services.

(d) The network shall be designed to minimise the extent of water supply outage required for any planned or unplanned maintenance activities.

(e) Pumping facilities shall have adequate standby pumping and emergency provisions to mitigate the consequences of pump or power failure, and:

- (i) All pump stations shall have 100% standby capacity.

(f) Drinking water systems shall be designed and equipped to prevent backflow into the pipeline during operation or maintenance.

6.2.3 Functionality

The functionality of the water supply system shall achieve the following:

(a) The system shall at all times comply with the provisions of the Health (Drinking Water) Amendment Act 2007 and the Drinking Water Standards for New Zealand.

(b) Wellington Water will not provide an on-demand supply from the reticulated water supply system in residential areas unless a reticulated wastewater system of suitable capacity is available.

(c) In any development, the reticulated supply shall be capable of providing uninterrupted flow and pressure to all existing and potential lots allowed for within the council's current district plan, and as measured at the downstream outlet of the service valve (refer to **Section 6.2.7 Levels of service**).

(d) Any shared, or private, reticulated water supply system shall:

- (i) Comply with the objectives and performance criteria of the Regional Standard for Water Services.
- (ii) Have sufficient capacity to supply simultaneously to all properties, the flows and pressures set out in the Regional Standard for Water Services.

(e) The network shall provide firefighting flows and pressures in compliance with SNZ PAS 4509, and the following clauses:

- (i) During firefighting scenarios, the pipeline pressure in elevated areas of water distribution zone shall remain positive.
- (ii) Any private firefighting mains shall be constructed to the performance requirements of the Regional Standard for Water Services.

(f) Trunk mains shall not have customer connections directly from the main.

- (i) All customer connections shall be from reticulation mains, which may in turn be connected to trunk mains.

(g) Pressure to all customer points of supply, in a reticulated network, shall be provided by gravity from a public storage reservoir, and:

- (i) Alternatives such as pressure boosting stations will not typically be considered.

(h) Pressure surges from demand or mechanical facilities shall be minimised through suitable design and provision.

(i) The network shall be designed so that no more than 50 lots will be isolated when isolating any reticulation pipe section for the purposes of maintenance.

6.2.4 Access

The following applies to access requirements for water supply assets:

(a) Provisions shall be made to allow suitable access for firefighting appliances and equipment to the firefighting water supply.

(b) Public pipelines shall be placed in the road reserve wherever possible, with suitable access for maintenance and operation. Where this is not possible, the pipe shall be placed on publicly owned land or land that is protected by an easement in favour of the council (refer to **Section 6.4.4 Easements**).

(c) Provisions shall be made so that that all facilities, such as reservoirs, flow/pressure monitoring stations, treatment facilities or pumping stations, are on publicly owned land, and accessible by vehicle during all weather conditions (refer also to **Section 6.4.17 Water supply pumping stations** and **Section 6.4.18 Reservoirs**). Such land shall:

  (i) Not be land-locked

  (ii) Have a corridor of publicly owned land so that suitable vehicle access and pipeline access to the facility can be developed that does not cross private land.

(d) The access performance criteria in this document applies to any existing, private water main that is proposed to be vested to council.

6.2.5 Environmental quality

The developer shall ensure that environmental quality is considered in the location, design and construction of all components of water systems. The following should be considered for environmental quality:

(a) Avoid adverse effects on cultural and heritage sites and respect cultural values, particularly the cultural values of tangata whenua.

(b) Preserve or protect areas of ecological significance, areas of significant habitat for indigenous flora and fauna, and outstanding natural features.

(c) Avoid, remedy, or mitigate adverse effects on freshwater ecosystems, watercourse margins, esplanade strips, harbours, and the coastal marine area.

(d) Avoid, remedy, or mitigate adverse effects on visual amenity.

(e) Provide for on-site silt and sediment management, erosion control and dust control during construction.

6.2.6 Contamination of the network

The network and its components shall be designed to reduce any risks of contamination of the water supply as required by the Health (Drinking Water) Amendment Act 2007.

6.2.7 Levels of service

6.2.7.1 Network pressure

Pressures in the network shall comply with the following clauses:

(a) The maximum pressure in any part of the water supply network shall not exceed 90 m head of pressure.

(b) The minimum pressure available at the downstream outlet of the point of supply shall not be less than those set out in **Table 6-1**.

(c) The minimum pressure shall be the pressure available immediately downstream of the point of supply when the property is continuously drawing water.

(d) The water supply network shall be capable of providing the minimum levels of service at peak demand, as calculated in **Section 6.3.1.1 Peak demand**.

(e) Where the water pressure is less than 10 m head of water at the final level on the building platform, a private boosting pump station may be permitted provided pressures compliant with **Table 6-1** can be achieved at the point of supply.

 (i) Such pump stations shall be sized so that they cannot deliver flows and pressures greater than the specified minimum levels of service at the final level of the building platform.

 (ii) The pump station shall be fitted with an approved double-check valve to prevent backflow from the property into the water supply.

 (iii) A private booster station serving multiple lots shall have the facility to connect a standby generator.

(f) Fire suppression sprinkler systems (whether commercial or residential) may have a flow and pressure requirement greater than Wellington Water's minimum standards.

(g) It is the designer's responsibility to demonstrate that the public network can supply the sprinkler system's flow and comply with all relevant standards.

Table 6-1 – Mandated levels of service for pressure at point of supply

Maximum pressure*	Minimum pressure**	Comment
90 m	25 m	10 m min. pressure may be accepted for highest properties adjacent to reservoir

* Gauge pressure as measured at any point in the public network.

** As measured during peak demand flow assuming reservoir level is at the reservoir floor (bottom water level)

6.2.7.2 Reservoir volume

Reservoirs shall be designed to accommodate the storage volume outlined in **Table 6-2**.

Table 6-2 – Mandated levels of service for storage volumes

Method	Storage (L/person)	Scenario
1	700	Where actual consumption is not known such as new developments
2	2 x Average Day Demand	Used when demand statistics are available from Wellington Water. The designer to target the greater of the volume determined by each method. Consult with Wellington Water to determine critical users and their consumption.
3	Maximum Day Demand + 20% + SNZ PAS 4509 firefighting requirements	
4	(20 L/person/day for 23 days + critical users allowance) x 1.43	

6.2.7.3 Hydraulic capacity of pipelines supplying a reservoir

Gravity water supply pipelines supplying water to a reservoir shall be designed to:

(a) Have sufficient hydraulic capacity to supply within a 24 hour period, the volume of water used on the forecast peak day (excluding fire demand or pipeline failure).

(b) Maintain reservoir volume at or above 70% full under normal (excluding fire demand or pipeline failure) operating conditions.

6.2.8 Point of supply

The following applies to the point of supply for a potable water system (see also **Section 6.4.13 Residential service connections**):

(a) The point of supply for a potable water connection is the boundary where the council responsibility ceases and private ownership begins.

(b) The legal definition is detailed in each council's by-laws. The by-law definition takes precedence over the descriptions given here.

(c) The point of supply, or the boundary between public and private responsibility, is typically the customer side of the service valve (toby) unless otherwise specified.

(d) The council shall own and maintain all pipework and fittings up to and including the point of supply.

(e) The point of supply shall be located in the road reserve 500 mm from the boundary, or in accordance with the following:

  (i) Where site constraints or other services prevent placing the point of supply in this location, the point of supply shall be located in the public road at a greater off-set from the road boundary.

  (ii) Where neither of these options are practicable for reasons of maintenance, access or boundary anomalies, alternative locations shall be discussed with Wellington Water.

(f) Service valves (or meters) should not be located in driveways or areas where vehicle traffic is likely. Where a meter cannot be accessed safely, a remote display shall be installed in a location that is safe and has ready access for meter readers and is either on the boundary or public land.

6.3 Design methods

The design methods presented here are considered to be acceptable for the purposes of developing solutions compliant with the objectives and performance criteria of this standard. Deviation from these methods will be considered with suitable evidence that the method is equivalent in function and outcome to the standard solutions presented in this document.

As a minimum, the designer shall:

(a) Conduct flow and pressure tests on the public main. Test results shall be submitted to Wellington Water as part of any application.

(b) Have calculations prepared by an appropriately qualified engineer to demonstrate the proposed scheme will comply with the requirements of both SNZ PAS 4509 and the Regional Standard for Water Services. Certified calculations shall be submitted to Wellington Water as part of any application.

(c) For larger subdivisions, or those that may have a significant impact on the existing network, Wellington Water may also require that numerical network modelling is used to determine the scheme's compliance with the performance criteria of this document.

6.3.1 Hydraulic design

6.3.1.1 Peak demand

The following applies to the calculation of peak demand figures:

(a) The peak demand is based on the ultimate population or number of dwellings expected in the development/area. The ultimate population for a development can be determined from **Section 5.3.1.2 Population**.

(b) The peak instantaneous residential demand Q_{peak} shall be determined using:

Equation 2 $$Q_{peak} = 0.0162 \times \text{Population}$$

(c) Peak day demand volume per person shall be assumed to be the litres per head figures presented in **Table 6-2**. Firefighting volumes are not included in the estimate of peak day demand.

(d) Where an area has predominantly industrial demand, and the demand is unknown, the designer may use the ADWF calculated in **Section 5.3.1.4 High density / industrial / commercial design flows** multiplied by a factor of 8, as the design demand for the water supply analysis.

(e) The peak demand shall be used to calculate minimum peak demand pressures within the network, and firefighting pressures.

6.3.1.2 Operating pressure

The following applies to the design of water supply operating pressure:

(a) The maximum operating pressure for any reticulation pipeline delivering potable water to domestic or commercial properties shall be 90 m.

(b) Any new pipeline required to operate at greater than 90 m to supply potable water to elevated areas remote from the supply reservoir, shall be constructed as dedicated high pressure trunk mains, and:

  (i) There shall be no service connections to private or commercial properties from these trunk mains, except as agreed in writing with Wellington Water and where there is no practical alternative connection.

(c) Subdivisions shall be designed so that the maximum mains pressure in any part of the new subdivision does not exceed 90 m.

(d) Where an existing main exceeds an operating pressure of 90 m, preference shall be given to designs that result in the new main being parallel to the high pressure mains and operating at pressures less than 90 m.

  (i) In the renewal section all service connections shall be disconnected from the high pressure main and re-connected to the new main.

  (ii) The new main shall be retained to supply elevated areas downstream or shall be replaced with a dedicated new high pressure trunk main.

(e) During design, consideration shall be given to inter-connection of subsequent renewals to create well networked pressure zones around high pressure trunk mains.

(f) All fittings and pipelines shall comply with the minimum pressure class specified in the Regional Specification for Water Services.

(g) An allowance for surge shall be made where the main is subjected to automated closing valves or the influence of pumps. The design operating pressure for any point in the system shall be calculated as:

    (i) Maximum possible static pressure + allowance for surge (See **Appendix 4**).

6.3.1.3 Firefighting flows

Firefighting flows shall be as outlined in the latest revision of SNZ PAS 4509. Compliant pressures shall be calculated with the firefighting flows being delivered simultaneously during a two thirds (2/3) peak demand period on a maximum demand day.

6.3.1.4 Domestic sprinkler systems

Domestic sprinkler systems:

(a) May be proposed for situations where the existing reticulation cannot meet the requirements of the FW2 water supply classification of SNZ PAS 4509.

(b) Shall be recorded as a requirement on a consent notice provided the reticulation can meet the FW1 requirements of SNZ PAS 4509.

(c) Are to be privately owned, operated and maintained.

The designer shall:

(d) Conduct tests on the public main; test results shall be provided by the applicant to Wellington Water.

(e) Have calculations prepared by an appropriately qualified engineer to demonstrate the proposed scheme will comply with the requirements of SNZ PAS 4509 and requirements of the proposed sprinkler system.

6.3.1.5 Allowable pipeline losses

The allowable head losses for a pipeline due to friction and turbulence, including fittings are as follows:

(a) At design peak demand, losses shall be:

    (i) ≤ 50 m/km for rider mains (typically 50 mm)

    (ii) ≤ 5 m/km for principal mains (100, 150, 200 mm)

    (iii) ≤ 3 m/km for trunk mains (≥ 300 mm).

(b) Higher pipeline losses may be considered at the discretion of Wellington Water where it can be demonstrated that there are no detrimental pressure or surge effects.

(c) Higher pipeline losses are permitted during firefighting scenarios.

(d) Losses shall be calculated using the Darcy-Weisbach method outlined in **Appendix 1**.

(e) For pump station fed systems, designers shall consider the hydraulic effects of new, clean pipe, as well as mature pipe on the operation of the pump station.

6.3.2 Re-rating of PVC and PE pipelines

The pressure rating of PVC and PE pipelines shall be determined in accordance with the operating conditions:

(a) Where PVC or PE pipelines are pressurised by pump, the pressure rating of the pipe shall be increased so that the re-rated pipe is suitable for the design operating conditions, as specified in the Regional Specification for Water Services.

(b) Where PVC or PE pipelines installed above ground or are subject to operating temperatures greater than 25°C, the pressure rating of the pipe shall be increased so that the re-rated pipe is suitable for the expected operating conditions, as specified in the Regional Specification for Water Services.

(c) Designers shall note that black PE pipe exposed to solar loading can have a wall temperature exceeding 55°C.

(d) Designers shall note that re-rating for temperature and for fatigue are cumulative.

6.3.3 Pipe surge

The effects of surge shall be accounted for in the design as follows:

(a) A surge analysis shall be carried out for any areas where a surge within the network is possible due to an automated valve, pump, or other proposed facility capable of inducing surge. Where a surge is identified, the effect of the surge shall be mitigated.

(b) For metallic pipes, surge analysis shall be carried out as described in **Section 6.4.9 Rising mains**.

(c) Where plastic pipes are proposed in a cyclic environment, such as rising mains or direct-on-line pumping into the reticulation, provisions for a potential increase in pipe class shall be made due to fatigue and/or surge. **Appendix 4 o**utlines an acceptable method for determining the effects of surge and fatigue on plastic pipes.

6.3.4 Network modelling

Network modelling shall be completed in accordance with the following:

(a) Network modelling shall typically use the values in **Appendix 1 Table A1-3** for pipe roughness, except where modifications are made for other pipe types such as unlined cast iron or asbestos cement.

(b) Wellington Water may request the modelling to be carried out using particular software or format. Additionally:

  (i) Wellington Water may be able to provide modelling services to the developer or wish to conduct the modelling in-house.

  (ii) The developer is to discuss requirements with Wellington Water prior to carrying out any modelling to confirm process and requirements.

(c) Where the model incorporates existing infrastructure, the model shall be calibrated against recent data:

  (i) Wellington Water may be able to provide some network data for this purpose.

  (ii) The WaterNZ Modelling Special Interest Group has published the *National Modelling Guidelines for Water Distribution Network Modelling*. Models shall be developed and calibrated in accordance with these guidelines.

(d) The developer shall submit a modelling report outlining the scenarios, assumptions, verification and results from the modelling activities.

(e) Wellington Water may require a peer review of the model to be carried out at the developer's expense.

6.3.5 Hydraulic report

All scheme designs shall be accompanied by a hydraulic report. The hydraulic report shall demonstrate how the proposed scheme complies with the performance criteria of this document and shall include, but not be limited to:

(a) Demonstration of compliance with minimum pressures at points of supply during peak demand.

(b) Demonstration of compliance with minimum pressures during firefighting scenarios, including multiple scenarios as necessary to demonstrate suitable coverage of all proposed lots, and noting that:

  (i) Minimum pressures in the network shall not fall below 10 m during firefighting scenarios and shall be compliant with the requirements of SNZ PAS 4509.

(c) The maximum pressures achieved in the network (including any allowances for surge where relevant).

(d) Life-cycle costs analyses (especially for pump selection and rising main sizing etc.).

(e) Head losses per kilometre for each pipe during peak demand flow.

(f) Hydraulic calculations

(g) Fatigue and pipe de-rating calculations

(h) Reservoir sizing report

(i) Modelling report where numerical network modelling has been carried out.

(j) Results of any surge/transient analyses.

(k) All assumptions made regarding the scheme.

6.4 General specifications for water supply

6.4.1 Information to be provided

In addition to the council's normal requirements for subdivision application, the developer shall, as a minimum, provide the following information with any water supply design:

(a) Evidence that the performance criteria outlined in this document can be met with the proposed design.

(b) Calculations and drawings as outlined below.

(c) Operations and maintenance guidelines for any reservoir, pumping station or any other mechanical facility to be vested to the council.

Any developer considering an extension or modification to the existing network should arrange a meeting with Wellington Water prior to concept design to determine the scheme's water supply needs.

6.4.1.1 Calculations

Calculations shall be prepared and presented as follows:

(a) The design details and calculations shall be prepared by a professional, qualified to a tertiary level and experienced in water supply design.

(b) Calculations shall demonstrate that required levels of service will be maintained.

(c) Calculations presented as part of any application shall include, but not be limited to:

  (i) Demand calculations (both staged and projected ultimate demands)

  (ii) Hydraulic calculations

  (iii) Network modelling reports

  (iv) Structural calculations for reservoirs and pumping stations

  (v) Pump curves and duty points

  (vi) Economic evaluations

  (vii) Structural trench design.

(d) All assumptions regarding the design shall be clearly listed.

(e) Hydrant testing shall be mandatory for the design of any firefighting supply, whether private or public, except where:

  (i) Wellington Water may waiver this requirement if existing information is held demonstrating the network has adequate capacity.

6.4.1.2 Design and construction drawings

The following applies to water supply design and construction drawings:

(a) Any building consents shall be sought under the council’s building compliance regulatory role.

(b) Proposed works shall not begin until construction plans have been approved.

(c) Drawings shall show:

  (i) The layout of the proposed reticulation including a legend, service connections, valves, hydrants, air valves, scour points, easements, stage termination points and any pertinent topographical features that may impact on the operation or future expansion of the network.

  (ii) Proposed materials, sizes and pressure class of all pipes.

  (iii) Typical and specifically engineered trench and installation details.

  (iv) Typical and specifically engineered thrust block details.

  (v) Junction and jointing details

  (vi) Where any anchor blocks, bulk heads, water stops, above ground pipelines, steep pipelines, or where any non-standard installation is required.

(d) Specific construction drawings for specific facilities such as reservoirs, pressure reducing valves (PRVs), water meters or pumping stations will also be required.

6.4.1.3 Asset operations and maintenance plan

All new assets will be accompanied by an asset operations and maintenance plan, as part of the completion documentation, which shall detail how the asset is to be operated and maintained over the life of the asset. A replacement schedule should also be included to show what works needs to be carried to ensure the asset is operable in perpetuity. The plan shall include as a minimum:

(a) Required inspection and condition assessment schedule.

(b) Required maintenance, both regular and occasional, to ensure continued operation.

(c) Required replacement schedule for components with a limited lifespan, or life span shorter than the nominal life expectancy of the asset as a whole.

(d) How the asset is to be operated or is intended to work including:

 (i) Stages where operator input is required should be highlighted.

(e) Health and safety and operational risks intrinsic to the asset, operators and public and either:

 (i) How they have been mitigated (through design), ***or***

 (ii) How they should be mitigated (through operation).

6.4.2 Network layout

The following applies to the potable water network layout (see **Standard Detail WS01 – Typical Water Reticulation Layout** in the Regional Specification for Water Services):

(a) Public mains should, as far as practicable, be laid in the road reserve and be arranged to:

 (i) Avoid dead ends and minimise friction losses, tendencies for surge and zones of stagnant water.

 (ii) Allow easy access for repairs and maintenance.

 (iii) Typically be parallel with property boundaries or road kerb lines.

 (iv) Maintain adequate clearance from buildings, structures and other infrastructure to avoid collateral damage from failures (see **Section 3.8 Building in close proximity to public pipelines**).

 (v) Cross other services as close to perpendicular as practicable and not place undue load on adjacent services (refer to additional requirements for adjacent services in the Regional Specification for Water Services).

 (vi) Take into consideration flexibility of distribution zone boundary changes and potential outage areas.

 (vii) Where practicable, limit the number of affected residents from any valve closures to 50 lots.

 (viii) Minimise the length of service connections and ensure that they do not cross carriageways where possible (see **Section 6.4.7 Rider mains**).

 (ix) Provide a fully networked system to minimise disruption when any section is shut down for maintenance.

(b) Principal mains shall be provided on both sides of the road in:

 (i) Major roads and dual carriageway roads

 (ii) Split level roads

 (iii) State highways and motorways

 (iv) Roads with railway lines

 (v) CBD and suburban centres

(vi) Roads with a central dividing island
(vii) Industrial/commercial areas.

(c) Where practicable, for ease of maintenance, reticulation mains with service connections shall be laid in the berm as opposed to the footpath or carriageway.
   (i) Mains shall not be laid under commercial verandas.
   (ii) New mains shall not be placed near mature trees, or proposed tree planting locations.

(d) Where a hydrant on a principal main is required in a private right-of-way in order to comply with SNZ PAS 4509, the main shall be a public main. The main shall be placed in an easement in favour of the council, clear of wheel tracks and constructed to the same standard as if laid in the public carriageway.

(e) Where a main is required to be laid in private land, the main shall have an easement (refer to **Section 6.4.4 Easements**) in favour of council registered over it on the property title.

6.4.2.1 Loops

Loops in the watermain network shall be used as follows:

(a) The network layout shall be designed to avoid dead ends as far as practicable to minimise water age and prevent the deterioration of water quality.

(b) Where a road or cul-de-sac terminates at a dead-end, and an access way or road reserve carries through to an adjacent street, the principal main shall be carried through to connect to the main in the adjacent street. The through-main shall be a minimum nominal diameter of 100 mm.

(c) Alternatively, Wellington Water may accept a looped rider main at the end of a short cul-de-sac.

6.4.2.2 Maximum branch main length

The following applies to the maximum length of branch mains:

(a) The maximum length of a branch, single-end fed reticulation main is 135 m long for a 100 mm pipeline, or 450 m long for a 150 mm diameter or larger pipeline.

(b) Dispensation for this clause may be applied for on a case-by-case basis taking into consideration minimum firefighting pressures, allowable pipeline losses and minimum peak pressures.

(c) Coastal roads where network loops are not practical are an example where dispensation may be considered.

6.4.2.3 Mains with no through flow (dead ends)

A pipe may be supplied by two water supply zones; one from each end. In normal operation, a normally shut valve shall separate the supply zones, resulting in a length of main that has no flow, but is under full operating pressure. The following applies to mains with no flow / dead ends:

(a) The shut valve and adjacent pipe forms a dead-end.

(b) Hydrants shall be placed either side of the shut valve to facilitate scouring of stale water either side of the shut valve.

(c) The maximum length of a dead end shall not exceed 10 m, except:

  (i) Where, for operational reasons, a dead end longer than 10 m is formed, a second shut valve shall be installed such that the section of "dead" pipe shall have a valve at both ends fully isolating the dead pipe.

  (ii) Hydrants shall be placed on the upstream side of each shut valve.

6.4.2.4 Rail / motorway / stream crossings

The following applies to watermains that cross beneath railways, streets, and streams:

(a) A water main, as far as is practical and where necessary, shall cross streets, railway lines, streams and underground services at right angles.

(b) Mains shall be installed within a steel encasement pipe when crossing beneath railway lines, motorways, or beneath structures such as embankments or monuments.

  (i) The steel encasement pipe shall be designed to the requirements of the latest revision of the Specification for the Installation of Utility Structures on Railway Land (C-SP-AE-64322).

  (ii) When installed in an encasement pipe, the water main shall be constructed in such a way that the main can be withdrawn and replaced without excavation of the road corridor, carriageway, or railway.

  (iii) The steel ducting shall be epoxy or concrete lined for protection against corrosion.

(c) Specification C-SP-AE-64322 shall be complied with for pipes in railway land.

(d) Special design, in consultation with Wellington Water, is required where a pipeline crosses above or beneath a stream and resource consent may be required.

6.4.3 Manholes

Manholes shall:

(a) Allow physical entry of a person and equipment to the pipe for purposes of maintenance, investigation or connection.

(b) Be constructed in pre-cast reinforced concrete with minimum number of risers to minimise risk of infiltration. Other materials may be accepted by Wellington Water upon application and with suitable reason.

(c) Be designed with a drainage discharge point into the bedding metal of the pipe.

6.4.3.1 Design to prevent floatation

See **Section 4.4.7.3 Design to prevent floatation.**

6.4.3.2 Deep manholes

See **Section 4.4.7.6 Deep manholes.**

6.4.4 Easements

Public water pipes should not be laid in private property. Easements in favour of the council are required for:

(a) Any public water supply assets proposed to be laid in private land, right-of-way, or private road (see **Section 6.2.4 Access**):

  (i) This includes any mains, service valves, service connections, chambers, or facilities.

  (ii) The pipe shall be laid along the centre of the easement such that it can be practically accessed, serviced, and replaced at any time in the future.

The width of easements shall be as follows:

(b) Council owned service pipes in private property shall have an easement width of 1m.

(c) Rider mains shall have a minimum easement width of 1.8 m.

(d) For principal pipelines up to and including 150 mm diameter, easements shall be the greater of 3 m or the pipe's outside diameter plus 2 x the depth to invert.

(e) For principal pipelines larger than 150 mm diameter, easements shall be the greater of 4m or the pipe's outside diameter plus 0.5 m plus 2 x the depth to invert.

(f) Bulk and trunk mains shall be assessed on a case–by-case basis to ensure provisions for future access, maintenance and renewal are accommodated.

6.4.5 Distribution zones

The following applies to distribution zones:

(a) Distribution zones are discrete water networks, typically supplied from a common source, that occupy separate topographical areas with different operating elevations.

(b) They have a discrete boundary that is generally denoted by shut (boundary) valves and/or PRVs.

(c) Moving a distribution zone boundary is not permitted without written dispensation, as it affects water quality compliance, existing customers and may increase the risk of failure of existing pipes.

(d) Creation of a distribution zone supplied through a PRV is at the discretion of Wellington Water.

6.4.6 Water mains

The following applies to water mains:

(a) New water supply networks for new subdivisions, or renewal of the existing water supply network, shall only be constructed using pipe sizes, materials and fittings and construction methods complying with the requirements of the Regional Specification for Water Services.

(b) If non-complaint sizes and/or materials, or construction methodology are proposed, written application shall be made to Wellington Water. Acceptance of non-complying sizes or materials or construction methodology shall be at the sole discretion of Wellington Water.

6.4.6.1 Materials

The permitted pipe materials for use in the water supply network are detailed in the Regional Specification for Water Services.

Other items to note when considering pipe materials are:

(a) Pipe bridges and above ground pipes shall be concrete lined steel (STCL) or concrete lined ductile iron (DICL).

(b) Pipes on banks with a slope greater than 1:5 (v:h) shall be laid in STCL or axially restrained DICL. These pipes shall also be anchored using anchor blocks (see **Section 6.4.21 Thrust and anchor blocks**).

(c) PE or PVC pipes shall not be used in areas that are contaminated, or may be potentially contaminated, with hydrocarbons.

6.4.6.2 Location

See **Section 4.4.5.4 Location**.

6.4.6.3 Pipe sizes

Regardless of the minimum hydraulic requirements for providing adequate firefighting and peak demand flows and pressures, the **minimum** nominal internal diameter of pipes shall be:

(a) 20 mm for customer service connections.

(b) 50 mm for rider mains.

(c) 100 mm for principal mains in residential areas.

(d) 150 mm for principal mains in industrial/commercial and CBD areas.

In addition to the minimum diameters above, the allowable nominal pipe sizes permitted for use in the network are detailed in **Table 6-3**.

Table 6-3 – Allowable nominal pipe diameters

Type	Permitted nominal internal diameter (mm) +	Allowable pipe material
Customer services	20, 25, 32, 40, 50	PE100 SDR11
	100, 150	PVC, STCL, DICL
Rider mains	50	PE100 SDR11
Principal mains (with customer connections)	100, 150, 200	PE100 SDR11, PVC, DICL, STCL
Trunk mains (no customer connections)	300, 400, 450, 500++, 600++, 750++	PE100 SDR11, STCL, DICL
Trunk mains greater than 750 mm nominal diameter	Sized in agreement with Wellington Water	STCL or DICL

\+ Outside diameter for PE pipes

++ StCL and DICL preferred for large diameters due to difficulty ensuring high quality jointing on large diameter PE100 pipes. However, pipes may be PE100 if these materials are not suitable for specific technical reasons only.

6.4.6.4 Minimum cover

The following applies to the minimum depth of watermain installation:

(a) No water main shall be laid at a depth of cover less than the minimum scheduled in the Regional Specification for Water Services.

(b) New water mains shall be designed to cross under existing services where possible.

(c) Where it can be shown that it is not possible cross under other services, Wellington Water may agree to reduce the depth of cover to the minimum special case stated in the Regional Specification for Water Services.

(d) If the minimum special case depth of cover cannot be achieved, a specific design shall be prepared for consideration by Wellington Water. This design shall consider pipe material and class, ground conditions, external loadings and connections to the pipeline either side of the crossing to maintain pipeline resiliency.

(e) If crossing under existing services requires the new water main be laid at a depth exceeding the maximum cover allowed by the Regional Specification for Water Services, options to reduce depth of cover to less than those specified may be considered and approved by Wellington Water.

 (i) The reduced depth of cover shall not be less than 300 mm below the listed minimum cover.

6.4.6.5 Maximum cover

The acceptable depth of cover shall, to some extent, be determined by method of installation and the health and safety risks that result from installation method.

Generally, the maximum depth of cover to water mains shall not exceed those specified in the Regional Specification for Water Services.

6.4.6.6 Terminal mains

The following applies to terminal mains that terminate at the end of a cul-de-sac or similar (see **Standard Detail WS01 – Typical Water Reticulation Layout** in the Regional Specification for Water Services):

(a) Terminal mains shall end at a hydrant, preferably situated in the carriageway.

(b) Any customer or rider main connections shall be positioned upstream of the terminal hydrant so the entire length of the principal main can be flushed through the hydrant.

(c) The length of pipe between the last service connection, or rider main connection, and the terminal hydrant flange/socket shall be between 500 mm and 1000 mm.

6.4.6.7 Bends and curves

The following applies to bends and curves:

(a) Pipes shall, wherever possible, be laid parallel to the kerb or carriageway centreline.

(b) To achieve small angles of deflection, rubber-ring jointed pipe may be laid with deflections at the joint up to the manufacturer's recommended safe deflection.

(c) Curvature using the pipe barrel will not be tolerated except in PE pipes.

(d) Where deflections greater than those obtainable on rubber ring joints (RRJs) are required, they shall be achieved using pipe fittings as specified in the Regional Specification for Water Services.

6.4.7 Rider mains

Rider mains are required to service groups of adjoining properties that do not have road frontage adjacent to a principal main. Individual services that cross the carriageway centreline are not preferred.

Rider mains shall:

(a) Be 50 mm nominal diameter (see **Section 6.4.6.3 Pipe sizes**).

(b) Be supplied from a principal main at both ends, except for private roads or right-of-ways.

(c) Have intermediate connections for rider mains longer than 100 m.

(d) Have at least one flushing point.

(e) Have a valve installed at all connections to principal mains.

6.4.8 Above ground mains

Any above ground mains must be approved by the Wellington Water in principle and design. Reticulation mains shall not typically be laid above ground, except where the main:

(a) Crosses over a stream.

(b) Crosses over a railway or vehicle lane via a pipe bridge or attached to the deck of another bridge.

(c) Is built within a tunnel.

(d) Is attached to the face of a retaining wall or steep bank.

The following applies to materials for above ground mains:

(e) PVC shall not be used to construct any above ground water main.

(f) Although suitable for use above ground, PE shall not be used to construct water mains above ground except where specifically approved by Wellington Water.

    (i) PE water mains shall not be attached to steel or concrete bridges.

(g) STCL may be used to construct any above ground water main. STCL above ground pipelines shall be protected from atmospheric corrosion by application of 150 microns (minimum) of zinc metal spray with a sealer coat applied over the sacrificial corrosion protection.

(h) DICL may be used to construct any above ground water main. DICL above ground pipelines shall be protected against atmospheric corrosion as recommended by the manufacturer.

The following applies to jointing methods and allowances for movement in above ground pipelines:

(i) Pipes installed in the vertical axis (or on a grade exceeding 50%) shall be flange jointed and be suitably restrained to walls or structures to withstand seismic loading plus normal service loads.

(j) Pipes installed on flatter grades may be RRJ. All RRJs shall be tied and capable of rotation, extension, and contraction.

(k) Where pipes cross a bridge abutment, they shall be able to accommodate movement that results in both longitudinal and vertical or lateral offset. This shall be achieved using a mechanical joint and not a rubber bellow.

(l) Where pipes cross an expansion joint interface, suitable means shall be provided to allow for longitudinal movement. This may be a sliding expansion joint or bellows.

(m) Provision must be made to allow for protection, maintenance and replacement.

6.4.9 Rising mains

The following applies to rising main design:

(a) Rising mains shall be designed in consideration with the design duty of existing or proposed pump sets.

(b) The length, material, and diameter of the rising main have a significant influence on the dynamic head on the pumps.

(c) The pumps and/or rising main shall be selected to enable the pumps to operate as close as possible to the best efficiency point.

(d) Rising mains and materials shall be designed to accommodate anticipated surges and test pressures.

  (i) A transient analysis may be required by Wellington Water for:

    1. Rising mains longer than 300 m
    2. With a flow greater than 30 L/s and a dynamic head greater than 14 m
    3. A high lift (~50 m or greater) system with a check valve.

  (ii) Surge scenarios shall include sudden loss of electricity (sudden stop) and direct-on-line starting (sudden start).

  (iii) Surge protection devices will be considered to mitigate the effects of surge.

  (iv) Variable frequency drives may be considered to mitigate the surge effects of sudden start, but not for sudden stop surges as power failure is still a credible risk.

(e) Due to the cyclical loading nature of rising mains, the main shall generally be of STCL or DICL.

  (i) Butt fusion welded PE100 pipe may be considered for pumped mains 100 mm to 300 mm diameter, and shall be used for pumped mains less than 100 mm nominal diameter.

  (ii) PE pumped mains shall be re-rated to allow for fatigue and, where appropriate, temperature (see **Appendix 4**).

(f) The proposed rising main option shall be shown to be the most economical through a net present value analysis (NPV) comparing capital and operating costs over a 50-year period.

  (i) A sensitivity analysis on the interest rate used shall also be shown. This may simply be varying the rate by 1% to 2% either side of the interest rate to demonstrate the effect this has on the preferred economic option. The interest rate used should be the average long-term lending rates published by the Reserve Bank of New Zealand unless otherwise specified by Wellington Water.

(g) Rising mains shall be designed as normal buried water supply pipelines allowing for anchor and thrust blocks, trench stops, bulkheads and suitable jointing.

6.4.10 Suction mains

Suction mains are the pipes that are laid continuous between the upstream network and the pumpset inlet. These pipes shall be designed to the same standard as rising mains.

An analysis of the upstream network is required to ensure:

(a) The pumping station's operation does not create detrimental or nuisance surges within the upstream network

(b) That satisfactory suction pressures can be maintained at the pump inlet under all design scenarios.

6.4.11 Cathodic protection for steel pipes

Cathodic protection shall be provided as follows:

(a) All steel pipelines shall be designed to accommodate the potential application of an impressed current cathodic protection system.

  (i) The design shall include bond cables across mechanical couplings, flange joints and valves to maintain electrical continuity.

  (ii) The pipe steel wall shall be insulated from concrete components (chambers and thrust blocks).

  (iii) Insulated joints shall be installed at branches on the pipeline and at both ends of the pipeline.

(b) For steel pipelines larger than 600 mm nominal diameter and longer than 1000 m, an impressed current cathodic protection system, including monitoring points, shall be installed that complies with AS 2832.1:2015.

6.4.12 Commercial service connections

Each commercial property on a lot, proposed, anticipated or otherwise, shall:

(a) Require a separate, single potable service connection from the public main up to and including the agreed point of supply (refer to **Section 6.2.8 Point of supply**).

(b) Have the size, depth of cover and material of the service pipe and the connection comply with the requirements of Regional Specification for Water Services.

6.4.12.1 Commercial water meters

A meter may be required to be installed as part of the connection (see **Section 6.4.23 Water meters**).

Water meters shall comply with the requirements of the Regional Specification for Water Services.

6.4.13 Residential service connections

The following applies to residential service connections:

(a) Each residential dwelling on a lot, proposed, anticipated or otherwise, shall require a separate, single potable service connection from the public main up to and including the agreed point of supply (refer to **Section 6.2.8 Point of supply**).

(b) Front sections (or dwelling units with individual street frontage) shall have the point of supply located adjacent to the street boundary, as outlined in **Section 6.2.8 Point of supply**.

(c) For properties supplied from a public main in a right-of-way or private land, the service valves shall be located in a shared property.

(d) The location of all service valves and service pipes shall be shown on the construction drawings for approval.

(e) Service valves should not be placed in driveways.

(f) The size, depth of cover and material of the service pipe and the connection shall comply with the requirements of Regional Specification for Water Services.

(g) Unit titled developments are exempt from this requirement and may be serviced by a single suitably sized service connection.

6.4.13.1 Residential water meters

A meter may be required to be installed as part of the connection (see **Section 6.4.23 Water meters**).

Water meters shall comply with the requirements of the Regional Specification for Water Services.

6.4.13.2 Connection to rural properties

Water supply connections from the reticulated water supply to rural or rural residential will be considered as follows:

(a) Connections will not be approved if the property is not connected to a reticulated public wastewater system. This is to limit the potential for an on-site wastewater system to be hydraulically overloaded.

(b) Connections may be considered by Wellington Water if the supply is a restricted flow supply and is metered.

6.4.14 Backflow prevention

The following applies to backflow prevention:

(a) The council's policy on backflow prevention shall be complied with at all times.

(b) Where required, backflow preventers must be installed, appropriate to the hazard classification of the user type.

(c) The backflow prevention device shall comply with NZBC and AS/NZS 2845.1.

(d) All commercial and industrial services shall require a testable backflow preventer installed downstream of the service valve and meter and as close as practicable to the point of supply.

   (i) A second shut-off valve shall be installed on the downstream side of the back-flow preventer and meter to allow the backflow preventer to be isolated for maintenance purposes.

(e) All fire service connections require a double check detector check backflow prevention device.

(f) Requirements for access and easements must be considered.

(g) Wellington Water, at its discretion, may also request additional backflow prevention to meet their obligations under the Health (Drinking Water) Amendment Act.

(h) Refer to the standard details in **Appendix 1** of the Regional Specification for Water Services, and the Approved Products Register.

6.4.15 Fire services

The following applies to fire services:

(a) Fire services for firefighting networks and automatic fire suppression sprinkler systems require specific consideration and approval and shall be applied for, and designs completed, outside the provisions of this document.

(b) Notwithstanding this, if a standard 20 mm nominal diameter domestic customer connection is inadequate to provide both the demand requirements of this standard, and those of NZS 4517, a separate metered connection to the public main shall be designed and applied for to supply the sprinkler system and a single water closet. The size of the connection shall be sufficient to meet the requirements of NZS 4517.

6.4.16 Secure connections

A customer, such as a hospital or commercial development, may require a secure supply which will reduce the potential for water outages due to maintenance activities. The following applies to secure water supply connections:

(a) Secure connections may be in the form of:

   (i) A dual connection from the same main, separated by a line valve and a minimum horizontal separation of 1 m, unless the connections have lateral restraint (flanged or welded connections), in which case they can be laid closer together (as per the minimum clearances between adjacent/parallel utilities as specified in the Regional Specification for Water Services.

   (ii) Connections to two separate individual principal mains, both with backflow preventers on them to avoid cross-connection.

(b) The form of the secure connection shall be discussed and approved at the discretion of Wellington Water.

(c) It is up to the designer to ascertain the design’s compliance with NZS 4541 if the connection is provided for the purpose of firefighting.

6.4.17 Water supply pumping stations

The following applies to water supply pumping stations:

(a) Pumping stations shall be provided by the developer to supply water to a reservoir at a higher hydraulic elevation than the sourced distribution zone.

(b) The designer shall discuss standard pumping station requirements with Wellington Water prior to preliminary design and shall comply with any Wellington Water technical specifications. Pumping station design shall, as a minimum, include:

(i) Consideration of rising main design (see **Section 6.4.9 Rising mains**), pressure surge potential and mitigation.

(ii) Consideration of available suction pressures and the detrimental effects the station may have on suction pressures when running.

(iii) Electrical supply including protection measures and terminals for emergency generator connection.

(iv) Variable speed drive (VSD) pump control unless agreed otherwise with Wellington Water.

(v) Pumpset selection and installation, including efficiency at operating flow rates.

(vi) Magnetic flow metering.

(vii) Manual and electronic pressure monitoring.

(viii) Seismic restraint systems for all equipment.

(ix) Bellows on inlet and outlet to reduce vibration and noise though the pipework unless agreed otherwise with Wellington Water.

(x) Anti-vibration base and mounts for pump and motor sets.

(xi) Consideration of practical maintenance of all equipment and pipe work.

(xii) SCADA (using Wellington Water-specified equipment and I/O conventions) with viable radio link.

(xiii) Permanent station building with suitable security, access, ventilation, acoustic dampening, lifting provisions (overhead gantry), drainage, parking and external visual mitigation.

(c) The design specifications shall be approved by Wellington Water along with acceptable pump makes.

(d) The developer shall provide all electrical connections and electricity accounts for the station. Switchboards will require terminals to allow the station to be powered by a mobile stand-by generator.

(e) Pipework within the station shall generally be flange jointed of either DICL or STCL.

(f) The pump station and access shall be placed completely within a separately titled lot or within road reserve (refer to **Section 6.2.4 Access**):

(i) A sealed access road of not less than 3.5 m width shall be provided to the nearest public street.

(ii) The immediate area around the station’s titled lot (if applicable) shall be fenced and provided with a locked gate.

(iii) The station shall be designed such that it complements the surroundings through the use of architectural featuring and/or landscaping and planting.

(iv) The final design shall be approved by Wellington Water.

(g) Operation and maintenance manuals will be required for all pumping stations as part of the completion documentation.

(h) Liaison with Wellington Water is required if the station is to be connected to part of the wholesale water supply network.

(i) If the pumping station building covers less than two thirds of the lot, the lot shall have permanent fencing or other methods to prevent access by the public and livestock.

6.4.17.1 Pumping stations serving a reservoir

The following applies to pumping stations that serve reservoirs:

(a) Pumping stations shall be designed with a minimum of two pumps in a duty/standby arrangement (100% standby capacity).

(b) Three pumps may be allowed in larger stations with Wellington Water approval. Where three pumps are installed, they shall be in a duty/assist/standby arrangement (with 50% standby capacity).

(c) The pumps shall be sized to pump the greater of the full reservoir storage volume over a 24-hour period or the peak day volume over an 18-hour period, without using the standby unit.

(d) Small stations (daily pumping volume less than 2500 m^3/day) shall be sized to pump the greater of the full reservoir storage volume over an 18-hour period or the peak day volume over a 15-hour period, without using the standby unit.

6.4.17.2 Booster pumping stations

Booster pumping stations:

(a) Will not typically be permitted for developments.

(b) Require special permission from the Wellington Water to be considered as an option.

(c) If permitted, shall be designed to provide, as a minimum, 1.5 times peak consumer demand using variable frequency drives and compatible pumpsets.

(d) Shall not be used for firefighting supply.

(e) All fire hydrants shall be supplied by gravity from reservoirs.

6.4.18 Reservoirs

The following applies to reservoir:

(a) Reservoirs shall, as a minimum, retain the volume outlined in **Table 6-2**, including firefighting volume and storage volume determined from the ultimate development population outlined in **Section 5.3.1.2 Population**.

(b) Council reserves the right to refuse developments that are proposed to be served by a small reservoir, typically those serving less than 100 sections and/or smaller than 250 m3 in size.

(c) Only designers that have been approved by Wellington Water are permitted to design reservoirs. The designer shall approach Wellington Water prior to preliminary design to ascertain the current Wellington Water specifications for reservoirs, which will supersede any requirements outlined in the Regional Specification for Water Services.

(d) Reservoirs shall be funded and constructed by the developer to the above specifications.

(e) The council reserves the right to construct the reservoir at the council's expense, with a contribution from the developer, if there is an additional purpose for the reservoir.

(f) The council may contribute to any reservoir being constructed by a developer if that reservoir is suitably sized to supply an area outside the proposed development.

(g) Reservoirs shall be sited on a separately titled and fenced lot and with a minimum 3.5 m wide gated and sealed vehicle access road (refer to **Section 6.2.4 Access**).

  (i) The separately titled lot and reservoir shall be vested to council.

  (ii) Security to the site and structures shall be to current Wellington Water standards. The site shall be secured to reduce unrestricted public access and prevent access by livestock.

  (iii) Vehicle access to the reservoir shall be no steeper than 1 to 6 (v:h).

  (iv) The reservoir shall be suitably screened and visually mitigated to complement the surrounding environment, including any security fencing or gates required.

(h) Operational and maintenance manuals are required as part of the completion documentation.

6.4.19 Water fittings

6.4.19.1 Fire hydrants

Fire hydrants shall:

(a) Comply with the requirements of the Regional Specification for Water Services.

(b) Only be placed on mains 100 mm nominal diameter or greater and may be used for:

  (i) Providing water for firefighting.

  (ii) Flushing water from terminal mains.

  (iii) Allowing air to enter, and discharge from, the main during mains filling or draining.

  (iv) Scouring.

  (v) Introducing water to the mains from adjacent zones or for disinfection or pressure testing.

  (vi) Introducing chlorine disinfection solution to the mains.

The following applies to the placement of fire hydrants:

(c) Maximum spacing shall be as per SNZ PAS 4509 and suitable for the highest risk fire hazard class in the vicinity.

(d) Special note shall be made of SNZ PAS 4509 requirements for hydrant spacing with regards to distance lines and access to buildings set back from the carriageway.

(e) Notwithstanding the requirements of SNZ PAS 4509, hydrants shall be:

  (i) Spaced at intervals not exceeding 90 m in commercial and industrial areas, and 135 m in residential areas.

  (ii) Placed at intersections and adjacent to special fire risks.

  (iii) In front of long right-of-ways.

  (iv) At high points in the reticulation for release of air.

  (v) At low points in the reticulation for emptying and re-filling the pipeline.

  (vi) Placed adjacent to all line and network valves.

  (vii) Placed with due consideration to the safe operation of the hydrant.

(viii) Placed at the end of terminal mains and at reticulation low points to allow for scouring.

(ix) Placed either side of a distribution zone boundary valve.

(f) Terminal hydrants shall be placed in the carriageway unless discharge can be made to a suitable sump or drain without flowing over unsealed public land and without nuisance. The terminal hydrant shall be mounted on a hydrant bend.

(g) Hydrants shall not typically be placed on rising mains or trunk mains where these mains are without services and there are adequate parallel principal mains available.

6.4.20 Valves

Only valves complying with the Regional Specification for Water Services and listed in the Approved Products Register shall be installed within the potable water supply network:

(a) Butterfly valves shall not be used in the water supply network except where approved by the Regional Specification for Water Supply.

(b) Where butterfly valves are approved for use, valves shall comply with all specified requirements.

(c) Valves are used to isolate sections of the network for operational or maintenance purposes. They shall be located:

(i) In a manner that minimises the number of properties affected by a mains closure.

(ii) At the beginning of any branch or rider main.

(iii) In locations that enable safe operation, taking into account traffic and access considerations.

(iv) In a manner that minimises the number of valves or hydrants required at intersections, whilst still achieving operational objectives.

(v) Either side of above ground pipelines and other pipeline structures that require separate maintenance or are expected to require inspection and/or repair following a seismic event.

(vi) At distribution zone boundaries.

(d) All buried valves shall be housed in a surface box in a manner approved by Wellington Water.

(e) At intersections, valves shall be placed on all branch pipelines and at least one placed on the through pipeline to maintain operational flexibility and limit potential customer disruption.

6.4.20.1 Gate valves 100 mm diameter or greater (sluice valves)

Gate valves 100 mm and greater shall comply with the requirements of the Regional Specification for Water Services.

Because of the height of the valve bonnet on gate valves, typically butterfly valves would be used in preference to gate valves on pipelines exceeding 500 mm diameter.

6.4.20.2 Gate valves 80 mm diameter

The following applies to 80 mm gate (sluice) valves:

(a) 80 mm pipelines do not comply with the size requirements of the Regional Specification for Water Services.

(b) Except in exceptional circumstances, new 80 mm diameter pipelines shall not be constructed. This shall not apply to renewal of existing 80 mm rising main where the pump station is sensitive to pipe DN.

(c) 80 mm gate valves shall only be used for repair and maintenance of existing 80 mm mains or on 80 mm service valves.

6.4.20.3 Gate valves 50 mm diameter or less

Gate valves 50 mm or less shall comply with the requirements of the Regional Specification for Water Services.

6.4.20.4 Zone boundary valves

Where a closed valve (100 mm diameter or greater) is used as a boundary between two distribution zones, a hydrant shall be installed either side of the valve to permit the scouring of stale water and use of a mobile PRV installation if required.

The surface box of the boundary valve shall be painted red.

6.4.20.5 Air valves

Air valves and their installation shall comply with the requirements of the Regional Specification for Water Services.

Generally, air valves shall not be installed on distribution mains that are not trunk mains, or bulk mains. Hydrants shall be used to manually introduce or release air in these cases.

6.4.20.6 Pressure reducing valves

The use of PRVs shall:

(a) Be avoided if at all practicable.

(b) Only be used with the approval of Wellington Water. Reduced capital costs shall not be the sole justification for their use.

(c) Where PRVs are approved, they shall comply with the requirements of the Regional Specification for Water Services.

6.4.20.7 Scour valves

Scour valves are generally required to drain the pipe for maintenance purposes, release air from pipes or to flush potentially stagnant water from ‘dead end’ mains.

(a) Scour valves are required at:

   (i) The end of all public and private rider mains.

   (ii) The end of all terminal reticulation mains (hydrants are acceptable).

   (iii) The low point between line valves of all mains with a nominal diameter greater than 200 mm.

(b) Scour pipes shall discharge to a visible location such as a stream, kerb, open channel, or pump-out chamber, to reduce the risk of the valve being inadvertently left open without detection. Additionally;

  (i) Scour pipes must not discharge to a closed stormwater structure such as a stormwater pipe.

  (ii) If discharge is to a stream or other water body, then potential impacts on water quality must be addressed.

  (iii) Scour pipes must discharge to an approved outlet and facility shall be provided to prevent damage, channel scour or flooding due to operation of the scour valve.

(c) Scour valves on reticulation larger than 50 mm shall include a chamber downstream of the scour valve for the pressure pipe to transition to gravity and to facilitate de-chlorination, before the water is discharged.

(d) Valves shall be sized to drain the main by gravity over a period not greater than 1 hour. Minimum scour sizes shall follow **Table 6-4**.

Table 6-4 – Minimum scour sizes

Main size	Scour size
50 mm	50 mm
100 to 200 mm	100 mm
250 to 300 mm	150 mm
350 to 375 mm	200 mm

(e) Backflow prevention shall be provided immediately upstream of the scour valve. A double spring check non-return valve shall be used for scour valves up to and including 50 mm (see **Standard Detail WS06 – Rider Main Scour Detail**). Check valves shall be used for scour valves larger than 50 mm.

6.4.21 Thrust and anchor blocks

All concrete for thrust or anchor blocks shall be minimum strength 20 MPa at 28 days.

6.4.21.1 Thrust blocks

The following applies to thrust blocks (see **Standard Detail WS03 – Typical Thrust Block Details** in the Regional Specification for Water Services):

(a) Thrust blocks shall be designed to resist the total unbalanced thrust and transmit all load to the adjacent ground. Calculation of the unbalanced thrust shall be based on the pressures experienced during pressure testing.

(b) Where the thrust block will not experience loads due to pressure testing, calculation of the unbalanced thrust shall be based on the design pressure.

(c) For PE water mains, calculation of the unbalanced thrust shall be the thrust due to Poisson's Response less the thrust due to hydraulic pressure.

(d) Calculation of unbalanced thrust shall include a factor of safety of 1.5.

(e) Thrust blocks are required regardless of any joint restraints employed in the pipework, with the exception that thrust blocks shall not be required on changes of direction on PE water mains.

(f) Special engineering design is required for thrust blocks on nominal pipe sizes greater than 300 mm. The design shall consider in-situ soil properties when designing the thrust blocks.

6.4.21.2 Anchor blocks

Anchor blocks are designed to prevent the movement of pipe bends in a vertical direction. See **Standard Detail WS04 – Typical Anchor Block Details** in the Regional Specification for Water Services.

(a) Anchor blocks are typically installed on vertical bends on banks and employ the weight of mass concrete to restrain the pipework.

(b) Where possible vertical changes in direction shall be designed so that anchor blocks are not required.

6.4.22 Water stops (bulkheads)

Water stops, also known as bulkheads, are required where:

(a) The potential for trench scour is high.

(b) The surrounding natural ground prevents sufficient natural drainage of the trench (if the trench is susceptible to water infiltration).

The bulkheads shall:

(c) Be keyed into the adjacent, natural ground by a minimum of 150 mm.

(d) Be spaced as per the requirements of **Section 4.4.5.7 Water stops**.

6.4.23 Water meters

6.4.23.1 Commercial meters

The following applies to commercial water metering:

(a) A single revenue meter shall be installed at the council side of the point of supply.

(b) For existing commercial service connections, where the meter is inside private property, the meter shall be relocated to the council side of the boundary during renewal of the meter.

6.4.23.2 Customer meters

The following applies to customer meters:

(a) All non-residential properties, or mixed residential and non-residential properties, extraordinary users as defined in the council's bylaws or charter, may be required to be metered at the point of supply.

(b) Developers should check the current metering policy with the council before submitting designs.

(c) Meters shall be installed to Wellington Water specifications.

(d) The meter and meter box shall be of a type approved by Wellington Water.

6.4.23.3 District area meters

District area meters are non-revenue meters designed to measure the gross community consumption. The following guidelines apply:

(a) District area meters are typically designed and installed by Wellington Water, but Wellington Water or council policy[14] may require the developer to install an area meter as part of any large multiple lot development.

(b) The area meter shall be an approved magnetic flow meter which shall be connected to Wellington Water's SCADA system.

(c) The arrangement of the meter installation shall be discussed with Wellington Water prior to detail design, but it shall typically include:

  (i) A pressure tapping with ball valve and, potentially, a pressure transducer.

  (ii) A suitably large chamber, preferably outside traffic lanes.

  (iii) Suitable operator access provisions.

  (iv) Suitable chamber drainage.

  (v) Upstream and downstream valves within a suitable vicinity.

  (vi) Suitable roadside control cabinet.

(d) The developer shall arrange the power supply for the meter operation.

6.4.24 Testing and commissioning

The following applies to testing and commissioning of the water supply:

(a) Unless otherwise stated, if records of testing and inspections are required, these records shall be provided to Wellington Water as part of the project completion and as-built documentation.

(b) For subdivisions, all water supply pipes, pumping stations, reservoirs and any relevant appurtenant structures and fittings will be tested upon completion of construction at the developer's expense, and as part of the council's approval process, prior to the issue of any S.224c certificate.

(c) Wellington Water shall be present during the tests and will sign the appropriate documentation to verify the test if successful.

(d) A minimum of 48 hours of notice is required to be given to the council prior to the test being carried out.

(e) The developer shall provide all labour, fittings and materials to carry out the test.

6.4.24.1 Pipes

The following applies to testing and commissioning of pipes and water mains:

(a) All water mains shall be tested in accordance with the requirements of Regional Specification for Water Services before commissioning.

(b) Before commissioning, the following shall be shown by testing to have been achieved:

---

[14] *For example, please see the Upper Hutt City Manual of Polices 2020, 3.13 Water conservation policy [Manual of policies (upperhuttcity.com)]*

(i) All welds on PE pressure mains shall comply with the performance requirements for PE welds set out in the Regional Specification for Water Services.

(ii) The water main, including all connections and fittings, is drip tight at the specified test pressure.

(iii) All internal surfaces of the water main, including connections and fittings, has been exposed to sterilising water. The concentration of free, available chlorine, and the contact time shall be as specified in the Regional Specification for Water Services.

(iv) The water main is free from pathogens as specified in the drinking water standards.

(c) Connecting to a public water main shall be carried out by a contractor approved by Wellington Water.

(d) The developer is not permitted to operate any public network valves without approval from Wellington Water.

6.4.24.2 Pumping stations

The following applies to testing and commissioning pumping stations:

(a) All pump stations shall be tested and certified in accordance with the Regional Specification for Water Services before being commissioned.

(b) A commissioning plan for pumping stations shall be submitted to, and approved by, Wellington Water prior to completion.

(c) All building and electrical work shall be tested and provided with a code of compliance certificate to the satisfaction of the council in its building regulatory role.

(d) Wellington Water will only accept the station once the station has satisfactorily met all the requirements of the commissioning plan and any relevant building and resource consents.

(e) Submission, in hard copy and electronic form, of operational and maintenance manuals comprise part of the commissioning requirements.

6.4.24.3 Reservoirs

All water reservoirs shall be tested, disinfected and certified in accordance with the Regional Specification for Water Services, and in accordance with the Drinking Water Standards before being commissioned.

7 APPENDICES

Appendix 1 Hydraulic design for drainage pipes

The following provides technical accompaniment to **Section 4.3.2 Hydraulic design** and **Section 5.3.2 Hydraulic design**. These pages relate specifically to stormwater and wastewater design.

Manning's Formula

Manning's Formula (**Equation 3**) can be used to estimate the capacity of the drain being designed.

$$Q = \frac{1}{n} A R^{\frac{2}{3}} \sqrt{S}$$

Equation 3

Where: Q = flow m^3/s

n = roughness coefficient (see **Table A1-1**)

A = cross-sectional area of water in pipe (m^2)

R = Hydraulic radius (A / wetted perimeter) m

S = decimal slope (m/m)

For circular pipes running partially full, the roughness coefficient Manning's n should be modified for pipes using the following:

$$n' = n\left(\frac{\left(1-\frac{d}{D}\right)-\left(1-\frac{d}{D}\right)^{7}}{2}+1\right)$$

Equation 4

Where: n' = modified Manning's n

n = Manning's n (from **Table A1-1**)

d = depth of water in pipe

D = diameter of pipe

See **Appendix 3** for graphical representations of pipe capacities for pipes running 80% and 100% full including an allowance for air entrainment.

Table A1-1 – Hydraulic roughness factors for Manning's Formula

Pipe material	**Manning's n**
Vitreous Clay	0.013
Precast Concrete Pipe	0.013
Cast in situ Concrete	0.015
PVC/PE	0.011
Corrugated Aluminium, PE or PP	0.025
Open channel	
Straight uniform channel in earth and gravel in good condition	0.0225

Pipe material	Manning's n
Unlined channel in earth and gravel with some bends and in fair condition	0.025
Channel with rough stony bed or with weeds on earth bank and natural streams with clean straight banks	0.03
Winding natural streams with generally clean bed but with some pools and shoals	0.035
Winding natural streams with irregular cross sections and some obstruction with vegetation and debris	0.045
Irregular natural stream with some obstruction with vegetation and debris	0.060
Very irregular winding stream obstructed with significant overgrown vegetation and debris	0.100

Air entrainment

Where the pipe exceeds grades of 10%, allowances shall be made for bulking of the flow due to air entrainment, and special precautions made to release the air and surplus energy.

The air to water ratio may be calculated from the following:

Equation 5 $$\frac{air}{water} = \frac{kV^2}{gR}$$

Where: k = coefficient of air entrainment:

= 0.004 for smooth concrete pipes

= 0.008 for cast in-situ concrete pipes

g = gravity (9.81 m/s^2)

R = hydraulic radius

V = velocity

Losses through structures

Losses through a structure shall be compensated for through a drop in the invert level through the manhole. The drop shall be additional to the entry and exit slopes and shall be introduced gradually across the manhole.

The losses to be accounted for are:

h_d Head loss due to change in direction

h_j Head loss due to junction (if applicable)

h_n Nominal headloss across structure

Therefore, the total drop (h_f) through the manhole to be accommodated shall be from:

Equation 6 $$h_f = h_d + h_j + h_n \quad \textbf{(m)}$$

Head losses due to a change in direction (h_d) shall be determined using the below equation where the loss coefficient (K_d) shall be determined from the figure presented in **Appendix 7**.

$$h_d = K_d \frac{V_i^2}{2g}$$

Equation 7

Alternatively, the loss coefficients in **Table A1-2** can be used (conservative).

Table A1-2 – Bend loss coefficient

Angle	K_d
22.5°	0.25
45°	0.60
90°	0.90

Pipe junctions and laterals joining the main flow increase turbulence in the manhole and the change in flow volume changes the flow momentum. Losses due to a junction shall be described by the following:

$$h_j = \left(\frac{D_L}{D_i}\right)^2 \frac{V_i^2}{2g}$$

Equation 8

Where D_i and V_i is the incoming pipe diameter and velocity and D_L is joining lateral diameter. ***Alternatively,*** the momentum equation, shown in the equation below and **Figure A1-1** may be used to determine h_j.

$$h_j = \frac{Q_1V_1 - Q_2V_2 - Q_3V_3\cos\theta_3 - Q_4V_4\cos\theta_4}{0.5(A_1 + A_2)g}$$

Equation 9

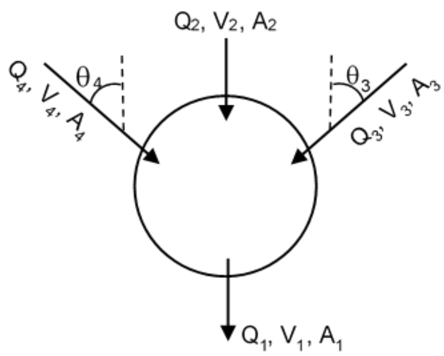


Figure A1-1 – Variables for use with Equation 10

The nominal loss h_n across the structure accounts for the changes in cross-section area as the pipe transitions from circular to open channel and back again as well as discontinuities and increased roughness of the haunching.

$$h_n = 0.1\frac{V_i^2}{2g}$$

Equation 10

Darcy-Weisbach Calculation (pressure pipes)

Pipeline losses shall be calculated using the Darcy-Weisbach Equation (**Equation 11**) where the Moody friction factor f can be determined using the Moody diagram or calculated using the Colebrook-White or Swamee-Jain method. The Swamee-Jain method is non-iterative and simpler to solve and differs from the iterative Colebrook-White method by less than 1% for turbulent flow. These methods should not be used where the Reynolds number exceeds 10^8 or pipe roughness is greater than 5% of the diameter.

Appendix 8 provides head loss charts for standard PVC pipes using the Swamee-Jain method and the roughness coefficients in **Table A1-3**.

Equation 11 $$h_f = f \frac{L}{D} \frac{V^2}{2g}$$ **(Darcy-Weisbach Equation)**

Where:	h_f	= headloss
	f	= friction factor determined by **Equation 12** or **Equation 13**
	L	= length of pipe (m)
	D	= internal diameter of pipe (m)
	V	= fluid velocity (m/s)
	g	= gravity (9.81 m/s^2)

The friction factor f can be determined using either the Colebrook-White method (**Equation 12**) or the Swamee-Jain Equation (**Equation 13**). **Table A1-3** provides the roughness factors ε to be used in either the Colebrook-White or Swamee-Jain equations. The roughness factors allow for fittings and ageing of a typical reticulation or trunk pipeline. Calculations for pump stations or areas with a large number of fittings may require special consideration.

Equation 12 $$\frac{1}{\sqrt{f}} = -2\log_{10}\left(\frac{\varepsilon / D}{3.7} + \frac{2.51}{R\sqrt{f}}\right)$$ ***(Colebrook-White Method)***

Equation 13 $$f = \frac{0.25}{\left[\log_{10}\left(\frac{\varepsilon / D}{3.7} + \frac{5.74}{R^{0.9}}\right)\right]^2}$$ ***(Swamee-Jain Method)***

Where:	ε	= pipe roughness (mm) from **Table A1-3**
	D	= internal pipe diameter (mm)
	R	= Reynolds number = (V x D)/10^{-6} for water (D in metres)

Table A1-3 – Colebrook-White pipe roughness

Material	Age of pipe (see notes below)		
	< 10 years+ (mm)	10-25 years+ (mm)	> 25 years* (mm)
Asbestos Cement (AC)	0.03	0.06	0.5
PVC / PE	0.06	0.06	0.15
Clay/earthenware	0.06	0.15	0.15
Cast iron	0.3	0.6	3
Concrete lined ductile iron (DICL)	0.06	0.15	0.15
Concrete lined steel (STCL)	0.06	0.15	0.15
Copper (Cu)	0.03	0.06	0.5
Ductile iron (unlined)	0.045	0.06	3
Galvanised iron (GI)	0.3	0.6	3.0
Steel (unlined)	0.03	0.06	3
Reinforced concrete (RC)	0.15	0.6	3
Unknown	0.03	0.06	0.5

+ These factors should only be used for the simulation and calibration of existing networks and pipelines. They shall NOT be used for the design of new pipelines.

* For the design of new/replacement pipelines, roughness factors for pipes >25 years shall be used to ensure network performance can be maintained throughout the lifespan of the pipeline/network.

Appendix 2 Porirua design sea-level determination

The design sea-level is based on the assumption that mean high water springs is used as the design, plus an allowance for sea-level rise and potentially storm surge and reduced atmospheric pressure.

Land Information NZ provide tidal information to Chart Datum (CD) reference. Porirua Harbour (@ Mana Cruising Club) is a secondary port based on the Port Taranaki standard port tidal predictions. The Mean High Water Springs and tide predictions for the standard and secondary ports are published in terms of local Chart Datum.

Chart Datum (CD) differs from standard MSL as Chart Datum is typically to a local datum near the tide gauge and is situated such that the tide is never measured as a negative. This means CD is typically much lower than local vertical datum which have a datum at or around MSL. Local vertical datum are the datum usually used for engineering surveying and contour mapping, e.g.: Wellington Vertical Datum 1953 (WVD).

A conversion from CD to WVD was established during the Porirua Harbour Bathymetric Survey 2009 by Discovery Marine Limited. The survey determined that:

Wellington Vertical Datum is 0.85m above Chart Datum (Mana Cruising Club).

Therefore, RL (WVD) = CD Level (Mana C1K1) – 0.85 m

New Zealand Vertical Datum 2016 (NZVD 2016) is also used in some places. WVD 1953 is 388 mm below NZVD 2016.

The standard design scenario requires an allowance of 1.0m for sea-level rise, and 250 mm for barometric pressure/storm surge. This results in the following design sea levels, as shown in **Table A2-1.**

Table A2-1 – Mean high water springs level in different datums

Datum	MWHS (m)	Seal level rise (m)	Barometric allowance (m)	Design level (m)
Chart Datum (Mana CC)	1.7	1.0	0.25	2.95
NZ Vertical Datum 2016	0.462	1.0	0.25	1.712
Wellington Local Datum 1953	0.85	1.0	0.25	2.10

Appendix 3 Nomographs for drainage pipes

The following charts are a graphical representation of the calculations from **Appendix 1** for Manning's Formula and air entrainment for Class 2 pre-cast concrete pipes.

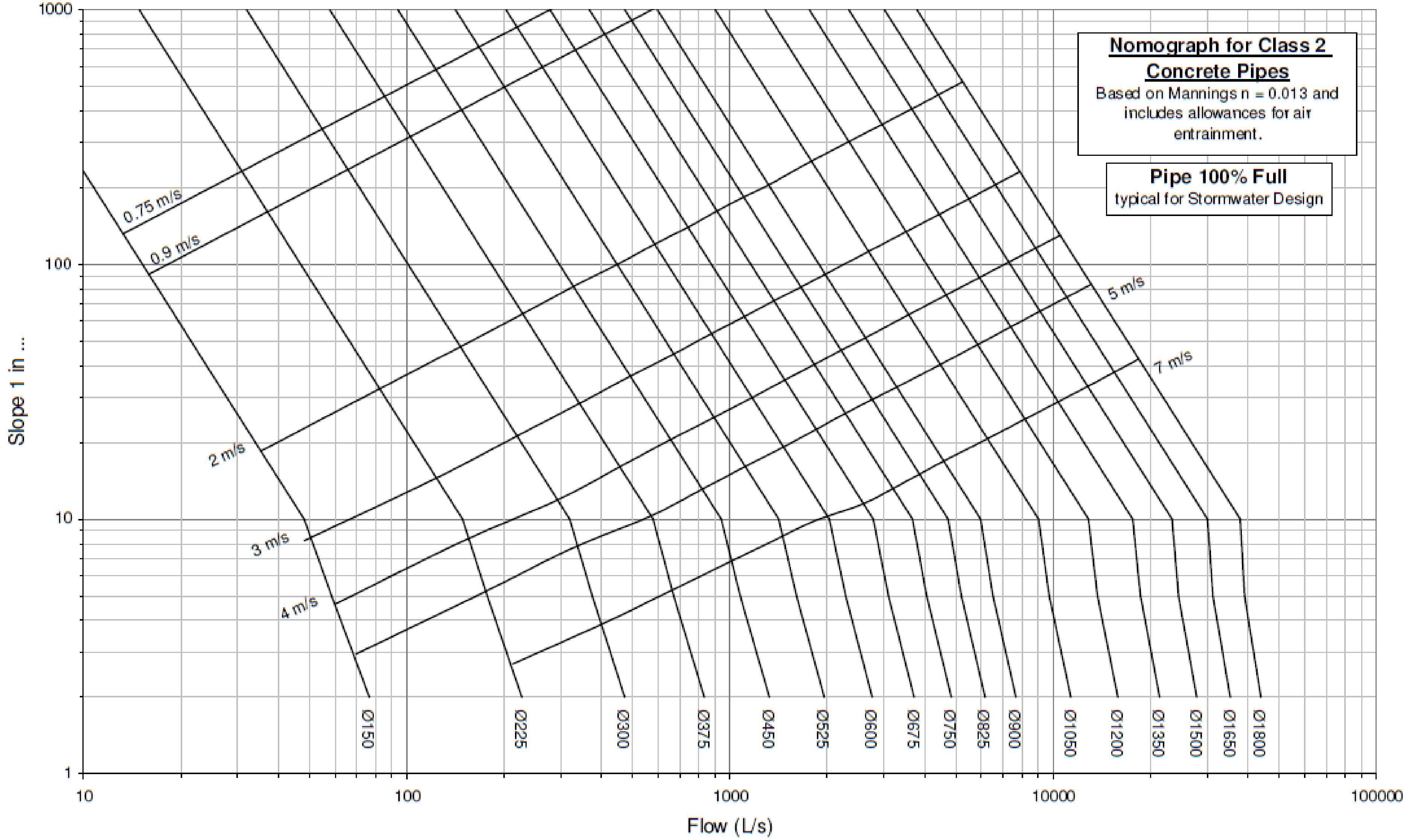


Figure A3-1 – Nomograph for Class 2 concrete pipes 100% full

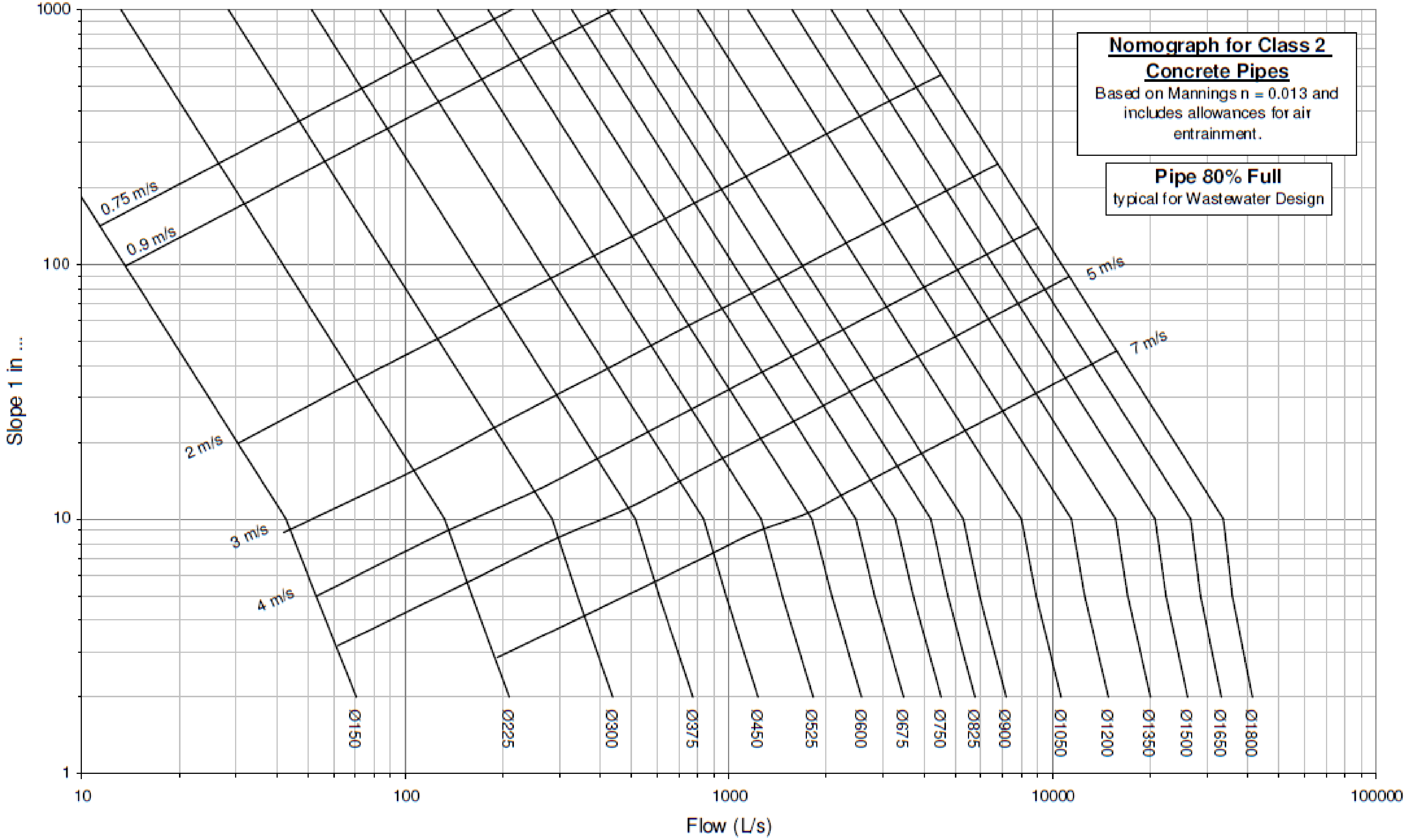


Figure A3-2 – Nomograph for Class 2 concrete pipes 80% full

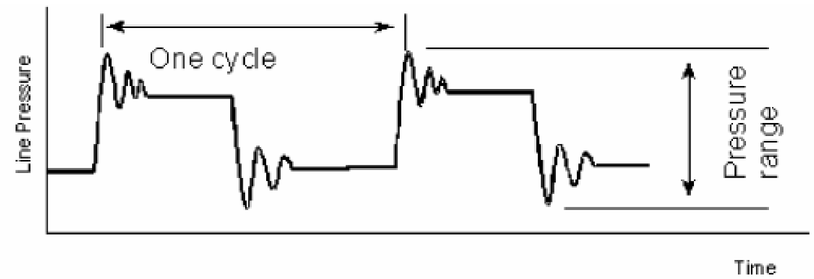
Appendix 4 Surge and fatigue calculations

Where plastic pipes are proposed in a cyclic environment, such as rising mains or direct-on-line pumping into the reticulation, provisions for a potential increase in pipe class shall be made due to fatigue and/or surge.

Surge is the sudden change in pressure caused by sudden changes in fluid velocity; for example, an unanticipated power failure resulting in the pumps shutting down and uncontrolled pressure transients (water hammer) in the pipeline. A transient analysis shall be carried out on all rising mains to ensure transients do not exceed the working pressure of the pipeline and fittings. Where transients are excessive, measures such as soft-starters or variable frequency drives on the pumps, surge control valves or increased pipe classes shall be considered.

Fatigue is a result of a large number of repetitive surge events. Generally, a larger number of smaller events can be tolerated than a lesser number of large surges.

Gradual diurnal changes in pressure due to normal consumer demand, as typically experienced by most reticulations, generally do not require specific fatigue design.



(from PIPA publication POP101[15])

Figure A4-1 – Definition of a pressure cycle and surge range

Where plastic pipes are used, and fatigue is expected, **Equation 14** and **Equation 15** should be used to determine equivalent operating pressures. Note that these can be used for water or wastewater pumping applications.

Equation 14 $$Cycles_{100} = Cycles_{day} \times CF \times 36500$$ **(kPa)**

Where:

	$Cycles_{100}$	=	equivalent cycles over 100 years
	$Cycles_{day}$	=	expected number of cycles per day
	CF	=	2 for pumped systems,
		=	1 for non-pumped systems

$Cycles_{100}$ is to be used to determine the Fatigue Cycle Factor (F) from **Table A4-1.**

[15] *Plastic Pipe Industry of Australia Ltd (PIPA) Guidelines POP101 – PVC Pressure Pipes Design for Dynamic Stresses*

Equation 15 $$OP_{equiv} = \frac{\Delta P}{F}$$

Where: OP_{equiv} = equivalent Operating Pressure (kPa)

ΔP = Max surge pressure – Min surge pressure (kPa)

F = Fatigue Cycle Factor from **Table A4-1**

The pipe class shall be based on the greater of the nominal working pressure or the OP_{equiv}.

Table A4-1 – Fatigue cycle factors[16]

Total cycles over 100 year pipe life ($cycles_{100}$)	PE80b PE100	PVC-U	PVC-M	PVC-O
26,400	1	1	1	1
100,000	1	1	0.67	0.75
200,000	1	0.81	0.54	0.66
500,000	0.95	0.62	0.41	0.56
1,000,000	0.88	0.50	0.33	0.49
2,500,000	0.80	0.38	0.25	0.41
5,000,000	0.74	0.38	0.25	0.41

PE80b - medium density PE; PE100 - high performance PE; PVCU-U - unplasticised polyvinyl chloride; PVC-M - modified polyvinyl chloride; PVC-O - molecularly oriented polyvinyl chloride

Alternative specific design is required for more complex situations, such as common rising mains or temperatures greater than 20 degrees.

Example fatigue calculation

The pressure in a pumped rising main surges to 950 kPa when started, to gradually stabilise at 400 kPa. When the pumps stop, the pressure in the pipe drops to a minimum of 100 kPa. The nominal working pressure in the pipe is 950 kPa and theoretically requires a minimum modified polyvinyl chloride (PVC-M) pipe class of nominal pressure 12 (PN12).

The pump is expected to start 8 times a day ($Cycles_{day}$) which is equivalent to 292,000 over 100 years. As it is a pumped system, $Cycles_{day}$ is multiplied by 2 which provides a $Cycles_{100}$ of 584,000. This translates into a Fatigue Cycle Factor of around 0.40 from the table above.

The surge pressure ΔP = 950 kPa – 100 kPa = 850 kPa. This means the equivalent operating pressure, as shown in **Equation 16**, is:

Equation 16 $$OP_{equiv} = \frac{850}{0.40}$$ **which = 2,125 kPa**

This suggests a minimum PN25 pipe is more appropriate as the OP_{equiv} of 2,125 kPa is greater than the original PN12 working pressure.

16 *From Plastic Pipe Industry of Australia Ltd (PIPA) Guidelines available from www.pipa.com.au: POP010A and POP101 – PVC Pressure Pipes Design for Dynamic Stresses*

Appendix 5 Pre-construction testing and assessment of load bearing capacity

A robust trench foundation with sufficient allowable bearing capacity is required to resist loading from the bulk trench backfill and dynamic surcharge loads (typically traffic) at surface level.

A poorly compacted foundation level can lead to settlement of the pipe trench, which can lead to potholes (or other carriageway defects), loss of grade on gravity mains and additional stresses in the pipeline itself.

In situ material should be tested at least 500 mm below the pipe foundation level prior to bulk excavation works or pipeline construction.

Information from preliminary testing (typically DCP) can be used to assess the allowable bearing capacity of the existing material at the pipe trench foundation level. Pre-construction testing at this level should be completed after initial preparation (surface trimming and light compaction) of the disturbed in situ ground.

Calculation of applied loading at the trench foundation level should follow AS/NZS 2566 and typically completed at the detailed design stage.

The following bearing capacity check can be made at the foundation level:

Equation 17 $$\textit{Total Factored Load}^{\dagger} \leq \textit{Allowable Bearing Pressure}$$

† Including impact factors where appropriate

If the applied loads at the foundation level result in an applied soil stress that is less than the allowable bearing capacity, the in situ material will provide a suitable trench foundation. The in situ test data should be used to produce an allowable bearing capacity, rather than the ultimate bearing capacity of the material.

The appropriate technical resources, as approved by Wellington Water, should be consulted when estimating the allowable bearing capacity of soils. This generally requires geotechnical engineering input, but is at the discretion of Wellington Water.

Appendix 6 Migration of fines

Where groundwater is present above the trench foundation level in fine grained soils, granular bedding material will typically provide a path for water movement, with the risk that fines are washed out of the surrounding ground causing a loss of support to the embedment and pipeline.

The limit for migration of fines, as outlined in AS/NZS 2566.1, is as follows:

Migration of fines will occur if:

Equation 18 $$D_{85,fine} \leq 0.2 \cdot D_{15,coarse}$$

Where:

$D_{85,fine}$ = particle size at which 85% pass occurs for the fine-grained material (typically the surrounding in situ soil)

$D_{15,coarse}$ = particle size at which 15% pass occurs for the coarse-grained material (typically the pipe embedment)

As part of the pipe laying, grading curves for in situ soils shall be acquired via pre-construction testing; grading curves for embedment material and bulk backfill shall be provided by the developer from the supplier.

The standard mitigation for migration of fines is installation of filter fabric around the pipeline embedment, which allows groundwater movement and prevents the unwanted transportation of fine-grained components.

Filter fabric shall be selected to match the material grading. Typically, filter fabric with the following properties will be suitable:

(a) Pore size of 75 microns

(b) Permeability 90 L/m2/s

(c) CBR (California Bearing Ratio) puncture resistance 1500 N

(d) Terram 1000 or Bidim A29 (or A39 for more robust applications)

Appendix 7 Losses through 1050 manhole

(Chart adopted from NZBC)

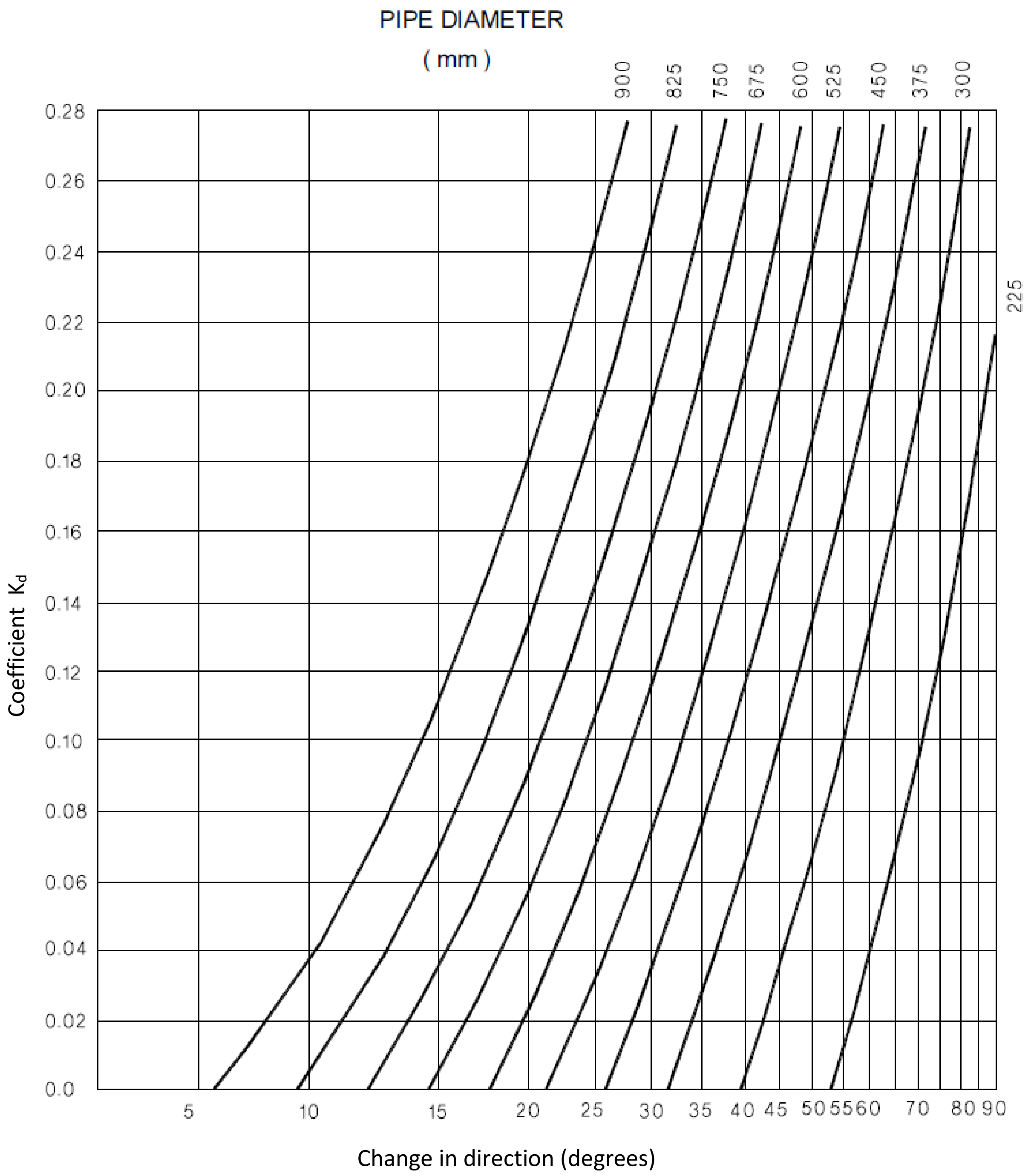


Figure A7-1 – Losses through 1050 manhole

Appendix 8 Standard PVC water pipe head losses

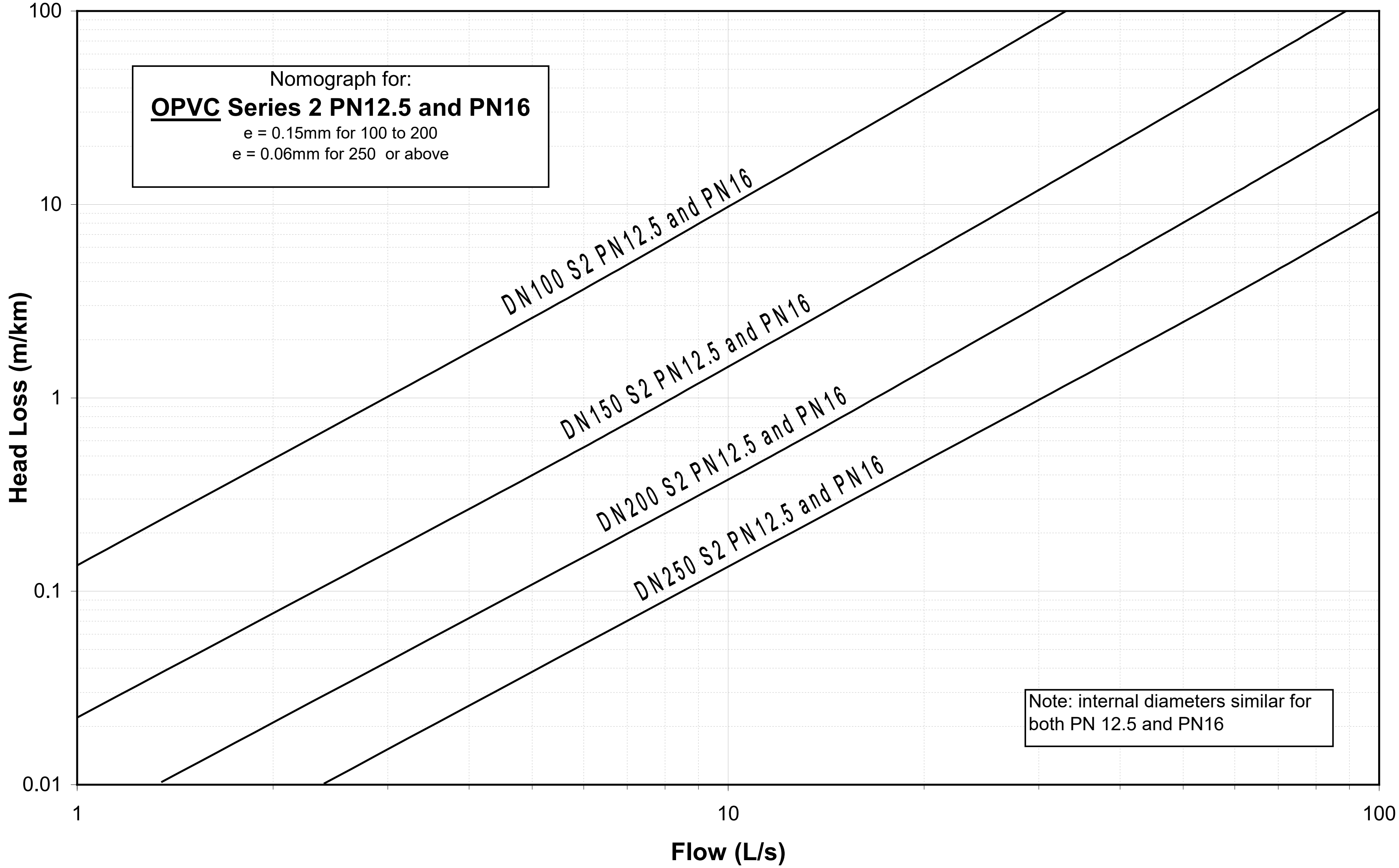


Figure A8-1 – PVC water pipe head loss PN12.5 and PN16

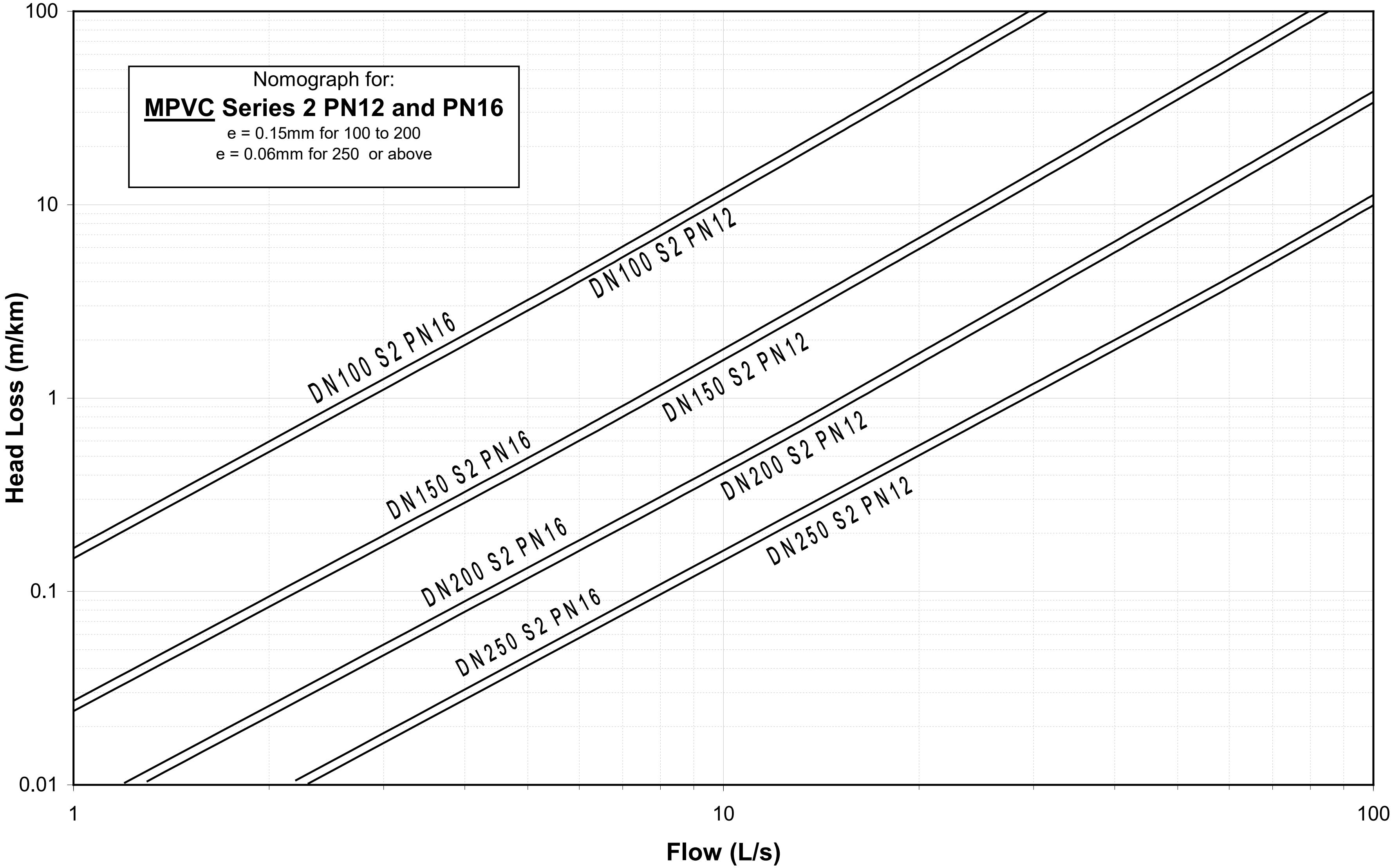


Figure A8-2 – PVC water pipe head loss PN12 and PN16

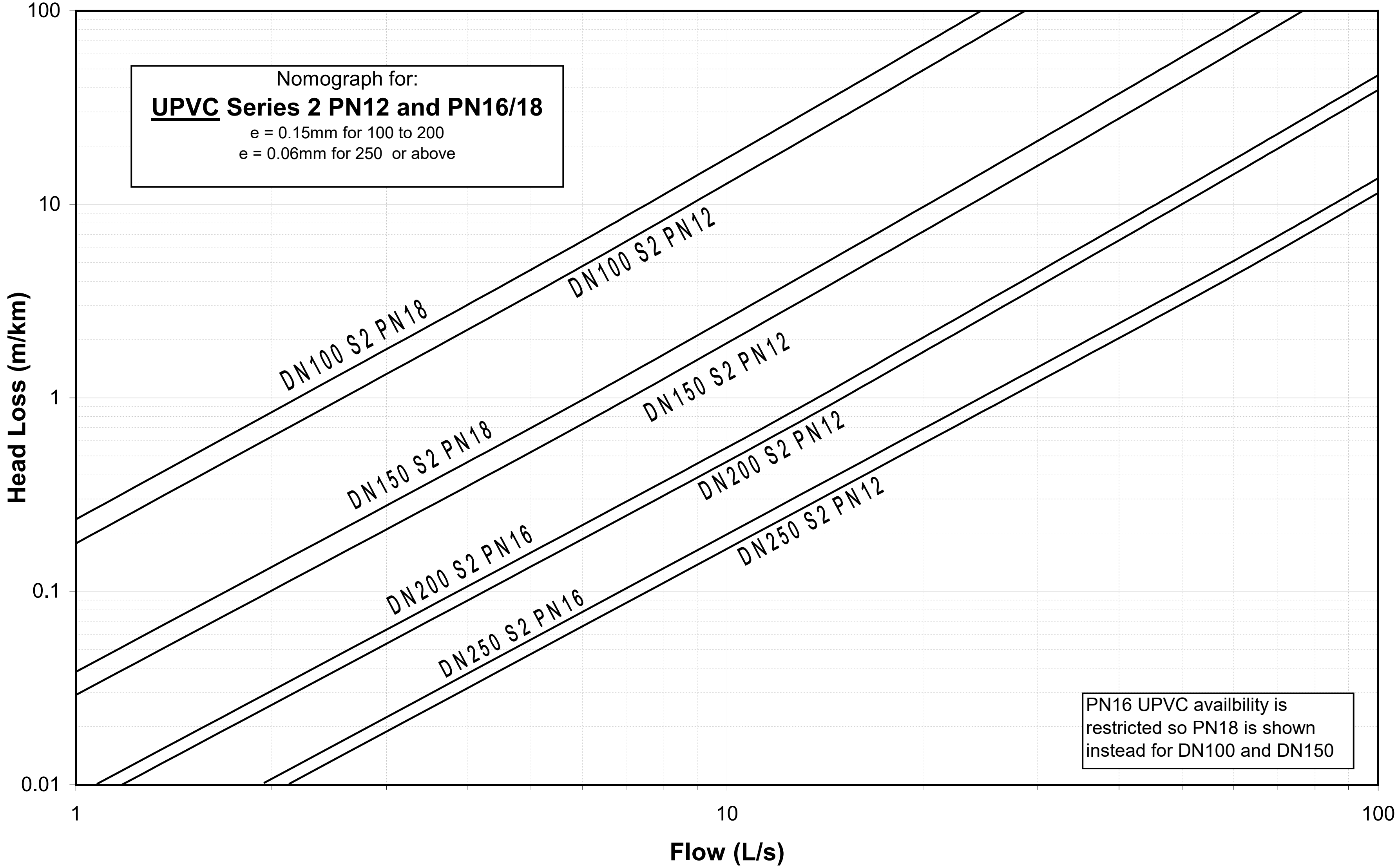


Figure A8-3 – PVC water pipe head loss PN12.5 and PN16/18

Appendix 9 Standard Details

Standard network layouts and engineering details are included in the Regional Specification for Water Services which is available on the Wellington Water website www.wellingtonwater.co.nz.

Wellington Water

Regional Specification for Water Services

December 2021 Version 3.0

Our water, our future.

This document was developed for Porirua, Hutt, Upper Hutt and Wellington city councils, South Wairarapa District Council, Greater Wellington Regional Council and Wellington Water Limited.

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Reviewer	Gary Cullen	09/12/2021	G.Cullen
Approver	Julie Alexander	09/12/2021	JAlexander

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1 INTRODUCTION

Wellington Water Limited is a shared service, council-controlled organisation, which is jointly owned by Hutt, Porirua, Upper Hutt and Wellington City Councils, South Wairarapa District Council and Greater Wellington Regional Council. On behalf of these councils, the three waters network (stormwater, wastewater and water supply) is managed under a trusted advisor model.

The Regional Specification for Water Services, and its parent document, the Regional Standard for Water Services (version 3.0), serve as updated versions of three waters infrastructure standards, and specifications to ensure a regionally consistent method of design and implementation of water services to meet outcomes of:

- Safe and healthy water,
- Respectful of the environment, and
- Resilient networks support our economy.

In July 2020, the Government launched the Three Waters Reform Programme – a three-year programme to reform local government three waters service delivery arrangements. From July 2024, New Zealand's three waters services will be managed by four, publicly-owned water service entities. After water reform it is expected that a new Regional Standard and Specifications will be produced, reflective of geographic arrangements.

The Regional Specification for Water Services (R.Spec) contains the minimum technical specifications for the materials, construction, installation, testing and commissioning of the stormwater, wastewater and water supply networks. It is the detail around how the Regional Standard is to be enacted.

The document is to be used in conjunction with the Regional Standard for Water Services (RSWS) available at www.wellingtonwater.co.nz.

The Regional Standard for Water Services provides minimum standards that must be applied to the design and construction of proposed infrastructure that will be vested in council, and to the maintenance, renewal, upgrade or decommissioning of existing public infrastructure.

1.1 Review of specification

The specification will be reviewed and revised as needed as policy and technology evolves. Users of this document should ensure that the latest published version is used. Feedback on the specifications can be made to:

Wellington Water Limited
Private Bag 39-804
Wellington Mail Centre 5045x, Lower Hutt

c/- Standards

Alternatively, feedback can be sent to the following email: standards@wellingtonwater.co.nz.

2 USING THE REGIONAL SPECIFICATION FOR WATER SERVICES

The Regional Specification for Water Services lists the technical requirements for materials and methods used in the construction of the three waters network infrastructure. The specification details the requirements for a specific product, process or activity. It is to be read in conjunction with the Regional Standard for Water Services, the Regional As-built Specification, Regional Draughting Manual and the Approved Products Register. The Regional Standard for Water Services outlines the network objectives, performance criteria for minimum operational and functional levels of service, design methodology and general specifications. The Approved Product Register lists products that comply with the requirements of the Regional Specification for Water Services.

This specification supersedes the Regional Specification for Water Services, May 2019.

2.1 Departures from this specification

Departures from this specification require the written permission of Wellington Water.

2.2 Definitions

For the purposes of this document, the following definitions and abbreviations shall apply.

2.2.1 Nominal pipe diameter

All pipe diameters referred to in this document are in millimetres (mm) and are nominal internal diameters, unless specifically noted otherwise. Only polyethylene pipes (PE) are denoted with a nominal outside diameter and should be post-fixed with the letters OD. For example:

63 OD	is 63 mm nominal outside diameter for PE pipes
100 mm	is 100 mm nominal internal diameter for other types of pipes

2.2.2 Definitions

Table 2-1 provides the terms used in this document:

Table 2-1 – Definitions

Term	Description
Building Line Restriction (BLR)	An angled line projecting up to the surface from below the pipeline.
Building in close proximity	Building works near new or existing public pipelines, and/or laying new or upgraded public pipelines near an existing structure or retaining wall.
Building near	Building in close proximity within a horizontal distance of 3 m measured from the outside of pipe, or within 5 m for pile driving.
Building over	Building in close proximity within a vertical height above the finished ground over a pipe that equals the depth to pipe invert plus 1 m, with a minimum height of 2.4 m, and a vertical depth of 300 mm below the pipe invert.

Term	Description
Building over and near	Building works within a zone around a pipe bounded horizontally by the lateral distance defined as building near, and the vertical height and depth defined as building over.
Building works	Structures, retaining walls, or any other works which may compromise the integrity, durability or accessibility of a pipe, or be compromised by a pipe. This includes new buildings and structures, modification of existing structures, demolition, temporary works including heavy machinery, excavation works and any work that changes the current form and shape of the ground.
Bulk water pipeline	Water supply pipeline from the water treatment plants to the network. The pipes are usually larger than 375mm and can be as large as 1400 mm in diameter. Also referred to as “bulk main”.
Council	The participating territorial authority within which the boundaries of the proposed scheme or renewal is located; or a delegated representative thereof (e.g., Wellington Water).
Developer	An individual or organisation having the financial responsibility for the project and includes the owner, contractor and constructor.
Drainage	Wastewater or stormwater pipework, channel or stream, and drain has the same meaning.
Network	All pipes, fittings, pumping stations, reservoirs, structures, treatment facilities and any other appurtenant components or facilities directly associated with water supply, wastewater or stormwater.
Overland flow	See ‘secondary flow”.
Potable water	Drinking water as defined in the Health (Drinking Water Amendment) Act 2007.
Principal main	A water main, typically 100 to 200 mm in diameter, that provides the firefighting and majority of water supply in a street. Sometimes called a distribution or secondary main.
Pumping station (in water supply)	A facility for mechanically increasing pressures in a pipeline typically used to fill reservoirs or increase pressures in a distribution zone.
Pumping station (in wastewater)	A facility for mechanically increasing pressure in a pipeline, or to lift effluent to a higher elevation in an adjacent manhole (lifting station); typically used to convey collected effluent to an adjacent catchment or trunk main.
Pumping station (in stormwater)	Similar to pumping station (wastewater) but designed to convey the stormwater to a safe discharge point.
Regional plan	Planning document developed to assist a regional council to carry out any of its functions in order to achieve the purpose of the Resource Management Act 1991.
Reticulation main	A water main that distributes water to customer connections. Could be either a principal main or rider main.

Term	Description
Rider main	A water main, typically less than 100 mm in diameter, and secondary to any principal main in a street.
Rising main	A dedicated pipeline running between a pump's discharge and a nominated discharge point; typically, a reservoir in water supply systems, or a manhole on a gravity drain for wastewater systems.
Secondary flow	The excess stormwater flow that cannot be contained by the primary network, typically due to extraordinary design storm or network blockage. Also referred to as overland flow or secondary overland flow.
Service valve	An isolation (water shut off) valve where a potable water connection is made between the public water supply (in the street) and the private dwelling or commercial building. Sometimes referred to as a "toby".
Sewer	A pipe that conveys wastewater/sewage, typically using gravity. Could also be called a sewer drain.
Stormwater	Rainwater that does not percolate into the groundwater or evaporate, but flows via overland flow, interflow, channels or pipes into a defined channel, open watercourse or a constructed infiltration facility.
Subdivision	The subdivision of land as defined in the Resource Management Act 1991.
Supervisory control and data acquisition (SCADA)	The council owned and operated telemetry and control systems used to remotely monitor and control facilities such as pumping stations, reservoirs, large-scale metering installations etc.
Trunk main (in water supply)	A water main typically 300mm or greater in diameter designed to transport water between reservoirs, distribution zones, source waters and reticulation mains. Sometimes called a transmission main or primary main.
Trunk main (in wastewater)	A large sewer that collects tributary flow from adjacent catchments and/or pumping stations.
Wastewater (sewage)	Water that has been used and contains unwanted dissolved and/or suspended substances from communities, including homes and businesses and industries.
Water supply	Water distributed for domestic, commercial, industrial and firefighting purposes.
Wellington Water	Wellington Water (abbreviated from Wellington Water Limited), when referred to as an entity, shall also mean the relevant territorial authority in relation to water services asset ownership and approvals; or the Engineer or Principal in relation to contractual approvals.

2.2.3 Abbreviations

Table 2-2 provides the abbreviations used in this document:

Table 2-2 – Abbreviations

Abbreviation	Description	Unit
ABS	Acrylonitrile butadiene styrene	
AC	Asbestos cement	
AS	Australian Standard Specification	
ASME	American Society of Mechanical Engineers	
ASTM	American Society for Testing and Materials	
AWWA	American Water Works Association	
BLR	Building Line Restriction	
BS	British Standard Specification	
BSP	British standard pipe	
CAR	Corridor access request	
CCTV	Closed-circuit television (video)	
dB(A)	Decibel A-weighted	dB(A)
DI	Ductile iron	
DN	Nominal diameter	mm
DWI	Drinking Water Inspectorate (UK)	
EF	Electrofusion	
EPDM	Ethylene-propylene diene monomer, a synthetic rubber	
GRP	Glass reinforced plastic	
GTAW	Gas tungsten arc welding	
GWRC	Greater Wellington Regional Council	
hr	Hour	hour
H	Head (water column measured in metres)	m
ha	Hectare	ha
ISO	International standards	
kPa	Kilopascal	10^3Pa
L	Litre	L
m	Metre	m
MPa	Megapascal (e.g. 10^6Pa)	MPa
m/s	Metres per second (e.g. ms^{-1})	m/s

Abbreviation	Description	Unit
m^3/s	Cubic metres per second (e.g. m^3s^{-1})	m^3/s
mg/L	Milligrams per litre and it can also be expressed as parts per million (ppm)	mg/L
mm	Millimetres	mm
MMAW	Manual metal arc welding	
MSL	Mean sea level (1953 Wellington Vertical Datum)*	m
N	Newton (1N = 1 kg m/s^2)	N
NBR	Nitrile	
NZBC	New Zealand Building Code	
NZS	New Zealand Standard Specification	
NCD	WCC New City Datum (same datum as MSL)	m
NCOPUATTC	National Code of Practice for Utility Operators' Access to Transport Corridors	
NSF	National Sanitation Foundation	
NZECP	New Zealand Electrical Code of Practice	
NZTA	NZ Transport Agency	
N/m/m	Newtons per meter per meter, used as a measure of the ring stiffness for a pipe.	
OD	Outside diameter	mm
PE	Polyethylene (generic)	
PE80b	Medium density PE (MDPE)	
PE80c	High density PE (HDPE)	
PE100	High performance PE (HPPE)	
PIPA	Plastics Industry Pipe Association of Australia Limited	
PN	Nominal pressure	bar
PP	Polypropylene	
PPE	Personal protective equipment	
ppm	Parts per million and it also can be expressed as milligrams per litre (mg/L)	ppm
PRV	Pressure reducing valve	
PVC	Polyvinyl chloride (generic)	
PVC-M	Modified polyvinyl chloride	
PVC-O	Molecularly oriented polyvinyl chloride	
PVC-U	Unplasticised polyvinyl chloride	

Abbreviation	Description	Unit
PWWF	Peak wet weather flow	L/s
RCA	Road Controlling Authority	
RMA	Resource Management Act 1991	
RTU	Remote telemetry unit	
RPZ	Reduced pressure zone	
R.Spec	Regional Specification for Water Services	
RSWS	Regional Standard for Water Services	
s	second	s
SCADA	Supervisory control and data acquisition	
SDR	Standard dimension ratio	
SN	Stiffness number	
STCL	Concrete lined steel	
STP	Specified test pressure	
TNZ	Transit New Zealand	
WMS	Work Method Statement	
WPS	Welding Procedure Specification	
WRAS	Water Regulation Advisory Scheme (UK)	
WWL	Wellington Water Ltd.	

*Note: Tide levels listed in Tide Tables published by Land Information New Zealand use a Wellington Standard Port zero datum equivalent to -0.929 m MSL or 3.551 m below benchmark K80/2 (LINZ code ABPC – updated Feb 2018). The actual average measured sea level is currently measured at around 1.12 m above Wellington Standard Port datum or 0.191 m MSL (1953 Wellington Vertical Datum).

2.2.4 Pipe gradients

This document uses a percentage to represent pipe or channel grades as opposed to a ratio (i.e., 1% instead of 1 in 100 (V:H)). The percentage grade can be calculated by dividing the ratio's vertical component by the horizontal component and multiplying by 100. Conversions are presented in **Table 2-3**.

Table 2-3 – Conversion table

Grade %	Grade ratio
0.33%	1 in 300
0.5%	1 in 200
1%	1 in 100
2%	1 in 50
5%	1 in 20
10%	1 in 10

Grade %	Grade ratio
20%	1 in 5
50%	1 in 2

2.3 References

New Zealand (NZS), Australian (AS) and joint (AS/NZS) standards are referenced throughout this document, as well as British (BS, BS EN), American Society of Mechanical Engineers (ASME), American Society for Testing and Materials (ASTM) and international (ISO) standards. Where a standard's year has been nominated, then that specific issue is to be used. Where no year is nominated, the latest version is to be used.

Where it is stated that a product must comply with a nominated standard, third party certification demonstrating compliance with the standard shall be made available from the manufacturer. The certifying agency shall be National Association of Testing Authorities approved and shall be acceptable to Wellington Water. Standards and documents referenced in this document are listed in **Table 2-4**.

Table 2-4 – Referenced documents and standards

Reference	Title
Regional Standard for Water Services (RSWS)	Wellington Water's Regional Standard for Water Services [IMMP-46]
As-Built Specification	Wellington Water's As-Built Specification [IMMP-48]
Draughting Manual	Wellington Water's Draughting Manual [IMMP-49]
NCOPUATTC	National Code of Practice for Utility Operators' Access to Transport Corridors
NZBC	New Zealand Building Code
NZTA M/07	Specification for roadmarking paints
TNZ M/4	Specification for basecourse aggregate
SNZ PAS 4509	New Zealand Fire Service firefighting water supplies code of practice
New Zealand standards	
NZS 3101.1 & 2	Concrete structures standard
NZS 3104	Specification for concrete production
NZS 3106	Design of concrete structures for the storage of liquids
NZS 3109	Concrete construction
NZS 3501	Specification for copper tubes for water, gas and sanitation
NZS 4219	Seismic performance of engineering systems in buildings
NZS 4442	Welded steel pipes and fittings for water, sewage and medium pressure gas
NZS 4517	Fire sprinkler systems for houses
NZS 4522	Underground fire hydrants

Reference	Title
NZS 4541	Automatic fire sprinkler systems
Joint Australian and New Zealand standards	
AS/NZS 1170.0	Structural design actions – Part 0: General principles
AS/NZS 1260	PVC-U pipes and fittings for drain, waste and vent applications
AS/NZS 1477	PVC pipes and fittings for pressure applications
AS 2129	Flanges for pipes, valves and fittings
AS/NZS 2280:2014	Ductile iron pipes and fittings
AS/NZS 2566.2	Buried flexible pipelines – Part 2: Installation
AS/NZS 2638.2	Gate valves for waterworks purposes – Part 2: Resilient seated
AS/NZS 2845.1	Water supply – Backflow prevention devices – Part 1: Materials, design and performance requirements
AS/NZS 2865	Safe working in a confined space
AS/NZS 2980:2007	Qualification of welders for fusion welding of steels
AS/NZS 3500.1	Plumbing and drainage – Part 1: Water services
AS/NZS 3518	Acrylonitrile butadine styrene (ABS) compounds, pipes and fittings for pressure applications
AS/NZS 3725	Design for installation of buried concrete pipes
AS/NZS 3862	External fusion-bonded epoxy coating for steel pipes
AS/NZS 4020	Testing of products for use in contact with drinking water
AS/NZS 4058	Precast concrete pipe (pressure and non-pressure)
AS/NZS 4087	Metallic flanges for waterworks purposes
AS/NZS 4129:2008	Fittings for polyethylene (PE) pipes for pressure applications
AS/NZS 4130	Polyethylene (PE) pipes for pressure applications
AS/NZS 4131	Polyethylene (PE) compounds for pressure pipes and fittings
AS/NZS 4158	Thermal-bonded polymeric coatings on valves and fittings for water industry purposes
AS/NZS 4331.1	Metallic flanges – Part 1: Steel flanges
AS/NZS 4331.2	Metallic flanges – Part 2: Cast iron flanges
AS/NZS 4671	Steel reinforcing materials
AS/NZS 4765	Modified PVC (PVC-M) pipes for pressure applications
AS/NZS 4998	Bolted unrestrained mechanical couplings for waterworks purposes
AS/NZS 5065	Polyethylene and polypropylene pipes and fittings for drainage and sewerage applications
Australian standards	
AS 1579	Arc-welded steel pipes and fittings for water and wastewater

Reference	Title
AS 1646	Elastomeric seals for waterworks purposes
AS 1741	Vitrified clay pipes and fittings
AS 1199.1	Sampling procedures for inspection by attributes – Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection
AS 2129	Flanges for pipes, valves and fittings
AS 2439.1:2007	Perforated plastics drainage and effluent pipe and fittings – Part 1: Perforated drainage pipe and associated fittings
AS 3996	Access covers and grates
AS 4794	Non-return valves for waterworks purposes – Swing check and tilting disc
AS 4795.1	Butterfly valves for waterworks purposes – Wafer and lugged
AS 4795.2	Butterfly valves for waterworks purposes – Double flanged
AS 4956	Air valves for water supply
International standards	
ANSI/NSF 61	Drinking water system components – Health effects
ANSI/AWWA C219/06	Bolted, sleeve-type couplings for plain-end pipe
ASME B31.4	Pipeline transportation systems for liquids and slurries
ASTM A312	Standard specification for seamless and welded austenitic stainless steel pipes
BS EN 1092	Flanges and their joints. Circular flanges for pipes, valves, fittings and accessories, PN designated, Steel flanges
BS 534	Specification for steel pipes, joints and specials for water and sewage
BS 2971	Specification for class II arc welding of carbon steel pipework for carrying fluids
BS 5163.1	Valves for waterworks purposes. Predominantly key-operated cast iron gate valves. Code of practice
BS 6920	Suitability of non-metallic products for use in contact with water intended for human consumption with regard to their effect on the quality of water
ISO 2531	Ductile iron pipes, fittings, accessories and their joints for water applications
ISO 5752	Metal valves for use in flanged pipe systems – Face-to-face and centre-to-face dimensions
ISO 13953	Polyethylene (PE) pipes and fittings -- Determination of the tensile strength and failure mode of test pieces from a butt-fused joint
ISO 13954	Plastics pipes and fittings -- Peel decohesion test for polyethylene (PE) electrofusion assemblies of nominal outside diameter greater

Reference	Title
	than or equal to 90 mm
ISO 13955	Plastics pipes and fittings -- Crushing decohesion test for polyethylene (PE) electrofusion assemblies
ISO 13956	Plastics pipes and fittings -- Decohesion test of polyethylene (PE) saddle fusion joints -- Evaluation of ductility of fusion joint interface by tear test
ISO 21307:2011	Plastics pipes and fittings -- Butt fusion jointing procedures for polyethylene (PE) pipes and fittings used in the construction of gas and water distribution systems

3 GENERAL REQUIREMENTS

This document provides the minimum technical and construction specifications for the three waters network and constitutes the minimum requirements of Council as a utility owner under the Local Government Act. Reference shall be made to this document when planning and designing new stormwater, wastewater and water supply infrastructure (the three waters) and for the renewal, upgrade or decommissioning of existing infrastructure.

3.1 Subdivision requirements

Requirements relating to the overall subdivision process, urban planning and other council utilities and services can be found in each council's subdivision codes and policy documents. Reference shall be made to these documents and their requirements when using this document.

3.2 Legislative and regulatory requirements

The requirements of this Regional Specification for Water Services (R.Spec) shall be read subject to the provisions of the latest versions and amendments of any applicable legislation and regulations, including, but not limited to:

(a) Building Act 2004, Building Regulations 1992, and New Zealand Building Code (NZBC)
(b) Civil Defence Emergency Management Act 2002
(c) Energy Efficiency and Conservation Act 2000
(d) Fire and Emergency New Zealand Act 2017
(e) Health (Drinking Water Amendment) Act 2007
(f) Health and Safety at Work Act 2015 and related regulations
(g) Land Drainage Act 1908
(h) Local Government Act 1974 and Local Government Act 2002, and related council by-laws and policies
(i) Resource Management Act 1991, including all applicable National Environmental Standards, regulations and regional and territorial planning documents
(j) Utilities Access Act 2010, National Code of Practice for Utility Operators' Access to Transport Corridor and the Installation of Utility Structures on Railway Land
(k) Electricity Act 1992, Electricity (Hazards from Trees) Regulations 2003

Other documents are referenced throughout this document at the relevant section.

3.3 Testing and inspection records

Unless otherwise stated, if records of testing and inspections are required, these records shall be provided to Wellington Water as part of the project completion and as-built documentation.

4 GENERAL SPECIFICATIONS

The following specifications shall be read in conjunction with the drainage and water supply specifications. They contain items that are relevant to both activities and are presented here to avoid duplication.

4.1 Health and safety obligations

The requirements of the Health and Safety at Work Act 2015 and the Health and Safety at Work Regulations 2016 shall be observed at all times.

In particular, under Section 43 of the Health and Safety at Work Act all developers must, so far as is reasonably practicable, ensure that the way all plant or structure is installed, constructed, or commissioned is done so without the risk to the health and safety of persons who:

(a) Construct or install the plant or structure.

(b) Use the plant or structure at a workplace for the purpose it was installed, constructed or installed.

(c) Carries out any reasonably foreseeable activity for the proper use, decommissioning, or dismantling of plant, or demolition or disposal of the structure.

(d) Are in the vicinity of the workplace and whose health and safety may be affected by a use of an activity referred to in paragraphs a) to c above.

Contractors and construction staff must meet their obligations under the Health and Safety at Work Act. For Wellington Water projects, this means complying with any minimum personal protective equipment requirements and mandated work practices, as well as any contractual obligations.

Designers, contractors and construction staff working for Wellington Water on assets under Wellington Water's control must comply with Wellington Water's minimum health and safety standards, which are available online.

4.1.1 Immunisations

All staff physically working on the wastewater or water supply networks must comply with the immunisations in **Table 4-1**.

Table 4-1 – Required immunisations

Network type	Immunisation	Frequency
Water supply	Hepatitis A	If no antibodies present[1]
	Hepatitis B	If no antibodies present[1]
	Polio	Every 10 years
	Typhoid	Every 3 years
	Tetanus	If not up to date[2]
Wastewater	Hepatitis A	If no antibodies present[1]
	Hepatitis B	If no antibodies present[1]
	Tetanus	If not up to date[2]

Network type	Immunisation	Frequency
	Measles, Mumps and Rubella	If not up to date[2]
	Polio	Every 10 years
Stormwater	No specific requirements	

[1] Refer to **Section 4.1.1**(a) **Immunisations**
[2] Based on Ministry of Health guidelines.

(a) The following testing treatment and immunisation regime shall be adhered to:
   (i) **Hepatitis A.** If a blood test proves the presence of antibodies, no vaccination is required. If no antibodies are detected, immunisation using appropriate vaccine shall be carried out.
   (ii) **Hepatitis B.** If a blood test proves the presence of antibodies, no vaccination is required. If no antibodies are detected, three consecutive vaccinations at monthly intervals shall be administered, followed by a blood test after one month.

(b) No contractor's staff employed on other sites involving work in or on any river, drain, or sewer, shall be allowed to carry out work on the water supply network unless permanently transferred and undergoing the above tests and vaccinations.

(c) Clearance Certificates, signed by a registered medical practitioner, shall be sent to Wellington Water at the first opportunity.

(d) Where the contractor's employees have already been certified, the contractor shall submit a list of names of such persons for checking. If new persons are engaged during the progress of the work, the contractor shall seek Wellington Water's direction as to what work they may be engaged upon pending production of a certificate.

(e) No person will be employed in making connections to existing water mains unless that person has clearance. Wellington Water reserves the right to order from the Site, at any time, any person for whom a satisfactory clearance has not been obtained.

(f) Workers are to immediately report the onset of any gastrointestinal illness. Such a worker is to be placed immediately on work not involving the handling of distribution components until free from diarrhoea for 48 hours, and with specific conditions (including Hepatitis A, Shigella, Typhoid and Cholera), a medical certificate of clearance is to be obtained.

4.2 Environmental management

Where construction work is being carried out on behalf of Wellington Water, environmental management plans are required, and the following considerations are required as a minimum.

The three waters network shall be designed so that no harm shall occur to the environment during construction, operation, maintenance, or demolition of the network.

4.2.1 Water ponding/stormwater management

The following applies to water ponding and stormwater management:

(a) Water ponding in the trench shall be prevented by means such as pumping and fluming.

(b) Discharge of sediment laden water where it may enter water may need approval from GWRC or Wellington Water.

  (i) Refer to the regional plan for rules regarding discharges to land where it cannot enter water (including groundwater in an aquifer protection area), or to water, or to the stormwater network. Discharges may require a resource consent from GWRC or written approval from Wellington Water.

  (ii) Discharge to the wastewater network needs written approval from Wellington Water and may also need a trade waste consent.

(c) When working in the road reserve:

  (i) The stormwater network shall be maintained and operated in accordance with the requirements of the NCOPUATTC.

  (ii) The requirements of the NCOPUATTC shall be complied with at all times.

4.2.2 Noise control

The following applies to noise control:

(a) Compliance is required at all times with standards for noise for the proposed activity and zone as defined in the District Plan, otherwise consent will be required under the Resource Management Act 1991.

(b) The best practical means of reducing the noise of continuous use equipment to affected people shall be employed at all times.

(c) The continuous noise level at residential and commercial property boundaries shall not exceed the ambient level by more than 10 dB(A).

(d) Any directions from the Council’s environmental noise control unit shall be complied with.

(e) The requirements under Section 5.3.5, *Noise and Vibration Management*, of the NCOPUATTC and the Corridor Manager’s Work Access Permit and Local and Special Conditions shall be complied with at all times.

4.2.3 Odour control

The following applies to odour control:

(a) Foul or offensive odours emitting from the works or other sources as a result of any construction work shall be minimised at all times.

(b) No foul or offensive odours shall be emitted from the works or other sources as a result of the work outside normal working hours or at other times when the site is not occupied.

(c) Potential odour situations (from or adjacent to the works site) shall be immediately reported to the “On-call Officer, Pollution Response” GWRC at 0800 496 734.

4.3 Working near trees

Where work is:

(a) In the road reserve, all work and activities must comply with the requirements of the NCOPUATTC.

(b) On private property, the works must comply with the agreement of the landowner, as well as:

(i) Comply with the rules in the relevant district plan related to the affected trees.

(ii) Comply with the Electricity (Hazards from Trees) Regulations 2003, where applicable, when working within the canopy of trees.

(iii) Comply with the requirements of NZECP 34[1] when using machinery close to overhead conductors (refer also to the Approved Code of Practice for Safety and Health in Tree Work: Part 1 Arboriculture[2] and Part 2: Maintenance of Trees Around Power Lines[3]).

Before any tree is affected by an excavation, the council arborist and private property owner, if relevant, must be contacted to liaise on the extent and nature of the work. Where the tree is to be kept, the following shall apply:

(c) Where the branches or roots of any tree may be harmed by the proposed activities, these shall only be trimmed by the council arborist or at their approval. Generally, roots shall first be exposed by hand digging, or hydro jetting.

(d) A tree-protection zone (as a guide, this is the area under the drip line of a tree or within a radius of half the height of the tree, whichever is greater) must be established by a qualified and experienced arborist (refer to **Standard Detail DR08 – Tree Dripline**).

(e) A temporary fence must be erected for the duration of the works.

(f) No materials, equipment, liquids or vehicles are to be positioned, and no work is to be carried out within the tree-protection zone without the prior approval of a qualified and experienced arborist.

(g) All care should be taken to minimise run-off from chemical / material storage sites.

4.4 Working with asbestos cement pipes

4.4.1 Design for replacement of asbestos cement pipes

The following applies to the design for replacement of asbestos cement (AC) pipes:

(a) So far as reasonably practicable, the designer shall not design for the on-line replacement of the AC pipe unless the AC is to be removed from the ground. Methods that are considered unacceptable include, but are not limited to, pipe bursting of AC pipes.

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[1] *New Zealand Electrical code of practice for electrical safe distances. NZECP 34:2001. Manager, Standards and Safety, Ministry of Consumer Affairs.*

[2] *Approved Code of Practice for Safety and Health in Tree Work: Part 1 Arboriculture. WorkSafe New Zealand. 2012*

[3] *Approved Code of Practice for Safety and Health in Tree Work: Part 2: Maintenance of Trees Around Power Lines. Department of Labour. 1996*

(b) Any excavation, removal, and disposal of the AC pipe shall be carried out in accordance with the approved code of practice for the Management and Removal of Asbestos[4], and the Health and Safety at Work (Asbestos) Regulations 2016.

(c) Where an AC pipeline remains on site, the pipe's Asset ID, location and alignment shall be included within the supplied as-built drawings to allow Wellington Water's asset database to identify the pipeline as including a hazardous material.

 (i) The AC pipe's physical condition shall be noted, as well as other details, such as whether it was capped, grouted, re-purposed or has experienced any other modification or treatment.

4.4.2 Working with AC pipes

The following applies to working with AC pipes:

(a) The approved code of practice for the Management and Removal of Asbestos[5] and the Health and Safety at Work (Asbestos) Regulations 2016 shall be complied with when working with or coming in contact with AC pipes and fittings.

(b) Personnel, when working with AC pipes and fittings, shall take all reasonable steps to prevent asbestos fibres from becoming airborne.

(c) When dealing with asbestos materials, the contractor is advised to follow the instructions given below (as a minimum requirement):

 (i) Health and Safety at Work (Asbestos) Regulations 2016 and

 (ii) Approved Code of Practice: Management and Removal of Asbestos.

(d) Cutting of AC pipe in a dry condition using a hand or power saw is not permitted.

(e) Hydro-excavation near AC pipe is not permitted.

(f) Personnel working with asbestos shall provide the necessary safety instructions to personnel, issue personal protection and equip personnel to safely work with material.

(g) All AC pipe shall be placed in a suitable bag and disposed of at a landfill registered to accept asbestos products.

4.5 Excavation

4.5.1 General

The following applies to excavation:

(a) Excavation shall only begin after all permissions and pre-possession documentation has been submitted and approved in writing by Wellington Water.

(b) Excavation work shall comply with the relevant legislation and regulatory documents outlined in **Section 3 General Requirements**, as well as relevant sections of the most current version of the Excavation Safety Good Practice Guidelines.

[4] *Approved code of practice: Management and removal of asbestos. WorkSafe New Zealand. 2016*

[5] *Approved code of practice: Management and removal of asbestos. WorkSafe New Zealand. 2016*

(c) Excavation risk assessments / planning must:

(i) Address:

1. the risk of excavation collapse, including at any depth where it is necessary for a worker to perform tasks within the excavation with their head and shoulders below ground level,
2. fall from heights (e.g. personnel/equipment/loads),
3. (iii) edge protection

(ii) Be in accordance with the requirements set out in (b) above.

Trenches:

(d) Shall be of sufficient width and depth to permit dewatering, bedding, and pipe jointing to be carried out with adequate working room and in a safe manner. Minimum clearance between the pipe wall and the side of the trench shall be as detailed in Table 4.2 of AS/NZS 2566.2:2002 or Figure 4 of AS/NZS 3725:2007, or superseding documentation, as appropriate.

(e) May be subject to conditions outlined by the Road Controlling Authority (RCA).

4.5.2 Definition of hard rock

Where the definition of hard rock is not specified in the contract, the default definition shall be taken as:

(a) Hard rock is considered to be ground that cannot be removed in-situ using a 10 tonne excavator fitted with a rock bucket and requires other means of removal.

4.5.3 Excavated material

The following applies to the stockpiling and disposal of excavated material:

(a) When dealing with excavated topsoil that is to be reused, it must be separately stacked, and measures must be taken to ensure that topsoil remains unmixed with clay or other deleterious matter. Similarly, turf that is to be reused shall be cut and safeguarded for later placement.

(b) Stockpiling of excavated material alongside the trench must be at a distance in accordance with Excavation Safety Good Practice Guidelines.

(c) Disposal of excavated material may require resource consent.

4.5.4 Trench dewatering

The following applies to trench dewatering:

(a) Trench dewatering may require resource consent.

(b) Where dewatering is required, the developer shall provide dewatering facilities so that pipe bedding, pipe laying, inspection of the pipe joints and backfilling can be carried out in a trench free of water before and after pipe installation. Where dewatering is not feasible, please refer to **Section 4.7.3 High groundwater environment**.

(c) Groundwater and foreign material shall not be allowed to enter the new pipe at any stage.

(d) If the developer wants to use the new stormwater or wastewater pipeline for dewatering, and this is compliant with the applicable consents, then the developer should propose this as part of their dewatering plan.

(e) Pump hoses, power cords, etc., used for dewatering shall not be run across the surface of any section of the roadway in use without adequate controls. Any slot or ditch required to carry these shall be constructed in accordance with the traffic control requirements and sealed, to provide a smooth surface for traffic, and be watertight. After the service is removed, the road surface shall be reinstated.

4.6 Typical trench arrangement

A typical trench arrangement is provided in **Figure 4-1** below.

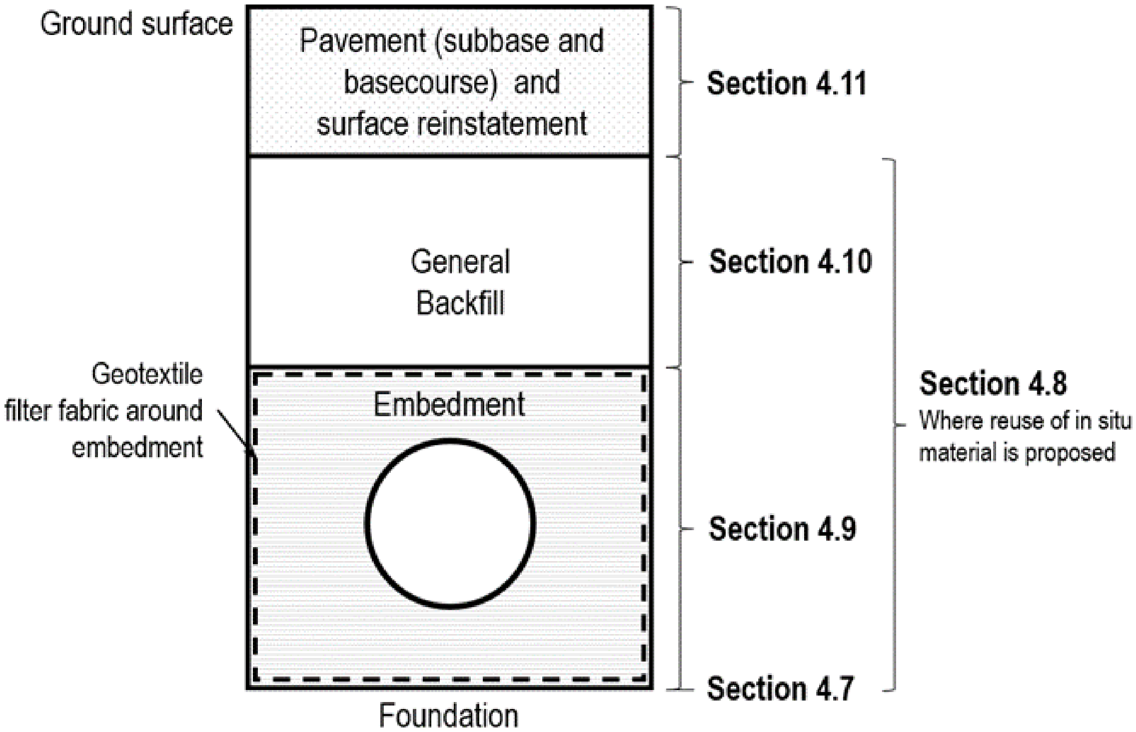

Figure 4-1 – Typical pipe trench arrangement

4.7 Trench foundation

4.7.1 Standard preparation of pipe trench foundation

The following applies to trench foundations for all pipes:

(a) The foundation of the trench is to be checked for stability of the soil.

(b) A robust trench foundation with sufficient allowable bearing capacity is required to resist loading from the bulk trench backfill and dynamic surcharge loads (typically traffic) at surface level.

(c) A plate compactor is first run over the trench foundation to bind the surface and identify any obvious weak spots.

(d) The in situ trench foundation shall be tested with a Scala penetrometer and must return a result of at least 4 blows per 50 mm of penetration. Where this cannot be achieved, an alternative requirement for the site-specific ground conditions may be approved. This must be verified using the method in **Appendix 5** of the Regional Standard for Water Services.

(e) Scala testing shall be carried out at 10 m intervals along the trench invert, or at any apparent change in ground condition.

(f) Soft, weak soil must be either strengthened, excavated and removed, or compacted to an acceptable standard (see **Section 4.7.2 Remedial measures for insufficient bearing capacity**).

4.7.2 Remedial measures for insufficient bearing capacity

Where the trench foundation level tested with a Scala penetrometer cannot achieve 4 blows per 50 mm of penetration, the following applies:

(a) If the applied loads at the trench foundation level results in soil stresses greater than the allowable bearing capacity, the in situ material will not provide a suitable trench foundation.

(b) Following failure to achieve the required compaction, the trench foundation should be further compacted with a plate compactor and retested with Scala penetrometer. If the required blows per 50 mm still cannot be achieved, Wellington Water may approve a lower minimum requirement.

(c) Where the trench foundation must be remedied, the trench must be over excavated and poor material removed. Imported, compacted fill will be installed in a raft below the trench foundation level to provide the required support, as shown in the figure below. The depth of this raft will be determined by the depth at which the in situ ground has suitable bearing capacity (at least equal to the applied soil stress at that level). Wellington Water will provide further direction if this depth exceeds 300 mm below the foundation level.

(d) Imported fill for the raft will generally be AP65 (graded material) compacted after placement to 6 blows per 50 mm.

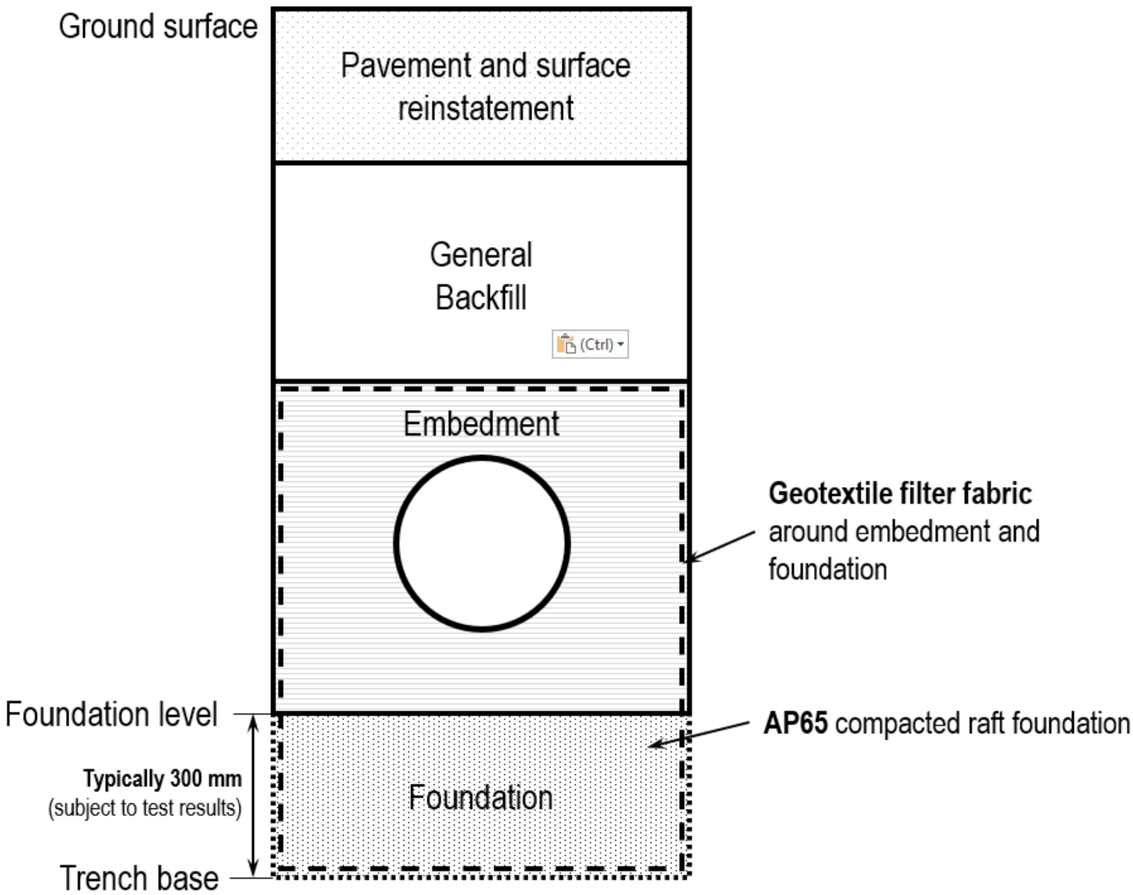

Figure 4-2 – Typical trench arrangement with a raft foundation constructed of imported fill

4.7.3 High groundwater environment

The following applies to loads in a high groundwater environment:

(a) Compaction of AP65 (or other basecourse) can be difficult below the water table due to the fines content of the material. The trench should be dewatered to install the raft arrangement as shown in **Figure 4-2** in accordance with the requirements of **Section 4.5.4 Trench dewatering**.

(b) Where dewatering is not feasible on site, it is acceptable to install single size drainage material in the submerged portion of an increased thickness raft, provided the groundwater level is below the original trench foundation.

(c) The soil stress from the applied loads acting on the in situ material beneath the base of the raft (including any drainage material) should be checked by Wellington Water to ensure it is less than the allowable bearing capacity for these soils. This will be determined by Wellington Water using the procedure outlined in **Appendix 5** of the Regional Standard for Water Services.

(d) If AP65 is being used above 10 mm drainage material with a typical grading curve, no fabric or other separation is required between these materials. Geotextile filter fabric requirements for other material combinations are to be checked using the procedure outlined in **Appendix 6** of the Regional Standard for Water Services. The minimum standard of fabric for this application is Bidim A29 or equivalent.

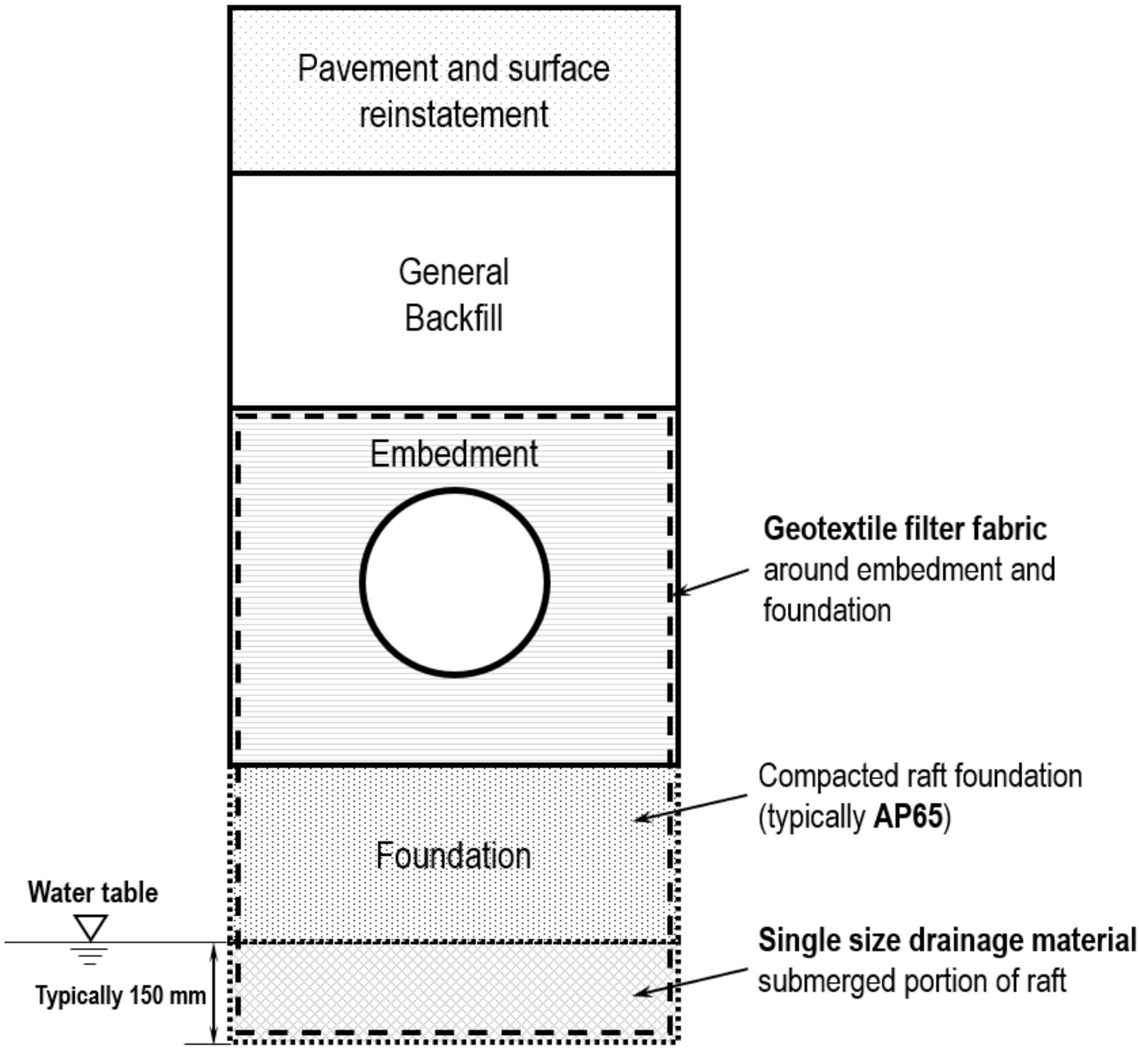

Figure 4-3 – Typical trench arrangement where the site has a high groundwater table

4.7.4 Extremely poor ground

The following applies to loads in poor ground conditions:

(a) If the in situ ground at the trench base is particularly poor (i.e. very soft, puggy clay), then AP65 will not be suitable as the raft construction material, as the compaction effort will press the raft material into the soft pug rather than compact it.

(b) In this instance, the trench must be over excavated and the poor ground removed. Refer to **Figure 4-4** for a typical detail of this arrangement. The additional depth of excavation shall be reinstated as follows:

(i) The raft shall be constructed from well-graded quarry forkings or river run gravel with a large maximum stone size (typically all passing 100 mm sieve, 1% max. passing 0.5 mm) or equivalent material, as agreed with Wellington Water.

1. This material is used as it can be compacted to form a bridging arrangement (raft) over poor ground.
2. Due to the larger particle size components, quarry forkings and river run material requires significantly more compactive effort compared to AP65 or other general graded backfill. This will require heavy duty shoring or trench boxes to be installed with wider trench widths.

(ii) The raft will typically be installed with a depth of 300-400 mm, depending on the maximum stone size.

(iii) A blinding layer of graded material of a depth appropriate to the material is to be placed over the raft and compacted for the purpose of achieving a Clegg reading (e.g. 150 mm for AP65 or 100mm for AP40).

(iv) Due to the low fines content of the quarry forkings and river run material, geotextile filter fabric will be required between the binding layer and the pipe embedment to mitigate against particle migration into the embedment materials.

1. The minimum standard of fabric for this application is Bidim A29 or equivalent.
2. If the contractor would prefer to delete the geotextile filter fabric, this would need to be verified using the procedure outlined in **Appendix 6** of the Regional Standard for Water Services.

(c) Post-construction Clegg Hammer testing is required to demonstrate the quarry forkings or river run material has achieved compaction. The target test reading should be determined using the procedure outlined in **Appendix 5** of the Regional Standard for Water Services.

(i) Clegg Hammer testing is to be undertaken only where a blinding layer has been installed on top of the quarry forkings or river run material. Avoid taking readings directly on a stone or boulder.

(ii) The contractor shall obtain approval from Wellington Water that the post-construction testing is being undertaken at appropriate locations; multiple readings will generally give a reliable result with outliers discarded.

(iii) Clegg Hammer readings are only representative for the most recent compacted layer.

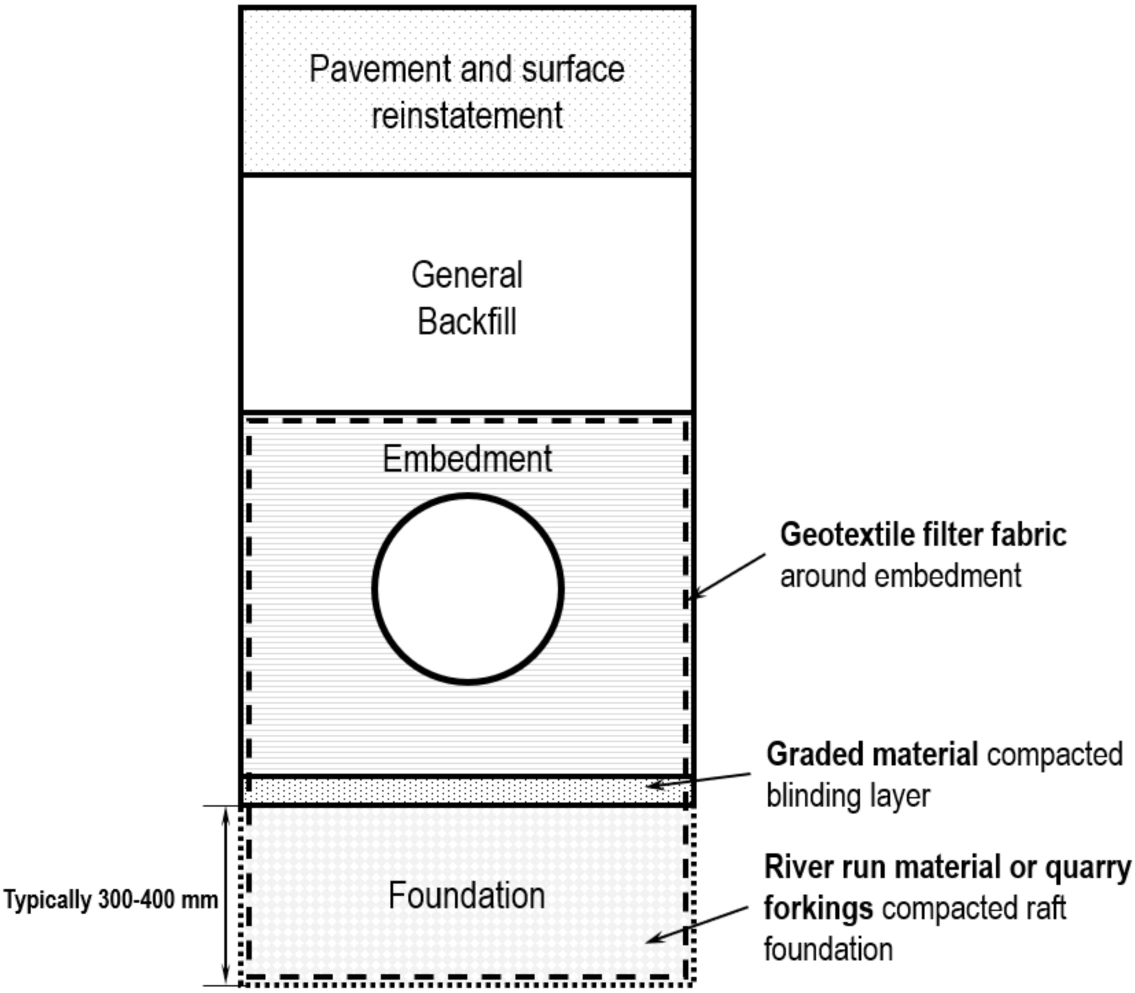

Figure 4-4 – Typical trench arrangement where the in situ ground is extremely poor

4.7.5 Post-construction testing

The following applies to testing of the pipe foundation:

(a) Compaction testing (typically Scala for basecourse materials or Clegg Hammer for quarry forkings or river run with large stones) should be recorded at regular intervals (typically 10 m) at the foundation level along the full pipeline alignment.

(b) See **Section 4.7.1**(f) **Standard preparation of pipe trench foundation** regarding locations of soft, weak soil.

(c) Compaction testing shall be conducted after compaction of the trench foundation and before preparation for laying and compacting the pipe embedment.

(d) Scala measurements shall be taken to depth of 300 mm below the trench foundation level. No measurement shall be recorded for the top 50 mm.

(e) Wellington Water or their representative shall witness a sufficient number of tests to confirm the necessary compaction is being achieved.

(f) Site compaction test records shall include (this applies for all compaction testing throughout trench depth):

(i) Site name

(ii) Contract number (where applicable)

(iii) Contractor's name (where applicable)

(iv) Location along trench as a chainage from a known point

(v) Test depth and trench level being tested

4.8 Reuse of in situ material

4.8.1 Compaction and testing for pipe embedment

The following applies to the reuse of in situ material for embedment. See **Section 4.9 Pipeline embedment** for general requirements for embedment material.

(a) Typically embedment is imported. There are opportunities to re-use excavated material as pipeline embedment in sand environments only.

(b) Wellington Water must approve the reuse of excavated material for pipe embedment.

(c) The compaction and testing requirements for native sand embedment material are outlined in **Section 4.9.4.3 Graded embedment material testing.**

(d) If the in situ material changes, the material parameters and compaction requirements must be re-evaluated.

4.8.2 Compaction and testing for general backfill

The following applies to the reuse of in situ material for general backfill. See **Section 4.10 General backfill** for general requirements for backfill material.

(a) Where reuse of material is proposed for backfill in a trafficable area, placement and compaction must be in accordance with the NCOPUATTC and NCOPUATTC local conditions.

(b) The level of compaction testing and minimum compaction targets to be achieved in a non-trafficable area will be determined by Wellington Water. The compaction achieved must be at least equal to that recorded in the adjacent in situ ground, tested by a Scala penetrometer.

4.9 Pipeline embedment

4.9.1 Flexible pipe embedment

The following applies to embedment of flexible pipes:

(a) The structural and embedment installation for flexible pipes should be in accordance with AS/NZS 2566.2.

(b) A standard embedment drawing for flexible pipes can be found in **Standard Detail DR03 – Typical Trench and Waterstop Details**.

(c) Flexible pipe materials (e.g. PE, PVC, steel, ductile-iron) deflect to an elliptical shape when put under applied loads, and in doing so, mobilise sufficient lateral earth pressures in the adjacent ground to resist the applied loads and control the cross-sectional deflection.

(d) The embedment zone for flexible pipes can be subdivided into the subzones shown in **Figure 4-5**.

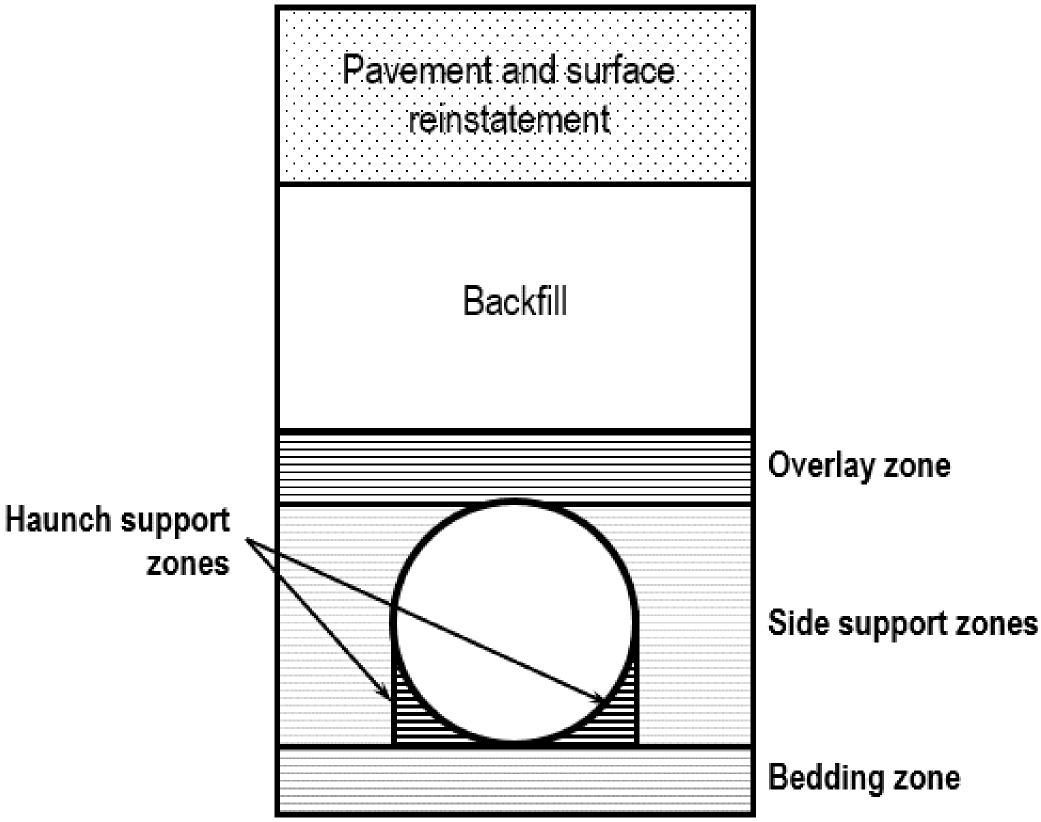

Figure 4-5 – Embedment for flexible pipes

4.9.1.1 Bedding, haunching and side zone material for flexible pipes

The following applies to embedment material for flexible pipes:

(a) Bedding, haunching and surround material for flexible pipes shall be a selected cohesionless material that complies with the grading curves of AS/NZS 2566.2. Typical material compliance with this specification is outlined in **Table 4-2** to **Table 4-6**.

(b) The material for all pipes shall be free of organics and sharp, angular aggregates.

Table 4-2 – Bedding, haunching and surrounds material for flexible pipes

In situ soil environment	Material
In a sand environment	Native Sand Imported sand (**Table 4-3**)
In all other environments	AP20* for > DN 150 AP10* for DN 63 to DN 150 AP5* for < DN 63 20 mm down, well graded gravel (**Table 4-6**)

* Single-size aggregate should be used where strict control of grading is essential. Pea-metal and single graded equivalents are acceptable; examples are given in **Table 4-4** and **Table 4-5**.

Table 4-3 – Imported sand material grading limits

Sieve size (mm)	Weight passing (%)
4.75	100
2.36	90-100
1.18	85-100
0.60	70-100
0.30	50-100
0.15	0-40
0.075	0-5

Source: Table G3 AS/NZS 2566.2

Table 4-4 – 5 to 14 mm drainage chip grading limits

Sieve size (mm)	Weight passing (%)
13.2	98-100
9.5	24-42
4.75	0-3
0.15	0-2

Source: Drainage General Conditions of Specification, WCC (2006)

Table 4-5 – Asphalt aggregate 8mm down grit typical grading

Sieve size (mm)	Weight passing (%)
6.7	100
4.75	92
2.36	29
1.18	12
0.075	12

Source: Horokiwi Quarries (2015)

Table 4-6 – Grading limits for bedding/surround material (typically used for bulk water pipes)

Sieve size (mm)	Weight passing (%)
6.7	100
4.75	92
2.36	29
1.18	12
0.075	12

Source: Table 6 AS/NZS 3725:2007 and Table G1 AS/NZS 2566.2:2002

4.9.1.2 Pipe surround for flexible pipes

The following applies to the pipe surround for flexible pipes:

(a) The minimum embedment zone dimensions for flexible pipes are given in AS/NZS 2566.2 Table 4.2.

(b) Careful placement and compaction of pipe embedment material to the specified embedment geometry is necessary to ensure the pipe is adequately supported. See **Section 4.9.4 Compaction and post-construction testing** for compaction requirements)

4.9.2 Rigid pipe embedment

The following applies to embedment of rigid pipes:

(a) The structural and embedment design for rigid pipes should be in accordance with AS/NZS 3725.

(b) A standard embedment drawing for rigid pipes can be found in **Standard Detail DR03 – Typical Trench and Waterstop Details**.

(c) Rigid pipe materials (e.g. concrete, vitreous clay) have inherent structural strength with applied loads taken by the pipeline itself. The embedment for rigid pipes is designed to distribute loads evenly around the pipe and provide sufficient support beneath the pipe to resist the total vertical loads and prevent excessive settlement.

(d) Because of this, pipe bedding, haunch and side zones are particularly important for rigid pipelines. These embedment subzones for rigid pipes are shown in **Figure 4-6**.

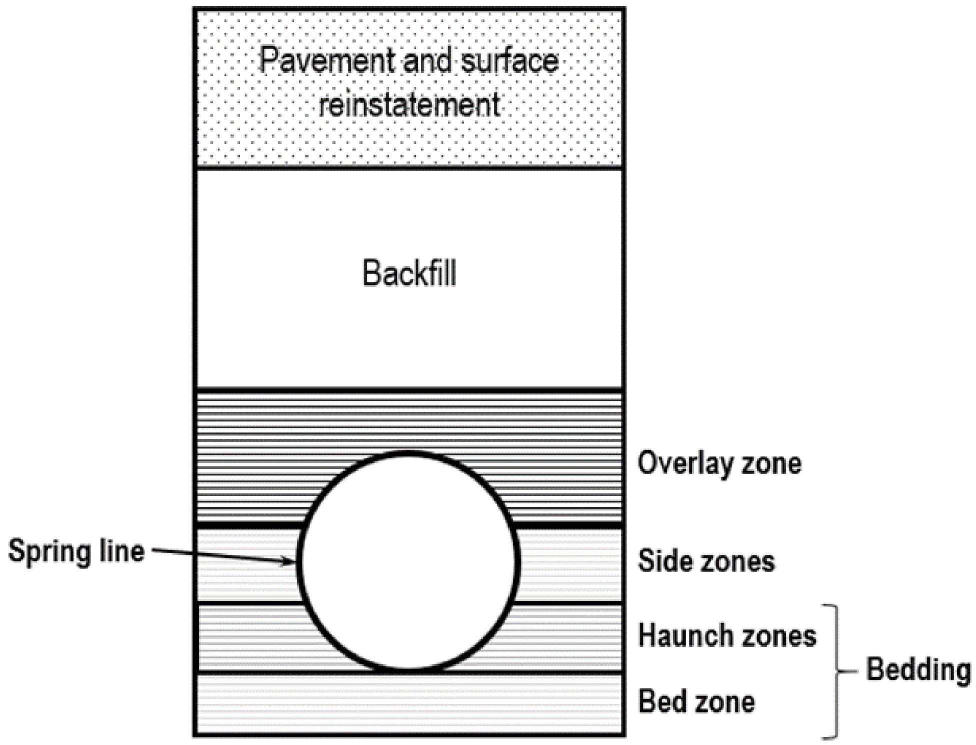

Figure 4-6 – Embedment for rigid pipes

4.9.2.1 Bedding, haunching and side zone material for rigid pipes

The following applies to material for rigid pipes:

(a) The material to be used for bedding, haunching and side zone material shall comply with **Table 4-6**, or **Table 4-7** and **Table 4-8**. Suitability shall be verified using the procedures outlined in AS/NZS 3725.

(b) Acceptable material within the grading limits will result in material that is well graded and free draining. Granular material that complies with this section, but that would break down when wetted, such as shale or conglomerates, are not suitable materials and shall not be used.

(c) The pipe embedment material shall not contain any organic material.

Table 4-7 – Bedding, haunching and side zone material for rigid pipes

In situ soil environment	All rigid pipes	Reinforced concrete pipes greater than 450 mm internal dia. only
In sand:		
• Bedding and haunching	Native Sand	Native Sand
• Side zone	Native Sand	Native Sand
In all other environments:		
• Bedding and haunching	5-20 mm drainage*	5-40 mm drainage*
• Side zone	5-20 mm drainage*	5-40 mm drainage*

* Complying with **Table 4-8**.

Table 4-8 – Drainage bedding, haunching and side zone

Sieve size (mm)	5-20 mm drainage dry mass passing (%)	5-40 mm drainage dry mass passing (%)
53.0	-	100
37.5	-	98-100
26.5	100	-
19.0	98-100	27-45
13.2	-	-
9.5	12-30	5-22
4.75	0-5	0-5
0.15	0-3	0-3

4.9.2.2 Pipe surround for rigid pipes

The following applies to pipe surround for rigid pipes:

(a) The minimum embedment zone dimensions for rigid pipes are given in AS/NZS 3725 Table 5.

(b) A rebate shall be formed in the bedding below any collars such that the pipe is supported on the full length of the barrel as opposed to only the collar.
   (i) A minimum of 50 mm of bedding material is required below any pipe collars.

4.9.3 Geotextile filter fabric and migration of fines

The use of geotextile filter fabric around pipeline embedment is the default arrangement in all cases (also note the requirements of **Section 4.7.2 Remedial measures for insufficient bearing capacity).** However, it can be deleted from surrounding the pipeline embedment if:

(a) The bedding and surround material meets the grading limits given in **Table 4-6**.

(b) It can be shown that migration of fines will not occur. The limit of migration of fines can be determined using information provided by the quarry and the method outlined in the **Appendix 6** of the Regional Standard for Water Services.

4.9.4 Compaction and post-construction testing

The following applies to the compaction of pipe embedment:

(a) The bed, haunch, side support and overlay shall be placed in a manner so that:
   (i) Uniform distribution and compaction of bedding is achieved, especially under the haunches of the pipeline.
   (ii) The pipeline position in the trench is maintained.
   (iii) The pipeline level and grade are maintained.
   (iv) The pipe and any pipe coatings are not damaged.

4.9.4.1 Graded material placement and compaction

The following applies to graded material placement and compaction:

(a) The contractor shall ensure that bedding along the trench edges is well compacted.

(b) The material shall be compacted in layers.

(c) Heavy machine compaction may be used to compact bedding below the pipeline.

(d) Light machine compaction, achieved only by hand operated machinery, shall be used to compact bedding in the overlay or around the haunches and the spring-line of the pipe.
   (i) Except that heavier machine compaction may be used when compacting bedding that is more than 150 mm clear of the spring-line of the pipe, as shown in **Figure 4-7**.

(e) The contractor is to ensure the compaction effort (and plant) applied will not cause damage to the pipe.

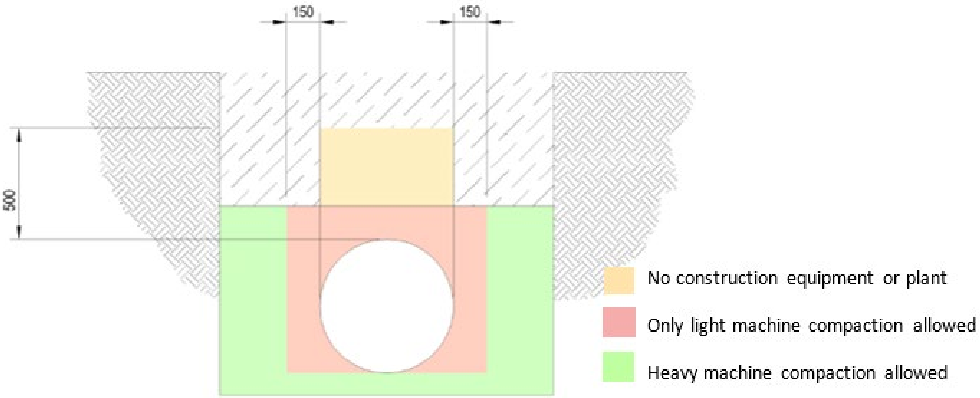

Figure 4-7 – Restrictions on use of heavy machine compaction

4.9.4.2 Single size gravel placement and compaction

The following applies to post-construction testing for single size gravel, which is drainage metal, processed aggregate or similar product. Grading limits for these materials are shown **Table 4-3** to **Table 4-5**:

(a) This material is often referred to as 'self-compacting' fill. This is a misleading phrase and implies that no additional compaction is required at installation stage. In fact, the material must be installed in discrete layers (of approximately 150 mm) and hand-tamped to ensure it is worked into all voids present below and around the pipeline, particularly in the haunch zones.

(b) Proper placement is critical for a single size embedment.

(c) No suitable field test for compaction is available.

(d) The following is critical for quality assurance:

  (i) Correct placement and workmanship as per the specification.

  (ii) Monitored by the Contractor's supervising engineer, recorded on daily inspection sheets and in site photographs showing correct methodology has been used for each pipe.

  (iii) Adequate material crushing strength to resist applied loads, durability (wetting and drying) and other material requirements as specified in the relevant design codes (such as AS/NZS 2566.2 or AS/NZS 3725).

  (iv) Quarry to provide the supporting evidence for (iii).

4.9.4.3 Graded embedment material testing

The following applies to post-construction testing for graded embedment materials (**Table 4-6**), which are graded gravels, sands, and other material:

(a) Graded embedment shall be compacted to achieve the mechanical properties required under AS/NZS 3725 and AS/NZS 2566.

(b) An acceptable compaction is to achieve a minimum of 4 blows per 50 mm with a Scala penetrometer.

(c) Where this cannot be achieved, a suitable test for compaction is to achieve at least 95% MDD of a lab based modified Proctor test (the percentage of MDD achieved on-site may exceed 100% MDD).

(i) The field test readings need to be calibrated to the MDD for the proposed embedment material prior to installation for in situ soils, and discuss with the supplier for imported fill.

(ii) To reduce the cost of field testing, it is acceptable to use a Scala penetrometer calibrated to the required percentage of MDD.

(d) Compaction testing should be executed and recorded at 10 m intervals for the full embedment depth, along the full pipeline alignment. Wellington Water may approve an increased interval length if representative tests at greater intervals are providing consistent results.

(e) It is preferable that compaction testing be completed for the full embedment depth.

(f) Where there are concerns about striking the pipe during testing, it will be acceptable to test to the top of the embedment provided that:

(i) The embedment material is the same as the general backfill material (e.g., native sand in sand environments)

(ii) The Developer has demonstrated a satisfactory technique for installation of embedment material as observed by Wellington Water on site during construction monitoring.

(iii) The Developer can demonstrate adequate compaction throughout the backfill for the full pipeline alignment at intervals as per **Section 4.9.4.3**(d) **Graded embedment material testing**.

(iv) The Developer accepts the additional risk associated with not testing the embedment compaction.

(g) Wellington Water or their representative shall witness in person a sufficient number of tests to be satisfied that the necessary compaction has been achieved.

4.9.5 Concrete bedding

4.9.5.1 Application

The following applies to the application of concrete bedding (cradle):

(a) Concrete bedding shall not be used for flexible pipeline materials.

(b) Concrete bedding is not typically specified for concrete pipe embedment under AS/NZS 3725; however, it may be necessary where a particularly high bedding factor is required.

(c) Graded material is preferable for all rigid pipe applications (see **Section 4.9.2 Rigid pipe embedment**); special allowance should be sought from Wellington Water prior to specifying concrete bedding.

(d) Pipe bedding performs a different function to the pipe trench foundation and is not interchangeable.

4.9.5.2 Requirements

The following applies to concrete bedding requirements:

(a) Effective performance of concrete bedding is reliant on a sound trench foundation. This can be achieved through the methodology outlined in **Section 4.7 Trench**

foundation or by using a blinding layer of weak concrete at the trench foundation level.

(b) Concrete bedding shall extend at least 150 mm either side of the pipe and shall have a thickness no less than 100 mm or 0.25 x pipe OD (whichever is greater).

(c) Pipes with collars shall be supported at their collar by a 20 mm thick H4 treated softwood block and the lower 90-degree arc of the barrel hand packed with concrete.

(d) Flush jointed pipes shall be supported at the joint by a 50 mm thick H4 treated softwood block and the lower 90-degree arc of the pipe barrel hand packed with concrete to ensure joints remain aligned during laying and backfilling.

(e) The surface of any concrete already hardened shall be chipped, washed and brushed clean, and shall have a layer of cement grout brushed before new concrete is placed on it.

(f) In wet trenches, the concrete bed shall be supported on each side by firmly fixed timber shutters, and a drainage channel shall be formed outside these. Water shall be kept below the bottom of the bedding by pumping from sumps or by other approved means.

(g) No concrete shall be placed into running water. Concrete may be placed to displace still water if permitted in writing from Wellington Water.

(h) Concrete used for pipe bedding shall have a minimum compressive strength of 20 MPa after 28 days.

(i) All concrete shall be allowed to set for at least 24 hours before any loads from pipelaying, backfilling, etc are applied.

4.9.6 Concrete surround

4.9.6.1 Application

The following applies to the application of concrete surround:

(a) Concrete surround is not typically required (or permitted) for flexible pipe materials. Project-specific approval should be sought from Wellington Water prior to specification.

(b) Concrete surrounding of concrete and earthenware drains will not normally be permitted.

4.9.6.2 Requirements

The following applies to concrete surround requirements:

(a) Where concrete surrounding is specified, then, except where the pipe is under a building, there shall be a physical break in the surround at each pipe joint to maintain pipe flexibility. This shall be created by the insertion of a plywood spacer (typically 18 mm thick) shaped to the pipe barrel and placed on the pipe barrel immediately adjacent to the collar of the connecting pipe.

(b) Pipes laid on a concrete cradle or concrete surrounded shall be supported at the collar on H4 treated softwood blocks (for flush jointed concrete pipes, the blocks shall be placed at the joint).

(c) Concrete used for pipe cradles and surrounds shall have a minimum compressive strength of 20 MPa after 28 days.

(d) Where concrete surrounding is specific for flexible pipeline materials, the pipe shall be wrapped in a soft, compressible material to provide a transition to the rigid concrete surround.

(e) For plastic pipe materials operating under pressure, steel reinforcement will be required in the concrete surround to carry the forces transferred from the pipeline.

4.10 General backfill

4.10.1 General

The following general guidelines apply to backfilling of an excavation above the embedment:

(a) No backfilling shall be carried out until the laying and jointing of the lines have been approved in writing by Wellington Water or their representative.

(b) Large vibrating rollers shall not be used within 500 mm of the top of pipes.

(c) At all times during backfilling, the contractor must ensure that the pipe coating and protective wrapping are not damaged in any way.

4.10.2 Backfill material

4.10.2.1 Road reserve and private drives

The following applies to backfilling road reserves and private drives (including trafficable paved areas):

(a) Any trench shall be backfilled in accordance with NCOPUATTC and NCOPUATTC local conditions.

4.10.2.2 Private property

Where backfilling is in private property (excluding private drives and paved areas), and unless otherwise specified in the approved drawings, general backfill material (see **Table 4-9**) shall be:

(a) Dry and free of rocks and organic and deleterious material.

(b) Placed uniformly and compacted to the specified relative compaction for the material.

(c) For non-cohesive material, compacted as outlined in **Section 4.10.3 Compaction and post-construction testing**.

(d) Where the finished trench surface settles below the level of the adjacent ground, the level shall be raised with additional material consistent with that used in the initial reinstatement, and surface made good.

Table 4-9 – Backfill material for private properties

In situ soil environment	Backfill material
Sand	Sand
Other – non-trafficked	GAP 40 or GAP 65 or suitable excavated material

4.10.3 Compaction and post-construction testing

The following applies to backfill placed above the embedment material (for buried flexible pipelines) or above the surround (for buried rigid pipelines):

(a) Placement and compaction shall be as per the NCOPUATTC and NCOPUATTC local conditions.

(b) A consistent level of compaction shall be achieved across each layer of backfill.

(c) Compaction measurements shall not be taken in the outside edge of the trench but taken in the middle 50% of the trench width.

(d) Compaction shall be measured by Scala penetrometer.

(e) A Clegg Hammer may be used as a cursory test, but Scala results are required as evidence of suitable compaction. The conversion of number of blows per 50 mm penetration to Clegg Hammer results is given in **Table 4-10**.

(f) Wellington Water or their representative shall witness in person a sufficient number of tests to be satisfied that the necessary compaction has been achieved, but not closer than 200 mm above the pipe.

(g) Ideally, to avoid the formation of voids, trench shoring should be raised above the layer that is about to be compacted before compaction is undertaken. However, it is acceptable to lift trench plates and sheet piles after compaction provided all voids have been filled on both sides of the plates and sheet piles.

Table 4-10 – Conversion between Scala penetrometer blows and Clegg Hammer results

Blows per 50 mm penetration	Indicative Clegg Hammer
7	CIV 35
4	CIV 25
3	CIV 15
2	CIV 10

4.11 Reinstatement

4.11.1 Pavement and surface reinstatement

The pavement layers and resurfacing of the trench shall, as a minimum, comply with the NCOPUATTC and NCOPUATTC local conditions or the appropriate subdivision code of practice. All compaction and post-construction testing for pavement layers shall also be in accordance with **Section 4.10.3 Compaction and post-construction testing**. The same standards required for trafficable and non-trafficable in the road reserve shall apply to private property also, unless otherwise agreed in writing with the property owner.

From May to August inclusive, grassed areas shall be reinstated with imported turf or by reinstating the existing excavated turf or as required by subdivision consent conditions.

4.11.2 Marking of hydrants, valves, service valves and pavement

Any street markings disturbed by construction works shall be remarked as per the NCOPUATTC and the relevant council's Code of Practice.

4.11.2.1 Hydrants

Marking of hydrants shall (see also **Section 6.2.11.4 Hydrant valves**):

(a) Comply with SNZ PAS 4509.

(b) Be carried out within 24 hours of the pipeline being commissioned.

(c) Include the hydrant box lid and any concrete surround, the triangle near the carriageway centreline pointing at the hydrant and a circle if required.

(d) Include reflective blue pavement markers to be installed on the centreline as per the standard.

4.11.2.2 Gate (sluice) valves

The following applies to marking of gate valves:

(a) Normally shut valves and fire service valves shall be marked with a non-slip reflective paint that complies with NZTA M/07 excepting colour.

(b) "Normally Shut" valves shall be painted <u>red</u>.

(c) "Fire Service" valves shall be painted <u>green</u>.

(d) Scour valves shall be painted <u>blue</u>.

(e) Gate valves shall be painted within 24 hours of commissioning of the pipeline.

4.11.2.3 Service valves

The following applies to the marking of service valves (see also **Section 6.2.11.5 Service valves**):

(a) Marking of the location of services valves shall be carried out within 2 weeks of commissioning of the pipeline or prior to vesting of the asset.

(b) Service valve locations shall be marked on the point of the adjacent kerb closest to the valve.

(c) They shall be identified by a "V" cut into the top of the kerb with the point of the "V" pointing towards the valve location.

(d) The "V" shall be a minimum of 100 mm long and be cut a minimum of 5 mm deep into the kerb.

4.11.2.4 Obsolete markings, service covers and blocks

Obsolete markings, service covers and blocks shall be removed within 24 hours of the pipeline being taken out of service.

4.12 Building in close proximity to public pipelines

The following applies to building in close proximity to public pipelines as defined in **Section 2.2.2 Definitions**. This section should be read in conjunction with **Standard Detail DR09 – Building in Close Proximity** and the design standards in the Regional Standard for Water Services.

(a) All load bearing foundations and piles should terminate below the building line restriction (BLR) and not within any prohibited zones for the type of foundations or piles (refer to **Standard Detail DR09 – Building in Close Proximity**).

(b) All new or upgraded pipelines should be laid so that none of the existing foundations terminate above the BLR or within an applicable prohibited zone (refer to **Standard Detail DR09 – Building in Close Proximity**).

(c) Where a pipeline is relocated around building works, a cut-off wall shall be constructed in the old trench to prevent ground water flow through the trench beneath the building works. A collection and diversion system may also be required at the discretion of Wellington Water if the ground water flow is significant.

(d) Where building in close proximity to an existing public pipeline cannot be avoided, then the existing pipe should be replaced with a new pipe and "sleeved" at the developer's expense (see **Section 4.12.1 Sleeving an existing pipe**)

   (i) Sleeving is required primarily to preserve access for maintenance and future renewal of the pipe.

   (ii) The sleeve is not intended to function as a future standalone pipe.

   (iii) The sleeve or "host pipe" must comply with **Section 4.12.1 Sleeving an existing pipe**.

(e) As sleeving is not always practicable for large pipes, building directly over a larger pipe (≥600 mm) without sleeving may be considered if:

   (i) The BLR requirements are still met (i.e., piles and building inner-edge points are below the BLR).

   (ii) It is demonstrated that there are no increased loads on the existing pipeline from the proposed building works, including no disturbance to the pipeline from piling or other construction activities.

   (iii) The building works are fully self-supporting and an excavation could be made to maintain or replace the pipe without undermining the foundations of any building works.

   (iv) The applicant provides Wellington Water with a PS2 producer statement from a Chartered (Structural) Engineer stating that the structure has been designed to meet the above conditions.

4.12.1 Sleeving an existing pipe

Sleeving consists of replacing an existing pipe with a new pipe that is housed within a new host pipe or "sleeve" that is laid at the same time.

The following applies to sleeving of pipes:

(a) The replaced pipe to be sleeved shall be:

   (i) Sized to accommodate the expected future capacity for the upstream catchment, regardless of the size of the existing pipe.

   (ii) Able to be removed and replaced without excavation of the host pipe (notwithstanding launch/receiving pits).

   (iii) Held concentrically centrally within the host pipe using polyethylene (PE) spacers, or similar purpose-designed spacers, with a minimum durability of the sleeved pipe.

   (iv) Not connected to any laterals or junctions.

   (v) Constructed from PE or other approved materials.

(b) The sleeve must be laid in accordance with the following requirements (see **Figure 4-8** for a diagram):

(i) The sleeve shall be laid with sufficient working space, within the same lot, or within adjacent public land with prior written approval from the landowner, to allow for maintenance and removal of the pipe as follows:

1. The launching end of the sleeve shall have a minimum length of clear working space adjacent to the building along the pipe alignment compliant with the requirements in **Table 4-11.**

Table 4-11 – Minimum clear space requirements for launch end of sleeve

Depth to sleeve invert	Minimum length of clear space
1.0 – 2.0m	4.0m
2.0 – 3.0m	6.0m
3.0 – 4.0m	8.0m

2. The receiving end of the sleeve shall have a minimum 2 m length of clear working space adjacent to the building along the pipe alignment.

3. The width of the clear working space shall comply with the easements widths detailed in the relevant section(s) of the Regional Standard for Water Services.

(ii) The sleeve should extend a minimum of 1.0 m and not less than half the sleeve invert depth outside of the building foundation. Greater clearances may be required at the discretion of Wellington Water.

(iii) The top of the sleeve must be a minimum of 600 mm depth below the underside of any slab / floor beams.

(iv) If sleeving is a condition of resource consent, an easement will be required to protect access to the working space.

(c) The host pipe shall be:

(i) Designed and constructed to accommodate the proposed loading.

(ii) Sealed against ingress of groundwater at both ends.

(iii) Large enough to accommodate the replaced pipe, including any collars or joints on the pipe (such as electrofusion (EF) couplers).

(iv) Constructed from approved materials compliant with this specification.

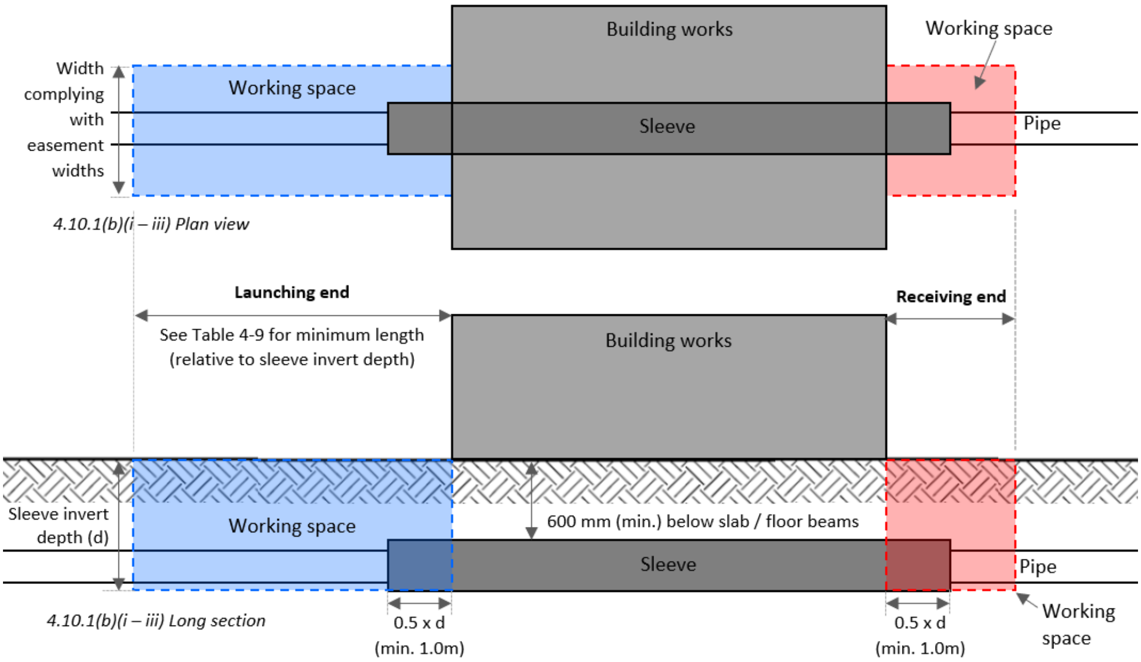

Figure 4-8 – Clearance and working space requirements for sleeved pipes

4.13 As-builts

As a minimum, as-builts shall comply with the Regional As-built Specification and Regional Draughting Manual which are separate to this document. As-builts shall also comply with any requirements individual councils may impose as part of any subdivision application.

4.14 Slip-lining

Slip-lining is where a new pipeline is inserted inside an existing pipeline. The following applies to the slip-lining of pipes:

(a) Slip-lining AC pipes should be considered only if there is no other practicable alternative because the AC pipe surrounding the new pipeline constitutes a hazard that places those working on the new pipeline at risk (see **Section 4.4.1 Design for replacement of asbestos cement pipes**).

(b) Although it is possible to install rubber ring jointed pipe such as PVC by slip-lining, unrestrained pipe shall not be used for slip-lining. Restraint joint PVC, restraint jointed ductile iron (DI) pipe, butt fusion welded PE pipe (that is externally de-beaded where needed) or butt-welded steel pipe may be used to slip-line deleted pipelines.

(c) For gravity pipelines, slip-lining shall be assessed on a case-by-case basis and approval of slip-lining as the preferred methodology must be obtained from Wellington Water in the design phase. Assessments shall include:

 (i) An options analysis (i.e., comparing risks and benefits of slip-lining to other methods such as open trench pipe replacement)

 (ii) Comment on the effect on grade and

 (iii) Calculations proving the network will continue to meet hydraulic design requirements.

(d) The new pipeline must be smaller than the existing pipeline resulting in an annular gap between the new pipe and the host pipe. The annular gap may, or may not, be filled by flowable grout or a similar material.

4.14.1 Slip lining installation

The following applies to the installation of pipes by slip lining:

(a) The host pipe shall be cut back a distance "d" either side of any connections to the inserted pipe, where "d" is 1.5 times the expected differential movement between the host pipe and the inserted pipe during a seismic event. This is required to prevent the connection to the inserted pipe being broken by impact with the host pipe.

(b) A proposed methodology shall be submitted to Wellington Water or their representative and shall include the location of launching and receiving pits, slip-lining methodology, maximum allowable pulling force as recommended by the pipe manufacturer and equipment to be used.

(c) Launching and receiving pits shall be excavated based on the proposed methodology. The location of the pits shall take into account traffic, hazards and the impact on the operation of the piped infrastructure.

(d) A section of the existing host pipe shall be removed to enable slip-lining activities. Any pipe cuts, especially on the pipe which will remain in service, shall be neat and square and made such that splitting or stressing of the existing pipe is avoided.

(e) The existing pipeline shall be cleared of any obstructions that will prevent the insertion of the liner. If inspection reveals an obstruction that is not at the location of the entry shaft and cannot be removed by cleaning and descaling, the pipe shall be exposed by excavation and the obstruction removed. Such excavation shall be approved in writing by Wellington Water prior to the commencement of the work.

(f) The cleaned pipe shall be proofed to ensure no further obstructions exist. The proover shall be:

   (i) Equivalent in diameter to the pipe to be pulled plus proposed skids and

   (ii) Pulled in the same direction that the proposed slip-lining will be carried out.

(g) PE100 pipe joints shall be butt fusion welded (see **Section 5.4.5.1 Butt fusion jointing**).

(h) Polythene coated 4 mm^2 copper tracer wire as per **Section 6.3.8 Warning tape / tracer wire**, shall be inserted along with the slip-lined pipe.

(i) The pipe shall be inserted into the existing main with a power winch and a steel cable connected to the end of the pipe by the use of an appropriate pulling head. The load on the pulling cable shall be monitored at all times to ensure the pipe's allowable pulling force is not exceeded. The inserted pipe shall:

   (i) Be guided into the host pipe using rollers and

   (ii) Not be bent beyond the allowable bending radius (see **Section 5.2.1 Drains laid on a curve**).

(j) During insertion of PE100 pipe, precautions should be taken to protect the new pipe to prevent any ragged edges of the existing main from scoring the outside of the new pipe as it is being pulled into the existing main.

  (i) Pipe scored greater than 10% of the pipes wall thickness shall not be permitted to be used or accepted for installation.

  (ii) This may be achieved using skids firmly attached to the pipe.

  (iii) Once the insertion is initiated, the pipe shall be continued to be pulled at a steady and uninterrupted rate to completion.

(k) The inserted PE100 pipe shall be pulled a minimum of 1 m beyond the end of the host pipe and allowed to relax after pulling for a minimum time of 24 hours before the annular gap is sealed. This is to allow for the pipe to shrink after relaxing. The time may be reduced for shorter pipe lengths at the discretion of Wellington Water.

4.15 Pipe-bursting

Pipe bursting, or pipe cracking, is the term used to describe a renewal method where a tapered cone is forced through the bore of the pipe which is to be renewed. The forcing cone, which is larger than the pipe being renewed, shatters and displaces the existing pipe. A new pipeline is then drawn-in behind the forcing cone.

The following applies to pipe-bursting:

(a) Pipes that shall NOT be pipe-burst are AC pipe and gravity pipe that is concrete haunched.

(b) Dips in gravity pipe need to be rectified or assessed to Wellington Water's approval prior to pipe bursting.

(c) Pipe bursting is typically used to renew a pipe with a new pipe of equivalent diameter. It is possible to renew the pipe with a larger pipe.

(d) The suitability of pipe bursting to renew any pipe is restricted by the depth of cover to the existing pipe and the potential for ground-heave and the proximity of other services.

  (i) Typically, where the difference in OD of the existing pipe and the OD of the forcing cone is greater than 0.1 times the depth of cover, pipe bursting would not be suitable.

(e) Pipe bursting shall not be used to renew AC pipelines because it leaves shattered asbestos fragments in the ground, which constitutes a hazard that places those working on the new pipeline at risk.

(f) Pipe bursting is achieved by:

  (i) A dynamic (typically pneumatic or hydraulic) impact tool, which forces the cone through the existing pipe. Dynamic bursting is not suitable for pulling-in new PVC pipelines.

  (ii) A static pulling of the forcing cone through the existing pipe. Static bursting is suitable for pulling-in PE and threaded PVC pipes.

(g) The existing pipeline shall be cleared of obstructions that will prevent the progress of the pipe bursting equipment.

(h) If inspection reveals an obstruction that is not at the location of the entry shaft and cannot be removed by cleaning and descaling, the pipe shall be exposed by excavation and the obstruction repaired or removed. Such excavation shall be approved in writing by Wellington Water prior to the commencement of the work.

(i) Where it is apparent from inspection that a repair has been made that has used ductile iron or steel couplings, the repair shall be excavated and the repair coupling removed.

(j) PE pipe shall be butt fusion welded.

4.15.1 Pipe bursting of pressure pipelines

The following additional points apply to the pipe bursting of pressure pipelines:

(a) Because PVC approved pressure pipes are rubber ring jointed, pipe bursting is not suitable for installing new PVC pressure mains.

(b) If the new PE pipe is scored to a depth exceeding 10% of the pipe wall thickness, the pipe shall be cut off to where the depth of scoring is less than 10% and a new section of pipe drawn-in.

(c) If the new PE pipe is scored to a depth exceeding 0.2 mm (or the minimum depth of peel), it shall not be welded using electrofusion couplers. A short length of new pipe may be butt fusion welded to the scored pipe, which can then be electrofusion welded together.

4.15.2 Pipe bursting of gravity pipelines

The following additional points apply to the pipe bursting of gravity pipelines:

(a) Where the existing pipe to be renewed is a gravity sewer and the grade less than 1%, it shall not be renewed using PE pipe. In such cases it shall be renewed using threaded PVC pipe.

(b) A pipe bursting machine shall be used that is suitable for the conditions anticipated with the existing pipeline.

4.15.3 Underground services near pipe bursting

Underground services shall be marked out prior to any pipe bursting, and the following approaches followed:

(a) Where pipe bursting is employed, a minimum clearance of 750 mm to other services (between barrels) is required where the proposed pipe is the same nominal internal diameter as the existing pipe.

(b) If a pipe with a larger internal diameter is to be pulled through the existing pipe, the minimum clearance to other services (between barrels) shall be 1000 mm.

(c) If the pipe crosses another utility, the junction shall be excavated prior to bursting such that earth pressures on the adjacent utility are not increased when the pipe is pulled past the junction.

4.15.4 Pipe bursting installation

The following applies to the installation of pipes by pipe bursting:

(a) The manufacturer of the pipe shall be consulted as to the safe pulling force to be used on the proposed pipe.

(b) Monitoring of the pulling force shall be maintained during installation.

(c) The safe pulling force shall not be exceeded at any time.

(d) A copy of the manufacturer's recommendations and the installation methodology shall be presented to Wellington Water or their representative prior to installation.

(e) Where the pulling force is exceeded, the installer may be required to replace the pipe at their expense.

(f) Prior to installation, the existing pipe shall be inspected and all bends, tees, fittings and steel and ductile iron couplings shall be removed.

(g) Tracer wire, as per **Section 6.3.8 Warning tape / tracer wire**, shall be used with all pipe bursting activity.

4.15.5 Pipeline recovery

Pipes installed by pipe bursting shall be:

(a) Pulled a minimum of 1 m beyond the end of the host pipe.

(b) Given suitable time to recover from thermal expansion and stretching before connecting to a rigid connection.

(c) Given a minimum period of 24 hours before connecting the pipeline to any valves, manholes, bends or other rigid connection.

4.16 Impact moling

The following applies to installation by impact moling:

(a) All the underground services shall be marked with depths prior to any impact moling operation. It is recommended that adequate target points are excavated to monitor this operation.

(b) Due to the inaccurate nature of impact moling, a clearance of 1000 mm is required between the proposed alignment and other parallel services.

(c) Tracer wire as per **Section 6.3.8 Warning tape / tracer** wire shall be used with all impact moling activity.

(d) Where an impact mole bore is forced off-line or prevented from advancing along the proposed alignment, the bore shall be stopped. The impact mole shall be excavated and exposed, the alignment corrected and the unit re-launched.

(e) To avoid the pipeline being contaminated with lubricating oil, either a front vented impact mole shall be used, or alternatively, a liner film within the pipe shall be installed. On completion of the bore the liner shall be removed, leaving a clean inner surface.

(f) Adequate time shall be allowed for the installed pipe to relax prior to any connections or fittings being made.

4.17 Directional drilling

The following applies to directional drilling:

(a) The objective is the installation of polyethylene pipelines on a proposed alignment by:

 (i) Creating a clean hole through which the new pipe is drawn-in.

 (ii) Creating a fluidised column of soil and mud through which the new pipe can be drawn-in and displace the fluidised ground.

(b) When complete, the polyethylene pipe should extend between the launch pit and drill pit, or new manholes in continuous, watertight lengths.

4.17.1 Underground services near directional drilling

The following applies to underground services near directional drilling:

(a) All underground services shall be located prior to the drilling operation.

(b) The drilling operator shall be liable for damages to any underground services despite any approval given by the Wellington Water or their representative.

(c) The proposed alignment of the pipe shall have a clearance of 1000 m from other parallel services, buildings or ground surface.

(d) A tolerance of ±100 mm will be permitted between the proposed and as-built alignment.

4.17.2 Directional drilling pipe installation

The following applies to directional drilling pipe installation:

(a) Directional drilling is suitable for installing:

   (i) New sewer pipes at grade

   (ii) Pressure pipelines and

   (iii) Stormwater pipelines typically less than 450 mm, although larger sizes are possible with appropriate rig and space for establishment.

(b) Voids greater than 50 mm around the proposed alignment shall be backfilled and sealed with bentonite grout (or similar approved material).

(c) No drilling fluid or waste material shall be discharged into the sewer or stormwater system. All waste material shall be disposed to an approved site. Spillage of any drilling fluid shall be cleaned immediately.

(d) It should be ensured that the pipes are not subjected to pulling loads in excess of the pipe manufacturer's recommended tensile loads. Pipes shall not be subjected to excessive bending stresses during pullback operations.

(e) All precautions shall be made to ensure that the end of the pipe to be passed through the bore is sealed to prevent the ingress of earth or other foreign matter.

(f) Tracer wire as per **Section 6.3.8 Warning tape / tracer wire**, shall be drawn through the bore with the pipe.

(g) The pipe shall be pulled a minimum of 1 m beyond the end of the host pipe and provided suitable time to recover from and stretching before connecting to a rigid connection.

(h) A minimum period of 24 hours shall pass before connecting the pipeline to any valves, manholes, bends or other rigid connection.

(i) Sewer pipelines at grades of 1% or flatter shall not be installed using directional drilling.

(j) Frac-outs are the loss of drilling mud to the environment either through ground surface, into streams or other structures:

   (i) To ensure frac-outs do not occur, the length of the drill-shot, ground conditions and mud pressures shall be considered.

(ii) Before drilling commences, the contractor shall provide for approval a procedure for the containment and clean-up where frac-outs could occur.

(k) A directional drilling machine shall be used that is suitable for the conditions anticipated. The size and capacity of the drilling equipment must be compatible with the torque and pull back required to perform the drilling, reaming and pipe pullback installation. It shall also be capable of installing a pipeline to the required tolerances.

(l) Directional drilling shall be carried out with either a "pit-launched" or "surface launched" machine. Appropriate drilling fluid or "mud" shall be used to facilitate the boring.

(i) Adequate sample pits shall be excavated to evaluate what type of bore head and "mud" to use for the operation.

(ii) A sonde or beacon shall be built into the head or fixed close to the head to monitor the progress of the drilling head.

(iii) A hard-wire guidance system and adequate target points is recommended to accurately monitor the progress of the drilling head while drilling.

(m) A 1:100 scale site plan shall be forwarded to Wellington Water and written approval obtained prior to drilling. The plan shall show all the underground services, buildings and proposed alignment of the pipe.

(n) PE100 pipe joints shall be butt fusion welded (see **Section 4.19.1 Butt fusion welding**).

(i) Where the depth of scoring on the pipe, for an area extending 50 mm all-round the contact area of the saddle, exceeds the depth of peel for electrofusion saddles the depth of peel may be increased so that.

1. The OD of the peeled pipe is not smaller than the minimum OD recommended by the manufacturer of the saddle.
2. The OD of the peeled pipe is not smaller than the minimum requirements of PIPA POP001.
3. Where this cannot be achieved the pipe shall be rejected.

(ii) Where the depth of scoring on PE100 pipe exceeds the depth of peel for electrofusion sockets:

1. The pipe ends shall be cut off.
2. Short sections of undamaged pipe shall be butt-welded to the end of each drill shot.
3. The drill shots shall be joined using an electrofusion socket fitting (coupler) installed on the new, undamaged pipe ends.

(iii) Where the ends of the drill-shot(s) need to be replaced with undamaged new pipe, the new pipe shall be butt-welded to the drill-shot(s), except where **Section 4.19.5**(g) **Welding PE pressure pipe** applies, in which case the following applies:

1. The drill-shots can be cut-back to a section of pipe where the depth of scoring is less than the peel depth for electrofusion sockets.
2. The undamaged new pipe is installed as a single length of pipe (a closing piece) between the end of each drill-shot.

3. No more than two electrofusion couplers are used to connect the closing piece to the two drill-shots.

(o) The alignment of the grade of the pilot hole shall be checked after drilling and compared against allowable tolerances. Where deviations are outside the allowable tolerances, a new pilot hole shall be drilled.

4.18 Lining as pipe rehabilitation

At this time, the Regional Specification for Water Services does not contain specifications for pipe rehabilitation using cured in place pipe (CIPP) lining, spiral wound lining, and fold and form lining. Please contact Wellington Water for the latest guidelines on these trenchless technologies.

4.19 Polyethylene welding

It is critical for PE pressure pipelines that butt fusion welds exhibit ductile yield, and electrofusion welds exhibit ductile decohesion.

Welding shall generally follow the requirements of PIPA POP001[6] and PIPA POP003[7], except where amended by this specification.

4.19.1 Butt fusion welding

The following applies to butt fusion welding (see also **Section 6.4.3 Polyethylene butt fusion and electrofusion welding**):

(a) Generally, butt fusion welding shall only be carried out on pipes that are of the same outside diameter, standard dimension ratio (SDR) and material (i.e., both pipes are PE100 or PE80b).

(b) Petrol powered chainsaws shall **NOT** be used to cut PE pipe.

(c) Fully automatic butt fusion welding machines shall **NOT** be used. A fully automatic machine completes a weld without prompting the operator to carry out checks.

(d) Pipes of the same OD, but a different wall thickness, shall be joined using an electrofusion coupler, or the wall of the pipe with the smaller SDR (that is the thicker wall) shall be machined to match the wall thickness of the pipe it is to be welded to.

(e) Only hydraulic butt fusion welding machines shall be used.

(f) Semi-automatic welding machines are approved for use. A semi-automatic machine cannot complete the weld without the operator checking, measuring and inputting a prompt for the machine to continue at critical stages (weld alignment, for example).

(g) All equipment used for butt fusion welding shall be maintained as per manufacturer's specifications and in good working order.

(h) Pressure gauges shall be calibrated within the last six months and in readable increments of at least 10 kPa.

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[6] *Industry guidelines. Electrofusion jointing of PE pipes and fittings for pressure applications. Issue 8.0. POP001. Plastics Industry Pipe Association of Australia Limited (PIPA). 2019.*

[7] *Industry guidelines Butt fusion jointing of PE pipes and fittings – recommended parameters. POP003. Plastics Industry Pipe Association of Australia Limited (PIPA). 2018.*

(i) The welding site shall be fully enclosed to protect it from environmental conditions such as wind, windblown dust, rain, dirt and bright sun.

(j) Gravity PE100 pipes less than or equal to 160 OD and that are laid at a grade less than 2% shall be internally de-beaded.

4.19.2 Electrofusion welding

The following applies to electrofusion welding (see also **Section 6.4.3 Polyethylene butt fusion and electrofusion welding**):

(a) Petrol powered chainsaws shall **NOT** be used to cut PE pipe.

(b) The contractor shall not commence electrofusion welding unless they have on-site all necessary plant to carry out electrofusion welding. This shall include effective alignment clamps, re-rounding clamps and PI tape suitable for the size of the pipe being welded.

(c) Electrofusion jointing shall be carried out using an automatic electrofusion control box designed for the fittings proposed to be used. The control box shall have a barcode reader and electronic data logging, which shall be downloaded daily and delivered to Wellington Water.

(d) Before preparing the pipe end, visible reversion shall be cut off so that the pipe end has a constant OD.

(e) Hand scrapers shall **NOT** be used, except where required to dress pipe ends.

(f) Witness marks should be scored on the pipe with a hand scraper in preference to using a non-depositing pen.

(g) The welding site shall be fully enclosed to protect it from environmental conditions such as wind, windblown dust, rain, dirt and bright sun.

4.19.3 Site QA forms

A welding log sheet shall be maintained by the operator as part of the quality documentation. The log sheet shall record the information shown in **Table 4-12**, as a minimum:

Table 4-12 – Minimum information required on welding log sheets

<table>
<tr><th>Weld type</th><th>Category</th><th colspan="2">Information required and details</th></tr>
<tr><td rowspan="10">All welds</td><td rowspan="3">General weld information</td><td colspan="2">Weld number</td></tr>
<tr><td colspan="2">Date and time weld was made</td></tr>
<tr><td colspan="2">Weld location (accurate to +/- 1 m when installed)</td></tr>
<tr><td rowspan="2">Welder information</td><td colspan="2">Welders name</td></tr>
<tr><td colspan="2">Certification details including currency</td></tr>
<tr><td rowspan="5">Pipe details</td><td colspan="2">PE material classification</td></tr>
<tr><td colspan="2">DN</td></tr>
<tr><td colspan="2">SDR</td></tr>
<tr><td colspan="2">PN</td></tr>
<tr><td>Pipe</td><td>Name</td></tr>
</table>

Weld type	**Category**	**Information required and details**		
		manufacturer	Code for date and place of manufacture	
Butt fusion welds	General	Welding parameter used, including revision no / date		
		Operators observations		
	Machine details	Make		
		Model		
	Pipe details	Measured OR calculated mean pipe wall thickness		
	Heater plate	Condition		
		Cleaned?		*Y / N / NA*
		Average temperature at 4 points – recorded for 2 sides		
	Alignment	Misalignment	Is misalignment visible?	*Y / N / NA*
			Record maximum misalignment	
		End-gap	Is end-gap visible?	*Y / N / NA*
			Record maximum end-gap (if present)	
	Cool time	Was cool time out of the clamps observed?		*Y / N / NA*
	External weld bead inspection	Width	Minimum and maximum	
		Height	Minimum and maximum	
		Bead fully rolled-over and round?		*Y / N / NA*
		Bead symmetrical on both sides?		*Y / N / NA*
		Bead uniform around weld circumference?		*Y / N / NA*
		Pitting visible?		*Y / N / NA*
		Surface of bead appears glassy or satin?		*Y / N / NA*
		Bead discoloured?		*Y / N / NA*
	Miscellaneous	Operator's observations		
Electrofusion welds	Fitting details	Type	Electrofusion socket / electrofusion saddle / electrofusion transition	
		Size	Record DN if applicable	
		Manufacturer		
		Model or designation		
	Pipe details	Out of round	Record measured ovality before re-rounding / record corrected ovality if re-rounded	
		Reversion	Is it visible?	*Y / N / NA*
			What does it measure?	
			Was it cut-off?	*Y / N / NA*

Weld type	Category	Information required and details		
		Pipe OD	Before peeling	
			After first peel	
			After second peel	
			After third or final peel	
		Pipe ends	Pipe ends cut square?	*Y / N / NA*
			Record each pipe end max. out-of-square	
	Cleaning solvent	Type	Cloth and liquid / wipes	
		Manufacturer's name and branding		
		Solvent type	IPA or ethyl alcohol	
		Concentration on label		
	Electrofusion control box	Make		
		Model		
		Currency of certificate of calibration		
	Miscellaneous	Was alignment clamp used?		*Y / N / NA*
		Was re-rounding clamp used?		*Y / N / NA*
		Did witness marks align with fitting?		*Y / N / NA*

The welding log sheet shall be submitted to Wellington Water as part of the project completion alongside the as-built documentation.

4.19.4 Pipeline testing and weld testing

Hydrostatic testing, or air testing, of the pipe to show that it is water tight shall not be accepted as evidence that the welds are full strength and ductile. Weld testing shall be as outlined in the following sections.

4.19.5 Welding PE pressure pipe

The following applies to the welding of PE pressure pipe:

(a) PE pressure pipe shall comply with AS/NZS 4130.

(b) The high pressure-single pressure welding parameter specified in ISO 21307:2011 shall not be acceptable.

(c) Acceptable welding parameters include:

(i) The single pressure-low pressure parameter specified in ISO 21307:2011

(ii) DVS 2207.1[8] and

(iii) Other welding parameters accepted in writing by Wellington Water.

[8] DVS 2207.1 *Welding of thermoplastics - Heated element welding of pipes, piping parts and panels made out of polyethylene.*

(d) PE pressure pipes shall be welded by qualified PE welding operators, whose certification is current and has a good track record and experience welding pipe of an equivalent size and class as the pipeline to be constructed in the contract.

  (i) Acceptable welding qualifications shall include certification under the existing New Zealand ITO framework, or certification under the proposed PIPA NZ qualification framework.

  (ii) Where a welder is not certified, or their certification is lapsed and they can show good experience welding pipe of an equivalent size and class to Wellington Water, they may be acceptable at the written discretion of Wellington Water.

  (iii) Where the welding operator is newly qualified and/or with limited experience, they shall weld under the supervision of a suitably qualified welding operator acceptable to Wellington Water.

(e) PE pressure pipe shall be welded **AND** destructively tested according to this specification.

(f) PE pressure pipe DN 125 and greater shall be butt fusion welded.

(g) Electrofusion socket couplers shall not be used to join PE pressure DN 125 and greater, except where welds must be completed in the trench (for example, to join pipe currently being laid to pipe that was previously laid during the contract).

(h) Welding of tapping saddles and tapping tees shall be by electrofusion saddle welding.

4.19.6 Welding PE gravity pipe

The following applies to the welding of PE gravity pipe:

(a) PE gravity pipe shall comply with AS/NZS 4130 or AS/NZS 5065.

(b) PE gravity pipes shall generally be welded by qualified welding operators, or welding operators with a good track record and experience welding pipe of an equivalent size and class to the pipeline to be constructed in the contract.

(c) PE gravity pipe shall be welded according to this specification.

(d) It shall not be necessary to destructively test welds according to this specification.

(e) The requirement for butt fusion welds shall generally be determined by the installation method.

(f) Electrofusion socket couplers shall be acceptable for the joining of PE gravity pipe.

(g) The contractor shall take care that the pipe ends are prepared correctly and bevelled so that the joint will not rag in operation.

4.19.7 Work method statement

Before site welding or pre-qualification welding commences, the contractor shall submit a work method statement (WMS) for acceptance in writing by Wellington Water.

The WMS shall contain the following information, dependent on weld type:

Table 4-13 – Information required for WMS

Weld type	Category	Information required and details

<table>
<tr><th>Weld type</th><th>Category</th><th colspan="2">Information required and details</th></tr>
<tr><td rowspan="28">All welds</td><td rowspan="4">Compliance information for proposed:</td><td colspan="2">Pipe to be used to construct the contract</td></tr>
<tr><td colspan="2">Welding parameters to weld the pipe</td></tr>
<tr><td colspan="2">Welding plant to be used to construct the contract</td></tr>
<tr><td colspan="2">Welding operators to carry out the construction welding</td></tr>
<tr><td>Method</td><td colspan="2">Detailed method information on how the contractor proposes to weld the pipe</td></tr>
<tr><td rowspan="2">Contract information</td><td colspan="2">Contract title</td></tr>
<tr><td colspan="2">Contract number</td></tr>
<tr><td>Introduction</td><td colspan="2">e.g., “This Work Method Statement outlines the steps and calculations to [butt fusion / electrofusion] weld PE pipes for the above contract.”</td></tr>
<tr><td>Referenced documents</td><td colspan="2">Including relevant standards for pipe, relevant standards welding parameters, WSA documents, PIPA guidelines, welding machine operating manuals etc.</td></tr>
<tr><td rowspan="6">Pipe specific details including:</td><td rowspan="4">Resin</td><td>Base resin manufacturer</td></tr>
<tr><td>Resin name</td></tr>
<tr><td>Batch information</td></tr>
<tr><td>Copies of conformance paperwork from resin manufacturer</td></tr>
<tr><td rowspan="2">Pipe</td><td>Pipe manufacturer</td></tr>
<tr><td>Pipe batch information</td></tr>
<tr><td rowspan="10">Welding machine details</td><td colspan="2">Manufacturer</td></tr>
<tr><td colspan="2">Model</td></tr>
<tr><td colspan="2">Age and condition</td></tr>
<tr><td colspan="2">Maintenance history</td></tr>
<tr><td colspan="2">Copy of current certificate of calibration</td></tr>
<tr><td colspan="2">Data logging and data logging output</td></tr>
<tr><td rowspan="4">Ancillary equipment</td><td>Pipe cutting equipment</td></tr>
<tr><td>Generator to be used</td></tr>
<tr><td>Pipe rollers</td></tr>
<tr><td>Welding shelter</td></tr>
<tr><td rowspan="2">Welding operator details including:</td><td colspan="2">Copies of certification</td></tr>
<tr><td colspan="2">Relevant experience (including track record from weld testing)</td></tr>
<tr><td>Proposed</td><td colspan="2">How pipe is cut</td></tr>
</table>

Weld type	Category	Information required and details	
	Welding Procedure Specification (WPS) including brief details on:	Handling of pipe	
		Pipe cleaning	Cleaning solvent proposed to be used
			Physically how the cleaning is carried out
		Alignment checking and how tolerances are measured	
		QA inspections and recording	
		Data log capture and delivery to Wellington Water	
Butt fusion welding	Additional welding machine details	Ram area	
		Ancillary equipment	Facing plate (does it have new cutters installed)
			Heater plate (is it skinned or bonded Teflon – condition of faces)
		Cleaning solvent	Brand
			Solvent used
			% Concentration of solvent and water
	Additional WPS details specific to weld type	Loading of pipe	
		Roller set-up and handling of weld during pull-off	
		Heater plate checking and recording	
		Control of the heat soak, weld, and cool times	
	Welding parameters	Welding parameters proposed for the welding – including worked calculations for each pipe size and pipe class to be welded.	
Electrofusion welds	Details of the electrofusion fittings proposed to be used including:	Manufacturer	
		Type and model number	
		Size and pressure rating	
		Batch number(s)	
	Additional welding machine details	Ancillary equipment	Details of proposed alignment clamps for use, and if used
			Details of re-rounding clamps proposed for use
			Details of peeling tool proposed to be used, including condition of cutters and depth of cut
			Pipe cutting equipment
	Additional WPS details specific to	How pipe is cut square	
		Pipe measurements	Mean OD
			Ovality

Weld type	Category	Information required and details	
	weld type		Reversion
		Pipe peeling	Details on extent of peel
			How depth of cut is measured,
			Required depth of peel
		Witness marking	
		Use of re-rounding clamps	
		Control of the weld and cool times	
		Re-fusing fittings	

4.19.8 Butt fusion welding framework

It is critical for PE pressure pipelines that butt fusion welds exhibit ductile yield, and electrofusion welds exhibit ductile decohesion.

To achieve this, welding operations carried out in these works shall follow the destructive testing process in **Figure 4-9.**

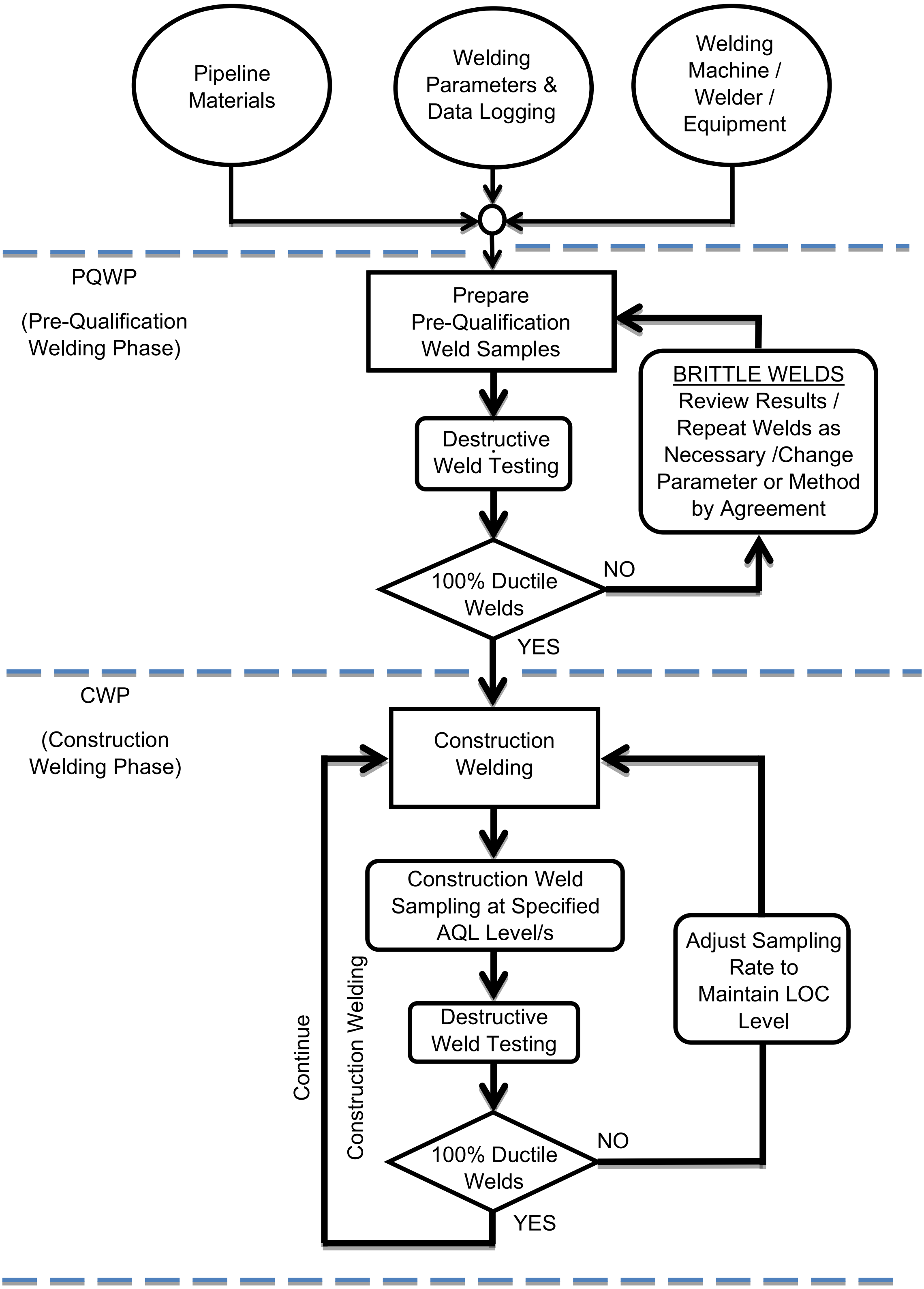

Figure 4-9 – Butt fusion welding framework

4.19.8.1 Pre-qualification welding and weld testing

The pre-qualification welding phase shall be carried out as follows:

(a) Before commencement of the PE welding portion of the contract works, the contractor shall:

- (i) Weld three pre-qualifying butt fusion welds for each size and class of pipe for which butt fusion welding will be used in the contract works.
- (ii) Weld three pre-qualifying electrofusion socket welds for each size of electrofusion coupler to be used in the contract works – except for electrofusion couplers smaller than 63 mm where prequalification welding shall not be required.
- (iii) Weld three pre-qualifying electrofusion saddle welds for each size of pipe for which PE saddles will be used in the contract works (i.e. no EF (electrofusion) saddles used, no EF saddle test welds required).

(b) The pre-qualifying welds shall be made:

- (i) Under site conditions
- (ii) In the presence of Wellington Water
- (iii) Using the plant and labour specified in the WMS and
- (iv) In accordance with the approved WMS.

(c) Where the contractor proposes to pre-qualify more than one welding operator, then each welding operator shall prepare three weld specimens for each weld specified above.

(d) The welds shall be cut-out as specified and marked with:

- (i) The Council and contract name.
- (ii) Test weld number (each weld shall be sequentially numbered so it can be individually identified).
- (iii) The welder’s name and certification number.
- (iv) Butt fusion welds shall be marked to show their orientation in the welding machine.

(e) The test welds shall be sent to an IANZ registered laboratory for destructive testing.

(f) The welds shall be tested and the performance requirements of the welds shall conform with requirements outlined in **Table 4-14.**

(g) A pass result shall occur when all pre-qualifying welds are shown by destructive testing to meet or exceed the performance requirements specified.

(h) A failed result shall occur when any of the three welds, for any one type of weld, do not meet the performance requirements specified.

(i) Following a pass result, the contractor is required to complete the contract welding in an identical manner using the same welding operator, equipment, and WMS that was used to prepare the pre-qualifying weld.

Table 4-14 – Weld performance and test requirements

Weld	Testing requirement	Performance requirement

Weld	Testing requirement	Performance requirement
Butt fusion weld – DN125 and greater	ISO 13953	Tensile Strength of any test piece shall be greater than 90% of the tensile strength of unaffected pipe wall. All test pieces shall be fully ductile. The weld shows no visual defect.[4] All test pieces after sectioning show no visual defect.[4]
Electrofusion socket weld – DN63	ISO 13955	% brittle decohesion shall be 0% The weld shows no visual defect.[4] All test pieces after sectioning show no visual defect. [4]
Electrofusion socket weld ≥DN125	ISO 13954	% brittle decohesion shall be equal to or less than L/3[1] The weld shows no visual defect.[4] All test pieces after sectioning show no visual defect. [4]
Electrofusion saddle weld	ISO 13956	Maximum brittle decohesion L_d =/< 50% [2] A_d =/< 25% [3] The weld shows no visual defect.[4]

1. Where L is the distance between the first and last element winding.
2. $L_d = (L/y) \times 100$ (%)
   Where L is the greatest length of brittle decohesion and y is the distance between the first and last element winding in any radial direction from the centre of the fitting.
3. $A_d = (A/A_{nom}) \times 100$ (%)
   Where A is the aggregate of all the areas where brittle decohesion has occurred and A_{nom} is the theoretical area of the total fusion zone, as declared by the manufacturer or measured on the fitting.
4. Visual defects shall include, but not limited to:
   (i) Butt Fusion Welds:
      a) Misalignment greater than 10%
      b) Beads that are not symmetrical, fully rolled-over and the correct size
      c) Pitting in the weld bead
      d) Discolouration or glassy appearance to a weld bead
   (ii) Electrofusion Welds:
      a) Hand scraped pipe
      b) Unevenly scraped pipe
      c) Insufficient peeled area
      d) Visible misalignment across an electrofusion coupler
      e) Melt-rise indicators uneven or not risen in an electrofusion fitting
      f) Loss of melt from the cold zone of an electrofusion weld
      g) Witness marks not visible

(j) Normal construction welding shall not commence until the welding contractor has successfully completed a satisfactory pre-qualifying weld.

(k) The contractor shall note that the results of weld testing will not be available for a period of approximately one week. The contractor shall allow for this in the programming of their work.

(l) Where a failed result occurs, the contractor shall re-evaluate their WMS and propose changes to achieve a pass result. When the revised WMS is acceptable to Wellington Water, the contractor shall prepare three new weld specimens (of the weld/s that failed) for testing.

(m) The cost to repeat the pre-qualifying test welds shall be deemed to be included in the contractor’s lump sum rate. The laboratory costs for repeat testing shall be paid by the contractor.

(n) The contractor shall note that, where a pass result is achieved for the pre-qualifying butt fusion welds, but not for one or more of the pre-qualifying electrofusion welds, it would be possible to mobilise on-site and undertake the construction butt fusion welding. However, the electrofusion fitting associated with the failed result cannot be installed on-site until the pre-qualifying electrofusion weld/s pass testing.

(o) When specifying the reporting of test results, Wellington Water shall require additional information to that specified by the standard. The test report shall detail the following information:

   (i) Date of the test
   (ii) Laboratory conducting the test
   (iii) Full identification of the pipe, including the nominal size, SDR rating, material and manufacturer
   (iv) Dimensions of the pipe before cutting the specimens, including diameter, ovality and wall thickness
   (v) Weld beads are symmetrical
   (vi) Identification of the sample by number or other
   (vii) Number of specimens tested
   (viii) Temperature of specimen at time of test
   (ix) Cross head speed
   (x) Maximum breaking load
   (xi) Printout in graphical form of extension of the cross head versus load
   (xii) Whether rupture occurred in the weld plane
   (xiii) Nature of the rupture in the weld plane (ductile or brittle) and
   (xiv) Any special observations made during or after the test.

4.19.8.2 Construction welding

The construction welding phase shall be carried out as follows:

(a) Construction welding shall not commence until the contractor can achieve three consecutive passes for each type of pre-construction weld.

(b) Welds will be sampled and destructively tested to maintain the level of confidence as established in the preconstruction welding phase.

(c) Welds shall comply with the performance requirements set out in this document.

(d) The Sampling Plan shall be designed in accordance with AS 1199.1 “Sampling Procedures for inspection by Attributes”.

(e) The Lot size shall not exceed 150 welds of the same type and size. Where the number of welds of the same type and size exceed 150 in number, the works shall be broken down into two or more smaller Lots of approximately the same size.

(f) The general inspection level shall be I.

(g) The Acceptance Quality Limit (AQL) shall be 2.5.

(h) To be acceptable, NO welds from the Lot shall fail (that is, not satisfy the performance requirements specified in this document). Where all welds pass, the Lot shall be acceptable and it shall not be subject to re-sampling.

(i) The contractor shall note the soonest time test results will be available is five working days after receipt of the welds by the testing Laboratory.

(j) Where the contractor chooses to continue welding they do so at their risk.

4.19.8.3 In case of failure

In case of failure:

(a) Where a weld fails testing, the Lot may not necessarily be rejected.

 (i) In the first instance a new Lot shall be created.

 (ii) The new Lot shall be from the last passed weld (or last accepted Lot), to the failed weld.

 (iii) The new Lot shall be sampled as follows:

General Inspection Level	= I
AQL	= 2.5
Acceptance Requirement	= No weld fails

(b) Where all welds pass, the failed weld will be considered an aberration and the new lot shall be accepted.

(c) Where one or more welds fail, the new Lot will be rejected. In this the contractor shall replace that section of pipeline, or the welds in that section (as agreed with Wellington Water), at their cost.

(d) The contractor is required to investigate the reason for the weld failure. As appropriate they will make changes to their WMS, as agreed with Wellington Water, and re-commence welding.

5 DRAINAGE SPECIFICATIONS

The following specifications pertain to technical aspects of general drainage construction. These may be superseded by specific specifications issued by Wellington Water for Wellington Water construction contracts. All other construction must comply with the following specifications unless dispensation is given in writing by Wellington Water.

5.1 Safety

The following requirements are for personnel who have been employed to work on Wellington Water projects and the councils' assets. They are minimum requirements, but do not constitute full compliance with all legislative requirements. Reference should be made to Wellington Water's health and safety policy and any relevant procedures and policies by those responsible for carrying out the works.

5.1.1 Drainage hazards

All workers shall be instructed about the hazards of working in sanitary and stormwater sewers. These hazards include:

(a) Bacterial and viral danger to food and drink in the absence of high standards of hygiene.

(b) Infection danger to open cuts.

(c) Rat bites, flea infestation.

(d) Toxic wastes which may burn or poison.

(e) Poisonous or explosive gases.

Workers coming into contact with sewage shall be inoculated against Hepatitis (infectious and B as available) and Tetanus. Refer to **Section 4.1.1 Immunisations** for relevant information on immunisations and vaccinations.

5.1.2 Drainage network underground entry

Entry to any parts of a live sanitary or stormwater sewer system is considered to be a confined space activity. Only personnel with third-party confined space entry certification shall enter a confined space.

All personnel shall comply with Wellington Water's Confined Space Entry process/policy which is available online.

5.2 Setting out

The following applies to setting out drainage pipes and systems:

(a) All drainage works shall be set out under the direction of a registered drainlayer, person qualified to the National Certificate in Infrastructure Works (Infrastructure Pipelaying Technician) (Level 3) or New Zealand Certificate in Pipe Installations (Level 4), and to the position and levels detailed on the approved drawings.

(b) Where the alignment is related to the street boundary, drains shall be laid with reference to permanent land transfer boundary pegs or temporary boundary marks placed by a licensed cadastral or registered professional surveyor responsible for the final land transfer pegging. Pipes *shall not* be laid by reference to the kerb line only.

(c) The deviation in level at any point from that specified or shown on the long section shall not be greater than 5 mm for grades flatter than 1%, or 10 mm for grades steeper than 1%.

(d) Where it is intended for the drain to be straight, the deviation from a perfectly straight line at any point shall not exceed the lesser of ¼ the internal diameter or 150 mm.

(e) The maximum joint displacement of flush jointed concrete pipes shall be 5 mm.

(f) Notwithstanding anything written in this specification, no change in direction at any point within the drain shall exceed the manufacturer's recommended maximum change.

5.2.1 Drains laid on a curve

The following applies to drains laid on a curve (PE only):

(a) PE drains laid with a curve between manholes shall be formed by bending the pipe. The tightest radius of curvature for bending shall be 50 x the OD of the pipe, but no tighter than the manufacturer's recommendation.

(b) A twin 1.0 mm TPS (thermoplastic-sheathed cable) electrical locator cable shall be laid along the top of the curved drain:

  (i) The ends of the cable shall be extended into the manholes and up to the lid so that locating instruments can be connected onto the cable.

  (ii) Joints in the cable between manholes will not normally be permitted as the normally permitted maximum spacing of manholes is less than the supplied length of the cable.

  (iii) If it is necessary to make joints in the cable, they are to be made with electrical connectors and shall be completely encased in a silicon rubber sealant to seal the joint against corrosion.

5.2.2 Drain invert at a manhole

For the purposes of measurement and setting out, the invert level of a drain at a manhole is:

(a) The level of a pipeline projected to the centre of the manhole. For example, the level the pipe invert would be if it was laid to the centre of the manhole. This excludes any change in grade or drop in the manhole.

(b) Not the level of the drain at the wall of the manhole.

(c) Not necessarily the actual finished level at the centre of the manhole.

5.2.3 Clearances from other utilities

The following applies to clearances from other utilities when setting out drainage pipes:

(a) Pipes shall be laid parallel to other services whenever practicable.

(b) Where a pipe crosses another utility, it shall be as close to perpendicular as practicable, and shall maintain minimum horizontal and vertical clearances as outlined by the other utility.

(c) Where these are not provided, the minimum clearances shown in **Table 5-1** shall be observed. The clearances are between utility pipe/conduit barrels.

Table 5-1 – Minimum clearances from drains as measured between barrels

Utility	Minimum horizontal clearance (mm)	Minimum vertical clearance (mm) when crossing
Gas Mains	300	150
Telecommunications conduits and cables	300	150
Electricity conduits and cables	500	225
Other drains	300	150
Water mains	1000*	200++

* or 1000 mm radial distance from watermain: i.e. horizontal can reduce when vertical increases.

++ Wastewater pipes should always be vertically lower than water supply mains to reduce the risk of cross contamination due to a water main failure.

5.3 Materials

The following applies to materials for the drainage network:

(a) All materials shall conform to the appropriate New Zealand Standard (NZS) . Where no appropriate NZS exists for a particular material, then the Australian Standard (AS) shall be used; or failing that, the British Standard Specification (BS) shall apply.

(b) All materials shall, at Wellington Water's discretion, be subject to test under the appropriate standard. Materials shall also be subject to Wellington Water's approval even though they conform to the appropriate standard specification.

(c) Current approved materials are listed in the Approved Products Register published on Wellington Water's website. Approvals are subject to change and care shall be taken that designers and specifiers are using the most current version.

(d) Materials that do not comply with the prescribed standards and/or specifications listed shall only be used with the written permission of Wellington Water and only after it has been demonstrated through third party certification that the item complies with the required standards.

(e) Materials used for construction and repairs shall be in a new condition and shall be suitable for the design life as required by the specification and associated standards.

5.3.1 Cement

The following applies to the use of cement:

(a) General purpose Portland cement shall be used unless otherwise specified in the design.

(b) Only dry, fresh cement shall be permitted for use in the manufacture of concrete.

(c) Additives shall be used only where specified in the engineering drawings and only when permitted in writing by Wellington Water.

5.3.2 Sand

Sand shall be clean, sharp and free from dust, shell, soft particles, loam, vegetable and other debris. Sand shall be graded as specified in the design before it is incorporated into the works.

5.3.3 Reinforcing steel

Reinforcing steel shall comply with AS/NZS 4671. Reinforcing rods shall be free of scale rust and bent and placed in accordance with NZS 3109.

5.3.4 Mortar

Mortar shall consist of one part of cement to two parts of sand by volume, thoroughly mixed with water to form a paste of a consistency suitable for the particular purpose. No mortar shall be used when more than two hours old unless it has an appropriate retarder.

5.3.5 Non-structural concrete

The following applies to non-structural concrete:

(a) All non-structural concrete shall have a minimum 28-day crushing strength of 17 MPa unless specified otherwise.

(b) It is preferable that ready mix concrete be used, although concrete may be mixed on site using a concrete mixer.

  (i) Hand mixing without the use of a concrete mixer will not be permitted.

  (ii) Specified concrete with strengths greater than 25 MPa shall be supplied as ready mix and shall not be mixed on-site (see **Section 5.3.6 Structural concrete**).

  (iii) Mixing shall be continued for at least two minutes and until the concrete is of an even colour and consistency throughout.

(c) The proportion of coarse aggregate to fine aggregate shall be between the limits of 1:1 and 2:1, so as to give the most desirable results for dense, strong concrete. The quantities of coarse and fine aggregate shall be separately determined by dry, loose volume, or by equivalent weight. The maximum aggregate size shall be 20 mm.

(d) The smallest quantity of water practicable shall be used to produce the desired workability and completion of the concrete.

(e) The slump shall not exceed 100 mm when measured in a standard cone. Wellington Water may, under exceptional circumstances, permit a greater slump.

(f) A minimum of 1 volume of cement to every 6 volumes of aggregate shall be used to give a minimum crushing strength at 28 days of 17 MPa. It should be noted when determining batch quantities that the crushing strength is dependent upon water content as well as cement content (i.e., the more water used, the weaker the concrete).

(g) If required by Wellington Water, standard test blocks shall be cast and cured.

5.3.6 Structural concrete

The following are the minimum standards for structural concrete and may be superseded by specific design.

(a) Measurements, mixing and delivery of materials shall be in accordance with NZS 3109 and NZS 3104, and the following conditions shall be observed:

  (i) No addition of water to the concrete in the agitator or in the bin will be permitted.

  (ii) No additives shall be used without the permission of Wellington Water.

(iii) Discharge of concrete from agitators and truck mixers shall be completed within one and a half hours after the introduction of mixing water to the cement or cement to the aggregates.

(b) All structural concrete for cast in-situ reinforced bases and walls shall comply with NZS 3109 and shall have a minimum crushing strength of 30Mpa at 28 days.

(c) The cover of concrete over reinforcement from any surface exposed to sewage or the atmosphere above sewage shall be at 75 mm. Notwithstanding this, cover to reinforcement shall be as per NZS 3101.1&2 for the relevant exposure classification.

(d) All bar intersections shall be tied with 16 gauge soft black iron wire and all ends of ties shall be bent into the body of the concrete away from the surface. No part of the wire ties shall protrude into the cover region.

(e) Secure formwork shall be erected to form the sides of all concrete slabs, headwalls and anchor blocks. Concrete bearing surfaces on headwalls and anchor blocks shall be cast against undisturbed ground. No concrete shall be placed until the formwork and reinforcement has been inspected and approved by Wellington Water.

(f) Wellington Water shall be given 24 hours' notice of any intention to place concrete and of the time the concrete has been ordered.

(g) A smooth face finish is required on all faces except those permanently buried.

(h) Surfaces shall be poured against clean plywood or steel faced shutters free from all blemishes and arranged to produce a smooth even and blemish free surface with no fins, offsets, air-holes or other disfigurements.

(i) Covers for protection from water, rain or frost shall be used as required. Concrete shall not be placed in ponded or running water. Running water over fresh concrete is not permitted.

(j) Concrete testing shall be prepared to standard 300 mm x 150 mm test blocks, if required. Slump tests may be required to be carried out on site. The contractor shall provide all test cylinders, slump cones, plates, trowels etc required for the testing of concrete.

5.3.7 Pipes

5.3.7.1 Concrete pipes

All concrete pipes:

(a) Shall conform to AS/NZS 4058.

(b) Shall have reached the equivalent of 7 days maturity before delivery to the site.

(c) Shall be free from cracks, flaws and other defects. No reinforcing shall be visible nor any rust stains.

Where concrete pipes are to be:

(d) Used for sewer applications, they shall be lined with a proprietary PE lining system or manufactured with suitable additives and sacrificial layer to achieve the durability requirements.

(e) In contact with a marine environment, either internally or externally, they shall be designed and manufactured to comply with the requirements of AS/NZS 4058 for pipe suitable for a marine environment.

5.3.7.2 Vitrified clay pipes

Vitrified clay pipes, also known as earthenware or ceramic pipes, shall be Class 4 and manufactured to AS 1741. Rubber-ring jointed pipes only shall be used.

5.3.7.3 PE100 Pipes

PE100 pipe used for gravity drainage applications shall be:

(a) Black in colour.

(b) Certified as Series 1 pipe complying with AS/NZS 4130.

(c) Permitted pipes sizes (outside diameter) are: 110, 160, 250, 315, 400, 450, 500, 560, 630, 710, 800, 900, 1000 mm.

(d) Minimum wall thickness equating to a maximum standard dimension ratio (SDR) of SDR17, which may require consideration of the installation methods and any anticipated pulling forces and shall be confirmed suitable or amended to a thicker wall by the designer.

5.3.7.4 Steel Pipes

Steel pipes shall:

(a) Be polyethylene tape coated and epoxy or concrete lined. Concrete linings shall have suitable additives and sufficient thickness to provide the required durability.

(b) Be manufactured to NZS 4442, AS 1579 or BS 534. Steel pipes used for rising mains and other pressure applications shall comply with the requirements of **Section 6.2.6 Steel pipes**.

(c) Be designed to ensure suitable provisions for flexibility have been accounted for to accommodate loading from seismic events, differential settlement or thermal expansion. This may be mechanical couplings, bellows or approved proprietary flexible joints.

(d) Steel pipes shall otherwise be welded. Tied couplings/axial restraint shall be considered for all situations.

5.3.7.5 Ductile iron pipes

Ductile iron pipes shall comply with AS/NZS 2280, be a minimum PN20 and concrete or epoxy lined. Concrete linings shall have suitable additives and sufficient thickness to provide the required durability.

5.3.7.6 Fastenings and gaskets

The following applies to fastenings and gaskets:

(a) All fastenings shall be selected to be compatible with the material to be fastened and to prevent galvanic corrosion.

(b) Where fastenings such as nuts, bolts and washers are in a wet-well or in contact with sewage, 316 stainless fastenings shall be used. Anti-galling compounds shall be used on all stainless steel threads.

(c) Where fastenings are:

(i) Exposed to an above ground environment, hot dipped galvanised fixtures may be used provided they can be wrapped with the full Denso system (primer, mastic, petrolatum tape and PVC outer wrap).

(ii) Buried, they shall be either hot dip galvanised or 316 stainless steel fastenings. All buried fastenings shall be wrapped with the full Denso system (primer, mastic, petrolatum tape and PVC outer wrap).

(d) All flanges and rubber ring joints shall use ethylene-propylene diene monomer (EPDM) gaskets. Nitrile (NBR) shall be used where long-term exposure to hydrocarbons is anticipated.

5.3.7.7 PVC-U Pipes

The following applies to PVC-U pipes:

(a) PVC-U pipes for non-pressure applications shall conform to AS/NZS 1260.

(b) Only plain walled pipes will be accepted.

(i) Solid walled sandwich construction pipes will be accepted where there is no difference in density between sandwich layers.

(ii) Foam sandwich pipes will not be accepted.

(c) Only rubber ring joints shall be used with PVC-U pipes.

(i) Solvent jointed pipes shall not be considered for public assets.

(ii) Rubber rings shall comply with AS 1646.

(iii) NBR rings shall be used where long-term exposure to hydrocarbons is anticipated.

(d) Spigots and sockets of pipes shall be thoroughly cleaned immediately before jointing, and rubber rings shall be free from dust, dirt or grease.

(e) Witness marks shall be marked and used as per the manufacturer's recommendations.

(f) The rubber rings shall be mounted inside the socket and lubricated using a suitable lubricant (Medlube or other proprietary AS/NZS 4020 certified product).

(g) The pipe shall be lined up and supported so as to be concentric with the pipes already laid in the same line. Pressure shall be applied to the socket end of the pipe. The spigot end shall be pushed into the preceding socket until the witness mark is just visible. The pipe shall NOT be pushed hard up against the back of the socket.

5.3.8 Manhole covers

The following applies to manhole covers:

(a) Manhole covers shall be circular and of an approved type and shall be made from ductile iron. Cast iron lids may be used by special permission.

(b) Only approved manhole covers shall be used on public drains.

(c) All covers shall comply with a minimum load rating to AS 3996 Class D. Higher loadings may be required depending on the anticipated application (e.g., airports or loading yards).

(d) General cover specifications are as follows:

(i) Sewer covers are to have two closed keyways (or one if hinged).

(ii) Stormwater covers are to have two open keyways (or one if hinged).

(iii) All covers shall fit the proprietary frame in any position without rocking. If necessary, the seating surfaces shall be machined.

(iv) The top surface of the frame and cover shall be flush.

(v) The frame and cover shall allow a 600 mm diameter minimum clear opening.

(vi) The cover shall be marked with the manufacturers name and year of manufacture.

(e) Particular attention is drawn to the need to ensure that the covers shall not rock and that the gap between the manhole cover and the frame does not exceed 2 mm at any point.

5.3.8.1 Hinged covers

Hinged covers shall be:

(a) Designed such that they can be installed with or without a captive hinge.

(b) Designed such that they can open under surcharge between zero and 90 degrees without the hinge disengaging from the frame.

(c) Able to “lock” into position once opened, to avoid accidental closure due to wind or impact.

(d) Able to “unlock” from the upright position by manual means and without special equipment.

(e) Able to be easily removed from the installed frame without special tools or excavation (unless it has a captive hinge for a specific reason).

(f) Installed on existing manholes during renewals, upgrades or where new pipe connections are added, and as outlined in **Section 5.6.11.1 Hinged manhole covers.**

5.3.9 Maintenance shaft covers

Maintenance shaft, or cleaning eye/lamp hole, covers shall be:

(a) Grey cast iron or ductile iron and of a design approved in writing by Wellington Water.

(b) Designed to comply with a minimum load rating to AS 3996 Class D. Higher loadings may be required depending on the anticipated application (e.g., airports or loading yards).

5.4 Jointing and laying of pipes

5.4.1 General

The following applies to jointing and laying of drainage pipes:

(a) New pipes shall be connected to existing pipes, whether mains or private laterals as set out in this section.

(b) Where a new pipe is joined onto an existing rigid pipe, then:

  (i) Only the minimum length of bedding shall be removed from beneath the existing pipe.

  (ii) Where more than two pipe diameters of bedding is removed from beneath existing pipe, then the bedding shall be replaced with concrete to prevent the existing pipe end from shearing off at or near the joint. This is because it is not possible to adequately support this section of pipe by ramming bedding material under the pipe, and as such, "concrete bedding" is used to support the pipe end.

(c) When connecting a new rigid pipe or PVC-U pipe to an existing pipe:

  (i) The first preference always shall be for a rubber ring joint. New drains, including repairs consisting of more than one pipe, shall be joined using the manufacturers supplied joint. Rubber sleeve jointed earthenware drains and rubber sleeves with stainless steel wires are not permitted.

(d) When normal rubber ring joints cannot be used, a Fernco connector, Fernco sleeve with stainless steel band clips, or a Naylor Band Seal Coupler, shall be used or a similar flexible connector or coupler approved in writing by Wellington Water. The connector or coupler DN end sizes shall match within 5 mm of the OD of the actual pipe end making the respective joint.

5.4.1.1 Joints in a liquefiable/sand environment

Where a rubber-ring/sleeved or flush joint is made in ground that is comprised of silt/sand or areas with a potential for liquefaction, the pipe joint shall be wrapped in filter-fabric that extends beyond the joint by a minimum of 450 mm in order to prevent the ingress of silt or sand in the event of a joint separation.

5.4.2 Changes in grade or direction

Changes in grade or direction between manholes shall be made using factory made bends. In exceptional circumstances, such as large diameter drains, the fabrication of epoxy jointed bends may be permitted for concrete pipes.

5.4.3 Repairs

Generally, repairs to pipes are carried out with the same material as the parent pipe.

5.4.4 Flush jointed concrete pipes

Flush jointed concrete pipes shall not normally be used, unless specifically approved by Wellington Water for exceptional circumstances. They shall be sealed with an approved sealant and epoxy. The sealant shall be guaranteed to give a watertight seal for 50 years.

5.4.5 Polyethylene pipe joints

Polyethylene pipes shall be joined using butt fusion or electrofusion welded methods. Butt fusion shall be used for directional drilling, pipe-bursting or slip-lining activities.

Jointing new PE to existing PE shall be as set out in **Section 4.19 Polyethylene welding**.

5.4.5.1 Butt fusion jointing

See **Section 4.19.1 Butt fusion welding**.

5.4.5.2 Electrofusion jointing

See **Section 4.19.2 Electrofusion welding**.

5.4.6 Cathodic protection

See **Section 6.3.9 Cathodic protection**.

5.5 Water stops

The following applies to water stops (refer to **Standard Detail DR03 – Typical Trench and Waterstop Details**):

(a) Water stops shall be constructed from 17 MPa concrete 150 mm thick, set a minimum of 150 mm into the sides and floor of the trench and shall extend 300 mm above the top of the pipe.

(b) Where concrete or earthenware pipes are used, the water stop shall be constructed immediately downhill of the collar of the pipe.

(c) If the drain is laid on metal (gravel) bedding and either subject to traffic loading or laid with more than 1.5 m of cover, then that portion of the pipe not encased by the water stop shall be supported on a concrete cradle along the full length of the pipe. This is to ensure the pipe is uniformly supported where subject to significant loading and the pipe is not subject to differential shear at the metal/concrete interface. The concrete bedding shall stop at the next pipe joint.

(d) Where PE pipes are used, then where the pipe passes through the water stop, it should be wrapped in an elastic material (e.g., a rubber sleeve secured with wire ties) to enable the pipe to deform inside the water stop.

5.6 Manholes

5.6.1 Manhole design

The following applies to manhole design (refer to **Standard Detail DR01 – Manhole Details**):

(a) Manholes shall be designed to withstand HN-HO-72 loadings as a minimum, or greater in areas where additional loading is anticipated, such as airports or loading yards. See **Section 5.6.10 Manhole lid construction** for loading requirements for manhole lids.

(b) Risers shall typically be precast reinforced concrete units complying with AS/NZS 4058 as a minimum for manufacturing. The manufacturer is to certify the riser design is suitable for the design loading.

(c) Specific internal linings may be specified depending on the potential effluent being transported, for example, sludge or centrate pipelines and manholes may require additional protection against corrosive gases and fluids.

5.6.1.1 Manhole design against liquefaction

Where new manholes are to be installed in areas identified with potential liquefaction, the following mitigations shall be employed:

(a) Manhole risers, lids and bases shall be fastened together using proprietary riser section joiners.

(b) Flanged precast concrete manhole bases shall be used.

(c) The manhole excavation shall be lined with filter fabric prior to the manhole base being placed. The filter fabric shall encase the manhole *and* the backfill of the excavation.

(d) The backfill shall be a compacted, non-cohesive, gap graded material (i.e., AP40 or similar).

5.6.2 Manhole construction

The following applies to manhole construction:

(a) The diameter of cast-in-situ bases of precast manholes shall be at least 300 mm plus the outside diameter of the manhole and shall be at least 150 mm thick.

(b) Manholes with a precast base shall be placed on a wet concrete bed or on 150 mm of bedding material.

(c) Precast manhole bases shall be used for all manholes constructed below the water-table or sea level.

(d) Manholes shall have the minimum practical number of risers. For the majority of manholes, only one riser will be necessary.

   (i) If more than one riser is used, a layer of mortar or an appropriate epoxy shall be placed on the joint before positioning the next riser, or

   (ii) Proprietary rubber rings or butyl mastic strips shall also be used to seal between riser sections. Rubber rings shall be appropriately lubed and set before jointing.

   (iii) Similarly, a layer of mortar shall be placed on the top of the top riser before placing the manhole roof.

   (iv) Epoxy ***shall not*** be used between the lid and the riser in case the lid needs to be removed in the future.

(e) For sewer manholes, all joints, except that between the top riser and the lid, shall be internally sealed with mortar, epoxy, butyl mastic strips or proprietary rubber rings. Joints between risers shall also be externally sealed with epoxy or other approved sealant. This external sealing is in addition to the internal sealing between risers.

(f) Where the manhole riser is the same diameter as, or smaller than the pipe diameter, then:

   (i) **Either** the manhole shall be formed by pouring concrete around the pipe up to near the top of the pipe and sitting the riser on the concrete haunch so formed. The riser shall be supported by the concrete haunch and not by the pipe. The opening into the drain shall be formed by cutting the top of the drain off and the size of the opening shall approximate the diameter of the riser.

   (ii) **Or** a precast manhole tee shall be used. Tee manholes in road reserve or any other location likely to receive traffic loading shall be designed and installed to take full HN-HO-72 loading or greater if additional loading is anticipated. A copy of the manufacturer's installation specification shall be given to Wellington Water. Alternatively, the lid can be isolated from the riser such that traffic loading is not transferred to the pipe. This may entail using an oversized lid supported by a ring-beam that is not structurally connected to the riser.

5.6.3 Manhole rungs

The following applies to manhole rungs:

(a) Rungs shall be installed in all manholes deeper than 1 m unless there is a specific dispensation approved by Wellington Water.

(b) Rungs shall be a "drop step" type and shall be constructed from 15 mm (minimum) 316 or 316L grade stainless steel.

(c) A 304 or 304L grade stainless steel may be used in stormwater environments. They shall have stainless steel nuts and washers and a rubber washer at the back of the manhole as a water seal.

(d) For drainage manholes, the alignment of the rungs shall be parallel to the flow as much as possible so as not to interfere with rodding activities.

(e) The manhole lid shall be oriented such that the entry hole is above the rungs.

(f) The first manhole rung shall be between 500 mm and 675 mm below the finished ground level.

5.6.4 Manhole safety grilles

Manhole safety grilles shall meet the following requirements:

(a) Manhole safety grilles shall comply with AS3996 Class A.

(b) Grilles shall be constructed from stainless steel 316L grade or an approved alternative material with adequate strength and corrosion properties.

(c) The maximum opening size of any section of the grille fit and surface shall not be able to pass a sphere larger than 150mm diameter. All products shall be marked in accordance with the conformity assessment body's (e.g., AS/NZS) requirements.

(d) Manhole safety grilles product certification (ISO Type 5) to AS3996 Class A. This certification shall include the fit to the access lid frame design meeting the specified load requirements.

5.6.5 Connections to manholes

The following applies to manhole connections:

(a) On all earthenware and concrete pipes entering (and leaving) a manhole, a flexible joint shall be provided within 2.5 times the outside diameter of the pipe or 700 mm of the outside edge of the manhole base, whichever is the lesser.

(b) PVC-U and PE pipes shall not be fixed to manholes until the temperature of the main has returned to ambient ground temperature.

(c) PVC-U pipes entering and leaving a manhole shall be fixed to manholes using factory made fittings.

(d) PE pipes shall be fixed to manholes either by the use of a puddle flange or by strips welded onto the pipe.

(i) Only the outlet pipe is to be flanged to the manhole.

(ii) The inside face of this flange shall be flush with the inside of the manhole wall.

(iii) Inlet pipes shall extend no less than 60 mm and no more than 100 mm into the manhole and butt against the benching/tiling.

(iv) The inlet pipes shall be sealed against the manhole wall, but not anchored.

(e) All sewer leads shall enter through the benching.

(f) Sump leads and normally dry stormwater leads may enter the manhole over the benching.

5.6.6 Expansion joints on PE pipes at manholes

The following applies to expansion joints on PE pipes at manholes:

(a) Normally the connection of PE to a manhole is 'fixed' into the manhole wall by use of a stub-flange anchoring the pipe into the manhole wall with epoxy-mortar and/or concrete.

(b) Where the incoming sewage is likely to have wide temperature fluctuations (e.g. due to significant volumes of process hot water), then suitable double rubber seal expansion joints fixed into the manhole wall may be necessary to accommodate the calculated longitudinal expansion and contraction of the PE pipe.

(c) Usually, an expansion joint is necessary at each end of the pipe, with an anchored sleeve at the centre of the pipe length to ensure ½ of the total movement takes place at each joint.

(d) The positioning of the pipe end within the expansion joint at construction shall be set according to the pipe ambient temperature, in relation to the expected temperature related movement.

(e) Specific design is required, as pipe movement is significantly reduced with increasing pipe depths.

(f) Laterals shall be connected at the manhole, or at the anchor sleeve.

5.6.7 Benching of manholes

The following applies to the benching of manholes:

(a) Manholes shall have a formed invert from inlet to outlet.

(b) Earthenware tiles and half pipes shall be used on all sewer pipes.

(c) Stormwater pipes may have benching formed from concrete half-pipes, or from in-situ placed concrete with a minimum 25 MPa strength trowelled to produce a smooth finish.

(d) Above the tile level, the channel shall have vertical 25 MPa concrete walls formed to the level of the outlet pipe soffit to form a full pipe depth channel through the manhole.

(e) The tiles etc used to form the invert shall be cut neatly as appropriate to form an invert with minimum spacing between the tiles.

(f) The gap between the tiles shall be filled with epoxy mortar.

(g) Bends must be sufficiently gentle for the flow not to leave the channel and deposit debris on the benching. As a guide, 45-degree springs or less would normally be required.

(h) Manholes shall be constructed to allow all drains entering (and leaving) the manhole to be inspected by a closed-circuit television (CCTV) camera. The size of the camera shall be taken as 470 long x 130 wide x 85 high (with 130mm being the width to the outside of the wheels).

5.6.8 Manholes on large pipelines

Where a manhole is required on a large pipeline, and where the manhole riser diameter is required to be smaller than the pipe it is connected to (an off-take riser), the installation shall be as follows:

(a) The manhole lid shall be isolated from the riser such that the traffic load is not transferred through riser to the connection with the pipe. This can be achieved by using an oversized lid which is resting on a suitably designed ring-beam surrounding, but not connected to the off-take riser.

(b) The top of the off-take riser shall be 150 mm below the underside of the lid.

(c) The gap between the off-take riser and the ring-beam shall be sealed with Sikaflex or similarly flexible sealant approved in writing by Wellington Water, at the top of the off-take riser.

5.6.9 Drops at manholes

External drop structures are not permitted within either the stormwater or wastewater network.

5.6.9.1 Haunched internal drop structures

The following applies to the construction of haunched internal drops:

(a) Normally dry stormwater drains DN 300 or smaller (e.g., sump leads) may enter on top of the benching, and do not require a haunched drop.

(b) A haunched internal drop in a manhole shall not exceed 500 mm from the inlet invert, to the receiving invert. Drops up to this height are to be benched in the manhole.

(c) Drops greater than 500 mm in wastewater manholes may be achieved through using an internal drop structure as described in **Section 5.6.9.2 Internal drop structures**.

(d) Haunched internal drops will not be permitted on sewer pipes greater than DN 225 (nominal bore) or DN 300 on stormwater pipes.

5.6.9.2 Internal drop structures

Internal drop structures (see **Standard Detail DR02 – Internal Drop Details)**:

(a) Will not normally be considered for stormwater applications but are acceptable within wastewater systems.

(b) Will not be permitted to be installed in an existing manhole, as there will be inadequate room in the manhole for the drop whilst retaining working room.

(c) Shall be avoided, where possible, by laying the approaching drain at a shallow grade, then descending to the manhole invert through a steep section of pipe at the final approach. A manhole is required at either end of the steep approaching inlet drain.

(d) Are required on wastewater systems where the approaching inlet grade is greater than 45 degrees. Internal drop pipework shall be designed to be clear of the design flow and the discharge shall be to a haunched channel. Internal drop pipes shall not be larger than 225 mm diameter (nominal bore). The minimum size for a manhole with an internal drop structure is the nominal manhole diameter plus the drop pipe outside diameter.

(e) Shall be fabricated from PVC-U, ABS or stainless-steel pipe.

(f) Shall ensure all discharge from the incoming pipe is collected by the drop structure and conveyed to the manhole floor without surcharge or “over-splashing”.

(g) Shall be securely fastened to the wall with stainless steel fasteners.

(h) Shall allow unobstructed access to the inlet of the incoming pipeline for the purposes of rodding and inspection.

(i) Shall permit unobstructed access to the drop structure pipe, through the top, for rodding and inspection.

5.6.10 Manhole lid construction

The following applies to manhole lids:

(a) Manholes in road reserves shall be designed to withstand HN-HO-72 loadings as a minimum.

(b) Manholes in areas where vehicles cannot access, such as hill sections, back sections or pedestrian access ways, may use lighter duty lids which shall have a minimum thickness of 150 mm for manholes up to and including 900 mm nominal internal diameter or 200 mm thick for manholes with a nominal diameter 1050 mm and larger.

(c) Manholes shall have the nominal 600 mm diameter or 1200 mm x 600 mm (for water supply) opening to the side which shall be placed above the manhole rungs. Rungs shall be aligned perpendicular to the main flow. The closest edge of the opening shall typically be between 100 mm and 200 mm from the inside wall of the manhole riser, or with up to 300 mm with written approval from Wellington Water.

(d) The finished ground level shall be a minimum of 150 mm above the top of the manhole lid, and no more than 300 mm. Where a distance of 300 mm is likely to be exceeded, a new manhole riser section shall be used to raise the lid to within acceptable tolerances.

5.6.10.1 Adjustment rings

Adjustment rings shall:

(a) Be manufactured from 40 MPa concrete.

(b) Have minimum cover to reinforcement of 50 mm from the inside face and 40mm from the outside face.

(c) Be internally reinforced with a minimum of D12 reinforcement with the entire ring being suitable for HN-HO-72 loading when installed as designed. This will typically result in a ring with a top-face width of around 105 mm.

(d) Sit on a bed of mortar between the lid and the adjustment ring to ensure a non-rocking interface with the lid.

  (i) Epoxy mortar is NOT to be used for this purpose to enable future removal of the ring if required.

  (ii) Butyl mastic strips or sealants shall be used where the manhole is in the berm and surface water ingress is expected.

5.6.10.2 Raising a manhole

Where a manhole frame and cover are to be raised, but the lid or slab remain at the same level, then the following approach shall be followed:

(a) Packing may be placed between the manhole slab/lid and frame, but this additional packing shall not exceed 100 mm.

(b) The packing shall be precast concrete adjustment rings. Bricks shall not be used for this purpose. Mortar may only be used to bed the adjustment ring and frame.

(c) The total packing (sum of packing between the frame and lid/slab) shall not exceed 300 mm. Where the required packing would exceed this amount, the manhole lid (or alternatively the manhole slab in recent WCC manholes) shall be raised instead by building up the supporting walls.

(d) Manhole walls shall be raised using the same construction technique as the existing walls. Precast manholes shall be raised using the minimum possible number of precast risers. Brick manholes shall be raised using a double row of bricks.

(e) In WCC, where a slab of an existing manhole (for drainage) needs to be raised, this shall be achieved using bricks, concrete paving stones or concrete adjustment blocks. The slab shall be raised no greater than 300 mm above the lid. Mortar shall be used to bed and seal the bricks, stones or blocks.

5.6.11 Manhole frame and covers

The following applies to manhole frames and covers:

(a) Only approved manhole covers shall be used on public drains.

(b) All covers shall comply with a minimum load rating to AS 3996 Class D (see also **Section 5.3.8 Manhole covers**).

(c) Covers on wastewater manholes shall have factory fitted, water-tight gaskets to prevent against surface water ingress.

(d) The opening in the manhole lid shall be aligned above any manhole rungs which shall typically be aligned such that entry is perpendicular to the flow. The frame and cover shall be aligned over the lid's access opening.

(e) The cover shall be finished flush with final ground level and shall not rock. Particular care shall be taken in carriageways and footpaths, both public and private, to ensure that the cover is flush.

(f) Where the manhole cover is to be set at an angle, the frame level can be set using 25 mm wide timber shims or steel set screws through the frame flange. The frame shall be set in a bed of mortar in between the lid or adjustment ring. Any set screws shall be removed after setting of the frame on the mortar to ensure full load engagement between the frame and the mortar. Timber shims may remain as these will compress and transfer the load.

(g) On completion of the manhole, the keyways shall be left clean and free of any debris. There should be silicone placed in the key-way to prevent the key-way from filling with debris between construction and inspection.

(h) The frame and any adjustment rings shall be haunched with 20 MPa concrete up to 25 mm below the finished ground level. A gradually tapering rounded haunch profile is required from the manhole lid to the frame with minimum of 50 mm cover to embedded adjustment rings.

(i) A light duty frame shall only be used where there is no vehicular traffic or possibility of vehicular traffic in the future.

5.6.11.1 Hinged manhole covers

Hinged covers shall be:

(a) Installed on existing manholes during renewals, upgrades or where new pipe connections are added.

(b) Oriented such that the hinge is oriented towards oncoming traffic, where installed in the carriageway. Should the lid pop open under surcharge, the cover will present a ‘ramp’ to oncoming traffic as opposed to a raised edge.

5.6.12 Changes in grade and direction

All changes in grade and direction shall be made within the manholes unless specifically detailed on the approved plans. Changes in grade and direction outside of manhole, where permitted, shall be formed using factory formed, smooth radius bends or similar.

5.6.13 Repairs to manholes

Minor repairs to manholes may be made by sealing leaks with Sikadur/Sikaflex, or a similar product approved in writing by Wellington Water, then making a more permanent repair by chemical or cement grouting.

5.6.14 Terminal rising-main manholes

Terminal rising-main manholes shall be designed such that turbulence is minimised as the discharge transitions from pressure to gravity flow.

Manholes that receive a rising-main discharge shall be:

(a) Lined with a coating or protective layer resistant to protect the concrete from hydrogen sulphide attack (if the manhole is of concrete construction).

(b) Vented to the atmosphere. Odour treatment may be required if the manhole is located in a built-up area. Odour treatment may require the vent to be force ventilated.

(c) Designed to prevent turbulence where the rising-main discharge traverses any change in grade and where the discharge enters the main flow channel.

(d) The downstream pipeline may also need corrosion protection.

(e) The downstream capacity of the network shall also be taken into consideration during the design stage.

5.7 Field drains

The following applies to field drains:

(a) Field drains shall be constructed from standard drainage pipes slotted to admit water. The slots shall be restricted to the top half of the pipe. All conditions relating to laying of pipes would normally apply to field drains.

(b) Perforated coil drain shall be heavy walled, smooth bore polyethylene with a minimum ring stiffness of 500 N/m/m at 5% deflection and comply with AS 2439.1.

(c) Flexible field drains laid with a main to remove trench water should be laid above the main or if laid beside the main, laid sufficiently far from the main to enable both pipes to be adequately backfilled with compacted material.

(d) Field drains should preferably be connected into a street channel or manhole rather than direct into a stormwater main. Field drains connected into a stormwater manhole may join in above the benching.

5.8 Testing

The following applies to testing of drains:

(a) Testing of drains shall be by either the water test or low pressure air test as outlined in this section (based on tests prescribed in New Zealand Building Code E1/VM1).

(b) For subdivisions, the following requirements must be met:

- (i) All sewer and stormwater pipes will be tested upon completion of construction at the applicant's expense and as part of Wellington Water's approval process.
- (ii) Wellington Water's representative shall be present during the test and will sign any appropriate documentation to verify the test if successful.
- (iii) A minimum of 24 hours of notice is required to be given to the Wellington Water prior to the test being carried out.
- (iv) The developer shall provide all fittings, water and materials to carry out the test.
- (v) The developer is required to have met the following requirements prior to pipe testing and Wellington Water arriving on site:
    1. Trenched and pipes laid.
    2. Bedding and surround material, top and bottom, shall have been laid over the pipe. Minimum 100 mm top and bottom of pipe.
    3. All pipe junctions exposed, including laterals and inspection eyes.
    4. Lines flushed and all residual debris cleaned out.
    5. All fittings and connection to have been installed prior to pressure test.
    6. Lines to have been pressurised overnight to the required pressure prior to the test commencing.

(c) For renewals, all mains and branch pipelines, including connections, may be tested after backfilling.

5.8.1 Water test

The following applies to water testing of drainage pipes:

(a) The upstream end of the section under test shall have a minimum head of 1.5 m above the pipe soffit. The maximum head at the lower end of the pipeline shall be 6 m.

(b) Concrete and earthenware pipes shall be soaked for 24 hours prior to the test.

(c) Care shall be taken to ensure that all air is expelled when filling the pipe with water.

(d) For concrete and ceramic pipes, the amount of leakage shall not exceed 0.5 mL water per mm pipe diameter per m pipe length per hour measured over a minimum period of 30 minutes. This is equivalent to 2.25 litres of leakage in 30 minutes for a 30 m long 300 mm diameter pipeline.

(e) For PVC-U and PE pipes, there shall be no leakage after 5 minutes.

5.8.2 Low pressure air test

The following applies to the low-pressure air test for drainage pipes:

(a) The low-pressure air test is applicable to pipelines only and should not be used where new manholes are required to be tested also.

(b) It is recommended concrete and earthenware pipes are soaked prior to the test being completed to ensure a positive test.

(c) Air is to be introduced into the pipeline until a pressure of 3 kPa is reached (300 mm water gauge pressure).

(d) Time is to be allowed for the air temperature to become uniform and pressure to stabilise, typically at least 3 minutes.

(e) The air supply is to be disconnected and the pressure drop measured after 5 minutes.

(f) The pipeline is acceptable if the pressure drop does not exceed 0.5 kPa (50 mm water gauge pressure).

(g) The low-pressure air test is highly susceptible to temperature fluctuations. A 1° C change in temperature can result in a 30 mm change in water gauge pressure. It is recommended to soak concrete and ceramic pipes prior to low-pressure air tests.

5.8.3 Testing of concrete manholes

The following applies to concrete manhole testing:

(a) Manholes may not be required to be tested, given that the allowable leakage (1 millilitre/millimetre diameter/meter length) over the typically short depth of the manhole is optically difficult to detect.

    (i) Notwithstanding this, all manhole joints shall be sealed and any obvious sign of infiltration or exfiltration shall be remedied prior to commissioning.

5.8.4 CCTV inspection

Wellington Water shall require the drain to be inspected with a colour CCTV camera as follows:

(a) This inspection shall be additional to the water or air test.

(b) Any defects detected by the camera inspection shall be made good and the relevant section of pipeline tested again.

(c) Developers are advised to carry out their own test before backfilling the trench.

(d) Acceptance of the drain will not be given until it has passed the water or air test and any CCTV inspection required.

5.8.5 Pressure line testing

Any pipelines that are subject to pressure, such as pumped rising mains or high-pressure inverted siphons, shall be tested to the same requirements as a water supply pipeline of an equivalent material and pressure class.

5.9 Wastewater pumping stations

5.9.1 General

The following applies to wastewater pumping stations:

(a) The station site shall be on a separately titled lot on the subdivision with a sealed vehicle access to a formed road. The lot shall be vested to the council.

   (i) Architectural featuring of any visible structures shall be within the context of the proposed subdivision and shall be subject to the approval of Wellington Water.

   (ii) The minimum standard for fencing is a 1.8 m high, 50mm diamond, 2.5 wire diameter chain link fence with rails top and bottom. In residential areas, fence design shall be considered within the context of the neighbourhood and/or agreed with adjacent landowners.

(b) Wastewater pumping stations are required to:

   (i) Pump 120% of the design peak wet weather flow (PWWF) in a duty, or duty assist arrangement with at least one other pump on standby. All pumps shall be of the same make and model.

   (ii) The duty shall be interchangeable between pumps.

   (iii) Have an operating wet-well storage sized to limit the maximum number of pump starts to 12 per hour, or per the manufacturer’s recommendation, whichever is less.

(c) As the pumps will be operating at dry-weather flow conditions most of the time, the selected pump shall be suitable for operating for long durations at the dry weather duty. Efficiency can be sacrificed when the pumps are operating at their wet weather duty, although they shall still be suitable to operate at this higher duty.

(d) Wet-wells shall be vented to prevent the build-up of corrosive gases. Fan assisted activated carbon odour control shall be provided in all residential and commercial/retail areas, however consideration will be given to reducing this requirement depending on the environment and any consents required under regional plan rules for discharges to air.

(e) Chamber lids and access covers shall be capable of withstanding HN-HO-72 loadings and shall also comply with the requirements of AS 3996 Class D.

(f) For wet wells and dry wells, lids shall be constructed to provide a minimum 1200 x 600 mm clear opening to allow for access and the movement of parts and equipment.

(g) All valves shall be operable either from the surface or from within a drywell/valve chamber. Valves, including isolation valves and non-return valves but excluding foot-valves, shall not be installed in the wet-well.

(h) The internal walls, floor and ceiling of all wet-wells shall be protected from corrosion using sulphate resistant linings or construction materials. Internal walls and ceiling shall be coated with: Sikagard 62, or Mastermix Multi-cote, or an equivalent.

(i) The internal walls, floor and ceiling of all dry-wells shall be lined with a Wellington Water approved sealant to assist with cleaning and maintenance.

(j) Floors of all dry wells shall be slip resistant.

(k) Chambers shall be designed to prevent floatation (with consideration given to possible liquefaction) and chamber latches shall be designed to be impervious to inflow and infiltration.

(l) Access hatches shall be large enough to easily remove equipment and light enough to be lifted safely by one person, gas assisted hatches may be necessary at larger installations; a hinged safety grill will be installed below each access hatch, however each installation will be considered separately.

5.9.2 Equipment requirements

Wastewater pumping stations are required to:

(a) Be metered using a full bore magnetic flow meter either each pump individually or on the common discharge.

(b) Have an approved non-return valve on each discharge pipe between the discharge isolation valve and the pump.

(c) Have a resilient-seated isolation valve to isolate the pump from any common discharge.

(d) Have a resilient-seated isolation valve on the pump suction (if in a dry-well arrangement).

(e) All valves in ground and buildings, for both trunk main and reticulation mains, shall be clockwise closing. All valves shall include a tag or other means to clearly indicate closing direction.

(f) Have an approved pressure transducer on each wet-well recording the wet-well level accurate to +/- 10 mm.

(g) Have an approved pressure transducer on the discharge recording the pressure to +/- 1 kPa (100 mm H_2O).

(h) Have a dry-well sump pump that discharges back into the wet-well (if in a dry-well arrangement). The sump pump shall sit in a sump at least 300 mm deep and be controlled by floats that start prior to the water level reaching the top of the sump wall and stops when the water level recedes 50 mm above the pump volute. The sump pump should be able to handle solids up to 30 mm diameter as a minimum.

(i) Have guide-rails and a self-seating discharge bend (if in a wet-well arrangement) to ensure the pump is lowered into place without fouling or requiring manual connection.

(j) Have a 316 stainless steel chain fixed to each pump to enable the lifting and lowering of any submersible pumps into position.

(k) Have an air-release mechanism between the pump and the non-return valve to promote self-priming in the event of an air-lock (if in a dry-well arrangement). The air discharge from the valve is to be piped back into the wet-well.

(l) Have a tapping on the common discharge with a 25 mm BSP male/female stainless steel ball valve fitted with lever handle with a manual safety release.

(m) Have single bellows mechanically isolating the pump from the suction and discharge pipe. Tie rods are not to be used with the bellows (dry-well installations).

(n) Have a metered water supply with reduced pressure zone (RPZ) backflow preventer installed to allow for wash-down and connection of the wet well and storage tank washer systems. The supply shall be fitted with a tap connection with 20 mm BSP (minimum) thread to allow fitting of a hose. The water service connection shall be minimum DN32 terminating in a stainless steel lockable cabinet adjacent to the wet well.

5.9.3 Pipework

The following applies to wastewater pumping station pipework:

(a) Pipework shall be ductile iron manufactured to AS/NZS 2280 and fusion epoxy bonded coated to AS/NZS 4158.

(b) Pipework shall have a minimum pressure rating of PN16 unless the design working pressure requires a higher pressure class.

(c) Flanged or spigoted bends, tees and “specials” fabricated from STCL may be permitted where ductile iron fittings are not practicable. These shall be manufactured to the requirements of NZS 4442 with the external surface either polyethylene tape wrapped or epoxy coated to AS/NZS 3862. An epoxy coating is to be applied over the internal concrete lining.

(d) Special abrasion resistant linings may need to be considered where pipework has a history of high grit and flow velocities. A specialist abrasion resistant coating maybe required where velocities exceed 4 m/s.

(e) ABS pipework may be used provided the pipe is suitably isolated from vibration. Stub flanges shall be used with backing rings; plastic flanges will not be permitted under any circumstances. All fitting in ABS are to be fabricated by the supplier.

(f) Flanges shall comply with the following:

  (i) Ductile iron flanges shall comply with the latest revision of AS/NZS 4087 Figure B5.

  (ii) Carbon steel flanges shall comply with the latest revision of AS/NZS 4087 Figure B7.

  (iii) No other flange materials shall be permissible.

(g) The inlet pipe from the network to the wet-well shall enter the wet-well above the all-pumps-start level such that the inlet flow is not affected by backflow from the station wet-well under normal PWWF operating conditions.

All pipework:

(h) Crossing a soil-structure interface shall be designed to withstand differential movement due to settlement or seismic movement.

(i) Shall be supported and designed to withstand seismic forces as per NZS 4219.

(j) In the wet-well shall be welded or flanged 316/316L stainless steel or ABS.

(k) Shall be arranged such that the rising main can drain directly into the wet-well.

5.9.4 Pumps

Pumps shall be:

(a) Of a non-clogging type with a minimum through-let of 75 mm where practicable. Hardened impellors shall be specified when ordering.

(b) Rated capable of a minimum 8 starts per hour when started direct online.

(c) Operated using a variable speed drive if rated 5 kW or greater.

(d) Be selected to have its duty point within ±10% of the best efficiency point (BEP) unless otherwise approved by Wellington Water.

(e) The minimum pump efficiency at the duty point shall not be less than 50%. Lower efficiencies may be approved in cases where:

(i) the pumps are very small, or

(ii) the pump curve is very flat thus resulting in low energy use, or

(iii) meeting this specification would result in excessive clogging.

5.9.5 Dry-well installations

The following applies to dry-well installations:

(a) Concrete plinths shall be used for dry-well plinths.

(b) Steel pump supports may be considered with ductile iron and/or steel suction and discharge pipework, which are less susceptible to vibration.

(c) Steel plinths will not be considered where ABS pipe is used.

(d) Forced positive ventilation to the dry-well should be used, with a fan blowing air in at the top and expelled from the pipe within 900 mm of the dry-well floor.

(i) The number of air-changes shall comply with the NZBC for an occupied space.

(ii) Prior to entry into the dry-well, operators are to have a clear line-of-site to the operating status of the ventilation system to confirm it is operational. This may require the installation of an additional alert system at the entry point.

(iii) Both the inlet pipe and the outlet ventilation pipes shall be to an external space with good natural ventilation and with both the inlet and outlet suitably separated to avoid mixing of the exhaust and incoming air.

(e) Dry-well hatches for below ground dry-wells shall be sealed against water ingress. They shall have a minimum load rating of AS 3996 Class D. Access openings shall be fitted with a protective screen which will prevent accidental falls into the dry-well when the hatch is open.

(f) The dry-well is to include a gantry system (or similar) which will enable pumps to be lifted to a lay down area. There shall be provision for suitably sized lay down area as well as a mechanical system in place to lift pumps from the lay down area to outside the dry-well.

(g) For each pump the minimum working room around the pumps shall be 600 mm

(h) The minimum working room in front of the control switchboard shall be 1200 mm.

(i) Flow meters and the control switchboard are to be housed within the dry-well unless dispensation is granted by Wellington Water.

(j) Bellows shall be installed on the delivery side and considered on the suction side of the pump, unless agreed otherwise with Wellington Water, to manage vibration and noise through the pipework.

(k) Dry-well installations shall have smoke detectors and emergency lighting connected to SCADA for alarming.

5.9.6 Electrical specification

The electrical design shall take into account the following:

(a) The electrical and SCADA specification and standard design shall be obtained from Wellington Water prior to design.

(b) The control switchboard shall be provided with a plug and wiring capable of allowing an emergency generator of a suitable size to power the station to start and maintain the station's design duty point at design peak wet-weather flow.

(c) The form of connection (plug or tails) must be approved by Wellington Water.

5.9.7 Private wastewater pumping stations

In addition to the above specification, the following shall be applied to private wastewater pumping stations that are not associated with a smart pressure sewer system:

(a) Pumps shall have an open multi-channelled impellor with a macerator/grinder on the intake (allowing maximum 8 mm free passing). Pumps shall also have thermal overload protection and a liquid temperature rating of 40°C.

(b) Materials and design shall have minimum 50 years durability.

(c) The rising main shall be a minimum of 63 mm OD high performance polyethylene (PE100) standard dimension ratio 11 (SDR11).

(d) 90-degree bends are not permitted on pipes less than 90mm OD. The preference is to use a long radius or swept bend constructed from a section of pipe. Two 45-degree bends may be used where required.

(e) All controls, electrical equipment and cables are to be provided with suitable weatherproof enclosures and sited above 1% AEP flood level.

(f) The station shall be fitted with an audible and visual alarm system indicating pump failure and overflow.

(g) Additional emergency storage or an emergency disposal field may be required depending on the surrounding environs and scope of the development.

(h) For pumping stations associated with smart pressure sewer systems, please contact Wellington Water for the latest guidance.

5.10 Stormwater pumping stations

5.10.1 General

The following applies to stormwater pumping stations:

(a) Wet-well pumping arrangements are generally acceptable and considered practicable for large installations.

(b) Submersible pumps shall be installed on guides (centrifugal pumps) or in casings (axial flow pumps) and shall be provided with a means to remove them without draining of the wet-well or taking the station out of operation.

(c) Electrical equipment shall be housed in a cabinet or structure that can be suitably accessed during wet-weather without compromising operator safety or safe operation of the station.

(d) Stormwater pumping stations are required to:

(i) Pump the design flow in a duty, or duty-assist (or multiple assist) arrangement with one pump on standby.

(ii) Have an operating regime and system that limits the number of pump starts to 8 per hour.

(e) A metered water supply and tap outlet shall be provided to the immediate vicinity of the station and fitted with and approved RPZ backflow preventer.

(f) The station site shall be on a separately titled lot on the subdivision with a sealed vehicle access to a formed road. The lot shall be vested to the council.

(g) If required by council or Wellington Water, the site shall be secured to prevent public access as outlined by Wellington Water.

(i) Architectural featuring of any visible structures shall be within the context of the proposed subdivision and shall be subject to the approval of Wellington Water.

(ii) The minimum standard for fencing is a 1.8 m high, 50 mm diamond, 2.5 mm wire diameter chain link fence with rails top and bottom. In residential areas, fence design shall be considered within the context of the neighbourhood and/or agreed with adjacent landowners.

(h) Chamber lids shall provide access openings centrally over each pump and shall be designed to withstand HN-HO-72 loadings and rated to a minimum of AS 3996 Class D.

(i) Access openings shall be provided with protective screens to prevent people from falling into the chamber while maintenance is being carried out.

(j) The wet well shall be designed such that the wet well can be isolated from the reticulation and drained without compromising minor stormwater flows. Isolation can be via a penstock gate or stop-logs specifically stored on-site.

5.10.2 Equipment requirements

Stormwater pumping stations are required to:

(a) Have an appropriate means to stop recirculation of pumped water either by non-return gate or motorised penstock.

(b) Have an isolation valve to enable the isolation and inspection/removal or any pump.

(c) Have an approved pressure transducer/probe on the suction side of the pumps to record levels/pressure to +/- 10 mm H_2O (0.1kPa).

(d) Have an approved pressure transducer/probe on the discharge side of the station recording the pressure to +/- 10 mm H_2O (0.1kPa).

(e) Have bar screens or similar to prevent rubbish entering the pump volute. A means of accessing and cleaning the screens shall be included in the design.

5.10.3 Pumps

The following applies to stormwater pumps:

(a) All pumps in a station shall be of the same make and model.

(b) Pumps shall be submersible pumps with a non-clogging hardened impellor.

(c) Pumps shall be rated capable of a minimum 8 starts per hour when started direct online.

(d) Valves shall isolate all pumps and incorporate an easily dismantled pipe joint near the pump, which enables easy removal of the pump.

(e) Each duty pump shall be capable of passing all required flows up to and including the design flow without exceeding the restriction on the number of starts.

(f) Where practical, the pumps shall be installed in a duty-standby arrangement with each pump capable of accommodating the full flow. The duty shall be interchangeable between pumps.

(g) Where multiple pumps are used, only one pump is required to be on standby while the others are on duty or assist; for example, in a three-pump arrangement, the full design flow can be carried by only two pumps with one pump on standby.

5.10.4 Pipework

The following applies to stormwater pumping station pipework:

(a) Pipework shall be ductile iron manufactured to AS/NZS 2280 and fusion epoxy bonded coated to AS/NZS 4158.

(b) Pipework shall have a minimum pressure rating of PN16 unless the design working pressure requires a higher-pressure class.

(c) STCL shall also be permitted manufactured to NZS 4442 and either polyethylene tape wrapped and concrete lined at the fabricators, or epoxy coated to AS/NZS 3862. AWWA M11[9] may also be used for the design of steel pipes.

(d) Suitably rated concrete pressure pipes may also be used for low pressure scenarios (less than 10 metres pressure).

[9] *M11 Steel pipe: A guide for design and installation.* American Water Works Association

(e) Special abrasion resistant linings may need to be considered where pipework is expected to have high flow velocities. A specialist abrasion resistant coating maybe required where velocities exceed 4 m/s.

(f) Flanges shall comply with the following:

  (i) Ductile iron flanges shall comply with the latest revision of AS/NZS 4087 Figure B5.

  (ii) Carbon steel flanges shall comply with the latest revision of AS/NZS 4087 Figure B7.

  (iii) No other flange materials shall be permissible.

(g) All pipework shall be supported and designed to withstand seismic forces as per NZS 4219.

5.10.5 Dry-well installations

See **Section 5.9.5 Dry-well installations**.

5.10.6 Electrical specification

The electrical design shall take into account the following:

(a) The electrical and SCADA specification and standard design shall be obtained from Wellington Water prior to design.

(b) Pumps over 2 kW shall employ a minimum of a soft starter on each pump capable of handling 8 starts per hour. Variable speed drives are permitted.

(c) The control switchboard shall be provided with a plug and wiring capable of allowing an emergency generator of a suitable size to power the station to start and maintain the maximum design flow rate.

(d) The form of connection (plug or tails) must be approved by Wellington Water.

6 WATER SUPPLY SPECIFICATIONS

6.1 Hygienic practices and immunisations

Any person, plant or material on a work site will be required to leave the site until hygiene and immunisation requirements of this specification are met.

A high standard of hygiene is to be maintained by all personnel working on the water supply reticulation.

Refer to **Section 4.1.1 Immunisations** for relevant information on immunisations and vaccinations.

6.1.1 Cleanliness

(a) Measures must be taken to ensure all pipes are clean and to prevent material getting inside the pipe during laying operations.

(b) Pipes must be inspected immediately prior to laying to ensure cleanliness.

(c) Outside working hours, the end of the pipe must be kept tightly sealed to prevent ingress by water or trench materials.

(d) Particular care must be taken where the pipe end could be affected by stormwater flows or groundwater levels under all conditions.

(e) An antibacterial lubricant suitable for use with potable water must be used on all gaskets and rubber rings coming into contact with potable water (see **Section 6.2.1.1 Suitability for contact with drinking water**).

6.1.2 Equipment

The following applies to the hygienic use of equipment:

(a) All items to be used on the water supply reticulation are required to be disinfected with 100 mg/L chlorine solution and hygienically maintained for work on the water supply reticulation.

(b) Any tools or clothing used on any work in or on any river, drain, sewer or other non-potable water work shall not be used on water supply work without first being disinfected. This shall also apply to excavator buckets.

(c) Any vehicle used in water supply work as a service vehicle for making inspections, attending leaks and other call-outs, or making connections, and equipped for the purpose of being a water service vehicle or carrying a permanent stock of spare fittings, should not be used on any non-potable water work:

  (i) If used on non-potable water work, the vehicle must be fully decontaminated in a manner approved by Wellington Water prior to returning to water supply work.

  (ii) The contractor shall provide a Certificate of Decontamination declaring what measures were taken.

  (iii) The contractor shall impose identical conditions to the above on any subcontractor they employ in the course of the Contract.

6.2 Materials

6.2.1 Materials compliance

The following applies to materials compliance for water supply:

(a) All materials shall conform to the standard specified. Compliance with the required standards shall be demonstrated by third party certification.

(b) All materials shall, at Wellington Water's discretion, be subject to test under the appropriate standard. Materials shall also be subject to Wellington Water's approval even though they conform to the appropriate standard specification.

(c) Current approved materials are listed in the Approved Products Register published on Wellington Water's website. Approvals are subject to change. Care shall be taken that designers and specifiers are using the most current version.

(d) Materials that do not comply with the prescribed standards and/or specifications listed shall only be used with the written permission of Wellington Water.

6.2.1.1 Suitability for contact with drinking water

Products and materials must comply with the following:

(a) Products, and their components, must be third party certified to AS/NZS 4020 to be considered for use in the public network.

(b) Wellington Water may consider products that are certified compliant with BS 6920 by a third party, or are registered as approved by the:

  (i) Drinking Water Inspectorate (DWI)

  (ii) Water Regulation Advisory Scheme (WRAS) or

  (iii) American National Standards Institute/National Sanitation Foundation standard ANSI/NSF 61.

(c) Compliance with the organisations listed in **Section 6.2.1.1**(b) **Suitability for contact with drinking water** does not necessarily mean it is compliant with AS/NZS 4020. ANSI/NSF 61 does not consider taste and odour effects or the potential for materials to promote the growth of microorganisms. BS 6920, which WRAS base their approvals on, does not test for leaching of mutagenic compounds or include testing for metallic products. DWI is the preferred alternative certification to AS/NZS 4020, as this uses BS 6920 test, plus a suite of other tests to ensure products are suitable for use in a public waters supply network.

(d) When assembling rubber ring joints, a water-based lubricant specifically made for this purpose, which is certified to AS/NZS 4020, shall be used in accordance with the manufacturer's instructions. The joint lubricant shall incorporate a bactericide.

6.2.1.2 Existing non-compliant pipes

If, during the course of construction work, a non-compliant pipe material is identified, Wellington Water, or their contracted representative, shall be contacted to gain approval for its renewal. This will include existing copper, PE80b, PE80c, alkathene, PVC and galvanised iron service pipes.

6.2.2 Concrete

See:

- **Section 5.3.1 Cement**
- **Section 5.3.3 Reinforcing steel**
- **Section 5.3.5 Non-structural concrete**
- **Section 5.3.6 Structural concrete**

6.2.3 PVC pipes

The only PVC variant pipes that are permitted for use in the network are PVC-U and modified polyvinyl chloride (PVC-M).

PVC pipes shall not be used in the following conditions:

(a) Where the pipeline is a pumped rising main.

(b) Where the pipeline is an above ground pipeline.

(c) Where lateral spreading is expected to occur.

(d) Where slope stability issues are expected to occur.

(e) Where ground liquefaction is expected to occur.

(f) Where the ground is contaminated by aromatic industrial solvents.

PVC-U and PVC-M pipes shall comply with the following:

(g) Pipes shall be jointed using EPDM elastomeric sealing rings in a socket spigot push fit arrangement.

(h) Jointing lubricant that complies with AS/NZS 4020 and comprising water based emulsions and a bactericide shall be used on all joints.

(i) Bends and tees used with PVC pipe shall be ductile iron and comply with AS/NZS 2280 or ISO 2531.

(j) Series 1 pipe shall be specified for all new subdivision and renewal projects.

(k) Series 2 pipe of a similar class as existing may be specified for repairs of an existing Series 2 compatible pipeline.

(l) Pipes shall be, as a minimum, rated to an operating pressure of 12 bar (PN12) although the pipe rating shall be designed and specified as per the method outlined in the Regional Standard for Water Services.

6.2.3.1 PVC-U pipes

PVC-U pipes shall comply with AS/NZS 1477.

6.2.3.2 PVC-M pipes

The following applies to PVC-M pipes:

(a) PVC-M pipes shall comply with AS/NZS 4765.

(b) PVC-M pipes shall not be used in areas contaminated with, or may potentially be contaminated with, chemicals, especially organic solvents.

6.2.4 Polyethylene pipes

The following applies to PE pipes:

(a) PE pipe manufactured with PE 100 material, a minimum of PN 16, SDR11 wall thickness to conform to AS/NZS 4130 and AS/NZS 4131. Metric diameters (Series 1) shall only be used.

(b) They shall be blue in colour, or black with blue stripes or black walled with blue external "jacket". Black pipes shall be used for any above ground applications.

(c) For PE pressure pipelines pipe compliance to AS/NZS 4130 shall be demonstrated by providing copies of the BRTs specified in Table A-1 of AS/NZS 4130.

(d) For PE pressure pipelines material compliance to AS/NZS 4131 shall be demonstrated by providing copies of the BRTs specified in Table A-1 of AS/NZS 4131.

(e) For PE fittings for pressure pipelines compliance to AS/NZS 4129 shall be demonstrated by providing copies of the BRTs specified in Table A-1 of AS/NZS 4129.

(f) Laboratories undertaking this testing shall be Third Party Certified to ISO 17025 by an accredited certifying authority.

(a) PE pipe should not be used where hydrocarbons are detected as it may result in tainting of potable water or long-term weakening of the pipe and reduction in the factor of safety.

(b) Any pipe with a surface scoring deeper than 10% shall not be used.

6.2.5 Ductile iron pipes

The following applies to ductile iron pipes:

(a) Pipelines conforming to AS/NZS 2280 may be used when repairing existing compatible pipelines, for new bulk water pipelines, or on special application to Wellington Water.

(b) New pipelines, other than those covered in (a) above, shall be laid with ductile iron pipe complying with ISO 2531. Pipes shall be securely wrapped with a polyethylene sleeve with a minimum thickness of 200 microns. The sleeve shall be wrapped with a minimum 48 mm wide PVC, polypropylene or polyethylene tape at 600 mm spacing.

(c) Additional protection will be specified by Wellington Water for installation in corrosive soils.

(d) Ductile iron pipe shall not be used in estuarine conditions or in soils with soil resistivity less than 1,000 Ohm-cm (because of corrosion) or where the ground is contaminated by hydrocarbon fuels.

(e) Allowable ductile iron pipe diameters for the bulk water distribution network are shown in **Table 6-1**.

(f) Refer to **Section 6.4.7 Ductile Iron Pipe**.

Table 6-1 – Allowable ductile iron and steel pipe diameters for the bulk water distribution network

Nominal diameter (mm)	Outside diameter (mm)
100	122
150	177
200	232
250	286
300	345
375	426
500	508
600	610
650	667
750	762
900	914
1050	1067
1200	1220
1400	1420

6.2.5.1 ISO 2531 for new pipelines

The following applies to ductile iron pipe ISO 2531 requirements:

(a) Ductile iron pipe shall comply with ISO 2531 and be of a minimum rating of PN25 (pipe's pressure rating when unrestrained).

(b) Restraining systems shall be used for all installations. The joint restraint system shall be selected based on the proposed laying environment and will have a minimum pressure rating of 16 bar.

(c) The pipe exterior shall be zinc coated under an epoxy coat at least 100 microns thick. The internal lining shall be concrete or epoxy coating.

(d) Ductile iron fittings shall be ISO 2531 and comply with the requirements in **Table 6-2**.

Table 6-2 – Ductile iron pipe ISO 2531 requirements

Item	Requirement
Compliance with manufacturing standard	ISO 2531
ISO 2531 Clause 4.1.4	AS/NZS 4020
ISO 2531 Clause 4.2.2.1	100 mm to 300 mm - 1.5 mm 400 mm to 600 mm - 2.5 mm 700 mm to 1,000 mm - 4.0 mm
ISO 2531 Clause 4.2.4.1	Standard pipe length shall be 5.5 m or 6.0 m

Item	Requirement
ISO 2531 Clause 4.4.2	Pipes shall be Portland cement mortar lined, or blast furnace slag cement mortar lined
ISO 2531 Clause 4.5.2	Fittings shall be FBE lined
Minimum allowable pressure class	C 40 (4 MPa) – for pipes 100 mm to 300 mm C 30 (3 MPa) – for pipes 350 mm to 600 mm C 25 (2.5 MPa) – for pipes 700 mm to 1,000 mm
Minimum allowable DN	100 mm
Maximum allowable DN	1,000 mm

6.2.5.2 AS/NZS 2280 for repairing bulk water pipelines and existing compatible pipelines

The following applies to ductile iron pipe AS/NZS 2280 requirements:

(a) For bulk water pipelines, ductile iron pipes shall be cement mortar lined internally and bituminous paint exterior coated conforming to AS/NZS 2280 PN35.

(b) Ductile iron pipes for reticulation complying with AS/NZS 2280 and rated to a minimum PN20 may be used.

(c) All socket-spigot DI pipe shall be joined using restraining gaskets to prevent joint pull-out. The proprietary gaskets shall ensure a minimum PN16 is retained by the pipe system and joint.

(d) Factory applied concrete internal lining in compliance with the above standard, and bitumen external coating is required as a minimum. Approved epoxy linings will be accepted as will zinc and/or epoxy coatings.

(e) Ductile iron pipes with factory applied protective coatings may be installed without polyethylene sleeving, but it must be demonstrated that the receiving ground conditions do not adversely impact on the durability of the pipe coating and design life of the pipe.

6.2.6 Steel pipes

The following applies to steel pipes:

(a) Steel pipe shall not be used in estuarine conditions (because of corrosion).

(b) Steel pipes shall be to NZS 4442 with wall thicknesses to NZS 4442 Table 2, column (b). Notwithstanding the values in column (b):

   (i) Pipes from 400 mm to 600 mm shall have a minimum wall thickness of 6.4 mm.

   (ii) Pipes larger than 600 mm shall have a wall thickness no less than the outside diameter divided by 95.

(c) Pipe to AS 1579 of similar dimensions may be considered on special application to Wellington Water.

(d) Steel pipe shall have a factory applied concrete lining and polyethylene wrapped external coating to the standard set out in NZS 4442. Factory applied epoxy or fusion bonded coatings will also be acceptable provided they are certified as compliant with the requirements of AS/NZS 4020.

(e) For pipes DN 650 (667 OD) and greater, the pipe shall have hemi-spherical slip in joints to BS 534 to permit welding both internally and externally with a full width fillet weld. The pipe bell shall be supplied with a tapped hole for nitrogen pressure testing of the completed joint.

(f) For pipes less than 600 mm, the pipes shall be plain ended and joined using full penetration butt weld.

(g) Welding bands may be required where a butt weld is not practicable.

  (i) The mating ends of the pipe shall be cut square and any exposed steel coated with a self-priming AS/NZS 4020 approved solvent free steel primer to prevent post installation corrosion.

  (ii) The joint shall be internally lined with mortar for pipes 600 mm nominal bore and greater.

(h) Flanged steel pipe is acceptable for all pipe sizes.

(i) Ferrules shall not be used on steel pipes.

(j) Allowable steel pipe diameters for the bulk water distribution network are shown in **Table 6-1**.

6.2.7 Copper pipes

Copper pipe shall comply with NZS 3501.

6.2.8 ABS pipes

The following applies to ABS pipes:

(a) ABS pipes and fittings shall comply with AS/NZS 3518 and dimensions shall be Series 1 (metric).

(b) Bends and tees shall be factory moulded and not fabricated post-production.

(c) All connections shall be cold solvent welded.

(d) ABS pipes will typically only be accepted in smaller pumping stations where ductile iron or steel pipework is impractical. It shall not be used for buried pipe applications.

6.2.9 Stainless steel pipes

The following applies to stainless steel pipes:

(a) Stainless steel pipes shall not be used in underground applications.

(b) The following may be used for above ground situations such as pumping stations or valve chambers: 316 or 316L.

(c) A minimum grade Schedule 40 stainless steel pipe conforming to ASTM A312 shall be used.

(d) Flanged joints are the preferred method of joining stainless steel pipes.

6.2.10 Manholes

Manholes are designed around the use of standard diameter concrete chamber risers (e.g., 1,500 mm and 2,100 mm) to allow the use of precast concrete top slabs to be used. The following applies to all manholes for water supply:

(a) The top slabs shall be capable of withstanding HN-HO-72 loadings and a minimum of AS 3996 Class D.

(b) All joints shall be rendered neat with mortar.

(c) The manholes shall be designed with a drainage discharge point into the bedding metal of the pipe.

(d) Stainless steel step irons at 300 mm centres shall be installed.

6.2.10.1 Bulk water pipeline access manholes

The following applies to manholes on bulk mains with 650 mm or larger diameters:

(a) Pipeline access manholes shall be installed no further apart than 300m.

(b) The 600 mm nominal diameter flanged branches shall be welded to the pipeline in accordance with this specification.

(c) The 600 mm nominal diameter cover plate shall be prepared and coated with 300 microns of Carboguard 690 in two layers or approved alternative potable water protective coating.

(d) A 25 mm stainless steel ball valve shall be fitted to the access chamber cover plates. Before fitting the access chamber cover plate, the faces of the flanges shall be perfectly clean.

(e) The joint shall be made with a 3 mm thick insertion rubber gasket. The bolts shall be carefully tightened in opposite pairs until the joint gasket is sufficiently compressed between the flanges to ensure water tightness at the pipeline hydraulic test pressure.

6.2.10.2 Manhole covers

The following applies to water supply manhole covers:

(a) Only approved covers shall be used on public pipelines.

(b) All covers shall be capable of withstanding HN-HO-72 loadings and comply with a minimum load rating to AS 3996 Class D. Higher loadings may be required depending on the anticipated application (e.g., airports or loading yards).

(c) General cover specifications are as follows:

  (i) The top surface of the frame and cover shall be flush.

  (ii) The cover shall allow a 600 mm diameter minimum clear opening.

  (iii) The cover shall be a heavy duty ductile iron Sika 1200 x 600mm or similar cover with hinged joints, bolted to the concrete top, to allow access to manually operated fittings e.g. air valves, flow meters.

(d) Particular attention is drawn to the need to ensure that the covers shall not rock.

6.2.11 Valves

For gate valves and butterfly valves (see **Standard Detail WS05 – Typical Valve Details**):

(a) The valve body shall be internally and externally coated with an approved coating conforming to AS/NZS 4158.

(b) Valves shall be fitted with a key dolly for operation with a standard valve key.

(c) Valve spindle extensions shall be installed, if required, to bring the top of the square drive to between 150 mm and 450 mm of the ground surface, with a target depth of 200 mm.

(d) All valves shall include a tag or other means to clearly indicate closing direction.

6.2.11.1 Gate valves

The following applies to gate valves DN 80 mm and greater:

(a) Gate valves to be used on the network as line, branch or scour valves, DN 80 and above, shall be resilient seated with a ductile iron body. They shall comply with AS/NZS 2638.2 and shall be anti-clockwise closing.

(b) Flanged valves shall be used for all installations.

(c) Socket, spigot, shouldered or groove end valves are not permitted for use in the network without special permission. The standard acceptable valves available for use in the network are listed in the Approved Products Register.

(d) Valves complying with BS 5163.1 may be considered for trunk water supply pipelines.

(e) For bulk water pipelines, gate valves shall be flanged to AS/NZS 4331.2

(f) All gate valves shall be a PN16 minimum, unless design conditions require a higher pressure class.

(g) Valves in buildings shall have hand-wheels.

(h) Buried valves DN 80 or greater shall be operated by a standard key and bar.

  (i) Spindle caps shall be a maximum of 450 mm below the finished ground level.

  (ii) Where unavoidable, extension spindles may be used to meet this requirement where mains are necessarily at depth, but the means of positively fixing the extension to the spindle shall be approved by Wellington Water to ensure a non-friction based fixing system is adopted that is not susceptible to failure over the required design life due to corrosion or wear. Extension spindles shall be one piece, secured to the valve spindle, colour-coded white or red to indicate closing direction and epoxy coated.

(i) Valves DN 100 and greater shall be flanged both ends.

(j) On rubber-ring jointed pipelines, including pipelines with restraint gaskets, in-line thrust blocks shall be installed on valves to resist forces due to differential pressures across the valve.

(k) Valves DN 375 and greater shall incorporate a bypass valve of no less than DN 100.

(l) Wellington Water may require valve chambers for large diameter valves, especially those with an actuator. Where valve chambers are required, the connection between the valve chamber and the pipeline shall be seismically resilient.

(m) Hand-wheels, spindle caps and nuts and bolts shall be protected against corrosion and, with the exception of hand-wheels, shall be suitable for buried application.

The following applies to gate valves less than DN 80:

(n) Gate valves less than DN 80 shall be manufactured to DIN 3552 Part 4 and of ductile iron with a resilient seated gate.

6.2.11.2 Butterfly valves

The following applies to butterfly valves:

(a) Butterfly valves shall comply with AS 4795.2 and be double flanged, resilient sealed, anti-clockwise closing, with a minimum pressure rating of PN 16 and suitable for bi-directional flow and end-of-line service.

(b) For pipes larger than 300 mm diameter, the valve seal shall be fixed on the valve.

(c) Face to face dimensions shall be to AS 4795.2 or ISO 5752.

(d) Lugged valves complying with AS 4795.1 will also be considered for certain applications where space is a premium, such as manhole applications.

(e) Semi-lugged or wafer style valves require specific approval for use anywhere in the water supply network and are not typically accepted without good reason.

(f) Butterfly valves shall have a handwheel and gearbox for valves DN 200 or greater. A position lockable lever is required for all valves smaller than DN 200. Position indication shall be fitted on the butterfly valve.

(g) Butterfly valves shall be fusion bonded epoxy coated to AS/NZS 4158 and designed for a 50 year service life.

6.2.11.3 Ball valves

Ball valves shall be:

(a) Typically used for applications up to DN 50.

(b) Two piece, full bore, lever operated heavy duty stainless steel ball valves with BSP threaded connections, suitable for a working pressure of at least PN 40.

6.2.11.4 Hydrant valves

Hydrants shall:

(a) Comply with NZS 4522 screw-down type.

(b) Be clock-wise closing with a non-rising spindle.

(c) Be bolted onto a ductile iron DN 80 riser or tee branch.

(d) Be installed with an outlet cap to prevent debris from entering the outlet when not in use.

(e) Be installed such that the top of the spindle cap is between 125 mm and 300 mm of the underside of the hydrant lid.

(f) Not have a frost plug.

(g) Have the following markings:

   (i) Surface markings shall be as outlined in SNZ PAS 4509 (see **Section 4.11.2.1 Hydrants**).

(ii) Blue reflective pavement markers shall be required for all hydrants.

(iii) Circles shall be placed around any hydrant that attracts a high risk of being obstructed by a parked vehicle. This typically includes:

1. Hydrants within 2.5 m of a kerb where parallel parking is allowed.
2. Where the centre of the hydrant is within 600 mm of a marked parking bay.
3. Any other area where Wellington Water considers the hydrant to be at risk of being obstructed.

6.2.11.5 Service valves

The following applies to services valves (tobies):

(a) Service valves (tobies) for residential properties requiring a DN 20 service pipe or less shall be an approved manifold as listed in the Approved Products Register.

(i) They shall be housed in an approved manifold box (see **Standard Detail WS08 – Typical Domestic Manifold and Water Meter**).

(ii) The box shall be high density PE if in the berm or footpath or cast or ductile iron if in a residential driveway.

(b) Service pipes greater than DN 20 shall have a gate valve of the same nominal diameter that meets the requirements of **Section 6.2.11.1 Gate valves**. Only valves listed in the Approved Products Register shall be used in the public network.

(c) Where a service pipe is replaced, or the existing service valve excavated, and the existing service valve is a 15 mm or 20 mm gate valve, this service valve shall be replaced with a manifold (see **Section 6.2.12 Service covers, boxes and blocks**), except where the valve is exposed (e.g. where the service pipe is laid up the side of a bank).

(d) See **Section 4.11.2.3 Service valves** for information on service valve markings.

6.2.11.6 Valve markings

The following applies to valve markings:

(a) Valves on water mains shall be marked by a 50 mm wide white painted "V" painted on the top of the kerb.

(b) The "V" shall point to the valve (it shall point toward the carriageway for valves in the carriageway and the opposite direction for valves in the berm).

(i) For valves in the carriageway, a single vertical stripe shall be painted on the vertical face of the kerb below the apex of the "V".

(ii) For valves in the berm, two vertical stripes shall be painted on the vertical face of the kerb below each leg of the "V".

(c) Valves that are normally shut (e.g., by-pass and boundary valves) shall be marked with red paint. The entire top block shall be painted red.

(d) Valve markings shall be made using road marking paint. The concrete surface shall be cleaned by wire brushing back to sound concrete to remove all concrete latence and organic matter before marking the valve.

6.2.12 Service covers, boxes and blocks

6.2.12.1 Service valve boxes

The following applies to services valve boxes:

(a) Service valve (toby) boxes shall be rated to AS 3996 Class B when located in the berm, Class C when located in the footpath and driveways and Class D in the carriageway.

(b) When a service valve is located in a metalled or asphaltic concrete drive, and the box is high density PE, the box shall be set with a 20 MPa concrete surround a minimum 100 mm thick and 150 mm wide. This is to prevent the box from being "squeezed" by the weight of the traffic onto the flexible surface. Alternatively, a cast or ductile iron box shall be used.

(c) All boxes shall use a base to both centrally locate the service valve and to spread vertical loads onto the bedding.

(d) All boxes should contain enough metallic material to enable the buried box to be located, using a metal detector, under at least 100 mm of soil.

6.2.12.2 Manifold boxes

Manifold boxes shall comply with **Section 6.2.12.2 Manifold boxes** (see **Standard Detail WS08 – Typical Domestic Manifold and Water Meter**) and the requirements listed below. Manifolds shall be:

(a) Centrally located within the plan area of the box.

(b) Housed in a box with a minimum clear opening of 300 x 260 mm and shall have a minimum depth of 350 mm.

(c) Vertically located so the base of the manifold is within 20 mm of the plastic base of the box.

(d) Located such that access to the connections is practicable without excavation.

(e) Located such that a manifold meter can be installed into the manifold port without adjustment of the box.

6.2.12.3 Meter boxes

The following applies to meter boxes:

(a) Meters shall be housed in an approved box that provides adequate space for removal of the meter, access to the isolation valve and visual inspection of the joints.

(b) The box shall be able to be drained to natural ground and in a position that is safe for meter readers to read.

(c) The lid shall be light and durable enough to be opened with a single person lift with a lifting weight of no greater than 15 kg and using a simple lifting key (e.g., a hinged 30 kg lid would be acceptable).

6.2.12.4 Valve blocks

The following applies to valve blocks:

(a) Gate valve blocks and covers shall be an approved system rated to AS 3996 Class D.

(b) Valves shall have a 150 mm PVC insert pipe extending from below the valve stem gland to just below the valve box lid.

(c) It shall be installed such that there is no traffic loading onto the PVC pipe and clear access from ground level down to the valve's spindle cap.

6.2.12.5 Hydrant blocks

The following applies to hydrant blocks:

(a) Hydrant blocks and covers shall be an approved system rated to AS 3996 Class D.

(b) Hydrant blocks shall be installed as per the requirements of NZS 4522.

(c) When a hydrant standpipe is installed on the threaded outlet, the standpipe does not contact the hydrant box at any point.

6.2.13 Fittings

6.2.13.1 Mechanical tapping bands

Mechanical tapping bands:

(a) Shall only be used for customer connections to the reticulation main.

(b) Shall not be used for rider main connections or the junction of two reticulation pipes.

(c) Shall be made from LG2 gunmetal, aluminium bronze, stainless steel or fusion bonded epoxy coated ductile iron and shall be of a two part fully encircling design.

(d) Shall be used to connect up to and including a 32 mm connection on a DN 100 pipe or 40 mm connection on to a DN 150 or DN 200 pipeline.

(e) Shall be installed with PP or PE insulators where tapping bands are used on ductile iron, cast iron or steel pipelines to protect against corrosion and stray currents. Alternatively, the tapping band shall be fusion bonded epoxy coated.

(f) If used on PVC pipelines, tapping bands shall be designed such that the fully tightened band will not cause ovalisation of the pipe by more than 3%.

(g) May have a "mains-cock" installed to aid in commissioning of pipelines. The mains-cock shall be an LG2 gunmetal, bronze ball valve or a screw-type proprietary valve (Talbot) that shall be left in the open position and wrapped with the full Denso system (primer, mastic, petrolatum tape and PVC outer wrap) after commissioning of the main.

(h) Shall not be used on polyethylene pipes.

6.2.13.2 Electrofusion tapping saddles and branch saddles

Electrofusion tapping saddles and branch saddles shall:

(a) Comply with AS/NZS 4129

(b) Manufactured from PE100 material

(c) Have a minimum installed pressure rating of PN16.

(d) Be installed using a welding clamp to ensure the saddle maintains the recommended welding contact area and pressure during installation.

(e) Be installed in accordance with the manufacturer's recommendation, notwithstanding the requirements of PIPA POP001[10].

6.2.13.3 Electrofusion reducing couplers and elbows

Electrofusion reducing couplers and elbows shall:

(a) Comply with AS/NZS 4129.

(b) Be manufactured from PE100 material.

(c) Have a minimum installed pressure rating of PN16.

(d) Be installed using a quad clamp alignment tool and re-rounding clamp to ensure the alignment of the fitting does not move during installation.

(e) Be installed in accordance with the manufacturer's recommendation, notwithstanding the requirements of PIPA POP001.

6.2.13.4 Mechanical compression fittings

Mechanical compression fittings:

(a) For use on polyethylene pipe shall not be used for new pipelines.

(b) Where permitted in writing, may be used where the pipeline is less than 63 OD. These shall be screw-type compression fittings when used on PE100 pipelines, manufactured from polypropylene and listed in the Approved Products Register. Inserts/pipe stiffeners shall be used.

(c) Shall comply with AS/NZS 4129 and rated to a working pressure of PN16.

(d) Large diameter compression couplings maybe considered when connecting to an existing pipe where a dry shut-off may not be possible and time is critical.

6.2.13.5 Direct tapping

The following applies to direct tapping:

(a) Direct tapping using a ferrule is not permitted on any pipe material type.

(b) All service and fire connections to a water supply main must be made via a proprietary fitting such as a tee, tapping band or electrofusion saddle.

(c) Steel branches or sockets may be welded onto existing steel pipes to create a suitable connection in-situ.

6.2.13.6 Mechanical couplings

Mechanical couplings:

(a) Are considered to be a repair fitting; use on new mains is to be minimised as much as practical through the use of socketed joints, welding or fusion jointing. Examples of permitted connection methods between new and existing mains are provided in **Standard Detail WS14 – Examples of Water Main Connections**.

(b) That are unrestrained (Gibaults) shall comply with AS/NZS 4998 up to 750mm pipes, or with ANSI/AWWA C219/06 for larger pipelines.

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[10] *Industry guidelines. Electrofusion jointing of PE pipes and fittings for pressure applications. Issue 8.0. POP001. Plastics Industry Pipe Association of Australia Limited (PIPA). 2019.*

(c) Shall use nuts, bolts and washers that are either 316 stainless steel or hot dip galvanised. An anti-galling compound shall be used on all stainless-steel threads.

(d) Shall be wrapped with the full Denso system (primer, mastic, petrolatum tape and PVC outer wrap) when buried or within a buried chamber. Mechanical couplings within pumping stations or other ventilated structures need not be wrapped, but shall have stainless steel nuts, bolts and washers.

(e) Shall be tightened to the torque specified on the fitting and in the manufacturer's recommended tightening pattern.

(f) Shall have a minimum pressure rating of PN16 when used with water. A higher-pressure rating may be required where design circumstances dictate.

(g) Shall not have an internal register, except for mechanical flange adapters which shall have a full circle register.

(h) That use metal teeth to form a restrained joint shall only be used by special permission. The restrained gasket shall be specifically designed for the pipe material it is mated to and rated to a minimum of PN16 when fully end loaded.

The following also applies to mechanical couplings:

(i) Where mechanical couplings are joining a PVC pipe to a more rigid pipe (cast-iron, ductile iron or steel pipe), the end ring with the tightening nuts shall be tightening on the rigid pipe. This provides a more even compression and seal. The sealing ring shall be lubricated with a potable approved lubricant.

(j) At locations requiring installation of mechanical joint couplings, pipe ends shall be cut square and, in the case of spirally welded steel pipe, the spiral welds ground smooth for a sufficient distance to allow installation of the coupling.

(k) For bulk water pipelines, the exposed steel shall be prepared and coated with 300 microns of *Carboguard 690* in two layers or approved alternative potable water protective coating.

6.2.13.7 Dismantling joints

The following applies to dismantling joints:

(a) Dismantling joints shall be PN16 rated (as a minimum), ductile iron or steel and coated to AS/NZS 4158 or AS/NZS 3862.

(b) Stainless steel components will be accepted provided they are electrically insulated from other non-stainless steel components.

(c) Elastomeric seals shall comply with AS 1646 and all wetted components shall comply with the requirements of AS/NZS 4020.

(d) All dismantling couplings shall be wrapped with the full Denso system (primer, mastic, petrolatum tape and PVC outer wrap) if buried.

6.2.13.8 Bends and tees

The following applies to bends and tees:

(a) Bends, tees, tapers, spools and tapped connectors shall be ductile iron fittings manufactured to AS/NZS 2280 and coated to AS/NZS 4158.

(b) Bends certified to ISO 2531 shall be used on pipelines with a metric outside diameter (Series 1).

(c) All fittings shall have a minimum pressure rating of PN16 unless the design requires a higher pressure class.

(d) Flanged or spigot bends, tees and "specials" fabricated from STCL may be permitted where ductile iron fittings are not practicable.

  (i) These shall be manufactured to the requirements of NZS 4442 for pipe up to DN 450.

  (ii) For pipes exceeding DN 450, they shall be manufactured in accordance with AWWA Manual M11[11].

  (iii) Fabricated steel fittings shall be either polyethylene tape wrapped and concrete lined at the fabricators, or epoxy coated to AS/NZS 3862.

(e) PVC bends and fabricated or moulded PE tees shall not be permitted.

(f) Socketed DI fittings used on PVC pipes shall be of a "long socket" pattern and use the minimum depth of engagement as outlined in WSA TN2[12].

(g) Coatings on DI and STCL fittings shall be free of holidays and rust.

(h) DI fittings installed in PVC pipelines that result in unbalanced thrust (such as tapers) shall be flanged so that they can be fixed into assembles that will control the unbalanced thrusts.

(i) DI fittings installed in PE pipelines shall be flanged.

(j) All bends and fittings shall be of sufficient length to allow anchorage against natural ground with concrete thrust blocks without encasing the pipe joints in concrete.

(k) Socket-socket electrofusion bends are permitted to be used on PE pipelines. Bends shall be of the correct material and SDR for the pipeline.

(l) Post-formed PE bends and mitred PE bends are permitted to be used on PE pipelines.

  (i) The maximum angle for butt fusion welded bends shall be 12 degrees.

  (ii) Both post-formed and mitred bends shall be de-rated.

  (iii) PE bends shall be long-spigot to allow butt fusion welding to the pipe string.

6.2.14 Pressure reducing valves

The following applies to pressure reducing valves (PRV):

(a) PRVs shall typically be hydraulically operated globe valves of an approved type and model as specified in the Approved Products Register.

(b) A concept design for a typical PRV installation is available from Wellington Water on request.

(c) PRVs and all associated fittings shall be PN16 pressure rated.

(d) They shall be selected to provide a minimum 10 year service life at design flows (average daily peak flow) without requiring replacement of any parts, including seals

[11] *M11 Steel pipe: A guide for design and installation.* American Water Works Association

[12] *WSA-TN2 Guidelines for the use of non-metallic pipes with ductile iron elastomeric joint fittings and spread sheet calculation.* Water Services Association of Australia

and diaphragms. The bonnet shall vent into the downstream pipe and not to the atmosphere.

(e) Noise shall be a consideration and selection shall be carried out to minimise the noise during higher flows. This may require two PRVs in series or parallel to eliminate excessive pressure differential and the associated noise.

(f) Where a PRV is to be used as the primary source of supply for an area, a low-flow bypass may be required to maintain suitable flow and pressure during low flow periods. This will be ascertained during the design stage to ensure the full range of design flows are achievable through the installation without excessive noise and cavitation, and with an acceptable design life:

  (i) PRV sizing shall be designed with a nominal life of 20 years at the design flows before overhaul is required.

  (ii) Design flows shall be 60% of time at min flow, 10% at peak flows and 30% at half peak flow.

(g) Fire hydrants shall be installed upstream and downstream of the PRV's isolation valves of any PRV that is to be used as a primary supply.

(h) An approved top-entry strainer shall be installed within the chamber between the upstream isolation valve and the PRV.

(i) Tappings, ball valves and oil filled pressure gauges with a 100 mm diameter dial face shall be installed immediately upstream and downstream of the PRV. Tappings on the PRV body shall not be used for the purpose of permanent gauges.

(j) A combination air-valve shall be installed immediately downstream of the PRV installation on pipelines 100 mm and greater.

6.2.14.1 Pressure relief valves

The following applies to pressure relief valves:

(a) A pressure relief valve shall be installed downstream of the PRV to prevent the downstream network from being over-pressurised due to a fault in the PRV.

(b) The relief valve shall be sized to carry the full flow at static pressure and shall be located on the main pipe.

(c) The pressure relief valve discharge shall be piped to the kerb or other point where the discharge will be visible.

(d) A contact plaque may be required, and supplied for installation, by the Wellington Water.

(e) The discharge pipe shall be sized appropriately but shall be a minimum of 63 OD PE100.

(f) It shall be located such that the discharge is channelled safely into the stormwater system without scouring or flooding. The potential for scour of a natural waterbody must comply with permitted activity standard in regional plan rule or consent for discharge will be required under RMA.

6.2.14.2 Chamber

The PRV, bypass PRV, pressure relief valve, strainer and gauges shall be housed in a precast concrete chamber. The chamber shall be:

(a) Located out of the carriageway where practicable and provide safe operator access.

(b) Drained, either to the ground where the chamber floor is above the water table, or to a kerb or open channel. The drain shall be designed such that stormwater cannot back-up through the drain into the chamber.

(c) Installed with an approved cover. An AS 3996 Class D rated frame and cover is required in the carriageway with a minimum 600 mm diameter clear opening. In the berm, an AS 3996 square Class C frame and cover is required with minimum dimensions of 600 x 900 mm.

6.2.15 Non-return valves

The following applies to non-return valves:

(a) Non-return valves used in the network shall comply with AS 4794.

(b) Resilient seated swing-check valves shall be used in the general reticulation.

(c) Non-slam wafer-check valves shall be used in water supply pumping stations.

6.2.16 Air valves

Air valves shall:

(a) Comply with AS 4956.

(b) Be either an air release, air/vacuum or combination type valve. The valve shall be selected by the designer to admit or expel air to prevent negative pressures and remove air from the system during adverse operating conditions. Combination valves are typically preferred on mains.

(c) Be of a make and model approved by Wellington Water.

(d) Be installed with an approved stainless steel ball valve for installation less than 50 mm, or an approved gate valve for larger installations, providing a means to isolate the valve for maintenance without affecting the operation of the main. Where the valve cannot be safely operated from the surface, a mitred gear box on a gate valve or butterfly valve shall be used to allow safe operation from the surface.

(e) Contain a small and a large orifice. The air valve float shall not prematurely seal the orifice at very high air discharge rates.

(f) Have flange joints encapsulated in the full Denso system (primer, mastic, petrolatum tape and PVC outer wrap).

6.2.16.1 Chamber

The air valve shall be housed in a precast concrete chamber that:

(a) Allows the valve to be safely isolated and maintained without excavation.

(b) Is located out of the carriageway where practicable, and provides safe operator access.

(c) Is positioned such that it is clear of potential ponding and areas with secondary overland flow to prevent the chamber filling with water during rainfall events.

(d) Has a drain; either to the ground where the chamber floor is above the water table, or to a kerb or open channel. The drain shall be located at the lowest point of the chamber and designed such that stormwater cannot back-up through the drain into the chamber.

(e) Has an approved cover on it. An AS 3996 Class D rated frame and cover is required in the carriageway with a minimum 600 mm diameter clear opening.

(f) Has an air vent that shall allow the exit of the air valve exhaust without pressurising the chamber.

  (i) The vent shall allow the entry of air into the chamber without drawing water or debris into the chamber.

  (ii) The vent shall be epoxy coated steel or ductile iron and shall not present a trip or vehicle hazard.

  (iii) Holes drilled into the manhole lid or a horizontal grate is not an acceptable air vent.

  (iv) The vent shall be sized to limit air velocity.

6.2.17 Water meters

Only brands listed in the Approved Products Register may be used within the public water supply system. Notwithstanding this, the following specification shall apply.

Meters shall:

(a) Have a current MID Pattern Approval Certificate to OIML-R49.

(b) Be suitable for outdoor and in-ground installation and maintain a service life of at least 20 years.

(c) Not have a pressure a rating less than PN16.

(d) Be installed such that:

  (i) There is an isolation valve upstream of the meter and strainer.

  (ii) There is a backflow prevention device or isolation valve downstream of the meter (for commercial properties only).

  (iii) It is in an approved underground box or externally accessed cabinet.

Where meters are mechanical, they shall:

(e) Have a design to allow the register to be clearly read throughout the life of the meter. This shall be either:

  (i) A sealed protected totalizer liquid filled register, or

  (ii) A copper and mineral glass dry register.

(f) Be installed such that there is a proprietary or approved strainer upstream of any mechanical meter.

6.2.17.1 Meter accuracy

Water meter performance (Q1, Q2, Q3 and Q4) shall be greater or equal to the performance calculated using the Q3 (permanent flow) and Q3/Q1 ratio, as listed in **Table 6-3**.

(a) Meter body lengths shall conform to those outlined in **Table 6-3**, which are the common lengths used in New Zealand[13].

(b) Meters DN 50 or less may be BSP threaded.

(c) Meters DN 50 or greater shall be flanged as per **Section 6.4.6.8 Flanged connections**.

(d) DN 50 meters may be either flanged or BSP threaded.

Table 6-3 – Minimum performance specification for meters

Nominal bore (mm)	Q3 (m^3/hr)	Meter body length (mm)	Minimum Q3/Q1 ratio	Typ. No. dwellings served*
15	2.5	134	R160	1
Manifold (40mm port)	2.5	n/a	R160	1 to 2
20	4	165	R160	3 to 5
25	6.3	260	R160	6 to 10
32	10	260	R160	11 to 22
40	16	300	R160	23 to 45
50	25	n/a	R315	By design
65	40	n/a	R400	By design
80	63	n/a	R400	By design
100	100	n/a	R400	By design
150	250	n/a	R630	By design

* Based on calculations for multiple residential dwellings from NZS 3500.1 where Q3 is not exceeded by the maximum probable simultaneous flow. This is conservative and is suitable for dense housing complexes or apartment buildings.

6.2.17.2 Magnetic flow meters

The following applies to magnetic flow meters:

(a) Magnetic flow meters shall be installed in chambers with suitable access for inspection and maintenance.

(b) Meters shall be supported as per the manufacturer's recommendations.

(c) Appropriate straight lengths of pipe are required both upstream and downstream of the meter. A standard guideline is 5 diameters length upstream and 3 diameters length downstream.

(d) Transmitter heads shall be remotely mounted in an above ground cabinet with safe pedestrian access for reading.

[13] *Water Meter Code of Practice 2003, WaterNZ*

(e) Chambers shall be provided with drains, except in areas with a high water table.

6.2.17.3 Meters on a fire service or sprinkler connection

See **Section 6.11 Fire Services**.

6.2.17.4 Detector check meters

See **Section 6.2.18.2 Detector check meters**.

6.2.18 Backflow preventers

The follow applies to backflow preventers:

(a) Backflow preventers shall be certified to comply with AS/NZS 2845.1. Approved backflow preventers are listed within the Approved Products Register.

(b) The installation of backflow prevention devices shall be in accordance with AS/NZS 3500.1.

(c) Installation of backflow prevention devices must be compliant with the relevant Standard Details in **Appendix 1**, unless prior approval is obtained from Wellington Water.

6.2.18.1 Reduced pressure zone device

The following applies to reduced pressure zone (RPZ) devices:

(a) RPZ devices shall be installed above ground and with:

  (i) A strainer immediately upstream of the device.

  (ii) An isolation valve both upstream and downstream of the RPZ and strainer.

  (iii) A suitable cabinet/cage around the device that will allow inspection and free drainage of the device.

(b) RPZ devices can eject some water from the port so drainage of the discharge is to be considered within the context of the environment it is installed in.

(c) The area around the RPZ shall be paved, or finished in concrete so that vegetation cannot grow up under the RPZ device.

(d) The clearance between the paved surface and the discharge point of the RPZ shall not be less than 300 mm.

(e) A meter may be installed between the strainer and the RPZ provided suitable diameters are provided upstream and downstream of the meter.

6.2.18.2 Detector check meters

The following applies to detector check meters:

(a) Detector check meters are required on all non-return valves that are on fire-services or other non-revenue connections.

(b) The non-return device shall be a double check detector assembly as a minimum that complies with AS/NZS 2845.1.

(c) The meter on the bypass shall comply with the requirements of **Section 6.2.17 Water meters**.

6.3 Pipe laying

6.3.1 Minimum cover to pipeline

Minimum cover to pipes shall be as set out in **Table 6-4**.

Table 6-4 – Minimum cover to pipelines (in metres)

Nominal bore (mm)	Carriageway / Motor crossing	Footpath	Berm
20 to 25	0.75	0.75	0.60
40 to 50	0.75	0.75	0.60
100 to 200	0.75	0.75	0.75
300 to 600	0.90*	0.90*	0.90*
≥700	1.00**	1.00**	1.00**

* May be less than 0.90 m for sections not exceeding 60 m in length and not less than 750 mm minimum depth of cover

** May be less than 1 m for sections not exceeding 60 m in length and not less than 750 mm minimum depth of cover

6.3.2 Maximum cover to pipeline

Maximum cover to pipes shall be as set out in **Table 6-5**.

Table 6-5 – Maximum cover to pipelines

Nominal bore (mm)	Maximum cover (m)
20 to 25	0.80
40 to 50	1.20
≥100	2.50*

* May exceed 2.5 m for sections not exceeding 30 m in length and not greater than 4.0 m maximum depth of cover

It shall be acceptable to exceed this depth of cover where the pipe is installed in a duct or a tunnel and can be withdrawn for repair. This would normally be achieved by horizontal directional drilling or micro tunnelling and would be a specific design approved by Wellington Water.

6.3.3 Minimum clearances from other utilities

The following applies to minimum water pipeline clearances from other utilities:

(a) Pipes shall be laid parallel to other services whenever practicable.

(b) Where a pipe crosses another utility, it shall be as close to perpendicular as practicable, and shall maintain minimum horizontal and vertical clearances equal to the greater of the minimum clearances outlined by the other utility and shown in **Table 6-6**.

Table 6-6 – Minimum water main clearances from utilities

Utility	Minimum horiz. Clearance (mm)	Minimum horiz. Clearance (mm)	Min. vertical clearance (mm) when crossing
	Non-bulk main	Bulk main	All
Other water mains	300	600	150
Gas mains	300	600	150
Telecommunications conduits and cables	300	600	150
Electricity conduits and cables	500	1000	225
Stormwater drains	300	300	150
Wastewater mains+	1000*	1000*	200+

+ Wastewater mains should always be below watermains to reduce the risk of cross-contamination as a result of a watermain failure.

* or 1000 mm radial distance from a watermain (i.e. horizontal can reduce when vertical increases).

Note: Clearances are between utility pipe/conduit barrels

6.3.4 Pipe handling

The following applies to handling pipes:

(a) Pipes and fittings shall be transported and handled in a manner that is safe and meets industry guidelines and the manufacturer's instructions.

(b) Pipes shall be secure during transport and shall not be allowed to roll or skid during transit.

(c) Sockets shall be clear of adjacent pipes and other sockets and shall be protected from damage.

(d) Pipes shall not be tipped or dropped onto the ground from the transport. Lifting equipment shall be used to unload pipes from the transport. Spreader bars shall be used for long (12 m) lengths of PVC and PE pipes to avoid undue bending stress on the pipe

(e) In storage, pipes shall be stacked on dunnage, on flat ground and with supports. Scalloped dunnage is preferred to minimise rolling potential. The ends of the pipe shall be sealed to ensure rubbish and animals cannot enter the pipe whilst in storage.

(f) Where PVC and PE pipes are to be stored long-term (longer than 3 months), they shall be protected from heat and ultra-violet radiation with covers or warehousing.

(g) Chains shall not be used to lift pipes.

6.3.5 Allowable grade

On bulk water pipelines the minimum fall gradient is 0.2%, and the minimum rising gradient is 0.1% relative to the flow direction.

6.3.6 Thrust and anchor blocks

Thrust blocks restrain the pipe by transferring pipe-thrust to the immediately adjacent undisturbed natural ground. Anchor blocks use their weight to hold the pipe in position.

Thrust and anchor blocks:

(a) Are required even where restrained joint pipes and fittings are used. This is to protect against future repairs and/or cut ins which may compromise the integrity of the restrained system.

(b) Shall be constructed from 20 MPa concrete at 28 days. The bearing face shall be poured against firm, clear and undisturbed natural ground. Flanges and sockets are to be kept clear of concrete and under no circumstances shall a joint be embedded in the thrust block. The concrete shall have a contact area with the pipe of at least a third of the pipes outside circumference. A polythene sheet shall be set between the concrete and the fitting.

(c) Pipes larger than DN 300 require specific design regarding reinforcement and concrete strengths due to the large loads.

(d) Shall not be placed under working or test load for at least 3 days after pouring.

6.3.6.1 Thrust blocks

Thrust blocks (see **Standard Detail WS03 – Typical Thrust Block Details**):

(a) Shall not be installed on PE pressure pipelines at changes of direction, tees and changes in pipe diameter unless specifically required by the designer.

(b) Thrust blocks are required at on PE pipelines any point where the PE pipeline terminates, or is connected to a different pipe material or is connected to a structure that is not able to provide the required thrust restraint. In the case of connection to a structure, the thrust restraint may be provided by the structure.

(c) Thrust blocks that are loaded during pressure testing shall be sized to resist forces when the pipe is pressurised to full test pressure.

(d) Thrust blocks that are not loaded during pressure testing (for example thrust blocks on cut-in specials) shall be sized to resist forces when the pipe is pressurised to maximum operating pressure.

6.3.6.2 Anchor blocks

The following applies to anchor blocks:

(a) Irrespective of whether an anchor can be constructed, vertical changes in direction shall, wherever possible, be designed so that they are thrust neutral in the vertical direction (see **Standard Detail WS04 – Typical Anchor Block Details**).

(b) Where straps are used to secure the pipe or bend to a block, 6 mm insertion rubber shall be placed along the full area of contact between the pipe wall and the strap. Insertion rubber shall be placed along the full contact area with the concrete block also.

(c) Straps and anchors shall be 316 stainless steel.

6.3.6.3 Precast thrust and anchor blocks

The following applies to precast thrust and anchor blocks:

(a) Precast blocks may be used to allow faster working reinstatement of the pipeline for pipes DN 200 and smaller.

(b) Precast blocks shall conform with the minimum standards outlined in this specification.

(c) Where there is a gap between the block and the natural ground, the gap may be filled with compacted lean-mix to ensure tight contact between the soil, block and fitting. The gap between the precast block and the natural ground shall be no greater than 75 mm.

(d) 6 mm insertion rubber shall be placed between the precast block and the fitting.

(e) Precast blocks are not permitted for pipe diameters larger than DN 200.

6.3.6.4 Allowable bearing pressure

The following is allowable bearing pressure:

(a) The bearing pressure of the soil shall be checked to ensure it has the minimum required bearing strength as specified in the design.

(b) A Scala Penetrometer maybe used to determine the in-situ bearing strength of the soil.

(c) As a guide for pipe DN 300 and smaller:

  (i) The ***vertical*** bearing pressure of the soil can be taken as:

    1. 65 kPa for 2 blows per 100 mm
    2. 100 kPa for 3 blows per 100 mm and
    3. 200 kPa for 7 blows per 100 mm.

  (ii) The ***horizontal*** bearing pressure shall be less than this and, in the absence of better geotechnical information, shall be taken as half the estimated vertical bearing pressure.

(d) For pipes larger than DN 300, suitable geotechnical advice shall be sought to calculate allowable bearing pressure and the size of the thrust block.

6.3.7 Fittings

All fittings shall be swabbed with a 50 mg/L chlorine solution and maintained as hygienically clean until installed within the pipeline. Only the surfaces which will come into contact with potable water need to be swabbed and maintained.

Magnetic flowmeters shall not be treated topically as the chlorine solution can damage the meter's lining.

6.3.8 Warning tape / tracer wire

The following applies to warning tape and tracer wire:

(a) Warning tape shall be placed 300 mm above all bulk, trunk, principal and rider main pipes and 100 mm above service pipes.

(b) The warning tape shall be:

  (i) Blue polyethylene or polypropylene

  (ii) A minimum of 100 mm wide and

  (iii) Detectable by either stainless steel wire or aluminium laminate.

(c) Where a pipe is installed by means of pipe bursting, a 2.5 mm compacted 316 stainless steel wire rope is to be co-drawn with the pipe as a tracer wire (see **Section 4.15 Pipe-bursting**).

(d) Where a pipe is installed by means of directional drilling, slip lining or impact mole:

  (i) A 4 mm^2 copper polythene sleeved tracer wire is to be co-drawn with the pipe.

  (ii) Warning tape and wires shall be electrically continuous and joints must be adequately overlapped and jointed to ensure no degradation of the electrical continuity over the life of the asset.

  (iii) This may require the use of electrical connectors.

(e) Where warning tape/wire is damaged due to a pipe repair or new connection, the warning tape/wire is to be fixed to maintain electrical continuity along the length of the pipe.

(f) Tape shall continue through service valve, hydrant and valve enclosures whilst maintaining tape conductivity (see **Standard Detail WS05 – Typical valve details**).

(g) Warning tape for a pipe is to be connected to warning tape above adjoining service connections and other pipelines and fittings such as service valves, hydrants and valves.

(h) The tape/wire shall be wrapped around the fitting with the tail end protruding above the fitting to just below any spindle cap or hand-wheel to avoid any fouling or obstruction to valve key operation.

6.3.9 Cathodic protection

(a) Electrical contact between buried metallic structures and the metallic pipe and pipe fittings shall be prevented.

(b) Insulating flanged joints shall be installed at flanges connecting above ground installations and magnetic flow meters.

(c) All non-welded joints in metallic pipe, including flanged connections, shall be joint bonded to provide electrical continuity. Joint bonds shall be insulated 16 mm^2 copper wire loops, sealed to prevent the ingress of moisture. Buried joint bonds shall be duplicated at each joint (i.e., two bonds per joint).

(d) The overall length of the conductor shall permit sufficient flexibility across the joint to prevent tensile stress on the bond cable. Cable to fitting connections shall be a dedicated corrosion-free stud or earthing boss welded to the pipe and liberally coated with Denso. The mechanical strength of a bond shall be sufficient to withstand the effects of backfilling and maintenance.

(e) Bare copper bond straps, conductivity screws and conductivity wedges shall not be used to provide electrical conductivity.

(f) Where electrical continuity bond cables are installed, the contractor shall prove the electrical continuity of the pipeline before and after backfilling.

(g) A multimeter continuity test or resistance test shall be carried out between each nut and an unprotected part of the flange on the opposite flange of the joint.

  (i) A resistance value above 100k ohms is considered satisfactory for these flange joints.

6.4 Pipe jointing

The following applies to pipe jointing:

(a) PVC pipes shall be rubber-ring jointed with a proprietary in-joint rubber ring.

(b) Ductile iron pipes may be rubber-ring jointed or flanged.

(c) Steel pipes shall be welded as per the requirements of this specification.

(d) To achieve the majority of the minor changes of grade and/or direction without installing fabricated bends, pipes shall be laid on smooth transition curves using the allowable deflection in the pipe joint.

  (i) Allowable deflection is 3 degrees in ductile iron pipes with rubber ring joints.

  (ii) Allowable deflection is 2 degrees in ductile iron pipes with Tyton-loc rings.

(e) Polyethylene pipes shall be butt fusion or electrofusion welded. Approved compression fittings may be used on 63 OD pipes and smaller. Axially restrained mechanical couplings may be used on PE pipes for maintenance repairs, or when connecting to an existing in-service PE pipe during cut-ins.

(f) In liquefiable land refer to the Regional Standard for Water Services for seismic design.

6.4.1 Rubber-ring joint

The following applies to rubber-ring jointing:

(a) Pipes may be joined to other pipe bends and tees using rubber-ring moulded socket-spigot joints. Elastomeric rings shall comply with AS 1646 and shall typically be EPDM. Other compounds such as NBR may be used where appropriate, such as where hydrocarbons are present or are potentially present in the soil.

(b) Witness marks shall be employed to ensure the appropriate insertion depth is obtained.

(c) Spigots are to be chamfered as per manufacturers recommendations. This is typically a 15-degree angle with the pipe axis and from a depth of half the pipe wall thickness.

(d) An AS/NZS 4020 approved lubricant shall be liberally applied to each socket and spigot prior to insertion to ensure the seal is not unseated or “pinched”. Lubricant shall only be placed on the sealing face of the ring and care shall be taken to ensure lubricant is not placed on the underside of the ring. Lubricant shall also be used on factory fitted sealing rings.

6.4.1.1 Restraining gaskets

Restraining gaskets shall:

(a) Only be used on PN35 ductile iron pipelines. Only specific brands shall be approved. These brands are listed in the Approved Products Register.

(b) Be lubricated in the same style as non-restraining gaskets.

(c) Not be reused if removed from an in-situ installation.

6.4.2 Mechanical compression fittings

6.4.2.1 Mechanical fittings for PE pipe

The following applies to PE mechanical compression fittings:

(a) All compression fittings shall be certified to AS/NZS 4129 and only those listed within the Approved Products Register shall be permitted for use in the water supply network.

(b) Proprietary stainless steel or plastic inserts/pipe stiffeners shall be used with all mechanical compression fittings used on polyethylene pipes.

(c) The pipe spigot shall be clean, free of scores, burrs, scratches and solvents and shall be inserted into the fitting square until the pipe reaches refusal.

(d) Fittings shall be hand tightened for fittings less than DN 40, or using a proprietary wrench as specified by the manufacturer for fittings DN 40 and greater. Do not over-tighten as this can damage the grip ring or the fittings threads resulting in pull-out.

(e) PE mechanical compression fittings shall only be used for the repair of PE pipelines up to 630 mm OD.

(f) Approved, axially restrained, mechanical fittings may also be used for the connection of new PE watermains to existing PE watermains.

6.4.2.2 Mechanical fittings for other pipes

The following applies to mechanical compression fittings for other pipes:

(a) All compression fittings shall be certified to AS/NZS 4998 and only those listed within the Approved Products Register shall be permitted for use in the water supply network, and only when socket, flanged, threaded or welded joints cannot practically be employed.

(b) The pipe spigot shall cut square, clean, free of scores, burrs and scratches.

(c) The pipe ends shall be marked with witness marks to ensure the correct end-gap is centred in the coupler before the fasteners are tightened.

6.4.3 Polyethylene butt fusion and electrofusion welding

The following applies to PE butt fusion and electrofusion welding (see also **Section 4.19 Polyethylene welding**).

(a) Where polyethylene pipes are connected to existing or new copper pipes, electrofusion transition couplings shall be used to join the two materials.

(b) Where PE water mains are connected to existing, in-service, PE water mains less than 315 mm OD, electrofusion couplers are preferred when site conditions allow. For larger mains or where the conditions for installation of electrofusion couplers (see **Section 4.19 Polyethylene welding**) cannot be met, connections shall be made using an approved PE mechanical compression fitting.

6.4.4 Flanges

6.4.4.1 General reticulation pipes

The following applies to flanges for general reticulation pipes:

(a) All flanges used in the water supply network shall be AS/NZS 4087 or BS EN 1092 rated to PN16. The following patterns are permitted:

  (i) Figure B5 for ductile iron fittings and

  (ii) Figure B7 for steel fittings.

(b) These patterns have an equivalent drilling pattern to BS10 Table D.

(c) 3 mm fibre reinforced EPDM gaskets shall be used with all flanges. NBR gaskets may be considered where the ground has, or may potentially have, hydrocarbons present.

(d) Bolts, washers and nuts to be used on all flanges shall be hot dipped galvanized or 316 stainless steel. An anti-galling compound shall be used with all stainless-steel threads to ensure threads do not seize.

(e) All flanges that will be buried, or have the potential to be buried, shall be coated and wrapped in the full Denso system (primer, mastic, petrolatum tape and PVC outer wrap). Flanges that are in a dry, ventilated environment, such as a pumping station, do not need to be wrapped.

(f) Prior to mating, the flange face shall be clean of dust, solvents, oil, grease and other materials. The flange faces shall be mated and the bolts tightened in a sequence of opposing pairs, with pairs generally perpendicular to each other. A torque wrench shall be used where specified by the manufacturer.

(g) Washers shall be used under all bolt heads and nuts.

6.4.4.2 PE stub flanges

The following applies to PE stub flanges:

(a) Flanged connections from a PE pipe to a flanged connection shall be made using butt fusion welded stub-flange or electrofusion stub flange.

(b) An adapter flange will be required for pipe above DN 180.

(c) Fittings such as “Slimline” stub flanges that reduce the wall thickness or reduce the pipe internal diameter will normally not be allowed.

6.4.4.3 Bulk water pipelines, trunk pipelines and general reticulation greater than DN 500

The following applies to bulk water pipelines, trunk pipelines and reticulation pipelines greater than DN 500:

(a) Flanges shall comply with AS/NZS 4331.1 PN16 unless otherwise specified.

(b) AS/NZS 4331.1 PN25 flanges shall be used where design pressures dictate.

(c) Flanges on steel pipes shall be flat faced, slip-on style flanges.

(d) All Blank flanges and flanges on access manholes shall be coated with 300 microns of Carboguard 690 or an alternative approved in writing by Wellington Water. The sealing faces of the flanges shall remain uncoated.

6.4.5 Copper pipe

The following applies to copper pipes:

(a) Copper pipes shall be joined to adjacent copper pipe by brazing.

(b) Where a connection to fittings or other material types is required, gunmetal crox nuts and nipples onto a BSP threaded transition piece is the approved method of connection.

(c) Jumper cables shall be used when working on existing copper services. This is to protect the pipe fitter from potential electric currents from properties earthed to the pipe.

6.4.6 Steel pipe welding

6.4.6.1 Welding specification procedure

All welding shall be carried out to the requirements of BS 2971 or ASME B31.4.

A Welding Procedure Specification (WPS) shall be provided to Wellington Water representative for approval at least 5 days prior to beginning work. The WPS shall include:

(a) Type of welds required

(b) Welders and their qualifications

(c) Equipment to be used and

(d) Methodology to be used.

6.4.6.2 Qualifications

All welding is to be carried out by a welder certified to AS/NZS 2980:2007. The certificate of any welder employed on the project shall be produced on request.

6.4.6.3 Safety

The following applies to steel pipe welding safety:

(a) Appropriate practices are described in AS/NZS 2865 and WTIA TN7[14] adopted by Worksafe Mahi Haumaru Aotearoa.

(b) Ventilation shall be appropriately addressed in Health and Safety procedures for both internal and external welding operations.

6.4.6.4 Welding considerations

The following considerations shall be accommodated in all WPS and welding operations:

(a) All welding shall be carried out with the pipework in a clean and dry condition. Where the work consists of pipework leak repair or a cut-in, every effort shall be made to obtain a watertight isolation

(b) Windbreaks and shelters shall be provided to protect the weld area from inclement weather.

(c) Butt welds must be full penetration.

[14] *Health and Safety in Welding – Technical Note 7 (TN7).Welding Technical Institute of Australia (WTIA). 2006. See https://worksafe.govt.nz/topic-and-industry/welding/health-safety-in-welding/*

(d) Fillet welds shall have equal leg length and have a throat of 0.7 x leg length plus 0 to 20% leg length and shall be mitred or slightly.

(e) A distance of at least 300 mm or 30 degrees of the pipe diameter shall be used to stagger any longitudinal welded joints between adjacent pipe sections.

(f) All circumferential lap welds in pipelines of DN 600 or greater shall be seal welded internally and externally, with the lining repaired post-welding and testing.

(g) The out-of-roundness of the pipe shall not exceed the lesser of 10% of pipe diameter or 10 mm.

(h) Welds joining temporary attachments to the pipeline must be to the same quality as the final weld is required. Temporary attachments must be removed carefully and the area visually inspected for any deleterious surface flaws

(i) All welding consumables shall be stored to the manufacturer's instructions and shall meet the recommendations given in ASME B31.4.

6.4.6.5 Welding preparation

The following applies to the preparation of steel pipe for welding:

(a) The weld preparation shall be clean, dry and free from grease, oxides, paint, dirt, slag or any foreign material that will affect the welding process and quality.

(b) All pipe materials 15 mm either side of the weld preparation shall be clean and rust free prior to any welding.

(c) All cut material shall be free of burrs.

(d) Surfaces to be welded shall be free of laminations, gouge marks, slag and any harmful condition that may affect the quality requirements of the deposited weld metal.

(e) Prior to commencing any welding, defects to the following maximum depths shall be removed by grinding to produce a cavity with a weld to depth ratio of not less than 4 to 1:

  (i) For manual welding (MMAW, GTAW): 2 mm

  (ii) For automatic welding (MMAW, GTAW): 1 mm, and

  (iii) Imperfection exceeding the above limits shall be weld repaired using an approved repair welding procedure.

(f) Pipes shall be held in the correct alignment and position using an alignment device until welding has been completed.

(g) Packers shall not be used when using welding bands. Gaps are to be filled using a 'buttering' method.

(h) Where unintentional excessive gaps occur due to ovality, buttering of the pipe with a layer no more than 10 mm thick of weld metal may be permitted to achieve the required root gap.

  (i) Buttering is not to be used as a general fabrication technique.

  (ii) All deposited weld metal shall be dressed smooth to meet the shape required before completing the weld.

  (iii) Buttered weld metal shall not protrude into the pipeline bore.

6.4.6.6 Butt welds and branch connection welds

The following applies to butt welds and branch connection welds:

(a) The root gap shall not be greater than 3 mm.

(b) The bevel angle shall be prepared within -0 to +5 degrees of the tolerance specified in the welding procedure.

(c) For single sided welding, the tolerance on the root gap shall not be -1.5 mm to +3.0 mm of the tolerance specified in the WPS.

(d) The gap between the mating surfaces of fillet welds shall not exceed 2.0 mm.

(e) Butt weld cap reinforcement shall not exceed 3 mm with a slope not exceeding a ratio of 4:1.

(f) The weld penetration into the pipe bore shall be even and not exceed 3 mm.

(g) The weld toes of butt and fillet welds shall blend smoothly with the parent material.

6.4.6.7 Tack welds

The following applies to tack welds:

(a) Tack welds must be to the same quality and workmanship as the final weld and strong enough to withstand the fabrication welding stresses.

(b) They should have a length of not less than the lesser of 40 mm or four times the thickness of the material.

(c) Tack welds that are not removed must be fully melted and incorporated into the completed weld.

(d) The size of tack welds shall be proportioned to withstand the load requirements and restraint of the weld joint being made.

(e) All cracked tack welds shall be completely removed before final welding commences.

(f) Tack welds that form part of the completed welds shall be ground at the start and the finish and completely fused into the final weld. The suitability of the technique shall be demonstrated to the satisfaction of Wellington Water or their delegated representative.

6.4.6.8 Flanged connections

The following applies to flanged connections:

(a) Flanges shall be welded to the pipe, square to the pipe end.

(b) The flange shall not be a tight fit on the pipe. However, the clearance between the outside diameter of the pipe and the bore of the flange shall not exceed 3 mm at any point, and the sum of the clearance on any diameter shall not exceed 5 mm during welding.

(c) Flanges shall be welded on both sides.

(d) See **Section 6.4.6.12 Repairs to concrete lining**.

6.4.6.9 Workmanship

The following applies to the workmanship of steel pipe welding:

(a) For double sided full penetration butt welds, the second side shall be cleaned to sound metal prior to depositing the second side runs. Should carbon arc air gouging be used, all carbon and other residue shall be completely removed by grinding or other approved mechanical means. Only qualified welders competent in gouging techniques shall be employed.

(b) All welds shall blend smoothly with the parent material and have a consistent profile.

(c) The use of backing bars requires the prior written approval of Wellington Water.

(d) The width of individual submerged arc weld beads shall not exceed seven times the consumable wire diameter.

(e) Peening of the final pass is not permitted.

6.4.6.10 Welding interruptions

The following applies interruptions to the welding process:

(a) Wherever possible, welding shall be a continuous operation.

(b) Welding shall not be discontinued before at least the root run and the hot pass are complete.

(c) If welding must be interrupted, the weld area shall be covered with a heat blanket to permit slow cooling.

(d) Before resumption of welding, on welds cooled to ambient temperature, the area shall be inspected visually for the presence of cracks. Where cracks are suspected, the weld shall be inspected by magnetic particle or dye penetrant examination by qualified specialist in non-destructive testing to determine acceptability.

(e) Following an interruption in welding, any required preheat shall be restored to the value indicated in the WPS before resumption of welding.

6.4.6.11 Testing and inspection

The following applies to testing and inspection of steel pipe welding:

(a) Following completion of joint welding and prior to the protective coatings and linings being applied, all welds shall be visually inspected.

(b) The weld metal as deposited shall meet the requirements of AS/NZS 2980:2007.

(c) No melting of the corners shall be allowed to occur to such an extent as to reduce the throat thickness of the weld.

(d) The weld metal shall be properly fused with the parent metal without undercutting or overlapping at the toes of the weld. Slight, intermittent occurrences may be permitted provided that the undercut or overlap does not form a sharp notch. The stop and start of each run of weld shall merge smoothly and shall show no pronounced hump or crater in the weld.

(e) All double lap welds of hemi-spherical joints shall be pressure tested. Nitrogen shall be introduced into the annular cavity between the welds, through tapped holes to a pressure of 1,000 kPa within the joint.

  (i) Oxygen or acetylene shall not be used for this test.

  (ii) The source of pressure shall be removed and the pressure in the joint monitored for 10 minutes using a suitably calibrated gauge.

  (iii) If the pressure in the annular cavity drops, both the welds shall be checked for leaks by applying a film of soap solution.

(iv) Detected leaks shall be marked and repaired by grinding and re-welding and the joint retested.

(v) The soap solution shall be washed off prior to any remedial work and at the completion of the inspection.

(f) Test results and any rework involved to complete a successful joint test, shall be recorded. A copy of this record shall be provided to Wellington Water.

(g) Wellington Water may require a specialist welding consultant to carry out further non-destructive testing. If defects exceed the acceptable limits, the defects shall be repaired and the welds retested.

6.4.6.12 Repairs to concrete lining

Welded pipe joints, bends and reducers shall be concrete lined by the hand application of an epoxy bonding agent and mortar as specified below.

(a) The bare steel between the ends of the pipe interior lining shall be cleaned of rust and other contaminants by wire brushing. At the time of application of the epoxy bonding coat the steel surface shall be free from all foreign substances liable to initiate rusting or liable to impair the bond between the pipe surface and the bonding coat.

(b) A bonding primer shall be used for large areas of pipe lining repair including welding bands, slip-in joints. The steel pipe surface shall be coated with Nitobond EP or a similar product approved in writing by Wellington Water. The coating shall be sufficiently mixed in accordance with the manufacturer's specification, and in sufficient batched lots to complete the bond priming of the bare steel.

(c) The concrete lining shall be repaired to the same thickness as the adjacent factory lining.

(d) Concrete lining must be reinstated up to the pipe end at flange joints and pipe ends.

(e) The existing concrete lining adjacent to the repair shall be cut back to sound material, with the cut face at right angles to the lining surface.

(f) The surface of the cured bond primer shall be scarified to improve adhesion, and a pre-mixed cement mortar with polymer fibres shall be applied to complete the lining repair. The mortar shall be Renderoc HB70 or a similar product approved in writing by Wellington Water, and shall be hand applied in such a manner to produce a tight, well compacted pipe lining, with the surface trowelled smooth to conform to the minimum mortar thickness.

(g) Small areas may be repaired using a Wellington Water approved AS/NZS 4020 compliant epoxy mortar such as Emaco S88C or Humebond when applied to the manufacturer's recommendations. Renderoc HB70 mortar or similar product approved in writing by Wellington Water can be used without bonding primer where there is only a thin strip of lining to repair such as at the end of pipe at flanges and couplings.

(h) The mortar lining, when completed, shall be well finished with no evidence of laitance and surface irregularities to give a smooth, true, dense surface, entirely continuous with the factory applied pipe lining. Where irregularities are identified, the lining shall be cut back and relined.

(i) Concrete lining that has not adhered to the steel surface shall be replaced. Lack of adhesion shall be identified by tapping the surface with a hammer and listening for a distinct hollow sound.

6.4.6.13 Repairs to external coatings

Any damaged **polyethylene wrapped** external coating on steel pipe shall be repaired in the following sequence:

(a) Cut away any loose coating and thoroughly clean the damaged area.

(b) Thoroughly wire brush the area.

(c) Apply primer as per manufacturer's instructions, overlapping the undamaged area by 100 mm.

(d) Apply a double layer of polyethylene tape starting 150 mm beyond the damaged area and 50 mm clear of the primer, wrapping in a spiral form similar to the existing coating. Ensure joints overlap by 25%. A second layer of outer wrapping shall be applied for added protection. Wrapping shall be applied in accordance with the tape manufacturer's recommendations.

(e) Alternatively, heat shrinkable sleeves may be used as described below.

Heat shrink sleeves shall be used to protect slip-in welded joints, welding bands and welded mitre joints less than 15 degrees. The following applies to heat shrink sleeves:

(f) Heat shrink sleeves shall be adhesive bonded wraparound shrink sleeves lined with a thick aggressive hydrophobic adhesive.

(g) The overlap patch is coated with a high softening point hot melt adhesive that bonds to the sleeve to protect the overlap from being peeled back while in service.

(h) The sleeve width shall be 450 mm.

(i) The correct temperature of the closure patch during application shall be shown with thermochromic paint.

(j) The sleeves shall be *Raychem* wraparound heat shrink sleeves, *UBE* shrinkable sleeves, or equivalent as approved in writing by Wellington Water.

(k) Be installed within two hours after a successful weld test. The following sequence shall be followed for applying heat shrink sleeves, although the manufacturer's instructions are to be strictly adhered to:

  (i) After welding, the weld area shall be power wire brushed to bright metal. The pipe coating shall be cleaned by brushing to 100 mm back from the edge of the proposed sleeve position to remove dirt.

  (ii) The area to be sleeved shall be evenly preheated to the manufacturer's recommended requirements. The sleeve shall overlap undamaged coating by a minimum of 80 mm.

  (iii) The sleeve shall be positioned and heat applied as recommended by the manufacturer.

6.4.7 Ductile Iron Pipe

The following applies to joints in ductile iron pipe:

(a) Ductile iron pipe jointing shall follow the joint manufacturer's specification.

(b) If repairs are needed to sleeving, it shall be repaired using tape for holes or tears smaller than the width of the tape. Sleeving shall be repaired using a patch of sleeving sealed with either tape or strap and buckle for larger holes or tears.

6.4.8 Cold solvent cement welds

The following applies to cold solvent cement welds:

(a) Only ABS pipes shall be jointed using cold solvent cement welds. ABS pipe shall only be welded to other ABS pipes and ABS fittings.

(b) The pipe shall be cut square, chamfered and free of burrs. Mating surfaces shall be abraded with emery tape.

(c) All mating surfaces shall be wiped and cleaned with a methyl ethyl ketone (MEK) solvent to ensure all water, dust, dirt, oil, grease and solvents are removed prior to applying a proprietary ABS solvent cement. Thinners shall not be used on the solvent cement or MEK.

(d) Solvent cement shall be applied as per manufacturer's recommendations. This may require multiple coats on larger pipe diameters. The spigot and socket shall then be immediately joined and axial pressure sustained for the appropriate welding period. Pipe sizes greater than DN 150 require a mechanical means of applying the sustained axial pressure such as a lever winch and strops or similar.

(e) Excess solvent cement at the join shall be cleaned up immediately.

6.5 Pressure testing of pipelines

Prior to commissioning of a pipeline, the pipeline and associated valves and fittings shall be pressure tested:

(a) Long pipelines shall be divided into smaller sections for testing. Test sections shall not exceed 400 m unless approved by Wellington Water.

(b) Long steel pipelines with slip-in welded joints can be pressure tested in one length.

(c) All tests shall be carried out in the presence of Wellington Water who will sign the appropriate documentation provided by the developer to verify acceptability of the test results.

(d) A minimum of 48 hours of notice is required to be given to Wellington Water prior to the test being carried out.

(e) The developer shall provide all equipment and materials needed to carry out the test.

(f) The developer is required to have met the following requirements prior to pipe testing and Wellington Water arriving on site:

  (i) All trenches excavated and pipes laid.

  (ii) All lines thoroughly flushed and all residual debris cleaned out.

  (iii) All fittings and connections (except to the live network) installed prior to pressure test.

  (iv) Pipe anchored securely.

  (v) Pre-test soaking completed.

(g) All air must be released from the pipeline during the filling operation. After all air has been released the pressure in the pipeline shall be allowed to build up to normal working pressure.

(h) The new pipeline shall be left to stand at this pressure for at least 24 hours prior to the pressure test.

(i) The test design must address potential health and safety risks of pipe fitting failure during filling, pre-test soaking and during the pressure test.

6.5.1 Testing of steel, ductile iron, and PVC pipes

Steel, DI and PVC pipelines shall be tested in accordance with the constant pressure (water loss) method as specified in AS/NZS 2566.2 and Appendix M4. Test duration shall follow **Table 6-7.**

Table 6-7 – Pipeline test durations for the constant pressure (water loss) method

Pipeline Nominal Diameter	Test Duration h (hours)
100 mm to 200 mm	1 h
200 mm to 600 mm	2 h
600 mm and above	3 h

The specified test pressure, measured at the lowest point in the pipeline, shall be:

(a) 1.25 x the working pressure of the pipeline with a minimum test pressure of 1,200 kPa for PN12 PVC pipe.

(b) 1.25 x the working pressure of the pipeline with a minimum test pressure of 1,600 kPa for PN15 PVC pipe.

(c) 1.5 x the working pressure of the pipeline with a minimum test pressure of 1,200 kPa for DI and steel pipe.

6.5.2 Testing of polyethylene pipes

PE pipes shall be tested by either the pressure rebound method or the pressure decay method.

6.5.2.1 Pressure rebound method

The pressure rebound method shall be used to test short sections of small pipe. This test method shall be limited to the pipe sizes and lengths in **Table 6-8**.

Table 6-8 – Pipe sizes and lengths suitable for pressure rebound method

Pipe size	Maximum allowable test length
63 mm	400 m
125 mm	350 m
180 mm	300 m
250 mm	250 m

The test shall not be used to test pipes larger than that listed in **Table 6-8**.

The PE pipeline shall be tested in accordance with pressure rebound as specified in AS/NZS 2566.2 and Appendix M7 except that:

(a) Specified test pressure (STP) for PE100 SDR11 (PN16) pipe shall be 1,700 kPa – when measured at the lowest point in the pipeline section.

(b) STP for PE100 SDR13.6 (PN12) pipe shall be 1,500 kPa – when measured at the lowest point in the pipeline section.

(c) The pressure drop shall be 30% of STP.

(d) The main test phase shall be 90 minutes.

(e) The pressure shall not drop at any time during the 90 minutes.

6.5.2.2 Pressure decay method

The PE pipeline shall be tested in accordance with pressure decay as specified in AS/NZS 2566.2 and Appendix M6. The STP shall be:

(a) For PE100 SDR11 (PN16) pipe shall be 1,700 kPa – when measured at the lowest point in the pipeline section.

(b) STP for PE100 SDR13.6 (PN12) pipe shall be 1,500 kPa – when measured at the lowest point in the pipeline section.

(c) The loading time t_L shall be not less than 50 minutes.

6.6 Pipe repairs

6.6.1 AC pipe failures

The following applies to the failure and repair of an AC pipe:

(a) The failure of a section of an AC pipeline shall result in the entire section of pipe between existing pipe joints being removed and replaced with a suitably rated length of approved PVC pipe.

(b) The PVC pipe shall be joined to the existing AC pipe with mechanical couplings at either end.

(c) Under no circumstances shall the AC pipe section be locally cut out around the point of failure and replaced, as the integrity of the remaining section of pipe is likely to be compromised by both the failure and initial aged condition.

(d) The AC pipe shall be bagged as per **Section 4.4 Working with asbestos cement pipes**.

6.6.2 PVC pipelines

The following applies to the failure and repair of PVC pipe:

(a) For PVC-U and PVC-O pipeline failures, the entire section of pipeline shall be removed and replaced with PVC-U pipe of the same or greater pressure rating. Jointing shall be achieved with mechanical couplings.

(b) PVC-M pipelines may be repaired by cutting out the failed section 300 mm either side of the failure, and at least 1 metre in length in total, and replacing with a suitable length of PVC-M pipe of the same pressure rating and joined with a mechanical coupling. If the failure is within 1 metre of a joint, the repair shall extend to, and include the joint.

(c) Where the failure is due to a leaking fitting, such as a tapping band, then a repair clamp is permitted to be used to make the repair.

6.6.3 Ductile iron and cast iron pipe failures

The following applies to the failure and repair of ductile and cast iron pipe:

(a) Failures due to pin holes can be repaired with a blank tapping band or a repair clamp.

(b) Cast-iron failures can be repaired using a section of ductile iron pipe and unrestrained mechanical couplings. Longitudinal splits require the entire pipe section to be replaced. Circular fractures can be repaired by either a repair clamp or by removing a section of pipe and replacing with a section of ductile iron pipe and joined with mechanical couplings.

(c) Ductile iron pipe failures should be repaired with a section of ductile iron pipe and restrained mechanical couplings. The plastic PE overwrap will also require reinstatement once the pipeline itself has been satisfactorily repaired.

(d) All couplings, repair clamps and tapping bands shall be suitably protected from corrosion by applying the full Denso system (primer, mastic, petrolatum tape and PVC outer wrap).

6.6.4 Steel pipe failures

The following applies to the failure and repair of steel pipe:

(a) Failures due to pin holes can be repaired with a blank tapping band or a repair clamp. Alternatively, a patch can be welded over the hole once all external coating has been removed.

(b) Larger failures will require the damaged section to be removed. Where the steel pipe section is in a continuously welded pipeline, the replacement section will need to be of the same diameter and joined to the existing pipe with butt welds and or welding bands. If unrestrained mechanical couplings are used, then tie-bolts shall be specifically designed and incorporated into the repair.

(c) Where the failure is not in a continuously welded pipeline, then the pipe can be joined using unrestrained mechanical couplings.

(d) All repairs shall be protected from corrosion using a suitable coating method such as heat-shrink sleeves, polyethylene tape wrap or the full Denso system (primer, mastic, petrolatum tape and PVC outer wrap).

6.6.5 Polyethylene pipe failures

The following applies to the failure and repair of PE pipe:

(a) Where possible, polyethylene pipe failures shall be repaired using electrofusion couplings and PE pipe of the same compound and diameter.

(b) Sufficient length of pipe either side of the repair shall be exposed to allow flexing of the pipe to maintain alignment across the electrofusion coupler.

(c) Electrofusion repair couplers shall be slip-on couplers.

(d) Electrofusion couplers shall NOT be used to repair the pipe where:

(i) The peel depth is less than the depth of scoring present on the pipe wall exceeds the depth of peel required.

(ii) The depth of indentation of the pipe wall by bedding chip exceeds the depth of peel required.

(iii) A drip-tight shut cannot be achieved.

(iv) Moisture lining the pipe wall cannot be controlled and removed.

(v) Adverse weather conditions.

(vi) Wet and muddy trench conditions.

(e) Care shall be taken to ensure suitable welding conditions are present before repairing the pipe.

(f) An electrofusion weld shall not be pressurised until the weld has reached ambient temperature. Typically, a period equivalent to twice the cool time shall elapse AFTER cool time is complete, and before the main is pressurised.

(g) Where electrofusion welding is not practicable due to in-situ conditions, approved mechanical couplings using grip-rings designed for PE pipe may be used. These shall be used with appropriate stainless steel pipe inserts. Where an electrofusion coupling or saddle has failed, the section with the faulty weld shall be removed and replaced with new PE pipe of the same compound and SDR.

6.7 Tapping of mains under pressure

The following applies to tapping mains under pressure:

(a) Under pressure tapping into a water main may be made using suitably designed equipment.

(b) Tapping saddles with built-in self-tapping connections are permitted.

(c) Tapping drills shall be either a twist drill for metallic pipes (20 mm to 32 mm connections) or a coupon retaining type for non-metallic pipes.

(d) Specialist equipment used for tapping large diameter connections shall be approved on a case by case basis. These shall retain the coupon after drilling for removal.

(e) Live tapping shall be carried out through a ball or gate valve (mains cock).

(f) After connecting the service pipe, the valve shall be secured in the open position by wrapping with petrolatum tape prior to backfilling.

6.8 Water supply shutdowns (cut-ins)

The following applies to temporary water supply shutdown (cut-ins):

(a) Temporary interruptions to the water supply network shall only be carried out in accordance with Wellington Water's supply shutdown process.

(b) All personnel carrying out shutdowns of the water supply must be under the supervision of a water qualified person on site at all times (Level 4 Water Reticulation) and must follow the Water NZ "Good Practice Guide – Hygiene Practices to prevent Water Supply Contamination".

(c) The shutdown plan shall use the correct template for water supply shutdowns:
   (i) Level 1
   (ii) Level 2 or
   (iii) Level 3.

6.8.1 General

The following applies to planned water supply interruptions:

(a) A shutdown plan must be submitted to Wellington Water at least five working days prior to the shutdown.

(b) Planned interruptions to normal water supply services shall, where possible, not be carried out during peak demand periods. The peak periods are:
   (i) 6am to 9am on any day
   (ii) 5pm to 9pm on any day and
   (iii) 7am to 11am Saturday, Sunday and public holidays.

(c) Where possible, shutdown shall be planned such that it does not last longer than 4 hours.

(d) Section 695 of the Health Act 1956 requires approval from the medical officer of health for any planned restriction or interruption of the provision of drinking water by a network supplier or a bulk supplier that is expected to exceed 8 hours .

6.8.2 Notifications

Interruptions shall be notified to the affected residents and business, as follows:

(a) Level 1 – Approved shutdown letters to domestic customers 24 hours prior to shutdown.

(b) Level 2 – Approved shutdown letters to affected business customers 5 working days prior to shutdown and to affected domestic customers 24 hours prior to shutdown.

(c) Level 3 – Approved shutdown letters to affected business customers within 5 working days prior to trial and shutdown and to affected customers 24 hours prior to trial and shutdown.

(d) Email shutdowns@wellingtonwater.co.nz 24 hours prior to any trial or actual shutdown. The Customer Hub will then advise the Client Council Call Centre and the New Zealand Fire Services. (This email address includes the Network Controller, all Customer Planning Engineers, the Customer Hub and Community Engagement Team.

(e) Email to the Project Engineer or Contracts Officers 24 hours prior to any trail or actual shutdown confirming that the shutdown is ready to proceed.

(f) Critical customers (dialysis patient, hospital, school or early childhood education facility) shall be notified 5 working days prior to any planned interruption of supply.

6.8.3 Critical and key account customers

The following applies to water supply shutdown and critical and key account customers:

(a) Critical and key account users include dialysis patients, hospitals, clinics, schools and educational facilities, and all non-residential customers.

(i) The designer shall contact Wellington Water (Customer Hub) to check for any dialysis patients within the planned shutdown area.

(ii) Critical and key account users shall be notified verbally as well as in writing.

(iii) A suitable time for the shutdown shall be negotiated with businesses where water is critical to the business (dialysis patient, schools, bakeries etc), or an alternative supply organised.

6.8.4 Trial shutdown

A trial shutdown will be required for all Level 3 shutdowns. In addition, Level 1 and Level 2 shutdowns may require checking to ensure all valves and hydrants are operable, and that there are no incorrectly closed valves in the network.

6.8.5 Reactive shutdown

The following applies to emergency and unplanned shutdowns:

(a) Emergency and unplanned shutdowns include reactive repairs to bursts, emergency situations, significant and major leaks and other situations which require an immediate isolation of the network to prevent further damage or risk to public health.

(b) Only Wellington Water Customer Operations Group (COG) shall carry out reactive shutdowns.

(c) In addition to following the Wellington Water Supply Process, reactive shutdown shall follow the Wellington Water COG Standard Operating Procedures (SOP).

(d) Affected customers shall be personally notified prior to the water being shut-off. Where customers are not present, a notice shall be left with the customer informing them of the interruption.

(e) Alternative supplies shall be arranged for critical and key account users where practicable.

(f) Where it is not practical to notify customers individually, the use of a clear and concise message broadcast over a vehicle mounted public address system may be used. This message shall be broadcast along the full length of all affected streets.

6.8.5.1 Emergency shutdown during planned construction works

Where the water supply network is inadvertently damaged during planned construction works, the contractor undertaking the works shall notify the Engineer to the contract, and the Wellington Water Customer Hub. The Wellington Water shall undertake a reactive shutdown and carry out any required repairs.

6.8.6 Temporary supplies

Any shutdown that requires a temporary supply into the network (such as trailer mounted temporary PRV, hydrant feed, tanker supplies, temporary pipes etc.) shall be classified as a Level 3 shutdown and follow the appropriate processes. These alternate supplies may require hydraulic calculations to confirm they are suitable.

6.9 Manholes

The following applies to manhole design:

(a) Manholes shall be designed to withstand HN-HO-72 loadings as a minimum, or greater in areas where additional loading is anticipated, such as airports or loading yards.

(b) Risers shall typically be precast reinforced concrete units complying with AS/NZS 4058 as a minimum for manufacturing. The manufacturer is to certify the riser design is suitable for the design loading.

6.9.1 Manhole construction

The following applies to manhole construction:

(a) The diameter of cast-in-situ bases of precast manholes shall be at least 300 mm plus the outside diameter of the manhole and shall be at least 150 mm thick.

(b) Manholes with a precast base shall be placed on a wet concrete bed or on 150 mm of bedding material.

(c) Precast manhole bases shall be used for all manholes constructed below the water-table or sea level.

(d) Manholes shall have the minimum practical number of risers. For the majority of manholes, only one riser will be necessary.

  (i) If more than one riser is used, a layer of mortar or an appropriate epoxy shall be placed on the joint before positioning the next riser.

  (ii) Proprietary rubber rings or butyl mastic strips shall also be used to seal between riser sections. Rubber rings shall be appropriately lubed and set before jointing.

  (iii) Similarly, a layer of mortar shall be placed on the top of the top riser before placing the manhole roof.

  (iv) Epoxy ***shall not*** be used between the lid and the riser in case the lid needs to be removed in the future.

6.9.1.1 Manhole design against liquefaction

See **Section 5.6.1.1 Manhole design against liquefaction**.

6.9.2 Manhole rungs

See **Section 5.6.3 Manhole rungs**.

6.9.3 Manhole lid construction

See **Section 5.6.10 Manhole lid construction**.

6.9.4 Hinged manhole covers

Where hinged manhole covers are installed in the carriageway, covers shall be oriented such that the hinge is oriented towards oncoming traffic.

6.9.5 Manhole safety grilles

See **Section 5.6.4 Manhole safety grilles**.

6.10 Connections to the main

The following applies to main connections:

(a) Any service pipe or fire service connection to a main, excluding a junction with another rider main or principal main, shall comply with this section.

(b) Pipes shall comply with the permitted types in **Section 6.2 Materials**.

(c) Tapped connections through the pipe wall shall be the greater of 500 mm, or 5 times the diameter of the principal main, from any other connection, pipe joint or fitting.

(d) It is important that the swarf from any tapping activity is removed from the pipe before commissioning.

(e) Tapped clamps shall only be used to repair a main where a ferrule has blown out or similar.

(f) All connections shall be installed with warning tape as per **Section 6.3.8 Warning tape / tracer wire**.

(g) Ductile iron tee sections or tapped connectors shall be used on:

  (i) Connections 40 mm or greater on 100 mm principal mains and

  (ii) Connections 50 mm or greater on principal mains 150 mm and greater.

6.10.1 Connections to the bulk water pipeline

The connections to existing in-service bulk water pipelines will be carried out by Wellington Water.

6.10.2 Service connections

Connections to the mains shall be made with:

(a) Tapping bands as per **Section 6.2.13.1 Mechanical tapping bands**.

(b) Electrofusion saddles as per **Section 6.2.13.2 Electrofusion tapping saddles**.

(c) Tee sections as per **Section 6.2.13.8 Bends and tees**.

(d) Tapped connectors as per **Section 6.2.13.8 Bends and tees**.

6.10.2.1 Existing galvanised iron service pipes

Existing galvanised service iron pipes shall be replaced where practicable. Where renewal is not practicably imminent, connections to the existing galvanised iron pipe shall be made using compression fittings designed specifically for this purpose.

6.11 Fire Services

The following applies to fire services:

(a) Branches off a principal main for a dedicated fire service supplying a building or complex shall be either concrete lined steel, concrete lined ductile iron or PE100 materials compliant with this specification.

  (i) The fire service branch shall be buried when in road reserve and shall be constructed in compliance with this specification up to the fire service valve (point of supply).

(ii) PE100 shall only be used where:

1. The principal main it connects to is also PE100.
2. The fire service branch does not require the installation of bends between the principal main and the fire service valve.
3. A minimum depth of cover equivalent to that required for a principal main is maintained between the principal main and the fire service valve.

(b) Fire service layouts shall comply with the requirements of NZS 4541 and NZS 4517.

(c) The fire service valve shall be located in the berm or footpath where possible, at least 500mm from the boundary.

(d) The fire service valve cover shall be clearly marked with the letters FS and painted green.

(e) Mechanical meters are not permitted on fire/sprinkler services for non-residential installations that are greater than 50 mm in diameter. Where a meter is required, a magnetic meter shall be installed.

6.12 Disinfection

6.12.1 New or lined pipelines

Prior to the commissioning of any pipeline, the pipeline and associated valves and fittings shall be disinfected and bacteriologically tested to eliminate risks to the public.

6.12.1.1 Chlorination

The following applies to disinfecting new or relined pipelines:

(a) The pipeline shall be thoroughly flushed with potable water to clear any debris.

(b) It shall be completely filled with water with a consistent level of chlorine between 20 and 30 ppm (mg/L).

(c) All hydrants and valves shall be operated to ensure all surfaces make contact with the highly chlorinated water.

(d) The pipeline shall be left to sit for 24 hours and the level of residual chlorine measured at three locations along the pipeline.

(e) The pipeline will be sufficiently chlorinated if the chlorine is 10 ppm or greater at all sample points.

(f) Prior to completion of the pipeline end connections, the highly chlorinated water shall be flushed from the pipe and replaced with potable water.

(i) The flushed water may be discharged to the nearest convenient stormwater system if the water is dechlorinated using sodium thiosulphate and the remaining residual chlorine concentration meets the permitted activity standard in the regional plan.

(ii) If the flushed water is to be discharged to the wastewater system, written approval is needed from Wellington Water, which may include the need to consider trade waste bylaws and the rate of discharge so as not to overload the sewer pipes or any downstream wastewater pumping stations.

(iii) An air gap must be maintained at the point of discharge.

6.12.1.2 Bacteriological testing

After disinfection and flushing, and prior to commissioning, the pipeline shall be tested to ensure disinfection was successful.

(a) A technician from a Wellington Water approved testing laboratory shall take samples over the full length of the pipe.

(b) If possible, two samples shall be taken over the first 100 m of the pipeline, and an additional sample from locations approximately every 100 m thereafter.

(c) A minimum of two samples is required for any pipeline.

(d) The samples shall be tested for residual chlorine levels and *E.coli*.

(e) The pipeline shall be deemed acceptable for commissioning if residual chlorine < 1 mg/L and *E. coli* < 1.

(f) If a pipeline fails the bacteriological tests, or if it is contaminated after testing, the pipeline shall be disinfected again, and bacteriological testing repeated prior to placing the pipeline into service.

6.12.2 Repairs

Repairs to pipelines that are in service shall be cleaned and disinfected in the following way:

(a) All fittings and pipes shall be sprayed and swabbed with a super-chlorinated solution (50 ppm residual chlorine) and protected from contamination.

(b) The internal lining of the open ends of pipelines shall be sprayed and swabbed with the super-chlorinated solution. Care shall be taken to ensure water from the trench does not enter the pipeline.

(c) After the repair is made, and where practicable, the repaired pipe shall be flushed such that potable water is drawn both ways through the repair location.

6.12.3 Reservoirs

Please note that these sections on reservoirs are currently under review and the most up-to-date guidance must be sought from Wellington Water.

6.12.3.1 Chlorination

Where it is necessary to chlorinate an existing reservoir to improve the level of free available chlorine, the following specification shall be followed:

(a) The standard chemicals used for chlorine dosing of potable water reservoirs are calcium hypochlorite in the form of HTH granules and sodium hypochlorite in the form of a solution.

- (i) Calcium hypochlorite (HTH) typically has an available chlorine level of between 60% and 65%.
- (ii) Sodium hypochlorite (SHS) typically has an available chlorine level of 15%.
- (iii) The level of available chlorine shall be checked prior to calculation for both HTH and SHS.

(b) A Ct = 7200mg/Lmin shall be achieved to provide effective chlorination of reservoirs.

(c) The use of other chemicals for the dosing of reservoirs is not permitted without the approval of Wellington Water.

(d) Previous experience has shown that the introduction of undissolved HTH granules or SHS solution through the reservoir hatches and allowing circulation by filling the reservoir is effective.

6.12.3.2 Chlorine dosage

The following applies to the chlorine dosage for reservoirs:

(a) Dosing of reservoirs is generally carried out to between 0.1 ppm and 0.3 ppm depending on the severity of the contamination and sensitivity of the consumers supplied. This has been found to be effective for treating low levels of bacterial contamination. Dosage levels are to be specified by Wellington Water.

(b) Once the required dosage has been verified, the amount of chlorine to be added to the reservoir must be determined. This can be done by physically measuring the depth of water within the reservoir to be dosed and calculating the volume by multiplying the depth measured by the reservoir floor area. Reservoir levels and storage volumes can also be obtained for most reservoir sites directly from the Wellington Water's SCADA system.

(c) Once the required dosage and volume of water are known, the amount of HTH or SHS can be calculated using the following formula:

$$HTH(g) or SHS(L) = \frac{Vol(m^3) \times req.dosage(ppm) \times 100}{Available Cl(\%)}$$

Available Cl for HTH = 65%

Available Cl for SHS = 15%

(d) Where a chlorine residual is or may be present prior to chlorinating the reservoir, a chlorine residual test shall be carried out on the reservoir water to determine the available chlorine already present. This must be allowed for when calculating the amount of chlorine to be added to ensure the correct dosage is achieved.

(e) Measurement of the quantity of HTH or SHS can be by weight or volume. Measurement by volume is generally more convenient and should be carried out using a measuring cylinder graduated to 20 ml.

  (i) 100 g of HTH will measure 90 ml. For smaller quantities 1 teaspoon of HTH is 5 g by weight.

6.12.3.3 Dosing procedure

The following applies to the dosing procedure for reservoirs:

(a) Water shall be fed into the reservoir through either manual operation of the pumps or other means of inflow control (e.g., control valve) prior to the addition of any chlorine into the reservoirs.

(b) This is arranged through the maintenance contractor and may involve liaison with the Wellington Water bulk water supply operators for those reservoirs supplied from the bulk water supply system.

(c) Flow of water into the reservoir shall be maintained for a minimum of ½ hour following the addition of chlorine or until the reservoir is full. Inflow into the reservoir shall stop before the reservoir top water level reaches the overflow level.

(d) The quantity of Chlorine shall be determined and introduced into the reservoir by uniformly scattering over the water surface over as large an area as possible via the reservoir entry hatches.

(e) Reservoirs having separate inlet and outlet pipelines shall have the Chlorine added through the hatch at the opposite end of the reservoir to the outlet pipeline.

(f) Regular water samples shall be taken from the reservoir outlet sampling tap and within the reticulation system over a 24 hour period to ensure satisfactory dispersion of the chlorine has been achieved.

6.12.3.4 Communication

The following applies to communication of cleaning and disinfection of reservoirs:

(a) Co-ordination with the Wellington Water bulk water operators may be required with regards to filling the reservoir if the reservoir is directly supplied from the bulk supply network.

(b) It is important to maintain communications with the drinking water assessor (Regional Public Health) throughout the process.

(c) Any anomalies in the commissioning process or sample results should be conveyed to the drinking water assessor for consideration of its significance.

(d) The disinfection procedure requires the handling of chemicals, and all staff handling the products should be appropriately equipped and trained in the safe handling and use of the chemicals.

6.12.3.5 Disinfection equipment

The following applies to disinfection of reservoir equipment:

(a) All equipment should be disinfected using a 50 mg/L chlorine solution.

(b) This includes all equipment to be taken into the reservoir and all clothing that will be in contact with the interior such as boots and gloves.

(c) A boot wash should be present at the hatch so footwear can be cleaned prior to entry.

(d) All brushes, shovels, hoses, machinery etc should be disinfected.

(e) Reservoirs are a confined space and petrol driven water blasters should not be used inside the reservoir without proper precaution.

6.12.3.6 Washdown

The following applies to the washdown of reservoirs:

(a) The walls, floor, ceiling and columns should all be scrubbed with a 50 mg/L (min) chlorine solution and hard bristled brushes.

(b) Care should be taken not to damage any internal seals and water blasting should be considered with care.

(c) Once the reservoir has been washed down; all equipment shall be evacuated and a pre-filling inspection carried out by the Wellington Water to ensure all areas have been suitably cleaned and all material has been removed to Wellington Water's satisfaction.

(d) The reservoir shall not be filled until Wellington Water is satisfied with the results of the wash down and has issued clearance.

6.12.3.7 Filling and dosing

The following applies to filling and dosing reservoirs:

(a) Once clearance has been received, the reservoir can be filled by opening the inlet valve (if the reservoir is designed with a top entry filling arrangement) or by water entering the reservoir via a hose through the hatch to maintain an air-gap.

(b) The reservoir should be filled to the overflow level.

(c) The reservoir is required to have a final free available chlorine concentration of at least 10 mg/L post-filling. This can be achieved through the use of a continuous dosing plant or by regular introduction of disinfectant solution as the reservoir fills.

(d) Any disinfectant introduced should be in a dilute solution form (i.e., do not introduce dry form HTH granules directly).

(e) Some mixing of the reservoir is likely to be required, and this can be achieved using a suitably disinfected powered mixer.

(f) Dosing should be calculated at:

$$HTH(g) = \frac{Vol(m^3) \times req.dosage(ppm) \times 100}{AvailableCl(\%)}$$

Where:

Vol	is the volume of water in the reservoir in m^3
HTH	(High Test Hypochlorite) is Calcium Hypochlorite dry granules. This can be replaced with Sodium Hypochlorite liquid (mL)
Req. dosage	is the target chlorine residual, typically around 0.3 ppm (mg/L) for reservoirs in normal operation
AvailableCL	is the available chlorine in the additive, either HTH (typically ~65%) or Sodium Hypochlorite (typically ~15%)

6.12.3.8 Sampling

The following applies to chlorine sampling in a reservoir:

(a) The chlorine residual of the tank should be tested 48 hours after filling to ensure suitable levels have been maintained.

(b) The chlorine residual should be at least 10 mg/L.

(i) If the sample results drop below 10 mg/L, it is indicative of some form of contamination and the water quality should be considered compromised.

(ii) The reservoir should be drained as per **Section 6.12.3.9 Draining the reservoir**, and thoroughly investigated to locate the source of the contamination.

(iii) The contamination may be due to animal or vegetable matter in the reservoir or a residual construction chemical depleting the chlorine. Once the source is identified, the disinfection procedure can be repeated from the washdown stage.

(c) Alternatively, the chlorine residual could be increased back above 10 mg/L by introducing additional disinfectant and monitoring for an additional 24 hours.

6.12.3.9 Draining the reservoir

The following applies to draining a reservoir after disinfection:

(a) If the residual chlorine concentration meets a permitted activity standard in the regional plan, the water may be discharged to the nearest convenient stormwater system.

(b) If the water is to be discharged to the wastewater system, the discharge needs written approval from Wellington Water, which may include the need to consider trade waste bylaws and the rate of discharge so as not to overload the sewer pipes or any downstream wastewater pumping stations.

6.12.3.10 Refilling of the reservoir

If the sampling results are satisfactory, the outlet and scour valves should be checked to ensure they are tightly closed, and the reservoir can be refilled using the normal inlet works. No air gap is required for this filling stage.

6.12.3.11 Pre and post-commissioning sampling

The following applies to pre- and post-commissioning sampling of reservoirs:

(a) A three day sampling programme shall begin once the reservoir has been filled.

(b) The drinking water assessor (Regional Public Health) shall be given at least two days advanced warning of the filling to ensure the drinking water assessor is aware of the sampling programme.

(c) Sampling of the waters should be sub-surface (at least 300 mm below the surface) and may require specialist equipment (suitably disinfected).

(d) The samples shall be sent immediately to the laboratory (if the samples were not collected by lab staff), where they shall be tested for:

(i) Total coliforms

(ii) E.Coli (<1)

(iii) Free available chlorine (<1 mg/L)

(e) The sample results shall be sent to the drinking water assessor who will advise of any concerns they may have with the results.

(f) An upper limit has not been set for total coliforms; however, a high result may result in the disinfection process being repeated as elevated total coliform counts may indicate poor disinfection contact time or non-faecal contamination.

6.12.3.12 Commissioning

The following applies to commissioning of reservoirs:

(a) The reservoir outlet valve can only be opened on the advice of Regional Public Health. The outlet valve will be operated by Wellington Water staff.

(b) The Wellington Water bulk water operators will need to be informed if the reservoir is filled directly from the bulk supply to ensure communication between the reservoir and the pumping station/filling valve is properly established and monitored.

(c) A commissioning plan should be established to detail the valving sequence to both commission the reservoir and terminate any alternative supply in operation.

(d) Wellington Water operational staff will take over full operational control of the reservoir once the final set of sample results are cleared by the Regional Public Health. All locks will be changed to the appropriate security series locks and access to the reservoir interior by the contractor is strictly forbidden without permission from Wellington Water.

(e) The contractor is still permitted to carry out works on the exterior, but care is to be taken around operational fittings such as air-valves and hydrants.

6.13 Reservoirs

The following applies to reservoirs:

(a) Reservoirs shall be above ground or buried reinforced concrete tanks.

(b) Reservoirs shall only be buried if required by the District Plan or by a resource consent condition.

(c) The concrete cover to reinforcement shall be increased 10 mm over and above the requirements of NZS 3101.1&2 to improve the durability of the reservoir.

(d) The minimum standard for fencing shall be a 1.8 m high, 50 mm diamond, 2.5 mm wire diameter chain link fence with rails top and bottom. However, any fence must be agreed with Wellington Water to complement the surrounding environment.

6.13.1 Foundation and geotechnical assessment

The following applies to reservoir foundation and geotechnical assessments:

(a) A geotechnical assessment shall be carried out to determine the suitability of the foundation material for the reservoir.

(b) Drilling on the proposed site, bore logging and interpreting of the data shall be carried out to support any geotechnical investigations.

(c) A spectra assessment shall be carried out on the proposed site by a recognised seismologist.

6.13.2 Structural design requirements

The structure shall be designed with a 100 year life expectancy and the design shall comply with contemporary design codes which shall include, but not limited to, the NZBC, NZS 3106 and AS/NZS 1170. For serviceability (SLS) and ultimate limit state (ULS) definition, see **Section 2.2 Definitions**.

6.13.2.1 General requirements

The following applies to general structural reservoir design:

(a) All roof and floor grades shall have a minimum grade of 1%.

(b) Walls shall be either cast in-situ reinforced, pre-stressed concrete or precast concrete wall panels. Precast column, beam and roof units are acceptable.

(c) Loadings design shall include those from slosh, excavation for repair and rapid changes in water level.

(d) Any floor, wall or roof joint (including construction joints) shall have the same life as the structure. The Consultant shall consider the alternatives available for the floor slab construction (e.g., continuous floor slab versus construction joints) and demonstrate the best jointing system with the same life as the structure has been chosen.

(e) The use of water stops and sealants shall be avoided or minimised where possible.

   (i) This is important, as many jointing materials have only limited lives of 15 to 20 years. That replacement can be costly involving isolation of the reservoir and uncovering of the reservoir.

   (ii) Careful detailing of joints is required, as the financial cost of retesting the structure for watertightness is considerable.

   (iii) Additional measures to mitigate leakage should be incorporated in the structure. Measures could include additives to the concrete to promote autogenous healing at cracks, bandages on interior joints and membrane coatings on the interior.

(f) The reservoir structure is to be designed to cope with a water pressure of at least one metre above the top of the reservoir walls.

(g) The lowest roof beam must be 300 mm above top water level (TWL) or 50 mm above the maximum water level expected when the reservoir is overflowing (250 mm above TWL). The minimum level of the roof slab shall be at least 450 mm above the TWL. The beams must be away from the overflow.

(h) The roof structure shall be watertight and graded so as to drain water satisfactorily from the roof area.

6.13.2.2 Buried reservoirs

For buried reservoirs:

(a) A continuous waterproof membrane shall cover the roof.

(b) Site concrete shall cover the membrane.

(c) A layer of drainage material shall cover the site concrete to ensure water will not pond on the graded roof.

   (i) The roof must be strong enough to take the required landscaping, tractor mowing loadings and large digger (at least 10 tonnes) loading for possible future maintenance.

   (ii) The landscaped material must be adequate to support turf all year around.

   (iii) A minimum of 300mm of fill, including top soil, is to be provided over the site concrete which protects the membrane.

(d) The walls of the reservoir that will be backfilled against, shall be sealed with at least two coats of Mulseal or equivalent after a successful water tightness test.

(e) A drainage blanket is required on the walls.

(f) Drainage material is required to be laid against the walls and must be of a grading and size such that the surface seal coat is not damaged.

6.13.3 Pipework

The following applies to reservoir pipework:

(a) Crossing of large pipes is to be avoided.

(b) Consideration must be given to location of pipes relative to ground levels, avoidance of dead legs, access to manually operated valves in an emergency, connection of pipes to the reservoir as they may be below reservoir floor level, means of assembling of pipework, any subsequent maintenance or replacement of valves or equipment, differential movements between pipes and structures, support and anchoring of pipes, access for staff, provision for differential movements where pipes connect to rigid structures, location of changes in diameter and access to interior of pipes for welded joints and lining reinstatement.

(c) All pipe and fittings shall comply with the materials specified in **Section 6.2 Materials**. Jointing and laying shall comply with this specification also.

(d) All pipework shall be protected against corrosion and braced against seismic forces as anticipated by the structural design.

(e) Consideration shall be given to water testing new reservoirs. Means shall be provided to ensure that the water-tightness of the isolation valves on the inlet, outlet and scour pipes can be confirmed. This may require:

  (i) Designing downstream pipework such that the valve face can be exposed and witnessed as drip tight.

  (ii) A second valve being installed downstream of the isolation valve, with a tapping point on the underside of the pipe between the two valves.

6.13.3.1 Valves

The following applies to reservoir valves:

(a) Valves used in reservoirs shall typically be resilient seated gate valves as per **Section 6.2.11 Valves.**

(b) For valves 600 mm and greater, resilient seated butterfly valves as per **Section 6.2.11.2 Butterfly valves** may be used with appropriate gearing and handwheels. Butterfly valves shall be in a chamber.

(c) Electrically actuated auto-closing valves of any size may be a resilient seated butterfly valve.

6.13.3.2 Inlet pipework

The following applies to reservoir inlet pipework:

(a) The inlet pipe shall have a resilient seated gate valve immediately adjacent to the reservoir wall to isolate the reservoir. Any seismic coupling shall be installed immediately upstream of this isolation valve. There are to be no fittings between that valve and the reservoir wall.

(b) For gravity filled reservoirs, the inlet shall have either a motorised plug valve or an altitude valve upstream of the isolation valve to control the flow into the reservoir as per the proposed filling logic. Reservoirs filled directly from a pumped rising main shall rely on the pump logic to control the filling rate.

(c) An approved, bi-directional magnetic flow meter shall be installed upstream of the control valve, or isolation valve if no control valve is required.

(d) The inlet shall enter the reservoir at a lower level, through the floor or wall of the reservoir, and rise as a standpipe to at least 80% of the height of the reservoir. This is to provide a non-return function to prevent the reservoir from emptying in the event of an inlet main failure. Alternatively, the inlet may rise up the outside of the reservoir and enter through the wall at the 80% level.

(e) The stand-pipe shall have a return pipe to the reservoir floor to ensure the final discharge enters is below the 25% level and opposite to the outlet to encourage turnover and maintain chlorine residual. An anti-siphon orifice approximately 25% of the standpipe diameter shall be positioned at the top of the standpipe to prevent back siphoning in the event of a failure.

(f) All pipes and fittings shall be flanged or axially restrained between the reservoir and the control valve. A flexible, seismic coupling is required immediately downstream of the inlet valve which is adjacent to the reservoir wall. The coupling shall meet the requirements of deflection, pull-out resistance and elongation as outlined in **Section 6.4 Pipe jointing**. Flex-tend couplings are an example of a fitting that would comply with this requirement.

(g) A valved bypass (normally shut) shall be provided between the inlet and outlet pipework. This bypass shall be:

   (i) Upstream of the inlet control valve

   (ii) Downstream of the inlet magflow meter

   (iii) Upstream of the outlet magflow meter and

   (iv) Downstream of the auto-closing valve.

6.13.3.3 Outlet pipework

The following applies to reservoir outlet pipework:

(a) The outlet pipe shall draw from the base of the reservoir through the floor of the tank.

(b) The outlet pipe shall have a resilient seated gate valve immediately adjacent to the reservoir wall to isolate the reservoir. There are to be no fittings between that valve and the reservoir wall. Any seismic coupling shall be installed immediately downstream of this isolation valve.

(c) A tapping shall be provided downstream of the resilient seated gate valve and include a 20 mm stainless steel ball valve which may be used as an alternative pressure tapping for monitoring reservoir level when the scour is being operated.

(d) The outlet shall have an automatic closing valve downstream of the reservoir isolation valve with a bypass around the valve to allow testing and a manually operated gate valve on it sized to allow average day demand flow through it over a short period.

(e) A hydrant, or 80 mm resilient seated gate valve with a hydrant outlet, shall be installed between the auto-closing valve and the reservoir isolation valve. This point shall be for emergency distribution of water in the event of catastrophic pipe failure downstream of the auto-closing valve.

(f) A combination air-valve is required downstream of the auto-closing valve in a chamber or tunnel that complies with the requirements of **Section 6.2.16.1 Chamber**. It shall be sized to ensure the outlet pipeline does not experience negative pressures in the event of a catastrophic pipe failure.

(g) An approved, bi-directional magnetic flow meter shall be installed downstream of the auto-closing valve.

(h) All pipe joints shall be flanged or axially restrained between the reservoir and the meter, which is located downstream of the auto-closing valve.

6.13.3.4 Scour pipework

The following applies to reservoir scour pipework:

(a) A scour valve is required to enable the reservoir to be drained in a controlled fashion.

(b) The inlet to the scour pipe shall be from a sump in the reservoir floor graded to at a slope of no flatter than 1%.

(c) The scour main and associated drains shall be sized to enable the full reservoir volume to be drained over a maximum of 24 hours.

(d) A resilient seated gate valve shall be located in the valve chamber/tunnel to enable isolation of the scour from the downstream network. The flanged valve shall be immediately adjacent to the reservoir wall or floor. A seismic coupling shall be installed immediately downstream of the isolation valve.

(e) A 20 mm pressure tapping with a stainless steel ball valve shall be included on the scour pipe between the reservoir wall and the isolation valve. The tapping is for a pressure transducer that will record the reservoirs operating level.

(f) The scour pipe shall connect to the stormwater network. The downstream stormwater network shall be checked to ensure the scour discharge can be conveyed without surcharge during dry-weather including the discharge point and any consenting concerns. The stormwater network shall be upgraded if it is not able to convey the flows.

(g) All pipes and fittings shall be flanged or axially restrained between the reservoir and the isolation valve immediately downstream of the reservoir wall.

6.13.3.5 Overflow pipe and stormwater assessment

The overflow pipe shall:

(a) Be sized to convey twice the maximum possible inflow of water when the water level is not less than 200 mm below the top of the reservoir wall (or freeboard).

  (i) The driving head between the overflow inlet and a point 200 mm below the top of the reservoir wall shall be sufficient to convey twice the maximum inflow regardless of whether water is supplied by pump or by gravity to the reservoir.

  (ii) The additional capacity is to cater for future increases in pump size or network upgrades increasing the inflow.

(b) Be an internal standpipe with a bell-mouthed entry. It shall be flanged near the floor to allow future replacement if required. The overflow rim shall be 75 mm above the nominal top water level of the reservoir.

(c) Connect to a manhole outside the reservoir which will subsequently connect to the stormwater network. The overflow pipe shall have a non-return valve on it to prevent rodent entry into the overflow pipe. The non-return valve shall be accessible from the manhole. The scour pipe may connect to this manhole also. The overflow manhole and subsequent drainage system shall comply with **Section 5 Drainage Specifications**.

The downstream stormwater network shall:

(d) Be investigated to ensure it can carry the design overflow event (current design pumped or gravity inflow) without surcharge or erosion. It shall be assumed that it is a dry-weather overflow event.

6.13.3.6 Water quality sampling taps

The following applies to reservoir water quality sampling taps:

(a) A 20 mm connection on the inlet and outlet pipe shall allow both pipes to have water drawn off them for the purposes of testing the incoming and outgoing water quality.

(b) The sampling taps shall be located either in a valve chamber or tunnel for buried reservoirs, or in the telemetry shed for above ground reservoirs. The location shall be selected to ensure there is a low health and safety risk for monitoring staff.

(c) The taps shall discharge to a small stainless steel basin that will discharge to a drain or natural ground.

6.13.3.7 Under drainage

Under drainage is for floor and walls (if reservoir is buried) and includes the following:

(a) A sump is to pick up water from the under drainage outlets and be pumped or piped by gravity to the overflow/scour pipe system.

(b) The system shall be designed to prevent any surcharging from the scour/overflow when the reservoir is overflow or scouring.

(c) The under drainage pipework is to drain specific sectors for monitoring purposes. A minimum of six sectors is required. Each sector outlet pipe is to have permanent engraved signage and discharge so any source of any leakage through the reservoir floor and/or walls can be identified.

(d) The underflow drains are to be laid in a grade away from the reservoir. There shall be no springs or seepage water flows into the under drainage. Any spring/seepage water is to be diverted away from the under drainage.

6.13.4 Roof hatches and ladders

The following applies to roof hatches and ladders into reservoirs:

(a) Hinged airtight access hatch covers shall be provided as non- venting hatches and will require a concrete, not steel, up-stand on the roof.

(b) A minimum of two hatches are required with each hatch being on opposite sides of the reservoir. A hatch shall be situated adjacent to the rim of the overflow pipe and another above the primary outlet. At least one of the hatches shall provide inclined access to the interior of the reservoir.

(c) All ladders and safety rails shall have extendable handrails and shall be designed to provide a safe environment for people working on the reservoir and shall be designed to meet the latest standards and codes.

  (i) Landings will be required on ladders.

  (ii) More than one ladder into the reservoir may be required for safe egress.

(d) At least one set of water level probes will be required. Water level probes are to be adjacent to the overflow which is adjacent to a hatch.

(e) The internal access ladder(s) shall incorporate handrails and be installed at a slope of 65 to 70 degrees from the horizontal.

  (i) Internal steelwork shall be stainless steel or galvanised steel.

  (ii) Provision shall be made at the hatch covers for the installation of limit switches and associated cabling to indicate when the lids are open as well as one set of water level probes.

  (iii) Wellington Water shall advise switch and probe requirements.

(f) Where compartments or inner/outer tanks are adopted, the hatches are to be positioned in such a way that there are two hatches per compartment or inner/outer tanks. Care should be taken that the foot of the ladders do not interfere with the pipe work inside the reservoir.

6.13.5 Electrical, monitoring and control equipment

The electrical and SCADA specification shall be obtained from Wellington Water prior to design. Notwithstanding this, the reservoir shall have:

(a) An approved seismically activated trigger system which shall provide the stimulus to operate the auto-closing valve in the event of an emergency.

(b) A pressure transducer accurate to 0.5 kPa (50 mm H_2O) to record the water level in the reservoir.

(c) Monitoring equipment to measure the instantaneous and cumulative inflow and discharge of water to and from the reservoir.

(d) Security monitoring equipment which shall monitor access alarms to the hatches and doors.

(e) Control equipment to operate the auto-closing valve as required

(f) A telemetry hut where the electrical and control equipment shall be housed in a dry and ventilated valve chamber, tunnel or external building. It shall be designed and constructed to the same structural standards as the reservoir it serves.

6.14 Water supply pumping stations

The following applies to water supply pumping stations:

(a) Water supply pumps shall generally be housed in an above ground structure.

(b) Underground stations will not typically be permitted.

(c) Water supply pumping stations shall have 100% standby for a duty-standby pump arrangement, or 50% standby for duty-assist-standby pump arrangement.

(d) The station site shall be on a separately titled lot in the subdivision with a sealed vehicle access to a formed road. The lot shall be vested with council. If required by the council or Wellington Water, the site shall be secured to prevent public access as outlined by Wellington Water.

(e) Architectural featuring of any visible structures shall be within the context of the proposed subdivision and shall be subject to the approval of Wellington Water.

(f) The minimum standard for fencing is a 1.8 m high, 50 mm diamond, 2.5 mm wire diameter chain link fence with rails top and bottom. In residential areas, fence design shall be considered within the context of the neighbourhood and/or agreed with adjacent landowners.

6.14.1 Building

The following applies to water supply pumping station buildings:

(a) The building that houses the pumps and electrical equipment shall:

  (i) Be above ground where possible.

  (ii) Have a standard 2100 mm high x 810 mm wide security door as a minimum.

  (iii) Have a 2100 mm high by 1600 mm wide or larger doors for stations where the pump unit cannot fit though a standard door.

  (iv) Contain gantry system which will enable pumps to be placed within 900 mm of the access door or provide another mechanical means to remove pumps from the station.

  (v) Be ventilated to ensure suitable volume of air change to meet both NZBC requirements and the cooling needs of the pump/motor sets.

  (vi) Have smoke detectors and emergency lighting connected to SCADA for alarming.

  (vii) Be positioned clear of land floodable by stormwater under 1% AEP event and clear of any secondary flow path.

  (viii) Have suitable, covered cable/pipe trenches and ducts to ensure clear working space and access around pumps.

  (ix) Have suitable drainage of floor and trenches.

  (x) Have suitable electric lighting.

(b) The building shall have acoustic mitigations to minimise the amount of pump noise that emits from the station. The District Plan guidelines for noise shall be considered an absolute minimum, and further mitigation is required where practical. This includes acoustic consideration for the building including vents, doors and roof.

(c) Electrical switchboards shall be housed above ground.

(d) The switchboards and pumps shall be separated so that the switchboards cannot be water damaged if a leak occurs in the pipework.

(e) Windows are not to be installed in pumping stations.

6.14.2 Pumps

The proposed pumpset shall be from a manufacturer and be a model approved by Wellington Water. That approval may be provisional on consideration of duty, efficiency, life and materials.

Pumpsets shall preferably be:

(a) Fitted with TEFC 4 pole electric motors (1450 rpm).

(b) Horizontally mounted and long-coupled configuration.

(c) Variable speed compatible motors and cabling.

(d) Flanged inlet and outlet.

(e) Ductile or cast iron base.

(f) Ductile, cast or stainless steel pump casing.

Concessions on speed and configuration can be made for smaller pumps (less than 15 kW) provided other mitigations are in place to compensate for noise and maintenance access.

All pumps, whether in a two or three pump arrangement, shall be of the same, make, model and duty size.

6.14.2.1 Pump plinths

The following applies to pump plinths:

(a) Pumps shall be installed on reinforced concrete plinths.

(b) Where levelling nuts are used to set the pump base before pouring the plinth, 6 mm insertion rubber “washers” shall be used with a standard steel washer between the rubber and levelling nut. This is to ensure full engagement of the base with the subsequently cured concrete plinth.

(c) The weight of pump plinths shall typically be the combined weight of the pump, motor, baseplate, coupling and coupling guard.

6.14.3 Pipework

The following applies to water system pump station pipework:

(a) Pipework shall be ductile iron manufactured to AS/NZS 2280 and fusion epoxy bonded coated to AS/NZS 4158 or STCL manufactured to NZS 4442.

(b) STCL pipe shall be internally lined with Portland cement mortar and be fusion bonded polyethylene wrapped, Polyken tape wrapped or epoxy coated to AS/NZS 3862.

(c) They shall have a minimum pressure rating of PN35.

(d) With the exception of pipework directly connected to the pump flanges, unrestrained mechanical couplers shall NOT be used. Pipework shall be continuous and thrust type dismantling joints shall be installed where required for dis-assembly and re-assembly.

(e) Unrestrained couplings such as bellows or mechanical couplings shall be used immediately after the pump discharge and suction flanges in order to prevent vibrations from the pump passing into the pipework, creating noise. The pipework shall be secured to resist the unbalanced forces at the pump connection.

(f) Flanged bends, tees and "specials" fabricated from STCL may be permitted where ductile iron fittings are not practicable. These shall be manufactured to the requirements of NZS 4442 and polyethylene tape wrapped and concrete lined at the fabricators, or epoxy coated to AS/NZS 3862.

(g) 316/316L/304/304L stainless steel (schedule 40 or 80) shall also be permitted.

(h) The pipework shall be designed such that:

  (i) Each pump can be isolated with resilient seated gate valves and butterfly valves, and removed whilst the other pumps are in operation.

  (ii) All valves in ground and buildings, for both trunk main and reticulation mains, shall be anti-clockwise closing. All valves shall include a tag or other means to clearly indicate closing direction.

  (iii) There is a non-slam non-return valve immediately upstream of each pump.

  (iv) Air valves installed immediately upstream of the pumps for the release of air when charging the pipework and for entry of air when draining the pipework.

  (v) Consideration should be given to installing an air valve immediately downstream if the non-return valve to reduce pressure transience on the discharge pipework.

  (vi) There is suitable room around the pipework to access flanges and fittings.

(i) Flanges in the local water network shall comply with the following:

  (i) Ductile iron flanges shall comply with the latest revision of AS/NZS 4087 Figure B5.

  (ii) Carbon steel flanges shall comply with the latest revision of AS/NZS 4087 Figure B7.

  (iii) No other flange material shall be permissible.

(j) Flanges in the bulk water pipeline shall comply with the following:

  (i) Rated PN16 and comply with the latest revision of AS/NZS 4331, except as detailed below.

  (ii) Where a higher rated flange is required, flange shall be rated PN25 and comply with the latest revision of AS/NZS 4331.

  (iii) Flanges on 375 mm nominal diameter pipe (426 mm O.D.) shall comply with the latest revision of AS/NZS 4087 Figure B5 for ductile iron flanges and AS/NZS 4087 Figure B7 for steel flanges.

(k) All pipework shall be supported and designed to withstand seismic loadings as determined for the seismic criticality (see **Section 3.7.4 Determination of Seismic Criticality** of the Regional Standard for Water Services) of the structure.

(l) Unrestrained couplings such as bellows or mechanical couplings shall not be used immediately after the pump discharge or suction flange unless the unbalanced forces on the pump are avoided.

(m) A hydrant shall be installed on both the suction and discharge mains entering the pumping station. This shall allow a PRV bypass or alternative pump connection external to the station. Depending on the zone arrangement, Wellington Water may require a permanent PRV bypass (remotely controlled) is installed as well as any required isolating valves and pipework.

6.14.4 Pumping station serving as a reservoir

The following applies to pumping stations that serve reservoirs:

(a) Stations shall be designed to allow all pumps to run simultaneously.

(b) The duty points of the pumps shall be selected with consideration to the following criteria:

  (i) Downstream reservoir set at 85% capacity

  (ii) Upstream reservoir set at 85% capacity

  (iii) Network demand equivalent to the peak period average day demand.

6.14.5 Electrical, monitoring and control equipment

The electrical and SCADA specification shall be obtained from Wellington Water prior to design. The pump station shall have the following monitoring equipment:

(a) A magnetic flow meter installed on the common discharge, or alternatively, on the common suction.

(b) A pressure transducer on the common discharge capable of reading the gauge pressure to +/- 5 kPa.

(c) A pressure transducer on the common suction capable of reading the gauge pressure to +/- 5 kPa.

(d) A 20 mm tapping on each of the pumps' suction pipework between the isolation valve and the pump, and 6 mm copper tubing leading from the tapping to the gauge board.

(e) A 20 mm tapping on each of the pumps' discharge pipework between the pump and the non-return valve, and 6 mm copper tubing leading from the tapping to the gauge board.

(f) A gauge board with oil filled dial gauges with a minimum 100 mm diameter face.

7 APPENDICES

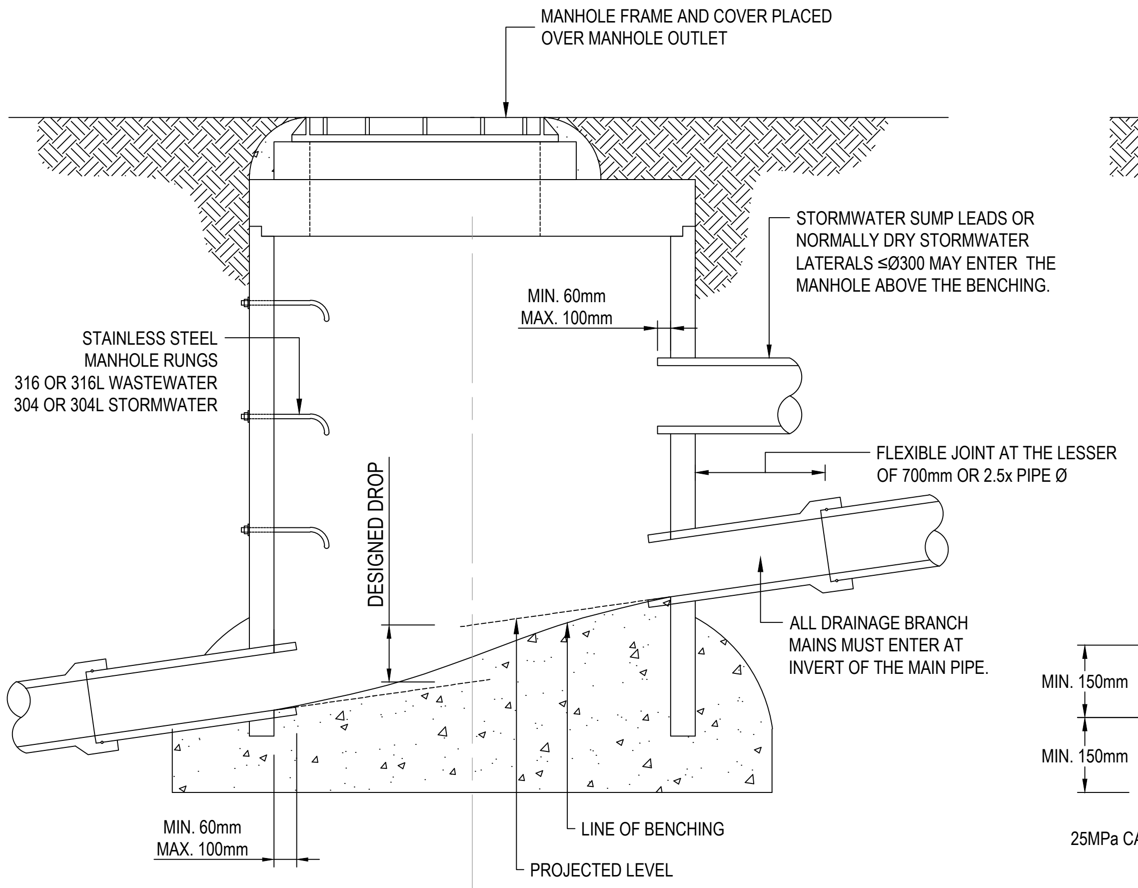
Appendix 1 Standard Details

The following Standard Details are provided below:

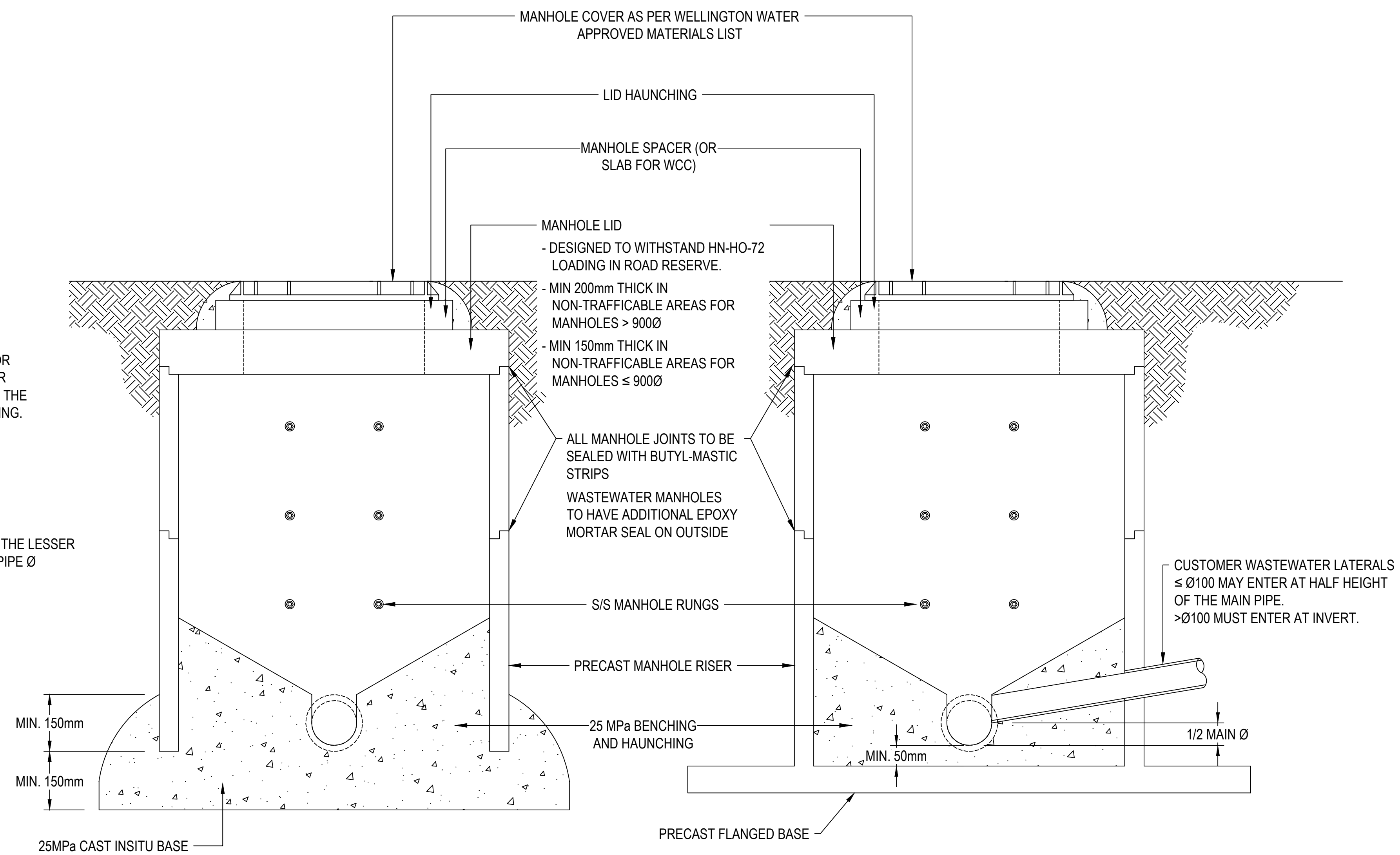
- DR01 – Manhole Details
- DR02 – Internal Drop Details
- DR03 – Typical Trench and Waterstop Details
- DR04 – Baffled Sump Plan and Sections
- DR05 – Trapped Yard Sump
- DR06 – Possible Location for Stormwater Soakage in Upper Hutt
- DR07 – Lateral Connections to Public Stormwater or Wastewater Mains
- DR08 – Tree Dripline
- DR09 – Building in Close Proximity
- WS01 – Typical Water Reticulation Layout
- WS02 – Water Distribution Pipe Junctions and Connections
- WS03 – Typical Thrust Block Details
- WS04 – Typical Anchor Block Details
- WS05 – Typical Valve Details
- WS06 – Rider Main Scour Detail
- WS07 – Fire Hydrant Box
- WS08 – Typical Domestic Manifold and Water Meter
- WS09 – Below Ground Meter and Backflow Installation
- WS10 – Above Ground Meter and Backflow Installation
- WS11 – Below Ground Meter and Backflow Installation
- WS12 – Above Ground Meter and Backflow Installation
- WS13 – Fire Service and Metered Supply
- WS14 – Examples of Water Main Connections

NOTES:

1. MANHOLES AND BASES TO BE DESIGNED AGAINST FLOATATION WITH A SAFETY FACTOR OF 1.25 IN AREAS OF HIGH WATER TABLE OR LIQUEFACTION POTENTIAL.
2. MANHOLE BENCHING AND BASE TO BE POURED TO A MINIMUM 150mm BELOW LOWEST PIPE INVERT. THIS INCLUDES MINIMUM DEPTH BETWEEN LOWEST PIPE INVERT AND PRECAST FLANGED BASE.
3. SAFETY GRILLES SHALL BE FITTED INTO MANHOLE ACCESS LID FRAMES FOR ALL NEW MANHOLES THAT ARE 3m OR DEEPER. GRILLES SHALL COMPLY WITH AS3996 CLASS A AND BE CONSTRUCTED FROM STAINLESS STEEL 316L GRADE OR AN APROVED ALTERNATIVE MATERIAL WITH ADEQUATE STRENGTH AND CORROSION PROPERTIES.



CROSS SECTION THROUGH STANDARD MANHOLE



TYPICAL MANHOLE BENCHING AND HAUNCHING DETAILS

TYPICAL MANHOLE BENCHING AND HAUNCHING DETAILS

REV	AMENDMENT	DWN	CHK	REV	DATE	AMENDMENT	DWN	CHK	DATE
A	PRELIMINARY ISSUE	AL			02/20				
B	MANHOLE DETAILS AMENDMENT	AL			03/21				

Wellington Water

DESIGN	WWL	-
UPDATE	A MCDONALD	10/21
DRAWING UPDATE	A LIM	10/21
CHECKED	E GREENBERG	11/21
REVIEWED	T STRANG	11/21
APPROVED	T STRANG	11/21

REGIONAL SPECIFICATION FOR WATER SERVICES

MANHOLE DETAILS

SCALE: NOT TO SCALE

SHEET No. 1 OF 1 SHEETS.

DRAWING SIZE: A1

PROJECT/FILE NUMBER: -

DRAWING N°. DR01

WARNING: PRINTED COPIES ARE UNCONTROLLED

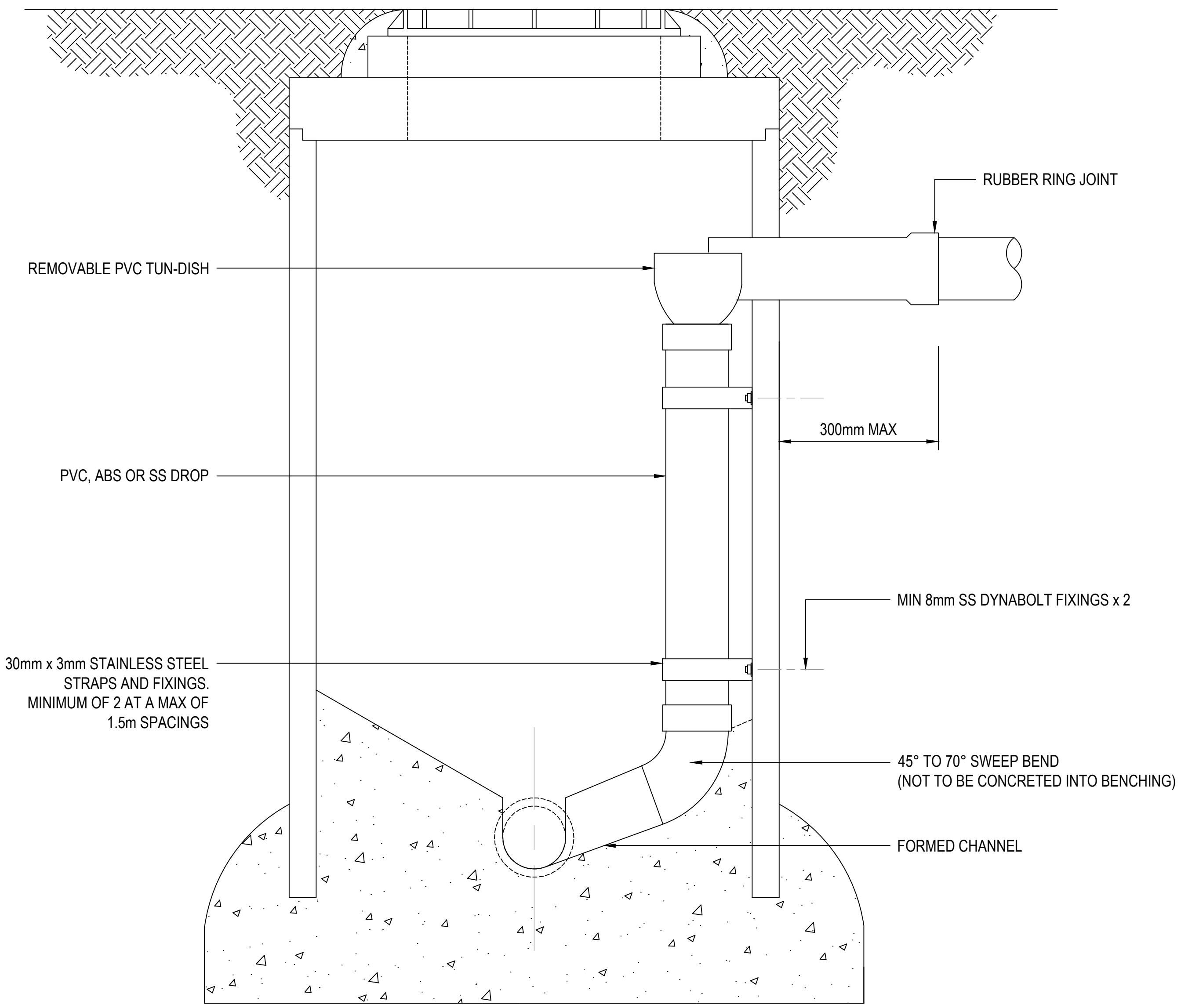
COLOUR PLOT

PLOT DETAILS:
Date Plotted: Nov 26, 2021 - 4:05pm
Plotted By: Andrew Lim

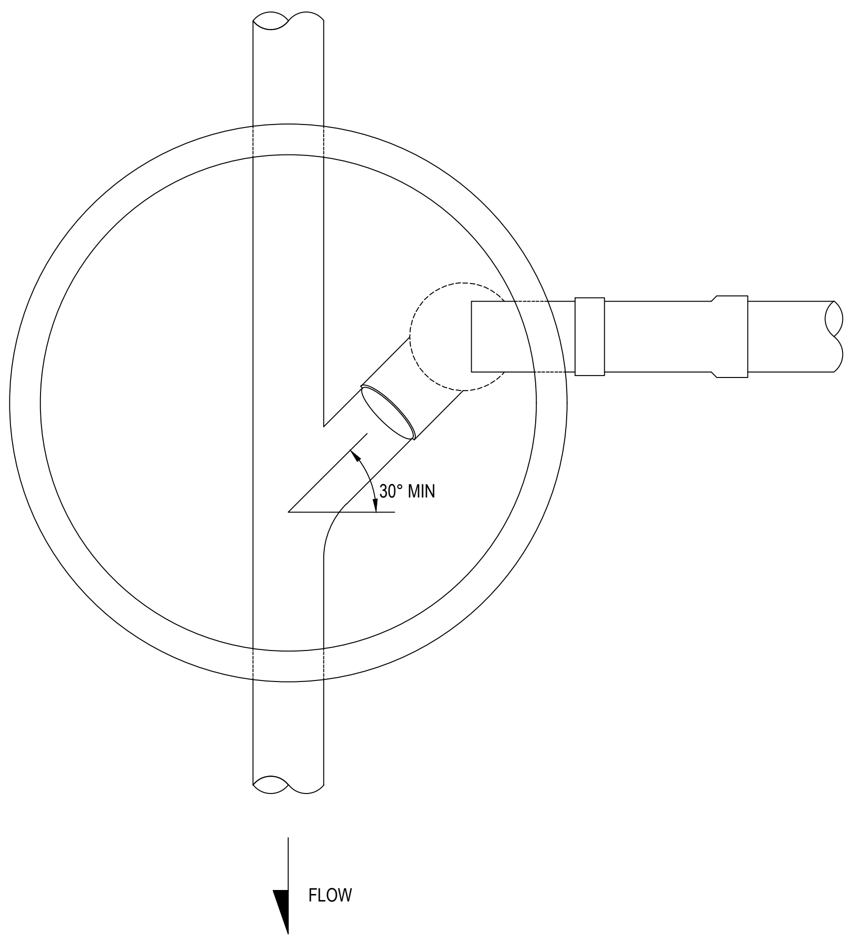
File Name: DR01 (2021) Manhole details.dwg
File Location: C:\USERS\ALIM\ONEDRIVE - WELLINGTONWATER\007 WWL\WWL\WATER SERVICES STANDARD DWG\WWL TEMPLATE\DR01-05

NOTES:

1. MINIMUM INTERNAL CLEARANCE BETWEEN DROP STRUCTURE AND OPPOSITE MANHOLE WALL SHALL BE 1000mm.
2. ALL METALLIC FIXINGS SHALL BE STAINLESS STEEL.
3. INTERNAL DROP SHALL BE FOR A MAXIMUM OF 225Ø.



TYPICAL INTERNAL DROP DETAILS



PLAN VIEW

REV	AMENDMENT	DWN	CHK	REV	DATE	AMENDMENT	DWN	CHK	DATE
A	PRELIMINARY ISSUE	AL			02/20				

Wellington Water

DESIGN	WWL	-
UPDATE	E GREENBERG	10/21
DRAWING UPDATE	A LIM	10/21
CHECKED	E GREENBERG	11/21
REVIEWED	T STRANG	11/21
APPROVED	T STRANG	11/21

REGIONAL SPECIFICATION FOR WATER SERVICES

INTERNAL DROP DETAILS

SCALE: NOT TO SCALE

SHEET No. 1 OF 1 SHEETS.

DRAWING SIZE: A1

PROJECT/FILE NUMBER: -

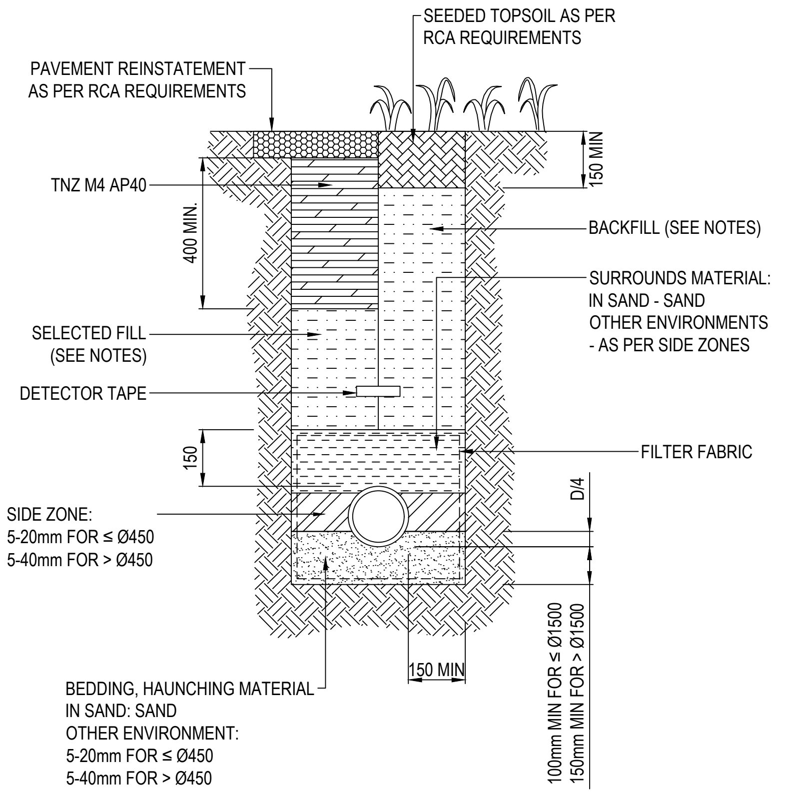
DRAWING N°. DR02

WARNING: PRINTED COPIES ARE UNCONTROLLED

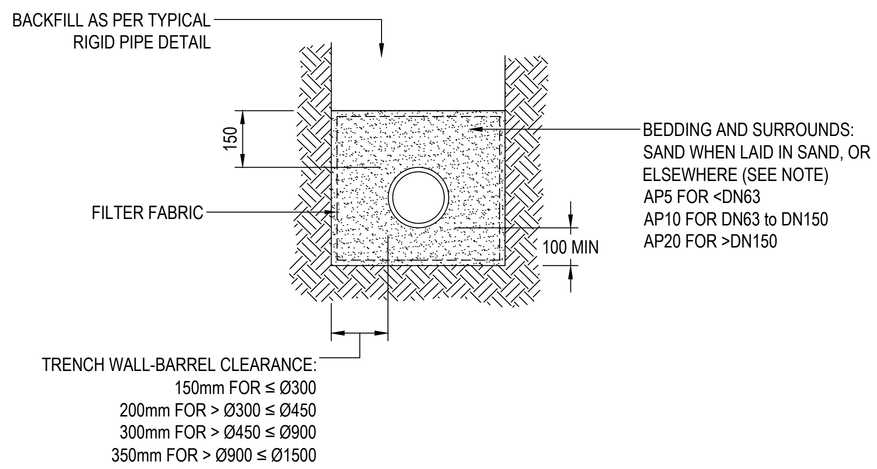
COLOUR PLOT

PLOT DETAILS:
Date Plotted: Nov 26, 2021 - 4:14pm
Plotted By: Andrew Lim

File Name: DR02 (2021) Internal drop details.dwg
File Location: C:\USERS\ALIM\ONEDRIVE - WELLINGTONWATER\007 WWL\WWL\WATER SERVICES STANDARD DWG\WWL TEMPLATE\DR01-05



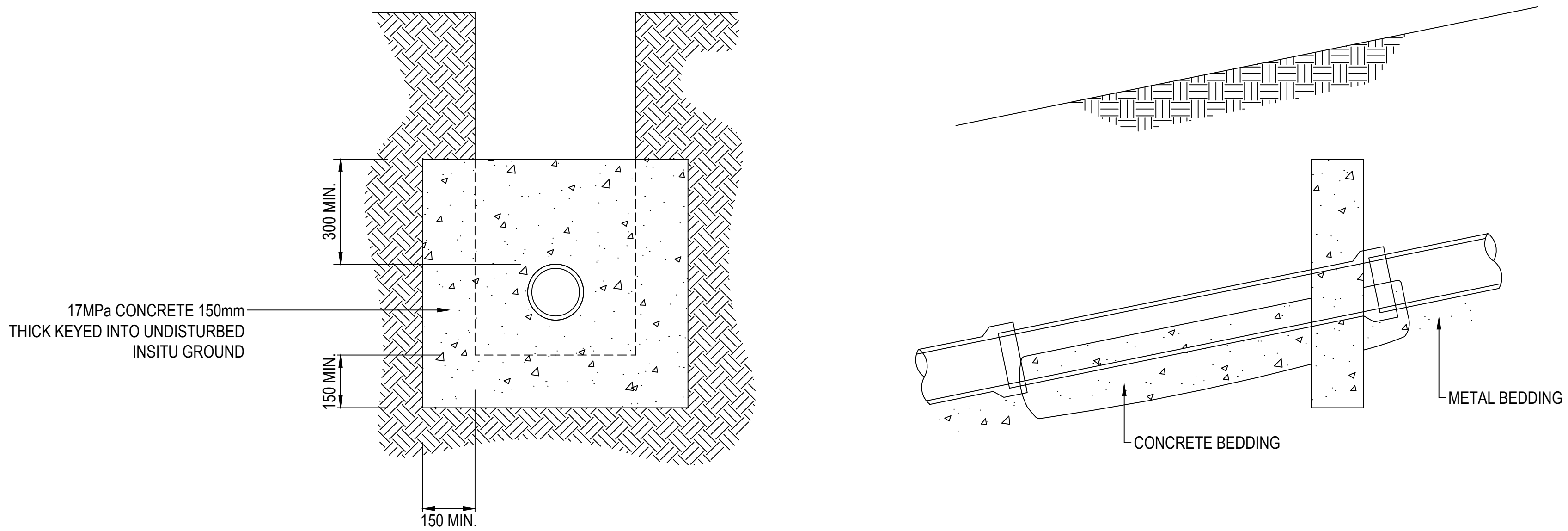
TYPICAL RIGID PIPE TRENCH DETAIL



TYPICAL FLEXIBLE PIPE BEDDING AND SURROUNDS DETAIL

NOTES:

1. BACKFILL IS GENERALLY AP40 OR AP65 BUT THIS MAY DIFFER IN CERTAIN AREAS IN ACCORDANCE WITH RCA OR OTHER REQUIREMENTS.
2. RIGID PIPES INCLUDE: CONCRETE PIPES, EARTHENWARE PIPES.
3. FLEXIBLE PIPES INCLUDE ALL PVC PIPES, ALL POLYETHYLENE PIPES, COPPER, POLYBUTYLENE, CORRUGATED STEEL AND ALUMINIUM PIPES, STEEL AND DUCTILE IRON PIPES.
4. FOR FLEXIBLE PIPES, BEDDING AND SURROUNDS MAY BE SINGLE SIZE AGGREGATE WHERE NECESSARY, FOR EXAMPLE 5-14mm OR 8mm DOWN.



TYPICAL WATERSTOP DETAIL

REV	AMENDMENT	DWN	CHK	REV	DATE	AMENDMENT	DWN	CHK	DATE
A	PRELIMINARY ISSUE	AL			02/20				

DESIGN	WWL	-
UPDATE	E GREENBERG	10/21
DRAWING UPDATE	A LIM	10/21
CHECKED	E GREENBERG	11/21
REVIEWED	T STRANG	11/21
APPROVED	T STRANG	11/21

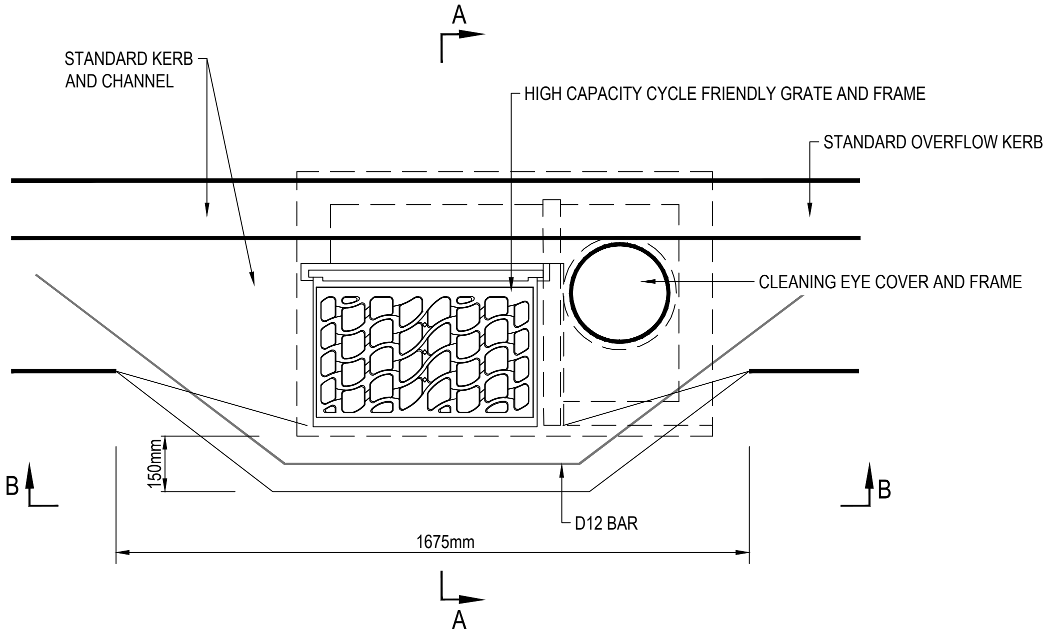
REGIONAL SPECIFICATION FOR WATER SERVICES

TYPICAL TRENCH AND WATERSTOP DETAILS

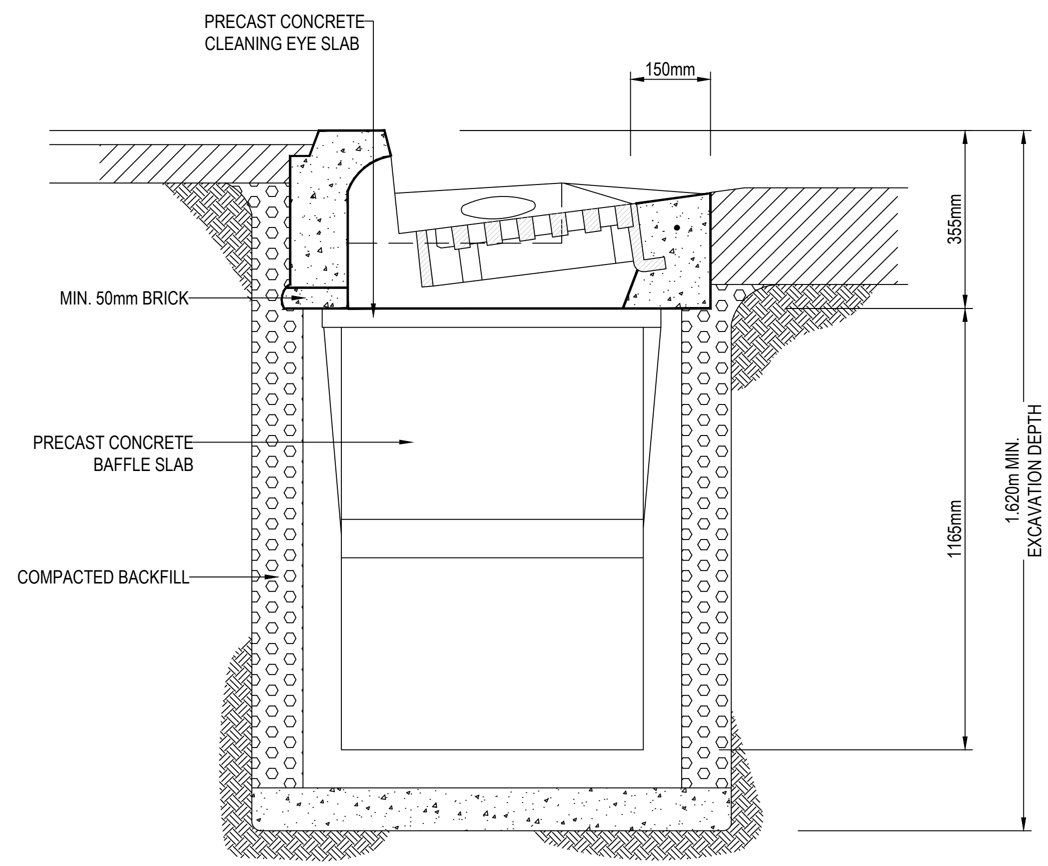
SCALE: NOT TO SCALE
SHEET No. 1 OF 1 SHEETS.
DRAWING SIZE: A1
PROJECT/FILE NUMBER: -
DRAWING N°. DR03

PLOT DETAILS:
Date Plotted: Dec 01, 2021 - 4:17pm
Plotted By: Andrew Lim

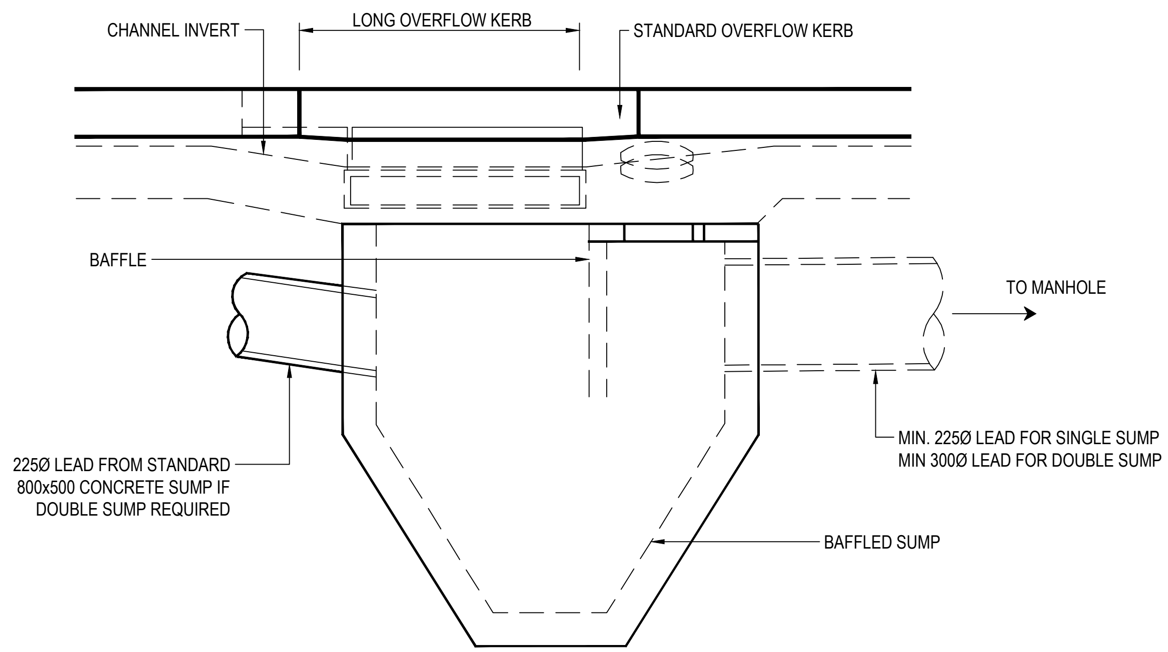
File Name: DR03 (2021) Trench and water stop details.dwg
File Location: C:\USERS\ALIM\ONEDRIVE - WELLINGTONWATER\007 WWL\WWL\WATER SERVICES STANDARD DWG\WWL TEMPLATE\DR01-05



SINGLE BAFFLED SUMP - PLAN



SECTION A-A



SECTION B-B

REV	AMENDMENT	DWN	CHK	DATE
A	PRELIMINARY ISSUE	AL		02/20

DESIGN	WWL	-
UPDATE	E GREENBERG	10/21
DRAWING UPDATE	A LIM	10/21
CHECKED	E GREENBERG	11/21
REVIEWED	T STRANG	11/21
APPROVED	T STRANG	11/21

Wellington Water

REGIONAL SPECIFICATION FOR WATER SERVICES

BAFFLED SUMP
PLAN AND SECTIONS

SCALE: NOT TO SCALE

SHEET No. 1 OF 1 SHEETS.

DRAWING SIZE: A1

PROJECT/FILE NUMBER: -

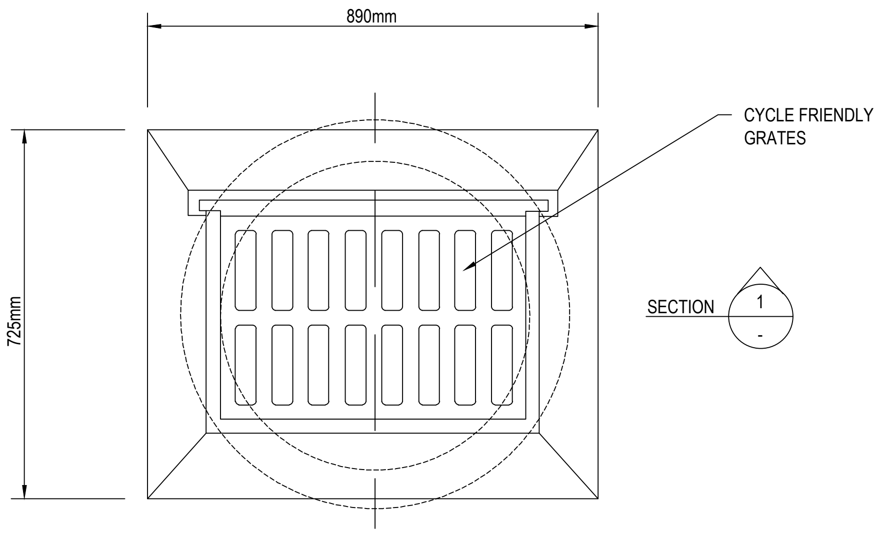
DRAWING N°. DR04

WARNING: PRINTED COPIES ARE UNCONTROLLED

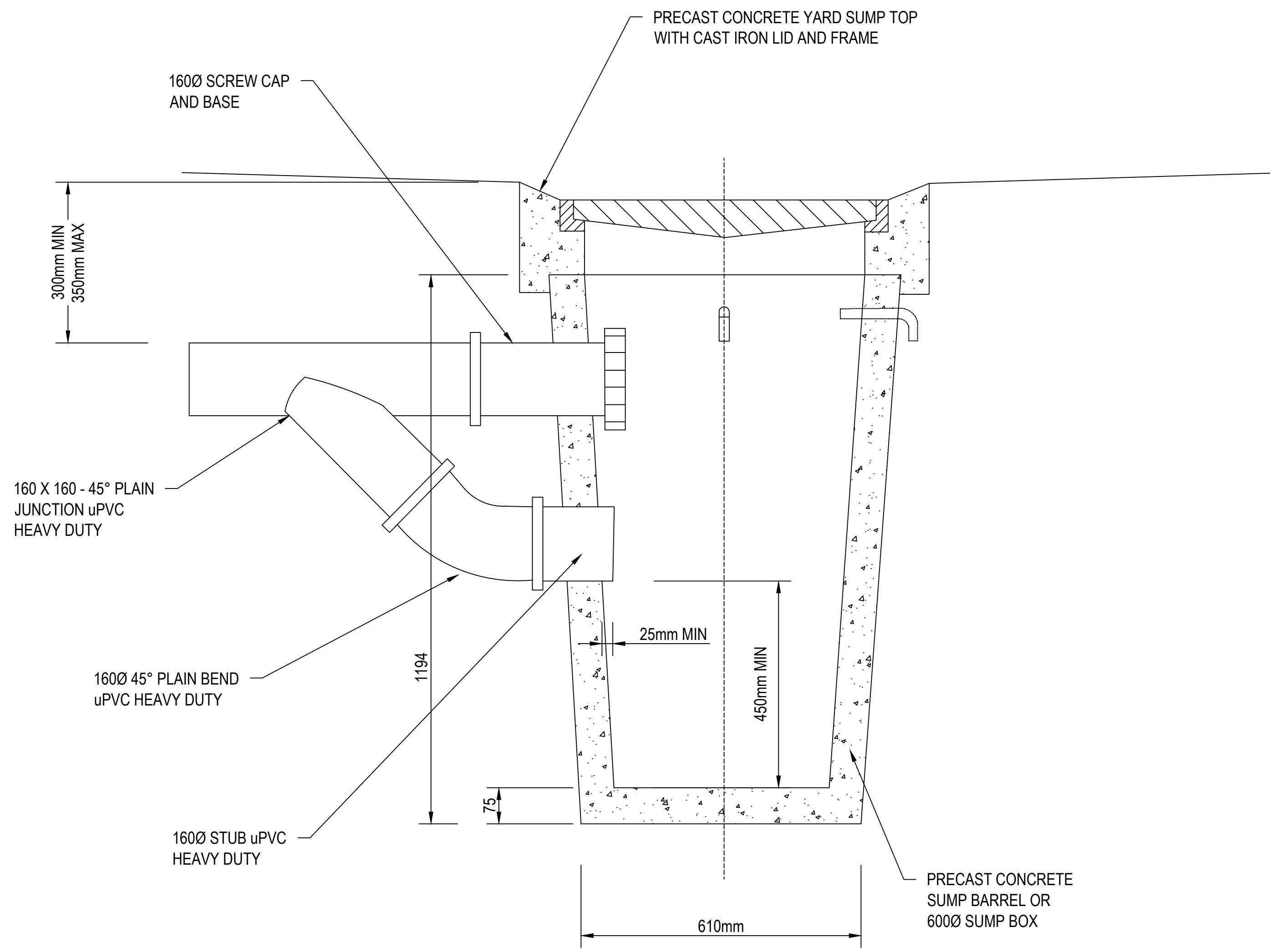
COLOUR PLOT

PLOT DETAILS:
Date Plotted: Dec 01, 2021 - 4:32pm
Plotted By: Andrew Lim

File Name: DR04 (2021) Baffled sump.dwg
File Location: C:\USERS\ALIM\ONEDRIVE - WELLINGTONWATER\007 WWL\WWL\WATER SERVICES STANDARD DWG\WWL TEMPLATE\DR01-05



PLAN



SECTION 1 / -

REV	AMENDMENT	DWN	CHK	REV	DATE	AMENDMENT	DWN	CHK	DATE
A	PRELIMINARY ISSUE	AL			02/20				

Wellington Water

DESIGN	WWL	-
UPDATE	E GREENBERG	10/21
DRAWING UPDATE	A LIM	10/21
CHECKED	E GREENBERG	11/21
REVIEWED	T STRANG	11/21
APPROVED	T STRANG	11/21

REGIONAL SPECIFICATION FOR WATER SERVICES

TRAPPED YARD SUMP

SCALE: NOT TO SCALE

SHEET No. 1 OF 1 SHEETS.

DRAWING SIZE: A1

PROJECT/FILE NUMBER: -

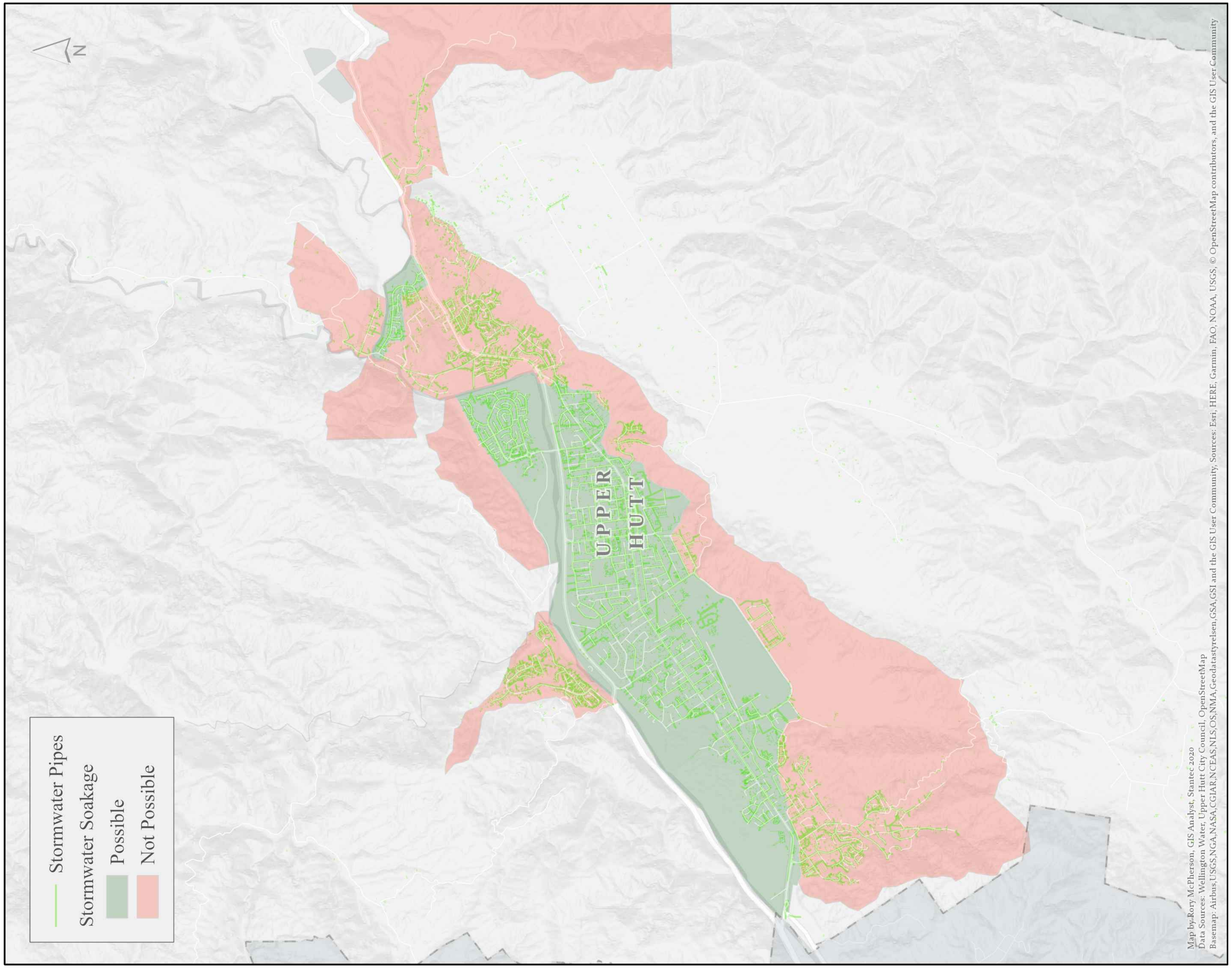
DRAWING N°. DR05

WARNING: PRINTED COPIES ARE UNCONTROLLED

COLOUR PLOT

PLOT DETAILS:
Date Plotted: Nov 29, 2021 - 9:44am
Plotted By: Andrew Lim

File Name: DR05 (2021) Trapped yard sump.dwg
File Location: C:\USERS\ALIM\ONEDRIVE - WELLINGTONWATER\007 WWL\WWL\WATER SERVICES STANDARD DWG\WWL TEMPLATE\DR01-05



REV	AMENDMENT	DWN	CHK	REV	DATE	AMENDMENT	DWN	CHK	DATE
A	PRELIMINARY	AA		02/20					

Wellington Water

DESIGN	WWL	-
UPDATE	E GREENBERG	10/21
DRAWING UPDATE	A LIM	10/21
CHECKED	E GREENBERG	11/21
REVIEWED	T STRANG	11/21
APPROVED	T STRANG	11/21

REGIONAL SPECIFICATION FOR WATER SERVICES

POSSIBLE LOCATION FOR STORMWATER SOAKAGE IN UPPER HUTT

SCALE: NOT TO SCALE

SHEET No. 1 OF 1 SHEETS.

DRAWING SIZE: A1

PROJECT/FILE NUMBER: -

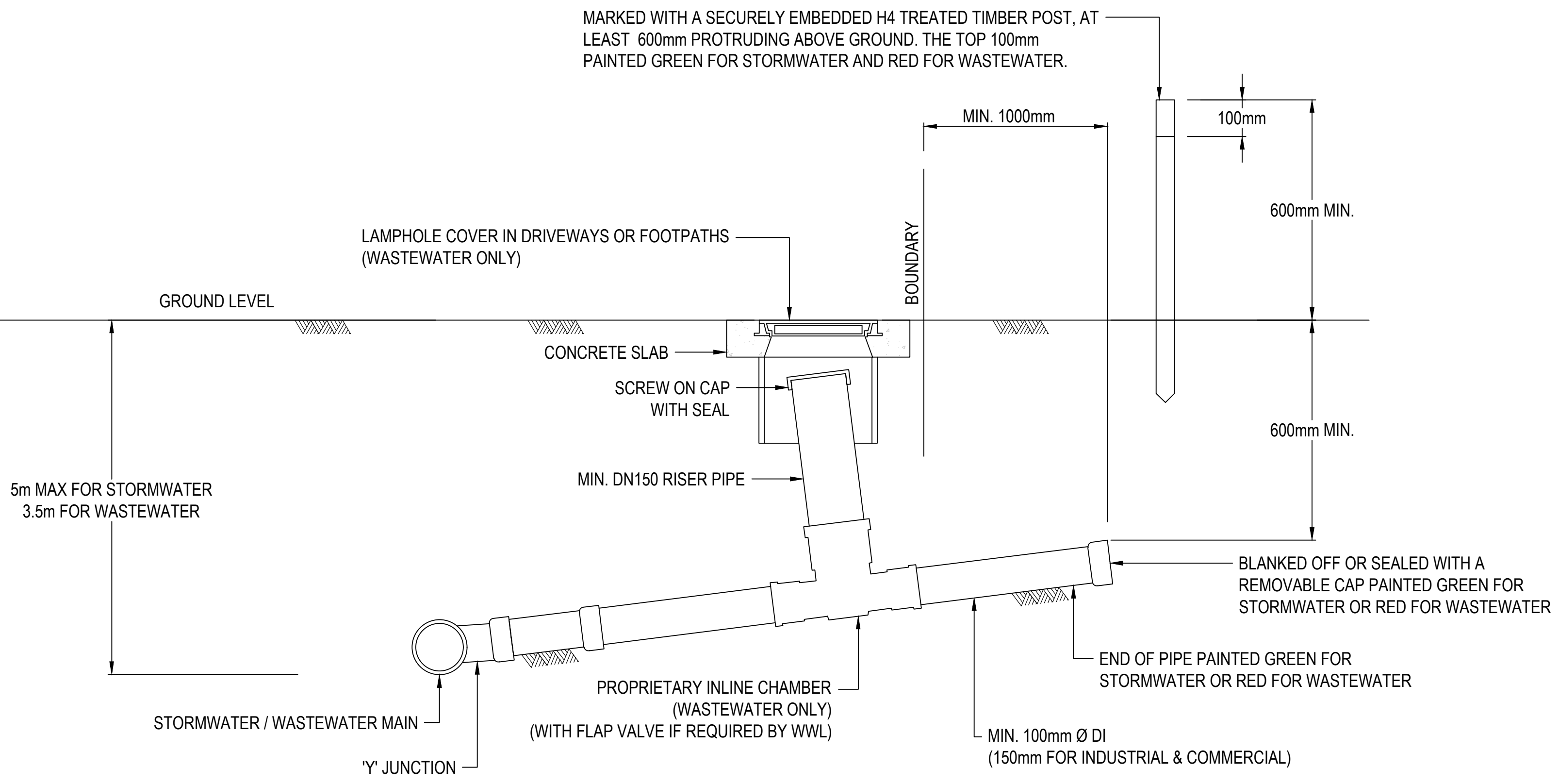
DRAWING N°. DR06

WARNING: PRINTED COPIES ARE UNCONTROLLED

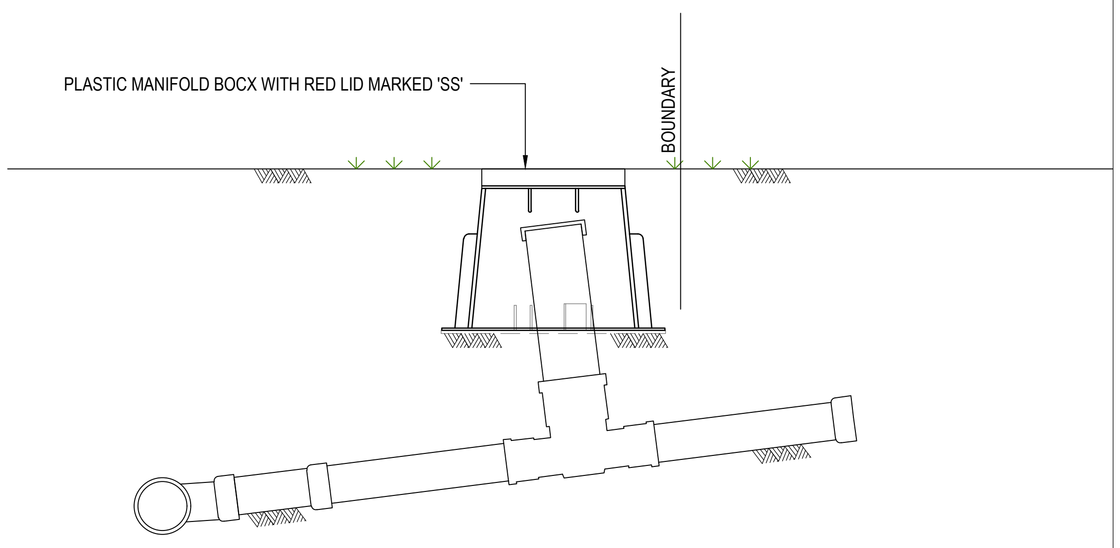
COLOUR PLOT

PLOT DETAILS:
Date Plotted: Dec 01, 2021 - 4:42pm
Plotted By: Andrew Lim

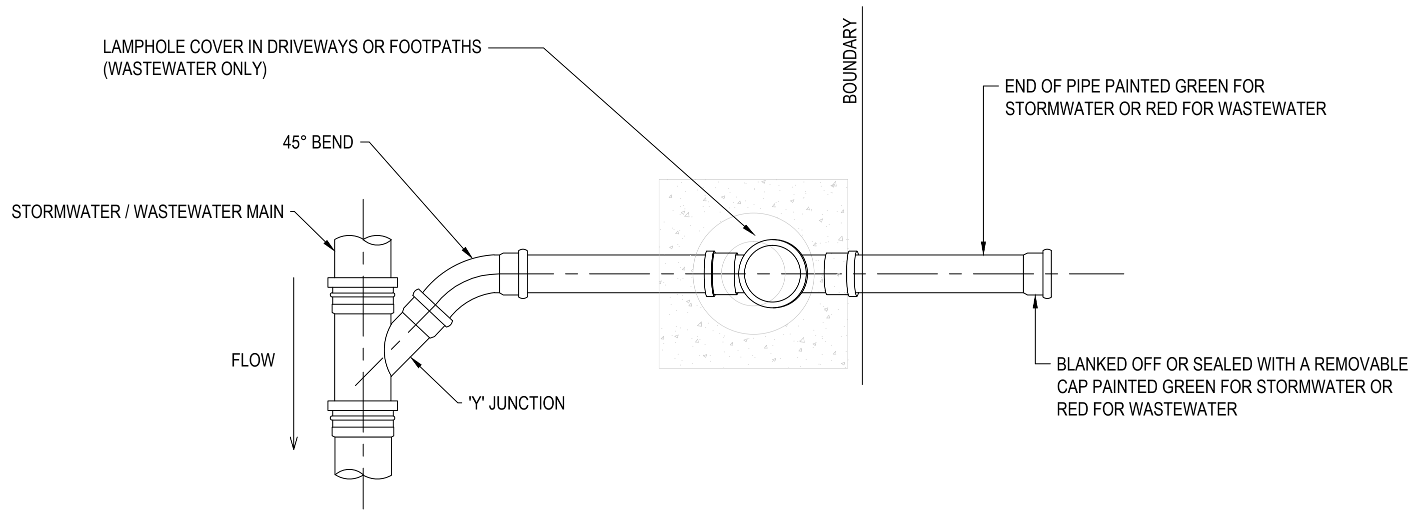
File Name: DR06 (2021) Stormwater soakage map.dwg
File Location: C:\USERS\ALIM\ONEDRIVE - WELLINGTONWATER\007 WWL\WWL\WATER SERVICES STANDARD DWG\WWL TEMPLATE\DR01-05



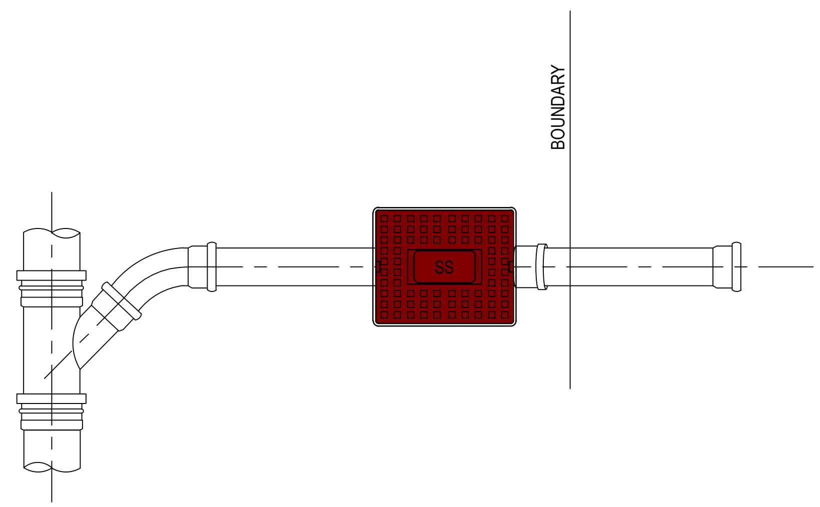
STANDARD STORMWATER OR WASTEWATER CONNECTION TO PUBLIC - SECTION VIEW



CLEANING EYE DETAIL FOR WASTEWATER CONNECTIONS IN GARDEN OR BERN AREAS - SECTION VIEW



STANDARD STORMWATER OR WASTEWATER CONNECTION TO PUBLIC - PLAN VIEW
(SEALED AREAS, E.G. FOOTPATHS, DRIVEWAYS)



CLEANING EYE DETAIL FOR WASTEWATER CONNECTIONS IN GARDEN OR BERM AREAS - PLAN VIEW

REV	AMENDMENT	DWN	CHK	REV	DATE	AMENDMENT	DWN	CHK	DATE
A	PRELIMINARY	AL			03/20				
B	CLEANING EYE DETAIL ADDED	AL	TS		10/21				

Wellington Water

DESIGN	WWL	-
UPDATE	T STRANG	10/21
DRAWING UPDATE	A LIM	10/21
CHECKED	E GREENBERG	11/21
REVIEWED	T STRANG	11/21
APPROVED	T STRANG	11/21

REGIONAL SPECIFICATION FOR WATER SERVICES

LATERAL CONNECTIONS TO PUBLIC STORMWATER OR WASTEWATER MAIN

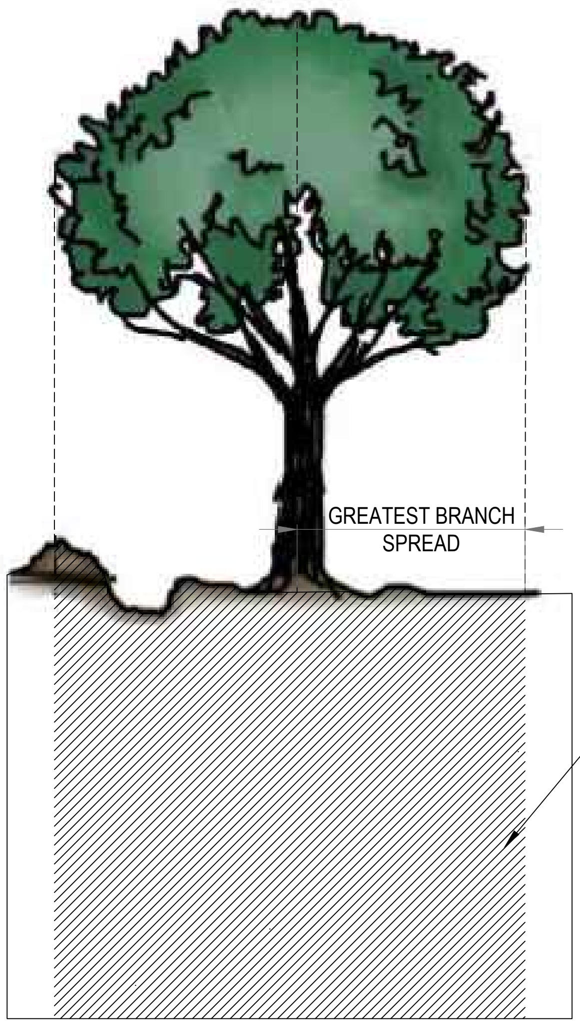
SCALE: NOT TO SCALE
SHEET No. 1 OF 1 SHEETS.
DRAWING SIZE: A1
PROJECT/FILE NUMBER: -
DRAWING N°. DR07

WARNING: PRINTED COPIES ARE UNCONTROLLED

COLOUR PLOT

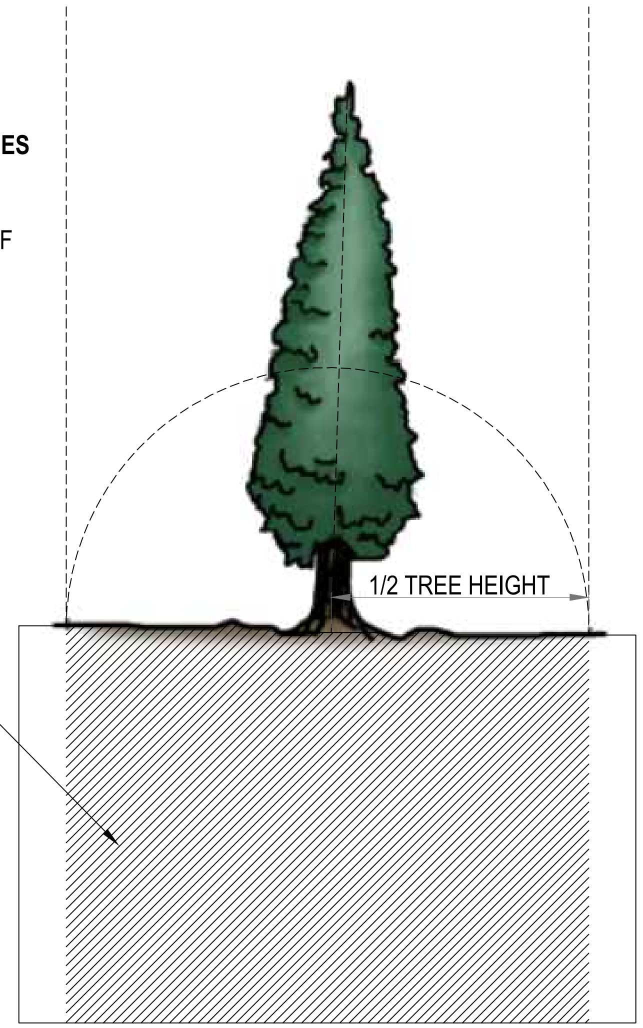
PLOT DETAILS:
Date Plotted: Dec 02, 2021 - 1:13pm
Plotted By: Andrew Lim

File Name: DR07 (2021) Lateral connections.dwg
File Location: C:\USERS\ALIM\ONEDRIVE - WELLINGTONWATER\007 WWL\WWL\WATER SERVICES STANDARD DWG\WWL TEMPLATE\EXCEL SHEET LIST



SPREADING CANOPY TREES

THE DRIPLINE IS DEFINED AS THE OUTER EXTENT OF THE BRANCH SPREAD.



COLUMNAR CANOPY TREES

THE DRIPLINE IS CALCULATED AS HALF THE HEIGHT OF THE TREE.

NOTES:
1. IF IN DOUBT ABOUT WHICH TO APPLY, USE WHICHEVER OF THE TWO MEASUREMENTS IS GREATER.
2. WITH IRREGULAR SHAPED TREES (e.g. LEANING TREES), THE DRIPLINE IS CALCULATED BY TAKING THE GREATEST RADIAL SPREAD OF THE CANOPY FROM THE TRUNK IN A FULL CIRCLE AROUND THE TREE.

REV	AMENDMENT	DWN	CHK	REV	DATE	AMENDMENT	DWN	CHK	DATE
A	PRELIMINARY ISSUE	AL			03/20				

Wellington Water

DESIGN	WWL	-
UPDATE	E GREENBERG	10/21
DRAWING UPDATE	A LIM	10/21
CHECKED	E GREENBERG	11/21
REVIEWED	T STRANG	11/21
APPROVED	T STRANG	11/21

REGIONAL SPECIFICATION FOR WATER SERVICES

TREE DRIPLINE

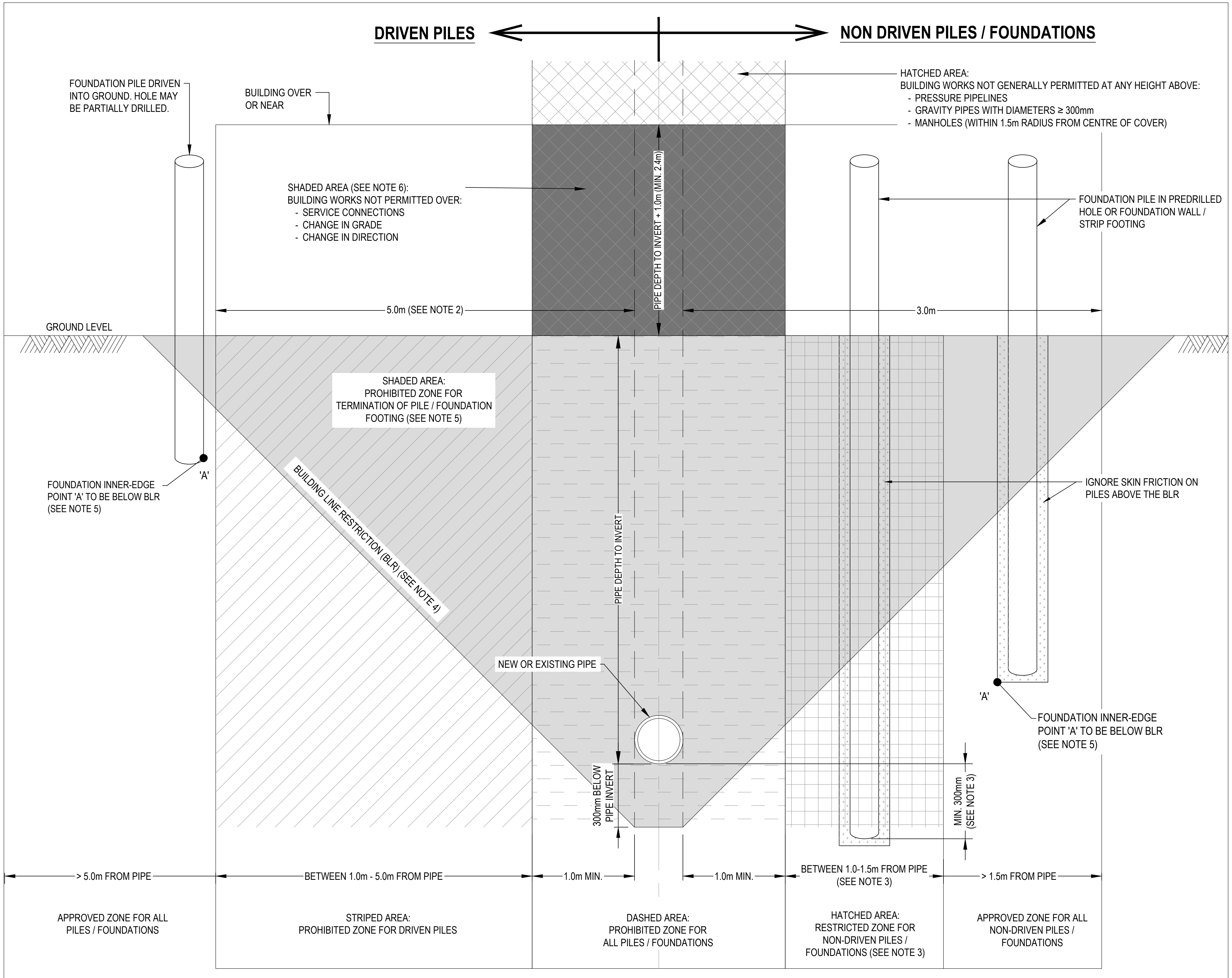
SCALE: NOT TO SCALE
SHEET No. 1 OF 1 SHEETS.
DRAWING SIZE: A1
PROJECT/FILE NUMBER: -
DRAWING N°. DR08

WARNING: PRINTED COPIES ARE UNCONTROLLED

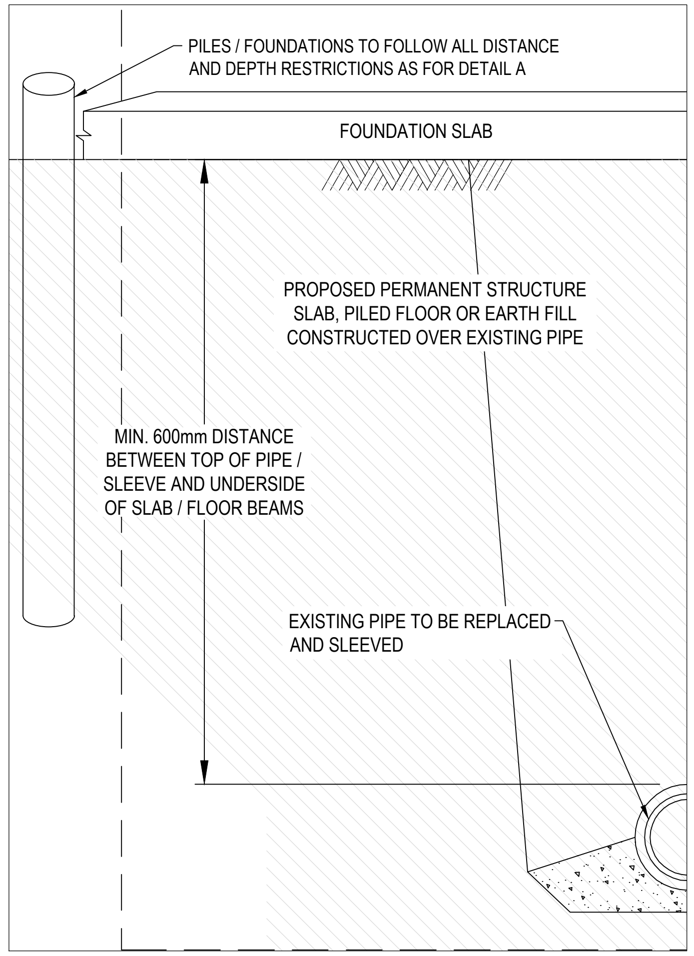
COLOUR PLOT

PLOT DETAILS:
Date Plotted: Dec 01, 2021 - 4:54pm
Plotted By: Andrew Lim

File Name: DR08 (2021) Tree dripline.dwg
File Location: C:\USERS\ALIM\ONEDRIVE - WELLINGTONWATER\007 WWL\WWL\WATER SERVICES STANDARD DWG\WWL TEMPLATE\DR01-05



DETAIL A: BUILDING NEAR PIPE



DETAIL B: BUILDING OVER PIPES - SLEEVING REQUIREMENTS

NOTES:

1. ALL HORIZONTAL DISTANCES ARE FROM THE OUTSIDE FACE OF THE PIPE / SLEEVE.
2. NO DRIVEN PILES WITHIN 5.0m OF ALL PIPELINES.
3. PILES WITHIN 1.0m - 1.5m FROM THE OUTSIDE OF THE PIPE REQUIRE WRITTEN APPROVAL FROM WELLINGTON WATER, AND MUST TERMINATE MIN. 300mm BELOW THE INVERT OF THE PIPE / SLEEVE.
4. THE ANGLE OF THE BUILDING LINE RESTRICTION (BLR) IS TYPICALLY 45 DEGREES (1H : 1V) FOR COHESIVE SOILS.
5. PILE / FOUNDATION INNER-EDGE POINT 'A' MUST BE BELOW THE BLR.
6. ZONE EXTENDS LONGITUDINALLY ALONG THE PIPE ALIGNMENT FOR A DISTANCE OF 1.0m OR THE DEPTH TO INVERT (WHICHEVER IS GREATER).

REV	AMENDMENT	DWN	CHK	DATE	REV	AMENDMENT	DWN	CHK	DATE
A	PRELIMINARY	AA	AM	02/21					
B	NOTES & LABELS REVISIONS	AA	AM	10/21					

Wellington Water

DESIGN	WWL	-
UPDATE	A MCDONALD	10/21
DRAWING UPDATE	A LIM	10/21
CHECKED	E GREENBERG	11/21
REVIEWED	T STRANG	11/21
APPROVED	T STRANG	11/21

REGIONAL SPECIFICATION FOR WATER SERVICES

BUILDING IN CLOSE PROXIMITY

SCALE: NOT TO SCALE
SHEET No. 1 OF 1 SHEETS.
DRAWING SIZE: A1
PROJECT/FILE NUMBER: -
DRAWING N°. DR09

WARNING: PRINTED COPIES ARE UNCONTROLLED

COLOUR PLOT

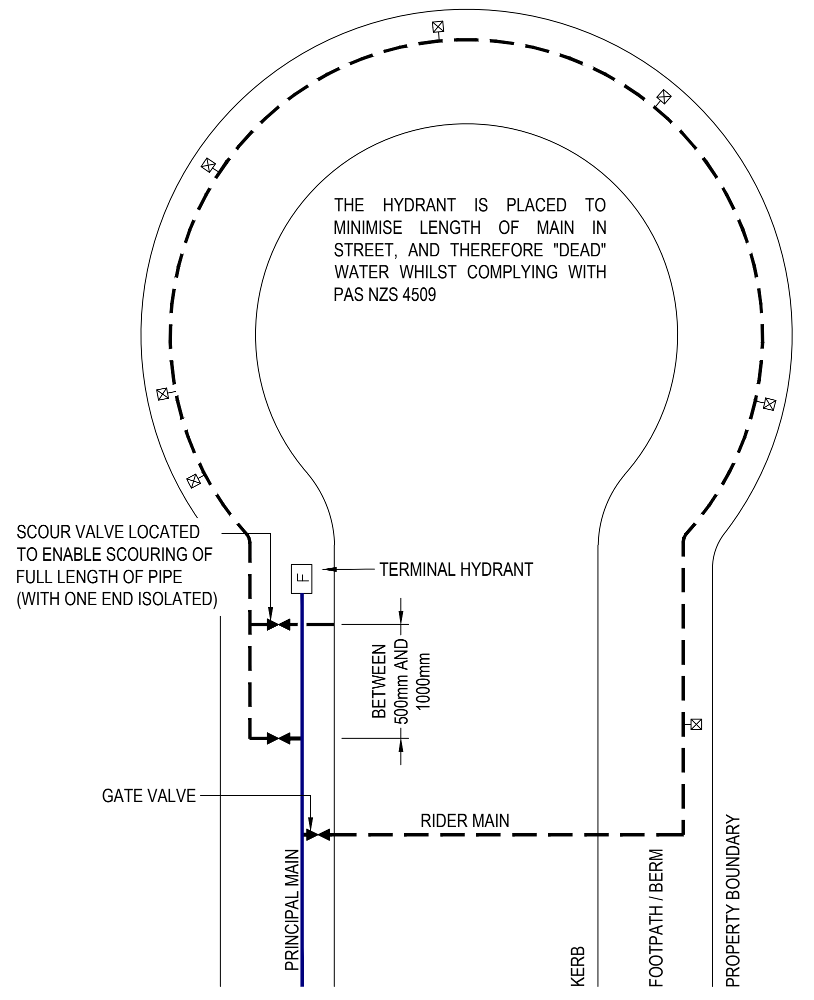
PLOT DETAILS:
Date Plotted: Dec 02, 2021 - 8:35am
Plotted By: Andrew Lim

File Name: DR09 (2021) Building in close proximity.dwg
File Location: C:\USERS\ALIM\ONEDRIVE - WELLINGTONWATER\007 WWL\WWL\WATER SERVICES STANDARD DWG\WWL TEMPLATE

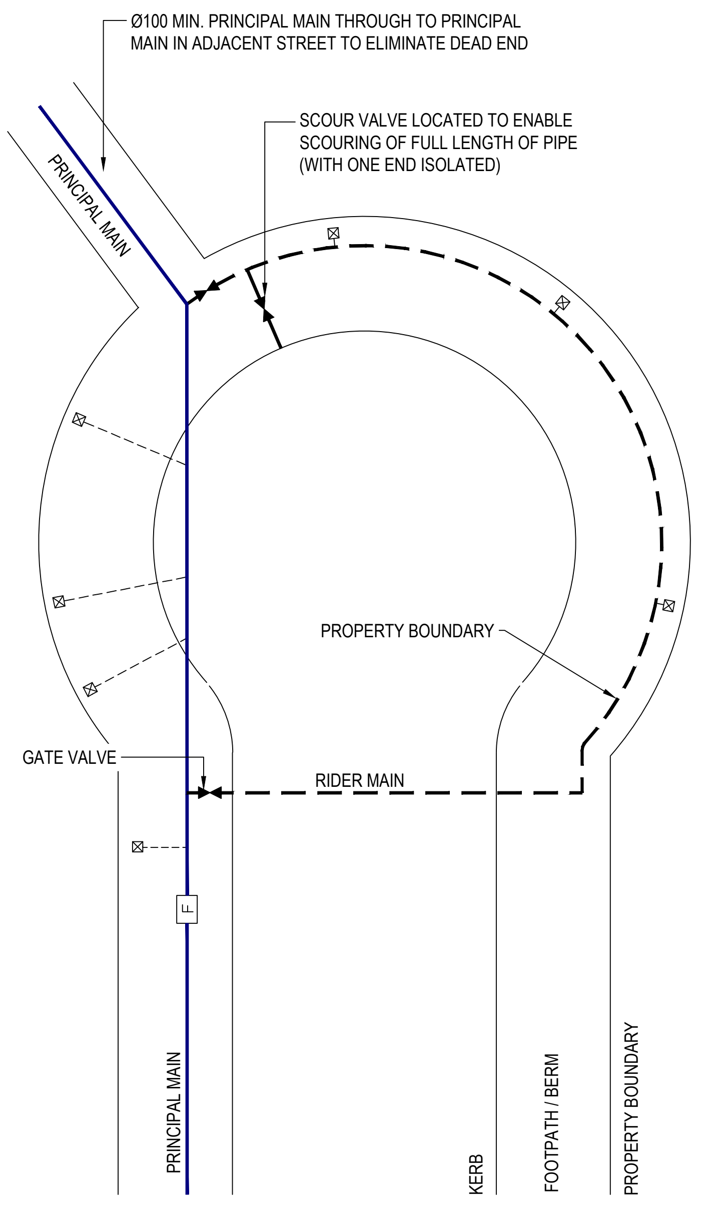
NOTE:
1. THE EXAMPLES SHOWN HERE ARE TYPICAL AND MAY VARY DUE TO IN-SITU CIRCUMSTANCE OR CHANGE IN COUNCIL POLICY.

SERVICES LEGEND

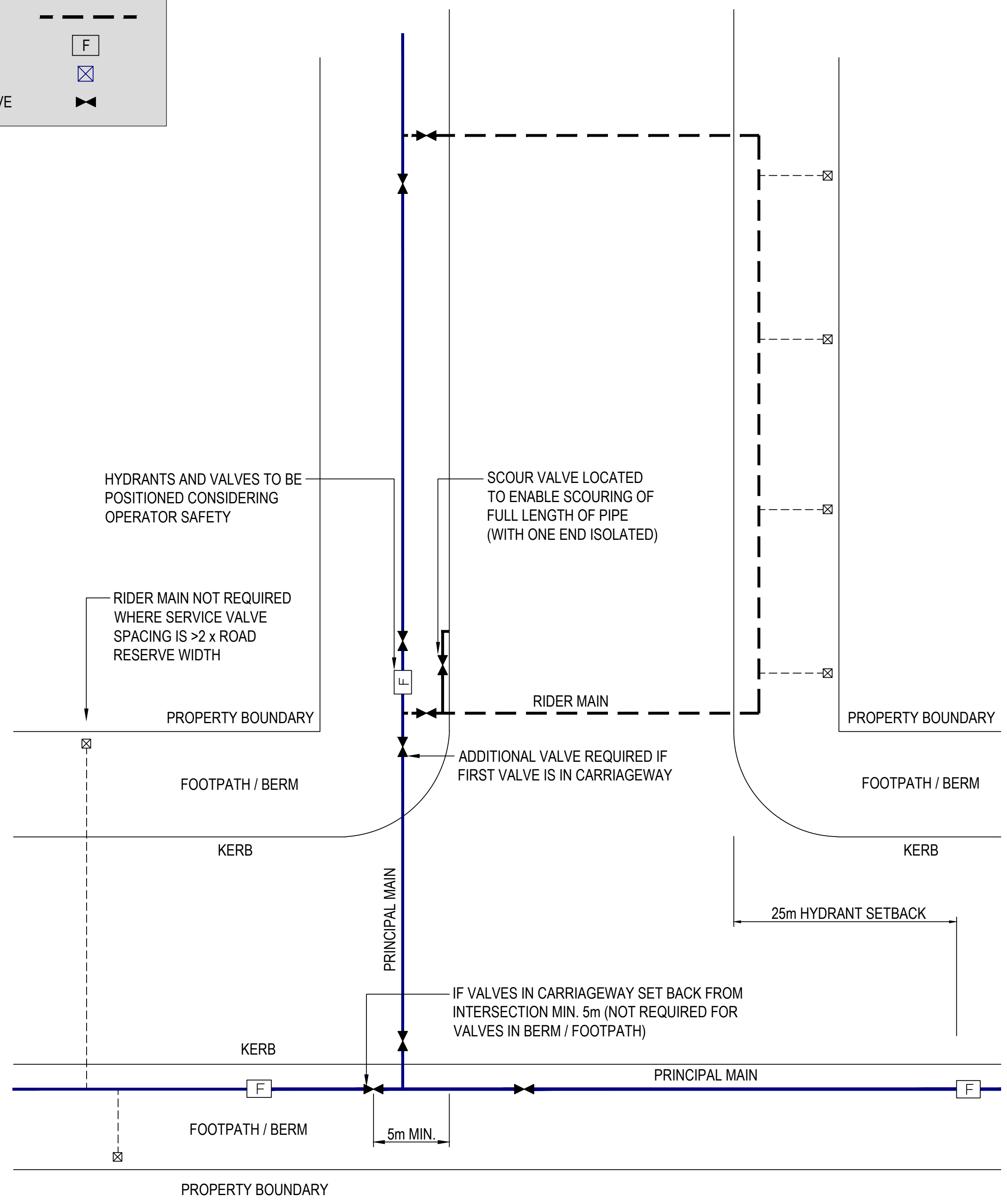
- PRINCIPAL MAIN
- RIDER MAIN
- HYDRANT
- SERVICE VALVE
- GATE VALVE / SCOUR VALVE



TERMINAL PRINCIPAL MAIN



LINKED PRINCIPAL MAIN



TYPICAL INTERSECTION

REV	AMENDMENT	DWN	CHK	REV	DATE	AMENDMENT	DWN	CHK	DATE
A	PRELIMINARY ISSUE	AL	EG		02/20				
B	SCOUR VALVES ON RIDER MAINS	AL	EG		11/21				

Wellington Water

DESIGN	WWL	-
UPDATE	E GREENBERG	10/21
DRAWING UPDATE	A LIM	10/21
CHECKED	E GREENBERG	11/21
REVIEWED	K WYNN	11/21
APPROVED	K WYNN	11/21

REGIONAL SPECIFICATION FOR WATER SERVICES

TYPICAL WATER RETICULATION LAYOUT

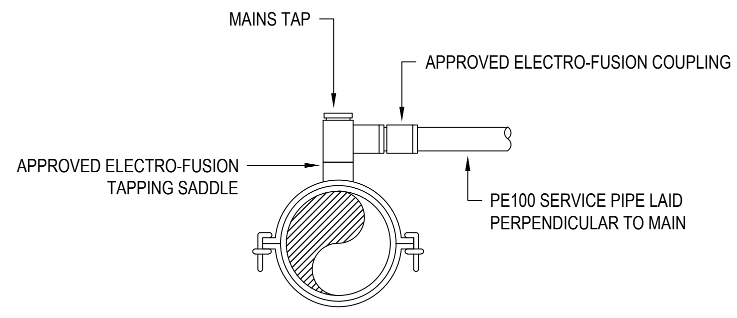
SCALE: NOT TO SCALE
SHEET No. 1 OF 1 SHEETS.
DRAWING SIZE: A1
PROJECT/FILE NUMBER: -
DRAWING N°. WS01

WARNING: PRINTED COPIES ARE UNCONTROLLED

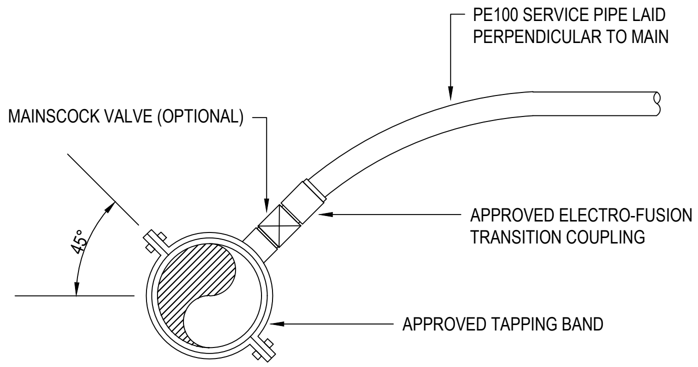
COLOUR PLOT

PLOT DETAILS:
Date Plotted: Dec 02, 2021 - 1:27pm
Plotted By: Andrew Lim

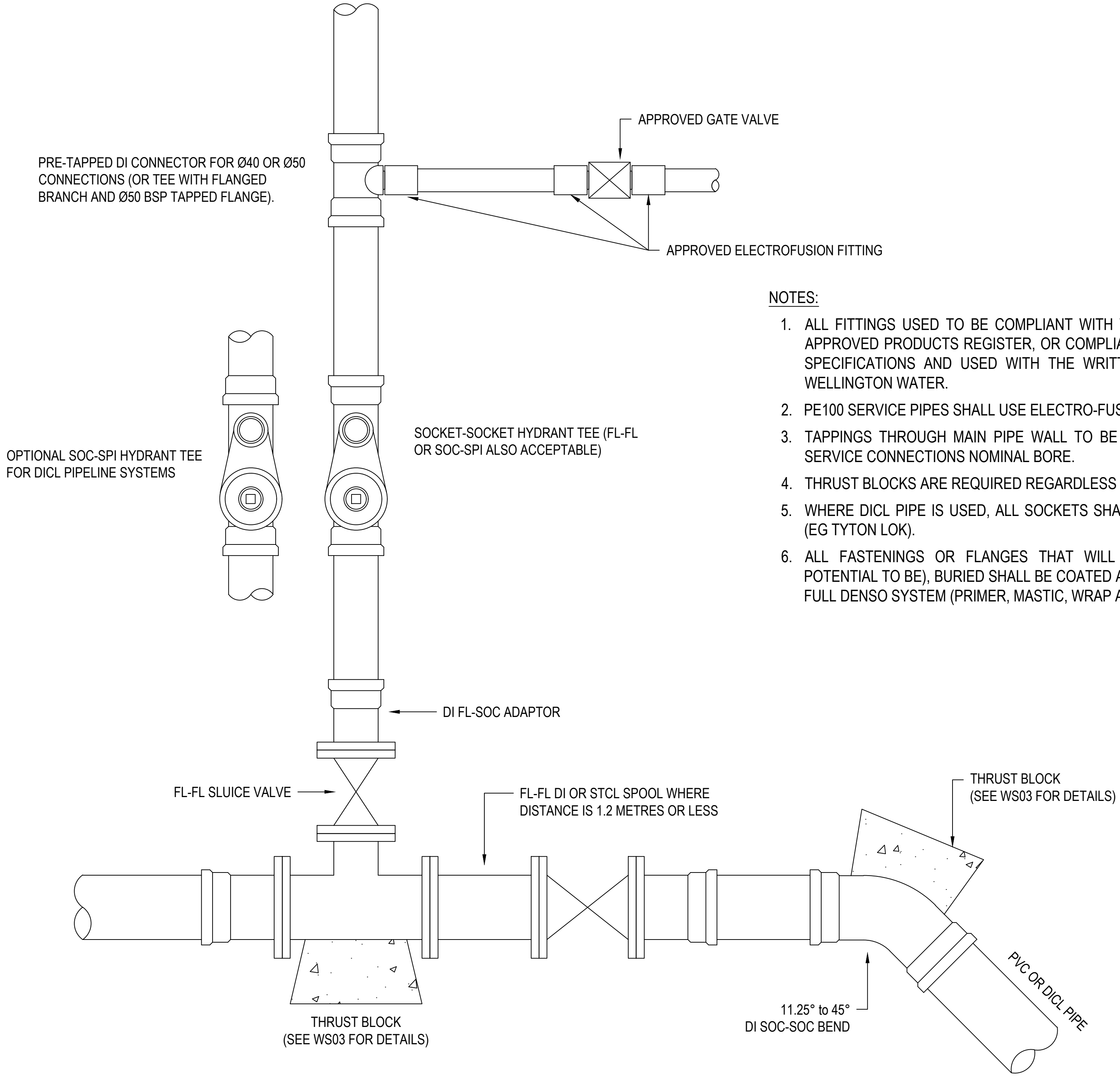
File Name: WS01 (2021) water reticulation layout.dwg
File Location: C:\USERS\ALIM\ONEDRIVE - WELLINGTONWATER\007 WWL\WWL\WATER SERVICES STANDARD DWG\WWL TEMPLATE\WS01-08



TYPICAL TAPPING TO PE PIPE



TYPICAL TAPPING TO PVC/DICL PIPE



TYPICAL PVC OR DICL PIPE CONNECTIONS ≤ DN200

NOTES:

1. ALL FITTINGS USED TO BE COMPLIANT WITH WELLINGTON WATER APPROVED PRODUCTS REGISTER, OR COMPLIANT WITH TECHNICAL SPECIFICATIONS AND USED WITH THE WRITTEN PERMISSION OF WELLINGTON WATER.
2. PE100 SERVICE PIPES SHALL USE ELECTRO-FUSION FITTINGS.
3. TAPPINGS THROUGH MAIN PIPE WALL TO BE SAME DIAMETER AS SERVICE CONNECTIONS NOMINAL BORE.
4. THRUST BLOCKS ARE REQUIRED REGARDLESS OF JOINT TYPE.
5. WHERE DICL PIPE IS USED, ALL SOCKETS SHALL HAVE GRIP RINGS (EG TYTON LOK).
6. ALL FASTENINGS OR FLANGES THAT WILL BE (OR HAVE THE POTENTIAL TO BE), BURIED SHALL BE COATED AND WRAPPED IN THE FULL DENSO SYSTEM (PRIMER, MASTIC, WRAP AND OVER WRAP).

REV	AMENDMENT	DWN	CHK	REV	DATE	AMENDMENT	DWN	CHK	DATE
A	PRELIMINARY ISSUE	AL			02/20				
B	REVISIONS	AL	EG		10/21				

Wellington Water

DESIGN	WWL	-
UPDATE	C WANG	10/21
DRAWING UPDATE	A LIM	10/21
CHECKED	E GREENBERG	11/21
REVIEWED	K WYNN	12/21
APPROVED	K WYNN	12/21

REGIONAL SPECIFICATION FOR WATER SERVICES

TYPICAL WATER DISTRIBUTION PIPE JUNCTIONS AND CONNECTIONS

SCALE: NOT TO SCALE
SHEET No. 1 OF 1 SHEETS.
DRAWING SIZE: A1
PROJECT/FILE NUMBER: -
DRAWING N°. WS02

WARNING: PRINTED COPIES ARE UNCONTROLLED

COLOUR PLOT

PLOT DETAILS:
Date Plotted: Dec 09, 2021 - 7:56pm
Plotted By: Andrew Lim

File Name: WS02 (2021) Water distribution pipe junctions and connections.dwg
File Location: C:\USERS\ALIM\ONEDRIVE - WELLINGTONWATER\007 WWL\WWL\WATER SERVICES STANDARD DWG\WWL TEMPLATE\WS01-08

NOTES:

1. THRUST BLOCKS TO BE POURED AGAINST FIRM, CLEAR AND UNDISTURBED NATIVE GROUND.
2. THRUST BLOCKS FOR PIPES >DN300 TO BE SPECIFICALLY DESIGNED.
3. MINIMUM BEARING AREAS MAY BE INCREASED PRO-RATA FOR INCREASED TEST PRESSURES.
4. THRUST BLOCK VOLUMES ARE FOR A 1600kPa TEST PRESSURE. ADJUST VOLUMES FOR HIGHER TEST PRESSURES.
5. MINIMUM COVER TO PIPE SHALL BE 600mm, OR SPECIFIC DESIGN IS REQUIRED.
6. SHALL NOT BE PLACED UNDER WORKING OR TEST LOAD FOR AT LEAST 3 DAYS AFTER POURING, WHERE THIS IS UNAVAILABLE, TOMMING WITH TIMBER STRUTS TO PROVIDE IMMEDIATE THRUST RESTRAINT IS ALLOWABLE IF APPROVED BY WELLINGTON WATER.

MINIMUM BEARING AREA (m²) FOR PN16 PIPES					
ASSUMED TEST PRESSURE 1600 kPa, ASSUMED HORIZONTAL SOIL BEARING PRESSURE 75kPa					
PIPE DN	11.25° BEND	22.5° BEND	45° BEND	90° BEND	END CAP / TEE / INLINE
Ø100	0.10	0.10	0.19	0.36	0.25
Ø150	0.11	0.22	0.43	0.80	0.57
Ø200	0.20	0.39	0.77	1.42	1.00
Ø250	0.31	0.61	1.20	2.22	1.57
Ø300	0.44	0.88	1.73	3.20	2.26
Ø375	0.69	1.38	2.70	5.00	3.53

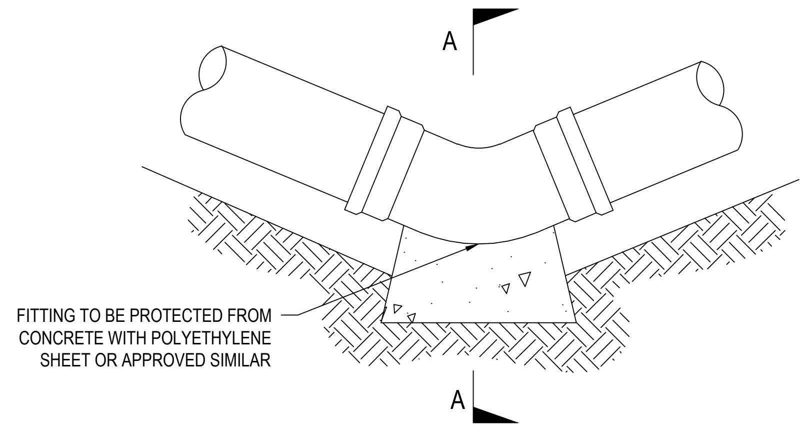
FACTOR OF SAFETY = 1.5

THE FOLLOWING FORMULAE CAN BE USED TO CALCULATE MIN. BEARING AREAS:

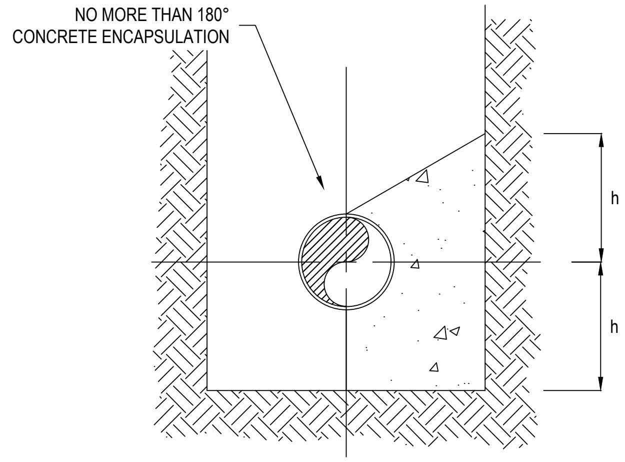
FOR BENDS = $\frac{AP2\sin(\theta/2)}{SBP}$ m²

FOR END CAPS / TEES = $\frac{AP}{SBP}$ m²

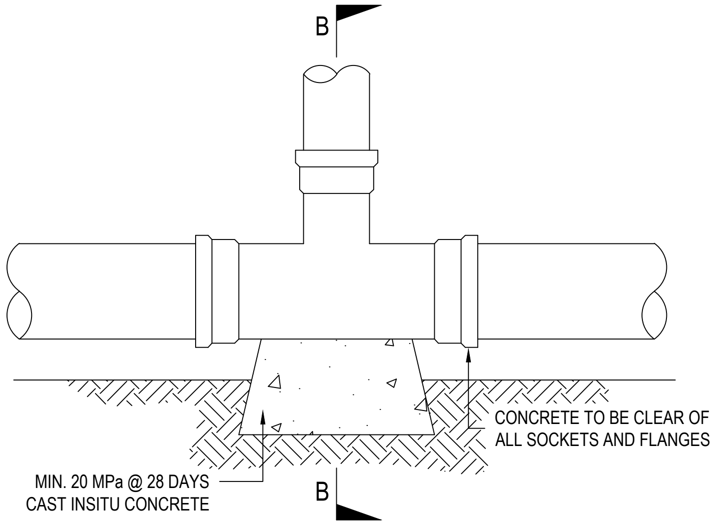
WHERE:
A = AREA OF PIPE (m² : USING OUTSIDE DIA. OF PIPE)
P = TEST PRESSURE OF PIPE (kPa)
θ = ANGLE OF BEND
SBP = SAFE BEARING PRESSURE OF IN SITU SOIL (kPa)



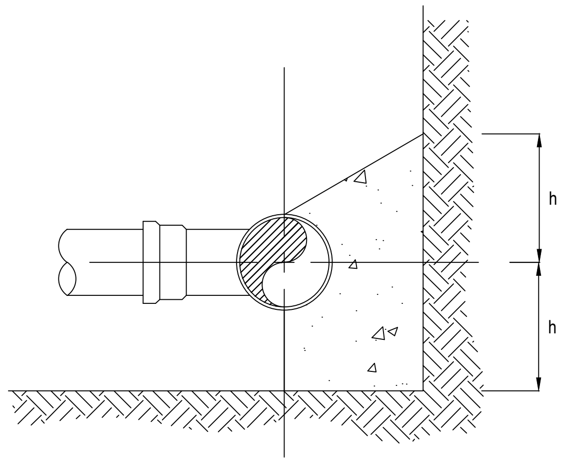
TYPICAL THRUST BLOCK DETAIL ON BENDS - PLAN VIEW



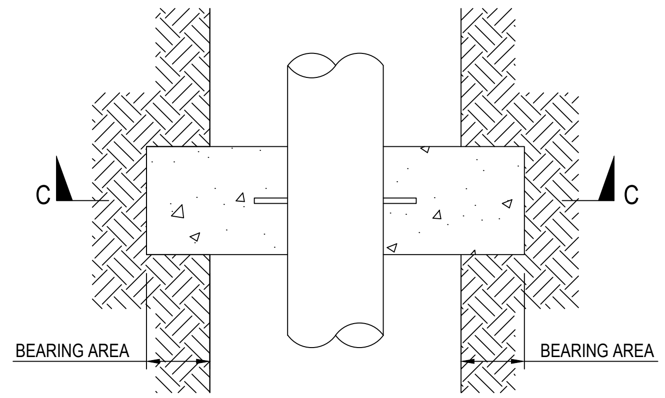
SECTION A-A



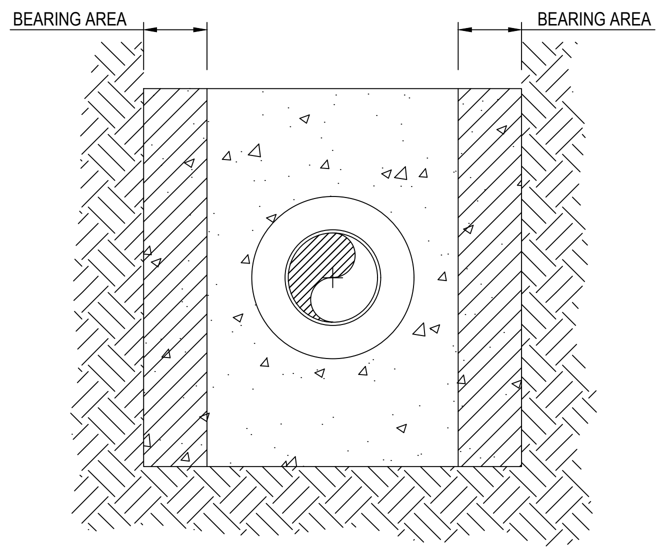
TYPICAL THRUST BLOCK DETAIL ON TEE - PLAN VIEW



SECTION B-B



TYPICAL IN-LINE THRUST BLOCK DETAIL - PLAN VIEW



SECTION C-C

REV	AMENDMENT	DWN	CHK	REV	DATE	AMENDMENT	DWN	CHK	DATE
A	PRELIMINARY ISSUE	AL			02/20				
B	TABLE AND DETAILS UPDATE	AL			11/21				

Wellington Water

DESIGN	WWL	-
UPDATE	C WANG	10/21
DRAWING UPDATE	A LIM	10/21
CHECKED	E GREENBERG	11/21
REVIEWED	K WYNN	12/21
APPROVED	K WYNN	12/21

REGIONAL SPECIFICATION FOR WATER SERVICES

TYPICAL THRUST BLOCK DETAILS

SCALE: NOT TO SCALE
SHEET No. 1 OF 1 SHEETS.
DRAWING SIZE: A1
PROJECT/FILE NUMBER: -
DRAWING N°. WS03

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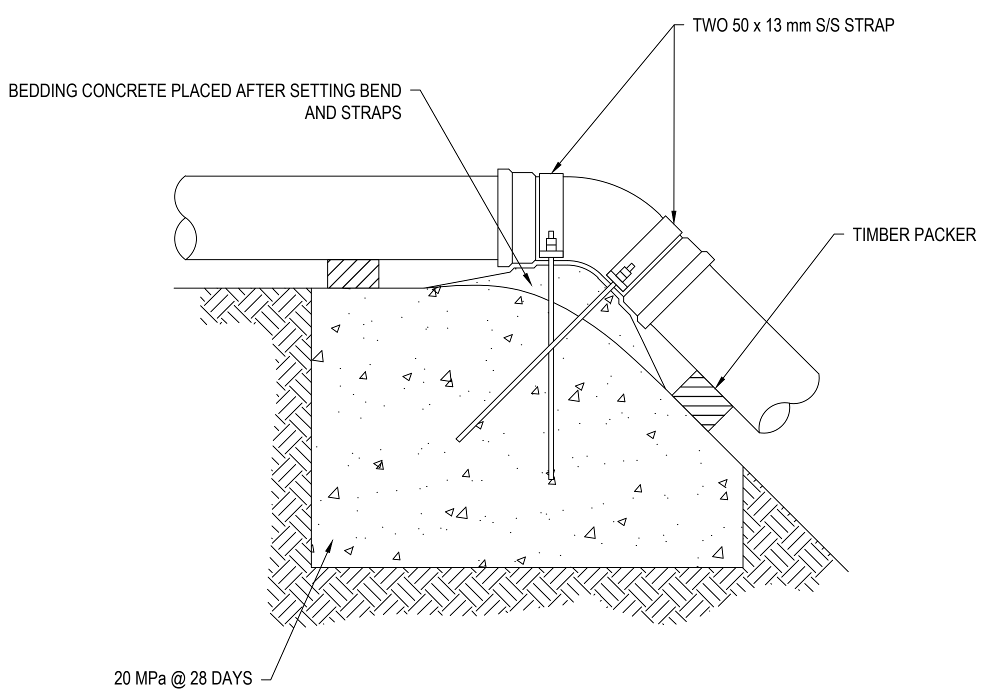
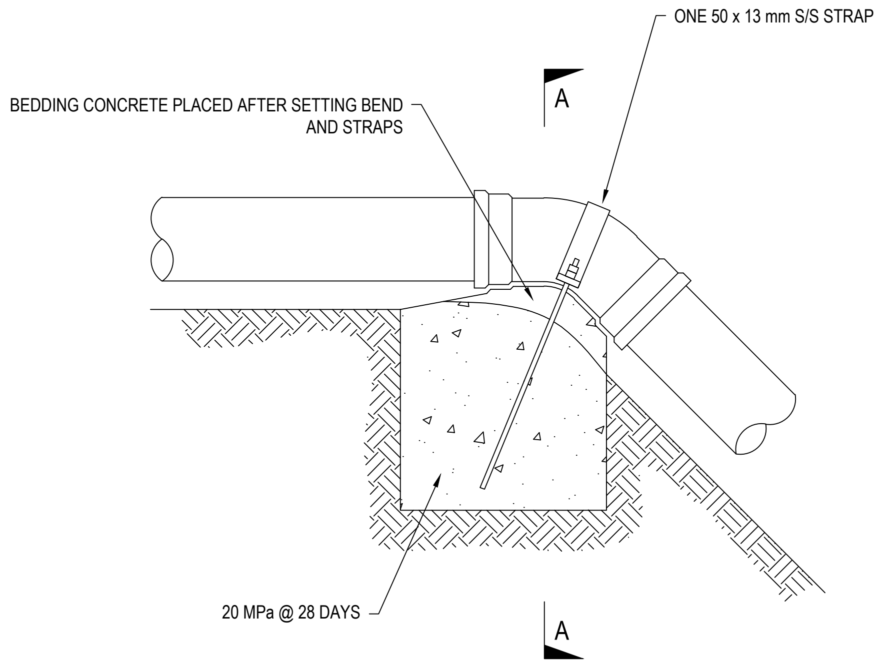
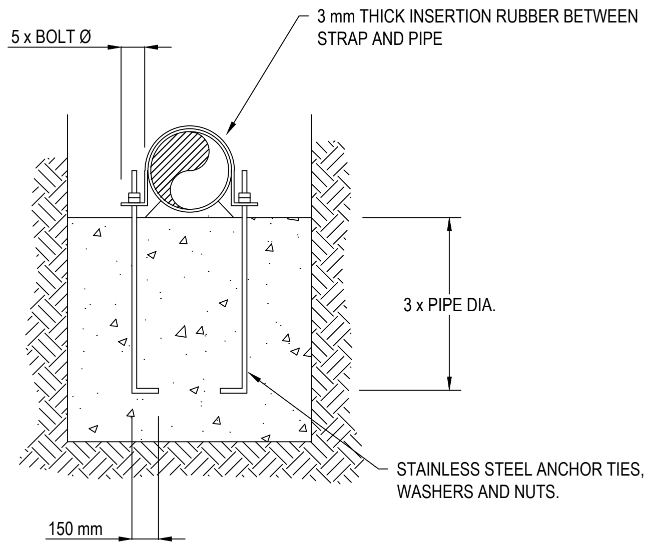
COLOUR PLOT

PLOT DETAILS:
Date Plotted: Dec 09, 2021 - 10:38am
Plotted By: Andrew Lim

File Name: WS03 (2021) Thurst block details.dwg
File Location: C:\USERS\ALIM\ONEDRIVE - WELLINGTONWATER\007 WWL\WWL\WATER SERVICES STANDARD DWG\WWL TEMPLATE\WS01-08







A-A

TYPICAL ANCHOR BLOCK DETAILS

MINIMUM ANCHOR VOLUME (m³) FOR 1600 kPa TEST PRESSURE				NO. OF STRAPS	THREAD SIZE
PIPE DN	11.25°	22.5°	45°		
Ø100	0.14	0.28	0.51	1	M12
Ø150	0.30	0.60	1.11	1	M16
Ø200	0.51	1.01	1.88	2	M16
Ø250	0.79	1.57	2.91	2	M20
Ø300	1.11	2.21	4.10	2	M20

THE FOLLOWING FORMULA CAN BE USED TO CALCULATE MINIMUM ANCHOR VOLUME:

$$\mathrm{F} = \mathrm{APsin}\,\theta$$

$$\mathrm{V} = \left(\left(\frac{F \times 1000}{g}\right) - M_W\right)/\rho$$

WHERE:

A = AREA OF PIPE (m² USING OUTSIDE DIA. OF PIPE)

ρ = TEST PRESSURE (kPA)

θ = ANGLE OF BEND

F = VERTICAL FORCE COMPONENT ON PIPE (kN)

g = ACCELERATION DUE TO GRAVITY (m/s²)

M_W = MASS OF WATER FOR A 1m SECTION OF PIPE (kg)

ρ = DENSITY OF CONCRETE (kg/m³)

1. VOLUMES CALCULATED USING VERTICAL FORCE ONLY, HORIZONTAL FORCE WILL BE ACCOMMODATED BY BEARING AREA OF ANCHOR BLOCK.
2. DENSITY OF CONCRETE ASSUMED TO BE 2300 kg/m^3
3. MASS OF WATER HAS BEEN INCLUDED IN THE EQUATION FOR A 1m LENGTH OF PIPE.
4. MINIMUM STRAP SIZE 50 x 13mm
5. NO SAFETY FACTOR HAS BEEN USED AS THERE IS LITTLE VARIABILITY IN THE INPUT VALUES.
6. THE MASS OF BEDDING AND BACKFILL HAS NOT BEEN INCLUDED IN THE CALCULATION.

NOTES:

1. ANCHOR BLOCKS TO BE POURED AGAINST FIRM, CLEAR AND UNDISTURBED NATIVE GROUND.
2. ANCHOR BLOCKS FOR PIPES >DN300 TO BE SPECIFICALLY DESIGNED.
3. ALL CONCRETE TO BE CLEAR OF FLANGES & SOCKETS.
4. ANCHOR BLOCK VOLUMES ARE FOR A 1600kPa TEST PRESSURE. ADJUST VOLUMES FOR HIGHER TEST PRESSURES.
5. ALL FASTENINGS OR FLANGES THAT WILL BE (OR HAVE THE POTENTIAL TO BE), BURIED SHALL BE COATED AND WRAPPED IN THE FULL DENSO SYSTEM (PRIMER, MASTIC, WRAP AND OVER WRAP).
6. ANCHOR TIES IN UNREINFORCED ANCHOR BLOCKS SHOULD EXTEND INTO THE BLOCK BY AT LEAST 3/4 OF THE DEPTH OF THE BLOCK.
7. ANCHOR BLOCKS LARGER THAN 1.2m^3 SHOULD BE REINFORCED. THE REINFORCED BAR SHOULD BE D16 AT 200mm CENTERS BOTH WAYS, ON ALL FACES. MINIMUM 75mm COVER.

REV	AMENDMENT	DWN	CHK	REV	DATE	AMENDMENT	DWN	CHK	DATE
A	PRELIMINARY ISSUE	AL			02/20				
B	CALCULATION FOR 1600 kPa AND ADDITIONAL NOTES	AL	AP		11/21				

Wellington Water

DESIGN	WWL	-
UPDATE	A PAWSON	11/21
DRAWING UPDATE	A LIM	11/21
CHECKED	E GREENBERG	11/21
REVIEWED	J EWEG	11/21
APPROVED	K WYNN	11/21

REGIONAL SPECIFICATION FOR WATER SERVICES

TYPICAL ANCHOR BLOCK DETAILS

SCALE: NOT TO SCALE
SHEET No. 1 OF 1 SHEETS.
DRAWING SIZE: A1
PROJECT/FILE NUMBER: -
DRAWING N°. WS04

WARNING: PRINTED COPIES ARE UNCONTROLLED

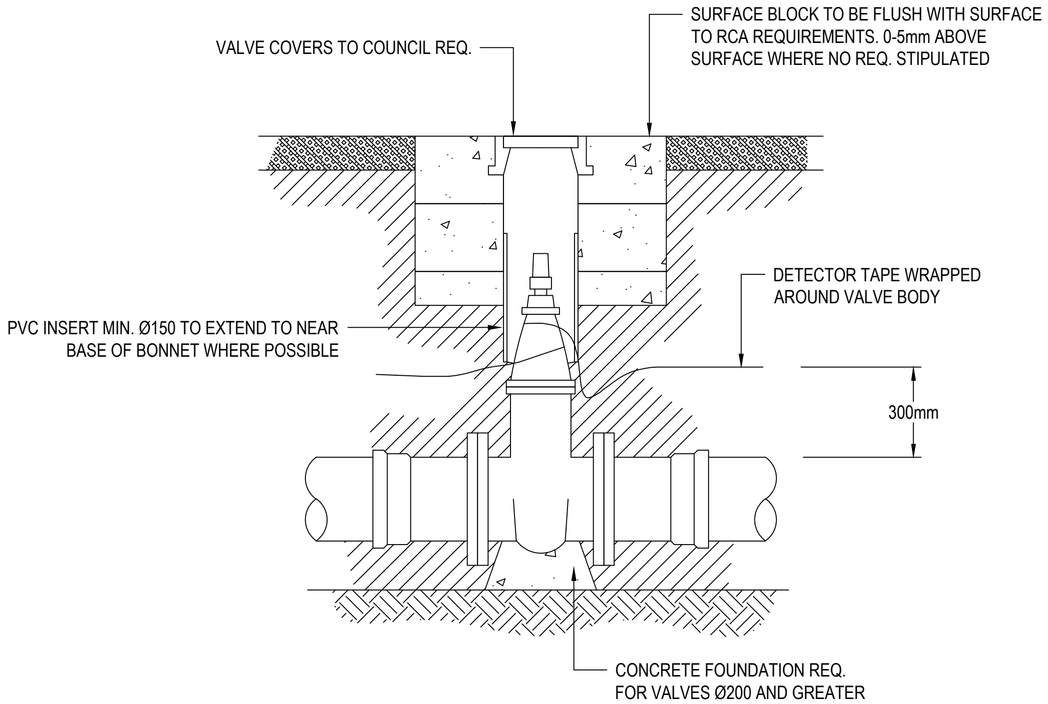
COLOUR PLOT

PLOT DETAILS:
Date Plotted: Dec 09, 2021 - 5:16pm
Plotted By: Andrew Lim

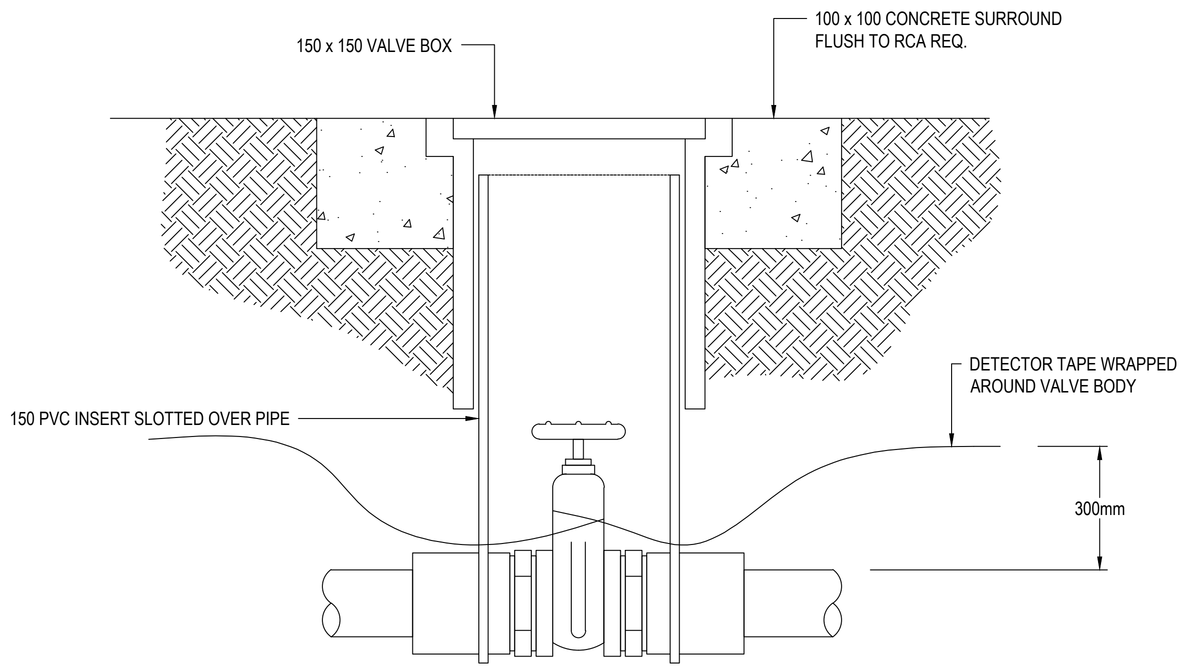
File Name: WS04 (2021) Anchor block details.dwg
File Location: C:\USERS\ALIM\ONEDRIVE - WELLINGTONWATER\007 WWL\WWL\WATER SERVICES STANDARD DWG\WWL TEMPLATE\WS01-08

NOTES:

1. NOMINAL DEPTH OF BETWEEN 100 AND 350mm FROM GROUND LEVEL TO TOP OF GATE VALVE SPINDLE CAP.
2. METALLIC DETECTOR / WARNING TAPE TO BE LAID 300mm ABOVE ALL BULK, TRUNK, PRINCIPAL AND RIDER MAIN PIPES AND 100mm ABOVE SERVICE PIPES AND CONTINUE THROUGH VALVE ENCLOSURE WHILST MAINTAINING TAPE CONDUCTIVITY.
3. THRUST BLOCKS MAY BE REQUIRED FOR VALVES TO SECURE AGAINST LATERAL THRUST WHEN VALVE CLOSED AND MAIN IS DRAINED ON ONE SIDE OF THE VALVE. REFER TO WS14 AND WS03.
4. ALL VALVES SHALL INCLUDE A TAG OR OTHER MEANS TO CLEARLY INDICATE CLOSING DIRECTION.
5. ALL FASTENINGS OR FLANGES THAT WILL BE (OR HAVE THE POTENTIAL TO BE), BURIED SHALL BE COATED AND WRAPPED IN THE FULL DENSO SYSTEM (PRIMER, MASTIC, WRAP AND OVER WRAP).



GATE VALVES
Ø80 AND ABOVE



GATE VALVES Ø50 OR LESS

REV	AMENDMENT	DWN	CHK	REV	DATE	AMENDMENT	DWN	CHK	DATE
A	PRELIMINARY ISSUE	AL			02/20				
B	REVISED NOTES	AL	EG		11/21				

Wellington Water

DESIGN	WWL	-
UPDATE	E GREENBERG	10/21
DRAWING UPDATE	A LIM	10/21
CHECKED	E GREENBERG	11/21
REVIEWED	K WYNN	12/21
APPROVED	K WYNN	12/21

REGIONAL SPECIFICATION FOR WATER SERVICES

TYPICAL VALVE DETAILS

SCALE: NOT TO SCALE

SHEET No. 1 OF 1 SHEETS.

DRAWING SIZE: A1

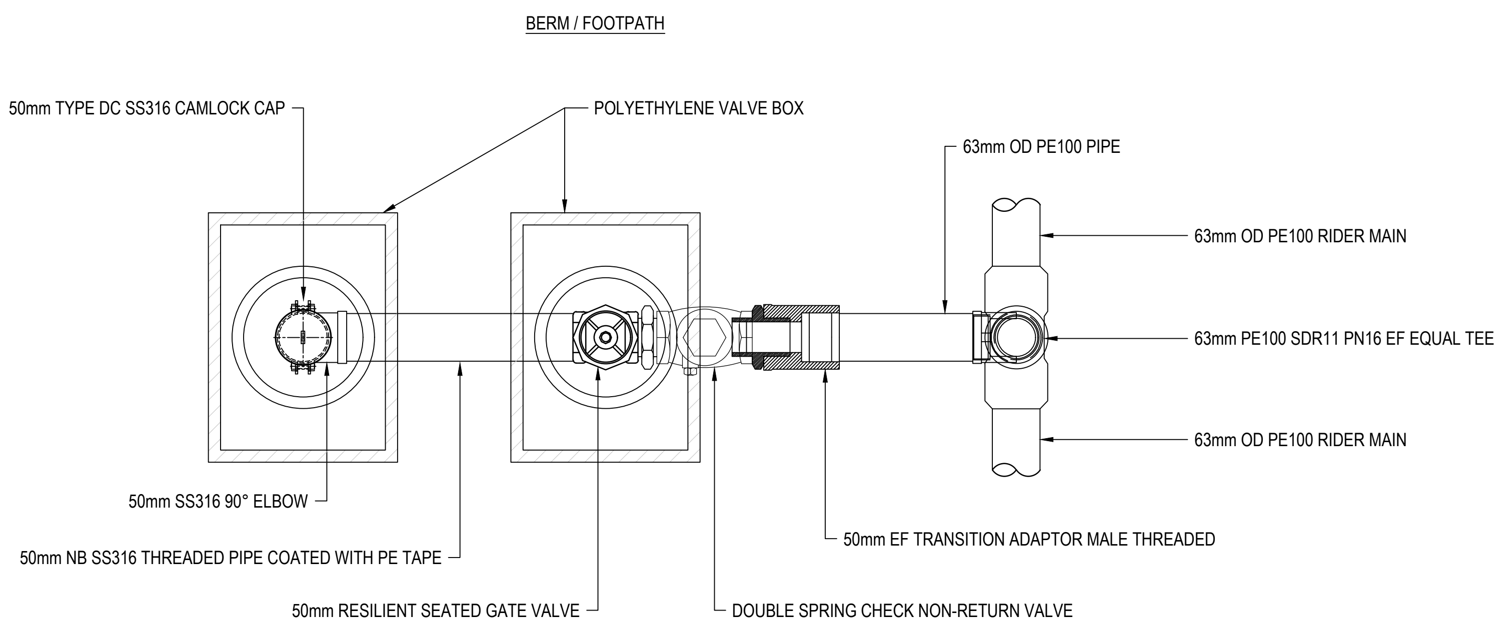
PROJECT/FILE NUMBER: -

DRAWING N°. WS05

COLOUR PLOT

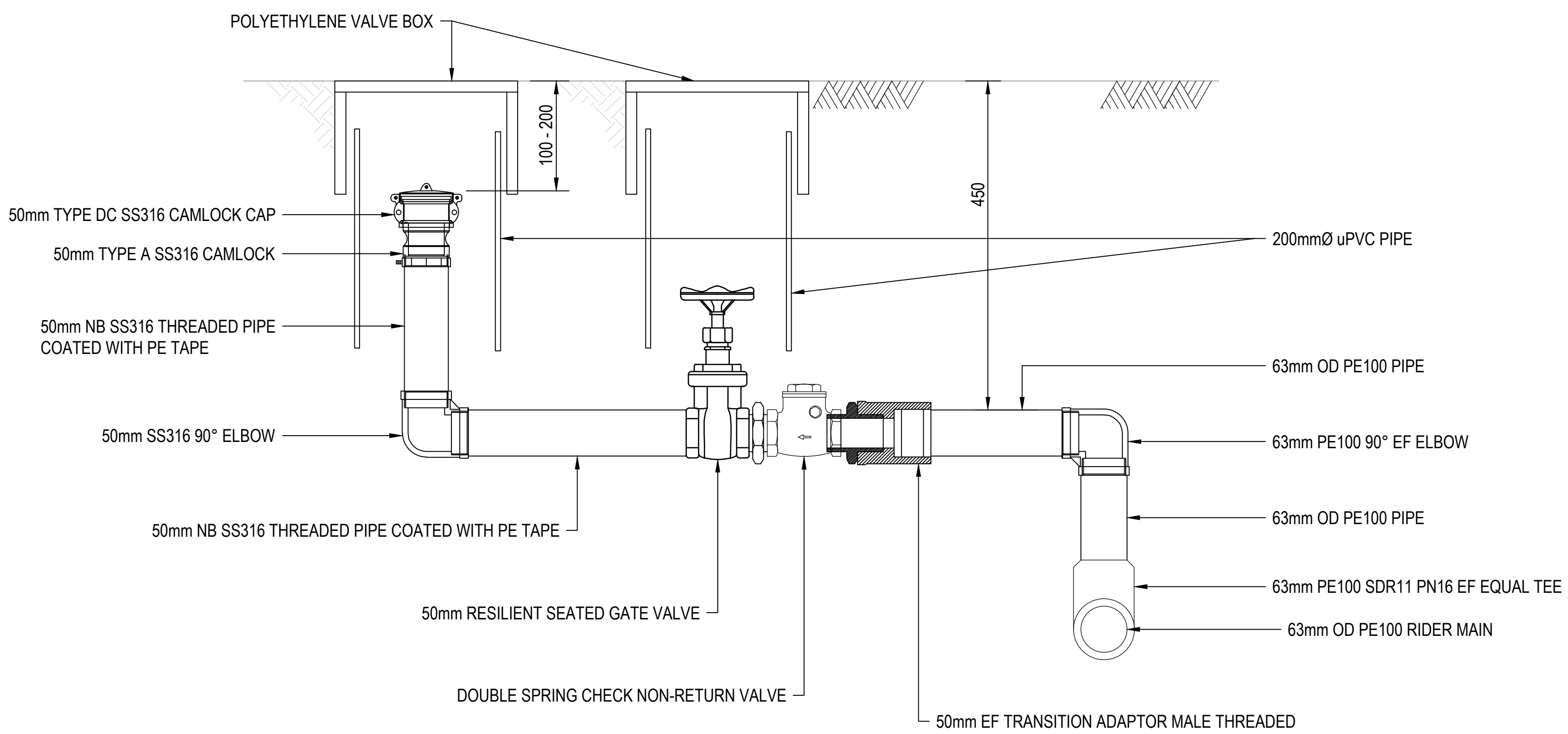
PLOT DETAILS:
Date Plotted: Dec 09, 2021 - 8:22pm
Plotted By: Andrew Lim

File Name: WS05 (2021) Typical valve details.dwg
File Location: C:\USERS\ALIM\ONEDRIVE - WELLINGTONWATER\007 WWL\WWL\WATER SERVICES STANDARD DWG\WWL TEMPLATE\WS01-08



PLAN

NOTE:
1. ALL FASTENINGS OR FLANGES THAT WILL BE (OR HAVE THE POTENTIAL TO BE), BURIED SHALL BE COATED AND WRAPPED IN THE FULL DENSO SYSTEM (PRIMER, MASTIC, WRAP AND OVER WRAP).



ELEVATION

REV	AMENDMENT	DWN	CHK	REV	DATE	AMENDMENT	DWN	CHK	DATE
A	PRELIMINARY ISSUE	AL			03/20				
B	BACKFLOW PREVENTION	AL	EG		11/21				

Wellington Water

DESIGN	J DUGGAN	09/21
UPDATE	E GREENBERG	10/21
DRAWING UPDATE	A LIM	10/21
CHECKED	E GREENBERG	11/21
REVIEWED	K WYNN	11/21
APPROVED	K WYNN	11/21

REGIONAL SPECIFICATION FOR WATER SERVICES

RIDER MAIN
SCOUR DETAILS

SCALE: NOT TO SCALE
SHEET No. 1 OF 1 SHEETS.
DRAWING SIZE: A1
PROJECT/FILE NUMBER: -
DRAWING N°. WS06

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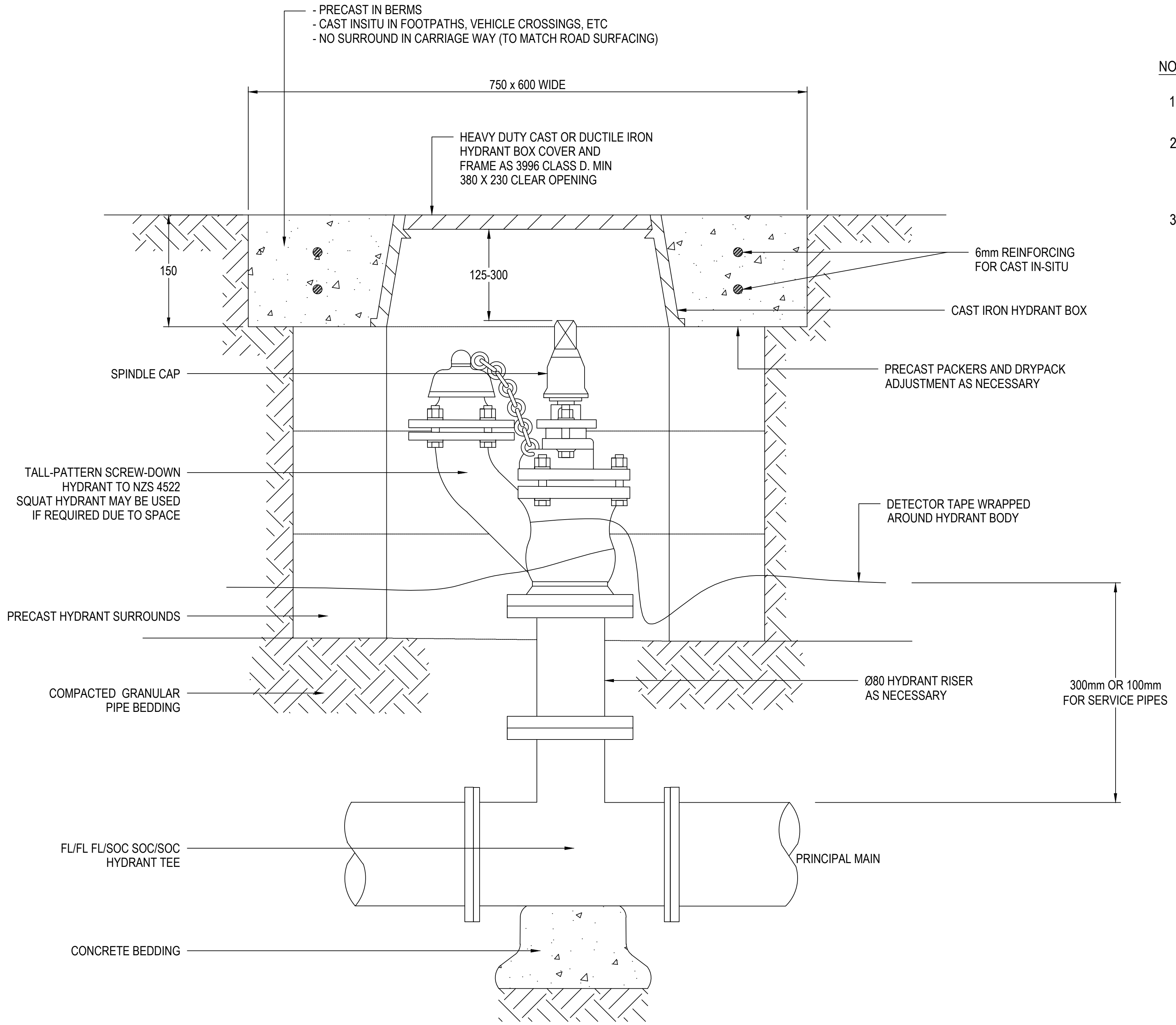
COLOUR PLOT

PLOT DETAILS:
Date Plotted: Dec 08, 2021 - 9:20am
Plotted By: Andrew Lim

File Name: WS06 (2021) Rider main scour detail.dwg
File Location: C:\USERS\ALIM\ONEDRIVE - WELLINGTONWATER\007 WWL\WWL\WATER SERVICES STANDARD DWG\WWL TEMPLATE\WS01-08



NOTES:

1. MARKING OF HYDRANTS SHALL INCLUDE THE HYDRANT BOX LID, ANY CONCRETE SURROUND AND REQUIRED ROAD MARKINGS.
2. METALLIC DETECTOR / WARNING TAPE TO BE LAID 200 TO 300mm ABOVE ALL BULK, TRUNK, PRINCIPAL AND RIDER MAIN PIPES AND 100mm ABOVE SERVICE PIPES, AND CONTINUE THROUGH HYDRANT ENCLOSURE WHILST MAINTAINING TAP CONDUCTIVITY.
3. ALL FASTENINGS OR FLANGES THAT WILL BE (OR HAVE THE POTENTIAL TO BE), BURIED SHALL BE COATED AND WRAPPED IN THE FULL DENSO SYSTEM (PRIMER, MASTIC, WRAP AND OVER WRAP).

REV	AMENDMENT	DWN	CHK	REV	DATE	AMENDMENT	DWN	CHK	DATE
A	PRELIMINARY ISSUE	AL			02/20				

DESIGN	WWL	-
UPDATE	E GREENBERG	10/21
DRAWING UPDATE	A LIM	10/21
CHECKED	E GREENBERG	11/21
REVIEWED	K WYNN	11/21
APPROVED	K WYNN	11/21

Wellington Water

REGIONAL SPECIFICATION FOR WATER SERVICES

FIRE HYDRANT BOX

SCALE: NOT TO SCALE

SHEET No. 1 OF 1 SHEETS.

DRAWING SIZE: A1

PROJECT/FILE NUMBER: -

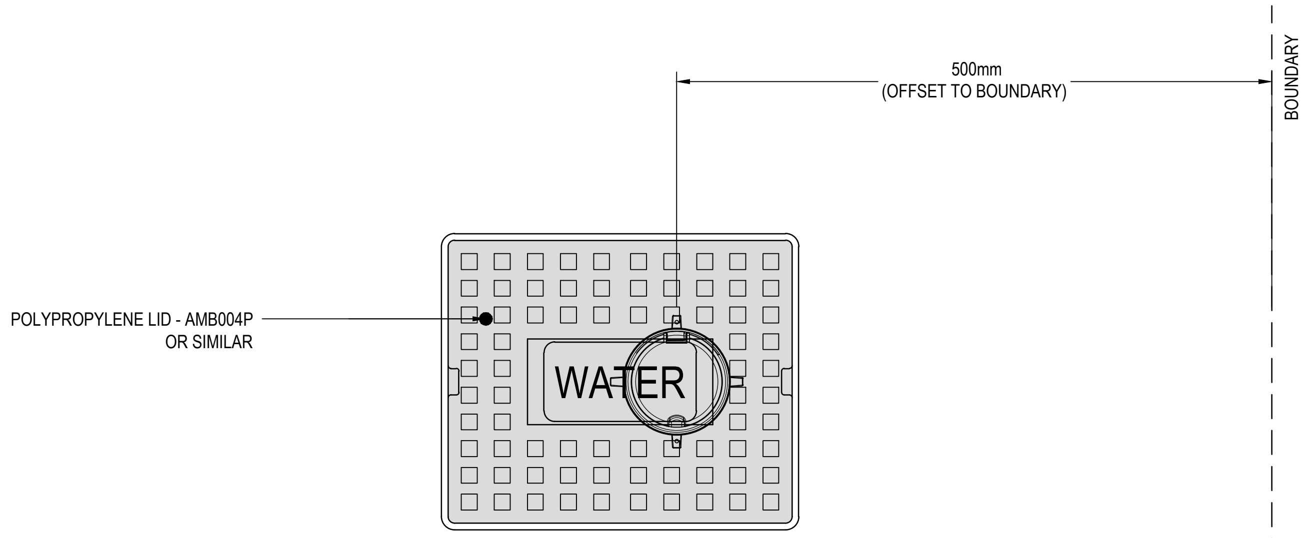
DRAWING N°. WS07

PLOT DETAILS:
Date Plotted: Dec 08, 2021 - 9:25am
Plotted By: Andrew Lim

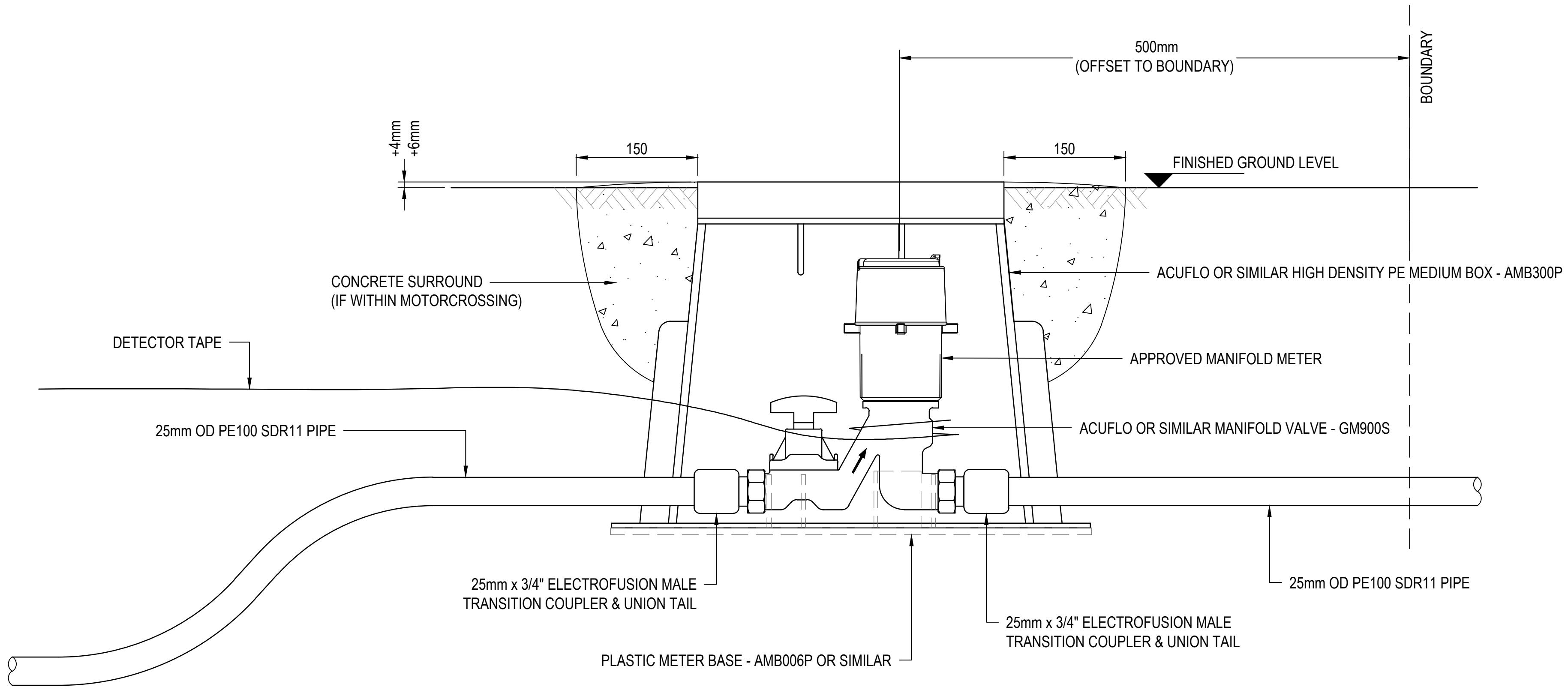
File Name: WS07 (2021) Fire hydrant box.dwg
File Location: C:\USERS\ALIM\ONEDRIVE - WELLINGTONWATER\007 WWL\WWL\WATER SERVICES STANDARD DWG\WWL TEMPLATE\WS01-08

NOTES:

1. VALVE AND METER SHALL BE LOCATED IN THE ROAD RESERVE ADJACENT TO THE STREET BOUNDARY OF THE PROPERTY SERVICED AS PER THE REQUIREMENTS OF THE REGIONAL STANDARD FOR WATER SERVICES.
2. VALVE BOX SHALL BE ARRANGED AT RIGHT ANGLES TO THE PROPERTY BOUNDARY.
3. VALVE BOX SHALL HAVE PLASTIC BASE CORRECTLY INSTALLED AND FITTED.
4. SERVICE VALVE (OR METER) SHOULD NOT BE LOCATED IN DRIVEWAYS OR AREAS WHERE VEHICLE TRAFFIC IS LIKELY.
5. WHERE THE SERVICE VALVE CANNOT BE INSTALLED OUTSIDE OF THE MOTORCROSSING, THE VALVE AND METER HIGH DENSITY PE BOX SHALL BE SET WITH A 20MPa CONCRETE SURROUND A MINIMUM 100mm THICK AND 150mm WIDE. ALTERNATIVELY, THE VALVE AND METER SHALL BE INSTALLED IN AN APPROVED DUCTILE IRON OR CAST IRON BOX COMPLETE WITH CONCRETE PACKER BLOCKS; SIZE OF BOX MUST BE SUFFICIENT TO ENABLE METER TO BE SERVICED WITHIN BOX.
6. THE TOP SURFACE OF THE CONCRETE SURROUND SHALL:
   - FALL 4-6mm TO PROVIDE POSITIVE DRAINAGE AWAY FROM THE BOX.
   - BE SQUARED WITHIN FORMWORK AND BE NEAT AND TIDY.
   - BE TROWELLED TO BE FLUSH WITH THE TOP OF THE BOX.
   - HAVE A BROOMED FINISH WHEN NOT IN THE CBD.
   - HAVE AN EXPOSED AGGREGATE FINISH WHEN IN THE CBD.
7. FOR NEW CONNECTIONS, A MINIMUM OF 1m SERVICE PIPE SHALL BE PROVIDED INSIDE THE BOUNDARY ON THE CUSTOMER SIDE OF THE MANIFOLD. THIS SERVICE SHALL BE SECURE PLUGGED.
8. DETECTOR TAPE TO BE INSTALLED ABOVE SERVICE PIPE ARRANGEMENT, UP TO THE SERVICE VALVE BOX.
9. CUT 'V' IN KERB TO MARK LOCATION OF THE SERVICE VALVE.
10. WHERE INSTALLATION CONFLICTS WITH LOCAL COUNCIL BYLAWS, THE BYLAWS TAKE PRECEDENCE. APPROVAL MUST BE OBTAINED PRIOR TO CONSTRUCTION FROM WELLINGTON WATER.



PLAN
NOT TO SCALE



SECTIONAL ELEVATION
NOT TO SCALE

REV	AMENDMENT	DWN	CHK	REV	DATE	AMENDMENT	DWN	CHK	DATE
A	PRELIMINARY ISSUE	SS	CB	GC	03/20				
B	REVISED TABLE AND NOTES	AL	DM	GC	07/20				
C	REVISED NOTES AND LABELS	AL	SS		10/21				

Wellington Water

DESIGN	T BIAGIOLI	09/19
UPDATE	S SURESH	10/21
DRAWING UPDATE	A LIM	10/21
CHECKED	E GREENBERG	11/21
REVIEWED	K WYNN	11/21
APPROVED	K WYNN	11/21

REGIONAL SPECIFICATION FOR WATER SERVICES

TYPICAL DOMESTIC MANIFOLD AND WATER METER

SCALE: NOT TO SCALE
SHEET No. 1 OF 1 SHEETS.
DRAWING SIZE: A1
PROJECT/FILE NUMBER: -
DRAWING N°. WS08

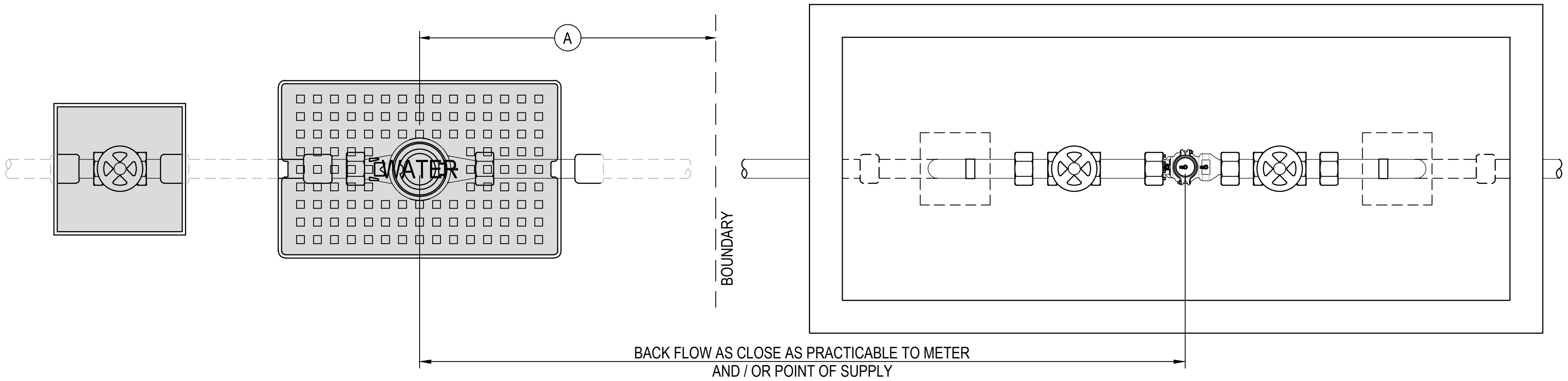
WARNING: PRINTED COPIES ARE UNCONTROLLED

COLOUR PLOT

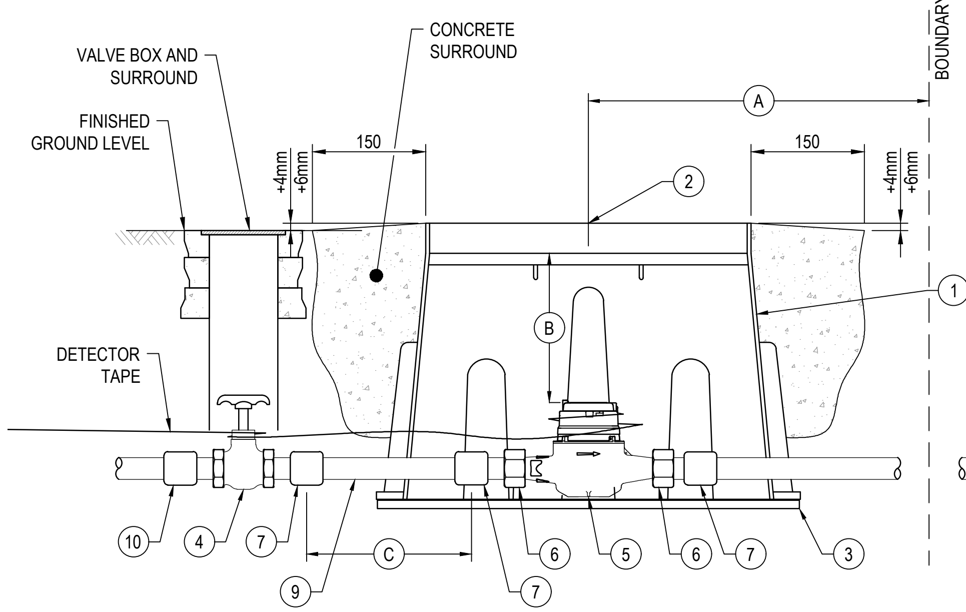
PLOT DETAILS:
Date Plotted: Dec 03, 2021 - 8:42am
Plotted By: Andrew Lim

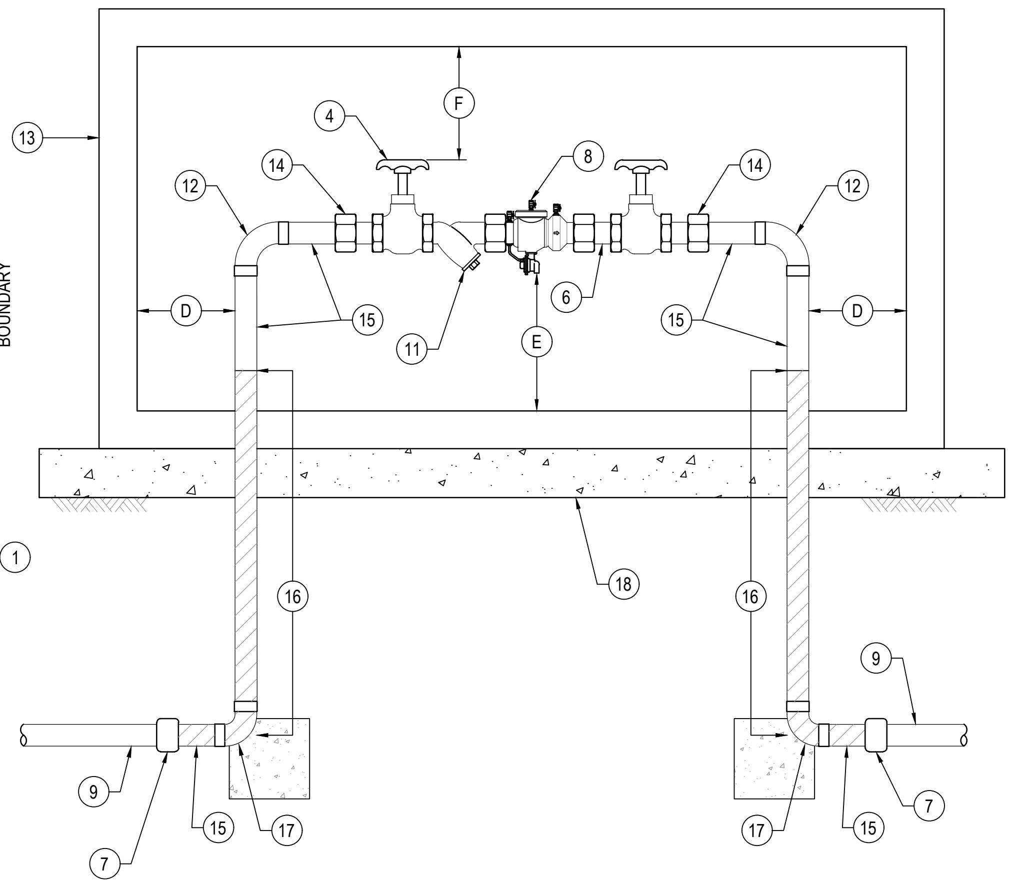
File Name: WS08 (2021) Domestic manifold and water meter.dwg
File Location: C:\USERS\ALIM\ONEDRIVE - WELLINGTONWATER\007 WWL\WWL\WATER SERVICES STANDARD DWG\WWL TEMPLATE\WCC WATER SUPPLY CONNECTION STANDARD

COMMERCIAL WATER METER - STANDARD BELOW GROUND INSTALLATION	
ITEM	DESCRIPTION / SPECIFICATION
1	ACUFLO OR SIMILAR MIDI BOX – AMB300P / JUMBO BOX - AMBJ320P
2	POLYPROPYLENE LID- AMBJ004P OR SIMILAR
3	PLASTIC METER BASE – AMB006P / AMBJ005P OR SIMILAR
4	SERVICE VALVE AS PER THE APPROVED PRODUCTS REGISTER
5	APPROVED IN-LINE WATER METER [25mm OR SMALLER TO BE MANIFOLD TYPE]
6	DR BRASS UNION TAIL
7	ELECTROFUSION THREADED TRANSITION FITTING
8	APPROVED BACKFLOW DEVICE
9	25, 32, 40mm PE100 SDR11 PIPE
10	CONNECTION AS REQUIRED
11	STRAINER - SCREEN SIZE BACKFLOW MANUFACTURER'S RECOMMENDATION
12	25, 32 & 40mm COPPER ELBOW MAY BE BRAZED OR CROXED BRAZED CONNECTION ONLY (FOR WCC)
13	CABINET OR PROTECTIVE ENCLOSURE (SEE NOTES)
14	CROX CONNECTION
15	25, 32 & 40mm COPPER PIPE
16	PIPE WRAPPED WITH DENSO GREASE TAPE
17	25, 32 & 40mm COPPER ELBOW BRAZED CONNECTION ONLY
18	CONCRETE SLAB - GRADED TO KERB FOR DRAINAGE
DIMENSION	
A	OFFSET: METER TO BOUNDARY 500mm
B	REQUIRED CLEARANCE: MINIMUM: 50mm MAXIMUM: 200mm
C	MINIMUM DIMENSION: 400mm
D	MINIMUM DIMENSION: 300mm
E	MINIMUM CLEARANCE: 300mm



PLAN
NOT TO SCALE





ELEVATION
NOT TO SCALE

NOTES:

1. SERVICE VALVE AND METER SHALL BE INSTALLED IN THE ROAD RESERVE OUTSIDE THE PROPERTY SERVICED. WHERE THIS IS NOT PRACTICABLE, LOCATION TO BE CONFIRMED WITH WELLINGTON WATER PRIOR TO INSTALLATION.
2. SERVICE VALVE AND METER SHALL BE POSITIONED IN THE ROAD RESERVE AS PER THE REQUIREMENTS OF THE REGIONAL SPECIFICATION FOR WATER SERVICES.
3. SERVICE VALVE AND METER BOXES SHALL BE SET-UP AT RIGHT ANGLES TO THE PROPERTY BOUNDARY.
4. METER BOX SHALL HAVE PLASTIC BASE CORRECTLY INSTALLED AND FITTED.
5. SERVICE VALVE AND METER SHOULD BE INSTALLED OUTSIDE OF THE MOTORCROSSING.
6. WHERE THE METER CANNOT BE INSTALLED OUTSIDE OF THE MOTOR CROSSING, THE PLASTIC METER BOX SHALL BE SET WITH A 20mPa CONCRETE SURROUND A MINIMUM 100mm THICK AND 150mm WIDE. ALTERNATIVELY, THE METER SHALL BE INSTALLED IN AN APPROVED DUCTILE IRON OR CAST IRON BOX COMPLETE WITH CONCRETE PACKER BLOCKS. SIZE OF BOX MUST BE SUFFICIENT TO ENABLE METER TO BE SERVICED WITHIN BOX.
7. THE TOP SURFACE OF THE CONCRETE SURROUND SHALL:
   - FALL 4-6 mm TO PROVIDE POSITIVE DRAINAGE AWAY FROM THE METER BOX.
   - BE SQUARED WITHIN FORMWORK AND BE NEAT AND TIDY.
   - BE TROWELLED TO BE FLUSH WITH THE TOP OF THE BOX.
   - HAVE A BROOMED FINISH WHEN NOT IN THE CBD.
   - HAVE AN EXPOSED AGGREGATE FINISH WHEN IN THE CBD.
8. DETECTOR TAPE TO BE INSTALLED ABOVE SERVICE PIPE ARRANGEMENT, UP TO THE METER BOX.
9. WHERE INSTALLATION CONFLICTS WITH LOCAL COUNCIL BYLAWS, THE BYLAWS TAKE PRECEDENCE. APPROVAL MUST BE OBTAINED PRIOR TO CONSTRUCTION FROM WELLINGTON WATER.

NOTES (ENCLOSURE):

1. THE ENCLOSURE SHALL BE PLACED AS CLOSE AS POSSIBLE TO THE BOUNDARY. WHERE THIS IS NOT PRACTICABLE, LOCATION TO BE CONFIRMED WITH WELLINGTON WATER PRIOR TO INSTALLATION.
2. THE ENCLOSURE SHALL BE CONSTRUCTED FROM POWDER COATED MILD STEEL MESH WITH POWDER COATED STEEL BRACKETS TO FORM EDGES AND VERTICAL SUPPORTS. VERTICAL SUPPORTS TO BE BOLTED INTO THE FINISHES AT GROUND LEVEL.
3. THE WIRE MESH ENCLOSURE SHALL HAVE A HINGED TOP PANEL FOR MAINTENANCE ACCESS TO FITTINGS AND PIPEWORK. PANEL IS TO BE SECURED WITH A PADLOCK OR OTHER SECURITY MECHANISM AS AGREED WITH WELLINGTON WATER.

REV	AMENDMENT	DWN	CHK	REV	DATE
A	PRELIMINARY ISSUE	SS	CB	GC	03/20
B	REVISED TABLE AND NOTES	AL	DM	GC	07/20
C	REVISED TABLE, NOTES AND ENCLOSURE	AL	SUS		10/21

Wellington Water

DESIGN	T BIAGIOLI	09/19
UPDATE	S SURESH	10/21
DRAWING UPDATE	A LIM	10/21
CHECKED	E GREENBERG	11/21
REVIEWED	K WYNN	11/21
APPROVED	K WYNN	12/21

REGIONAL SPECIFICATION FOR WATER SERVICES

BELOW GROUND COMMERCIAL METER AND BACKFLOW INSTALLATION (25mm TO 40mm)

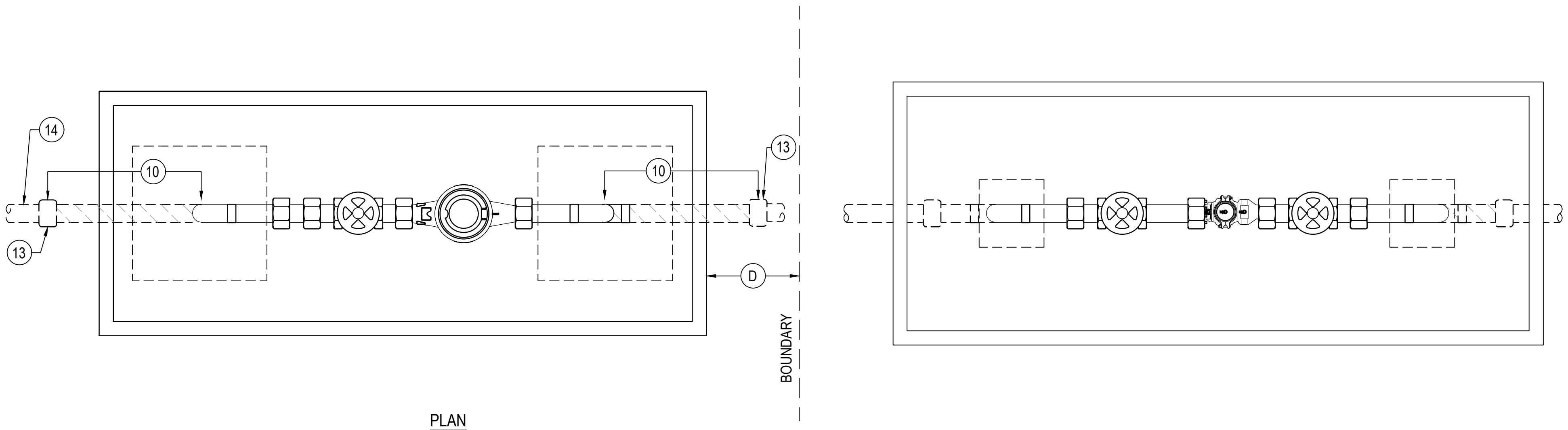
SCALE: NOT TO SCALE
SHEET No. 1 OF 1 SHEETS.
DRAWING SIZE: A1
PROJECT/FILE NUMBER: -
DRAWING N°: WS09

WARNING: PRINTED COPIES ARE UNCONTROLLED

COLOUR PLOT

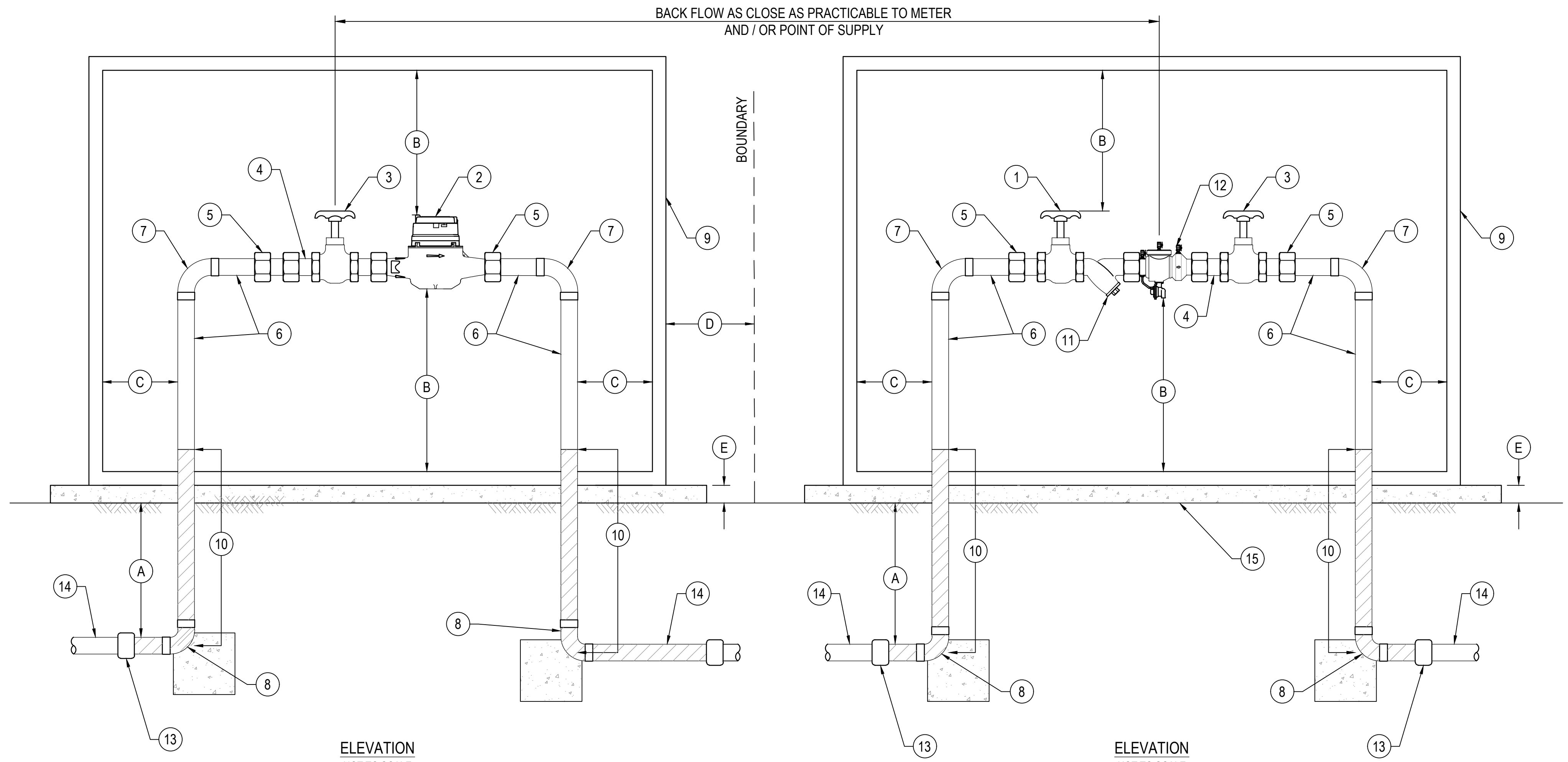
PLOT DETAILS:
Date Plotted: Dec 09, 2021 - 5:24pm
Plotted By: Andrew Lim

File Name: WS09 (2021) Below ground commercial meter 25mm to 40mm.dwg
File Location: C:\USERS\ALIM\ONEDRIVE - WELLINGTONWATER\007 WWL\WWL\WATER SERVICES STANDARD DWG\WWL TEMPLATE\WCC WATER SUPPLY CONNECTION STANDARD



PLAN
NOT TO SCALE

COMMERCIAL WATER METER - STANDARD ABOVE GROUND INSTALLATION	
ITEM	DESCRIPTION / SPECIFICATION
1	SERVICE VALVE AS PER THE APPROVED PRODUCTS REGISTER
2	APPROVED IN-LINE WATER METER
3	BUILDING ISOLATION VALVE
4	DR BRASS UNION TAIL
5	CROX CONNECTION
6	32 & 40mm COPPER PIPE
7	32 & 40mm COPPER ELBOW BRAZED CONNECTION ONLY
8	32 & 40mm COPPER ELBOW BRAZED CONNECTION ONLY
9	CABINET OR PROTECTIVE ENCLOSURE (SEE NOTES)
10	PIPE WRAPPED WITH DENSO GREASE TAPE
11	STRAINER - SCREEN SIZE TO BACKFLOW MANUFACTURER'S RECOMMENDATION
12	APPROVED BACKFLOW DEVICE
13	ELECTROFUSION THREADED TRANSITION FITTING
14	32, 40mm PE100 SDR11 PIPE
15	CONCRETE SLAB - GRADED TO KERB FOR DRAINAGE
DIMENSION	
A	DEPTH TO SERVICE PIPE: MINIMUM: 600mm
B	MINIMUM CLEARANCE: 300 mm
C	MINIMUM CLEARANCE: 300mm
D	DISTANCE TO BOUNDARY: MAXIMUM: 400mm
E	MINIMUM THICKNESS: 100mm FIBRE REINFORCED 150mm UN-REINFORCED



ELEVATION
NOT TO SCALE

ELEVATION
NOT TO SCALE

NOTES:

1. VALVE AND METER SHALL BE INSTALLED IN THE ROAD RESERVE OUTSIDE THE PROPERTY SERVICED.
2. METER ASSEMBLY AND CABINET CAN BE SET-UP EITHER PARALLEL OR PERPENDICULAR TO THE PROPERTY BOUNDARY, BUT MUST BE SQUARE WITH THE BOUNDARY.
3. THE COPPER PIPE SHALL BE WRAPPED WITH DENSO GREASE TAPE WHERE IT IS IN CONTACT WITH CONCRETE AND IN THE BOUNDARY AREA BETWEEN BELOW GROUND AND ABOVE GROUND.
4. SERVICE SHALL BE CLEARLY MARKED AS PER THE REQUIREMENTS OF THE REGIONAL SPECIFICATION FOR WATER SERVICES.
5. DETECTOR TAPE TO BE INSTALLED ABOVE SERVICE PIPE ARRANGEMENT, UP TO THE FIRST UPSTREAM VERTICAL BEND (FITTING No. 8).
6. WHERE INSTALLATION CONFLICTS WITH LOCAL COUNCIL BYLAWS, THE BYLAWS TAKE PRECEDENCE. APPROVAL MUST BE OBTAINED PRIOR TO CONSTRUCTION FROM WELLINGTON WATER.

NOTES (ENCLOSURE):

1. THE ENCLOSURE SHALL BE PLACED AS CLOSE AS POSSIBLE TO THE BOUNDARY. WHERE THIS IS NOT PRACTICABLE, LOCATION TO BE CONFIRMED WITH WELLINGTON WATER PRIOR TO INSTALLATION.
2. THE ENCLOSURE SHALL BE CONSTRUCTED FROM POWDER COATED MILD STEEL MESH WITH POWDER COATED STEEL BRACKETS TO FORM EDGES AND VERTICAL SUPPORTS. VERTICAL SUPPORTS TO BE BOLTED INTO THE FINISHES AT GROUND LEVEL.
3. THE WIRE MESH ENCLOSURE SHALL HAVE A HINGED TOP PANEL FOR MAINTENANCE ACCESS TO FITTINGS AND PIPEWORK. PANEL IS TO BE SECURED WITH A PADLOCK OR OTHER SECURITY MECHANISM AS AGREED WITH WELLINGTON WATER.

REV	AMENDMENT	DWN	CHK	REV	DATE	AMENDMENT	DWN	CHK	DATE
A	PRELIMINARY ISSUE	SS	CB	GC	03/20				
B	REVISED TABLE AND NOTES	AL	DM	GC	07/20				
C	REVISED TABLE, NOTES, PLAN VIEW AND ENCLOSURE	AL	SUS		10/21				

Wellington Water

DESIGN	T BIAGIOLI	09/19
UPDATE	S SURESH	10/21
DRAWING UPDATE	A LIM	10/21
CHECKED	E GREENBERG	11/21
REVIEWED	K WYNN	12/21
APPROVED	K WYNN	12/21

REGIONAL SPECIFICATION FOR WATER SERVICES

ABOVE GROUND COMMERCIAL METER AND BACKFLOW INSTALLATION (32mm TO 40mm)

SCALE: NOT TO SCALE
SHEET No. 1 OF 1 SHEETS.
DRAWING SIZE: A1
PROJECT/FILE NUMBER: -
DRAWING N°. WS10

WARNING: PRINTED COPIES ARE UNCONTROLLED

COLOUR PLOT

PLOT DETAILS:
Date Plotted: Dec 09, 2021 - 5:08pm
Plotted By: Andrew Lim

File Name: WS10 (2021) Above ground commercial meter 32mm to 40mm.dwg
File Location: C:\USERS\ALIM\ONEDRIVE - WELLINGTONWATER\007 WWL\WWL\WATER SERVICES STANDARD DWG\WWL TEMPLATE\WCC WATER SUPPLY CONNECTION STANDARD

FIRE SERVICE CONNECTION WITH METERED SERVICE CONNECTION - STANDARD BELOW GROUND INSTALLATION	
ITEM	DESCRIPTION / SPECIFICATION
1	DI TEE ON MAIN - BRANCH FLANGED
2	SERVICE VALVE - APPROVED RESILIENT SEATED GATE VALVE - FLANGE / FLANGE - AS / NZS 4087 FIG B5 MUST BE FLANGED TO TEE ON MAIN
3	FLANGE DI SPOOL, LENGTH = 5 x DIA. MINIMUM (REFER NOTE 4)
4	APPROVED METER
5	APPROVED THRUST TYPE DISMANTLING JOINT
6	APPROVED BACKFLOW DEVICE
7	MAINTENANCE TOP PANEL
8	CAST-INSITU CONCRETE THRUST BLOCK (SEE NOTES)
9	WATER PIPE (50mm OR GREATER) - AS / NZS 2280 FLANGED BENDS - DI FLANGED SPOOLS (REFER NOTE 4) - ALL FLANGES AS / NZS 4087 FIG B5
10	CABINET OR PROTECTIVE ENCLOSURE (SEE NOTES)
11	CONCRETE SLAB - GRADED TO KERB FOR DRAINAGE
12	STANDARD PRECAST CONCRETE MANHOLE
13	PN16 STRAINER - SCREEN SIZE TO BACKFLOW MANUFACTURER'S RECOMMENDATION
14	90° FLANGED DI BEND
15	REMOTE READER FOR METER LOCATED IN TOBY BOX
16	VALVE SUPPORT BRACKET AS PER SUPPLIER'S RECOMMENDATION

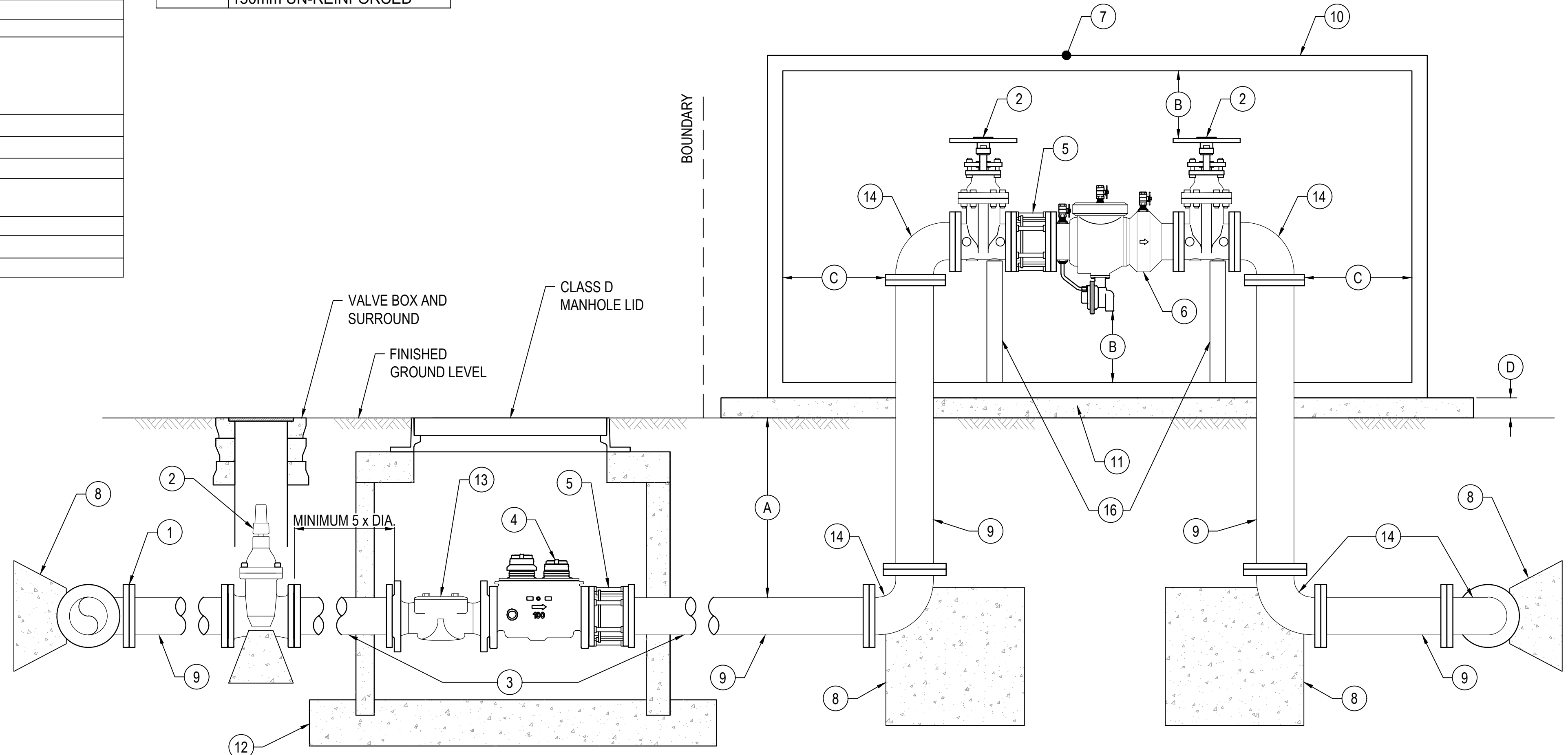
ITEM	DIMENSION
A	DEPTH (TO MAIN): MINIMUM: 700mm MAXIMUM: 800mm
B	MINIMUM CLEARANCE: 300mm
C	MINIMUM CLEARANCE: 300mm
D	MINIMUM THICKNESS: 100mm (FIBRE REINFORCED) 150mm UN-REINFORCED

NOTES:

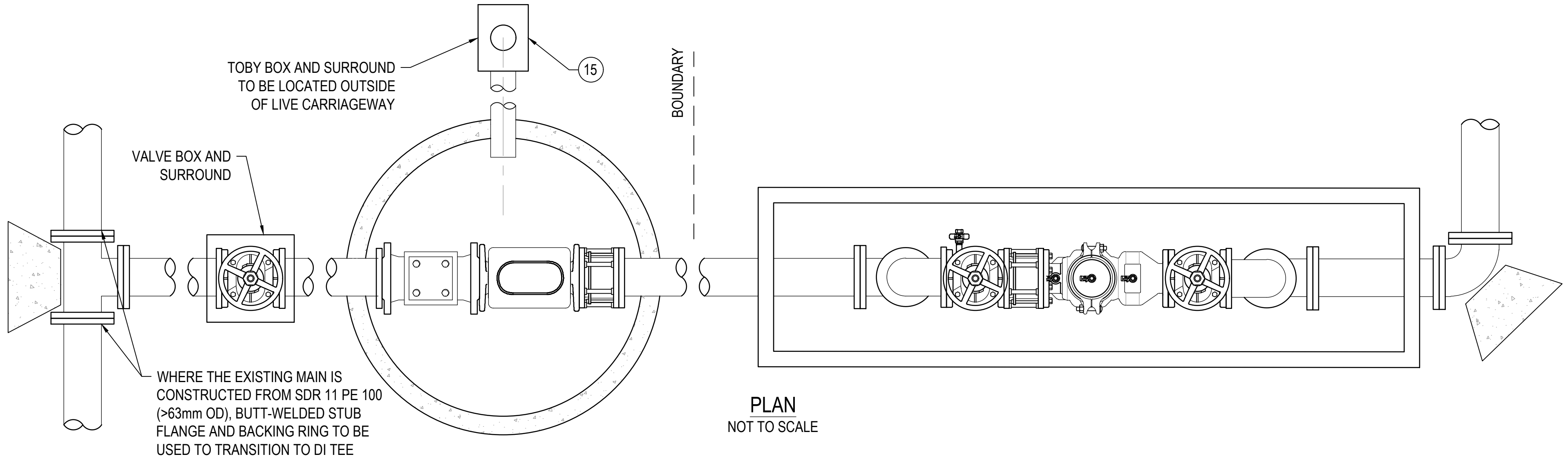
1. VALVE AND METER SHALL BE INSTALLED IN THE ROAD RESERVE OUTSIDE THE PROPERTY SERVICED. BACKFLOW PREVENTER SHALL BE INSTALLED AS CLOSE AS PRACTICABLE TO THE PROPERTY BOUNDARY (ON THE PUBLIC OR PRIVATE SIDE), AS APPROVED BY WELLINGTON WATER. VALVE AND METER INSTALLATION CAN BE SET-UP EITHER PARALLEL OR PERPENDICULAR TO THE PROPERTY BOUNDARY, BUT MUST BE SQUARE WITH THE BOUNDARY.
2. VALVE SHALL BE CLEARLY MARKED AS PER THE REQUIREMENTS OF THE REGIONAL SPECIFICATION FOR WATER SERVICES.
3. THRUST BLOCKS SHALL BE INSTALLED TO PROVIDE VERTICAL SUPPORT AS WELL AS HORIZONTAL THRUST RESTRAINT - THRUST BLOCKS SHALL BE SIZED AND INSTALLED IN ACCORDANCE WITH THE REGIONAL SPECIFICATION FOR WATER SERVICES.
4. CLS SPOOLS MAY BE PERMITTED FOLLOWING AGREEMENT WITH WELLINGTON WATER.
5. DETECTOR TAPE TO BE INSTALLED ABOVE SERVICE PIPE ARRANGEMENT, UP TO THE METER CHAMBER.
6. WHERE INSTALLATION CONFLICTS WITH LOCAL COUNCIL BYLAWS, THE BYLAWS TAKE PRECEDENCE. APPROVAL MUST BE OBTAINED PRIOR TO CONSTRUCTION FROM WELLINGTON WATER.

NOTES (ENCLOSURE):

1. THE ENCLOSURE SHALL BE PLACED AS CLOSE AS POSSIBLE TO THE BOUNDARY. WHERE THIS IS NOT PRACTICABLE, LOCATION TO BE CONFIRMED WITH WELLINGTON WATER PRIOR TO INSTALLATION.
2. THE ENCLOSURE SHALL BE CONSTRUCTED FROM POWDER COATED MILD STEEL MESH WITH POWDER COATED STEEL BRACKETS TO FORM EDGES AND VERTICAL SUPPORTS. VERTICAL SUPPORTS TO BE BOLTED INTO THE FINISHES AT GROUND LEVEL.
3. THE WIRE MESH ENCLOSURE SHALL HAVE A HINGED TOP PANEL FOR MAINTENANCE ACCESS TO FITTINGS AND PIPEWORK. PANEL IS TO BE SECURED WITH A PADLOCK OR OTHER SECURITY MECHANISM AS AGREED WITH WELLINGTON WATER.



ELEVATION
NOT TO SCALE



PLAN
NOT TO SCALE

REV	AMENDMENT	DWN	CHK	REV	DATE	AMENDMENT	DWN	CHK	DATE
A	PRELIMINARY ISSUE	SS	CB	GC	03/20				
B	REVISED TABLE AND NOTES	AL	DM	GC	07/20				
C	REVISED TABLE, NOTES AND STRAINER LOCATION	AL	SUS		11/21				

Wellington Water

DESIGN	T BIAGIOLI	09/19
UPDATE	S SURESH	10/21
DRAWING UPDATE	A LIM	10/21
CHECKED	E GREENBERG	11/21
REVIEWED	K WYNN	12/21
APPROVED	K WYNN	12/21

REGIONAL SPECIFICATION FOR WATER SERVICES

BELOW GROUND COMMERCIAL METER AND BACKFLOW INSTALLATION (50mm AND LARGER)

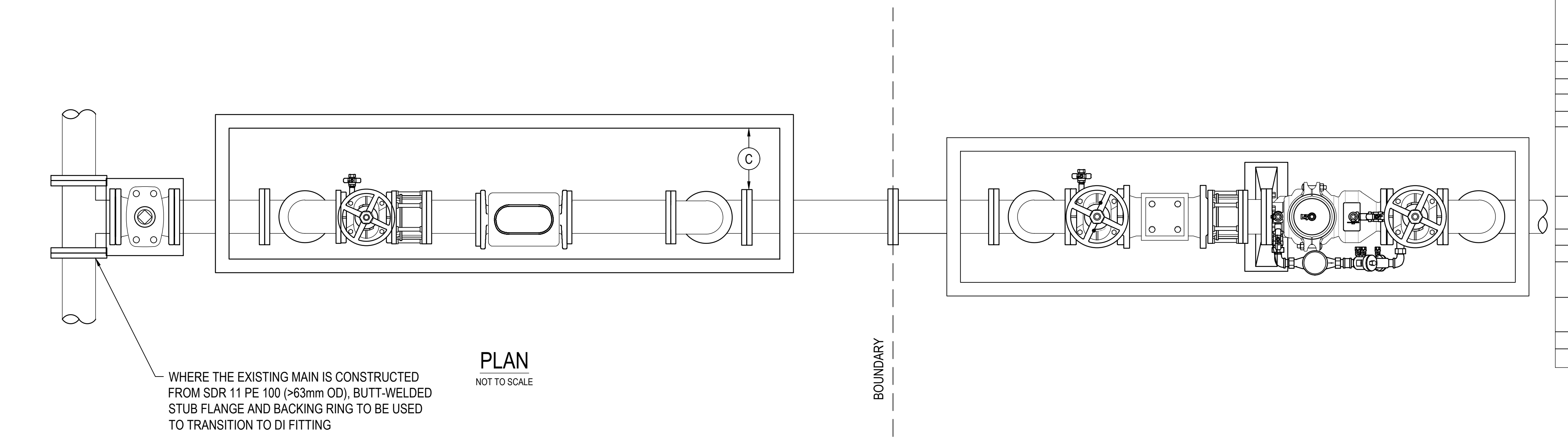
SCALE: NOT TO SCALE
SHEET No. 1 OF 1 SHEETS.
DRAWING SIZE: A1
PROJECT/FILE NUMBER: -
DRAWING N°. WS11

WARNING: PRINTED COPIES ARE UNCONTROLLED

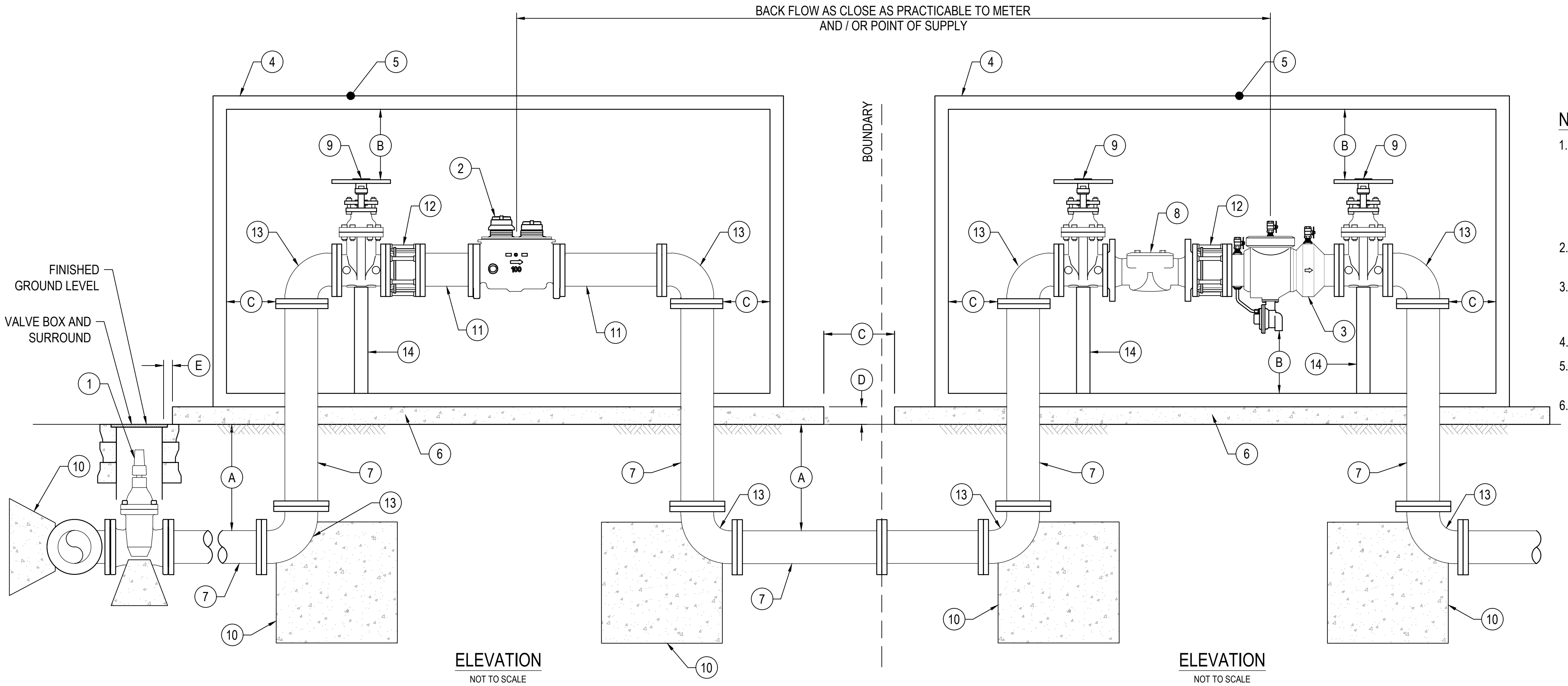
COLOUR PLOT

PLOT DETAILS:
Date Plotted: Dec 09, 2021 - 5:09pm
Plotted By: Andrew Lim

File Name: WS11 (2021) Below ground commercial meter 50mm and larger.dwg
File Location: C:\USERS\ALIM\ONEDRIVE - WELLINGTONWATER\007 WWL\WWL\WATER SERVICES STANDARD DWG\WWL TEMPLATE\WCC WATER SUPPLY CONNECTION STANDARD



PLAN
NOT TO SCALE



ELEVATION
NOT TO SCALE

ELEVATION
NOT TO SCALE

COMMERCIAL WATER METER - STANDARD ABOVE GROUND INSTALLATION	
ITEM	DESCRIPTION / SPECIFICATION
1	SERVICE VALVE - APPROVED RESILIENT SEATED GATE VALVE - FLANGE / FLANGE - AS / NZS 4087 FIG B5
2	APPROVED METER
3	APPROVED BACKFLOW DEVICE
4	CABINET OR PROTECTIVE ENCLOSURE (SEE NOTES)
5	MAINTENANCE TOP PANEL
6	CONCRETE SLAB - GRADED TO KERB FOR DRAINAGE
7	WATER PIPE (50mm OR GREATER) - AS / NZS 2280 FLANGED BENDS - DI FLANGED SPOOLS (REFER NOTE 5) - ALL FLANGES AS / NZS 4087 FIG B5 & B7
8	PN16 STRAINER - SCREEN SIZE TO BACKFLOW MANUFACTURER'S RECOMMENDATION
9	ISOLATION VALVE (FOR TESTING BACKFLOW DEVICE)
10	CAST IN-SITU CONCRETE THRUST BLOCK (SEE NOTES)
11	FLANGE DI SPOOL (REFER NOTE 5) LENGTH = 5 x PIPE NOM. DIAMETER
12	APPROVED THRUST TYPE DISMANTLING JOINT
13	90° FLANGED DI BEND
14	VALVE SUPPORT BRACKET AS PER SUPPLIER'S RECOMMENDATION

DIMENSION	WCC
A	DEPTH (TO MAIN): MINIMUM: 700mm (OR AS REQUIRED FOR HEADROOM ON VALVE) MAXIMUM: 900mm MAXIMUM: 1,300mm (FOR WCC)
B	MINIMUM CLEARANCE: 300mm
C	MINIMUM CLEARANCE: 300mm
D	MINIMUM THICKNESS: 100mm (FIBRE REINFORCED) 150mm UN-REINFORCED
E	MINIMUM OFFSET TO VALVE SURROUND : 300mm

NOTES:

1. VALVE AND METER SHALL BE INSTALLED IN THE ROAD RESERVE OUTSIDE THE PROPERTY SERVICED. BACKFLOW PREVENTER SHALL BE INSTALLED AS CLOSE AS PRACTICABLE TO THE PROPERTY BOUNDARY (ON THE PUBLIC OR PRIVATE SIDE), AS APPROVED BY WELLINGTON WATER. VALVE AND METER CAN BE SET UP EITHER PARALLEL OR PERPENDICULAR TO THE PROPERTY BOUNDARY, BUT MUST BE SQUARE WITH THE BOUNDARY.
2. VALVE SHALL BE CLEARLY MARKED AS PER THE REQUIREMENTS OF THE REGIONAL SPECIFICATION FOR WATER SERVICES.
3. THRUST BLOCKS SHALL BE INSTALLED TO PROVIDE VERTICAL SUPPORT AS WELL AS HORIZONTAL THRUST RESTRAINT - THRUST BLOCKS SHALL BE SIZED AND INSTALLED IN ACCORDANCE WITH THE REGIONAL SPECIFICATION FOR WATER SERVICES.
4. CLS SPOOLS MAY BE PERMITTED FOLLOWING AGREEMENT WITH WELLINGTON WATER.
5. DETECTOR TAPE TO BE INSTALLED ABOVE SERVICE PIPE ARRANGEMENT, UP TO THE VERTICAL BEND (FITTING No. 13).
6. WHERE INSTALLATION CONFLICTS WITH LOCAL COUNCIL BYLAWS, THE BYLAWS TAKE PRECEDENCE. APPROVAL MUST BE OBTAINED PRIOR TO CONSTRUCTION FROM WELLINGTON WATER.

NOTES (ENCLOSURE):

1. THE ENCLOSURE SHALL BE PLACED AS CLOSE AS POSSIBLE TO THE BOUNDARY. WHERE THIS IS NOT PRACTICABLE, LOCATION TO BE CONFIRMED WITH WELLINGTON WATER PRIOR TO INSTALLATION.
2. THE ENCLOSURE SHALL BE CONSTRUCTED FROM POWDER COATED MILD STEEL MESH WITH POWDER COATED STEEL BRACKETS TO FORM EDGES AND VERTICAL SUPPORTS. VERTICAL SUPPORTS TO BE BOLTED INTO THE FINISHES AT GROUND LEVEL.
3. THE WIRE MESH ENCLOSURE SHALL HAVE A HINGED TOP PANEL FOR MAINTENANCE ACCESS TO FITTINGS AND PIPEWORK. PANEL IS TO BE SECURED WITH A PADLOCK OR OTHER SECURITY MECHANISM AS AGREED WITH WELLINGTON WATER.

REV	AMENDMENT	DWN	CHK	REV	DATE	AMENDMENT	DWN	CHK	DATE
A	PRELIMNARY ISSUE	SS	CB	GC	03/20				
B	REVISED TABLE AND NOTES	AL	DM	GC	07/20				
C	REVISED TABLE AND NOTES, VALVE REMOVAL	AL	SUS		11/21				

Wellington Water

DESIGN	T BIAGIOLI	09/19
UPDATE	S SURESH	10/21
DRAWING UPDATE	A LIM	10/21
CHECKED	E GREENBERG	11/21
REVIEWED	K WYNN	12/21
APPROVED	K WYNN	12/21

REGIONAL SPECIFICATION FOR WATER SERVICES

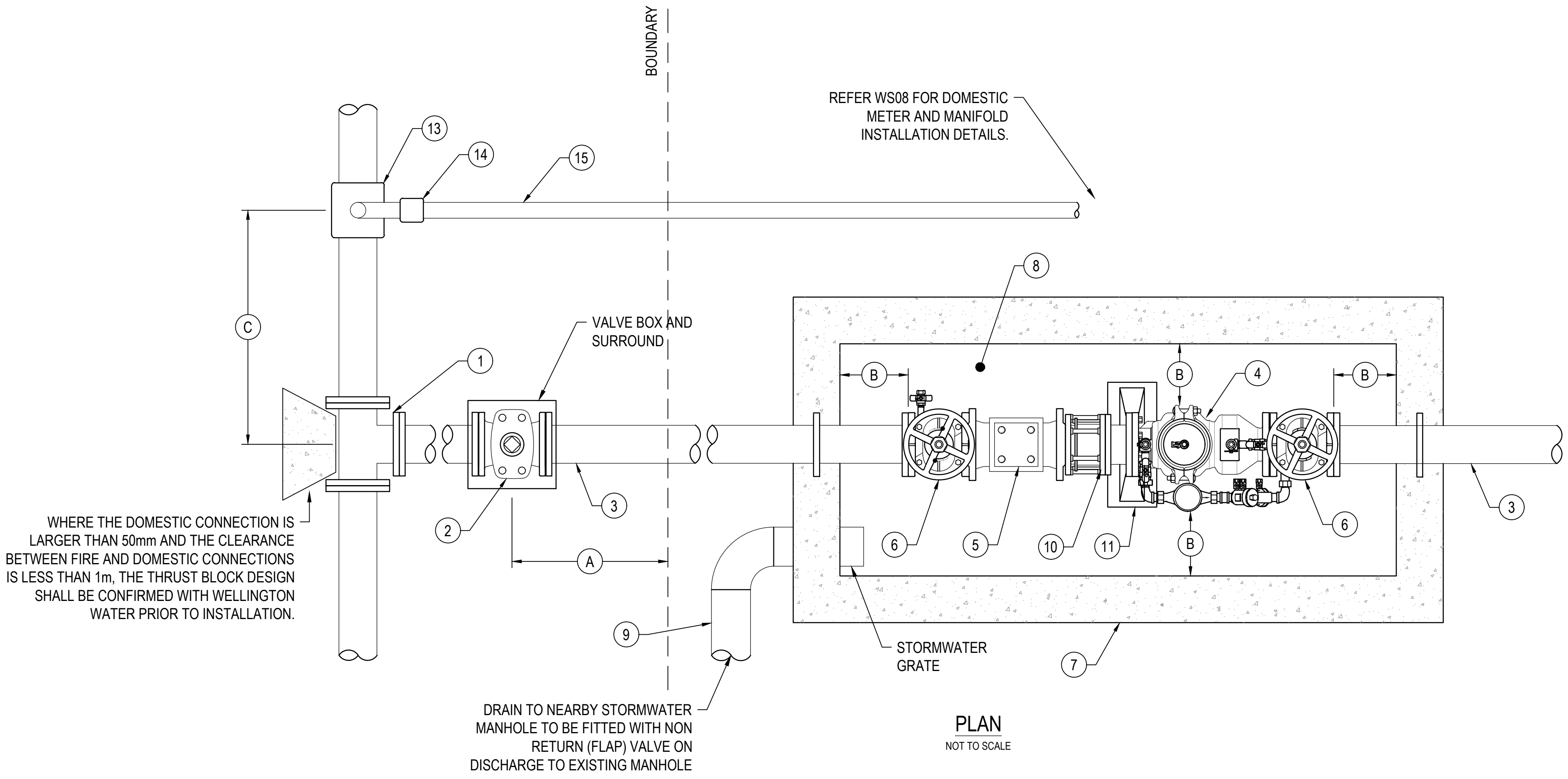
ABOVE GROUND COMMERCIAL METER AND BACKFLOW INSTALLATION (50mm AND LARGER)

SCALE: NOT TO SCALE
SHEET No. 1 OF 1 SHEETS.
DRAWING SIZE: A1
PROJECT/FILE NUMBER: -
DRAWING N°. WS12

PLOT DETAILS:
Date Plotted: Dec 09, 2021 - 7:35pm
Plotted By: Andrew Lim

File Name: WS12 (2021) Above ground commercial meter 50mm and larger.dwg
File Location: C:\USERS\ALIM\ONEDRIVE - WELLINGTONWATER\007 WWL\WWL\WATER SERVICES STANDARD DWG\WWL TEMPLATE\WCC WATER SUPPLY CONNECTION STANDARD

FIRE SERVICE CONNECTION WITH METERED SERVICE CONNECTION - STANDARD BELOW GROUND INSTALLATION	
ITEM	DESCRIPTION / SPECIFICATION
1	TEE ON MAIN - BRANCH FLANGED
2	SERVICE VALVE - APPROVED RESILIENT SEATED GATE VALVE - FLANGE / FLANGE - AS / NZS 4087 FIG B5 MUST BE FLANGED TO TEE ON MAIN
3	FLANGED CLS PIPE - MINIMUM WALL THICKNESS = 4.8 mm - FLANGED AS / NZS 4087 FIG B7
4	APPROVED DOUBLE-CHECK DETECTOR-CHECK BACKFLOW DEVICE
5	PN16 STRAINER - SCREEN SIZE TO MANUFACTURER'S RECOMMENDATION
6	APPROVED ISOLATION VALVES (FOR TESTING BACKFLOW DEVICE)
7	PURPOSE DESIGNED CONCRETE CHAMBER (SEE NOTES)
8	CHAMBER LIDS (SEE NOTES)
9	DRAIN (100 mm NB MINIMUM)
10	APPROVED THRUST TYPE DISMANTLING JOINT
11	METER / BACKFLOW SUPPORT (SHOWN WITH HARDWOOD WEDGES)
12	VALVE SUPPORT BRACKET AS PER SUPPLIER'S RECOMMENDATION
13	APPROVED TAPPING BAND
14	ELECTROFUSION MALE TRANSITION FITTING
15	PE100 SDR11 PN16 PIPE
DIMENSION	
A	OFFSET: VALVE TO BOUNDARY 500 mm
B	MINIMUM CLEARANCE: 300 mm
C	MINIMUM CLEARANCE: 1000 mm UNLESS FLANGED (IN WHICH CASE THE CLEARANCE DISTANCE CAN BE REDUCED TO THE CLEARANCES SPECIFIED FOR PARALLEL WATER MAINS IN THE REGIONAL STANDARD FOR WATER SERVICES.



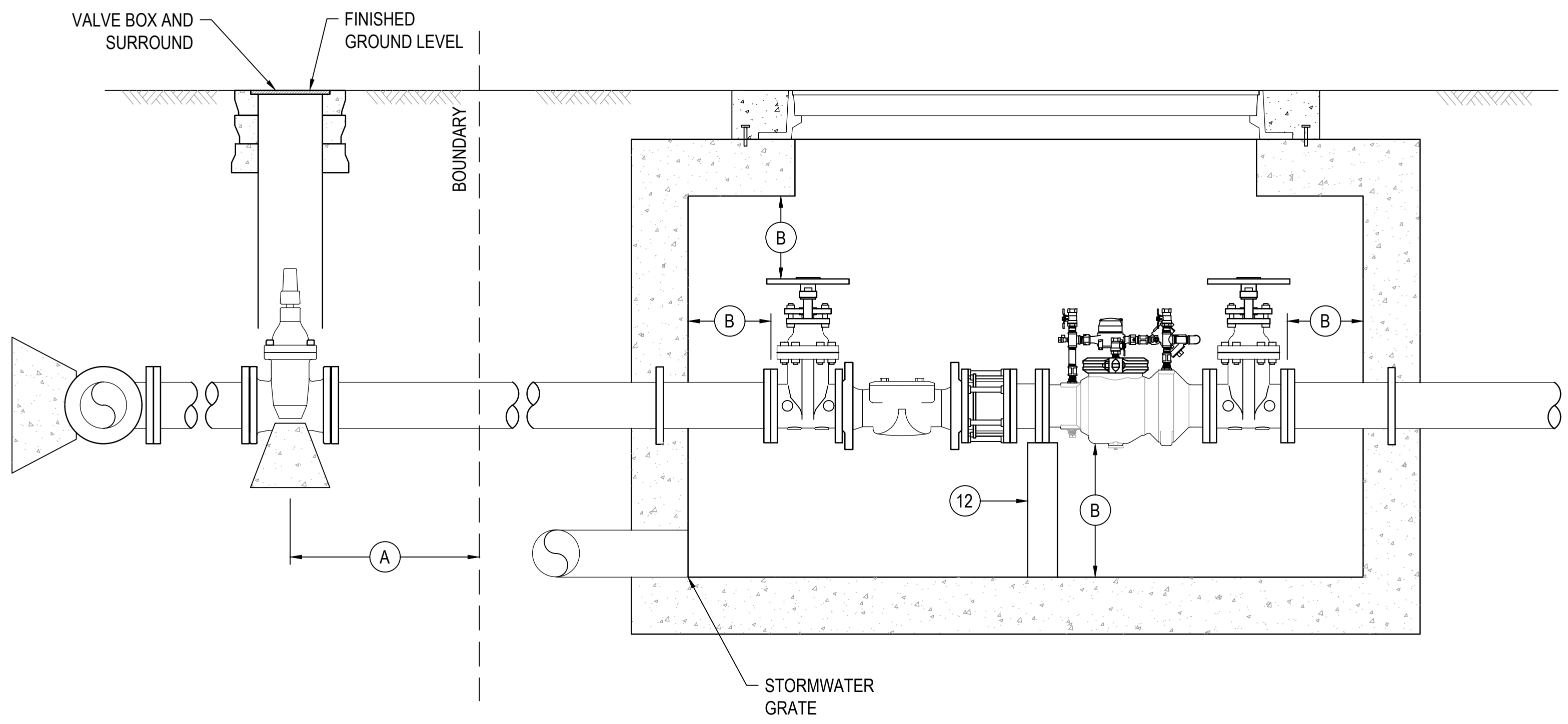
PLAN
NOT TO SCALE

NOTES:

1. VALVE AND BACKFLOW SHALL BE INSTALLED IN THE ROAD RESERVE OUTSIDE THE PROPERTY SERVICED - EXCEPT WHERE APPROVED IN WRITING BY WELLINGTON WATER.
2. VALVE AND METER INSTALLATION CAN BE SET-UP EITHER PARALLEL OR PERPENDICULAR TO THE PROPERTY BOUNDARY, BUT MUST BE SQUARE WITH THE BOUNDARY.
3. FIRE VALVE ON MAIN SHALL HAVE SPECIAL VALVE BOX WITH "FS" CAST AS PER THE REQUIREMENTS OF THE REGIONAL SPECIFICATION FOR WATER SERVICES. THE LID SHALL BE PAINTED GREEN (IN REFLECTIVE PAINT).
4. DETECTOR TAPE TO BE INSTALLED ABOVE SERVICE PIPE ARRANGEMENT, UP TO THE METER CHAMBER
5. WHERE INSTALLATION CONFLICTS WITH LOCAL COUNCIL BYLAWS, THE BYLAWS TAKE PRECEDENCE. APPROVAL MUST BE OBTAINED PRIOR TO CONSTRUCTION FROM THE ENGINEER.

NOTES (CHAMBER):

1. THE CHAMBER SHALL BE PLACED AS CLOSE AS POSSIBLE TO THE BOUNDARY. WHERE THIS IS NOT PRACTICABLE, LOCATION TO BE CONFIRMED WITH WWL PRIOR TO INSTALLATION.
2. THE CHAMBER SHALL BE CONSTRUCTED FROM EITHER PRE-CAST, OR PLACED IN-SITU REINFORCED CONCRETE WITH WALLS NOT LESS THAN 150 mm THICK.
3. THE CHAMBER SHALL PROVIDE A MINIMUM OF 200 mm MAINTENANCE ROOM AROUND ALL FITTINGS.
4. A DRAIN SHALL BE INSTALLED IN THE CHAMBER - A FLAPGATE VALVE SHALL BE INSTALLED ON THE DRAIN TO PREVENT SURCHARGE AND VERMIN ENTRY TO PIPE.
5. THE CHAMBER SHALL HAVE REMOVABLE LIDS INSTALLED - THE LIDS SHALL BE FULL WIDTH AND FULL LENGTH GATIC, WEBFORGE OR SIKA LIDS SHALL BE ACCEPTABLE (OR SIMILAR APPROVED BY WELLINGTON WATER).



ELEVATION
NOT TO SCALE

REV	AMENDMENT	DWN	CHK	REV	DATE	AMENDMENT	DWN	CHK	DATE
A	PRELIMINARY ISSUE	SS	CB	GC	03/20				
B	REVISED TABLE AND NOTES	AL	DM	GC	07/20				
C	REVISED TABLE, NOTES, SERVICE VALVE LOCTION AND LID FOR CHAMBER	AL	SUS		11/21				

Wellington Water

DESIGN	T BIAGIOLI	09/19
UPDATE	S SURESH	10/21
DRAWING UPDATE	A LIM	10/21
CHECKED	E GREENBERG	11/21
REVIEWED	K WYNN	12/21
APPROVED	K WYNN	12/21

REGIONAL SPECIFICATION FOR WATER SERVICES

FIRE SERVICE CONNECTION AND METERED SUPPLY

SCALE: NOT TO SCALE
SHEET No. 1 OF 1 SHEETS.
DRAWING SIZE: A1
PROJECT/FILE NUMBER: -
DRAWING N°. WS13

WARNING: PRINTED COPIES ARE UNCONTROLLED

COLOUR PLOT

PLOT DETAILS:
Date Plotted: Dec 09, 2021 - 5:12pm
Plotted By: Andrew Lim

File Name: WS13 (2021) Fire service connection and metered supply.dwg
File Location: C:\USERS\ALIM\ONEDRIVE - WELLINGTONWATER\007 WWL\WWL\WATER SERVICES STANDARD DWG\WWL TEMPLATE\WCC WATER SUPPLY CONNECTION STANDARD

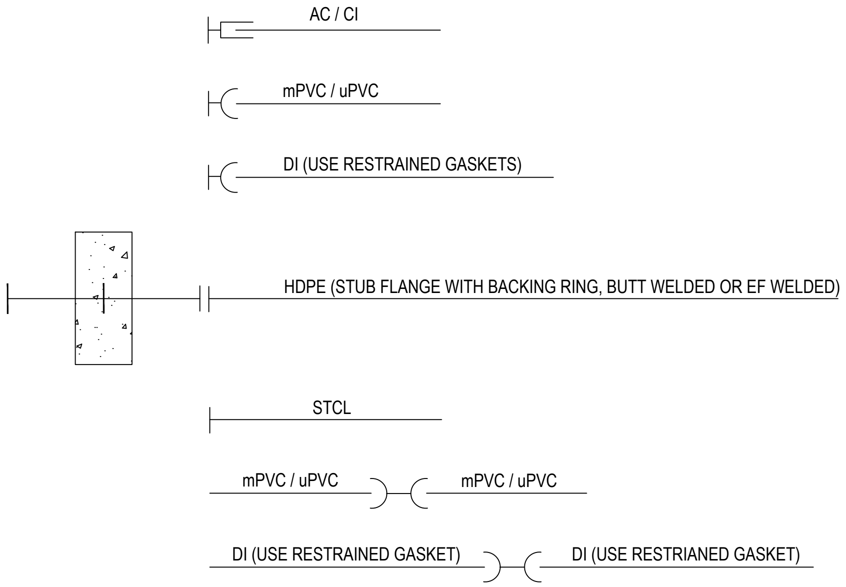
NOTES:

1) CONNECTION TO EXISTING PIPES WILL TYPICALLY OCCUR AT A FLANGE DI BEND OR TEE OR AT A FLANGED STCL SPECIAL.

2) STCL OR DI SPOOL WITH A PUDDLE FLANGE AND CONCRETE THRUST WALL SHOULD BE USED WHEN CONNECTING HDPE PIPE TO AC, CI, PVC OR DI TO ACCOMMODATE THE FORCES GENERATED BY THE POISSON EFFECT IN THE HDPE.

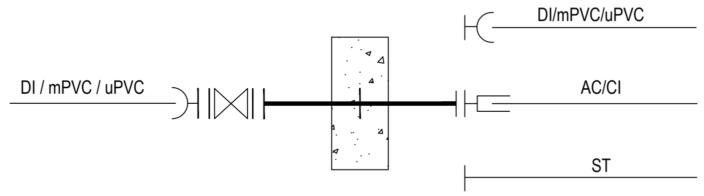
3) IF THERE IS A DIFFERENCE IN THE DEPTH OF THE EXISITNG MAIN AND THE NEW MAIN THEN A ROCKER PIPE OF THE SAME MATERIAL AS THE NEW MAIN MAY BE USED AND A MECHANICAL JOINT MAY BE USED TO CONNECT IT TO THE EXISTING MAIN. IF THE DEFLECTION IS GREATER THAN 3° THEN A STCL SPECIAL OR STANDARD DI FLANGED BENDS WILL BE REQUIRED.

PREFERRED CONNECTIONS FOR VARIOUS MATERAL TYPES.



PIPE ABBREVIATIONS	
AC	ASBESTOS CEMENT
CI	CAST IRON
DI	DUCTILE IRON
HDPE	HIGH DENSITY POLYETHYLENE
mPVC	MODIFIED POLYVINYL CHLORIDE
uPVC	UNPLASTICISED POLYVINYL CHLORIDE
STCL	STEEL CEMENT LINED

STCL OR DI FLANGED SPOOL WITH A PUDDLE FLANGE AND CONCRETE THRUST WALL SHOULD BE USED WHEN AN IN-LINE VALVE HAS BEEN INSTALLED TO ENSURE THE VALVE IS RESTRAINED FROM EITHER DIRECTION. THE PUDDLE FLANGE SPOOL AND IN-LINE VALVE SHOULD BE FLANGED TOGETHER.



ACCEPTABLE CONNECTION TYPES FOR REPAIRS OR CONNECTIONS TO EXSITING PIPES WHERE THE PREFERRED CONNECTIONS ARE NOT POSSIBLE.

LEGEND	
	FLANGED/FLANGED JOINT
	FLANGE/SOCKET ADAPTER
	MECHANICAL FLANGE ADAPTER
	MECHANICAL JOINT
	SOCKET/SOCKET CONNECTOR
	SLUICE VALVE
	PUDDLE FLANGE WITH CONCRETE THRUST BLOCK

EXAMPLES OF WATER MAIN CONNECTIONS

NOTE: DOES NOT INCLUDE FIRE HYDRANTS

PLAN VIEWS

DIAGRAMMATIC ONLY

REV	AMENDMENT	DWN	CHK	REV	DATE	AMENDMENT	DWN	CHK	DATE
A	PRELIMINARY ISSUE	AL			02/20				
B	RATIONALISED NUMBER OF CONNECTIONS	AL	EG		11/21				

Wellington Water

DESIGN	WWL	-
UPDATE	J EWEG	11/21
DRAWING UPDATE	A LIM	11/21
CHECKED	E GREENBERG	11/21
REVIEWED	J EWEG	11/21
APPROVED	J EWEG	11/21

REGIONAL SPECIFICATION FOR WATER SERVICES

EXAMPLES OF WATER MAIN CONNECTIONS

SCALE: NOT TO SCALE

SHEET No. 1 OF 1 SHEETS.

DRAWING SIZE: A1

PROJECT/FILE NUMBER: -

DRAWING N°. WS14

WARNING: PRINTED COPIES ARE UNCONTROLLED

COLOUR PLOT

PLOT DETAILS:
Date Plotted: Dec 03, 2021 - 9:11am
Plotted By: Andrew Lim

File Name: WS14 (2021) Examples of water main connections.dwg
File Location: C:\USERS\ALIM\ONEDRIVE - WELLINGTONWATER\007 WWL\WWL\WATER SERVICES STANDARD DWG\WWL TEMPLATE